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Technical Report Overview

Report: 2020 Line Creek Operations Local Aquatic Effects Monitoring Program (LAEMP) Report for Dry Creek

Overview: This report presents the 2020 results of the local aquatic effects monitoring program developed for Teck's Line Creek Operations at Dry Creek. The report presents data and evaluates the magnitude and extent of influence of mine operations on water quality, calcite, and benthic invertebrate communities downstream of Dry Creek at Line Creek Operations.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information
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Future studies will be made available at **teck.com/elkvalley**

2020 Line Creek Operations Local Aquatic Effects Monitoring Program (LAEMP) Report for Dry Creek

Prepared for:
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2020 Line Creek Operations Local Aquatic Effects Monitoring Program (LAEMP) Report for Dry Creek

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EXECUTIVE SUMMARY

Permit 106970 was issued in 2013 to Teck Coal Limited (Teck) by the BC Ministry of Environment (now Ministry of Environment and Climate Change Strategy; ENV) for the Phase II Project of Line Creek Operations (LCOII). The initial placement of waste rock in the Dry Creek watershed occurred in 2015, although minimal spoiling occurred that year. To comply with discharge requirements for total suspended solids in Permit 106970, Teck constructed the Line Creek Operation (LCO) Dry Creek Water Management System (DCWMS), which began operating in 2015. Water from upper Dry Creek is collected in a headpond and then conveyed by pipeline to a distribution system that directs the water into two lined sedimentation ponds that operate in parallel. Under the original operational framework, discharge from the sedimentation ponds was combined and conveyed into a constructed discharge channel, which continuously flowed into Dry Creek downstream of the east tributary of Dry Creek. Another requirement of Permit 106970 was to develop and implement a local aquatic effects monitoring program (LAEMP) to assess potential effects of LCOII on Dry Creek, Grace Creek, and Unnamed Creek (ENV 2013). LCO Dry Creek LAEMP results will be used to evaluate current inform future monitoring and management requirements.

A Structured Decision Making (SDM) process was initiated in 2016 to develop recommendations for water quality site performance objectives (SPOs) and in-stream flow requirements (IFRs) for Dry Creek, along with an updated LCO Dry Creek Water Management Plan that includes water management actions, physical works, and operational procedures to achieve the recommended SPOs and IFRs, and monitoring and adaptive management recommendations. The SDM process involves a multi-party working group composed of the Ktunaxa Nation Council (KNC), ENV, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), the Ministry of Energy Mines and Petroleum Resources (EMPR), Fisheries and Oceans Canada (DFO), and Teck. Operational recommendations developed through the SDM process are informed throughout the year by Dry Creek LAEMP monitoring results.

LCO Dry Creek LAEMP monitoring started in 2014, with two monitoring areas in Dry Creek, one immediately downstream of the DCWMS (LC_DCDS) and one upstream of the mouth of Dry Creek (LC_DC1), Grace Creek, and Unnamed Creek. The first three years of annual monitoring conducted in September indicated little change in conditions in the creeks. A step-wise increase in water quality (e.g., nitrate, total selenium, and sulphate concentrations) was observed in May 2017. In 2018, a further increase in aqueous concentrations of mine-related constituents was observed at monitoring areas in Dry Creek, and the rate of change in Dry Creek was faster than projected using the Regional Water Quality Model, but acute and chronic toxicity test results indicated low potential for effects. Calcite indices associated with biological samples were within the regional normal range and were similar to or lower than values observed in past cycles of the LCO Dry Creek LAEMP. In 2018, unexpectedly elevated concentrations of selenium in benthic invertebrate tissue samples collected in Dry Creek were observed, particularly at the area immediately downstream from the sedimentation ponds (LC_SPDC). These observations led to a response as identified via Teck's adaptive management response framework. Additional sampling was initiated in December 2018 and February 2019 that included four more areas in Dry Creek upstream (LC_DC3) and downstream (LC_SPDC, LC_DC2, and LC_DC4) of the DCWMS. The extra sampling confirmed elevated tissue selenium concentrations in Dry Creek, particularly immediately downstream from the sedimentation ponds. Despite the observed changes in water quality, calcite, and invertebrate tissue selenium concentrations, benthic invertebrate communities were similar between the two areas sampled in upper versus lower Dry Creek.

In 2019, aqueous concentrations of mine-related constituents including nitrate, sulphate, total selenium, total cadmium, and total lithium continued to increase in Dry Creek relative to levels observed in 2018. Benthic invertebrate community endpoints were generally within regional normal ranges in 2019 except at areas LC_DC3 and LC_SPDC, where endpoints including the combined proportion of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (%EPT) were outside normal ranges. A pathway for benthic invertebrate selenium tissue bioaccumulation in Dry Creek was theorized wherein enhanced primary production in the DCWMS sedimentation ponds promotes the generation of organic selenium compounds (specifically DMSeO and MeSe[IV]), which may be related to increased benthic invertebrate tissue selenium concentrations in Dry Creek downstream of the DCWMS. Dry Creek benthic invertebrate tissue selenium concentrations gradually decreased over the course of 2019. As a result of higher-than-expected aqueous and tissue selenium concentrations downstream of the DCWMS, the decision was made (via the SDM process) to bypass the sedimentation ponds seasonally beginning in 2020, only filling them during freshet and higher-flow periods.

In 2020, the objectives for the Dry Creek LAEMP were structured into 5 study questions:

1. 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?
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 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?

This report evaluates Dry Creek monitoring data up to the end of the 2020 calendar year to evaluate those questions.

Concentrations of aqueous mine-related constituents including total selenium, nitrate, total nickel, sulphate, and total cadmium, have increased over time on Dry Creek. Constituents including nitrate, total selenium, and total nickel exceeded interim screening values and/or benchmark (where applicable) values at multiple areas on Dry Creek in 2020. Constituent concentrations were more frequently elevated at areas LC_DC3 (the Dry Creek area farthest upstream), 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. Aqueous organoselenium (specifically DMSeO and MeSe[IV]) concentrations were elevated at areas LC_SPDC and LC_DCDS during DCWMS sedimentation pond dewatering in August 2020, however activation of the DCWMS bypass reduced concentrations to levels lower than observed over the same periods in 2019. Elevated aqueous organoselenium concentrations were further evaluated in supplemental weekly biological and water quality (including selenium speciation) sampling on Dry Creek downstream of the DCWMS between September 23rd and November 14th. This supplemental sampling was initiated based on guidance from the SDM aquatic health qualified professionals. Similar trends in aqueous constituents were not detected in the Fording River downstream of Dry Creek or in Grace Creek (LC_GRCK).

Acute toxicity testing of Dry Creek DCWMS effluent showed no test failures in 17 samples collected at area LC_SPDC in 2020. Although chronic toxicity effects were noted for LC_DCDS in all quarters, there was a low proportion of adverse responses in 2020, only slightly higher than for 2019. Nitrate was identified as potentially causing observed effects in tests with *Ceriodaphnia dubia* (Q1), however no water quality constituents were identified as a potential cause of the remaining adverse results observed in 2020. Potential adverse effects of Dry Creek water on biota have been attributed to nitrate toxicity intermittently between 2018 and 2020 although those attributions have been without a discernable pattern.

Benthic invertebrate community endpoints were mostly within regional normal ranges and not changing at most Dry Creek areas in 2020. Results for %EPT, percent Ephemeroptera (%E), and percent Chironomidae were outside of normal ranges (at frequencies that varied by area) at areas upstream (LC_DC3) and immediately downstream (LC_SPDC and LC_DCDS) of the DCWMS. Temporal changes observed in Dry Creek benthic invertebrate communities included decreases in %EPT and %E in 2020 relative to 2019 at areas LC_DC3, LC_DCDS, and LC_DC1. Changes in benthic invertebrate community endpoints over time and values outside of normal ranges were most commonly observed at areas LC_DC3 and LC_DCDS. Proportional data for benthic invertebrate communities must be interpreted with caution, however, as increases in a given taxon may be misinterpreted as a decrease in another. Increased benthic invertebrate tissue selenium concentrations did not appear to be a primary driver of changes in benthic invertebrate community structure upstream and downstream of the DCWMS. Decreases in %E and increases in %non-Chironomidae Diptera (%NCD) were correlated with changes in aqueous mine-related constituents including nitrate, selenium, sulphate, and nickel. Changes observed on Dry Creek were not consistent with trends observed on the Fording River downstream of the mouth of Dry Creek, indicating that it is unlikely that input from Dry Creek is having measurable effects on Fording River benthic invertebrate communities.

Benthic invertebrate tissue selenium concentrations have either been stable or decreasing in Dry Creek in 2020 compared with 2018 and 2019. Tissue selenium concentrations at most areas downstream of the DCWMS are still elevated relative to reference conditions, the regional normal range, and regional benchmarks, but they did not increase in 2020 relative to 2019. Elevated organoselenium concentrations detected during dewatering may have caused tissue selenium concentrations to increase relative to June 2020 concentrations downstream of the DCWMS (although this increase was frequently on-significant). Tissue selenium concentrations then gradually decreased during the bypass period despite this change not being significant. Furthermore, the DCWMS bypass was likely effective in reducing the magnitude of the seasonal tissue selenium spike observed in late summer 2019.

Tissue selenium concentrations in Westslope Cutthroat Trout (WCT) sampled opportunistically at area LC_DC2 in October 2020 (n=21[1]) were all below the Elk Valley site-specific benchmark and were within the range of values for fish sampled on the Fording River in 2018 for the RAEMP. Furthermore, WCT at LC_DC2 had tissue selenium concentrations reflective of feeding at LC_DC2 or farther downstream throughout Dry Creek, where dietary benthic invertebrate tissue selenium concentrations were lower than at LC_DCDS. Westslope Cutthroat Trout abundance and biomass sampling was excluded from Dry Creek monitoring in 2020 as a proactive measure in response to a decline in the Upper Fording River Westslope Cutthroat Trout population in 2019, as advised by the Elk Valley Fish and Fish Habitat Committee (EVFFHC) and discussed with

[1] A total of 25 WCT stranding mortalities occurred at LC_DC2 in October 2020. Meristics data were collected from all fish. Of those, muscle tissue was collected from 21 WCT that were deemed viable for analysis based on the estimated time of collection from time of mortality. Four fish had decomposed to a point that precluded reliable analysis.

the EMC. Fewer redds were identified during 2020 surveys than in any previous year of DCFFHMP sampling. This may be related to low temperatures on Dry Creek in 2020 (degree day recruitment thresholds not met at LC_DC1, LC_SPDC, and LC_DCEF) and intermittently low DO concentrations (below the BCWQG for buried embryos and alevin). Otherwise, fish habitat conditions on Dry Creek were generally sufficient for adult WCT survival, with temperature thresholds not exceeded and DO concentrations above BCWQGs. Calcite Index values for Dry Creek did not increase in 2020 relative to previous years and were all within the regional normal range.

Changes to aquatic receptors in Dry Creek are occurring as a result of recent mine operations. Specifically, concentrations of some aqueous mine-related constituents are increasing in Dry Creek faster than anticipated, most notably: total selenium, nitrate, sulphate, total nickel, total dissolved solids, total uranium, and total lithium (study question 1). Based on toxicity tests, there is potential for individual or population-level effects on the benthic invertebrate communities of Dry Creek due to aqueous nitrate enrichment (study question 2). Benthic invertebrate abundance and taxonomic richness within Dry Creek have not increased, however %EPT and %E decreased at some areas, indicating that sensitive taxa may be impaired and community-level changes may be occurring (study question 3). Changes in benthic invertebrate tissue selenium concentrations have occurred as a result of mine-related changes to Dry Creek, most notably increased bioaccumulation of selenium due to increased primary production in the sedimentation ponds. Benthic invertebrate tissue selenium concentrations were above EVWQP benchmarks and the regional normal range 2020 but remained stable relative to 2019, possibly related to DCWMS operational adjustments (Study Question 4). Fish tissue selenium concentrations were below the regional benchmark and within the range of values for Fording River samples in 2018. Fish habitat was adequate for adult WCT survival in 2020 with respect to DO concentrations and thermal regimes. Temperature and DO were intermittently less-than-optimal for WCT early life stages on Dry Creek in 2020, however low dissolved oxygen and annual temperature regime do not appear to be related to mine impact or proximity to the DCWMS. Comparison of flow rates with Instream Flow Requirements (IFRs) was not possible for the 2020 LAEMP since the development of updated IFRs for Dry Creek is currently underway as part of the SDM process. Once the updated IFRs are formalized these will be considered in the interpretation of Study Question 5 for the 2021 LAEMP report.

The rate and magnitude of changes to Dry Creek water quality and benthic invertebrate tissue chemistry have been greater than anticipated over the past three years of LAEMP monitoring. In response to these results, monitoring and pond management 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 the Dry Creek LAEMP also provide information that supports Teck's Adaptive Management Program (Teck 2018b). 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.

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ACRONYMS AND ABBREVIATIONS

%Ephemeroptera (%E) – relative proportion of Ephemeroptera

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

AEM – Aquatic Effects Monitoring

AJM – AJM Environmental Inc.

AMP – Adaptive Management Plan

ANOVA – Analysis of Variance

AWTF – Active Water Treatment Facility

BCWQG – British Columbia Water Quality Guidelines

CA – Correspondence Analysis

CABIN – Canadian Aquatic Biomonitoring Network

CI – Calcite Index

DCWMS – Dry Creek Water Management System

DCFFHMP – Dry Creek Fish and Fish Habitat Monitoring Program

DFO – Fisheries and Oceans Canada

DMSeO - Dimethyl Selenoxide

DO – Dissolved Oxygen

Ecofish – Ecofish Research Limited

EFN – Environmental Flow Needs

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

dw – Dry Weight

FHAP – Fish Habitat Assessment Procedure

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

FRO – Fording River Operation

HR ICP-MS – High Resolution Inductively Coupled Plasma Mass Spectrometry

HRT – Hydraulic Retention Time

HSD - Honestly Significant Difference

IC_{25} – Inhibition Concentration; statistical calculation of effluent concentration that causes a 25% reduction in growth and reproduction of test organisms

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

MAD – Mean Annual Discharge

MBCM – Million Bank Cubic Meters

MCT – Measure of Central Tendency

MeSe(IV) - Methylseleninic Acid

MOD – Magnitude of Difference

MQ – Management Question

MWMP - Mine Water Management Plan

MWMxT – Mean weekly maximum water temperature

NCD - non-Chironomidae Diptera

NOEC – No Observed Effect Concentration

Nupqu – Nupqu Resource Limited Partnership

PC – Principal Components

PCA – Principal Components Analysis

Qx – referring to calendar quarters

QA/QC – Quality Assurance / Quality Control

QP– Qualified Professional

RAEMP – Regional Aquatic Effects Monitoring Program

SDM – Structured Decision Making

SPO – Site Performance Objective

SSD – Species Sensitivity Distribution

Teck – Teck Coal Limited

TIEs – Toxicity Identification Evaluations

TN:TP – Total Nitrogen to Total phosphorous

TSS – Total Suspended Solids

WCT – Westslope Cutthroat Trout

1 INTRODUCTION

1.1 Background

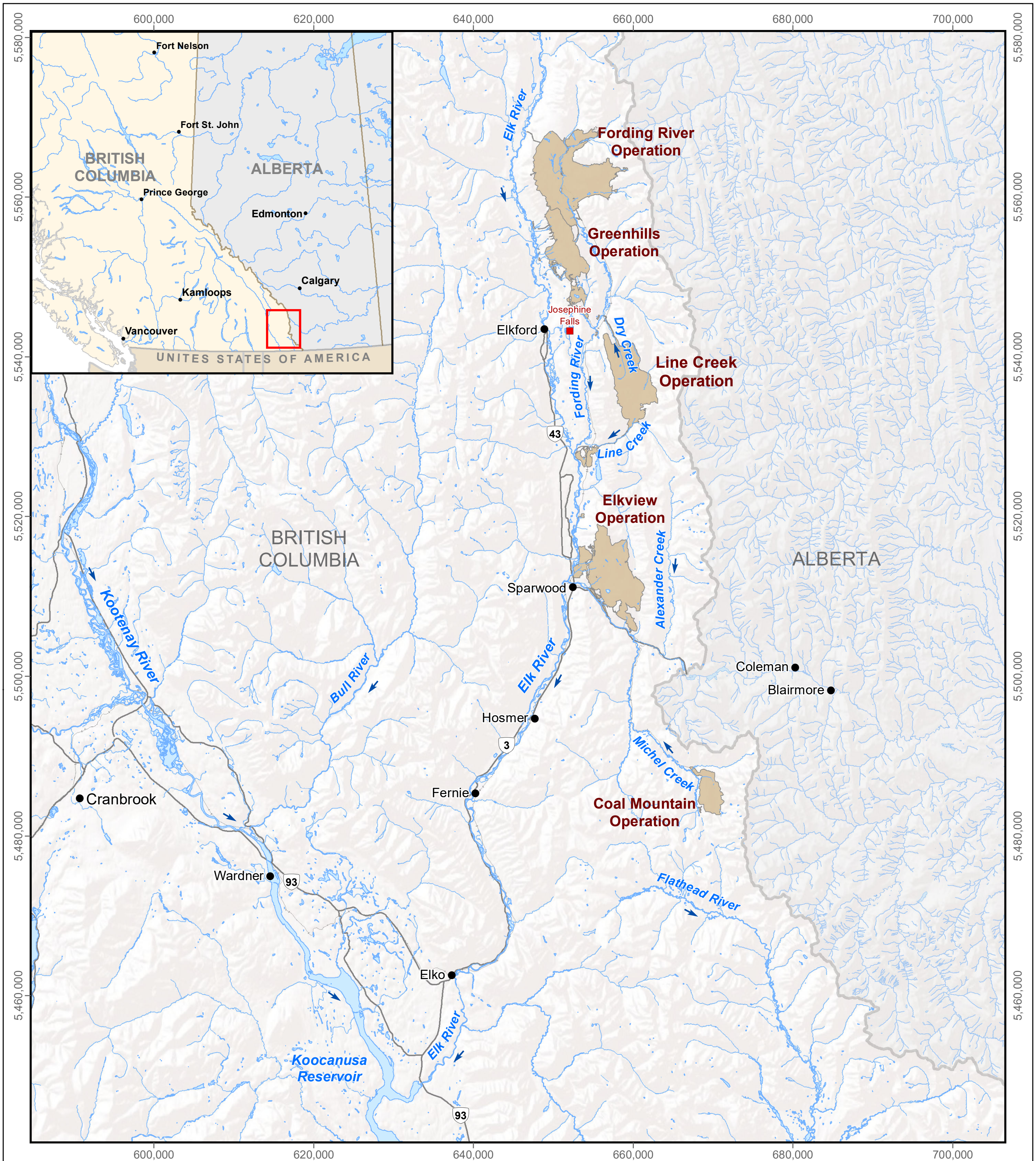
Teck Coal Limited (Teck) currently operates four steelmaking coal mines in the Elk River watershed in southeastern British Columbia (BC) which are the Line Creek Operation (LCO), Fording River Operation (FRO), Greenhills Operation (GHO), and Elkview Operation (EVO; Figure 1.1). A fifth mine, Coal Mountain 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 compared with subsequent years (2016: <10 MBCM; 2017: <26 MBCM; 2018: <28 MBCM; 2019: <11 MBCM; 2020: <12 MBCM). 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[2] 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) which is designed to help meet the total suspended solids discharge limits, as outlined in Permit 106970. 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).

An initial condition of the LCOII approval was to mitigate mine-related effects on aquatic biota in Dry Creek by diverting mine-affected water from upper Dry Creek directly to the Fording River (EAO 2013). Subsequently, concerns were raised that a reduction in flow in Dry Creek would also have the potential to adversely affect aquatic biota, particularly fish. As a result, *Environmental Management Act* Permit 106970 was issued to LCO by the BC Ministry of Environment[3] (October 25, 2013) with a requirement to develop and implement a local aquatic effects monitoring program (LAEMP).

Section 5.4 of permit 106970 (version October 25, 2013) outlines the requirements for the LCO Dry Creek LAEMP as follows:

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

[3] Now the B.C. Ministry of Environment and Climate Change Strategy (ENV).



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

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minnow environmental inc. A Trinity Consultants Company

Figure 1.1

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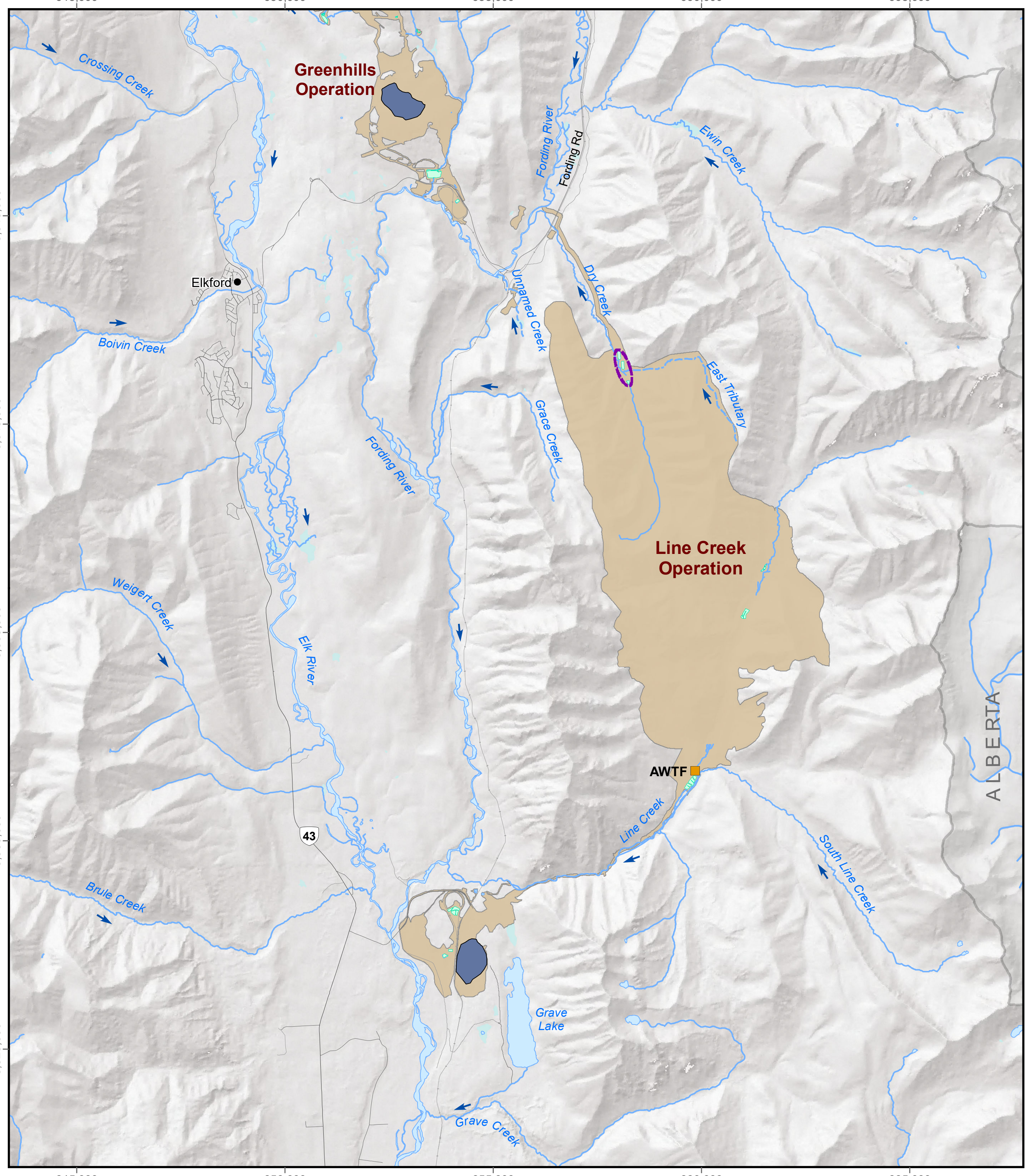

LEGEND
- Dry Creek Water Management System
- Active Water Treatment Facility (AWTF)
- Settling Pond
- Tailings Pond
- Teck Coal Mine Operation

Overview of Line Creek Operation

0 2.25 4.5 9 km

Projection: North American Datum 1983 UTM Zone 11N
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Figure 1.2

Document Path: S:\Projects\197202\197202.0009 - Teck Dry Creek 2019\4 - GIS\Study Design\19-09 Figure 1.2 Overview LCOII.mxd

> "The permittee must develop and implement a local Aquatic Effects Monitoring (AEM) 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. In addition to evaluating the potential effects of contaminants on environmental resources, the LAEMP for LCO Dry Creek should also include monitoring and assessment of stream flows and fish, and fish habitat."

Concurrent with the LAEMP, recommendations for site performance objectives (SPOs), instream flow requirements (IFRs), and environmental flow needs (EFNs) for Dry Creek are being developed through a Structured Decision Making (SDM) process. The results of on-going investigations including findings presented in this report (e.g., higher-than-expected water quality and enhanced selenium bioaccumulation in Dry Creek within and downstream from the DCWMS) will inform the development of SPOs and IFRs. The SDM process involves a multi-party working group composed of the Ktunaxa Nation Council (KNC), British Columbia Ministry of Environment and Climate Change Strategy (formerly MOE, ENV), the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), the Ministry of Energy Mines and Petroleum Resources (EMPR), Fisheries and Oceans Canada (DFO), and Teck. The working group has worked to seek consensus on a set of recommendations for water quality SPOs, IFRs, and EFNs for Dry Creek, and an updated LCO Mine Water Management Plan (MWMP) was submitted to ENV June 30, 2020 (as per the permit requirements) that outlines the water management objectives, strategies, and mitigation options to achieve the agreed-upon SPOs and IFRs (Teck 2020c). The MWMP Plan included changes to the DCWMS (i.e., seasonal bypass of the sedimentation ponds via an existing bypass pipeline to avoid generation of organic selenium species in the ponds; see Section 1.3 for details) and the MWMP will be reviewed annually as updates and adjustments are required (Teck 2020c).

The 2020 LAEMP period of study includes all biological and water quality sampling conducted on Dry Creek from January 2020 through December 2020. 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 106970 requirements, the conceptual site model outlining potential effects to aquatic receptors (see Minnow 2020b for details), previous LCO Dry Creek LAEMP reports (Minnow 2015, 2016, 2017, 2018b, 2019, 2020a), and input from the 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?

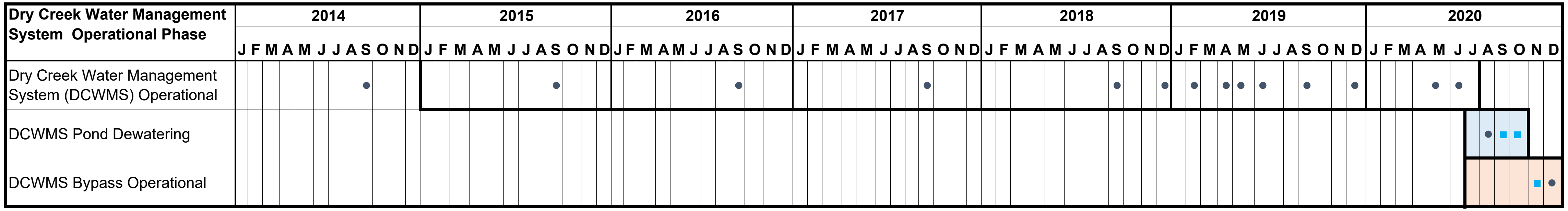
Five specific questions were further developed to help answer the above question and guide data evaluation:

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 106970. 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 diverts flow from upper Dry Creek (discharging through the rock drain downstream of LC_DC3) into the headpond where it is then piped over the East Tributary to a splitter box (Figure 1.4). At the splitter box flocculant is added, as required, to enhance sediment removal and reduce the amount of TSS in the effluent (Teck 2018a, 2019a). 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).

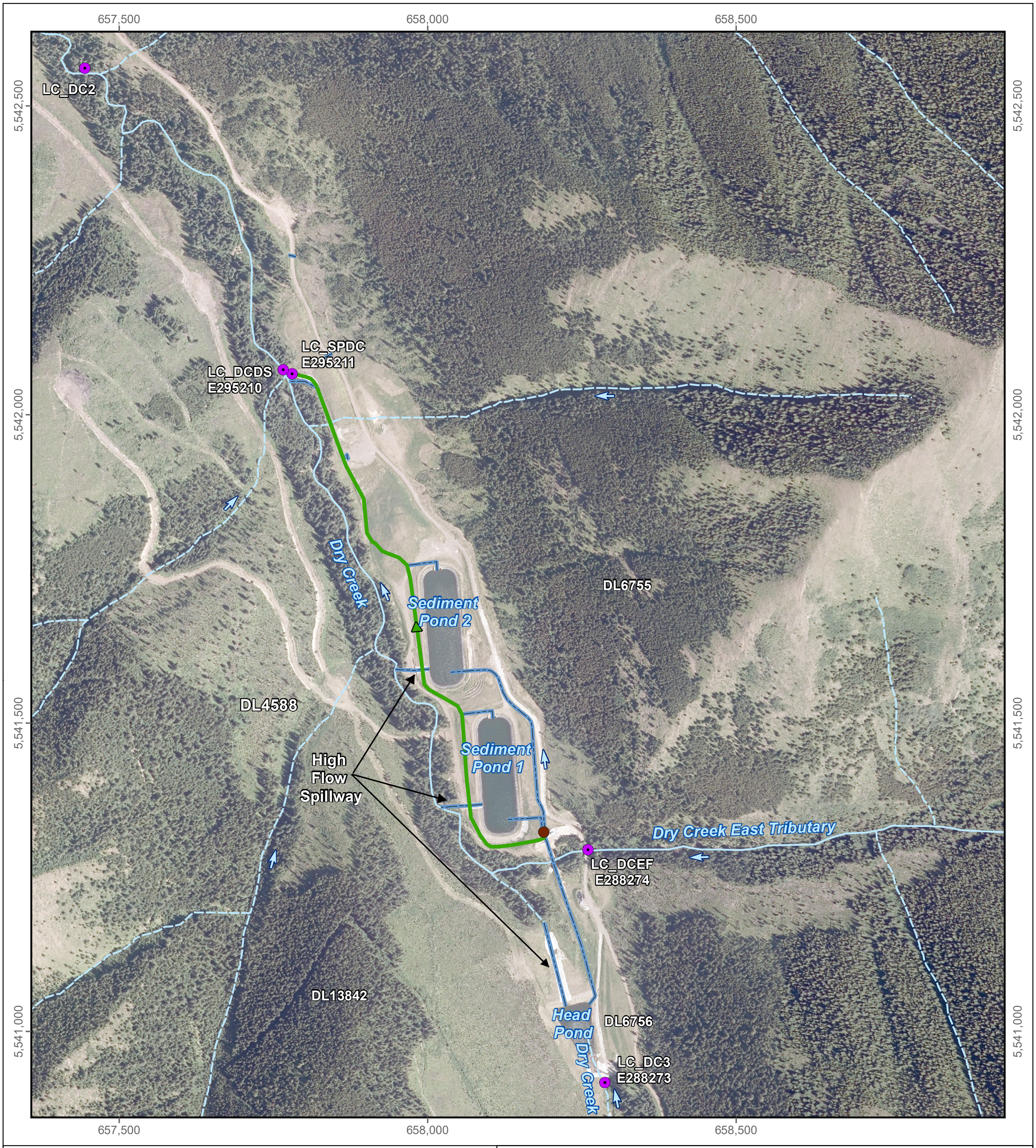
Sampling for the LCO Dry Creek LAEMP began in September 2014, prior to initial commissioning of the DCWMS and supporting infrastructure in 2015 (Figure 1.3). Annual monitoring for the Dry Creek LAEMP in 2014 to 2017 focused on two areas downstream of the DCWMS (Minnow 2015, 2016, 2017, 2018b). In 2018, aqueous concentrations of mine-related constituents in Dry Creek (e.g., nitrate and total selenium), were greater than previously observed (Minnow 2019) and the



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

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

Figure 1.3: Overview of LAEMP and Supplemental Sampling Events in Relation to Operational Phases of the Dry Creek Water Management System Operation, 2014 to 2020



LEGEND

- Biological Sampling Area
- Splitter Box
- DCWMS Bypass
- Water Management Structure Piping
- Watercourse
- Intermittent Watercourse

LCO Dry Creek Water Management System

0 150 300 600 Meters

N W E S

Projection: North American Datum 1983 UTM Zone 11N

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Figure 1.4

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0024 - Dry Creek LAEMP\4 - GIS\Dry Creek LAEMP\20-24 Figure 1.4 LCO Dry Creek Water Management System.mxd rate of change was greater than predicted in the LCOII project application (Teck 2011) or in Regional Water Quality Model updates. These results led to additional Dry Creek LAEMP biological and water quality sampling (including concurrent sampling for aqueous selenium speciation during biological sampling) and the addition of new biological sampling locations in Dry Creek upstream (LC_DC3) and downstream (LC_SPDC, LC_DC2, and LC_DC4) of the DCWMS[4] (Minnow 2019).

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 (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 organic selenium species generation in Dry Creek and the resulting 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 (Lorax 2020, Minnow 2020). Utilizing the structured decision making (SDM) process a decision was made to bypass the sedimentation ponds seasonally, only filling them during freshet and higher-flow periods (Figures 1.3 and 1.4; Teck 2020c). The seasonal DCWMS bypass diverts water from the DCWMS headpond directly to LC_SPDC. The bypass is activated every year during summer with ponds pumped and discharge entering Dry Creek at area LC_SPDC (Figure 1.4). In 2020 pond dewatering and bypass operation began in July, with pond dewatering completed in September and bypass active through December (Figure 1.3).

In August 2020 elevated aqueous concentrations of organoselenium species dimethyl selenoxide (DMSeO) and methylseleninic acid (MeSe[IV]) were detected at areas LC_SPDC and LC_DCDS, likely the result of discharge from pond dewatering (see Section 2.4.3). These results led to a meeting of the SDM aquatic health qualified professionals (QPs) who advised Teck to initiate a temporary halt on pond dewatering followed by the initiation of additional weekly sampling on Dry Creek between September 23rd and November 14th (Figure 1.3). Weekly sampling was designed to evaluate the effects of elevated concentrations of aqueous organoselenium species downstream of the DCWMS as well as potential for selenium bioaccumulation/reduction in primary producers and benthic invertebrates. As such, in addition to water quality and benthic invertebrate tissue monitoring, weekly supplemental sampling included collection of periphyton community samples.

[4] 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.

Effluent discharge (i.e., combined mine-impacted water from the two sedimentation ponds) was historically released into a manmade sedimentation pond discharge channel with artificial boulder substrate area prior to entering lower Dry Creek (i.e., LC_SPDC; Figure 1.4). Although the habitat at LC_SPDC was unique compared with other Dry Creek areas and had artificial substrate, abundances of adult Westslope Cutthroat Trout (*Oncorhynchus clarkii*; Westslope Cutthroat Trout [WCT]) at LC_SPDC in 2016 and 2018 were higher than downstream in Dry Creek (Ecofish 2019). In addition, aqueous and benthic invertebrate tissue selenium concentrations at LC_SPDC were elevated relative to areas farther downstream of the DCWMS over the same period (Minnow 2020a). In October 2018, a fish exclusion fence was constructed between areas LC_DCDS and LC_SPDC as a proactive temporary measure to prevent fish access the DCWMS sedimentation ponds and limit dietary exposure of WCT to benthic invertebrates in the discharge channel. This area was permanently modified in October of 2020 for the same purpose, 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 (Figure 1.5). Flow reduction at LC_SPDC during the construction process in October 2020 resulted in the stranding mortalities of 25 WCT downstream at area LC_DC2 on October 8th. Stranded fish were sampled opportunistically for tissue analysis. A subset of remaining fish were sent for necropsy however pathologist reports were not available in time for inclusion in this report.

1.4 Linkage to the Adaptive Management Plan

As required in Permit 107517 Section 10, Teck has developed an Adaptive Management Plan (AMP). The purpose of the AMP is to support implementation of the Elk Valley Water Quality Plan (EVWQP) to achieve water quality and calcite targets, to be protective of human health and the environment, and where necessary, restorative, and to facilitate continuous improvement of water quality in the Elk Valley (Teck 2018b). Following an adaptive management framework, the AMP identifies six Management Questions that will be re-evaluated at regular intervals as part of AMP updates throughout EVWQP implementation. Data from the RAEMP (Minnow 2018c) and the various LAEMPs (including the LCO Dry Creek LAEMP) will feed into the adaptive management process to address these Management Questions that collectively address the environmental management objectives of the AMP (Teck 2018b) and the EVWQP (Teck 2014). The AMP also identifies key uncertainties that need to be reduced to fill gaps in current understanding and support achievement of the EVWQP objectives.

Monitoring data from the LAEMP will contribute to the broader data set assessed every three years within the RAEMP, in addition to addressing questions specific to the LCO Dry Creek LAEMP on an annual basis. The RAEMP is designed to evaluate multiple management related

Figure 1.5: Area LC_SPDC Operational Changes, 2020

1. May 2020, looking upstream from midpoint of area LC_SPDC.
2. October 8, 2020, looking upstream from midpoint of area LC_SPDC following the initiation of DCWMS bypass and conclusion of seasonal pond dewatering in 2020.
3. October 13, 2020, Placement of extended discharge pipe (completed in October, 2020) through area LC_SPDC looking downstream from farthest upstream point of area LC_SPDC.
4. May 3, 2021, Current water sampling location for area LC_SPDC: bottom of pipe through area LC_SPDC/discharge point immediately upstream of area LC_DCDS.

questions, such as Management Question #2, (i.e., "Will aquatic ecosystem health be protected by meeting the long-term site performance objectives?) and Management Question #5 (i.e., "Does monitoring indicate that mine-related changes in aquatic ecosystem conditions are consistent with expectations?"). Additionally, for each Management Question a "Key Uncertainty" framework has been also developed to identify data gaps and direct future work (as described in annual AMP Reports). Information acquired from the LCO Dry Creek LAEMP will be used in conjunction with studies in the Elk Valley area (including other LAEMPs) to reduce these uncertainties and provide additional context to the ecological conditions of the Elk Valley region.

The evaluation of biological triggers for potential management action is a requirement of Permit 107517 and is incorporated as part of Management Question #5 of the AMP (Teck 2018b). Generally, triggers are intended as a simple way to flag potential unexpected monitoring results that may require action. In the 2020 LCO Dry Creek LAEMP, percent EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]; %EPT) and composite-taxa benthic invertebrate tissue selenium concentration were assessed against their respective biological triggers (additional information and methods pertaining to this analysis can be found in Appendix H). A third draft biological trigger, WCT muscle tissue selenium, could not be analyzed as part of the Dry Creek LAEMP because opportunistic WCT collection occurred at LC_DC2 in 2020. Projected water quality data is not available for this area, and thus the application of biological trigger analysis for the Westslope Cutthroat Trout muscle tissue selenium endpoint could not be employed.

The Dry Creek LAEMP was designed following an adaptive approach to monitor conditions associated with the LCOII Project and the DCWMS as well as to answer site-specific questions on an annual basis (Section 1.2). The adaptive management framework may be implemented at any time during the course of each annual LAEMP cycle (results are reported on May 31st of each year for the preceding calendar year) depending on the answers to site-specific LAEMP questions and on available data. Results of monitoring completed in 2014 to 2017 triggered minor study design adjustments. Results from 2017 were evaluated as part of the SDM process, which included re-evaluation of the regional water quality model and a detailed flow accretion study to evaluate shallow ground water and surface water interactions (Golder 2019a, Golder 2019b).

In September of 2018 Dry Creek benthic invertebrate tissue selenium concentrations were elevated and not consistent with what would be expected based on current water quality concentrations and application of the selenium bioaccumulation model (Teck 2020a). These results led to additional monitoring, as a potential need for a response was identified via the AMP response framework under Management Question 5 of Teck's Adaptive Management Plan (i.e., "Does monitoring indicate that mine-related changes in aquatic ecosystem conditions are consistent with expectations?"). 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 the detail in the 2019 Annual AMP report (Teck 2020a). The investigation of cause identified waste rock as the source of selenium in Dry Creek, and conditions in the DCWMS sedimentation ponds as a contributing factor to enhanced selenium bioaccumulation downstream of the DCWMS. Adjustments implemented as part of the AMP response framework included the addition of more monitoring areas and sampling events as part of the LAEMP to increase the understanding of spatial resolution and seasonality of conditions, introduction of a temporary barrier excluding fish from area LC_SPDC in October 2019, replacement of area LC_SPDC and the pool upstream of LC_SPDC with a discharge pipe (Figure 1.5), and implementation of the DCWMS bypass in 2020.

In late 2018, concentrations of mine-related constituents (primarily selenium, nitrate, and sulphate) in LCO Dry Creek were higher than projections modelled for LCOII development in the project proposal (Teck 2011) and were increasing more quickly than expected. As a result, ongoing monitoring and management efforts have been re-evaluated through the SDM process and AMP response framework. Elevated aqueous nitrate concentrations were the focus of further investigations in 2019 and adjustments (including changes to the Dry Creek LAEMP study design and operational changes at LCO) were made in response to those results as outlined in detail in the 2019 Annual AMP report (Teck 2020a). The investigation of cause identified blasting residue on waste rock as the source of selenium, nitrate, and sulphate in Dry Creek. Several adjustments have been implemented as part of the AMP response framework, including moving waste placement to LCO Phase I, an updated water quality model for Dry Creek, and utilization of drill hole liners for blasting (Teck 2020a). Additionally, the LCO nitrate compliance action plan is under development alongside an updated LCO Dry Creek Water Management Plan that will outline the objectives and mitigation options.

During DCMWS dewatering in August 2020 elevated aqueous organoselenium (specifically, DMSeO and MeSe(IV)) concentrations were detected downstream of the DCWMS at areas LC_SPDC and LC_DCDS (See Section 3.7). This led to the addition of supplemental monitoring efforts from September 23rd to November 14th upon receipt of the selenium speciation data. Adjustments implemented as part of the AMP response included an immediate halt to dewatering as well as implementation of additional weekly biological and water quality monitoring at Dry Creek areas downstream of the DCWMS starting September 23rd, 2020 (for full details of supplemental weekly sampling see Section 2).

For more information on the adaptive management framework, the Management Questions, the Key Uncertainties, the Response Framework, Continuous Improvement, linkages between the

AMP and other EVWQP programs, and AMP reporting, refer to the AMP (Teck 2018b) and the 2019 Annual AMP report (Teck 2020d).

2 METHODS

2.1 Overview

The general approach for the LCO Dry Creek LAEMP includes analysis and interpretation of collected data in relation to the each of the study questions. This report includes data collected up to the end of 2020 calendar year for all study parameters. Historical data are also presented where appropriate.

Water quality and biological samples were collected from established monitoring areas in Dry Creek, the Dry Creek East Tributary, Grace Creek, Unnamed Creek, and the Fording River (Table 2.1, Figure 2.1). These monitoring areas include all areas sampled for the Dry Creek LAEMP since 2014, as well as all areas added to the LAEMP in late 2018[5] (Minnow 2019). Monitoring areas sampled in 2020 included mine-exposed areas upstream and downstream of the DCWMS as well as associated reference areas (LC_DCEF and LC_UC). Specifically, LC_DC3 is situated upstream of the DCWMS and reflects water quality on Dry Creek immediately downstream of LCOII spoiling and prior to DCWMS effects. Monitoring areas LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1 are downstream of the DCWMS and provide spatial resolution of the potential influence of the DCWMS on Dry Creek. LC_FRUS and FR_FR5 are situated in the Fording River upstream of the Dry Creek mouth, and LC_FRB is in the Fording River downstream of the mouth of the Fording River (Figure 2.1). LC_GRCK is situated in Grace Creek, which receives relatively low mine influence compared with Dry Creek and is west of Dry Creek (Figure 2.1). The associated reference areas are situated in the east tributary to Dry Creek (LC_DCEF) and in Unnamed Creek which is North of Dry Creek (LC_UC; Figure 2.1). 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 (20% of LC_DCEF flow) or enters Dry Creek further downstream as groundwater input (upstream of LC_DC4; 80% of LC_DCEF flow; Golder 2019b). This flow regime was first observed in a flow accretion study conducted by Golder Associates Ltd. (Golder) in November 2018, and then verified in a follow-up study using date from August 2019 (Golder 2019b). Results from the flow accretion study will be used to help interpret water quality and aquatic health results in the Dry Creek LAEMP, although applicability may be limited due to the study being completed over only two seasons.

To address the study questions described in Section 1.2, the 2020 LCO Dry Creek LAEMP included evaluation of the following components:

[5] 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, 2020

<table>
<tr><th rowspan="3">Area</th><th rowspan="3">Area Type</th><th colspan="7">Sampling Location</th></tr>
<tr><th rowspan="2">Teck Location Code</th><th rowspan="2">Biological Sampling Area (Alternative Names)</th><th rowspan="2">Environmental Monitoring Station Number (EMS #)</th><th rowspan="2">Location Description</th><th colspan="2">UTM (NAD83, Zone 11U)</th></tr>
<tr><th>Easting</th><th>Northing</th></tr>
<tr><td rowspan="7">Dry Creek</td><td>Mine-exposed</td><td>LC_DC3</td><td>-</td><td>E288273</td><td>Dry Creek upstream of Headpond</td><td>658294</td><td>5540918</td></tr>
<tr><td>Reference</td><td>LC_DCEF</td><td>-</td><td>E288274</td><td>East Tributary near confluence with Dry Creek</td><td>658260</td><td>5541295</td></tr>
<tr><td>Mine-exposed</td><td>LC_SPDC[a]</td><td>-</td><td>E295211</td><td>Dry Creek sediment ponds outlet; effluent to Dry Creek</td><td>657821</td><td>5542042</td></tr>
<tr><td>Mine-exposed</td><td>LC_DCDS</td><td>-</td><td>E295210</td><td>Dry Creek downstream of sediment ponds outlet</td><td>657766</td><td>5542073</td></tr>
<tr><td>Mine-exposed</td><td>LC_DC2</td><td>-</td><td>-</td><td>Dry Creek approximately 0.6 km downstream from sediment ponds outlet</td><td>657445</td><td>5542561</td></tr>
<tr><td>Mine-exposed</td><td>LC_DC4</td><td>-</td><td>-</td><td>Dry Creek 1.6 km downstream from the sediment ponds outlet</td><td>657172</td><td>5543327</td></tr>
<tr><td>Mine-exposed</td><td>LC_DC1</td><td>LC_DC1 (DRCK)</td><td>E288270</td><td>Dry Creek upstream of Fording Mine Road</td><td>656519</td><td>5544658</td></tr>
<tr><td rowspan="3">Fording River</td><td>Mine-exposed</td><td>FR_FR5[b]</td><td>-</td><td>-</td><td rowspan="2">Fording River upstream of Dry Creek and Ewin Creek, and downstream of Chauncey Creek</td><td>657173</td><td>5548723</td></tr>
<tr><td>Mine-exposed</td><td>-[b]</td><td>LC_FRUS (FO28)</td><td>E295232</td><td>656307</td><td>5545255</td></tr>
<tr><td>Mine-exposed</td><td>LC_FRB</td><td>LC_FRB (FO29)</td><td>-</td><td>Fording River downstream of Dry Creek</td><td>655275</td><td>5543711</td></tr>
<tr><td>Unnamed Creek</td><td>Reference</td><td>LC_UC[c]</td><td>-</td><td>E295213</td><td>Unnamed Creek</td><td>655351</td><td>5543087</td></tr>
<tr><td>Grace Creek</td><td>Mine-exposed</td><td>LC_GRCK</td><td>-</td><td>E288275</td><td>Grace Creek upstream of the CP rail tracks</td><td>654303</td><td>5540755</td></tr>
</table>

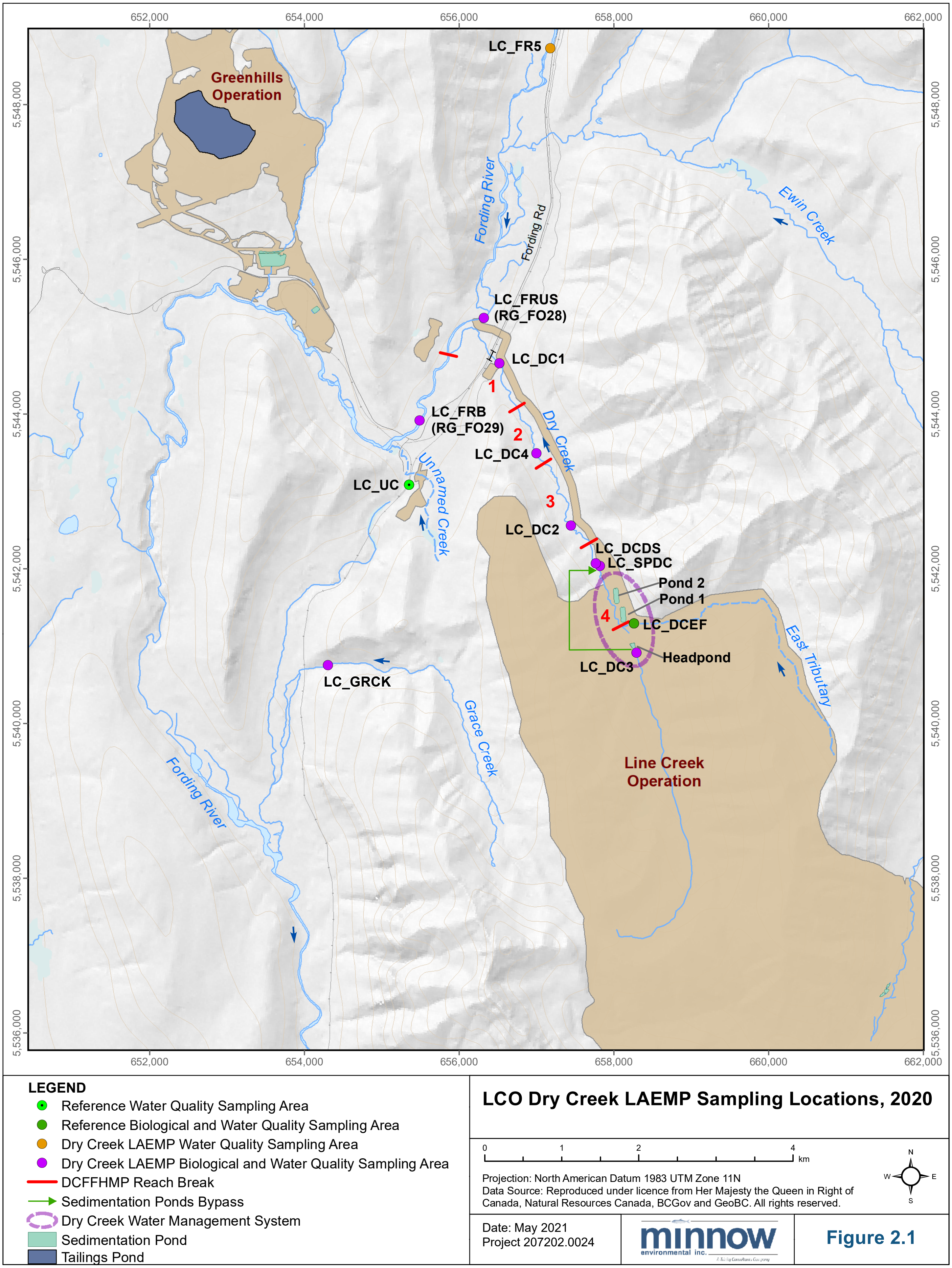
Historical Sampling Areas for LCO Dry Creek LAEMP (Minnow 2019).

Note: "-" indicates no data available.

[a] Discharge water sampling location where toxicity testing was completed; however, not part of the summary of receiving environment sampling locations as per sections 5.1 and 5.4 of Permit 106970.

[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 2019 (Minnow 2020a).



LCO Dry Creek LAEMP Sampling Locations, 2020

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: May 2021
Project 207202.0024

minnow environmental inc.

Figure 2.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 207202.0024 - Dry Creek LAEMP\4 - GIS\Dry Creek LAEMP\20-24 Figure 2.1 LCO Dry Creek LAEMP Sampling Locations.mxd

- Benthic invertebrate density, community, and tissue selenium concentrations (composite-taxa samples);
- Concentrations of total selenium, nitrate, total nickel, sulphate, cadmium, nutrients, selenium species, and other constituents (i.e., those listed in Section 2.2.1) in water, based on routine water quality monitoring;
- *In situ* water quality (including temperature and dissolved oxygen) at routine water quality monitoring locations;
- Acute (at LC_SPDC) and Chronic (LC_DCDS) toxicity of water samples;
- Calcite index; and
- Temperature and redd surveys as part of the Dry Creek Fish and Fish Habitat Monitoring Program (as reported separately by Nupqu Resource Limited Partnership and AJM Environmental Inc. [Nupqu and AJM; 2021]; Appendix F).

Water quality monitoring presented in this report includes requirements specified under Permit 106970 and acute and chronic water toxicity testing results represent the requirements of Permit 107517 (ENV 2013 and 2021, respectively; Table 2.2). Biological sampling in 2020 was completed in accordance with the 2020 LCO Dry Creek LAEMP study design (Minnow 2020b) and did not include biological monitoring at the Unnamed Creek reference area (LC_UC; as per Minnow 2020b.

In response to elevated aqueous concentrations of organoselenium species at areas LC_SPDC and LC_DCDS additional weekly sampling was completed between September 23rd and November 14th. This sampling was beyond the scope of the 2020 LCO Dry Creek LAEMP study design (Minnow 2020b). Supplemental weekly sampling evaluated the following components at Dry Creek areas downstream of the DCWMS:

- Benthic invertebrate tissue selenium concentrations (composite-taxa samples);
- Periphyton community composition[6];
- Concentrations of nutrients, total selenium, selenium species, and other analytes (i.e., those listed in Section 2.2.1) in water, based on routine water quality monitoring;

[6] Periphyton community monitoring was completed to better understand primary productivity and periphyton community composition in relation to algal bioaccumulation of selenium and the reduction of selenium in Dry Creek. Details of this monitoring (including background, methods, and results) are presented in Appendix G. Details are not included in the main body of the present report because periphyton community monitoring does not directly relate to the LCO Dry Creek LAEMP study questions (see Section 1.2).

Table 2.2: Summary of Water Quality Monitoring for Permit 106970

Area	Area Type	Teck Water Station Code (associated Biological Station Code in brackets)	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	Chronic
Dry Creek	Mine-exposed	LC_DC3	E288273	Dry Creek upstream of Headpond	658294	5540918	-	-	Q	-	-
	Reference	LC_DCEF	E288274	Dry Creek East Tributary near confluence with Dry Creek	658260	5541295	M	M	Q	-	-
	Mine-exposed	LC_SPDC[e]	E295211	Dry Creek sediment ponds outlet; effluent to Dry Creek	657821	5542042	W/M	W/M	Q	Q	-
	Mine-exposed	LC_DCDS	E295210	Dry Creek downstream of sediment ponds outlet	657766	5542073	W/M	W/M	Q	-	Q/SA[f]
	Mine-exposed	LC_DC2	-	Dry Creek approximately 0.6 km downstream from sediment ponds outlet	657445	5542561	-	-	Q	-	-
	Mine-exposed	LC_DC4	-	Dry Creek 1.6 km downstream from the sediment ponds outlet	657172	5543327	-	-	Q	-	-
	Mine-exposed	LC_DC1 (DRCK)	E288270	Dry Creek upstream of Fording Mine Road	656519	5544658	W/M	W/M	Q	-	-
Fording River	Mine-exposed	LC_FRUS[g]	295232	Fording River upstream of Dry Creek and Ewin Creek, and downstream of Chauncey Creek	656307	5545255	-	-	-	-	-
	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, 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 2.5).

[b] Parameters consistent with Permit 106970 (see Table 2.3 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 106970 requirement. Chronic toxicity testing as per permit 107517 requirement.

[e] Discharge water sampling location where toxicity testing was completed; however, not part of the summary of receiving environment sampling locations as per sections 5.1 and 5.4 of Permit 106970.

[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).

- *In situ* water quality (including temperature and dissolved oxygen) at routine water quality monitoring locations.
- In addition, fish tissue sampling was completed opportunistically using WCT mortalities that occurred due to stranding (see Section 1.3). Although fish tissue quality monitoring is not included in the LAEMP study questions, these data have been incorporated into the discussion of Study Question 5 (Fish and Fish Habitat).

The timing of sampling, as well as the methods associated with sample collection, laboratory analysis, and data analyses are described in the following sections.

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 in accordance with monitoring requirements under Permit 106970, as well as data collected at unpermitted biological monitoring areas (Tables 2.2 and 2.3).

Receiving water quality is monitored at permitted areas in Dry Creek (LC_SPDC, LC_DCDS, and LC_DC1), the Fording River (LC_FRB), low[7] mine-exposure area Grace Creek (LC_GRCK) and reference areas Dry Creek East Tributary and Unnamed Creek (LC_DCEF and LC_UC; Table 2.1 and Figure 2.1). Sampling location FR_FR5 was included as an alternative to area LC_FRUS, a Fording River area also upstream of Dry Creek, which was removed from Permit 106970 in September 2015. FR_FR5[8] is not a permitted water monitoring area, and in 2020, water quality at FR_FR5 was sampled monthly from May through December (Table 2.2). Water samples were collected from Dry Creek areas LC_DC3 and LC_DC4 monthly prior to, and weekly following the start of freshet in 2020. Water samples were collected from Dry Creek area LC_DC2 monthly prior to September 23rd, and weekly from then onward. Water samples were collected monthly from reference area LC_DCEF (Table 2.2), and concurrently with biological sampling conducted in May and September at LC_FRUS in 2020. At area LC_SPDC, extension of the pipe bypassing the discharge channel was completed in October 2020, and water samples for routine monitoring and selenium speciation have been collected from the decant of this pipe since completion of that construction (LC_SPDC; Figure 1.5).

[7] Grace Creek is downgradient of the LCOII development footprint however it is far enough from mine property that mine-influence is low relative to Dry Creek.

[8] FR_FR5 is located approximately 4.5 km upstream of LC_FRUS, with Ewin Creek (a reference tributary not influenced by mining) entering the Fording River between LC_FRUS and FR_FR5 (Figure 2.1).

Table 2.3: Water Quality Parameters Required Under Permit 106970[a]

Category	Parameters
Field Parameters	water temperature, specific conductance, dissolved oxygen (DO), pH
Conventional Parameters	pH, DO, specific conductance, total dissolved solids (TDS), total suspended solids (TSS), hardness, alkalinity, dissolved organic carbon (DOC), total organic carbon (TOC), turbidity
Major Ions	bromide, fluoride, calcium, chloride, magnesium, potassium, sodium, sulphate, sulphide
Nutrients	ammonia, nitrate, nitrite, total Kjeldahl nitrogen (TKN), orthophosphate, total phosphorus, biochemical oxygen demand
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 5, Appendix 2A of Permit 106970.

Collection of selenium speciation samples from Dry Creek LAEMP areas began in late 2018. Selenium speciation sampling frequency was variable[9] on Dry Creek in 2019 and 2020, but sampling was conducted weekly at most areas from March to November 2019 and March through December 2020. Selenium speciation sampling frequency was also variable at area LC_DCEF with samples generally collected monthly with the exception of November and December 2019. Selenium speciation sampling was only conducted concurrently with biological sampling (i.e., not routinely) at areas LC_GRCK, LC_FRB, and LC_FRUS. Selenium speciation samples were not collected at areas FR_FR5 or LC_UC.

Detailed annual water quality reports are submitted by Teck to ENV quarterly and interpreted annually in accordance with Permit 106970 (Teck 2021a). Data from 2012 to the end of December 2020 were downloaded from Teck's EQuIS™ database for each of the above monitoring locations (Table 2.2), including:

- Order Constituents (cadmium, nitrate, selenium, and sulphate; Teck 2014)[10]
- Nutrient concentrations (i.e., nitrate [noted above], nitrite, ammonia, total phosphorus, and orthophosphate);
- Selenium concentrations (i.e., total and dissolved selenium concentrations, and selenium speciation results[11] including concentrations of selenate, selenite, dimethylselenoxide, methylseleninic acid, selenocyanate, selenomethionine, methaneselenonic acid[12] selenosulphate, and unknown selenium species);
- Concentrations with existing SPOs for Dry Creek (total selenium [noted above] and total cadmium) and/or have previously been identified via SDM and/or AMP response frameworks on Dry Creek (total selenium, nitrate, sulphate, and non-selenate selenium species [all noted above]);
- Concentrations of constituents with early warning triggers under the AMP (i.e., total dissolved solids, sulphate [note above], total concentrations of antimony, barium, boron,

[9] Selenium speciation sampling occurred more frequently than was prescribed in the study design (quarterly) at Dry Creek areas LC_DC3, LC_DCDS, LC_DC4, and LC_DC1, with samples generally taken weekly from April through December, but with some variability throughout the year. Selenium speciation sampling at area LC_DC2 was lower in 2020 than 2019 between March and August, and higher between September and December.

[10] Collectively referred to as "Order constituents" because they are specifically named in Provincial Order M113 issued in April 2013.

[11] Selenium speciation samples were first collected from Dry Creek in November 2018.

[12] The selenium species methaneselenonic acid is identified as an "unknown" selenium species (Se_Unknown; see Appendix I) eluting between methylseleninic acid and selenomethionine in laboratory reports associated with the LCO Dry Creek LAEMP. For the present report, these "unknown' species results have been identified exclusively as methaneselenonic acid throughout 2020 results to maintain consistency in data interpretation of selenium speciation results.

lithium, manganese, molybdenum, nickel, selenium [noted above], uranium, and zinc, and dissolved concentrations of cadmium [noted above] and cobalt);

- Concentrations of analytes with British Columbia Water Quality Guidelines (BCWQG; BCMOECCS 2019, 2021), SPOs for LCO Dry Creek (total selenium and total cadmium; ENV 2013, and/or water quality benchmarks (Teck 2014), see Appendix Table B.1 for a list of analytes and associated screening values; and
- *In situ* water quality data (i.e., temperature, pH, specific conductivity, and dissolved oxygen).

Quality assurance and quality control (QA/QC) measures associated with routine water quality monitoring were discussed in the annual water quality report for Permit 106970 (Teck 2021a). Quality control results associated with water samples collected concurrently with biological samples are discussed in greater detail in the Data Quality Review (DQR) in Appendix A (see Appendix I for applicable laboratory reports).

2.2.2 Laboratory Analysis

Water samples were analyzed by ALS Environmental, Calgary, Alberta, for parameters consistent with Permit 106970 (i.e., conventional parameters, major ions, nutrients, and total and dissolved metals) using standard methods (Table 2.3).

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

2.2.3 Data Analysis

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. Data extracted from Teck's EQuIS database were screened for text values and converted to a common unit (e.g., all metal concentrations were converted to mg/L). Values reported as less than a poor laboratory reporting limit (LRL) were removed from the data set, unless they consisted of 80% or more of the data. Poor LRLs were defined as values reported as < LRL for which the LRL exceeding the maximum observed (detected) value for that parameter.

Aqueous concentrations of the Order Constituents (dissolved cadmium, nitrate, total selenium, and sulphate; Teck 2014) observed at each monitoring area for the calendar year (i.e., January to December 2020) were compared to EVWQP level 1 and/or level 2 benchmarks (Golder 2014a, 2014b; Teck 2014; Appendix Table B.1). Concentrations of constituents with SPOs outlined in permit 106970 (total selenium and total cadmium; ENV 2013) were also compared to objective values for relevant areas (Appendix Table B.1). Concentrations of the remaining constituents listed in Section 2.2.1 were compared to applicable BCWQGs (BCMOECCS 2019, 2021), and to and/or water quality benchmarks if available (Golder 2014a, 2014b; Teck 2014). Plots of Order Constituents, constituents with early warning triggers under the AMP, and constituents with an SPO were prepared using available data from 2012 to 2020 for each monitoring area individually relative to BCWQGs and water quality benchmarks (where applicable), and as combined plots to allow for visual comparison among areas. Concentrations of aqueous selenium species selenate, selenite, dimethyl selenoxide (DMSeO), methylseleninic acid (MeSe([V]), and combined DMSeO and MeSe(IV) were plotted against benthic invertebrate tissue selenium concentrations for each Dry Creek area.

Annual means of water quality data were computed by first taking a mean of results within months and then averaging monthly means. If replicate sample results were available, the Kaplan-Meier (K-M) mean of the replicates was used. Monthly means were also calculated using the KM method. 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 2020) and involved calculating the area under the K-M *survival* curve. The K-M method is non-parametric and can accommodate multiple Laboratory Reporting Limits (LRLs).

A Principal Components Analysis (PCA) was completed to distill water quality results for use in benthic invertebrate correlation testing (Section 2.4.2). 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 Kaplan-Meier mean water chemistry parameters calculated from 2013 to 2020. 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 2020).

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 2020. 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 2020). 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 is 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:

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

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 5 pairwise comparisons, the minimum number required for all consecutive increases or decrease to be significant at α = 0.05.

An Analysis of Variance (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 2020. 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 Analysis of Variance (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 ($\alpha = 0.05$) then post-hoc contrasts were conducted to test for pairwise differences among years with an $\alpha = 0.05$ 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 = $(\bar{x}_i - \bar{x}_{2012})/\bar{x}_{2012} \times 100\%$

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 2020 annual mean against all historical means and the previous year (2019).

Following the completion of the statistical analyses outlined above, 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 as the focus for data interpretation. The four criteria applied to the water quality results are as follows:

> **Criteria 1:** Constituents had concentrations exceed applicable BCWQGs and/or site-specific effect benchmarks in > 50% of samples in a year for ≥ 50% (i.e., ≥ 3) of the mine-exposed areas on Dry Creek in 2020;
>
> **Criteria 2:** Seasonal Kendall trend analysis indicated significant increases in concentration with a trend slope (average percentage change in concentration per year) > 50% for ≥ 50% (i.e., ≥ 3) of the mine-exposed areas on Dry Creek in 2020;

Criteria 3: and 2-way ANOVA analysis indicated concentrations increased >100% between the first year of sampling and 2020 and were significantly higher in 2020 than 2019 at ≥ 50% (i.e., ≥ 3) of the mine-exposed areas on Dry Creek in 2020;

Criteria 4: Constituents that have existing SPOs for Dry Creek (total selenium and total cadmium) and/or have previously been identified by SDM and/or AMP response frameworks on Dry Creek (total selenium, nitrate, sulphate, and non-selenate selenium species).

Complete results for statistical testing of Dry Creek LAEMP water quality data from 2012 to 2020 can be found in Appendix Tables B.2 and B.3 (i.e., all constituents evaluated, see Section 2.2.1). Time-series figures of water quality constituents plotted against BCWQGs, regional benchmarks and normal ranges (where applicable) are included in Appendix B for constituents that were not the focus on more detailed interpretation (i.e., did not meet the criteria listed above).

2.3 Study Question 2: Acute and Chronic Toxicity

Water samples were collected quarterly at area LC_SPDC in 2020 by LCO operations for acute toxicity testing, as stipulated in Permit 106970 (Table 2.2). LC_SPDC was located in the discharge channel at the outlet of the DCWMS sedimentation ponds (Figures 1.4 and 2.1) and approximately 30 m upstream of the upper Dry Creek monitoring area LC_DCDS until October 2020. An extension of the pipe was completed in October 2020 to bypass the discharge channel, and acute toxicity samples will continue to be collected from the decant of this pipe (LC_SPDC) prior to Dry Creek. The following acute toxicity tests were conducted at LC_SPDC:

- Acute toxicity test using rainbow trout (*Oncorhynchus mykiss*); Report EPS 1/RM/9 July 1990 (with May 1996 and May 2007 amendments; Environment Canada 2007a); and
- Acute toxicity test using *Daphnia* spp.; Report EPS 1/RM/11 July 1990 (with May 1996 amendments; Environment Canada 1996).

Chronic toxicity tests were also completed on water samples collected quarterly and semiannually in 2020 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 completed as follows:

Quarterly tests:

- 72-hour growth/inhibition test using a freshwater alga (*Pseudokirchneriella subcapitata*), conducted using method: EPS1/RM/25 (Environment Canada 2007b); and

- 7-day test of reproduction and survival using a cladoceran (*Ceriodaphnia dubia*), conducted using method: EPS1/RM/21 (Environment Canada 2007c)[13].

Semi-annual tests - Q2 and Q4:

- 30-day early life stage toxicity test using rainbow trout, conducted using method: EPS 1/RM/28- 1E (Environment Canada 1998); and
- 28-day water-only test of growth and survival using a freshwater amphipod (*Hyalella azteca*), conducted using methods adapted from USEPA (2000). In 2019 Q2 *H. Azteca* test was invalid and therefore repeated in Q3 (Table 2.1).

Semi-annual tests - Q1 and Q3:

- 30-day early life stage toxicity test using fathead minnow (*Pimephales promelas*), conducted using methods: EPA-712-C-96-121; USEPA 1996; and E1241-05; ASTM 2013.

Mean test site responses were compared to responses for tests of samples from local reference areas. Chronic toxicity results for each individual endpoint for each species were then categorized into one of the three categories: 'no adverse response', 'possible adverse response', and 'likely adverse response'.[14] Toxicity tests and associated quality assurance/quality control (QA/QC) measures were completed and reported by the Nautilus Environmental Company Inc. contracted by Teck to complete tests in accordance with the above listed methods. The results were summarized in reports completed in accordance with Permits 106970 and 107517 (Teck 2021a, Golder 2021a).

2.4 Study Questions 3 and 4: Benthic Invertebrates

2.4.1 Overview

Timing of biological sampling on Dry Creek in 2020 (i.e., benthic invertebrate community and tissue chemistry) and calcite assessment was consistent with the 2020 LCO Dry Creek LAEMP study design (Minnow 2020b) with one exception. The 2020 LAEMP study design included

[13] A single bioassay was used for each test area, with the test allowed to continue to 8 days (per request of the EMC). The lab collected and compiled data for both 7- and 8-d test length, and the results of the two test durations for C. dubia are compared in the interpretive report (Golder 2021a).

[14] No adverse response: response not significantly lower than one or more references or response is below the regional normal range with an effect size of <20% relative to the mean of batch-specific references. Possible adverse response: response significantly lower than one or more references in the batch and not below the local normal range with an effect size of 20-50% relative to the mean of batch specific references or response is significantly lower than references and the local normal range, but not below the regional normal range. Likely adverse response: response significantly lower than one or more references in the batch and below the local and regional normal range or response is significantly lower than references but not below the local normal range with an effect size >50% relative to the mean of batch-specific references.

benthic invertebrate tissue chemistry sampling in December 2020 at LC_SPDC (Minnow 2020b), however this was not completed because the discharge channel area has been bypassed with an extension of the pipe from the sedimentation ponds now discharging directly to Dry Creek (Figure 1.5; see Section 1.3 for details). Therefore, no further biological sampling will be conducted at area LC_SPDC.

Sampling dates in 2020 were consistent with LAEMP sampling in 2019 (Minnow 2020a). LAEMP sampling events completed on Dry Creek in 2020 took place May 4 to 11, June 22 to 25, August 28 to September 3 (September[15]), and November 30 to December 2 (December[15]; Tables 2.4, and 2.5). A total of ten biological sampling areas were monitored in 2020, the same as those sampled in 2019 (Tables 2.1, 2.4, and 2.5; Figure 2.1).

Weekly sampling on Dry Creek was determined necessary as part of the SDM process response to elevated aqueous organoselenium concentrations at areas LC_DCDS and LC_SPDC in August 2020. This additional weekly sampling was beyond the scope of the 2020 LCO Dry Creek LAEMP study design (Minnow 2020b). Supplemental weekly sampling included additional benthic invertebrate tissue chemistry, water quality and aqueous selenium speciation monitoring consistent with LAEMP methods and occurred weekly from September 23rd to November 12th at areas LC_DCDS, LC_DC2, LC_DC4, and LC_DC1 (Tables 2.4 and 2.5; Figure 2.1).

2.4.2 Study Question 3: Benthic Invertebrate Community

Triplicate benthic invertebrate community samples were collected during each sampling event (Table 2.4). Effort was made to target similar habitats for collection of both tissue and community samples within each sampling area (riffle habitat whenever possible). Replicates were collected from three stations within each sampling area either in separate riffles or in riffle sections as far apart from one another as possible (ideally a minimum of 50 m apart) where habitat allowed and sampling could be completed safely. Benthic invertebrate community samples were collected at all ten biological monitoring areas in May and September, and from areas LC_DCDS and LC_DC1 in June and December 2020 (Table 2.4).

Benthic invertebrate community samples were collected according to the Canadian Aquatic Biomonitoring Network (CABIN) protocol (Environment Canada 2012), which involves a three-minute- travelling kick collection using a net with a triangular aperture measuring 36 cm per side and a mesh (400 µm). During sampling, the technician moved across the stream channel (from bank to bank, depending on stream depth and width) in an upstream direction. The net was

[15] September and December LAEMP sampling began at the end of August and November, respectively. To keep references to those sampling events concise they will be referred to as the ‘September’ and ‘December’ LAEMP sampling trips.

Table 2.4: Benthic Invertebrate Community Sampling for Dry Creek LAEMP and Supplemental Sampling, 2020

Area		May	June	September	December
Mine-exposed	LC_DC3	n=3 (√)	-	n=3 (√)	-
Reference	LC_DCEF	n=3 (√)	-	n=3 (√)	-
Mine-exposed	LC_SPDC[b]	n=3 (√)	-	n=3 (√)	-
	LC_DCDS	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
	LC_DC2	n=3 (√)	-	n=3 (√)	-
	LC_DC4	n=3 (√)	-	n=3 (√)	-
	LC_DC1	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
	LC_FRUS	n=3 (√)	-	n=3 (√)	-
	LC_FRB	n=3 (√)	-	n=3 (√)	-
	LC_GRCK	n=3 (√)	-	n=3 (√)	-

Notes: "-" Indicates area was not sampled. " √" = target sample size was met.

[a] Supplemental sampling was implemented in response to increased aqueous organoselenium concentrations at LC_DCDS and LC_SPDC during sedimentation pond dewatering.

[b] Biological sampling was discontinued at area LC_SPDC following operational changes in October, 2020.

Table 2.5: Benthic Invertebrate Composite-Taxa Tissue Selenium Sampling for Dry Creek LAEMP and Supplemental Sampling, 2020

Area		According to 2020 LCO Dry Creek LAEMP Study Design				Supplemental Sampling[a]							
		May	June	September	December	23-Sep-20	30-Sep-20	6-Oct-20	15-Oct-20	21-Oct-20	28-Oct-20	5-Nov-20	12-Nov-20
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_SPDC[b]	n=5 (√)	n=5 (√)	n=5 (√)	-[b]	-	-	-	-	-	-	-	-
Mine-exposed	LC_DCDS	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
Mine-exposed	LC_DC2	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
Mine-exposed	LC_DC4	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
Mine-exposed	LC_DC1	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
Mine-exposed	LC_FRUS	n=5 (√)	-	n=5 (√)	-	-	-	-	-	-	-	-	-
Mine-exposed	LC_FRB	n=5 (√)	-	n=5 (√)	-	-	-	-	-	-	-	-	-
Mine-exposed	LC_GRCK	n=5 (√)	-	n=5 (√)	-	-	-	-	-	-	-	-	-

Notes: "-" Indicates area was not sampled. "√" = target sample size was met.

[a] Supplemental sampling was implemented in response to increased aqueous selenium concentrations following sedimentation pond dewatering

[b] Biological sampling was discontinued at area LC_SPDC following operational changes in October, 2020.

held immediately downstream of the technician's feet, so the detritus and invertebrates disturbed from the substrate were passively collected into 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, the contents poured into a labelled plastic jar, and preserved to a final concentration of 10% buffered formalin in water.

Consistent with the requirements of the CABIN sampling protocol, supporting habitat information (e.g., water velocity and depth, *in situ* water quality [temperature, dissolved oxygen, conductivity, and pH], periphyton coverage scores, and substrate characteristics [100 pebble count], etc.) was collected concurrent with benthic invertebrate community samples (Environment Canada 2012). As stipulated by the CABIN sampling method, the intermediate axis (i.e., the axis perpendicular to the longest axis) was measured for each of 100 pebbles, which were collected randomly at each benthic invertebrate sampling area. The pebbles were collected over an area that included the benthic invertebrate sampling path while avoiding characterization of previously-disturbed substrate. Moving through the sampling area, the technician stopped at every second step to reach down and evaluate the substrate nearest to the big toe of his/her right foot, taking care not to bias results by avoiding larger boulders. The intermediate axis of the pebble was measured in centimetres to two significant digits. If the pebble could not be picked up, it was measured in the water (e.g., large boulders and embedded cobbles). For every 10^{th} pebble encountered during sampling, an estimate of the degree of embeddedness in surrounding materials was recorded.

In addition to the CABIN requirements, measurements of calcite presence and concretion were made on a total of 100 particles (concurrent, and on the same particles used in the 100-pebble count) using methods described by Teck (2016). Consistent with the Teck methodology for monitoring calcite, an adaptation of the Wolman pebble count was used to characterize calcite deposition by also recording the presence (score = 1) or absence (score = 0) of calcite on each particle. The degree of concretion 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. The results for the 100 particles were then be expressed as a Calcite Index (CI) based on the following equation (Teck 2016):

$CI = CI_p + CI_c$

Where:

$$CI = Calcite\ Index$$

$$CI_p = Calcite\ Presence\ Score = \frac{Number\ of\ pebbles\ with\ calcite}{Number\ of\ pebbles\ counted}$$

$$CI_c = Calcite\ Concretion\ Score = \frac{Sum\ of\ pebbles\ concretion\ scores}{Number\ of\ pebbles\ counted}$$

Calcite measurements taken from 40 reference areas during 2015 sampling were used to characterize the regional calcite index normal range for the Elk Valley as part of the 2018 RAEMP report, and the upper limit (97.5th percentile) was defined as CI = 1.0 (Minnow 2018a).

2.4.2.1 Laboratory Analysis

Benthic invertebrate community samples were sent to Cordillera Consulting (lead taxonomist Scott Finlayson), in Summerland, BC, for sorting and taxonomic identification. Organisms were identified to the lowest practicable level (LPL; typically genus or species). At the beginning of the sorting process, the total number of preserved organisms in each sample was estimated. If the total number was estimated to be greater than 300, then the sample was sub-sampled for sorting and enumeration. In such cases, the CABIN method requires that a minimum of 5% of each sample (i.e., five cells in a Marchant sorting box) and 300 organisms be analyzed. Sorting efficiency and sub-sampling accuracy and precision were quantified using methods outlined by Environment Canada (2012). Total organism abundance was reported for every distinct taxon identified in each sample (see Appendix I for raw data).

2.4.2.2 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[16] as well as site-specific normal ranges[17].

[16] 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).
[17] 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).

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 2020 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). All statistics were conducted in R (R Core Team 2020).

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 September data for all years with paired mine-exposed and reference data. Mine-exposed areas of Dry Creek were compared to reference area LC_DCEF, where sampling was initiated in 2019. As such, temporal comparisons were limited to data from 2019 and 2020. Benthic invertebrate community endpoints from the Fording River downstream (LC_FRB) and upstream (LC_FRUS; "reference" for the purposes of the analyses) of Dry Creek were also compared temporally using data from 2018 to 2020. This comparison was completed to evaluate the potential influence of Dry Creek on the benthic invertebrate community in the Fording River. Benthic invertebrate community endpoints evaluated across years are listed above. For each endpoint, an overall Analysis of Variance (ANOVA) with factors Year, Area and Year × Area was fit. The ANOVA models and contrasts were conducted in R (R Core Team 2020) 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 Honestly Significant Difference test (HSD) which corrects for the number of comparisons.

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 2020).

Benthic invertebrate community data collected in all seasons (May, June September, and December) 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 2020 only to show the spatial variability in benthic invertebrate endpoints. The regional normal range is defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 2012 to 2019 data) reported in the 2017 to 2019 RAEMP report (Minnow 2020c). 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 reference monitoring areas. The site-specific normal ranges presented were those estimated using regression modelling for the RAEMP (Minnow 2020c).

Dry Creek Benthic invertebrate community structure was also assessed using a multivariate ordination technique known as correspondence analysis (CA), which is used to create synthetic species abundance axes extracted in a sequential manner. The purpose of the CA was to evaluate the community differences in terms of spatial and seasonal variability. Each score (number) on a CA axis is the sum of a weighted vector of species abundances. Species with correlated abundances vary together and have similar weights and scores on a CA axis. When depicted in two-dimensional plots, taxa that tend to co-occur plot together, while those that rarely co-occur plot farther apart. Similarly, areas sharing many taxa plot closest to one another, while those with little in common plot furthest apart. The greatest variation among either taxa or areas is explained by the first axis, with other axes accounting for progressively less variation. Therefore, this type of multivariate analysis describes not only which areas have distinct benthic communities, but also how these benthic communities differ among areas (i.e., which particular taxa differ in abundance). Analysis included all benthic invertebrate community samples across all seasons in order to determine the degrees to which seasonal and spatial differences among communities contribute to overall variability among benthic invertebrate community samples. Prior to CA, the data were screened for rare taxa, as these can distort results. Taxa occurring at five or fewer of the areas and constituting less than 0.05% of the total organism abundance (1% at the family level), were removed from the analysis. After screening and data reduction, abundances were log (x+1) transformed. Scores for both taxa and areas were calculated using the vegan package (Oksanen et al. 2019) in R (R Core Team 2020) to evaluate the associations of organisms and areas.

As recommended by the Environmental Monitoring Committee (EMC), an assessment of whether changes in physical and chemical parameters may be related to variability in benthic invertebrate community structure was conducted for September 2019 to 2020[18] data across all Dry Creek and Fording River areas. Spearman Rank Correlations were conducted with benthic invertebrate community endpoints including total abundance, taxonomic richness, %EPT, %Ephemeroptera, %Diptera, CA Axis 1, and CA Axis 2 against a variety of physical and chemical parameters (including water quality variables, substrate characteristics, habitat variables, and *in situ* water quality measurements; Appendix Figure D.4; Appendix Tables D.6 to D.8). CA Axis scores were calculated using the approach described above for CA, but using September data only rather than from all seasons. For water chemistry parameters, annual mean concentrations were calculated for different seasons and then averaged across the year prior to the benthic sampling date. 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 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 45 independent comparisons (corrected alpha = 0.05/45 = 0.00111). Water chemistry parameters were also analyzed using PCA (see Section 2.2.3 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 significantly correlated with physical or chemical variables were generated to visualize relationships (Appendix Figure D.4).

2.4.3 Study Question 4: Benthic Invertebrate Tissue

Benthic invertebrate tissue chemistry sampling was completed in accordance with the 2020 LCO Dry Creek LAEMP study design (Minnow 2020b), with the addition of supplemental weekly sampling outlined in Section 2.4.1. Four sampling events (May, June, September, and December) outlined in the LAEMP study design and eight supplemental weekly sampling events (weekly September 23rd to November 14th) were conducted in 2020 (Table 2.5). Five replicate composite-taxa benthic invertebrate tissue samples were collected from each

[18] 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.

sampling area during May, June, September, and December sampling events (Table 2.5). Three replicate composite-taxa benthic invertebrate tissue samples were collected from each sampling area during supplemental weekly sampling events (Table 2.5).

Samples were collected using the kick and sweep method described in Section 2.4.2, except that 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). These samples are useful for comparison to baseline data, and as an estimate of dietary selenium exposure for consumer organisms (e.g., fish, birds).

Upon collection of the sample using the kick and sweep sampling method, organisms in the sample were carefully removed from sample debris using tweezers until a minimum of approximately 0.5 g of wet tissue was obtained. Invertebrate tissue samples were then photographed to document taxa composition, placed into labelled, sterile, 20 mL scintillation vials and stored in a cooler with ice packs until transfer to a freezer later in the day.

2.4.3.1 Laboratory Analysis

Frozen samples were shipped by courier in coolers with ice packs to TrichAnalytics Inc. in Saanichton, BC. Samples were dehydrated upon receipt and were analyzed using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Results for selenium and other parameters were reported on a dry weight basis along with moisture content to allow conversion to wet weight values, as required (see Appendix I for laboratory reports).

2.4.3.2 Data Analysis

Composite-taxa benthic invertebrate tissue selenium concentrations were plotted for all areas (i) from 2018 to 2020; (ii) in May, June, September and December, 2020; and (iii) for weekly samplings between September and November, 2020 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 2020c);
- corresponding site-specific effect benchmarks (outlined in Table E.1);
- shading indicating the DCWMS operational status (DCWMS Operation, Dewatering/Bypass operation, and Bypass operation).

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 and is undertaking updates to a selenium speciation bioaccumulation tool to help predict and interpret bioaccumulation in areas with detectable organoselenium species (Bruyn and Luoma 2021). For every 2020 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.

Potential effects of different operational phases of the DCWMS on benthic invertebrate tissue selenium concentrations were evaluated for Dry Creek and Fording River areas from December 2018 through 2020. The analyses were completed by separately evaluating changes at each mine-exposed area of Dry Creek relative to reference (LC_DCEF) and at the Fording River downstream (LC_FRB) and upstream (LC_FRUS[19]) of Dry Creek. The ANOVA model that was fit to the data for each mine-exposed area (and the reference area) was:

$$Y = CI + Period\ + Time(Period) + Period \times CI + Time(Period) \times CI + \epsilon$$

where:

- Y = response variable;
- CI = a fixed factor for area type with two levels (control [reference] and impact [mine-exposed]);
- Period = (DCWMS operation December [2018 to July 2020]), dewatering/bypass operational [July and August 2020], and bypass operational [September to December 2020], where each period included between one to eight individual sampling events and reflected the operational status of the DCWMS);
- $Period \times \mathrm{CI}$ = the interaction between $Period$ and CI with a significant effect suggesting the difference between mine-exposed and reference areas varies among periods;
- $Time(Period) \times \mathrm{CI}$ = the interaction between $Time(Period)$ and CI with a significant effect suggesting the difference between mine-exposed and reference areas varies among periods, but it depends on which sampling months are being compared; and

[19] LC_FRUS is not in reference condition but is upstream of the mouth of Dry Creek therefore is used as a “reference” in the comparison of conditions in the Fording River downstream of Dry Creek (LC_FRB) to evaluate potential effects of Dry Creek on the Fording River.

- ϵ = the error term.

Interpretation of the ANOVA table began by assessing the significance of the interaction between $Time(Period)$ and CI. If the interaction was significant, then the differences among mine-exposed and reference areas varied among DCMWS operational periods, but it depended on which sample months were compared. In that case, contrasts were conducted to determine differences between periods for each sampling event using an α = 0.1[20], with a Bonferroni correction for the number of tests. Contrasts were evaluated among all three DCWMS operational periods. Differences among sampling events within a given period were not statistically contrasted.

The magnitude of difference for a significant contrast was expressed in terms of the number of standard deviations as follows:

Magnitude of Difference = $\frac{(\bar{X}_1 - \bar{X}_2)}{S_r}$

where:

- $\bar{X}_1$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Sampling Event 1;
- $\bar{X}_2$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Sampling Event 2, and
- S_r= the standard deviation of the residuals in the ANOVA.

If the interaction term between $Time(Period)$ and CI was not significant, then the interpretation of the ANOVA table continued by assessing the significance of the interaction between $Period$ and CI. This term in the model assessed whether the relative differences between mine-exposed and reference area depended on period and if significant, contrasts (with Bonferroni correction) were used to compare among all time periods.

The magnitude of difference for a significant contrast was expressed in terms of the number of standard deviations using the equation above, where:

- $\bar{X}_1$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Time Period 1;
- $\bar{X}_2$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Time Period 2; and

[20] In this analysis a post-hoc bonferroni correction was required because the post-hoc comparisons were more complex. Because bonferroni correction is a more strict post-hoc correction that Tukey's HSD we used a more conservative p-value of 0.1 in the analysis.

- S_r= the standard deviation of the residuals in the ANOVA.

Testing the significance of the interaction terms is the key hypothesis of interest in these ANOVA models, as it tests for changes in the relative differences between the mine-exposed and reference areas over time. If all interaction terms are not significant, then it can be concluded that there are no period effects that can be attributed to DCWMS operational periods. If the interaction terms are significant, then the contrasts among sampling events within the "DCWMS operational" period also present a key tool for the purpose of evaluating DCWMS performance during operation. Data were log10-transformed prior to analysis using ANOVA. The ANOVA models and contrasts as well as plots for visualizing those results were conducted in R (R Core Team 2020).

Changes in September composite-taxa benthic invertebrate tissue selenium concentrations from 2018 to 2020 in Fording River sampling areas and from 2019 to 2020 for Dry Creek sampling areas were quantified using an ANOVA with factors Area and Year as their interaction. Response variables were log10 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 Year and Area was significant, as it was for selenium concentrations in Dry Creek Sampling Areas, it indicated that the differences between the areas changed over time and post-hoc comparisons were conducted to 1) test for differences between the first year of sampling and each subsequent year for each area, and 2) test for differences between the exposed and reference areas in each year.

When the Year was significant rather than the Area and the interaction between Year and Area, as it was for selenium concentrations in Fording River Sampling Areas, it indicated that there were no differences between the areas and annual differences remained unchanged across areas and post-hoc comparisons were conducted to 1) test for differences between the first year of sampling and each subsequent year for all areas, and 2) test for differences between the exposed and reference areas in all years.

For all significant post-hoc temporal comparisons, a magnitude of difference (MOD) between years was calculated as:

$$MOD_{Year} = \frac{MCT_{Year} - MCT_{Baseline\ Year}}{MCT_{Baseline\ Year}} \text{ x } 100\%$$

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

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

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

Changes in composite-taxa benthic invertebrate tissue selenium concentrations among months in 2020 for all Dry Creek monitoring areas (including reference; LC_DCEF). Areas were quantified using an ANOVA with factors Area and Month and their interaction. The factor Month included May, June, September, and December for each of the Dry Creek areas. Response variables were log10 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 2020 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 measure of central tendency (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.

Changes in composite-taxa benthic invertebrate tissue selenium concentrations between weeks from September to November in 2020 for Dry Creek Sampling Areas were also quantified using an ANOVA analysis, but with factors *Area* and *Week* and their interaction. The factor *Week* was categorized from Week 1 to Week 8 with Week 1 and Week 8 corresponding to sampling completed on September 23rd and November 12th, respectively at LC_DCDS, LC_DC2, LC_DC4, and LC_DC1. The analysis was completed as outlined above for the ANOVA with factors *Area* and *Month*, except that the MOD was calculated as the difference in MCT between given weeks and between given areas.

2.5 Study Question 5: Fish and Fish Habitat

Nupqu and AJM were retained by Teck to complete the Dry Creek Fish and Fish habitat Monitoring Program (DCFFHMP) in 2020. This study was initiated in 2016 (led by Ecofish Research Ltd. from 2016 to 2019) and characterized water temperatures and Westslope Cutthroat Trout (WCT) relative abundance, biomass, density, and spawning (Ecofish 2019; Ecofish 2020a). These data are used to assess whether changes in fish and fish habitat (including instream flows and calcite index) are occurring within Dry Creek as a result of mine operations. Westslope Cutthroat Trout is the only fish species present in Dry Creek.

In 2019, recommendations for the experimental design of the DCFFHMP were proposed to change from a Before-After response monitoring program[21] to an on-going trend analysis to support assessment of multiple stressors (Hatfield et al. 2019). Annual monitoring for the DCFFHMP from 2016 to 2019 was completed by Ecofish (2017, 2018, 2019, 2020a). In 2020, the DCFFHMP monitoring was conducted by Nupqu and AJM and is summarized in this document (Section 7). Previously completed components of the DCFFHMP include an instream flow study (Healey et al. 2016) and a fish habitat assessment procedure (FHAP) of Reaches 1 to 4 (Buchanan et al. 2017; Figure 2.1).

In 2020, fish collection efforts were not completed in Dry Creek in an effort to help reduce the potential for stress on Westslope Cutthroat Trout populations in Dry Creek related to DCFFHMP sampling activities. This exclusion of fish abundance and biomass monitoring in 2020 was based on feedback from the EMC and the Elk Valley Fish and Fish Habitat Committee (EVFFHC) and was implemented as a proactive measure in response to a decline in the Upper Fording River Westslope Cutthroat Trout population in 2019 (Cope 2020). It should also be noted that the

[21] Focused on the effects of implementation of the Dry Creek Water Management Strategy (DCWMS).

DCFFHMP work completed in 2020 did not assess physical habitat (Nupqu and AJM 2021) that was evaluated in previous monitoring years (e.g., stream gradient, habitat type, cover, and substrate characteristics). As a result, the 2020 DCFFHMP completed by Nupqu and AJM was restricted to water temperature monitoring and WCT redd surveys so the interpretation that can be derived from these is more limited than in previous LCO Dry Creek LAEMP reports. For the present report, supplemental analyses were completed (described below) using available data from Nupqu and AJM (2021) and from prior years to provide greater context than could be derived from 2020 results alone. Results of the work completed by Nupqu and AJM in 2020 are appended as a separate report (Nupqu and AJM 2021; Appendix F) and are adapted herein, in combination with supplementary analyses completed by Minnow, to assess whether changes in fish and fish habitat are occurring within Dry Creek as a result of mine operations (Section 7).

2.5.1 Fish Abundance and Fish Health

Ecofish monitored fish abundance from 2016 to 2019 using closed-area electrofishing at six sites in Dry Creek (Ecofish 2019 and 2020a). Minnow traps were also employed to capture WCT from 2016 to 2019 but this was not an efficient form of fish capture and was removed from planned study designs going forward (Ecofish 2020a). Analyses of these data yielded relative abundance and biomass density estimates for WCT in Dry Creek from 2016 to 2019. In 2020, closed-area electrofishing collections were excluded from the DCFFHMP in an effort to help reduce the potential for stress on WCT populations in Dry Creek related to DCFFHMP sampling activities (see above). As such, no WCT biomass or abundance data were included in the 2020 DCFFHMP.

Measures of fish population and community health were assessed from 2016 to 2019 (Ecofish 2019and 2020a). Measures of fish health previously reported include population age structure, geographic distribution of age classes, and relative fish condition. However, due to the reduced sampling program in 2020 these analyses could not be repeated.

A limited amount of individual fish tissue data is available from fish collected opportunistically as incidental mortalities associated with a dewatering event that occurred in October 2020. Twenty-one WCT were opportunistically sampled (out of a total of 25[22] WCT mortalities) for fish tissue chemistry and aging structure analysis as a result of their stranding on October 8th and October 10th. The stranding was the result of unexpectedly low flow rates as a result of construction upstream at area LC_SPDC. Reach 3 of Dry Creek was impacted by the flow manipulations resulting in fish mortalities in this area (Figure 2.1). The majority (n = 17) of fish were collected within 24 hours of the dewatering event (i.e., October 8th, 2020) and n = 8 fish were collected with 72 hours (i.e., collected on October 10th, 2020). Four fish were collected on

[22] Muscle tissue was collected from 21 WCT that were deemed viable for analysis based on the estimated time of collection from time of mortality. Four fish had decomposed to a point that precluded reliable analysis.

October 16th, 2020 but were not sampled for meristics due to the level of decomposition and uncertainty as to whether those mortalities were associated with the stranding event. Collected fish (n = 25) were measured (see details in Section 2.5.2) and biological samples were taken for aging (n = 15 fish), and to assess selenium concentration (n = 21 muscle tissue). The length and age of collected fish are presented along with relative condition and selenium concentration in muscle tissue. Following Ecofish (2020a) discrete age class size bins (size classes) were defined for specific WCT fork length ranges based on data collected from 2016 to 2019 (Ecofish 2019 and 2020a). Individual fish were then assigned to an age class based on their observed fork length[23].

Comparisons of WCT fish health (i.e., condition) in 2020 to previous years were not completed due to potential inaccuracies in 2020 for assessments of fish weight related to time between fish mortality and sample collection.

2.5.2 Fish Tissue Analysis

Tissue samples were opportunistically collected from the WCT mortalities that occurred associated with the dewatering event. This sampling is beyond the scope of the 2020 LCO Dry Creek study design (Minnow 2020b) and study questions (Section 1.2) but were included in the 2020 Dry Creek Local Aquatic Effects Monitoring Program (LAEMP) monitoring to better understand the dietary exposure of WCT in Dry Creek to selenium.

Sampling for seventeen fish was completed within 24 hours of mortality and sampling for eight fish was completed within 72 hours of mortality. Each WCT was assigned a unique identification code. Body weight was measured using an appropriately sized spring scale (e.g., 100 g, 500 g, 1,000 g). Total and fork length were determined using a measuring board equipped with a metre stick (± 1 mm). External fish condition, including the presence of any deformities, erosion, lesions, tumors, or parasites, was documented. To the extent possible, WCT gender was determined during dissection.

Dorsal muscle tissue samples were taken for metals analysis from each fish. A sterilized scalpel was used to cut a filet from each fish, skin was removed from the sample with a scalpel and the remaining muscle sample was placed into a sterile microcentrifuge tube. Following removal of the dorsal muscle sample, otoliths were removed (n=15) for aging structure analysis and the remaining fish was retained for whole-body pathology[24]. Samples were stored on ice until transfer to a freezer later in the day. Muscle tissue samples were sent to TrichAnalytics Inc. in

[23] Fish aging data were not considered to be reliable and so age estimates were based on an age-length key (Ecofish. 2020a).

[24] Pathology reports for these fish have not been provided to Teck at the time of reporting

Saanichton, BC where samples were analyzed using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (ICP-MS) as described in Section 2.4.3.1. Aging structures were sent to AAE Tech Services in Winnipeg, MB for analysis.

Muscle selenium concentrations were compared to upper and lower Fording River data from 2018 and the site-specific benchmark for WCT muscle tissue selenium toxicity developed for the Elk Valley (15.5 mg/kg dry weight [dw]; Elk Valley Water Quality Plan; Golder 2014b). Selenium concentrations in WCT muscle were also plotted against benthic invertebrate tissue selenium concentrations (individual results from September to November 2020) for areas LC_DCDS, LC_DC2, and LC_DC4 to assess how WCT tissue selenium concentrations compare to dietary selenium exposure in the vicinity of where the WCT were collected. WCT muscle tissue selenium concentrations were further plotted against mean benthic invertebrate tissue selenium concentrations for September, October, and November at areas LC_DC2, LC_DCDS, LC_DC4, and LC_DC1 relative to a 1:1 proportional relationship between WCT and benthic invertebrate tissue selenium concentrations. The purpose of this visualization was to assess the trophic transfer and bioaccumulation of selenium from benthic invertebrates to WCT upstream/downstream and before/after the stranding event. Comparison with a 1:1 proportional relationship between WCT and benthic invertebrate tissue selenium concentrations gives insight into WCT feeding location and timing, as well as the effects of elevated benthic invertebrate tissue selenium at Dry Creek areas closest to the DCWMS on fish tissue chemistry. To assess the selenium concentration in the ovary of adult female WCT, an ovary-to-muscle relationship of 1.6:1 was applied (Nautilus and Interior Reforestation 2011).

2.5.3 Redd Surveys

Redd surveys were completed in reaches 1 to 4 of Dry Creek by walking along the stream bank and visually enumerating observed redds and fish displaying spawning characteristics and / or behaviors in Dry Creek. Redd surveys were completed in both June and July from 2016 to 2018 and in 2020; in 2019 the survey occurred in early and mid-July (Ecofish 2019 and 2020a; Nupqu and AJM 2021). In 2020, redd surveys were completed on June 30th and July 7th. Both surveys began in Reach 1 at the railway immediately upstream of the Fording River Road (which is approximately a third of the length of Reach 1 upstream of the confluence with the Fording River), and ended in Reach 4 (Nupqu and AJM 2021). On June 30th, the survey ended midway through Reach 4, and on July 7th, the survey extended to the end of Reach 4 and included a survey of the East Tributary from its confluence with Dry Creek to the bridge upstream. An accompanying redd survey on the Upper Fording River was completed by Lotic Environmental Inc. on July 2, 2020 that included a survey of the portion of Dry Creek Reach 1 downstream of the Fording River Road.

These data were provided to Nupqu to avoid duplication of sampling in the lower portion of Reach 1 and the results of both surveys are described below.

2.5.4 Physical Habitat, Temperature, Dissolved Oxygen, and Flow

Physical habitat data including stream gradient, habitat type, cover, and substrate characteristics were collected at each of the closed-area electrofishing sites from 2016 to 2019 following methods described by Bech (1994), but were not measured in 2020 (Nupqu and AJM 2021). Some features of the physical habitat were measured during benthic invertebrate community monitoring completed as part of LAEMP sampling (See Section 2.4.2).

Guidelines for the protection of aquatic life (Oliver and Fidler 2001) state that water temperature should not exceed 19 °C or fall below 1 °C in coldwater tributary streams. The upper threshold of 19 °C is considered appropriate for WCT survival because this species has an upper incipient lethal temperature of 19.6 °C (95% CI = 19.1 to 19.9 °C; Bear et al. 2007). Optimum growth for WCT has been reported at 13.6 °C and suitable thermal habitat occurs where maximum daily temperatures are between 13 to 15 °C (Bear et al. 2007). However, exposure to prolonged periods of warm water is a useful indicator of potential thermal stress experienced by WCT and is calculated as mean weekly maximum water temperature (MWMxT). Hunter (1973) noted that the preferred MWMxT range of WCT is 9 to 12 °C and peak spawning occurs in temperatures from 6 to 17 °C. Optimal MWMxT for Cutthroat Trout rearing is similar, ranging from 7 to 16 °C (Oliver and Fidler 2001). Therefore, water temperature was assessed by determining the number of days each year when instantaneous or daily mean water temperatures exceeded 18 °C as a potential effects threshold for WCT (Ecofish 2019, Nupqu and AJM 2021), assessing minimum, maximum, and average monthly temperatures, and by determining the total number of days when mean daily temperatures were within 1 to 18 °C (Nupqu and AJM 2021).

The number of growing degree days was also calculated for each reach of Dry Creek. Growing degree days are calculated as the sum of temperatures for each day in a "growing" season; the growing season for WCT is defined as beginning the first week when average water temperature exceeds 5 °C and ending the first week that average water temperature drops below 4 °C (Coleman and Fausch 2007). For WCT, recruitment failure may occur when there are less than 800 growing degree days in a growing season, when 800 to 900 growing degree days are observed recruitment may be sustained in some years, whereas recruitment sufficient to sustain the population is expected when growing degree days exceed 900 (Coleman and Fausch 2007).

Rapid temperature changes of >1 °C per hour may result in thermal stress for WCT, so hourly temperature changes were evaluated from 2016 to 2020. From 2016 to 2019, water and air temperature were assessed based on data collected at seven instream and two air monitoring stations. Monitoring locations are reported in Ecofish (2019 and 2020a). In 2020, the same monitoring locations were used to assess instream water temperature with an additional logger was installed to provide air temperature data from June to October (Nupqu and AJM 2021). The new logger was located 100 m upstream of the Fording River. Two instream loggers from the DRY-WQ06 location were removed by Teck on October 7th prior to infilling of the sediment pond outlet channel (see Nupqu and AJM 2021 for details). Data quality assurance and quality control measures as well as summarization techniques used to assess water temperature endpoints are summarized in Nupqu and AJM (2021) and included in Appendix F.

The methods for assessing temperatures outlined above (i.e., evaluation of daily and monthly temperature, growing degree days, and hourly temperature changes) are consistent with those reported by Ecofish (2019) and Nupqu and AJM (2021; Appendix F) but differ from those outlined in Ecofish (2020b) as part of the Aquatic Data Integration Table (ADIT). The temperature evaluation approach detailed by Ecofish (2020b) focuses on comparing MWMxT to temperature screening values that were established based on optimal and lethal temperatures reported in the guidelines for juvenile Cutthroat Trout (Oliver and Fidler 2001). Temperature screening values focus on the juvenile life stage because this is the relevant life stage for the summer rearing period when peak annual temperatures are expected (Ecofish 2020b). It is recommended that the temperature assessment methods outlined by Ecofish (2020b) are used for data interpretation the 2021 LCO LAEMP since these are more suitable and easier to interpret in the context of the physiological requirements for WCT and for the purposes of the Aquatic Data Integration Table (ADIT) (Ecofish 2020b).

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 BCWQG for the protection of aquatic life (BCMOECCS 2021) state that long-term (chronic, 30-day mean) DO concentrations should not fall below 8.0 mg/L and that instantaneous (acute) DO should not fall below 5.0 mg/L. For buried embryos and alevins, the guidelines state that the 30-day mean DO concentrations should not fall below 11 mg/L and instantaneous (acute) DO should not fall below 9 mg/L. The annual minimum and 30-day mean DO concentrations at seven locations in Dry Creek in 2020 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.

Flow data were collected in Dry Creek by Teck and Kerr Wood Leidal (2021) at two hydrometric stations located at LC_DC1 and LC_DCDS in 2020. Mean daily, monthly, and annual discharge rates for 2020 were tabulated and mean daily discharge rates were plotted relative to timing and duration (periodicity) of life history activities for WCT. The life history periodicity ranges used in this evaluation were developed for WCT in Dry Creek and reviewed by the Aquatic and Riparian Task Group as part of the Dry Creek SDM process (Teck 2021b). Instream flow requirements (IFRs) for Dry Creek were outlined as part of the 2015 approval letter for the Dry Creek Water Management plan (Permit 106970; ENV 2015). Comparison of flow rates with IFRs was not conducted for the 2020 LAEMP since the development of updated IFRs is currently underway as part of the SDM process. Updated IFRs have been proposed in Teck (2021b) and once these have been formalized will be incorporated into the 2021 Dry Creek LAEMP reporting to develop a better understanding of the relationship between Dry Creek flows and fish habitat in the context of WCT life stage periodicity.

3 STUDY QUESTION 1: WATER QUALITY

3.1 Overview

Monitoring data were evaluated in this section to address Study Question #1: 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? To address this study question, monitoring of constituents listed under permit 106970 (Table 2.3) and concentrations of selenium species continued in 2020 (see Sections 2.2.1 and 2.2.3 for details). Water quality data were plotted and analyzed statistically to assess changes over time. Data were also evaluated against BCWQG and/or water quality benchmarks or interim screening values (Appendix Table B.1).

Water quality data collected concurrently with biological sampling for the present study were of acceptable quality as characterized by good detectability, concentrations below LRLs in almost all method blank samples, good laboratory precision and accuracy, and good field sampling precision. Therefore, the associated data are considered acceptable for this study. QA/QC associated with water samples collected routinely by Teck for Permit 106970 were discussed in the annual water quality report for Permit 106970 (Teck 2021a). Temporal changes in concentrations of aqueous constituents evaluated for the Dry Creek LAEMP were statistically evaluated as outlined in Section 2.2.3. Although 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 Section 2.2.1), detailed data interpretation was focused on those that satisfied the criteria listed in Section 2.2.3. These constituents included total selenium, nitrate, total nickel, sulphate, total cadmium, and organoselenium species[26] (Table 3.1). For graphical plots and the results of statistical analyses for remaining water quality constituents see Appendix B.

3.2 Total Selenium

Aqueous total selenium concentrations have increased significantly since the start of baseline and LAEMP monitoring at all Dry Creek areas, based on Seasonal Kendall results (Figure 3.1; Table 3.2; Appendix Figures B.33 and B.34; Appendix Tables B.2 and B.3). Mean total selenium

[26] This interpretation focused on organoselenium species (particularly DMSeO and MeSe(IV) specifically (excluding selenite and other individual selenium species) as elevated concentrations of those constituents are a need for a response was identified through the AMP response framework in 2020.

Table 3.1: Criteria for Detailed Evaluation of Water Quality Endpoints in 2020 LCO Dry Creek LAEMP

Water Quality Endpoint	Criteria for Inclusion			
	All Three Satisfied			Or Only
	2-Way ANOVA[a]	Seasonal Kendall[b]	Guidelines/ Benchmarks[c]	SPO or AMP/SDM[d]
Total Selenium	√	√	√	√
Nitrate	-	√	√	√
Nitrite	-	√	-	-
Total Nickel	√	√	√	-
Sulphate	√	√	-	√
Total Mercury	-	-	√	-
Total Lithium	√	-	-	-
Total Uranium	√	-	-	-
Total Dissolved Solids	√	-	-	-
Total Cadmium	√	-	-	√
Dissolved Cadmium	√	-	-	-
Total Zinc	√	-	-	-
Selenate	-	√	-	-
Organoselenium (DMSeO and MeSe[IV])	-	-	-	√

One or both criteria for detailed evaluation met.

Notes: "√" indicates criteria met. "-" indicates criteria not met.

[a] In 2-way ANOVA results analyte concentrations increased >100% between first year of sampling and 2020 *and* was significantly higher in 2020 than 2019 at ≥ 50% (i.e., ≥ 3) of the mine exposed areas on Dry Creek in 2020 (Appendix Table B.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 2020 (Appendix Table B.2).

[c] Analyte exceeded BCWQG and/or site-specific benchmark(s) in 2020 (Appendix Table B.4).

[d] Analyte has SPO for Dry Creek LAEMP area(s) under permit 106970 (ENV 2013) and/or elevated analyte concentrations have triggered AMP or SDM response frameworks (Appendix Table B.1).

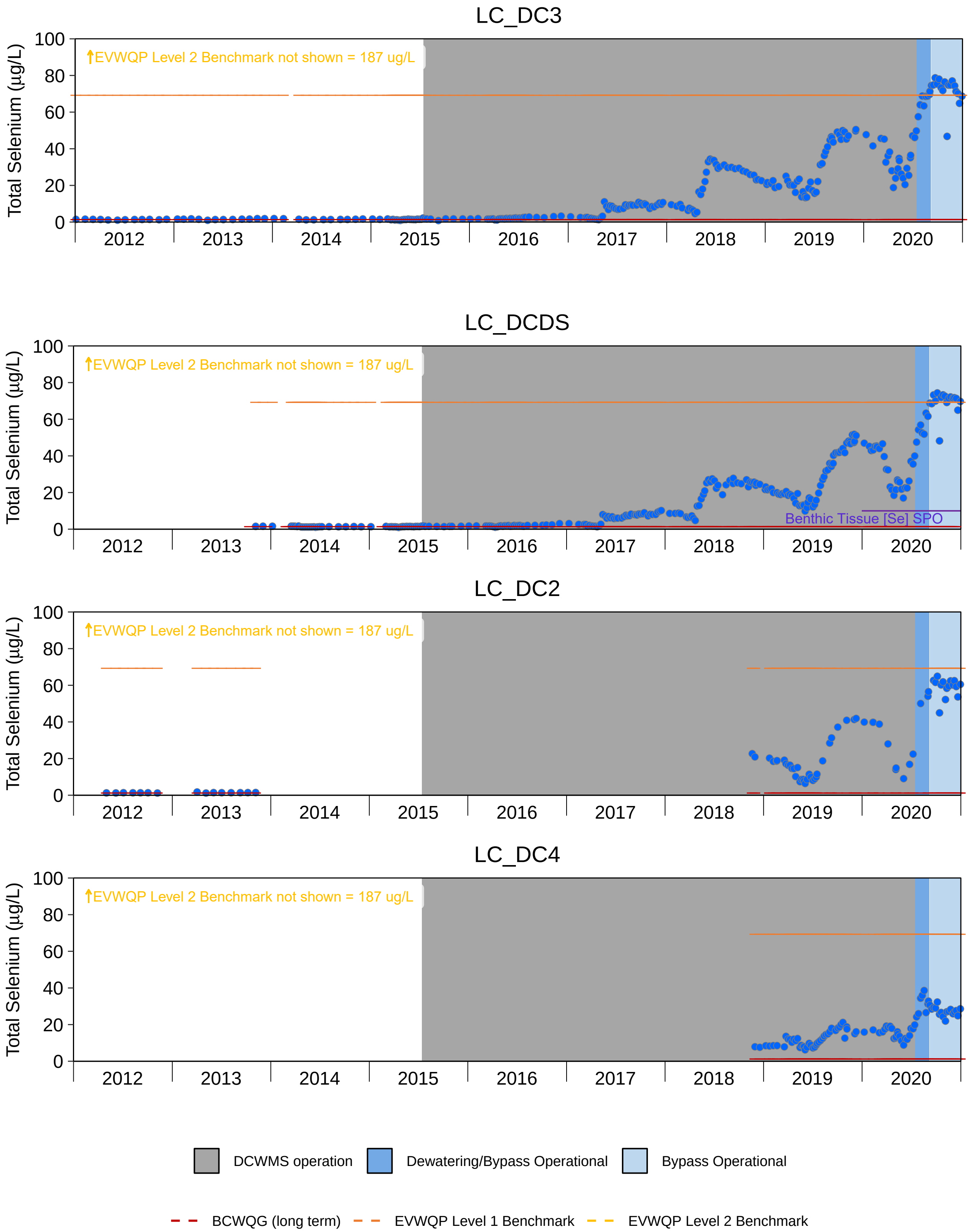


Figure 3.1: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

Table 3.2: Summary of 2020 Water Quality Statistical Results and Comparison with Benchmarks and Guidelines, Dry Creek LAEMP, 2020

Endpoint	Watercourse	Seasonal Kendall			2-way ANOVA				Exceedances	
		# of areas with significant increase	Areas with significant change	Range[a] of Mean Annual % Change	# of areas with significant increase	Areas with significant change	Range[a] of % change between first year[b] of sampling and 2020	Change between 2019 and 2020	BCWQG	EVWQP Benchmark
Selenium	Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	28 - 186	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	75 - 3,278	√	+	+
	Fording River	2	FR_FR5, LC_FRB	1 - 2.9	0	-	NS	-	+	+
	Other	1	LC_GRCK	1	0	-	NS	-	+	-
Nitrate	Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	32 - 571	1	LC_DC4	65 - 45,390	√	+	+
	Fording River	0	-	NS	0	-	NS	-	+	+
	Other	0	-	NS	0	-	NS	-	-	-
Nickel	Dry Creek	5	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC1	15 - 81	3	LC_DC3, LC_SPDC, LC_DCDS	252 - 1,604	√	-[c]	+[d]
	Fording River	0	-	NS	0	-	NS	-	-[c]	+[d]
	Other	0	-	NS	0	-	NS	-	-	-
Sulphate	Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	26 - 88	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	53 - 1,385	√	-	-
	Fording River	2	FR_FR5, LC_FRB	2.2 - 2.4	0	-	-	-	-	-
	Other	3	LC_UC, LC_DCEF, LC_GRCK	1 - 2.1	1	LC_UC	-	√	-	-
Total Cadmium	Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	5.5 - 20	4	LC_SPDC, LC_DCDS, LC_DC2, LC_DC4	28 - 204	√	-	-
	Fording River	0	-	NS	-	-	NS	-	-	-
	Other	0	-	NS	-	-	NS	-	-	-
Organoselenium	Dry Creek	1	LC_DC3	25	1	LC_DC3	75	√	N/A	N/A
	Fording River	-	-	-	0	-	NS	-	N/A	N/A
	Other	-[e]	-	-	-[e]	N/A	N/A	-	N/A	N/A

Significant increase.

Significant decrease.

Notes: "Other" refers to Grace Creek (LC_GRCK), Dry Creek East Tributary (LC_DCEF), and Unnamed Creek (LC_UC); "√" indicates significant change; "+" indicates 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] There is no BC water quality guideline for total nickel.

[d] Interim Elk Valley water quality plan benchmark for benthic invertebrate health.

[e] Selenium speciation samples not collected at areas LC_UC and LC_GRCK.

concentrations were significantly higher in 2020 than 2019 and higher in 2020 than the pooled means of all previous years sampled for areas on Dry Creek (as determined by the 2-way ANOVA). Significant increases over time also occurred at both reference areas (LC_DCEF and LC_UC) as well as areas FR_FR5, LC_FRB, and LC_GRCK (as determined by Seasonal Kendall analyses), but concentrations at those areas in 2020 were not significantly higher than 2019 or higher than the pooled means for all years sampled. The percent increase over time in total selenium concentrations was higher at areas in Dry Creek than at reference (LC_DCEF and LC_UC), Grace Creek (LC_GRCK) or the Fording River (FR_FR5, LC_FRB; Table 3.2; Appendix Tables B.2 and B.3).

Selenium concentrations exceeded the BCWQG (2 µg/L) for all samples from Dry Creek and Fording River monitoring areas in 2020. Selenium concentrations also exceeded the EVWQP level 1 benchmark (70 µg/L) at Dry Creek areas LC_DC3, LC_SPDC, and LC_DCDS as well as Fording River area FR_FR5 (Figure 3.1; Appendix Table B.4; Appendix Figure B.33). The EVWQP benchmark for selenium was exceeded on Dry Creek for the first time in 2020 (Appendix Figure B.33). No samples from either reference area exceeded the BCWQG for total selenium in 2020.

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). The SPO was exceeded in all 2020 samples at area LC_DCDS (Figure 3.1) and non-compliance reports were submitted to the British Columbia Ministry of Environment and Climate Change Strategy (formerly MOE, ENV) in each incidence (Teck 2021a). The SPO was not exceeded at LC_GRCK or LC_UC (Appendix Figure B.33).

The proportion of water samples in Grace Creek having selenium concentrations above the BCWQG was above the threshold required for further biological monitoring at that area (50% of samples >2 µg/L total Se) in 2020 (64%, Appendix Table B.4). The threshold was established anticipating future mine impact at LC_GRCK, which was not exceeded in 2019. Biological sampling was already ongoing at LC_GRCK in 2020 as a precautionary measure and will continue in 2021. Screening of 2021 LC_GRCK aqueous selenium concentrations against this threshold will be included in the 2021 Dry Creek LAEMP report.

Annual maximum and mean total selenium concentrations were highest at area LC_DC3 (the area farthest upstream on Dry Creek and closest in proximity to the LCOII expansion) in 2020. Selenium concentrations were similar to LC_DC3 at three areas closest to the downstream end of the DCWMS (LC_SPDC, LC_DCDS, and LC_DC2;) and lowest on Dry Creek at areas LC_DC1 and LC_DC4 in 2020 (Appendix Table B.4; Appendix Figure B.33). LC_DC1 and LC_DC4 are downstream of groundwater input from reference area LC_DCEF (Golder 2019b). The decrease in selenium concentrations at areas LC_DC4 and LC_DC1 is therefore more likely a result of dilution with groundwater flow from LC_DCEF than proximity to LCOII spoiling or DCWMS effects. Selenium concentrations were higher on Dry Creek than at both reference areas (LC_DCEF and LC_UC) and area LC_GRCK. Annual maximum and mean selenium concentrations at Fording River area FR_FR5 (farthest upstream of the mouth of Dry Creek) were higher in 2020 than areas LC_DC3 and Fording River area LC_FRB (downstream of the mouth of Dry Creek). Furthermore, selenium concentrations were higher at Fording River areas than the Dry Creek areas closest to the mouth of Dry Creek (LC_DC1; Appendix Table B.4; Appendix Figure B.33), all indicating there was no detectable influence of Dry Creek on total selenium concentrations in the Fording River in 2020.

Elevated concentrations of several mine-related constituents, including selenium, initially led to these results and future monitoring efforts being tracked with a potential need for response per the AMP response framework in 2018 (Section 1.4 for details; Teck 2019b). Investigations and adjustments as part of that response are currently ongoing.

3.3 Nitrate

Aqueous nitrate concentrations have increased significantly over time since mining started in this watershed at all Dry Creek areas (based on Seasonal Kendall results; Figure 3.2, Table 3.2; Appendix Table B.2). Results of the 2-way ANOVA indicated that nitrate was significantly higher in 2020 than 2019 and higher in 2020 than the pooled means of all previous years at area LC_DC4 (Table 3.2; Appendix Table B.2). High intra-annual variability in nitrate concentrations likely contributed to the lack of statistically significant differences over that period at the remaining Dry Creek areas, therefore limiting the conclusions that can be drawn from the statistical results. Despite the lack of statistically significant increase between 2019 and 2020 (due to high variability as described above), annual mean and maximum aqueous nitrate concentrations were higher in 2020 than 2019 at all Dry Creek areas (Appendix Table B.4, Minnow 2020a; Appendix Figure B.25). Nitrate concentrations have not changed significantly at any of the Fording River areas, reference areas, or LC_GRCK since 2019 (Table 3.2; Appendix Tables B.2, B.3).

Nitrate concentrations were higher than the BCWQG for long-term chronic exposure at Dry Creek and Fording River areas throughout 2020. The BCWQG for short-term acute exposure was also exceeded at LC_DC3 (46% of samples), LC_SPDC (38% of samples), LC_DCDS (35% of samples), and LC_DC2 (56% of samples) in 2020 (Figure 3.2; Appendix Table B.4; Appendix Figure B.25). Nitrate concentrations exceeded the EVWQP level 1 and 2 benchmarks in all samples from areas LC_DC3, LC_SPDC, and LC_DCDS, and in >90% of samples from area LC_DC2 in 2020 (Figure 3.2). The nitrate EVWQP level 1 benchmark was also exceeded in >90% of samples from areas LC_DC4 and LC_DC1 and in ≥50% of samples from these areas the level 2 benchmark was exceeded. In the Fording River, nitrate concentrations exceeded the

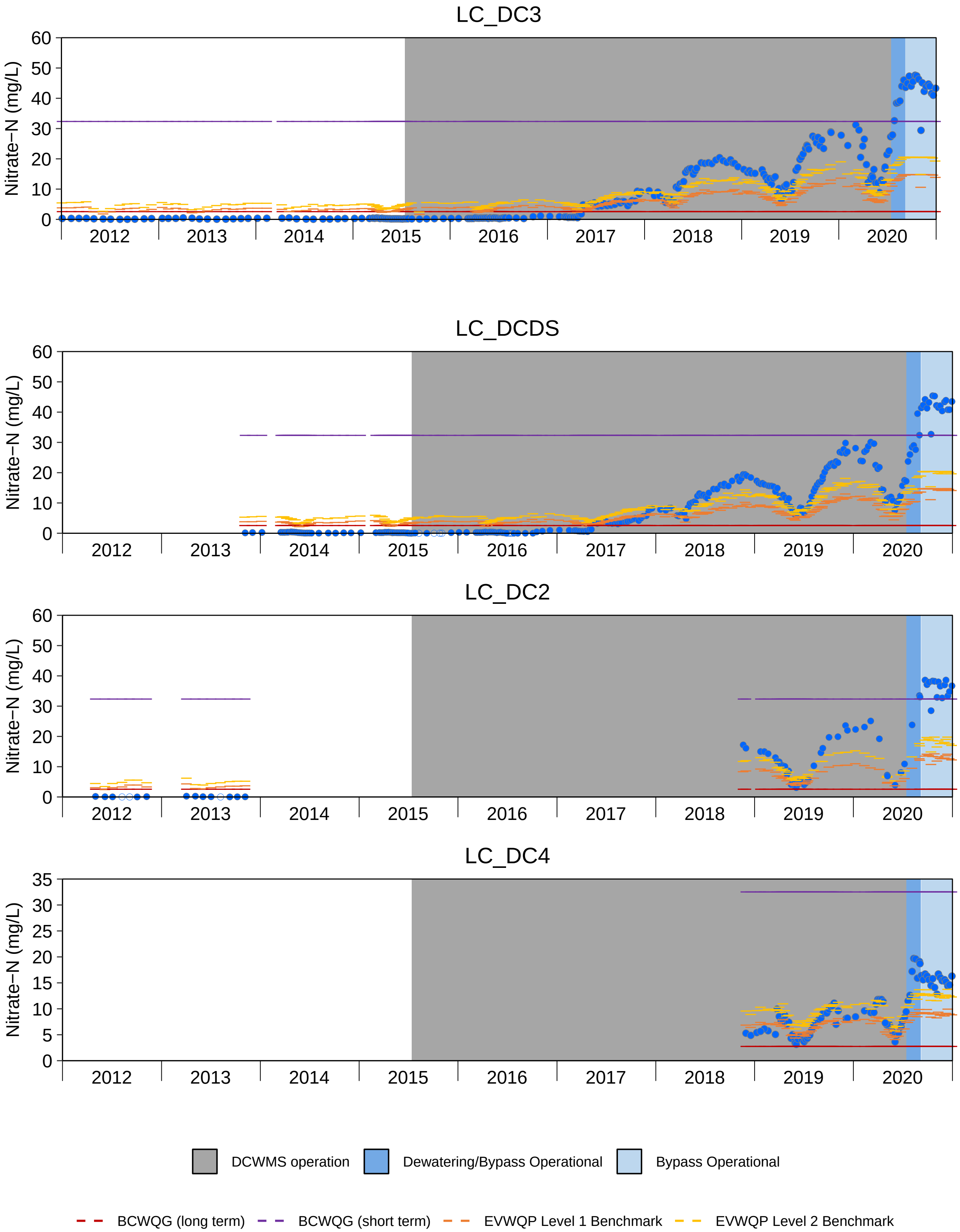


Figure 3.2: Time Series Plots for Nitrate−N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

EVWQP level 1 benchmark at areas FR_FR5 (75%) and LC_FRB (18%), but concentrations were below BCWQGs and EVWQP benchmarks at areas LC_DCEF, LC_UC, and LC_GRCK in 2020 (Appendix Table B.4; Appendix Figure B.25).

Annual mean and maximum nitrate concentrations in 2020 were highest on Dry Creek at area LC_DC3, followed by LC_SPDC, LC_DCDS, and LC_DC2, respectively (Figure 3.2). At areas LC_DC4 and LC_DC1 mean annual and maximum nitrate concentrations were less than half those observed at LC_DC2 in 2020 (Appendix Table B.4; Appendix Figure B.25). This indicates that dilution by groundwater input from LC_DCEF (between LC_DC2 and LC_DC4) is likely reducing nitrate concentrations downstream of LC_DC2. Annual mean and maximum nitrate concentrations in 2020 were higher at FR_FR5 than LC_FRUS and LC_FRB, which are located farther downstream on the Fording River (Figure 2.1). Mean and maximum annual nitrate concentrations were higher in the Fording River downstream of Dry Creek (LC_FRB) than upstream (LC_FRUS) in 2020 (Appendix Table B.4), however low sampling effort at LC_UC (n=2 for all of 2020) precludes reliable comparison between those areas. It is therefore unlikely that elevated nitrate in Dry Creek is impacting the Fording River downstream.

Elevated concentrations of several mine-related constituents, including nitrate, were 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 already underway 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 (~80% bagged at Dry Creek in 2019) to reduce nitrate releases from waste rock placed in the LCO Dry Creek watershed (Golder 2021b). Modelling results indicate effects on WCT early life stages in Dry Creek, and that the magnitude of those effects will be greatest at LC_DCDS. Effects of elevated aqueous nitrate concentrations on biota are discussed in more detail in sections 4, 5.4, and 7.5.3.

3.4 Total Nickel

Total nickel concentrations have increased significantly since the start of monitoring at all areas of Dry Creek except LC_DC4 (based on Season Kendall results; Figure 3.3, Table 3.2; Appendix Table B.2). Results of the 2-way ANOVA indicated nickel concentrations were significantly higher in 2020 compared with 2019 and compared to the pooled means of all previous years sampled at areas LC_DC3, LC_SPDC, and LC_DCDS (Table 3.2; Appendix Table B.3). Nickel concentrations have not changed significantly at the Fording River areas

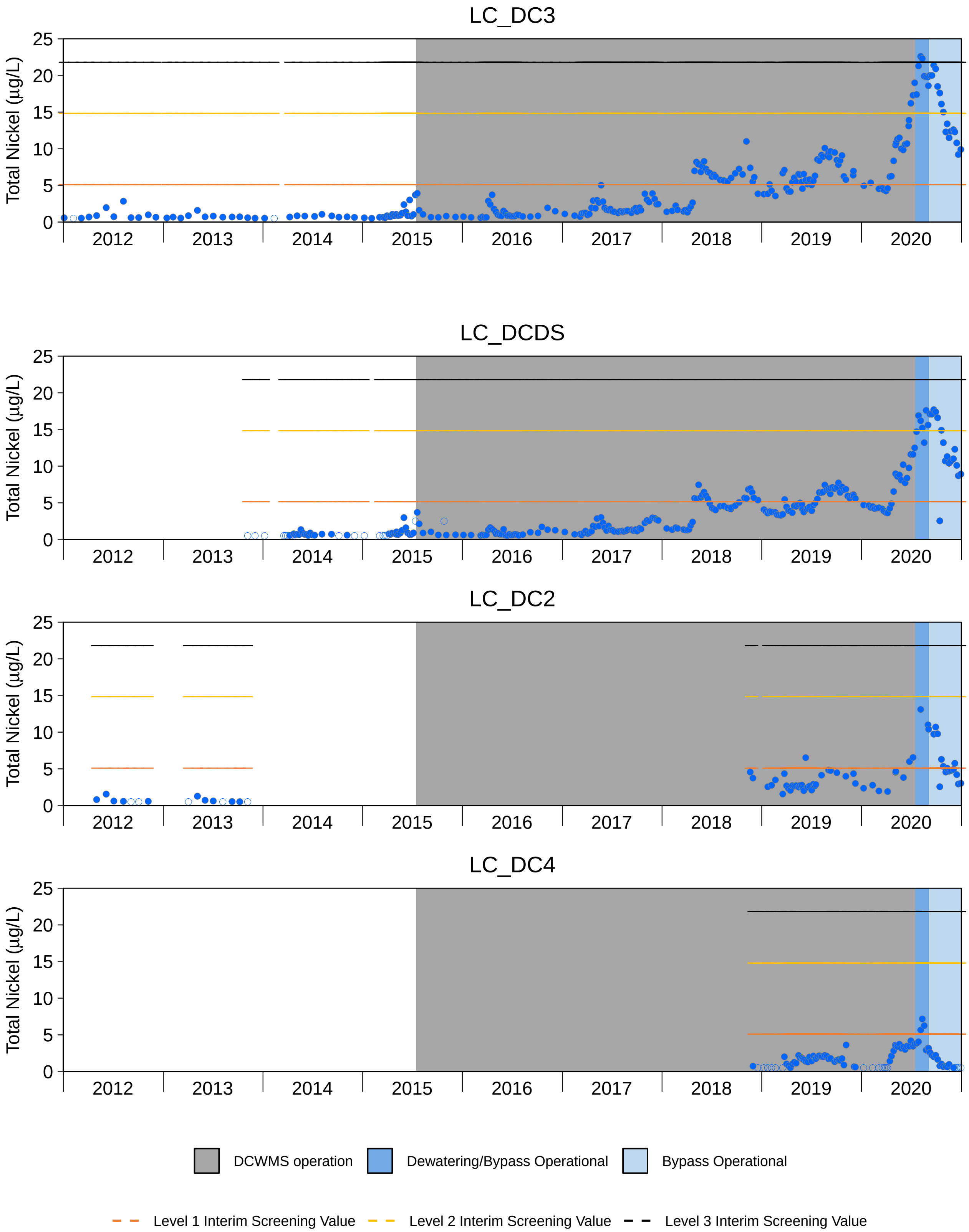


Figure 3.3: Time Series Plots for Total Nickel from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

(FR_FR5, LC_FRUS, and LC_FRB), Grace Creek (LC_GRCK), or either of the reference areas (LC_DCEF and LC_UC) since monitoring was initiated (Table 3.2; Appendix Table B.2; Appendix Figure B.23).

Nickel concentrations exceeded the level 1 interim screening value for benthic invertebrate health at all monitoring areas of Dry Creek except for LC_DC1 in 2020. In addition, nickel concentrations in 2020 exceeded the level 2 interim screening value at LC_SPDC and LC_DCDS, and the level 3 interim screening value at LC_DC3 (in 4% of samples), neither interim screening value having been exceeded previously on Dry Creek (Figure 3.3; Appendix Table B.4; Appendix Figure B.23). Nickel concentrations at areas LC_DC3, LC_SPDC, LC_DCDS, and LC_DC2 increased substantially more during the late summer peak than in previous years and did not decrease to seasonal minima below the EVWQP level 1 interim screening value in late 2020 as in late 2018 and 2019. Increases in nickel concentrations are related to spoiling of waste rock in Dry Creek, and modelling is currently underway to project nickel concentrations throughout the valley. Interim screening values were not exceeded at the Fording River areas, reference areas, or LC_GRCK.

Nickel concentrations on Dry Creek were highest at area LC_DC3, decreased at each successive area downstream, and were lowest at area LC_DC1. Annual mean nickel concentrations decreased by approximately half from LC_DCDS to LC_DC2 and from LC_DC2 to LC_DC1 (Appendix Figure B.23; Appendix Table B.4). The reduction between LC_DC2 and LC_DC4 is consistent with the groundwater input from reference area LC_DCEF between those areas as identified in the Golder accretion study (Golder 2019b), and similar changes in other aqueous constituents. However, the reduction between LC_DCDS and LC_DC2 was unexpected given the lack of groundwater or tributary input over that section of Dry Creek. Annual maximum and mean nickel concentrations at all Dry Creek areas were higher than Fording River areas upstream and downstream of the mouth of Dry Creek, both reference areas, and LC_GRCK. Mean annual nickel concentrations were similar among Fording River areas, but were highest at LC_FRUS, indicating that Dry Creek did not have a detectable impact on nickel concentrations downstream of the mouth of Dry Creek in 2020 (Appendix Table B.4).

3.5 Sulphate

Sulphate concentrations have significantly increased at all Dry Creek LAEMP areas (i.e., those on Dry Creek, Fording River, Grace Creek, and both reference areas) since the start of LAEMP monitoring, except for at area LC_FRUS (based on Seasonal Kendall results; Figure 3.4; Table 3.2; Appendix Figures B.37 and B.38)

The average percentage of annual increases at Dry Creek areas (26 to 88%) were at least an order of magnitude higher than Fording River areas (2.2 to 2.4%), reference areas (1.1 to 2.1%),

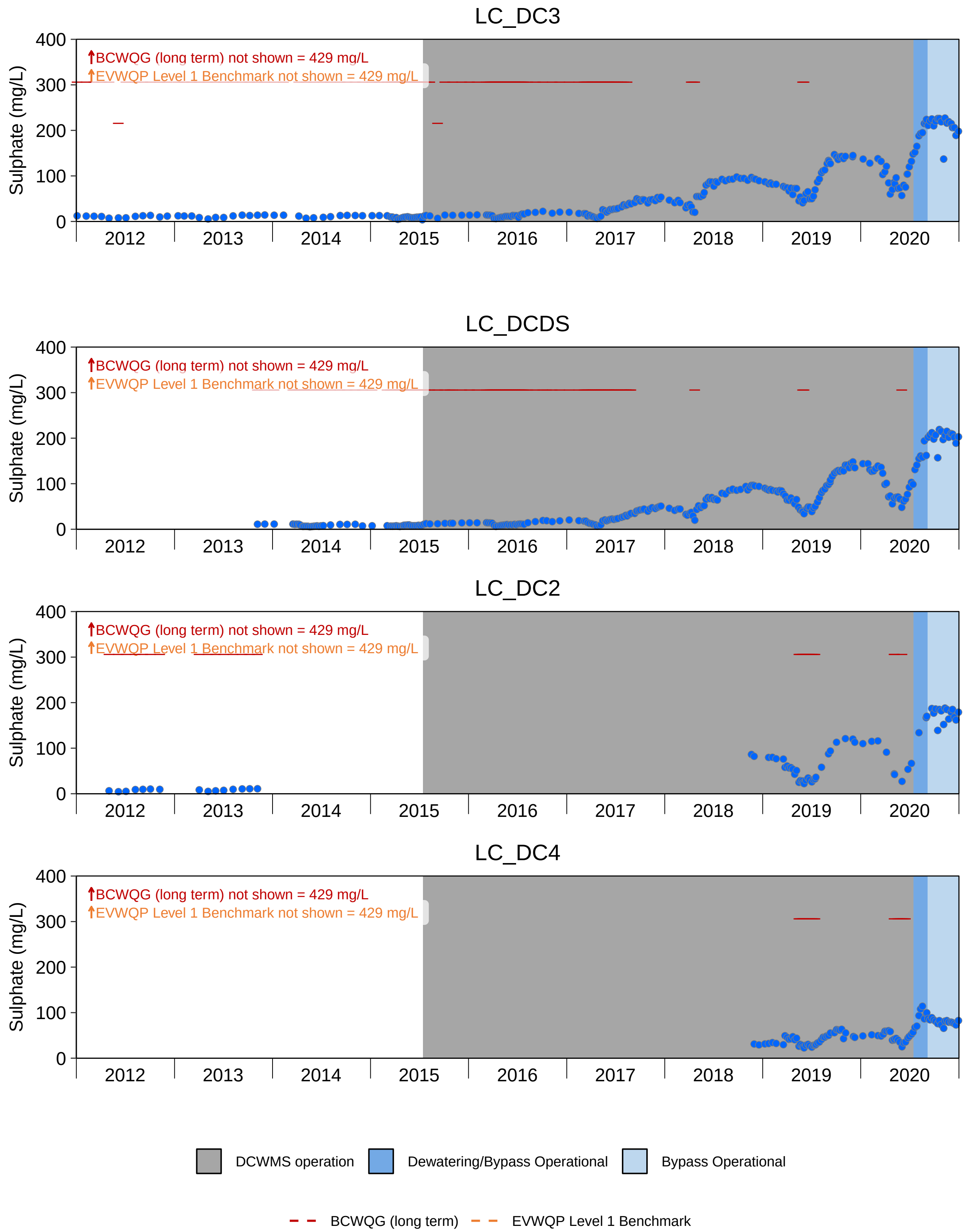


Figure 3.4: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. 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).

and Grace Creek (1.3%; Table 3.2). Results of the 2-way ANOVA indicated that sulphate concentrations at Dry Creek areas were significantly higher in 2020 than 2019, and significantly higher than the pooled means of monitoring data from 2012 to 2019 (Table 3.2; Appendix Table B.3).

Sulphate concentrations remained below the BCWQG and EVWQP benchmark throughout 2020 at all Dry Creek LAEMP monitoring areas (Appendix Table B.4; Appendix Figure B.37).

Dry Creek annual maximum and mean sulphate concentrations in 2020 were highest at area LC_DC3 and decreased at each successive area downstream. The largest decrease in sulphate concentrations occurred between LC_DC2 and LC_DC4. Sulphate concentrations at the Fording River areas upstream (FR_FR5) and downstream (LC_FRB) of the mouth of Dry Creek were higher than area LC_DC3, indicating that Dry Creek did not have a detectable impact on Fording River sulphate concentrations in 2020 (Appendix Table B.4; Appendix Figure B.37). A need for a response to elevated concentrations of several mine-related constituents, including sulphate, was identified via the AMP response framework in 2018 (Section 1.4 for details; Teck 2019b). Investigations and adjustments as part of that response are ongoing.

3.6 Total Cadmium

Total cadmium has significantly increased since the start of LAEMP monitoring at all monitoring areas of Dry Creek (based on Seasonal Kendall results; Figure 3.5; Table 3.2; Appendix Tables B.1 and B.2). Average annual percentage increases ranged from 5.5% (LC_DC1) to 20% (LC_DC4 and LC_SPDC). Total cadmium concentrations were significantly higher at Dry Creek areas LC_SPDC, LC_DCDS, LC_DC2, and LC_DC4 in 2020 compared with 2019 values and pooled means of all previous years sampled (based on 2-way ANOVA results; Table 3.2; Appendix Table B.3).

There are BCWQGs and EVWQP benchmark values for dissolved cadmium, but no such guidelines or benchmarks exist for total cadmium (Appendix Table B.1). Permit 106970 outlines an SPO for total cadmium at Dry Creek area LC_DCDS as well as Grace Creek and Unnamed Creek that came into effect January 1, 2020 (ENV 2013). There was an exceedance of the SPO for total cadmium at LC_DCDS on June 2, 2020, and it was therefore included for detailed evaluation (Table 3.1; Appendix Table B.4; Appendix Figure B.9). The result was 0.342 µg/L, while the calculated SPO in this instance was 0.30 µg/L, based on a hardness value of 163 mg/L. The exceedance was reported to ENV on April 9, 2021 (Teck 2021a).

Annual mean and maximum total cadmium concentrations in 2020 were highest on Dry Creek at areas LC_DC3 and lowest at area LC_DC1 (Appendix Table B.4; Appendix Figure B.9). Concentrations decreased by approximately half between LC_DC2 and LC_DC4, likely due to

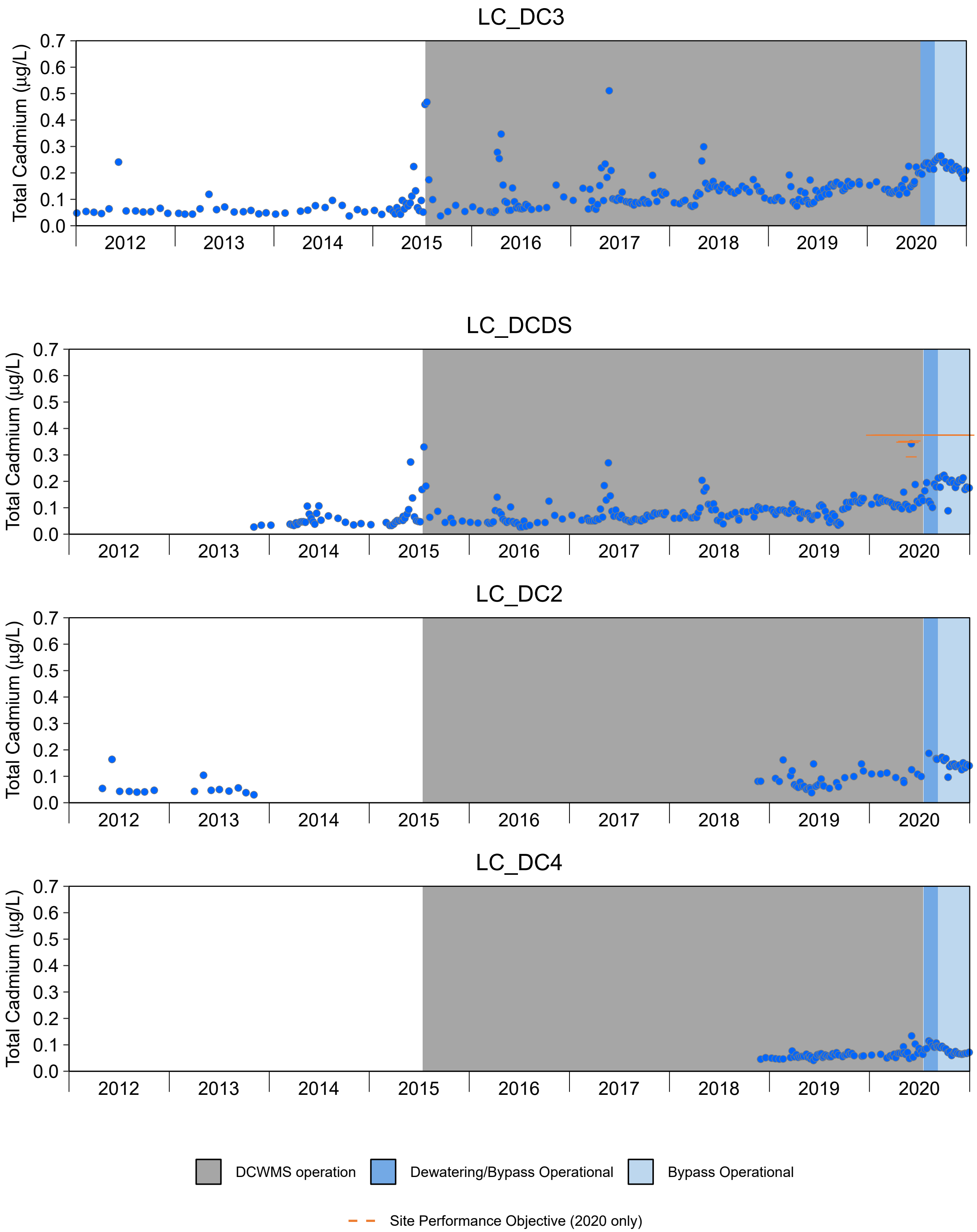


Figure 3.5: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

groundwater input from reference area LC_DCEF entering Dry Creek at that point. Annual mean total cadmium concentrations were similar among Fording River areas 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 2020.

3.7 Organoselenium

Temporal statistical comparisons were completed for Dry Creek monitoring areas and LC_DCEF between 2019 and 2020 but were not completed for the areas LC_GRCK, LC_FRUS, and LC_FRB due to low overall replication in 2019 and 2020. Statistical comparisons did not include available data from 2018 due to low replication in that year. DMSeO concentrations at LC_DC3 were significantly higher in 2020 than 2019, with the increase estimated as between 25% (as determined by Seasonal Kendall analyses) and 75% (as determined by 2-way ANOVA analyses; Table 3.2, Figure 3.6; Appendix Tables B.2, B.3). DMSeO concentrations did not increase significantly downstream of the DCWMS between 2019 and 2020, and MeSe(IV) concentrations did not increase significantly between 2019 and 2020 throughout Dry Creek monitoring areas (Appendix Tables B.2, B.3; Appendix Figure B.43).

Water quality guidelines or site-specific benchmarks applicable to Dry Creek do not exist for aqueous organoselenium species. Concentrations of DMSeO and MeSe(IV) were generally similar and highest among areas located closest downstream of the DCWMS (LC_SPDC, LC_DCDS, and LC_DC2; Figure 3.6). DMSeO and MeSe(IV) concentrations peaked at those areas in late summer 2019 and 2020 during pond dewatering. During the period of bypass there was little seasonal and overall variability in organoselenium concentrations downstream of the DCWMS (Figure 3.6, Appendix Figure B.43). These results support the theorized pathway wherein enhanced primary production and / or heterotrophic microbial activity in the sedimentation ponds promotes the generation of organoselenium compounds, which is the cause of increased tissue selenium concentrations in periphyton and benthic invertebrates downstream of the DCWMS (see also Section 6, Minnow 2020a, and Lorax 2020). Elevated concentrations of DMSeO and MeSe(IV) were detected at areas LC_SPDC and LC_DCDS during dewatering of the DCWMS in August 2020 (Figure 3.6). At LC_DCDS combined concentrations of DMSeO and MeSe(IV) ranged from <0.011 to 0.040 µg/L in July prior to dewatering, and ranged from 0.056 to 0.462 µg/L during dewatering in August (Figure 3.6, Appendix Table B.5). A separate investigation concluded that the increased concentrations of aqueous organoselenium species downstream of the DCWMS in Dry Creek were related to algal proliferation and reduction of selenium in the sedimentation ponds (Lorax 2020). The increased organoselenium concentrations downstream of the DCWMS in August 2020 were consistent with the flushing of these bioaccumulated organoselenium species from the sedimentation ponds

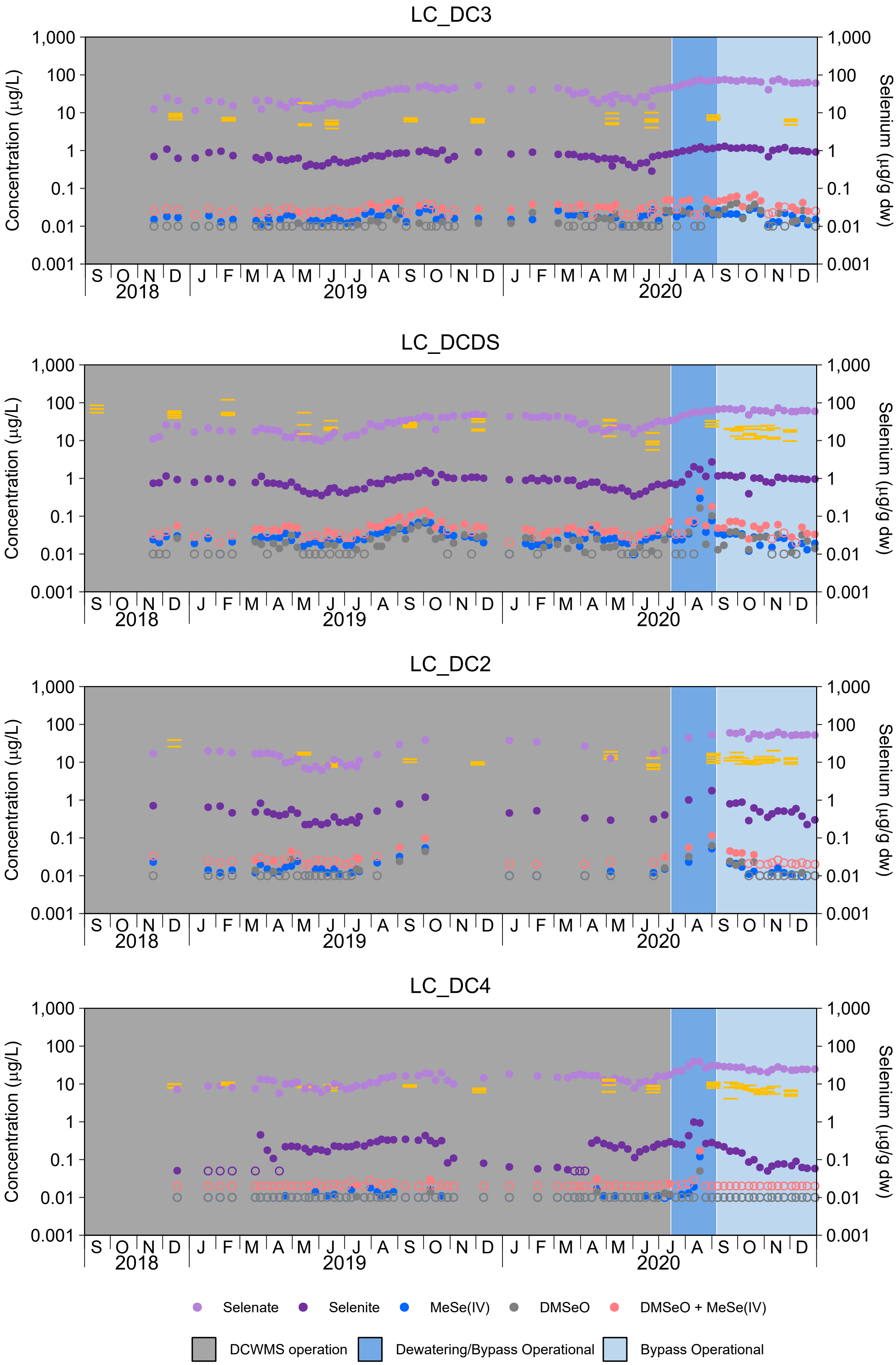


Figure 3.6: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, January 2018 to December 2020

Notes: Samples at the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars. DCWMS shading does not apply to all areas. 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).

during dewatering. Following pond dewatering, with the DCWMS bypass active, organoselenium concentrations at LC_DCDS were lower in late summer and fall 2020 than over the same period in 2019 when the DCWMS was active (Figure 3.6). This demonstrates the overall effect of seasonal DCWMS bypass was an attenuation of the late summer peak in DMSeO and MeSe(IV) concentrations downstream of the DCWMS. Concentrations of DMSeO and MeSe(IV) were below detectable levels in most samples from LC_DC4 and LC_DC1 in 2019 and 2020 (Appendix Figure B.43 Appendix Table B.5) likely due to a combination of distance downstream from the DCWMS, dilution from LC_DCEF groundwater input downstream of area LC_DC2 (Golder 2019b), uptake by periphyton, and degradation of organoselenium species (via hydrolysis and / or photolysis) into species such as dimethyl selenide and dimethyl diselenide (Golder 2021b).

Organoselenium concentrations were below detectable levels in all samples collected in 2020 from reference area LC_DCEF, Fording River areas LC_FRB and LC_FRUS, and LC_GRCK (Appendix Figure B.43 Appendix Table B.5). These results indicate that Dry Creek did not have a detectable impact on organoselenium concentrations in the Fording River in 2020, including during DCWMS dewatering.

3.8 Nutrient Status

Dry Creek was nitrogen and phosphorus co-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 on Dry Creek concurrent with increasing nitrate concentrations (Figure 3.2). As a result, Dry Creek nutrient limitation shifted to phosphorus limitation over the same period total since phosphorus concentrations did not increase, and even decreased at area LC_DC1 (Figure 3.7; Appendix Tables B.2 and B.3).

Trophic status on 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 (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 have positive effects on productivity; however, concentrations can reach nuisance and even toxic levels that cause impairment to biological communities (CCME 2016). As Dry Creek is now phosphorus limited and its trophic status is moving in the direction of eutrophication, it is unlikely that further increases in nitrogen concentrations will contribute positively to productivity in existing Dry Creek biological communities. Given nitrate concentrations have exceeded BCWQGs (including the

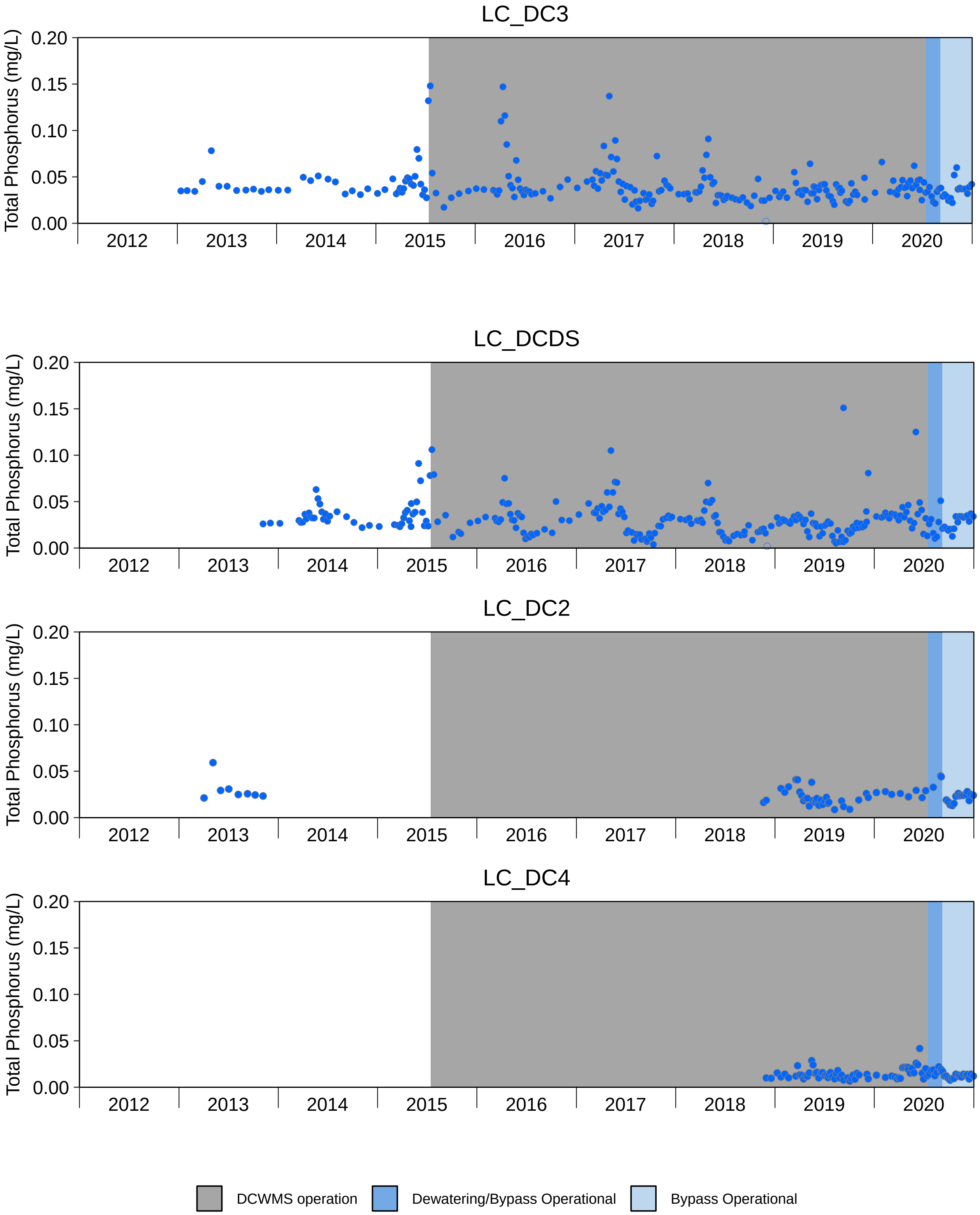


Figure 3.7: Time Series Plots for Total Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

maximum for short-term exposure) and EVWQP benchmarks on Dry Creek, it is likely that nitrate is already acting as a stressor in Dry Creek.

3.9 Summary

Concentrations of mine-related constituents including total selenium, nitrate, total nickel, sulphate, and total cadmium, have increased over time on Dry Creek. Constituents including nitrate, total selenium, and total nickel exceeded guideline and/or benchmark (where applicable) values on Dry Creek in 2020. Constituent concentrations were more frequently elevated at areas LC_DC3 (the Dry Creek area immediately downstream of LCOII spoiling and prior to DCWMS effects), 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. Aqueous organoselenium (specifically DMSeO and MeSe[IV]) concentrations were elevated at areas LC_SPDC and LC_DCDS during DCWMS sedimentation pond dewatering in August 2020; however, activation of the DCWMS bypass reduced concentrations to levels lower than observed over the same periods in 2019. Similar trends in aqueous constituents were not detected on the Fording River downstream of Dry Creek or on Grace Creek (LC_GRCK).

Elevated concentrations of mine-related constituents have been continually monitored as a need for a response was identified via the AMP response framework in 2018. Continuing investigations into causes of and mitigation options for increasing concentrations of aqueous constituents are currently underway. Operational changes to the DCWMS including development and implementation of the seasonal bypass and modification of discharge channel area LC_SPDC (Figure 1.5) have been completed to minimize organoselenium bioaccumulation and effects to biota. The inclusion of additional sampling areas and increased sampling frequency have been enacted to improve monitoring resolution and better detect changes in aqueous constituents and biota. Additional investigation of causes and effects (including integrated effects assessment modelling; Teck 2020b) of increased concentrations of aqueous mine-related constituents are currently underway. The LCO nitrate compliance action plan is under development alongside an updated LCO Dry Creek Water Management Plan that will outline the objectives and mitigation options.

4 STUDY QUESTION 2: AQUEOUS TOXICITY

Acute toxicity testing was conducted quarterly with water samples collected from LC_SPDC using the water flea *Daphnia magna* and rainbow trout in 2020. Out of 17 samples collected no samples caused mortality to either organism (Table 4.1; Appendix Table C.1).

Chronic toxicity testing was performed quarterly on water samples collected at LC_DCDS to evaluate potential effects on water flea (*Ceriodaphnia dubia*) and green algae (*Pseudokirchneriella subcapitata*). Semi-annual chronic toxicity tests were conducted to evaluate potential effects on amphipods (*Hyallela Azteca;* Q2 and Q4), fathead minnow (*Pimephales promelas;* Q1 and Q3), and rainbow trout (*Oncorhynchus mykiss;* Q2 and Q4). Results are discussed on species-specific bases below.

For quarterly tests in 2020 except for Q1, effects to *C. dubia* (survival and reproduction) were either not significantly different when compared to reference or were categorized as 'no adverse response' (i.e., based on low effect-size relative to reference and results falling within the local and normal range), according to decision criteria (Table 4.2; Golder 2021a). In Q1 of 2020, *C. dubia* reproduction for LC_DCDS showed a 'likely adverse response' (i.e., the response was significantly lower than one or more references and below the regional normal range). In Q4 2018 *C. dubia* reproduction showed a 'possible likely response' (i.e., the response was within the local and regional normal ranges but exhibited a 30% effect size when compared to the average reference response in Q4 2018). In Q2 and Q4 2016 *C. dubia* reproduction showed 'likely adverse responses'; however, the cause was not identified. Nitrate was identified as potentially causing the observed effects in both the 2018 and 2020 events, corresponding with elevated aqueous nitrate in those quarters (Section 3.3). Overall, chronic toxicity results for this species at LC_DCDS have been similar between 2018 and 2020, with the frequency of adverse responses greater than 2015 and 2017 (when no adverse responses were observed), but lower than 2016 (Table 4.2).

Effects on cell yield for *P. subcapita* (cell yield) at LC_DCDS were observed in Q3 but were not significantly different when compared to reference in any other quarter in 2020. *P. subcapita* cell yield for LC_DCDS in Q3 showed a 'possible adverse response' (Table 4.2). This was the first potential adverse response for *P. subcapita* at area LC_DCDS. The water quality constituent causing the observed effects on this species in 2020 are unknown (Golder 2021a).

Effects on dry weight and survival of *H. azteca* were observed at LC_DCDS in 2020 in Q2 and Q4, respectively (Table 4.2). *H. azteca* survival at LC_DCDS showed a 'likely adverse' response in Q4; however, variability among replicates within those tests was high (i.e., control-normalized survival response ranged from 38 to 84%) and results were not significantly lower than reference.

Table 4.1: Summary of Acute Toxicity Test Results for LCO Dry Creek LAEMP Monitoring Stations, 2020 (Teck 2021a)

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_SPDC	Dry Creek sediment ponds outlet; effluent to Dry Creek	2020	0	17	0	17

Acute toxicity test failure(s) (> 50% test mortality).

Table 4.2: **Results of Quarterly and Semi-Annual Chronic Toxicity Tests at LC_DCDS 2015 to2020[a] (Golder 2016, 2017a, 2018, 2019, 2020a, 2021)**

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]	-	-	-	-	-

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).
[boxed] 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 annotate with constituent identified as potentially contributing to observed response: H_RV = high inter-replicate variability NO3 = nitrate; 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.

A 'possible likely response' was observed for *H. azteca* dry weight at LC_DCDS in Q2 (Table 4.2). No water quality constituent was identified as potentially contributing to the observed responses observed in *H. azteca* at LC_DCDS in 2020 (Golder 2021a). In 2019 there were three potential adverse responses in *H. azteca* at LC_DCDS, with possible and likely adverse effects responses attributed to nitrate toxicity for *H. azteca* dry weight and survival, respectively, in Q4. Overall, in terms of frequency of potentially adverse responses toxicity to *H. azteca* at LC_DCDS was slightly lower in 2020 than 2019 (one fewer significant response for dry weight in 2020), and the mean percent survival and mean dry mass were generally higher in 2020 than 2019.

No potential adverse responses were detected for *O. mykiss* at LC_DCDS in 2020 for any of the four test endpoints (survival, viability, length, and wet weight; Table 4.2; Golder 2021a). Despite this result, every *O. mykiss* test in 2020 had evidence of microbes in one or more replicates. Two test results in Q4 2020 (low *O. mykiss* survival and viability) were significantly lower than one or more references but were classified as no adverse response. In 2019, the same Q4 tests resulted in 'likely adverse responses' for each endpoint (Table 4.2). Nitrate was identified as the potential cause of those responses in 2019, indicating that it may be related to toxicity to *O. mykiss* at LC_DCDS, although the effects unexpectedly did not result in potential adverse responses in 2020 despite elevated nitrate concentrations (Section 3.3).

Effects to fathead minnow survival and biomass showed a "likely adverse" response in Q1, 2020, however variability among replicates within those tests was high (ranging from 21 to 107% and 19 to 98%, respectively; Table 4.2; Golder 2021a). No water quality constituent was identified as potentially contributing to the observed responses observed in fathead minnow at LC_DCDS in 2020 (Golder 2021a). There were no other potential adverse responses in Q1, and none identified in Q3 (Table 4.2). No tests of toxicity on fathead minnow endpoints had evidence of microbial interference in either quarter. No potentially adverse responses were detected for fathead minnow in 2019, indicating that toxicity may have been higher in Q1 of 2020 (Table 4.2). However, the high variability in the 'likely adverse' responses, the lack of significantly low results in most other 2020 tests for fathead minnow, and generally similar test results preclude drawing conclusions around increasing toxicity of LC_DCDS water to fathead minnow between 2019 and 2020.

Overall, acute toxicity testing of Dry Creek DCWMS effluent showed no test failures in 17 samples collected at area LC_SPDC in 2020 (Teck 2021a). Although chronic toxicity effects were noted for LC_DCDS, there was a low proportion of adverse responses in 2020, only slightly higher than for 2019. Since 2018, nitrate was identified as potentially causing observed effects in tests with *C. dubia* (Q4 2018 and Q1 2020), *H. azteca* (Q4 2019) and *O. mykiss* (Q4 2019). No water quality constituents were identified as a potential cause of the remaining adverse results observed in all years. Potential adverse effects of Dry Creek water on biota have been attributed to nitrate toxicity intermittently between 2018 and 2020 although those attributions have been without a discernable pattern (Table 4.2). However, nitrate has been linked to potential adverse effects in LC_DCDS chronic toxicity tests every year since 2018 but not prior to this. This trend corresponds to the increasing trend in nitrate observed at LC_DCDS since 2018 (Section 3.3), possibly indicating the potential for increasing nitrate concentrations on Dry Creek to result in adverse effects on biota (see Sections 5.4 and 7.5.3 for further discussion of potential effects of nitrate to the receiving environment). It should be noted that all 'likely adverse' responses occurred for samples taken during lower-flow conditions (Q1 and Q4) when input from reference area upstream of the DCWMS (LC_DCEF; which has lower aqueous nitrate concentrations than in Dry Creek), is reduced. As a result of elevated nitrate concentrations and potential nitrate toxicity on Dry Creek, the need for a response via the AMP response framework was identified in 2018 and Teck has initiated mitigative actions including the LCO Nitrate Compliance Action Plan to manage water quality in the Dry Creek watershed.

5 STUDY QUESTION 3: BENTHIC INVERTEBRATE COMMUNITY

5.1 Overview

Benthic invertebrate communities were sampled in Dry Creek, the Fording River, and Grace Creek during May, June, September, and December 2020 LAEMP sampling 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 Regional Aquatic Effects Monitoring Program (RAEMP), and are the endpoints changing over time? In all Dry Creek LAEMP areas and across all sampling events communities were composed mainly of Ephemeroptera, Diptera, and Plecoptera (Figure 5.1; Appendix Tables D.1 to D.3).

Benthic invertebrate community data collected for the present study were of excellent 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 for interpretation.

5.2 Comparison to Normal Ranges

Endpoints related to benthic invertebrate community structure were evaluated relative to regional normal ranges and site-specific normal ranges defined in the RAEMP (Minnow 2020c). Normal ranges were developed using data from September sampling, so comparability with May, June, and December monitoring data is not possible due to high seasonal variability in benthic invertebrate community structure, so interpretation focused only on September data.

5.2.1 Dry Creek

Total benthic invertebrate abundance was within regional and site-specific normal ranges at all Dry Creek areas except for LC_SPDC and taxonomic richness (number of taxa identified to LPL) was within regional normal ranges for all Dry Creek areas except for LC_SPDC (at the DCWMS discharge channel; Figure 5.1). The total proportion of EPT (combined proportions of Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [Appendix Figures D.1 and D.2; caddisflies], all considered sensitive taxa; %EPT) was below the regional normal range for all samples from areas LC_DC3 (upstream of the DCWMS) and LC_SPDC, and in one sample from area LC_DC1, upstream of the mouth of Dry Creek. Percent EPT values were within but close to the lower prediction limit of the site-specific normal range in two of three samples at area LC_DC1 in September 2020, whereas the third value was below the %EPT regional and site-specific normal ranges. Absolute abundance of EPT was within regional and site-specific

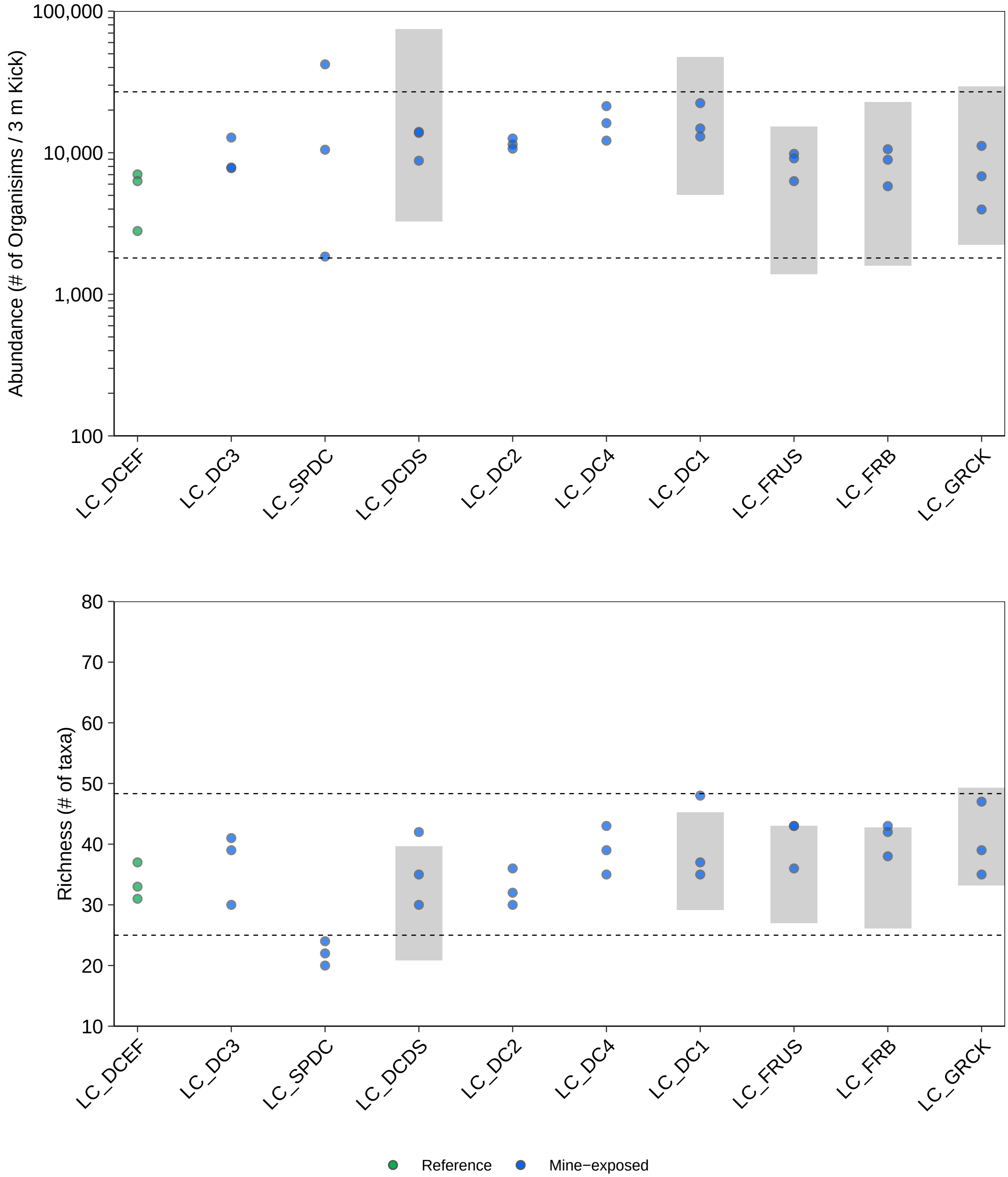


Figure 5.1: **Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2020**

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.

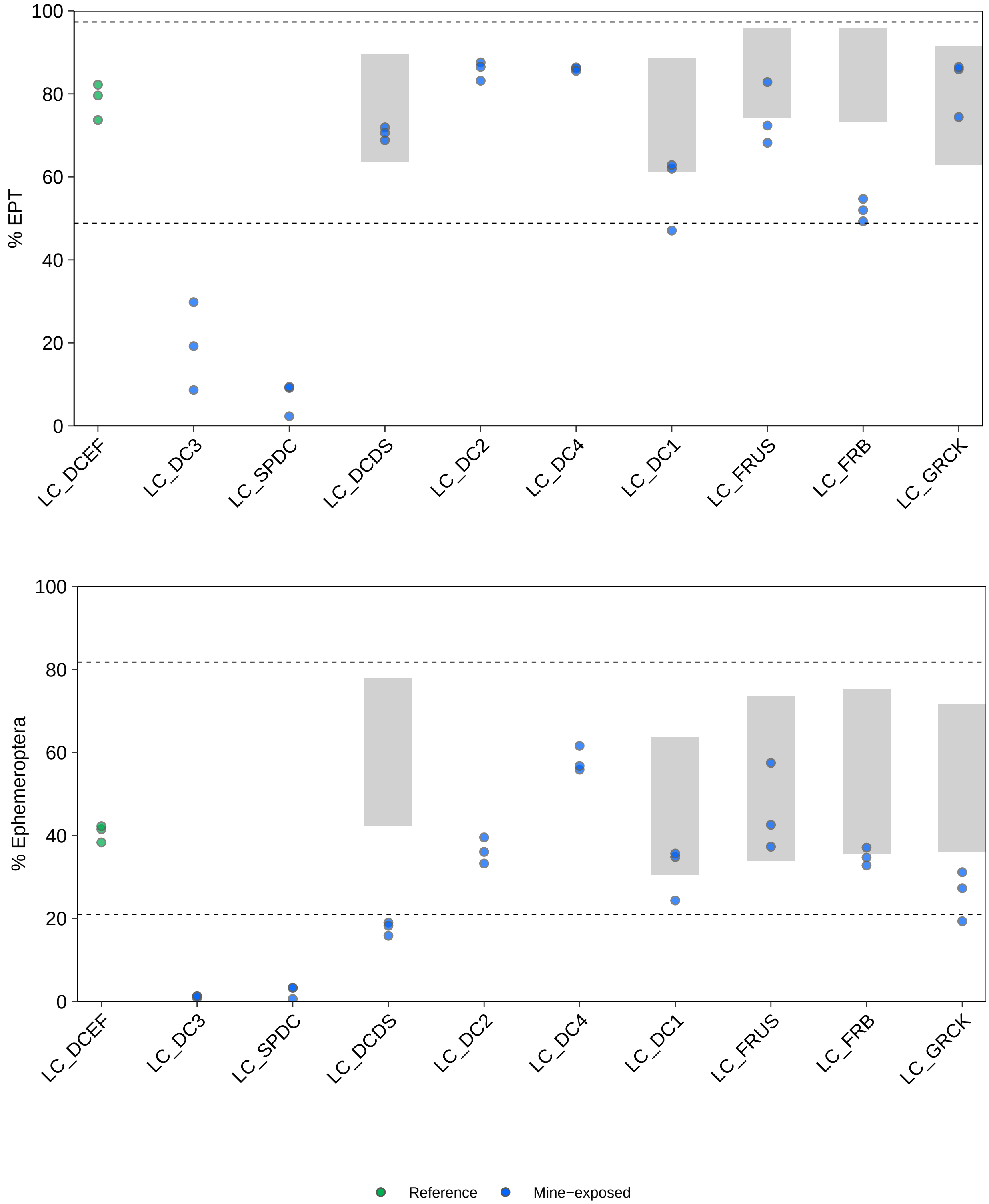


Figure 5.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2020

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.

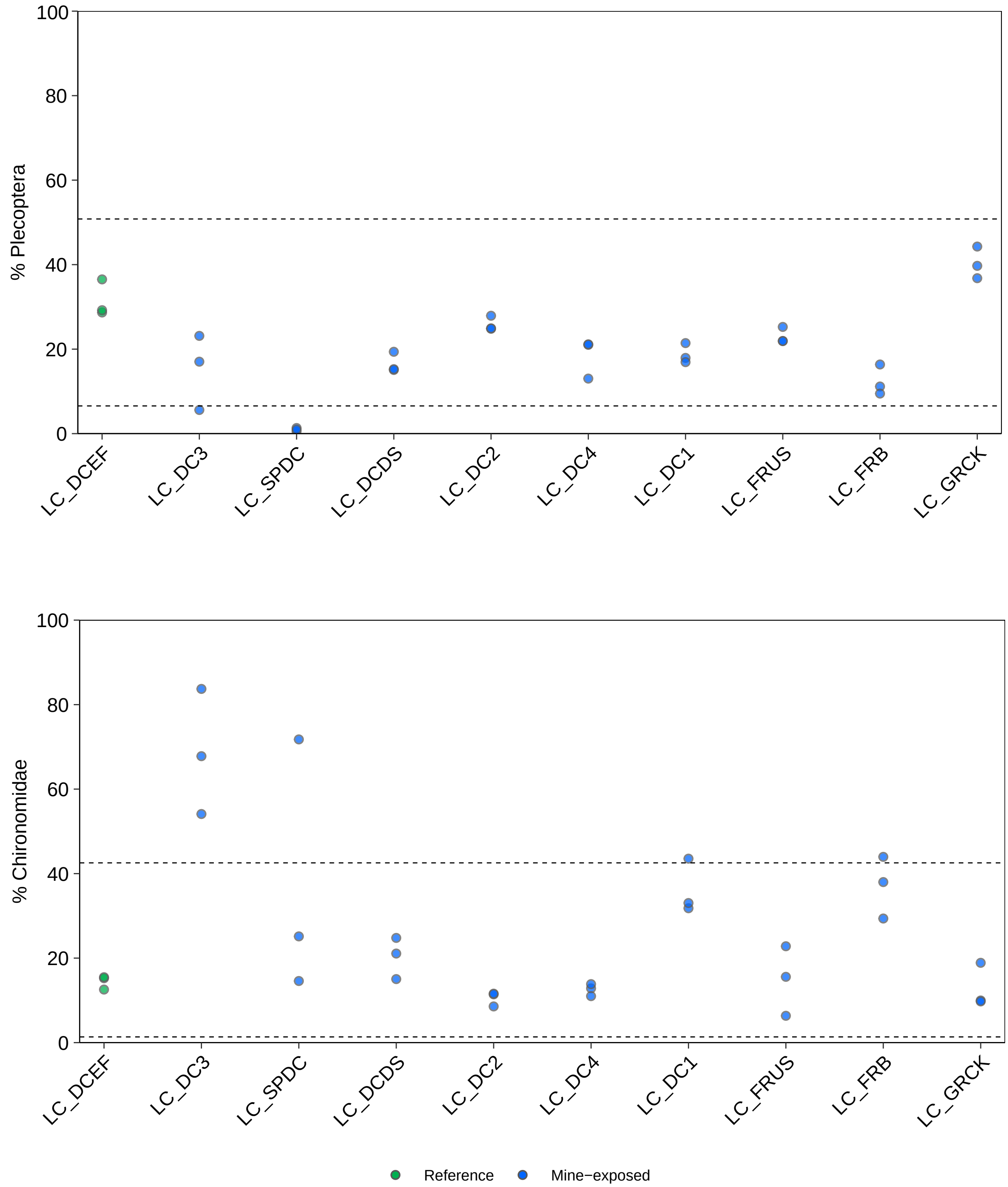


Figure 5.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2020

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.

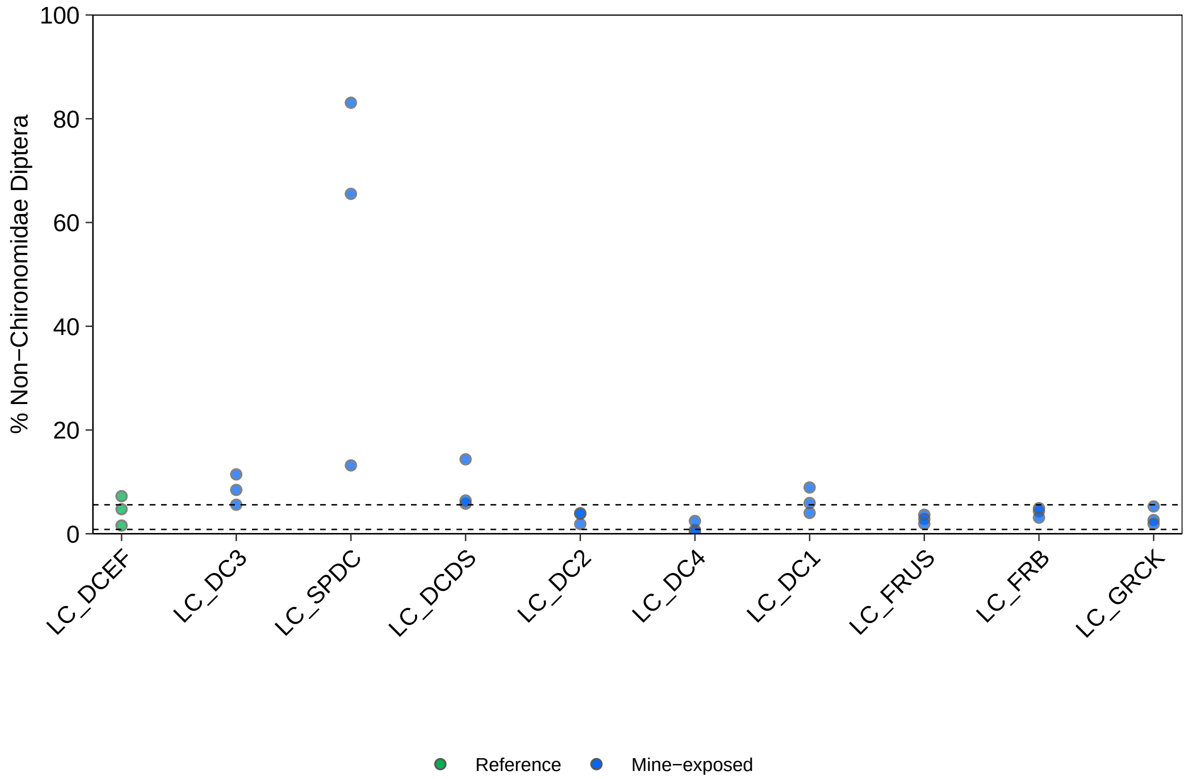


Figure 5.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2020

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.

normal ranges in September 2020 for all samples from all areas except for one replicate each from areas LC_DC3 and LC_SPDC, both below the regional normal ranges (Appendix Figure D.1). The proportion of Ephemeroptera (%E) was below the regional normal range at LC_DC3, LC_SPDC, and LC_DCDS, and below the site-specific normal range in one sample from LC_DC1. Absolute abundance of Ephemeroptera was within regional and site-specific normal ranges at all areas except for LC_DC3 and LC_SPDC, which were both below regional normal ranges for all replicates (Appendix Figure D.1). Ephemeroptera abundances were close to the minimum of the site-specific normal range at area LC_DCDS. The proportion of Chironomidae (%C) was above the regional normal range at area LC_DC3 and in one sample each from LC_SPDC and LC_DC1. Absolute abundances of Chironomidae were within the regional normal range for all Dry Creek areas. Proportions of non-Chironomidae Diptera (%NCD; e.g. Simuliidae and Psychodidae) were above regional normal ranges for all replicates from areas LC_DC3, LC_SPDC, and LC_DCDS, and in two of three replicates from LC_DC1. Benthic communities in Dry Creek areas closest to the discharge (LC_SPDC and LC_DCDS) and upstream of the DCWMS (LC_DC3) had endpoints outside of normal ranges more frequently than communities at or downstream of LC_DC2, however proportional data for benthic invertebrate communities must be interpreted with caution, as increases in a given taxon may be misinterpreted as a decrease in another. In this case, reduced proportions of EPT are being driven by low abundances of Ephemeroptera at LC_SPDC and LC_DC3. At areas LC_DCDS and LC_DC1 because proportions of EPT and Ephemeroptera were below the respective regional and site-specific normal ranges in samples where absolute abundances of those taxa were within normal ranges, those differences are likely being driven by high proportions of other taxa, particularly NCD.

5.2.2 Fording River and Grace Creek

Total benthic invertebrate abundance and LPL taxonomic richness were within or slightly above regional and site-specific normal ranges at Fording River areas LC_FRUS and LC_FRB, and area LC_GRCK in September 2020 (Figure 5.1). Percent EPT was within regional and site-specific normal ranges at LC_GRCK. Percent EPT was within the regional normal range but below site-specific normal ranges at both LC_FRUS and LC_FRB. Percent E was within the regional normal range at areas LC_DCEF, LC_FRB, LC_FRUS, and in all but one sample at LC_GRCK. Percent E was within the site-specific normal range at LC_FRUS and below site-specific normal ranges in two of three samples at LC_FRB and all samples at LC_GRCK. Percent C was within the regional normal range for all samples from LC_FRUS and LC_GRCK, and in all but one sample from LC_FRB. Benthic invertebrate communities were similar between Fording River areas upstream of the mouth of Dry Creek in relation to normal ranges, with most endpoints generally within or close to the regional normal range and within site-specific normal ranges for most samples. Benthic community endpoints were mostly within normal ranges at LC_GRCK.

5.3 Spatiotemporal Changes and Biological Trigger Assessment

Analyses of potential changes in benthic invertebrate community endpoints over time and among areas at Dry Creek LAEMP mine-exposed (Dry Creek areas and Fording River area LC_FRB) areas relative to changes at reference area LC_DCEF (for Dry Creek areas) and upstream comparison area LC_FRUS[27] (for LC_FRB) over the same period were assessed for the first time for this LAEMP cycle (Figures 5.2 to 5.8; Appendix Tables D.4 and D.5; see Section 2.4.2 for ANOVA methods). Periods assessed were 2019 to 2020 for Dry Creek areas and 2018 to 2020 to Fording River areas[28].

Benthic invertebrate total abundance did not change significantly between 2019 and 2020 at Dry Creek areas when evaluated in relation to changes at reference area DCEF over the same time frame (Figure 5.2; Appendix Table D.4). Total abundance was similar to the reference area for most Dry Creek areas with the exception of LC_DC1, which was significantly higher. Total abundance decreased between 2019 and 2020 at area LC_FRB relative to area LC_FRUS, but overall the values between the areas were not significantly different in 2020 (Appendix Table D.5). Taxonomic richness decreased at area LC_DC3 between 2019 and 2020, and increased at LC_SPDC over the same period (Figure 5.3). Despite that increase, taxonomic richness was lower than reference at area LC_SPDC in 2020. Taxonomic richness did not change between 2018 and 2020 at area LC_FRB and was not different from LC_FRUS in 2020.

Percent EPT decreased significantly between September 2019 and September 2020 at Dry Creek areas LC_DC3, LC_DCDS, and LC_DC1 (Figure 5.4; Appendix Table D.4). In 2020, %EPT was lower than LC_DCEF at areas LC_DC3, LC_SPDC, and LC_DC1. Absolute abundances of EPT declined between 2019 and 2020 at all Dry Creek areas except for LC_DC2 and LC_SPDC, as well as at reference area LC_DCEF (Appendix Figure D.3). Changes in %EPT were observed at the monitoring areas upstream and directly downstream of the DCWMS, as well as near the mouth of Dry Creek, driven by reductions in Ephemeroptera abundance. At reference area LC_DCEF %EPT increased between 2019 and 2020 despite a decrease in absolute abundance of EPT, indicating that proportions of non-EPT taxa declined at LC_DCEF offsetting the reduction in EPT abundance. Reductions in absolute abundance of EPT were not offset by reductions in other

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

[28] Replicate September data were available for the period from 2018-2020 for Fording River areas, and 2019-2020 for Dry Creek.

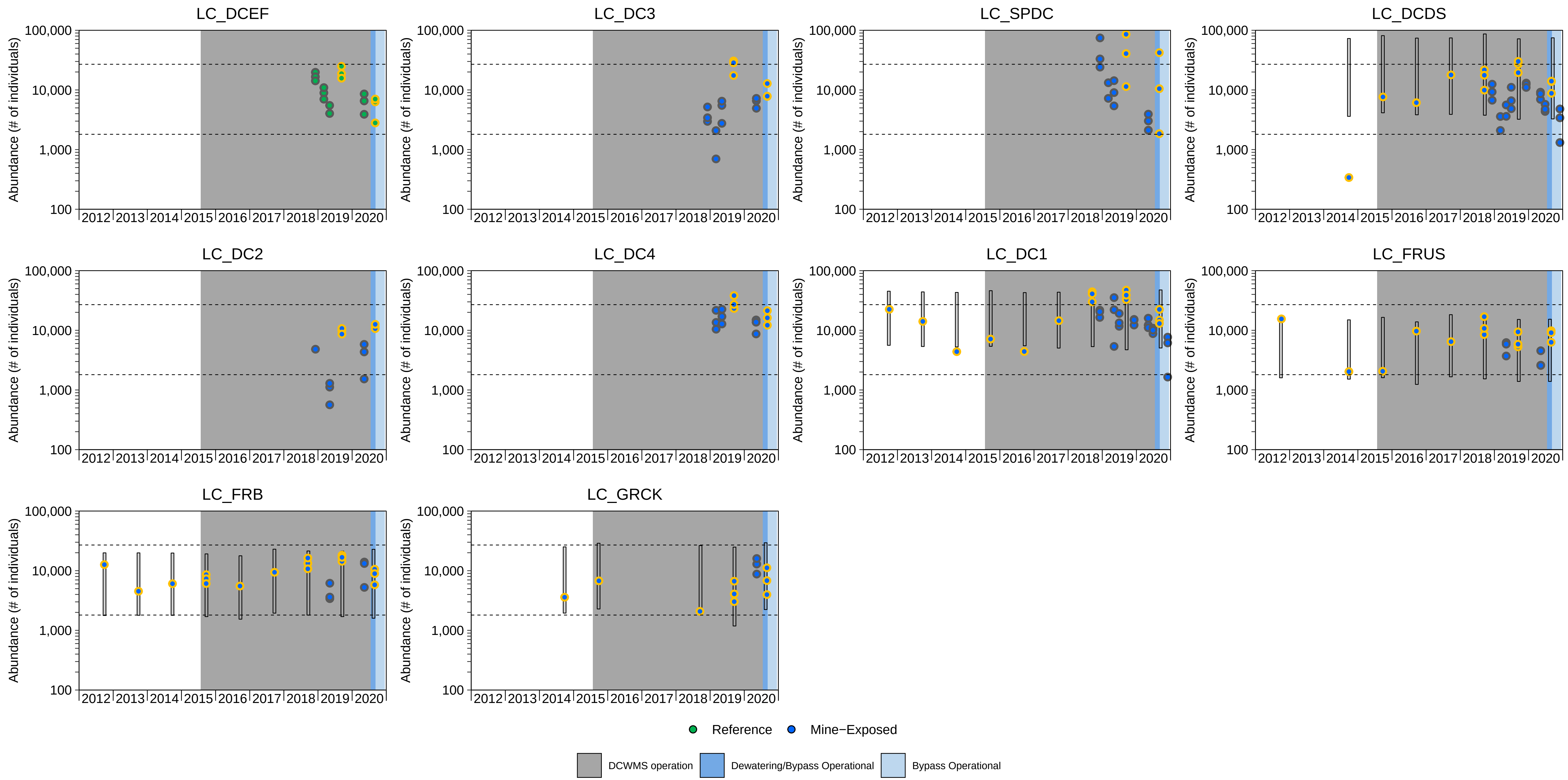


Figure 5.2: Benthic Invertebrate Community Total Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2020

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.

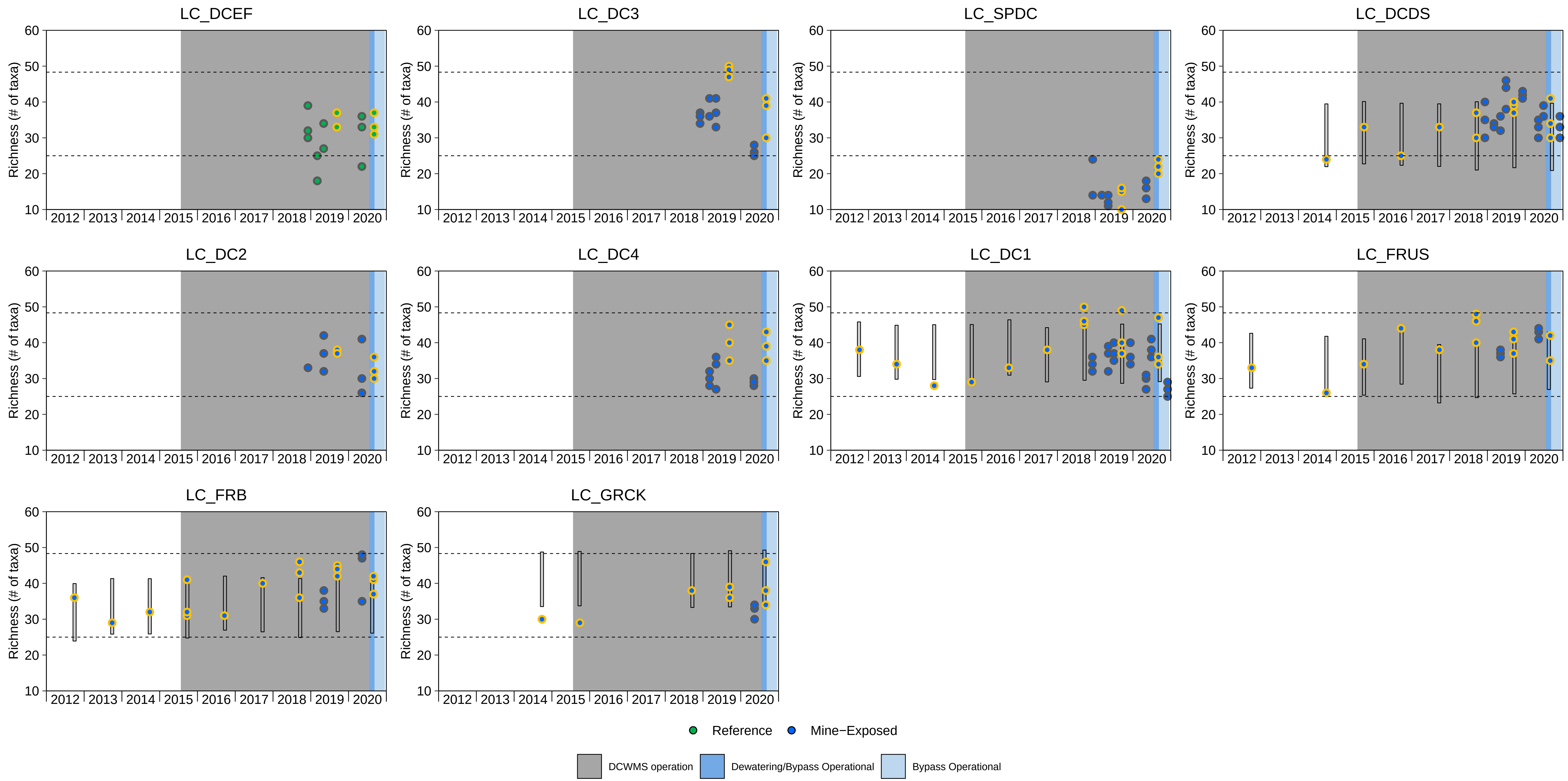


Figure 5.3: Benthic Invertebrate Community Taxonomic Richness from Dry Creek LAEMP Sampling Areas, 2012 to 2020

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.

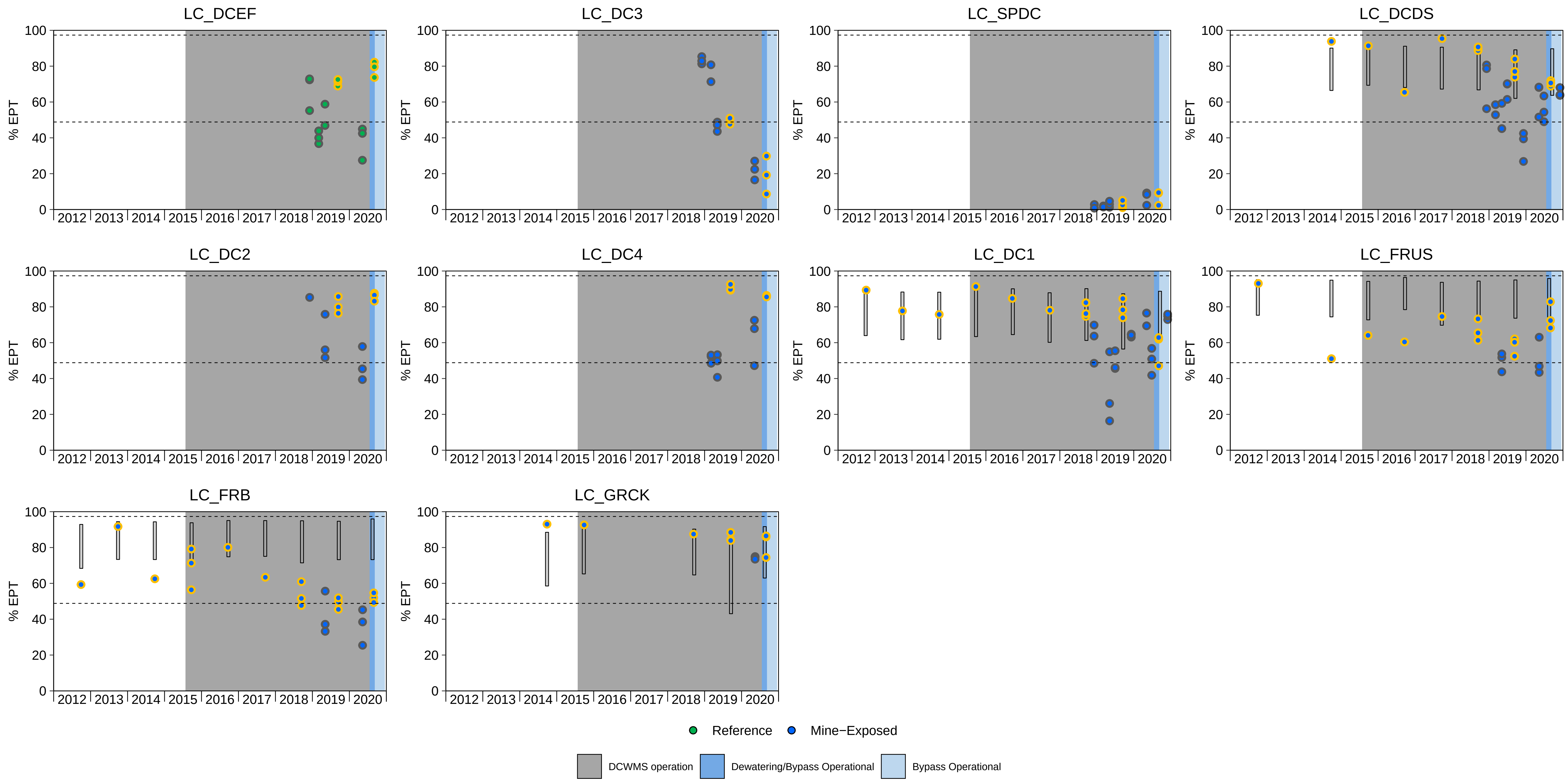


Figure 5.4: Benthic Invertebrate Community % EPT from Dry Creek LAEMP Sampling Areas, 2012 to 2020

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.

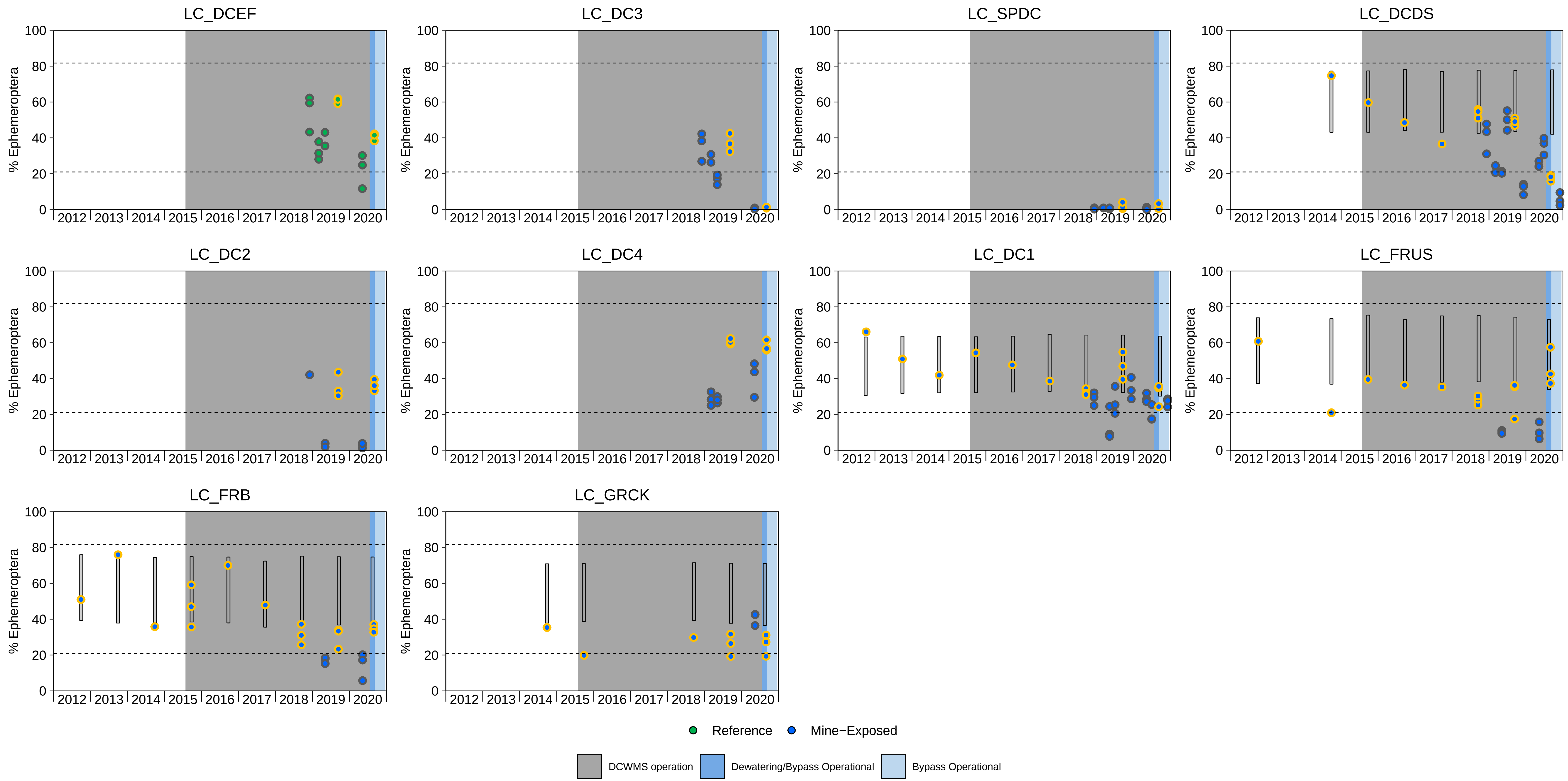


Figure 5.5: Benthic Invertebrate Community % Ephemeroptera from Dry Creek LAEMP Sampling Areas, 2012 to 2020

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.

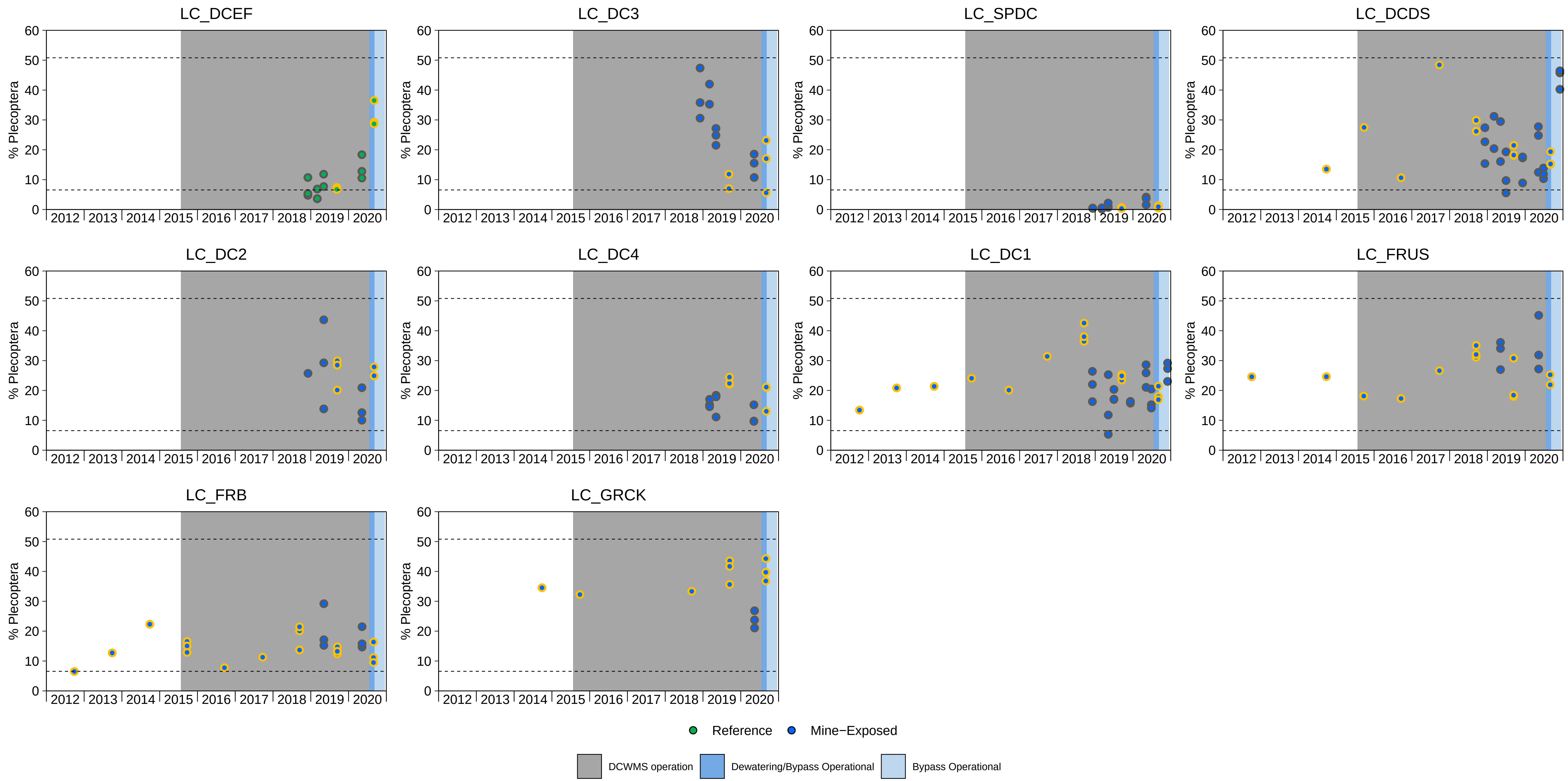


Figure 5.6: Benthic Invertebrate Community % Plecoptera from Dry Creek LAEMP Sampling Areas, 2012 to 2020

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling.

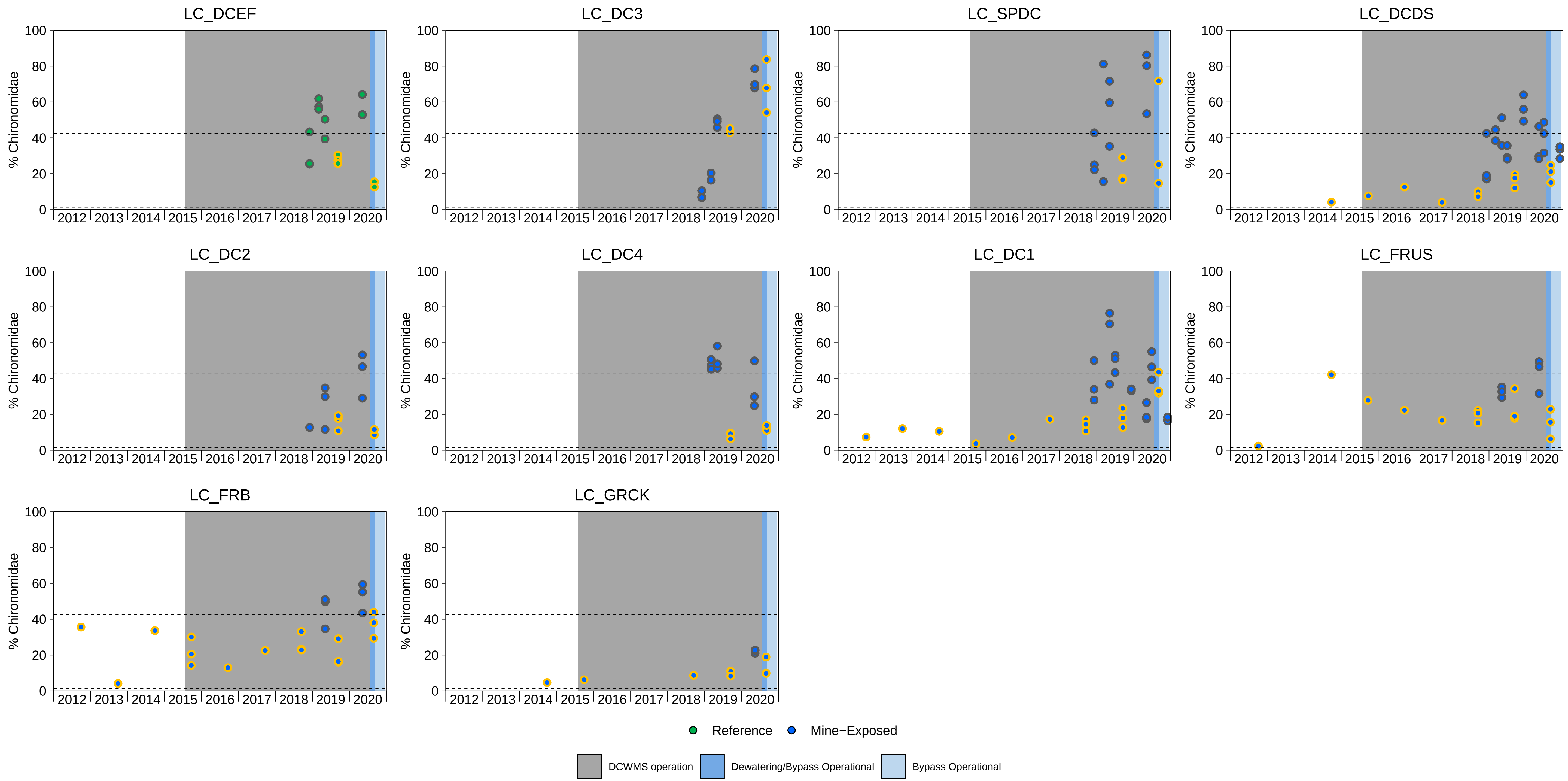


Figure 5.7: Benthic Invertebrate Community % Chironomidae from Dry Creek LAEMP Sampling Areas, 2012 to 2020

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling.

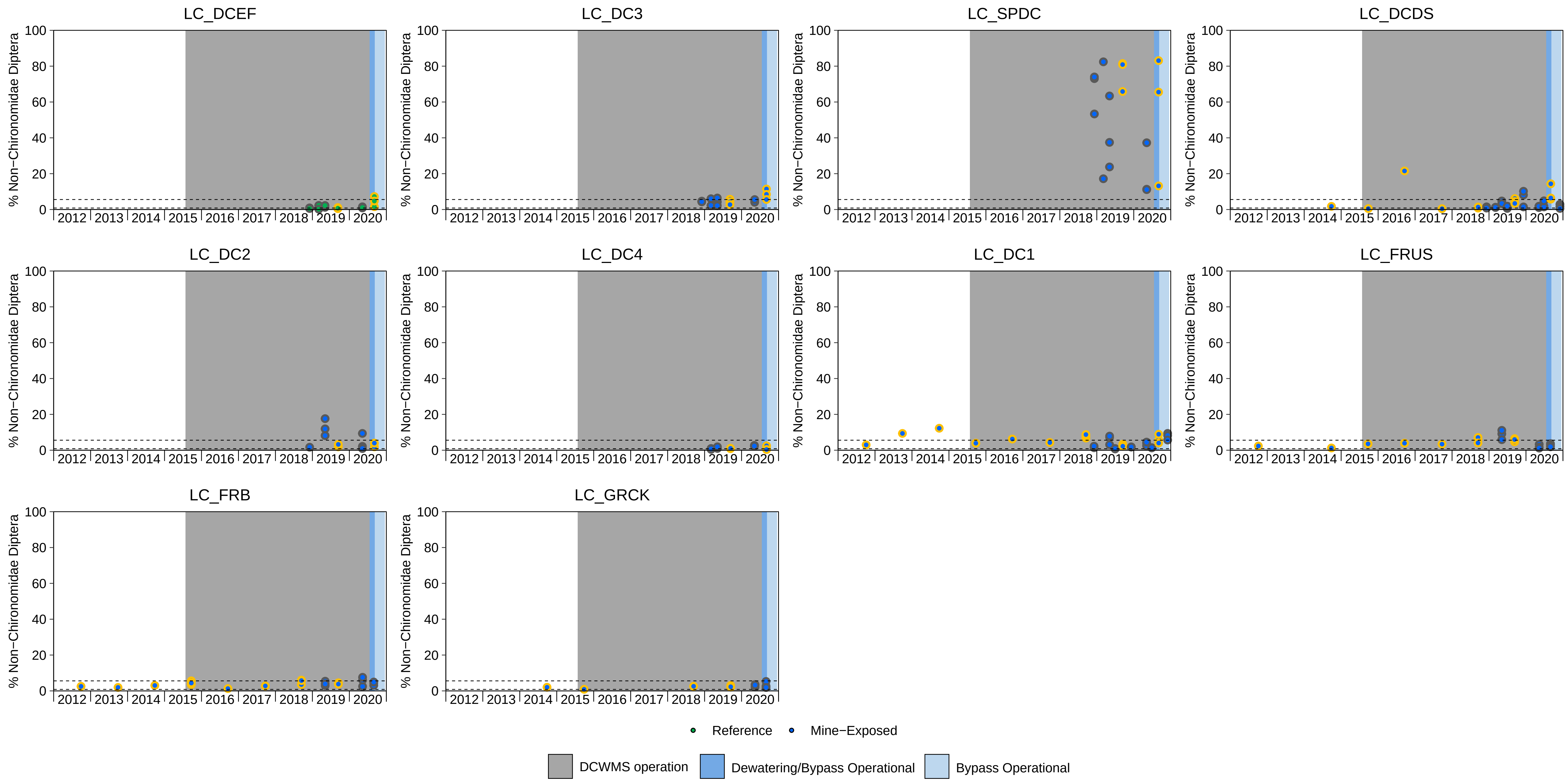


Figure 5.8: Benthic Invertebrate Community % Non-Chironomidae Diptera from Dry Creek LAEMP Sampling Areas, 2012 to 2020

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling.

taxa at areas LC_DC3, LC_DCDS, and LC_DC1, indicating that community-level changes are likely being driven different factors at reference and mine-exposed areas. At area LC_FRB (Fording River downstream of the mouth of Dry Creek), %EPT increased between 2019 and 2020 relative to changes at LC_FRUS, however the absolute abundance decreased over that period, and %EPT was lower at LC_FRB than LC_FRUS in 2020 (Appendix Table D.5). The absolute abundance of EPT was not significantly different between the two Fording River areas in 2020.

Percent EPT was also assessed against the biological trigger values established for this endpoint (information pertaining to the determination of the biological trigger values can be found in Appendix H). This was completed for Dry Creek LAEMP monitoring areas with available water quality predictions (i.e., 2 mine-exposed areas [LC_DCDS and LC_DC1]; see Appendix H for details). Mine-exposed area LC_DC1 had one out of three replicate samples that corresponded to a biological trigger (i.e., %EPT was below the biological trigger values). Percent EPT at these areas has not been previously flagged for further investigation. Based on the magnitude of trigger exceedance (only one of three replicates at LC_DC1), this area is not believed to warrant further investigation.

Significant decreases in %E occurred between September 2019 and September 2020 at areas LC_DC3, LC_SPDC, LC_DCDS, and LC_DC1 (Figure 5.5; Appendix Table D.4). At reference area LC_DCEF, %E also decreased over the same period. Despite the corresponding decrease at reference and mine-exposed areas, %E was significantly lower than reference area LC_DCEF at areas LC_DC3, LC_SPDC, LC_DCDS, and LC_DC1 in 2020. At area LC_DC4 %E was significantly higher than LC_DCEF in 2020, likely related to the decrease in %E at area LC_DCEF, as values did not change significantly at LC_DC4 between 2019 and 2020 and %E was not different between the two areas in 2019. Absolute abundances of Ephemeroptera declined between 2019 and 2020 at all Dry Creek areas except for LC_DC2 and LC_SPDC, as well as at reference area LC_DCEF (Appendix Figure D.4). Ephemeroptera abundances were significantly lower than reference at areas LC_DC3 and LC_SPDC, not significantly different at area LC_DCDS, and higher than reference at areas LC_DC2, LC_DC4, and LC_DC1. Over the same period, %P more than doubled at reference area LC_DCEF, and values there were significantly higher than LC_DC3, LC_SPDC, LC_DCDS, and LC_DC1 (Figure 5.6; Appendix Table D.4). Furthermore, significant decreases in %P occurred between September 2019 and September 2020 at areas LC_DC4 and LC_DC1. At Fording River area LC_FRB, %E increased between 2018 and 2020 but was not significantly different from area LC_FRUS in 2020, (Appendix Table D.5). Percent P decreased at LC_FRB between 2018 and 2020 and was significantly lower than LC_FRUS in September 2020.

Percent C was significantly higher than reference at areas LC_DC1 and LC_DC3 in September 2020, and increased significantly between 2019 and 2020 at LC_DC1 although because the absolute abundance of C didn't change at either area, it is unlikely to have contributed to the effects on %E and %P (Figure 5.7; Appendix Figure D.5; Appendix Table D.4). At reference area LC_DCEF and area LC_DC2, %C decreased between 2019 and 2020, and absolute abundance decreased over that period at LC_DCEF. Chironomidae abundance was higher than reference at areas LC_DC3, LC_SPDC, LC_DCDS, and LC_DC1, although there were no temporal changes in C abundance at those areas. Percent NCD increased significantly at areas LC_DC1 and LC_DCEF between 2019 and 2020 and was significantly higher than reference at area LC_SPDC, driven by a high proportion of Simuliidae (Figure 5.8; Appendix Table D.4; Appendix I). Neither %C or %NCD changed significantly between 2018 and 2020 at area LC_FRB, but %C was higher at LC_FRB than LC_FRUS.

In the 2019 LAEMP report high proportions of oligochaetes (%O) at area LC_FRB relative to LC_FRUS were flagged as a potential indicator of mine influence from Dry Creek (Minnow 2020a). The observational[29] increasing trend in %O at LC_FRB was not observed in 2020, and proportions were similar to LC_FRUS in 2020 and within the regional normal range (Appendix Figures D.1 and D.6; Appendix Table D.5). Mine influence has not decreased between 2019 and 2020 on the Fording River, indicating that elevated %O at area LC_FRB in 2019 was likely not mine-related.

Overall, benthic invertebrate abundance and taxonomic richness values were consistent over the 2019 to 2020 period at Dry Creek LAEMP areas and were similar to reference. Proportions of sensitive taxa (%EPT, %E, and %P) declined between 2019 and 2020 at several areas on Dry Creek including LC_DC3 (Dry Creek area farthest upstream; %EPT and %E), LC_SPDC (%E), LC_DCDS (%EPT and %E) and LC_DC1 (Dry Creek area farthest downstream; %EPT and %E); and although decreases in E abundance were observed at all of those areas, those proportional decreases may have also been correlated with increases in abundances for other taxa (Appendix Tables D.1 to D.3). Areas showing temporal changes in benthic community endpoints varied by endpoint with no consistent spatial patterns. In general, decreases in %EPT and %E between 2019 and 2020 on Dry Creek were contrasted by increases in both endpoints over the same period at area LC_FRB. This difference in outcomes suggests that input from Dry Creek is currently having limited effects on Fording River benthic invertebrate communities.

[29] Statistical analysis of temporal trends in benthic invertebrate community endpoints was not completed as part of the 2019 Dry Creek LAEM report.

5.4 Correlation Analysis

Spearman Rank Correlation analysis was used to assess relationships between benthic invertebrate community endpoints and physicochemical parameter data (e.g., water quality constituents and habitat variables) collected from all Dry Creek areas and LC_DCEF during September 2019 and 2020 sampling (Table 5.1; Appendix Figure D.7). Correlations were considered significant if their Spearman's rank 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. Only two Dry Creek LAEMP benthic invertebrate community endpoints had correlations with physicochemical variables matching those criteria: %E and %NCD (Table 5.1). Water quality constituents correlated with changes in both %E and %NCD included most of those evaluated in detail in Section 3 (nitrate, sulphate, selenium, nickel, DMSeO, and MeSe(IV)). Correlated variables were similar for both benthic community endpoints; however, the direction of correlation was opposite. For example, increasing nitrate concentrations were correlated with decreasing %E and increasing %NCD. No habitat variables (e.g., substrate characteristics, water quality, flow velocity) were significantly correlated with changes in these benthic invertebrate community endpoints and met the criteria for R_s value.

Significant changes in benthic invertebrate communities occurred concurrently with increases in concentrations of nitrate (as well as other aqueous constituents; Section 3.3) on Dry Creek (Section 5.3). Specifically, proportions of sensitive benthic invertebrate taxa (e.g., %E and %EPT) decreased in areas where increases in nitrate to above effects benchmarks occurred (e.g., LC_DC3 and LC_DCDS). The potential effects of increased nitrate concentrations on benthic invertebrate communities in Dry Creek were modelled using data from *Ceriodaphnia dubia* as part of the Integrated Effects Assessment (Teck 2020b). Modelling results indicated there is potential for community-level changes on benthic invertebrates in Dry Creek in response to increasing nitrate concentrations, and that the magnitude of effects will be greatest at LC_DCDS relative to other Dry Creek areas. Correlation analysis results further support those results, demonstrating that changes to Dry Creek benthic invertebrate communities may have occurred as a result of increasing concentrations of mine-related aqueous constituents including nitrate (Table 5.1).

Area LC_SPDC was an outlier in terms of area morphology and benthic invertebrate community structure, and its benthic invertebrate community had high proportions of Simuliidae (a non-Chironomidae diptera) and very low %E (Figure 5.1). It is possible that the unusual community composition at LC_SPDC is skewing correlation results. Furthermore, concentrations of water quality constituents correlated with significant changes in benthic community structure were relatively high at area LC_SPDC compared with other Dry Creek areas, which may also

Table 5.1. **Spearman's Correlation Relationships between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, Dry Creek, September 2019 and September 2020**

Parameter	Abundance (# organisms/ 3 min kick)		Richness (# taxa)		% Ephemeroptera		% Plecoptera		% Trichoptera		% EPT		% 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	0.527	0.000334	0.388	0.0111	0.211	0.181	-0.149	0.345	-0.298	0.055	-0.0595	0.708	0.249	0.111	-0.165	0.296	0.175	0.266
Calcite (%)	0.536	0.000252	0.321	0.0379	0.177	0.263	-0.0394	0.804	-0.205	0.194	0.0162	0.919	0.217	0.167	-0.123	0.437	0.0372	0.815
Concreted (mean)	0.103	0.518	0.201	0.201	0.111	0.483	-0.38	0.013	-0.414	0.00635	-0.266	0.0888	0.108	0.495	-0.144	0.364	0.458	0.00227
Embededness (%)	-0.124	0.434	0.372	0.0152	0.202	0.198	0.125	0.431	0.217	0.167	0.0827	0.603	0.266	0.0892	-0.227	0.149	0.235	0.134
D16	-0.38	0.0131	-0.415	0.00624	-0.482	0.00122	-0.0723	0.649	0.112	0.478	-0.24	0.125	-0.115	0.468	0.525	0.000362	-0.0121	0.94
D84	-0.31	0.0459	-0.0593	0.709	-0.169	0.285	-0.0925	0.56	0.0592	0.71	-0.154	0.329	0.209	0.184	0.241	0.124	0.234	0.135
Water Velocity (m/s)	0.391	0.0105	0.217	0.168	0.0869	0.584	0.151	0.34	0.113	0.477	0.196	0.214	0.0364	0.819	-0.0486	0.76	-0.185	0.241
Water Depth (cm)	0.0451	0.776	0.0975	0.539	-0.0883	0.578	-0.291	0.0613	0.0922	0.562	-0.106	0.505	-0.031	0.845	0.119	0.454	0.0335	0.833
Annual PC1	-0.187	0.235	-0.127	0.421	-0.766	<0.0001	-0.371	0.0155	-0.00609	0.969	-0.523	0.000384	0.0351	0.825	0.662	<0.0001	0.369	0.0161
Annual PC2	0.0519	0.744	0.224	0.153	0.506	0.000628	0.403	0.0081	0.0694	0.662	0.375	0.0143	0.352	0.0224	-0.486	0.0011	-0.207	0.188
Annual Temperature (°C)	0.264	0.0907	-0.28	0.0727	-0.203	0.197	-0.185	0.24	0.216	0.169	-0.0714	0.653	-0.109	0.494	0.347	0.0243	-0.252	0.107
Annual Total Alkalinity as CaCO3 (mg/L)	0.531	0.000295	0.56	0.000114	0.538	0.000235	0.0839	0.597	-0.0571	0.719	0.283	0.0698	0.0112	0.944	-0.532	0.000288	0.0446	0.779
Annual Nitrate (mg/L as N)	-0.183	0.246	-0.189	0.229	-0.711	<0.0001	-0.4	0.00871	-0.03	0.851	-0.47	0.00169	-0.0736	0.643	0.63	<0.0001	0.289	0.0632
Annual Nitrite (mg/L s N)	-0.0836	0.599	-0.379	0.0133	-0.616	<0.0001	-0.443	0.00329	0.123	0.438	-0.373	0.0151	-0.205	0.193	0.624	<0.0001	0.0543	0.733
Annual Ammonia (mg/L as N)	0.182	0.249	-0.166	0.293	-0.508	0.000585	-0.462	0.00208	-0.142	0.37	-0.499	0.000774	0.111	0.483	0.583	<0.0001	0.247	0.115
Annual Phosphorus (mg/L)	-0.151	0.34	-0.0486	0.76	-0.694	<0.0001	-0.372	0.0151	-0.0505	0.751	-0.479	0.00133	0.0713	0.653	0.585	<0.0001	0.356	0.0206
Annual Sulphate (mg/L)	-0.15	0.344	-0.184	0.243	-0.69	<0.0001	-0.445	0.00314	-0.0446	0.779	-0.481	0.00126	-0.0982	0.536	0.604	<0.0001	0.313	0.0438
Annual Total Dissolved Solids (mg/L)	-0.196	0.213	-0.194	0.219	-0.703	<0.0001	-0.402	0.00827	-0.0295	0.853	-0.457	0.00233	-0.1	0.527	0.603	<0.0001	0.278	0.0741
Annual Dissolved Aluminum (mg/L)	-0.0802	0.613	-0.197	0.211	-0.613	<0.0001	-0.339	0.0283	0.174	0.269	-0.332	0.0316	0.0282	0.859	0.56	0.000116	0.109	0.494
Annual Total Antimony (mg/L)	-0.0256	0.872	-0.0884	0.578	-0.689	<0.0001	-0.531	0.000298	-0.244	0.12	-0.587	<0.0001	0.00865	0.957	0.62	<0.0001	0.41	0.007
Annual Total Arsenic (mg/L)	-0.198	0.209	-0.0916	0.564	-0.748	<0.0001	-0.416	0.00616	-0.129	0.416	-0.587	<0.0001	0.0812	0.609	0.689	<0.0001	0.43	0.00448
Annual Total Barium (mg/L)	-0.171	0.279	0.121	0.447	0.617	<0.0001	0.567	<0.0001	0.332	0.0319	0.569	<0.0001	0.0222	0.889	-0.606	<0.0001	-0.297	0.0563
Annual Dissolved Cadmium (mg/L)	-0.164	0.298	-0.119	0.454	-0.655	<0.0001	-0.457	0.00233	-0.0553	0.728	-0.476	0.00145	-0.123	0.438	0.541	0.000219	0.354	0.0216
Annual Total Chromium (mg/L)	-0.0587	0.712	0.111	0.484	-0.495	0.000864	-0.125	0.428	0.126	0.425	-0.24	0.126	0.226	0.15	0.379	0.0134	0.251	0.109
Annual Total Cobalt (mg/L)	-0.17	0.282	-0.144	0.363	-0.736	<0.0001	-0.413	0.0066	-0.0481	0.763	-0.515	0.000488	0.00391	0.98	0.628	<0.0001	0.354	0.0215
Annual Total Copper (mg/L)	-0.41	0.00697	0.0627	0.693	-0.585	<0.0001	-0.115	0.47	0.11	0.488	-0.447	0.00298	0.158	0.317	0.424	0.00512	0.511	0.00054
Annual Total Iron (mg/L)	-0.19	0.227	0.173	0.273	-0.57	<0.0001	-0.113	0.475	0.151	0.339	-0.307	0.0478	0.213	0.175	0.375	0.0144	0.372	0.0153
Annual Total Lead (mg/L)	-0.258	0.0986	0.029	0.856	-0.576	<0.0001	-0.0663	0.676	0.319	0.0398	-0.247	0.115	0.184	0.243	0.397	0.00927	0.248	0.114
Annual Total Lithium (mg/L)	-0.555	0.000136	-0.262	0.0931	-0.191	0.225	-0.0513	0.747	0.0847	0.594	-0.179	0.257	-0.195	0.217	0.0706	0.657	0.269	0.0851
Annual Total Manganese (mg/L)	-0.119	0.454	0.0288	0.856	-0.698	<0.0001	-0.263	0.0926	-0.0163	0.918	-0.459	0.00224	0.195	0.216	0.534	0.000272	0.382	0.0126
Annual Total Molybdenum (mg/L)	-0.107	0.5	-0.135	0.393	-0.724	<0.0001	-0.504	0.000663	-0.12	0.448	-0.573	<0.0001	-0.0281	0.86	0.652	<0.0001	0.396	0.0095
Annual Total Nickel (mg/L)	-0.177	0.262	-0.151	0.34	-0.705	<0.0001	-0.414	0.00636	-0.0529	0.739	-0.481	0.00127	-0.0388	0.807	0.616	<0.0001	0.308	0.0471
Annual Total Selenium (mg/L)	-0.19	0.229	-0.192	0.223	-0.708	<0.0001	-0.401	0.00841	-0.0298	0.852	-0.464	0.00196	-0.0871	0.583	0.617	<0.0001	0.284	0.0682
Annual Total Thallium (mg/L)	-0.236	0.133	-0.174	0.27	-0.746	<0.0001	-0.422	0.00532	-0.00691	0.965	-0.536	0.000257	-0.00254	0.987	0.646	<0.0001	0.375	0.0143
Annual Total Uranium (mg/L)	-0.153	0.333	-0.141	0.373	-0.724	<0.0001	-0.435	0.004	-0.0553	0.728	-0.52	0.00042	-0.00837	0.958	0.614	<0.0001	0.365	0.0174
Annual Total Zinc (mg/L)	-0.564	0.000101	-0.273	0.0801	-0.714	<0.0001	0.0293	0.854	0.0607	0.702	-0.401	0.00854	0.0835	0.599	0.511	0.000536	0.337	0.0292
Annual Dimethylseleneoxide (ug/L)	-0.135	0.395	-0.356	0.0208	-0.689	<0.0001	-0.468	0.00179	0.0399	0.802	-0.463	0.002	-0.129	0.416	0.685	<0.0001	0.149	0.348
Annual Methylseleninic Acid (ug/L)	-0.049	0.758	-0.288	0.0642	-0.693	<0.0001	-0.482	0.00121	-0.011	0.945	-0.507	0.000605	-0.0483	0.761	0.685	<0.0001	0.195	0.215
Annual Selenate (ug/L)	-0.201	0.202	-0.247	0.115	-0.731	<0.0001	-0.394	0.00984	-0.0202	0.899	-0.459	0.00222	-0.0926	0.56	0.635	<0.0001	0.242	0.122
Annual Selenite (ug/L)	-0.0505	0.751	-0.253	0.106	-0.69	<0.0001	-0.502	0.000706	-0.072	0.651	-0.504	0.000659	-0.0986	0.535	0.675	<0.0001	0.21	0.181
Dimethylseleneoxide (% of Total Selenium)	0.0675	0.671	-0.0901	0.570	0.439	0.00365	0.264	0.0907	0.0729	0.647	0.287	0.0651	0.0265	0.868	-0.34	0.0276	-0.294	0.0587
Methylseleninic Acid (% of Total Selenium)	0.0933	0.557	-0.136	0.392	0.292	0.0605	0.0616	0.698	-0.1	0.528	0.0655	0.68	0.0736	0.643	-0.167	0.289	-0.147	0.353
Selenate (% of Total Selenium)	0.0641	0.687	-0.146	0.357	-0.278	0.0747	0.183	0.245	0.349	0.0236	0.186	0.239	0.0611	0.701	0.149	0.345	-0.389	0.011
Selenite (% of Total Selenium)	0.0241	0.879	-0.152	0.338	-0.00999	0.95	-0.122	0.443	-0.135	0.395	-0.14	0.376	0.189	0.23	0.104	0.512	-0.00804	0.96
Benthic Invertebrate Tissue Selenium (mg/kg dw)	0.00853	0.957	-0.245	0.118	-0.295	0.0583	-0.118	0.456	0.479	0.00134	-0.00755	0.962	-0.0859	0.589	0.356	0.0205	-0.204	0.194

P-value < 0.05/45 (0.05 Bonferroni Corrected for 36 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 and PC2 are principal component axes from PCA on annual water chemistry analytes (see Appendix Tables D.7 and D.8 for details).

skew correlations between elevated concentrations of water quality constituents, low %E, and high %NCD. Subsequent correlation analysis as part of the 2021 LAEMP report without data from LC_SPDC (as biological sampling at that area has been discontinued) will be valuable to verify the results of this test without potential outlier data.

5.5 Correspondence Analysis

Prior to 2018, Dry Creek LAEMP benthic invertebrate community samples were only collected in September (late summer/early fall). Starting in 2018 Dry Creek benthic invertebrate communities were sampled over multiple seasons, with additional LAEMP biological sampling conducted in May, June, and December (2019 and 2020) and one sampling event in February (2019). The relative contributions of spatial and temporal collection variability to overall variability in benthic invertebrate community structure were evaluated using a Correspondence Analysis (CA) to determine comparability of data among seasons as opposed to among areas. Clustering and separation of groups of data points representing the same season would indicate that seasonal (as opposed to spatial) variability is driving overall variability, whereas clustering of data points corresponding to a given area would indicate that spatial variability is driving overall variability.

In the case of 2019 and 2020 Dry Creek LAEMP benthic invertebrate community data, CA axes explained 17.0% (CA1) and 11.9% (CA2) of variability (Figure 5.9; Appendix tables D.6 to D.8; Appendix Figure D.8). There was a clear separation of areas sampled in September along CA2 in the positive direction. There was also a clear separation of LC_SPDC along CA1, which is not surprising given that the benthic community at that area was unique morphologically and in terms of benthic invertebrate community structure compared with the rest of Dry Creek, regardless of season. There is also a more subtle separation along CA2 between two clusters, one composed mostly of February and December samples, and the other mostly May and June samples. Aside from LC_SPC there are no clearly separated clusters representing individual areas.

Given that data points are mostly grouped by season and generally not grouped by area it is possible to conclude that seasonal variability is more meaningful than spatial variability. Benthic invertebrate community samples collected from different Dry Creek LAEMP areas during the same season are likely more similar than samples collected from a single area over multiple seasons.

5.6 Summary

Benthic invertebrate community total abundance and taxonomic richness were within or close to regional and site-specific (where available) normal ranges at most Dry Creek LAEMP areas

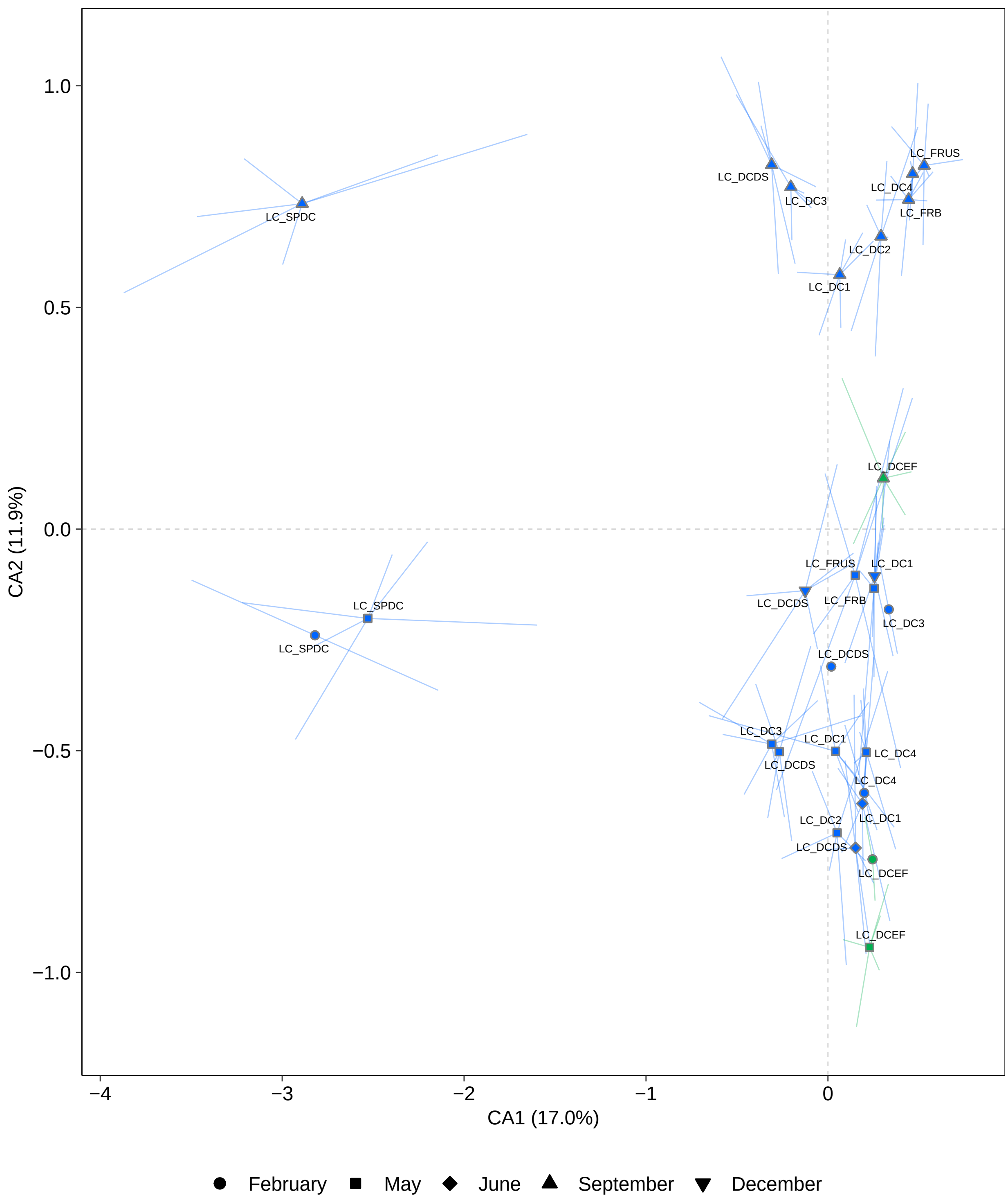


Figure 5.9: Correspondence Analysis Bi-plot for Benthic Invertebrate Community Measured in All Seasons at Dry Creek, 2019 to 2020

Notes: Reference areas are shown in green and mine−exposed areas are shown in blue. Analysis was completed on log10(x+1) transformed data. Areas with fewer than five taxa present were removed from analysis. Taxa that were present at less than five areas and contributed less 0.05% of the total abundance were removed from analysis. Analysis was completed on benthic invertebrate community data assessed at the lowest practicable level (LPL).

in 2020. At areas upstream (LC_DC3) and immediately downstream (LC_SPDC and LC_DCDS) of the DCWMS, endpoints including %EPT, %E, and %C were outside of the normal ranges more frequently than at areas farther downstream (LC_DC1 and LC_DC4; Section 5.2.1).

Total abundance and taxonomic richness values remained consistent over the 2019 to 2020 period at Dry Creek LAEMP areas and were similar to reference. Temporal changes observed in Dry Creek benthic invertebrate communities included decreases in sensitive taxa (%EPT and %E) between 2019 and 2020 at areas LC_DC3, LC_DCDS, and LC_DC1. Changes in benthic invertebrate community structure between 2019 and 2020 were most commonly observed at Dry Creek areas DC3 (upstream of the DCWMS) and DCDS (downstream of the DCWMS). Other temporal changes in Dry Creek benthic invertebrate communities did not follow any consistent patterns.

Results for benthic invertebrate community endpoints at area LC_FRB were within or close to regional and site-specific normal ranges, and results were similar to area LC_FRUS (upstream of the mouth of Dry Creek). Decreasing %EPT and %E between 2019 and 2020 on Dry Creek was contrasted by increases in both endpoints over the same period at area LC_FRB. These differences suggest that it is unlikely that input from Dry Creek is having measurable effects on Fording River benthic invertebrate communities.

Changes in Dry Creek benthic invertebrate communities, specifically decreases in %E and increases in %NCD were correlated with changes in aqueous mine-related constituents including nitrate, selenium, sulphate, and nickel. Modelling results indicated the potential for further community-level changes to Dry Creek benthic invertebrate communities as a result of nitrate enrichment, particularly at area LC_DCDS (Teck 202b). Concentrations of aqueous mine-related constituents correlated with changes in benthic invertebrate community structure were similar between areas LC_DC3 and LC_DCDS, two areas where changes in benthic invertebrate community, including reduction in proportions of sensitive taxa (%EPT and %E), were observed in 2020. It is therefore likely that increasing concentrations of aqueous mine-related constituents, particularly nitrate, are contributing to community-level effects on Dry Creek benthic invertebrates. Investigations into the causes of increasing concentrations of aqueous mine-related constituents are currently underway. An AMP framework is already in place to address increasing concentrations of nitrate, sulphate, and selenium on Dry Creek. Investigation of causes and effects (including integrated effects assessments) of increased concentrations of aqueous mine-related constituents are also proceeding. The LCO nitrate compliance action plan is under development alongside an updated LCO Dry Creek Water Management Plan that will outline the objectives and mitigation options.

6 STUDY QUESTION 4: BENTHIC INVERTEBRATE TISSUE SELENIUM

6.1 Overview

Monitoring data were evaluated in this section 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? To address this study question, selenium concentrations in composite-taxa benthic invertebrate tissue samples were evaluated over time and in relation to DCWMS status. In 2020, the DCWMS was fully operational from January to July 15th, with bypass of the DCWMS initiated on July 16th. This was followed by a period from August 4th to September 4th, 2020 when the sedimentation ponds were dewatered into Dry Creek and the DCWMS bypass was operational. From September through December 2020, pond dewatering was complete and the DCWMS bypass remained operational (see Section 1.3 for details).

Benthic invertebrate tissue data collected for the present study were of good quality as characterized by good detectability, appropriate LRLs, and good laboratory precision and accuracy. Therefore, the associated data can be used with a good level of confidence for interpretation (see Appendix A for details).

6.2 Normal Ranges, Benchmarks and Biological Trigger Evaluation

Benthic invertebrate tissue selenium concentrations exceeded the regional normal range (maximum: 7.79 mg/kg dw; Minnow 2020c) in at least one sample from all Dry Creek monitoring areas, Fording River areas (LC_FRUS and LC_FRB), and LC_GRCK in 2020 (Figure 6.1; Appendix Table E.2). Mean tissue selenium concentrations higher than the normal range were most common in the areas immediately downstream of the DCWMS (LC_SPDC, LC_DCDS, and LC_DC2), less common downstream of area LC_DC2 (areas LC_DC4 and LC_DC1), and did not occur upstream of the DCWMS in 2020. Specifically, mean tissue selenium concentrations exceeded the regional normal range at areas LC_SPDC, LC_DCDS, and LC_DC2 (the three areas closest to DCWMS discharge) during every sampling event in 2020, whereas upstream of the DCWMS at area LC_DC3 mean tissue selenium concentrations did not exceed the normal range during any sampling event in 2020

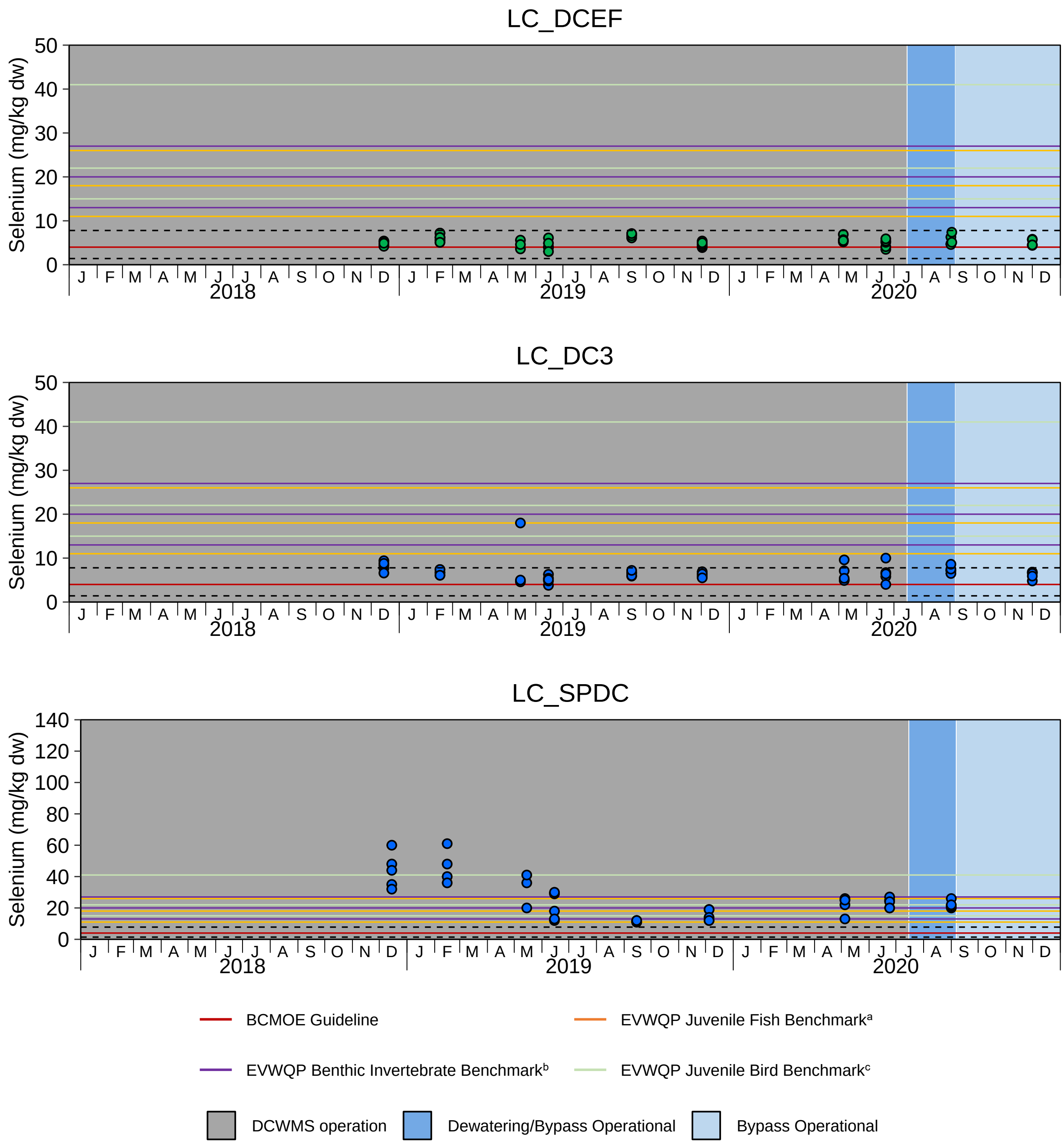


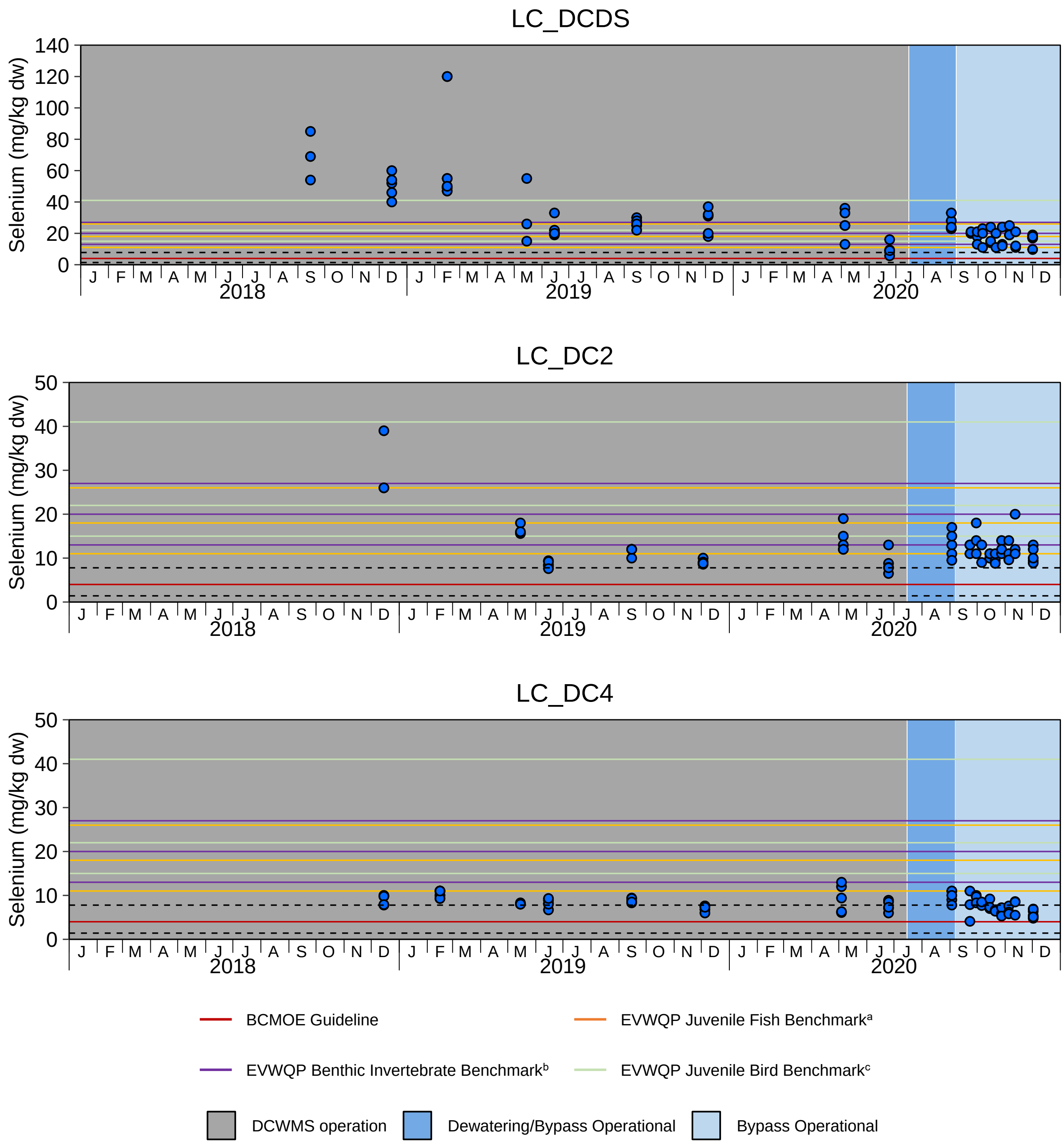
Figure 6.1: Selenium Concentrations (mg/kg dw) in Composite−Taxa Benthic Invertebrate Samples from LCO Dry Creek LAEMP Sampling Areas, 2018 to 2020

Notes: Dashed black lines 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. Reference areas are shown in green and mine−exposed areas are shown in blue. 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).

[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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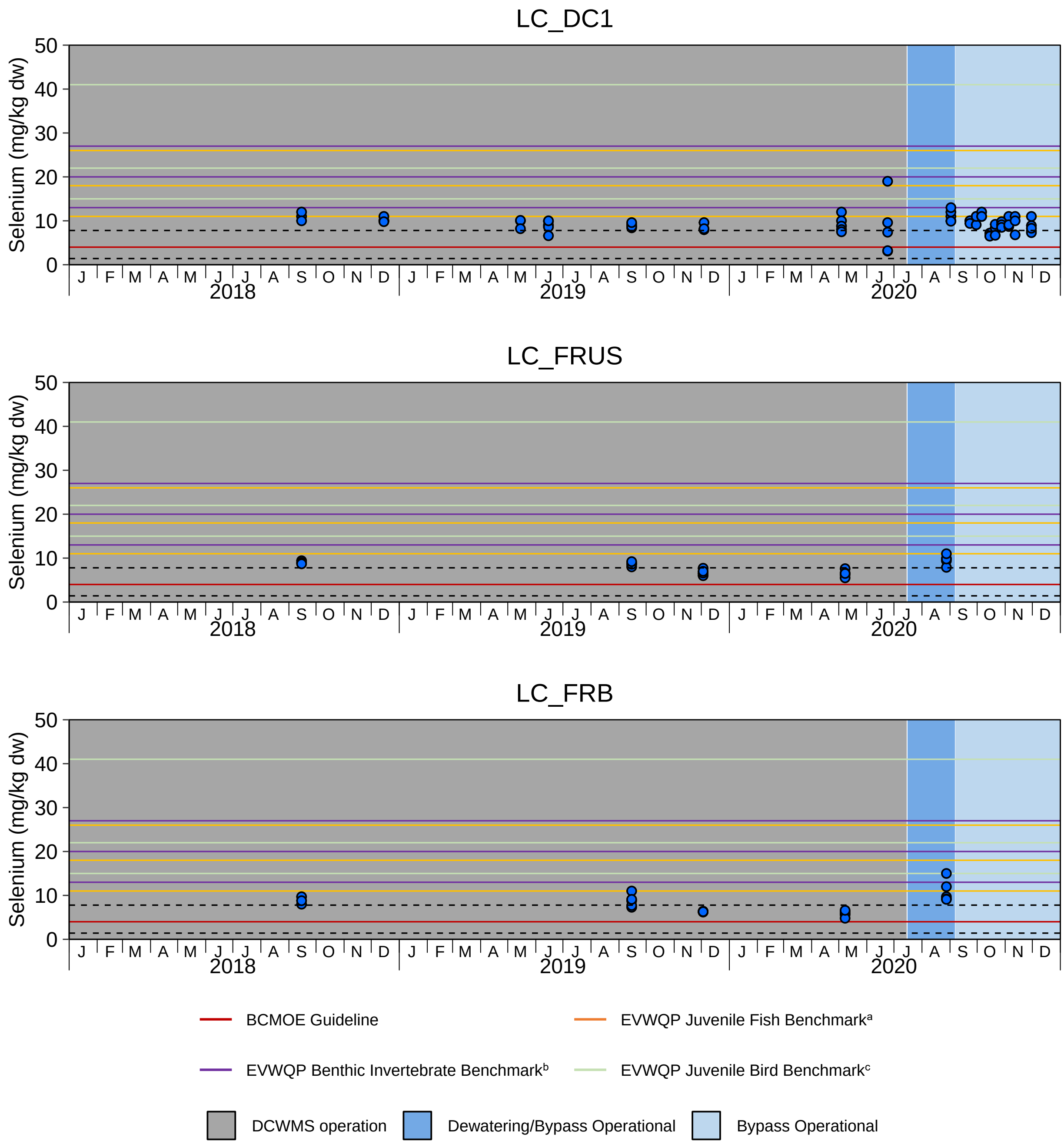

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[a] - 11, 18, and 26 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014),respectively, for dietary effects to juvenile fish.

[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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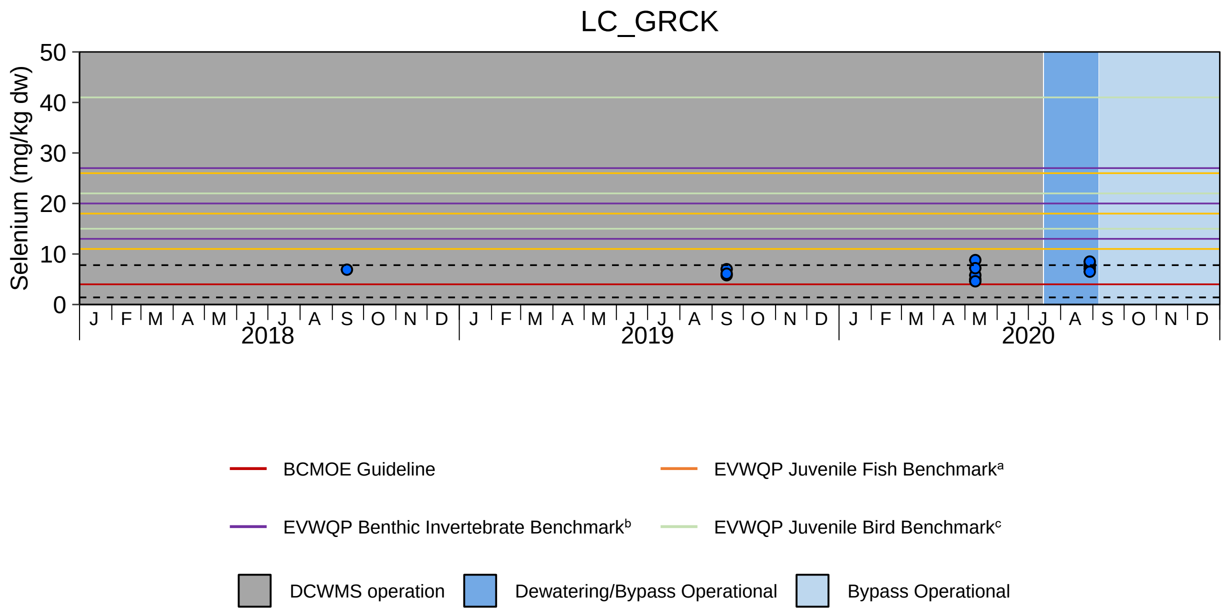

Figure 6.1: Selenium Concentrations (mg/kg dw) in Composite−Taxa Benthic Invertebrate Samples from LCO Dry Creek LAEMP Sampling Areas, 2018 to 2020

Notes: Dashed black lines 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. Reference areas are shown in green and mine−exposed areas are shown in blue. 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).

[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.

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[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.

(Appendix Table E.2). Benthic invertebrate tissue selenium concentrations were predicted for Dry Creek areas using the selenium speciation bioaccumulation tool[29] (b-tool; Bruyn and Luoma 2021). Field-measured mean benthic invertebrate tissue concentrations were below b-tool predictions for all sampling events at reference area LC_DCEF and area LC_DC3, and frequently above b-tool predictions at areas LC_SPDC (mean tissue selenium concentrations above predicted values for two of three sampling events), LC_DCDS (above for eleven of twelve sampling events) and LC_DC2 (above for seven of eleven sampling events; Appendix Table E.3; Bruyn and Luoma 2021). Farther downstream of the DCWMS, mean benthic invertebrate tissue selenium concentrations exceeded the regional normal range during fewer than half of 2020 sampling events at area LC_DC4, and during most sampling events at area LC_DC1. This difference is unexpected given that concentrations of selenium and organoselenium decreased over increasing distance from the DCWMS and were generally slightly lower at LC_DC1 than LC_DC4 (Section 3). Field-measured mean benthic invertebrate tissue selenium concentrations at both areas were also not consistent with b-tool modelling predictions, with mean tissue selenium concentrations lower than predicted values for nine of twelve sampling events at LC_DC4, and higher than predicted for eight of twelve sampling events at area LC_DC1 (Appendix Table E.3; Bruyn and Luoma 2021). It is possible that variability between LC_DC1 and LC_DC4 is related to variability in microhabitats sampled or community composition between areas. Mean benthic invertebrate selenium concentrations in 2020 exceeded the normal range during September sampling at LC_FRUS and LC_FRB but did not exceed the normal range during May sampling and did not exceed the normal range for any sampling event at LC_GRCK or reference (LC_DCEF) in 2020 (Figure 6.1; Appendix Table E.2).

The EVWQP level 3 benchmarks for effects to benthic invertebrates (27 mg/kg dw) and juvenile fish (26 mg/kg dw) were exceeded in at least one sample from LC_SPDC and LC_DCDS in 2020 and the level 2 benchmarks (20 and 18 mg/kg dw, respectively) were exceeded at LC_DC2 (Appendix Tables E.1 and E.2). These exceedances occurred in May and September at LC_DCDS, June at LC_SPDC, and May and November at LC_DC2. The exceedance of the EVWQP level 3 benchmarks at LC_DCDS in September may be related to increases in aqueous organoselenium concentrations during DCWMS sedimentation pond dewatering, as detailed in Sections 3.7 and 6.4. There was also an exceedance of the level 2 benchmark for effects to juvenile fish at LC_DC1 in June 2020. The observation of benthic invertebrate selenium concentrations higher than the level 3 benchmark for effects to juvenile fish is consistent with results of the Teck Integrated Effects Assessment Modelling (Teck 2020b). This evaluation

[29] 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 (Bruyn and Luoma 2021).

indicated the potential for effects to the growth of juvenile WCT in Dry Creek as a result of dietary exposure to benthic invertebrate tissue selenium concentrations. Results of those modelled effects to WCT juvenile growth indicated the magnitude of potential effects will be greatest for fish feeding at area LC_DCDS. The level 3 benchmark for dietary effects to juvenile birds was not exceeded at areas LC_SPDC or LC_DCDS in 2020 despite exceedances of this benchmark at both areas in 2018 and 2019 (Figure 6.1). Most tissue selenium samples were below the EVWQP level 1 benchmark for growth, reproduction, and survival of benthic invertebrates from areas LC_DC4 and LC_DC1 across all 2020 sampling events (Figure 6.1, Appendix Table E.2). All benthic invertebrate tissue selenium samples from LC_DC3 were below the EVWQP level 1 benthic invertebrate benchmark in 2020. The level 1 benchmarks for fish (11 mg/kg dw), invertebrates (13 mg/kg dw), and juvenile birds (15 mg/kg dw) were exceeded at area LC_FRB in 2020, whereas only the benchmark for fish was exceeded at LC_FRUS. No benchmark exceedances occurred at areas LC_DCEF or LC_GRCK in 2020.

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 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). Replicates exceeded the biological trigger at both LC_DCDS and LC_DC1 (55 of 65 and 6 of 65 replicates, respectively), with exceedances occurring in all 2020 sampling events at LC_DCDS and at all LAEMP sampling events and two supplemental sampling events at LC_DC1 (Section 2.4.3). The biological trigger exceedances for these replicates is likely related to algal bioaccumulation and reduction of selenium in the DCWMS sedimentation ponds upstream of areas LC_DCDS and LC_DC1 (Lorax 2020, Minnow 2020a). In 2018, elevated benthic invertebrate tissue selenium concentrations on Dry Creek led to the need for a response as identified via the AMP response framework, responses are ongoing (Teck 2019b). Further investigations and mitigation activities are currently underway, including development of a biokinetic model for selenium bioaccumulation, and modifications to the DCWMS operations in efforts to decrease generation of organoselenium compounds that occurs via primary production and / or heterotrophic microbial activity in the sedimentation ponds. Further information regarding the selenium concentrations in benthic invertebrate tissue biological trigger as it pertains to the Dry Creek LAEMP can be found in Appendix H.

6.3 Spatiotemporal Trends

Benthic invertebrate tissue selenium concentrations at each Dry Creek LAEMP area in 2020 were generally within or lower than the range of values for that area in 2018 and 2019 (Figure 6.1).

Changes in benthic invertebrate tissue selenium concentrations at Dry Creek LAEMP monitoring areas were assessed over multiple time scales (monthly for LAEMP sampling during 2020, and weekly during supplemental sampling) using 2-way ANOVAs.

Spatial comparison of tissue selenium concentrations on Dry Creek generally resulted in the same three groupings of areas with similar values during each sampling event (Figure 6.2; Appendix Table E.4). Specifically, mean benthic invertebrate tissue selenium concentrations were similar at LC_DC3 and LC_DCEF during each sampling event, as were those at the farthest downstream areas LC_DC1 and LC_DC4 and the areas closest to DCWMS discharge (LC_SPDC and LC_DCDS; Figure 6.2). Tissue selenium concentrations in 2020 were higher at area LC_DCDS than upstream of the DCWMS (LC_DC3) during all sampling events except for June. In June 2020, mean tissue selenium concentrations were lower than b-tool predictions for all areas except for LC_SPDC. In May, b-tool prediction values were lower than observed mean tissue selenium concentrations at LC_SPDC, LC_DCDS, LC_DC2, and LC_DC4 (Figure 6.1; Appendix Table E.3). Tissue selenium concentrations were higher downstream of the DCWMS in June at area LC_SPDC, however. These consistent area-wise groupings suggest that position on Dry Creek (and proximity to the DCWMS) was a reliable predictor of relative benthic invertebrate tissue selenium concentrations in 2020, regardless of season.

Changes in benthic selenium concentrations at areas downstream of the DCWMS were monitored over the supplemental weekly sampling period (September 23 to November 14) in response to elevated aqueous organoselenium (DMSeO and MeSe[IV]) concentrations detected at areas LC_SPDC and LC_DCDS during pond dewatering (Figure 3.6; for details see Section 2.4.1). The rationale for adding this sampling was the previously-established connection between increased organoselenium downstream of the DCWMS and elevated tissue selenium concentrations (Lorax 2020, Minnow 2020a). The mean benthic invertebrate tissue selenium concentrations at each monitoring area on Dry Creek did not vary significantly among weeks (Figure 6.3; Appendix Table E.5). There was a general decreasing trend in benthic invertebrate tissue selenium concentrations downstream of the DCWMS during the supplemental sampling period despite the differences among weeks not being statistically significant. This non-significant decreasing trend was most evident at LC_DC4 and LC_DC1, and less evident at LC_DCDS due to greater variability (Figure 6.1; Appendix Table E.2). The lack of significant change in tissue selenium concentrations over the weekly sampling period at LC_DCDS is likely due to variability in results, and at areas further downstream (i.e., LC_DC2, LC_DC4, and LC_DC1) is likely due to the narrow range of results. The absence of a statistically significant changes suggests that pond dewatering had limited influence on benthic invertebrate tissue selenium concentrations downstream (as measured during weekly supplemental sampling), with the exception of the slight (non-significant) decreasing trend

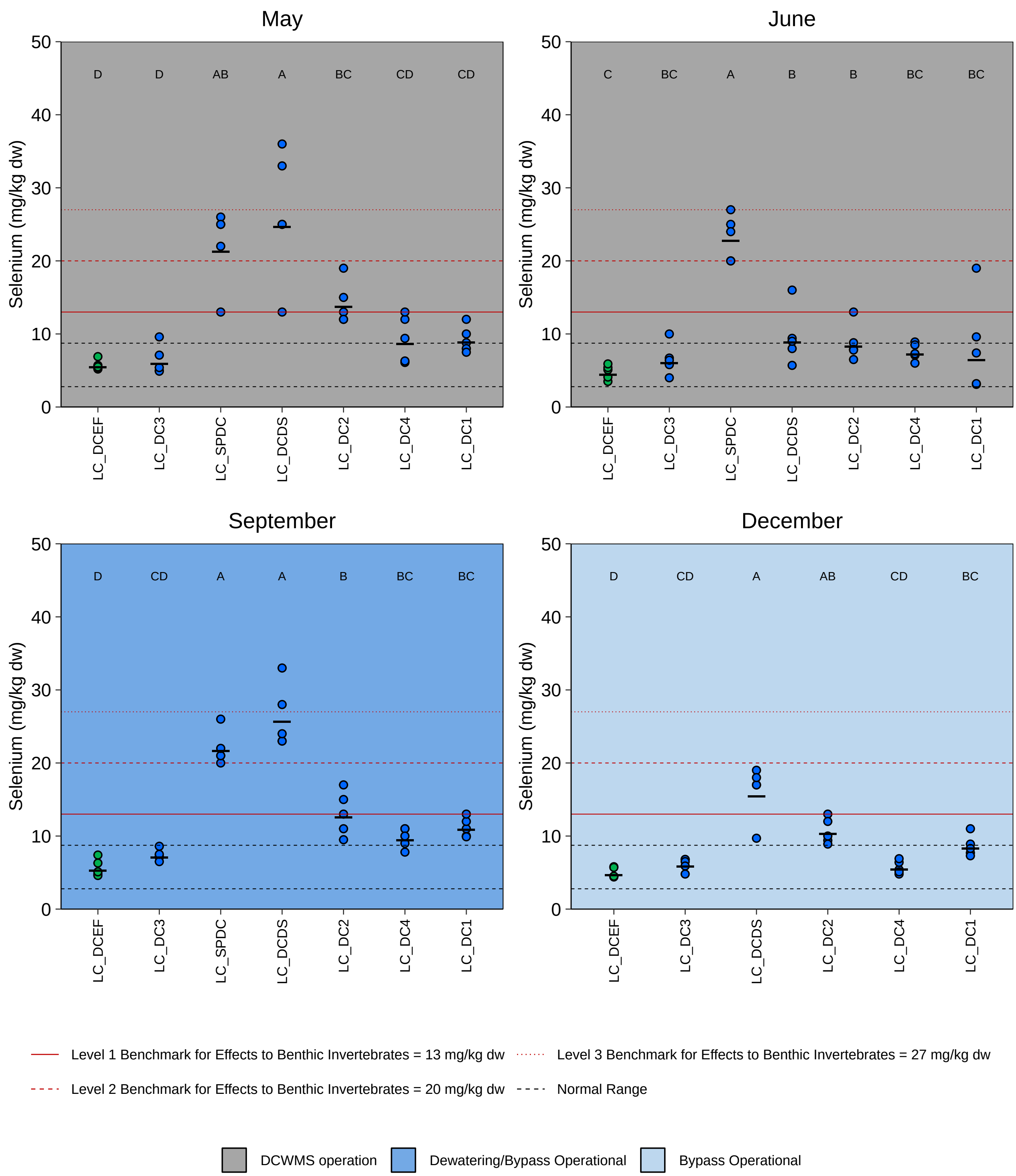

Figure 6.2: Selenium Concentrations (mg/kg dw) in Composite−Taxa Benthic Invertebrate Samples from Dry Creek Sampling Areas, 2020

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 (a = 0.05) in a Tukey's HSD test following a two−way ANOVA by area with Selenium log10 transformed.

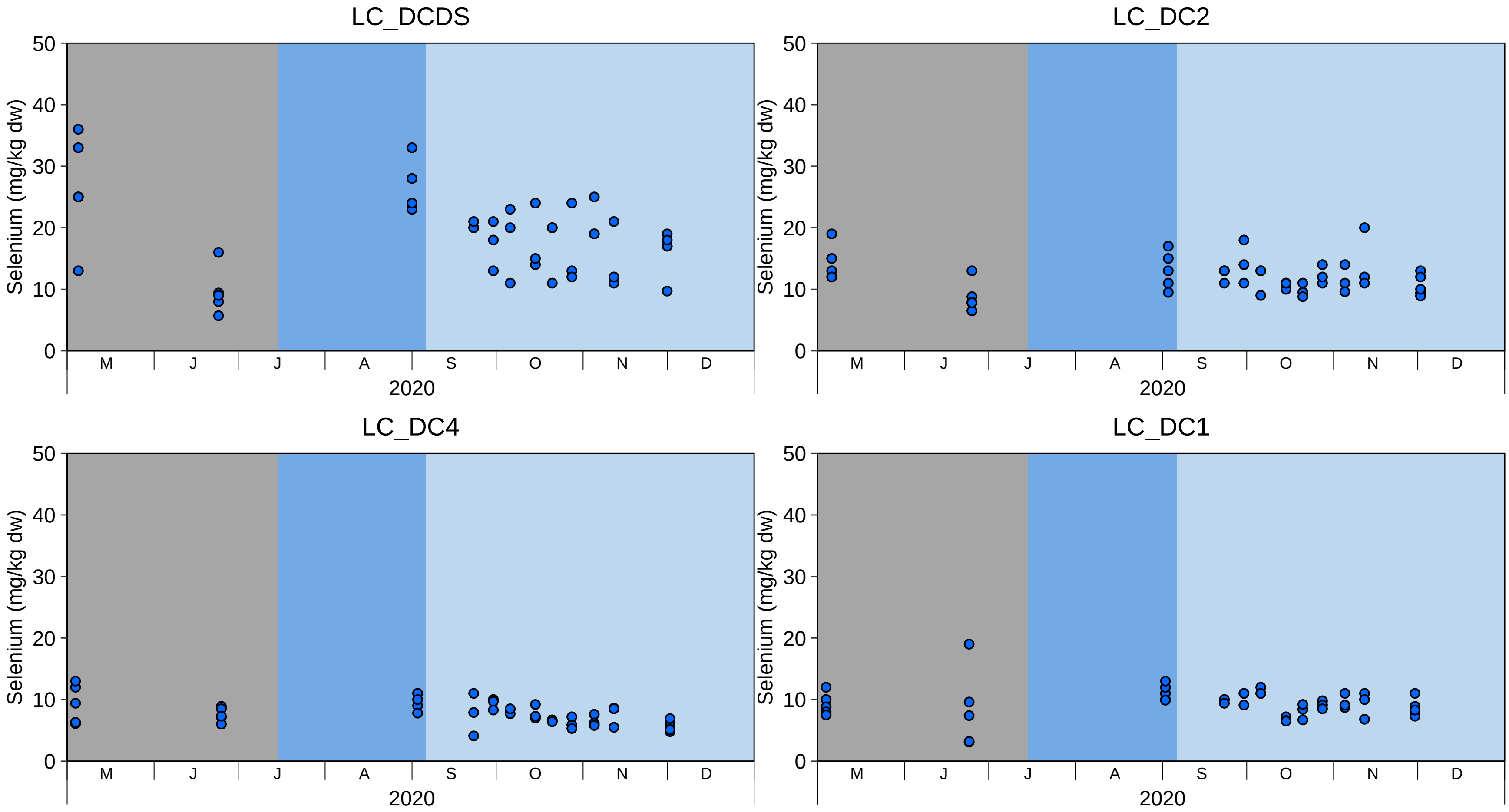

Figure 6.3: Selenium Concentrations (mg/kg dw) in Composite−Taxa Benthic Invertebrate Samples from LC_DCDS, LC_DC2, LC_DC4, and LC_DC1, Dry Creek, 2020

observed in selenium concentrations at areas located furthest downstream. Evaluation of changes in benthic invertebrate selenium concentrations during DCWMS dewatering but prior to the weekly sampling period (i.e., September 2020) are detailed in Section 6.4. The weekly monitoring results are consistent with findings that the activation of the DCWMS bypass may have been effective in mitigating the selenium bioaccumulation downstream of the DCWMS that was observed in previous years (Figures 3.6 and 6.1; Appendix Table E.5; Minnow 2019, 2020; Teck 2020e).

6.4 DCWMS Operational Periods

Higher-than-expected concentrations of aqueous and tissue selenium on Dry Creek in 2018 and 2019 led to mitigative steps including operational changes to the DCWMS which were realized in 2020 (Section 1.3). To evaluate the potential effects of different operational phases of the DCWMS on benthic invertebrate tissue selenium concentrations, an asymmetric 2-way ANOVA was used to compare results for each mine-exposed area of Dry Creek to reference (LC_DCEF) and the Fording River downstream of Dry Creek (LC_FRB) to upstream (LC_FRUS), compared among DCWMS operational periods (see Section 2.4.3.2 for details).

Significant differences in benthic invertebrate selenium concentrations at areas downstream of the DCWMS were observed between 2020 and late 2018/early 2019, relative to changes at reference over the same time frame (Appendix Tables E.6 to E.12). Benthic invertebrate tissue selenium concentrations peaked at some areas (particularly LC_SPDC, LC_DCDS, and LC_DC2) in late 2018 and early 2019 (Figure 6.1), which is well documented in previous reports (Minnow 2019, 2020), and have not reached similar concentrations since. Therefore, data interpretation is focused on comparisons of results from 2020 to 2019 to evaluate potential changes in benthic invertebrate tissue selenium related to the DCWMS dewatering and bypass in 2020. Complete results of the asymmetric 2-way ANOVA for each monitoring area can be found in Appendix Tables E.6-E.12.

Benthic invertebrate tissue selenium concentrations during DCWMS dewatering (sampling conducted in September 2020[30]) and bypass (sampling conducted in December 2020) were similar to or significantly lower than during DCWMS operation (relative to changes at reference over the same time frame), with two exceptions (Figure 6.4; Appendix Tables E.6 to E.11). Specifically, tissue selenium concentrations at LC_SPDC were significantly higher

[30] Benthic invertebrate tissue sampling was not conducted immediately following the increase in aqueous organoselenium concentrations (Section 3.7), as selenium speciation sample analysis results were pending. Sampling was resumed (and supplemental weekly sampling prescribed) as soon as those results were obtained.

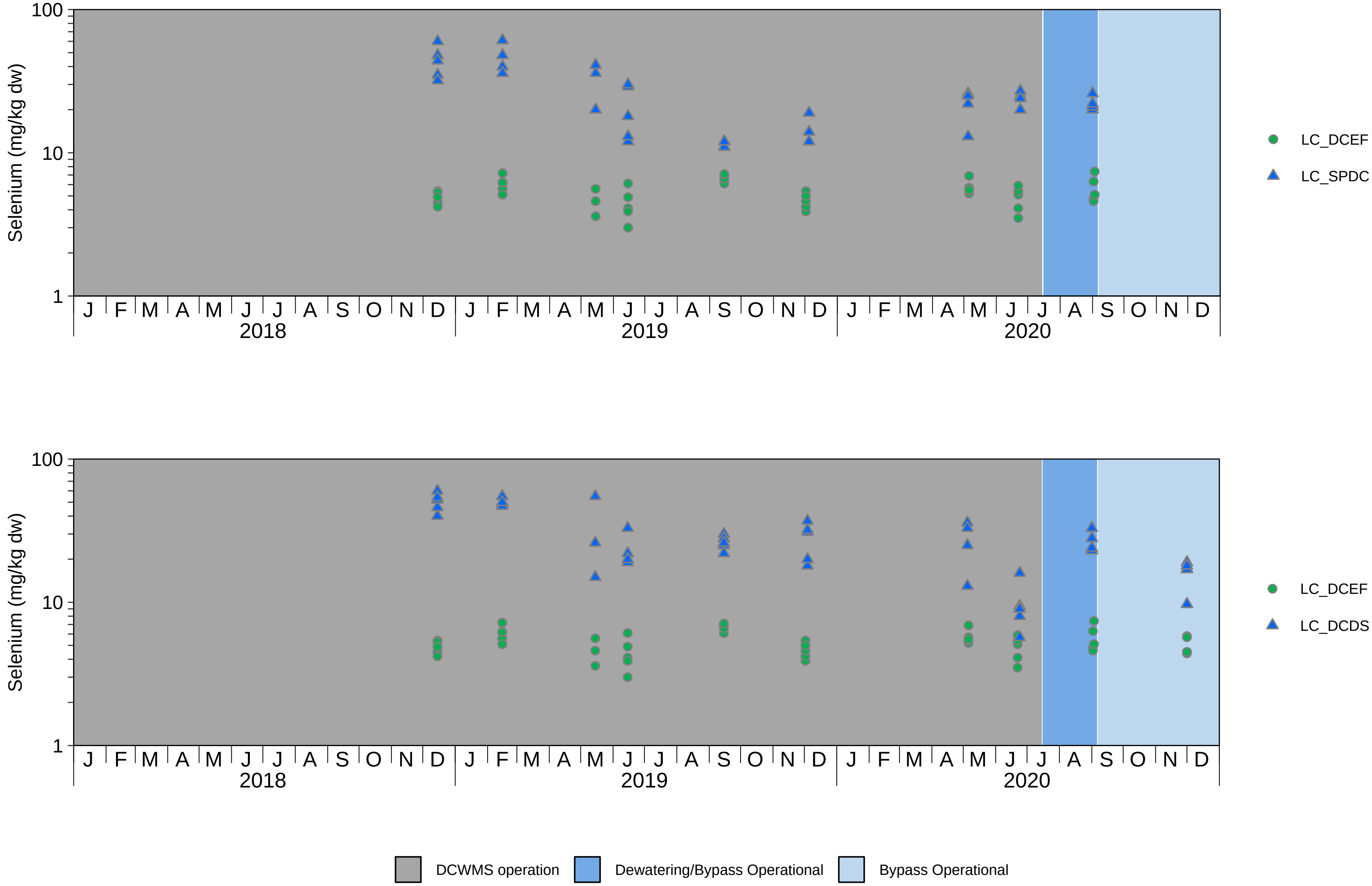

Figure 6.4: Benthic Invertebrate Tissue Selenium Concentrations, for LC_SPDC, LC_DCDS, and LC_DC1 (Mine−exposed Areas) Relative to LC_DCEF (Reference Area), 2018 to 2020

Notes: Only data collected simultaneously at both stations are displayed.

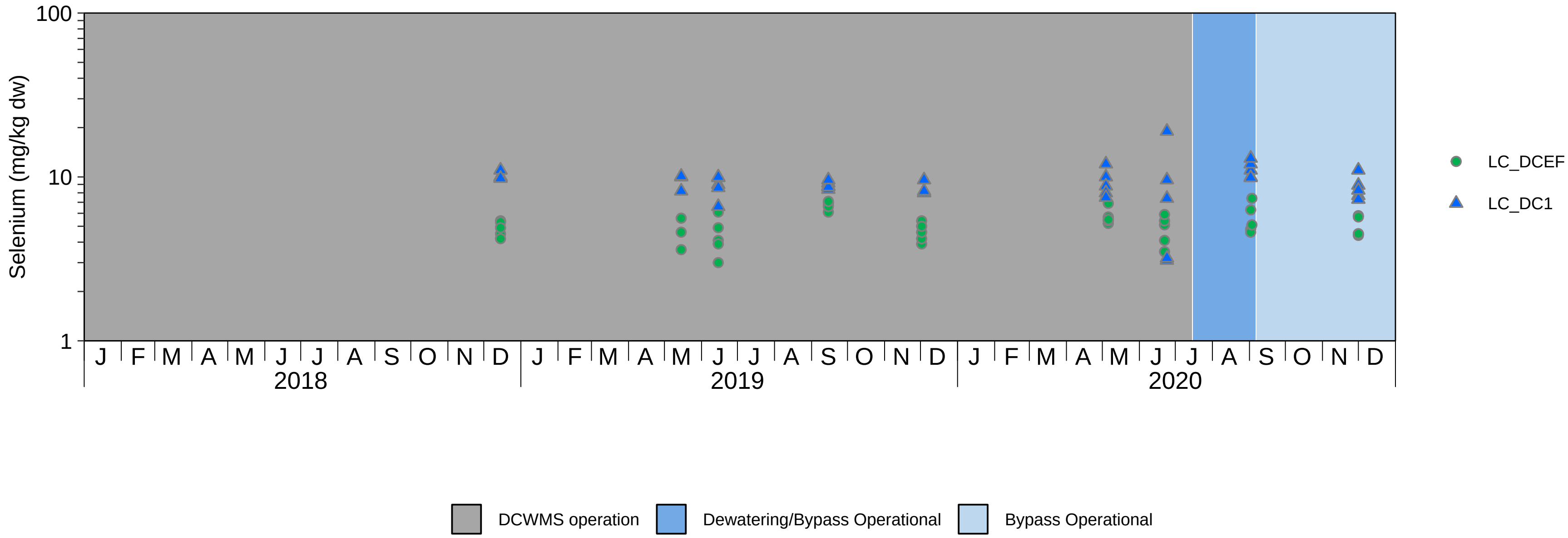

Figure 6.4: Benthic Invertebrate Tissue Selenium Concentrations, for LC_SPDC, LC_DCDS, and LC_DC1 (Mine−exposed Areas) Relative to LC_DCEF (Reference Area), 2018 to 2020

Notes: Only data collected simultaneously at both stations are displayed.

during dewatering (September 2020) than in September 2019, relative to reference. This difference was likely a result of low tissue selenium concentrations in September 2019 (compared to all other sampling events) rather than an increase in tissue selenium concentrations in September 2020. This is supported by the absence of significant differences between tissue selenium concentrations at LC_SPDC in September 2020 compared all other sampling events in 2020 (May and June; Figure 6.4; Appendix Tables E.4 and E.7). Tissue selenium concentrations in benthic invertebrates from LC_DCDS were significantly higher during DCWMS dewatering (September 2020) than in June 2020 (during DCWMS operation), relative to reference Figure 6.4; Appendix Table E.8). This was likely related to a combination of increased aqueous organoselenium concentrations downstream of the DCWMS during dewatering (Figure 3.6; Section 3.7) and tissue selenium concentrations reported in June 2020 that were significantly lower than those from all other sampling events in 2020 at LC_DCDS (and fell below the b-tool predictions; Appendix Tables E.3 and E.4).

Although not statistically significant, mean benthic invertebrate tissue selenium concentrations were lower in June 2020 than in May 2020 at all areas downstream of the DCWMS except for LC_SPDC (Appendix Table E.2). This may have reflected a combination of a general downward trend in benthic invertebrate tissue selenium concentrations on Dry Creek which was reversed by increased aqueous organoselenium concentrations downstream of the DCWMS related to pond dewatering (Figures 3.6 and 6.1; Appendix Figure B.43) and low tissue selenium concentrations reported in June 2020. As indicated above, benthic invertebrate selenium concentrations in June 2020 were below the b-tool predictions for all areas except LC_SPDC (see Section 6.3) and at LC_DCDS were significantly lower in June than all other sampling events (Appendix Table E.4). At LC_DCDS, the increase in benthic invertebrate tissue selenium concentrations between June and September was statistically significant, relative to reference (Figures 6.1; Appendix Table E.8), but this was not observed elsewhere on Dry Creek (Appendix Figure E.1; Appendix Tables E.6 to E.11).

Benthic invertebrate tissue concentrations during dewatering remained within the range of values observed in late 2019 and early 2020, indicating that conditions were less conducive to elevated tissue selenium concentrations during dewatering than peak tissue selenium conditions in 2018. Tissue selenium concentrations decreased gradually during the supplemental weekly sampling period and into December, likely due to the DCWMS bypass being active following dewatering, although differences among weeks were not significant (Figures 6.1 and 6.3; Appendix Table E.5; see Section 6.3 for details). These results suggest that DCWMS dewatering and the resulting increase in aqueous organoselenium may have slightly influenced benthic invertebrate tissue selenium concentrations downstream in September although changes were not frequently statistically significant (Figures 3.6 and 6.1; Appendix Figure B.43).

On the Fording River, benthic invertebrate tissue selenium concentrations were higher at LC_FRB during dewatering than during DCWMS operation compared with changes at area LC_FRUS over the same period (Figure 6.5; Appendix Table E.12). However, the absence of a similar significant increase during DCWMS dewatering at area LC_DC1 (closest in proximity upstream of the mouth of the Fording River), relative to reference, indicates that the increase at LC_FRB was likely not related to changes in the DCWMS operational status (Figures 6.4 and 6.5). Aqueous organoselenium concentrations were below detectable limits for all samples from LC_FRB in 2020, further supporting the observation the increase in benthic invertebrate was not related to DCWMS dewatering.

6.5 Summary

Benthic invertebrate tissue selenium concentrations from Dry Creek in 2020 remained relatively unchanged from 2019 (Figure 6.1). Tissue selenium concentrations were similar to or significantly lower during DCWMS bypass than DCWMS operation with two exceptions (one at LC_SPDC and one at LC_DCDS). During DCWMS dewatering when peaks in aqueous organoselenium concentrations were observed (August/September 2020), mean benthic invertebrate tissue selenium concentrations were higher at LC_DCDS, LC_DC2, LC_DC4, and LC_DC1 than in June 2020, but this increase was only statistically significant at LC_DCDS (relative to reference). The benthic invertebrate tissue selenium concentrations reported in September were followed by a gradual (although non-significant) downward trend during supplemental weekly sampling completed during the remainder of bypass period in 2020 (i.e., until December). Benthic invertebrate tissue selenium concentrations from Dry Creek areas downstream of the DCWMS remained higher than regional normal ranges and benchmarks (Level 3 exceedances: LC_SPDC [3 of 14 replicates in 2020] and LC_DCDS [4 of 14 replicates]; Level 2 exceedances: LC_DC2 [2 of 44 replicates] and LC_DC1 [1 of 49 replicates]; Level 1 exceedances: LC_DC4 [5 of 44 replicates]) in 2020. Mitigative steps including changes to the DCWMS to decrease the potential for selenium reduction and bioaccumulation in the sedimentation ponds, and removal of area LC_SPDC are underway (See Section 1.3) and additional steps are being considered as part of ongoing AMP framework and SDM response processes.

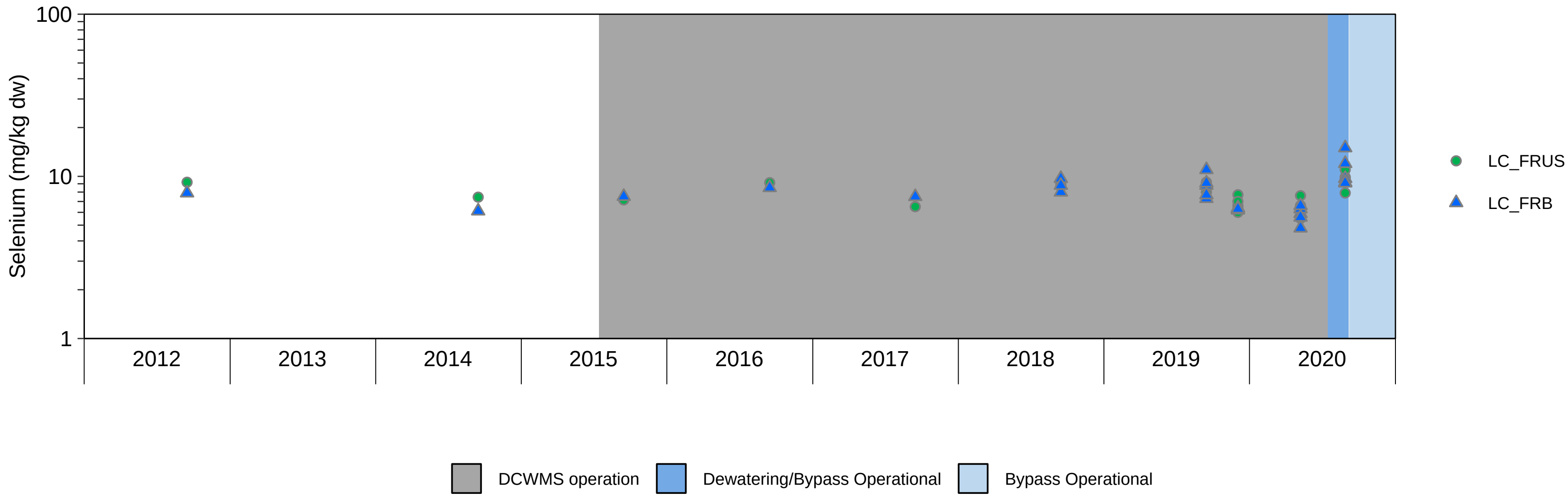

Figure 6.5: Benthic Invertebrate Selenium Concentrations, for LC_FRB (Downstream) Relative to LC_FRUS (Upstream), 2012 to 2020

Notes: Only data collected simultaneously at both stations are displayed.

7 STUDY QUESTION 5: FISH AND FISH HABITAT

7.1 Overview

Fish and fish habitat monitoring was conducted in 2020 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 redd surveys, water temperature, and dissolved oxygen measurements in Reaches 1 to 4 of Dry Creek; electrofishing was not conducted in 2020 following recommendations from the EVFFHC. Fish tissue chemistry results for 2020 sampling were derived from opportunistic sampling of incidental WCT mortalities collected from Reach 3 in October 2020 (see Section 2.5.2 for details). Water temperature was assessed for the DCFFHMP based on data collected at 5 Dry Creek locations, the Dry Creek East Tributary, and Fording River directly below the mouth of Dry Creek. In 2020, flow in Dry Creek was characterized based on data collected at 2 hydrometric stations (LC_DC1 and LC_DCDS).

7.2 Fish Health

Comparisons of the relative abundance of WCT captured among Reaches 1 to 4 in Dry Creek could not be completed in 2020 as in previous years (See Section 2.5.1 for details). Past results indicate moderately consistent total catch from 2017 to 2019 (54, 55, 55, respectively; Ecofish 2019 and 2020a), but that total catch in 2016 (92 fish) was nearly double that observed in 2017 to 2019 (Ecofish 2019). Similarly, the proportion of captured age classes has been relatively consistent over time with age 3 and 4+ fish yielding the highest relative density in catch estimates, except in 2019 where age 2+ was the most frequently caught age class (Ecofish 2019 and 2020a). However, total juvenile biomass (g/100m^2 of age 1 to 3 years) was lower in 2019 (46 g/100m^2) compared to 2018 (59.6 g/100m^2). No fry (age 0+) have been observed in Dry Creek since 2016, although sampling methodologies and timing have not targeted fry.

A limited amount of individual fish health data are available from the fish mortalities that were collected during opportunistic sampling after the fish stranding event that occurred in October 2020 (see Section 2.5.2 for details). A total of 25 WCT were stranded and opportunistically sampled from the dry stream channel in Reach 3: 17 fish were collected within 24 hours of the dewatering event (i.e., October 8th, 2020) and eight fish were collected within 72 hours (i.e., October 10th, 2020). Fish collected represented a broad range of sizes from 78 mm to 254 mm fork length. However, most fish collected ranged from 121 to 194 mm (Table 7.1).

The age of fish collected in 2020 were estimated to range from 1 to 4+ years old (Table 7.1) based on an age length key developed on data from 2016 to 2019 (Ecofish 2019 and 2020a; Table 7.2). Three-year old fish were the most frequent age group (n = 10), followed by two-year

Table 7.1: Individual Fish Metrics from Opportunistically[a] Collected Westslope Cutthroat Trout, Dry Creek, October 2020

Sample	Date	Fork Length (mm)	Weight (g)	Sex	Total Length (mm)	Age[b]	Muscle Selenium (mg/kg dw)	Ovary Selenium (mg/kg dw)	Abnormalities	Mortality
LC_DC2-WCT-1	2020-Oct-08	145	34	M	152.9	3	9.9	-	None	24 hr
LC_DC2-WCT-2	2020-Oct-08	157	44	M	165.4	3	11	-	None	24 hr
LC_DC2-WCT-3	2020-Oct-08	124	14	M	131.1	2	9.3	-	Pupil reduced	24 hr
LC_DC2-WCT-4	2020-Oct-08	195	83	M	204.9	4	10	-	None	24 hr
LC_DC2-WCT-5	2020-Oct-08	140	32	M	147.7	2	10	-	None	24 hr
LC_DC2-WCT-6	2020-Oct-08	110	13	M	116.5	2	10	-	None	24 hr
LC_DC2-WCT-7	2020-Oct-08	138	28	M	145.7	2	11	-	None	24 hr
LC_DC2-WCT-8	2020-Oct-08	101	12	M	107.2	1	-	-	None	24 hr
LC_DC2-WCT-9	2020-Oct-08	86	6	M	91.6	1	-	-	None	24 hr
LC_DC2-WCT-10	2020-Oct-08	178	62	M	187.3	4	9.5	-	None	24 hr
LC_DC2-WCT-11	2020-Oct-08	169	48	M	177.9	3	11	-	Lesion on posterior	24 hr
LC_DC2-WCT-12	2020-Oct-08	151	34	M	159.2	3	9.8	-	Reduced/damaged tail	24 hr
LC_DC2-WCT-13	2020-Oct-08	163	50	M	171.7	3	10	-	None	24 hr
LC_DC2-WCT-14	2020-Oct-08	81	5	M	86.4	1	-	-	None	24 hr
LC_DC2-WCT-15	2020-Oct-08	169	45	M	177.9	3	11	-	None	24 hr
LC_DC2-WCT-16	2020-Oct-08	148	35	M	156.1	3	9.8	-	None	24 hr
LC_DC2-WCT-17	2020-Oct-08	150	37	M	158.1	3	9.8	-	None	24 hr
LC_DC2-WCT-18	2020-Oct-09	256	184	F	268.4	4+	14	22.4[c]	None	24 hr
LC_DC2-WCT-19	2020-Oct-09	80	5	M	85.3	1	-	-	None	72 hr
LC_DC2-WCT-20	2020-Oct-09	186	69	M	195.6	4	8.9	-	None	72 hr
LC_DC2-WCT-21	2020-Oct-09	156	42	M	164.4	3	11	-	None	72 hr
LC_DC2-WCT-22	2020-Oct-09	125	20	M	132.1	2	9.7	-	Reduced/damaged tail	72 hr
LC_DC2-WCT-23	2020-Oct-09	157	44	M	165.4	3	11	-	None	72 hr
LC_DC2-WCT-24	2020-Oct-09	124	20	M	131.1	2	9.2	-	Reduced/damaged tail	72 hr
LC_DC2-WCT-25	2020-Oct-09	130	26	M	137.3	2	14	-	None	72 hr

Notes: "mg/kg dw" = milligrams per kilogram of organism dry weight.
[a] Flow reduction at LC_SPDC during the construction process in October 2020 resulted in the stranding mortalities of 25 WCT downstream at area LC_DC2 on October 8th. Stranded fish were sampled opportunistically for tissue analysis. Some specimens were also sent to a pathologist for necropsy although results were not available in time for inclusion in this report.
[b] Age assigned based on 2020 age-length key.
[c] Ovary tissue selenium concentration was estimated from muscle selenium concentrations (based on the ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation [2011]).

Table 7.2: Westslope Cutthroat Trout Fork Length Range and Corresponding Age Classes, Dry Creek, 2016 to 2020

Year[a]	Age Class	Fork Length Range (mm)
2016	Fry (0+)	34-67
	Juv. (1+)	68-106
	Juv. (2+)	107-143
	Juv. (3+)	144-176
	Adult (≥4+)	182+
2017	Fry (0+)	-
	Juv. (1+)	70-89
	Juv. (2+)	111-139
	Juv. (3+)	145-179
	Adult (≥4+)	180+
2018	Fry (0+)	-
	Juv. (1+)	66-86
	Juv. (2+)	112-139
	Juv. (3+)	144-175
	Adult (≥4+)	176+
2019	Fry (0+)	-
	Juv. (1+)	67-94
	Juv. (2+)	104-145
	Juv. (3+)	152-172
	Adult (≥4+)	176+
2020	Fry (0+)	34-66
	Juv. (1+)	67-94
	Juv. (2+)	104-143
	Juv. (3+)	144-175
	Adult (≥4+)	176+

[a] 2016 to 2019 data found in Faulkner et al. 2019 and Faulkner et al. 2020.

old fish (n = 7; Table 7.2). All fish collected opportunistically in 2020 were male (n=24), except for one female which was the largest (256 mm) and oldest fish (4+ years old) collected (Table 7.1).

7.3 Selenium in Fish Tissue

Selenium toxicity in the aquatic environment is associated with bioaccumulation through dietary exposure. Toxicity in fish manifests primarily through maternal uptake and transfer into eggs which results in reproductive effects such as early life stage mortality and developmental deformities (USEPA 2016). Westslope Cutthroat Trout muscle tissue data collected for the present study were of good quality as characterized by good detectability, 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 (see Appendix A for details).

All of the WCT sampled (n=21) at area LC_DC2 in Reach 3 of Dry Creek in 2020 demonstrated muscle selenium concentrations below the Elk Valley site-specific benchmark of 15.5 µg/g dw (Figure 7.1; Table 7.2). Tissue selenium concentrations were not elevated relative to samples collected on the upper and lower Fording River in 2018 and were within the range of values for tissue samples collected on Dry Creek in 2019 (Figure 7.1). The ovary selenium concentration of the single female WCT collected in 2020 was estimated as 22.4 (µg/g dw), which is below the level 1 site-specific benchmark for WCT eggs in the Elk Valley (25 µg/g dw), however, sampling occurred outside the spawning window and ovary condition was regressed (i.e., did not contain mature eggs) (Table 7.2; Golder 2014).

Benthic invertebrate selenium concentration data from September LAEMP and weekly supplemental sampling were plotted with WCT tissue selenium data to assess dietary selenium conditions at LC_DC2 as well as upstream (LC_DCDS) and downstream (LC_DC4) of opportunistic sampling (Figure 7.2). WCT tissue selenium concentrations were within the range of benthic invertebrate tissue selenium concentrations at LC_DC2, and lower than benthic invertebrate tissue selenium concentrations upstream at LC_DCDS. Although WCT have access to upstream areas with higher dietary selenium concentrations, the similarity in selenium concentrations in WCT muscle and benthic invertebrates from LC_DC2 suggests that dietary exposure for these fish may have occurred in the vicinity of LC_DC2. WCT tissue selenium data were also plotted against mean benthic invertebrate selenium concentrations for September, October, and November at four Dry Creek areas including LC_DC2 to assess the ratio of tissue to dietary selenium for opportunistically sampled WCT (Figure 7.3). The ratios of WCT selenium concentrations to dietary (benthic invertebrate) selenium concentrations were slightly less than a 1:1 ratio at area LC_DC2, slightly greater than 1:1 downstream at area LC_DC1, and roughly equal at area LC_DC1. At LC_DCDS, the ratios were lower than and farther from the 1:1 ratio

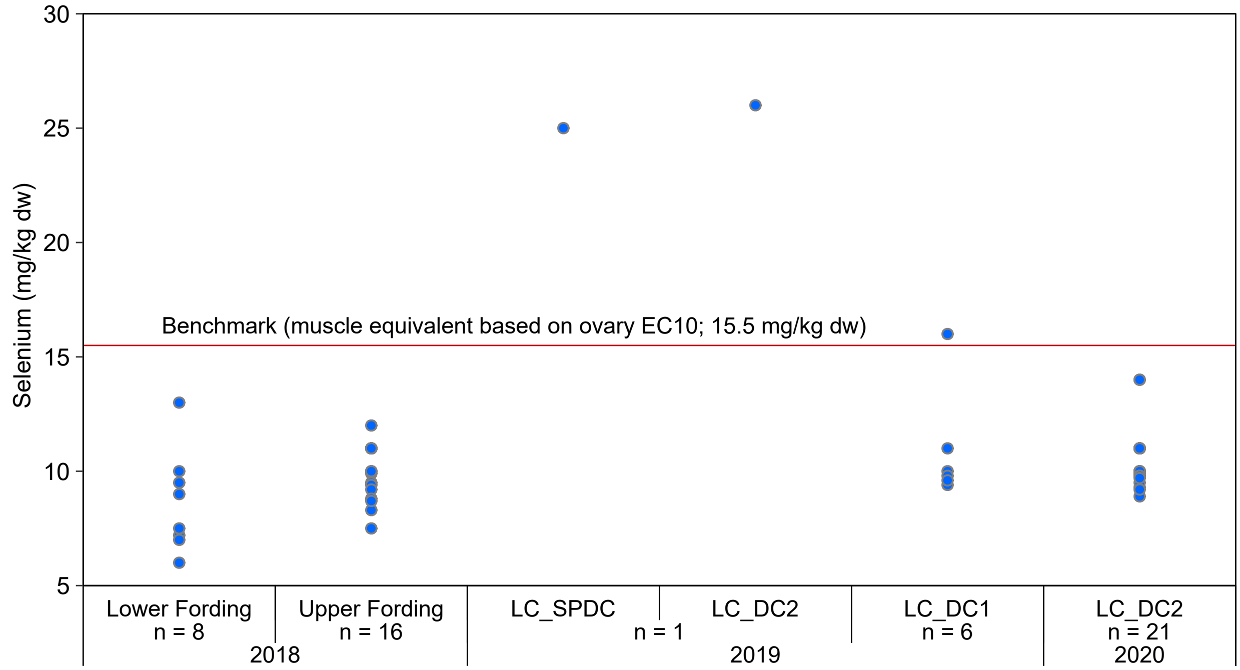

Figure 7.1: Westslope Cutthroat Trout Muscle Selenium Concentrations Compared Between Dry Creek Sampling Areas and Fording River Areas, 2018 and 2020

Notes: Samples were collected in September 2018, July (LC_DC2, LC_SPDC) and September (LC_DC1) 2019, and October 2020.

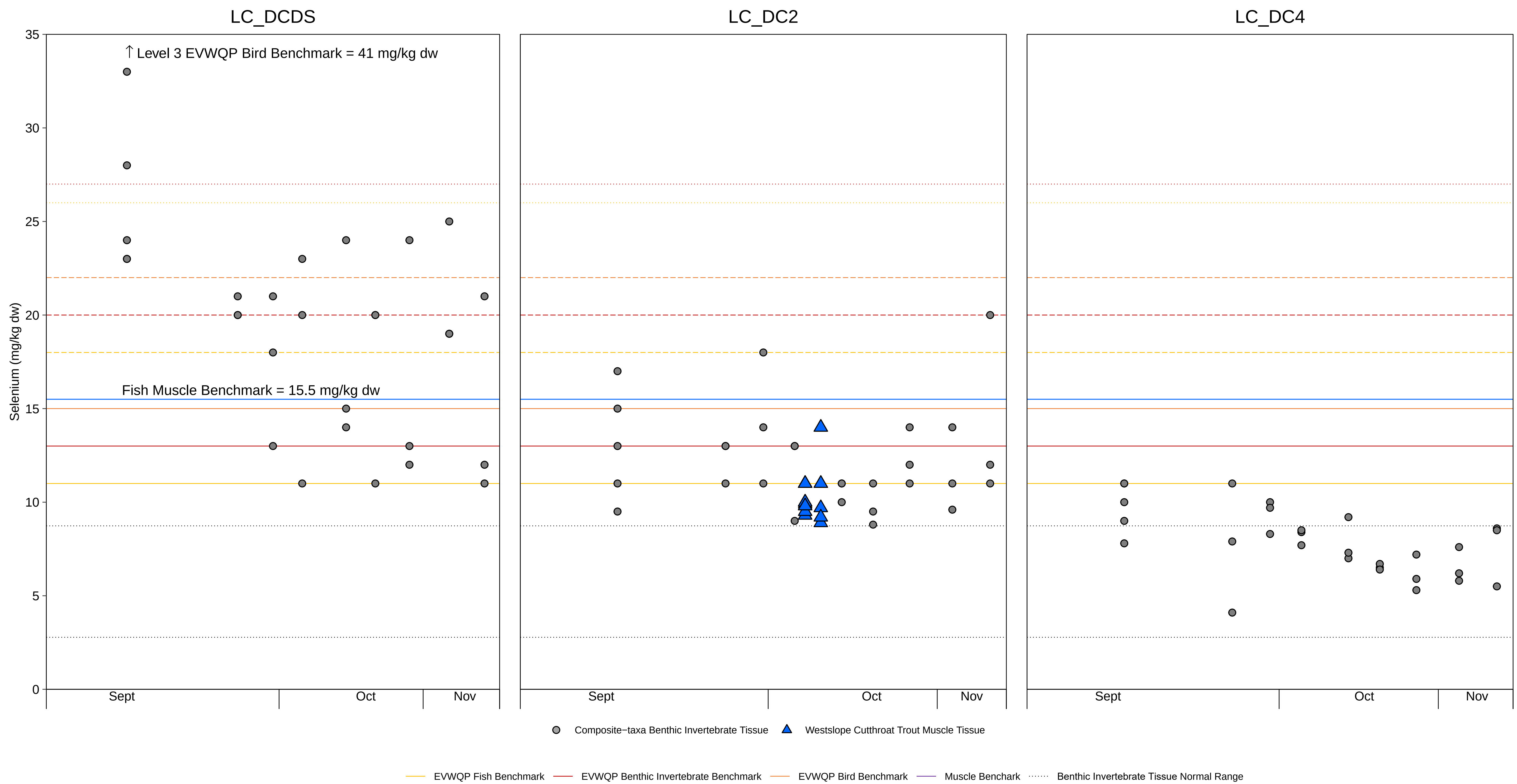

Figure 7.2: Composite−taxa Benthic Invertebrate (BI) and Fish Muscle Tissue Concentrations, Dry Creek, 2020

Notes: Regional normal range for benthic invertebrate tissue selenium 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. Level 1 benchmarks are shown with a solid line, level two benchmarks are shown with a dashed line, level three benchmarks are shown with a dotted line.

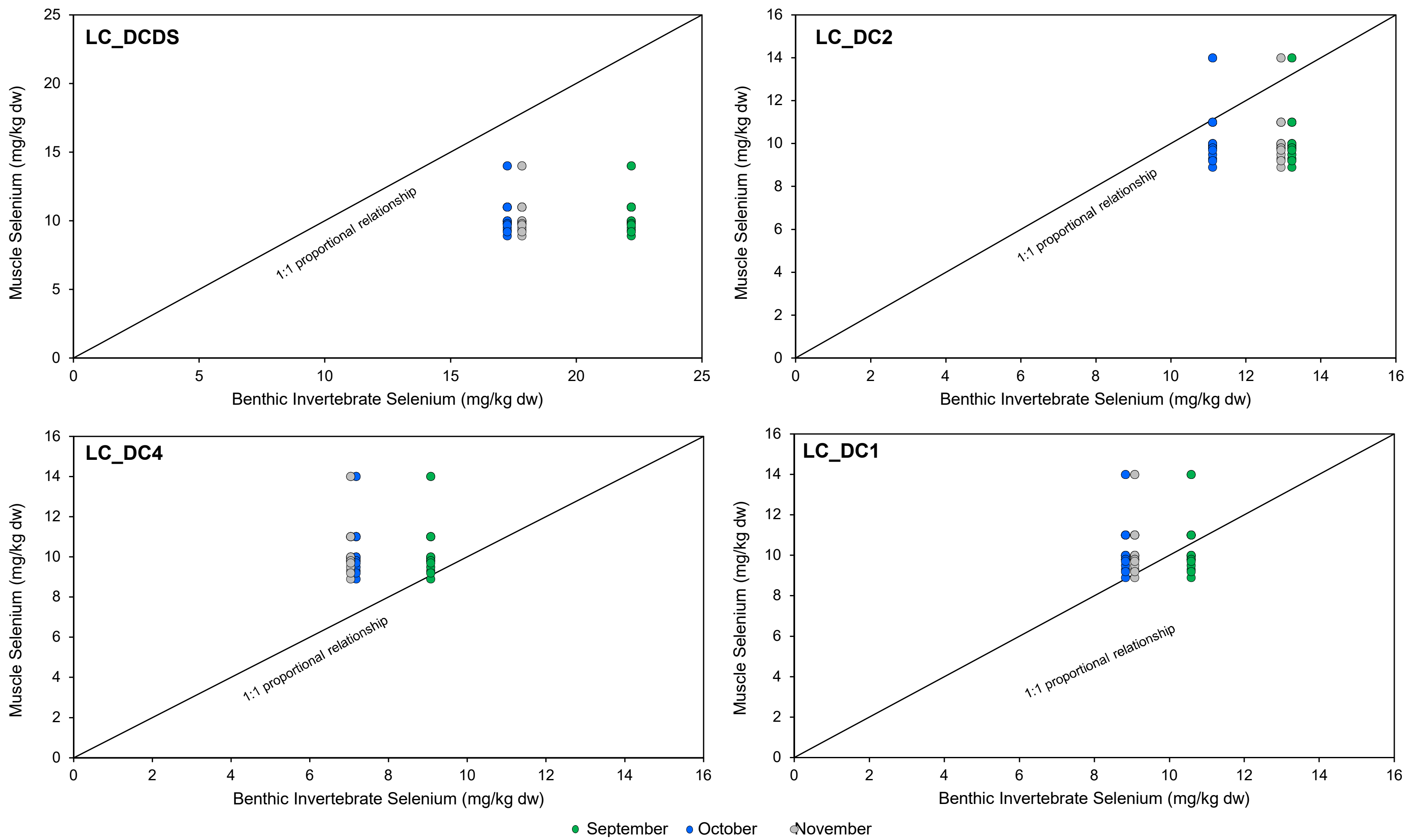

Figure 7.3: Westslope Cutthroat Trout Muscle Tissue Selenium Concentrations Collected at Dry Creek Area LC_DC2 Compared to Mean[a] Tissue Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples from Dry Creek Areas LC_DCDS, LC_DC2, LC_DC4, LC_DC1

Notes: Month represents month benthic invertebrate tissue was collected.

[a] Benthic invertebrate tissue chemistry data area a mean of data collected from all sampling that month, including supplementary weekly sampling.

than the other areas. Overall, these results suggest the WCT that were evaluated may have fed throughout the section of Dry Creek between LC_DC2 and LC_DC1 (which includes area LC_DC4) but likely not at LC_DCDS. The modelled effects of elevated benthic invertebrate tissue selenium on Dry Creek WCT juvenile growth indicate that maximum effects would occur at area LC_DCDS (Teck 2020b). Fish collected at LC_DC2 likely were not feeding preferentially at LC_DCDS despite the lack of barriers between those areas, which may be the case for other WCT on Dry Creek.

7.4 Redd Surveys

Redd surveys have been completed in Dry Creek since 2016. From 2016 to 2019, Reaches 1 to 4 were surveyed on two occasions each year: once in mid to late June, and once in July. Evidence of spawning was assessed as the presence of redds, or the presence of adult fish displaying spawning behaviour (Ecofish 2019 and 2020a). The majority of redds and spawning-sized WCT were observed in June in Reach 1 across all sampling years (2016 to 2019). Fish larger than 150 mm fork length have been observed demonstrating spawning behaviour in Dry Creek, suggesting this size class and larger represents reproductively mature fish. From 2016 to 2018 the maximum number of redds (n = 31) and WCT > 150 mm (n = 23) were observed during the first survey in June (Ecofish 2019). Due to an unusually cold spring, the first redd survey in 2019 did not occur until July 6th and fewer redds and adults were observed than in previous years (Ecofish 2020a). In 2019, the fewest WCT > 150 mm (n = 2 on July 6th and n = 5 on July 17th) were observed since observations began in 2016 (Ecofish 2020a).

Redd surveys conducted in 2020 occurred on June 30th and July 7th. Five redds were observed in June: one in Reach 1, one in Reach 2, and three in Reach 3. One redd was observed on July 7th in Reach 3, but it is believed to be the same redd observed in June (Nupqu and AJM 2021; Appendix F). A total of six WCT redds were observed in Dry Creek in 2020, which is lower than any previous year of sampling in support of the DCFFHMP (Ecofish 2019). Variability in results from redd surveys were potentially present in 2020 due to different sampling crews used (surveys conducted by Ecofish prior to 2020, and by Nupqu and Lotic in 2020), an incomplete survey of Reach 4 (completed during survey the following week), and heavy rain on June 30 that caused reduced visibility. Furthermore, in previous years of DCFFHMP sampling, redd surveys were generally separated by at least two weeks (2017 - four weeks; 2018 - three weeks - 2019 - ten days; 2020 – eight days), which would reduce the likelihood of counting the same redd twice in successive surveys. Consistent staffing of redd survey crews would also reduce the likelihood of double-counting of redds while also confirming criteria for redd identification are kept consistent among surveys. No WCT were observed during either redd survey in 2020. The survey of the

Fording River and lower portion of Reach 1 in Dry Creek on July 2nd did not discover additional redds in Reach 1 or observe any adult WCT (Nupqu and AJM 2021).

7.5 Fish Habitat

7.5.1 Water Temperature

Water temperature in Dry Creek is spatially heterogenous as well as seasonally and annually variable among monitoring stations (Ecofish 2019). This variability was observed across previous years of monitoring (2016 to 2019), where the East Tributary was consistently the coldest area sampled in the summer (average summer temperature < 5°C) and the warmest in the winter. The warmest summer monthly average and instantaneous temperatures have been consistently observed at LC_SPDC (Ecofish 2020a); however, mean daily water temperatures have not exceeded the potential effects threshold of 18°C at any monitoring station from 2016 to 2019. Instantaneous water temperatures exceeded 18°C in July of 2017 and 2018 in the area immediately downstream of the DCWMS. Monitoring stations farther downstream from the DCWMS had intermittent mean summer water temperatures that fell between the cool water observed in the East Tributary and the warmer water near the DCWMS. Maximum weekly water temperatures for rearing occasionally exceeded the 16°C threshold in both 2017 and 2018 at stations near the DCWMS (Ecofish 2019 and 2020a). From 2016 to 2019, minimum daily winter water temperatures commonly fell below 1°C (from 13 to 154 days) at all monitoring stations except in the East Tributary in 2019 when average daily winter temperatures remained above 1°C (Ecofish 2019 and 2020a). A cool spring in 2019 resulted in delayed warming of Dry Creek and no upper water temperature thresholds were exceeded in 2019.

Dry Creek water temperature patterns in 2020 were consistent with previous years where the East Tributary and DRY-WQ02 (immediately downstream of the East Tributary/ Dry Creek confluence) were the coolest in the summer and warmest in the winter compared to other sampling areas (Table 7.3; Nupqu and AJM 2021). Similarly, monitoring at LC_SPDC and LC_DCDS demonstrated the highest summer temperatures, the largest daily fluctuations, and winter temperatures below 1°C (Nupqu and AJM 2021; Appendix F). Mean daily and instantaneous water temperatures did not exceed 18°C at any station in 2020, nor was the optimal rearing maximum of 16°C exceeded in 2020 (Table 7.3).

Recruitment in WCT is associated with the length of the growing season; fewer than 800 degree days can result in recruitment failure and greater than 900 degree days can sustain annual recruitment (Coleman and Fausch 2007). From 2016 to 2019, growing degree days were consistently above 800 at all monitoring stations except for the East Tributary and DRY-WQ02 (downstream of the confluence with the East Tributary; Ecofish 2019 and 2020a).

Table 7.3: Summary Statistics for Average, Minimum, and Maximum Water Temperatures (°C) at the Seven Monitoring Sites in the 2020 Dry Creek Fish and Fish Habitat Monitoring Program (Adapted from Nupqu and AJM 2021)

Month	DRY-WQ03 East Tributary			DRY-WQ04 Dry Creek u/s of East Tributary (d/s of LC_DC3)			DRY-WQ02 Dry Creek below confluence with East Tributary			LC_SPDC			LC_DCDS			DRY-WQ01 Dry Creek mouth at Fording River (d/s of LC_DC1)			FRD-WQ01 Fording River at Dry Creek mouth		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Jan-20	2.2	1.40	2.7	0	0	0.10	0.60	0	1.30	0.30	0.10	0.40	0.10	-0.10	0.30	1.00	0.20	1.70	0.30	0	1.50
Feb-20	1.90	1.30	2.6	0.10	0	0.10	0.30	-0.10	1.20	0.20	0.10	0.50	0.10	-0.10	0.40	0.80	0.20	1.70	0.20	0	1.60
Mar-20	1.90	1.10	2.5	0	0	0.10	0.50	-0.10	1.80	0.30	0.10	0.60	0.10	-0.10	0.40	0.90	0.20	1.90	0.50	-0.10	2.9
Apr-20	1.80	0.60	2.7	0	-0.10	0.10	1.30	0	2.6	1.10	0.20	3.4	0.90	-0.10	3.2	1.40	0.20	3.7	1.80	0	5.1
May-20	2.4	1.30	4.8	0.40	-0.20	2.2	2.4	1.20	4.8	4.4	2.3	7.6	3.3	1.50	6.0	3.4	1.30	7.0	3.8	1.60	6.9
Jun-20	3.8	1.80	6.1	2.9	1.10	6.1	3.8	1.80	6.2	7.2	4.8	11.9	5.5	3.0	10.2	5.2	3.1	8.4	5.6	3.4	8.8
Jul-20	4.2	3.0	5.6	5.4	3.1	8.3	4.5	3.0	5.9	8.9	6.2	12.0	7.3	4.9	11.5	5.9	3.8	8.7	7.8	4.7	11.9
Aug-20	3.9	3.4	4.4	7.1	4.9	9.5	4.6	3.5	5.8	9.3	6.6	14.9	8.6	5.4	15.6	6.0	3.7	9.8	8.5	5.4	12.2
Sep-20	3.8	3.3	4.4	8.0	6.2	9.7	4.3	2.9	5.7	6.6	3.7	9.2	6.2	3.4	9.5	4.9	2.9	7.1	6.6	3.6	10.0
Oct-20	3.3	2.10	4.2	6.5	4.2	8.3	3.0	0	6.1	-	-	-	3.0	0	8.8	3.5	1.20	5.6	3.8	0	8.0

Average minimum temperatures for each site for the period of record.
Average maximum temperatures for each site for the period of record
The overall maximum temperatures for each site for the period of record
Minimum temperatures for each site for the period of record
Notes: "Avg", "Min", and "Max" denote the monthly average, maximum, and minimum temperatures.

Growing degree days in 2020 were the lowest reported throughout DCFFHMP sampling at all monitoring stations; neither LC_SPDC or DRY-WQ01 (immediately upstream of the mouth of Dry Creek) met the 800 degree day recruitment threshold (LC_SPDC: 741 degree days, DRY-WQ01: 671 degree days; Appendix Table F.2; Nupqu and AJM 2021). In all previous years of monitoring (2016 to 2019), LC_SPDC demonstrated the longest growing season, and the decrease in 2020 may be related to initiation of the DCWMS bypass on July 16, 2020, as discharge to LC_SPDC prior to bypass may have been warmer due to heat accumulation in the sedimentation ponds (Figure 1.5). The weekly average temperature in the East Tributary did not exceed 5°C from 2017 to 2019 (i.e., zero growing degree days) and therefore recruitment is not possible in this reach during the monitored years. In 2020, a growing season was not observed in either the East Tributary or immediately downstream of its confluence with Dry Creek (DRY-WQ02; Nupqu and AJM 2021; Appendix F).

Hourly rates of change in water temperature from 2016 to 2019 infrequently exceeded the 1 °C per hour guideline at stations closest to the DCWMS but when exceedances occurred the magnitude was large (-3.1 to + 3.7 °C per hour; Ecofish 2019 and 2020a). Other monitoring locations more frequently exceeded the hourly rate of change guidelines, but the magnitude of exceedance was small (e.g., DRY-WQ01 had the highest number of occurrence of exceedances but at low magnitude -1.5 to + 1.6 °C per hour). In 2020, hourly rates of change of - 4.3 to + 5.6 °C per hour were reported at the stations immediately downstream of the DCWMS (LC_SPDC and LC_DCDS) with 120 exceedances of the 1 °C per hour guideline (Nupqu 2021; Appendix F). Areas downstream of LC_DCDS monitoring stations demonstrated more frequent exceedances of the 1 °C per hour guideline (247 occurrences), but of lower magnitude (-1.5 to +1.5 °C per hour; Nupqu and AJM 2021; Appendix F).

As outlined in Section 2.5.4, the evaluation of water temperature based on daily and monthly means, growing degree days, and hourly rates of change are consistent with the methodology used in Ecofish (2019) and Nupqu and AJM (2021; Appendix F). To better align with the Aquatic Data Interpretation Tool (ADIT), it is recommended that temperature evaluation for the 2021 Dry Creek LAEMP follow the methods detailed in Ecofish (2020) which compare MWMxT to established screening values for juvenile Cutthroat Trout.

7.5.2 Dissolved Oxygen

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 2020, six surface water quality monitoring stations were evaluated to assess mean annual and mean monthly (30-day mean) 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 below the chronic guideline of 8.0 mg/L and DO concentrations in Dry Creek are not considered limiting for juvenile or adult WCT (Table 7.4; Appendix Table B.4). However, mean 30-day DO concentrations at all monitoring stations were below the BCWQG for the protection of buried embryos and alevins (11 mg/L) during July and August of 2020, as DO concentrations ranged between 9.0 mg/L and 10.8 mg/L (Table 7.4). In addition, four monitoring stations were observed to have DO concentrations below the mean 30-day DO guideline in June (LS_SPDC, LC_DCDS, LC_DC4, and LC_DC1), and all but LC_DC1 had concentrations below the guideline in September 2020 (Table 7.4). DO concentrations below the guidelines for buried embryos and alevins (11 mg/L) were also observed at the reference area (LC_DCEF) from July to September 2020, and in several other months (January, April, and October to November) when DO concentrations below the guideline were not observed at other areas (Table 7.4). However, annual minimum DO concentrations were above the BCWQG instantaneous minimum value for buried life stages (9 mg/L) at areas LC_DCEF, LC_DC4, and LC_DC1, whereas they were slightly below at areas LC_SPDC (annual minimum: 8.60 mg/L), LC_DCDS (8.53 mg/L), and LC_DC2 (8.84 mg/L; Appendix Table B.4).

Westslope Cutthroat Trout in Dry Creek have been observed to spawn from mid-June to early July and eggs incubate in gravel redds for 6 to 7 weeks prior to hatching (Northcote and Hartman 1988). 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). Hatching and emergence timing is delayed at colder temperatures and recruitment may be limited when growing degree days are less than ~800 (Coleman and Fausch 2007). Observed mean monthly DO conditions in Dry Creek (Table 7.4) in 2020 suggest that WCT embryos and alevins may have experienced hypoxic stress in July and August (mean monthly DO concentrations <11 mg/L), which may impact survival and recruitment. However, this was also true at the reference area (LC_DCEF) indicating that the decreased DO concentrations are likely not mine-related. The majority of WCT redds observed between 2016 and 2020 were found in Reach 1 (LC_DC1) where DO concentrations were below the 11 mg/L guideline in June, July, and August in 2020. Mean monthly DO concentrations in the water column at LC_DC1 ranged from 10.1 mg/L (August) to 10.7 mg/L (June) throughout the period of lower DO (June to August); these values were only slightly less than the guideline, indicating that the potential for adverse effects due to long-term reduced DO concentrations is likely limited.

Data to support a temporal analysis of the 30-day mean DO concentrations are available consistently from monitoring stations LC_DCEF, LC_DCDS, and LC_DC1 beginning in 2012. In all years (2012 to 2020), DO concentrations were below the recommended guideline for embryos and alevins in July and August at station LC_DC1 (except for July in 2018;

Table 7.4: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Dry Creek, 2020

Month	LC_DCEF	LC_SPDC	LC_DCDS	LC_DC2	LC_DC4	LC_DC1
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

Mean 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).

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 Table F.1). For years where data is available, areas LC, SPDC, LC_DCDS, LC_DC2 and LC_DC4 show similar trends of DO concentrations below embryo and alevin guidelines in the summer months.

7.5.3 Instream Flow and Water Quality

Dry Creek is a third order stream with an estimated mean annual discharge (MAD) of 0.198 m^3/s (Golder 2016). Flow in Dry Creek is highest during spring run-off in May and June, with flow low and stable throughout the winter. Dry Creek is approximately 9 km long with a watershed area of 28 km^2 with contribution from one tributary (LC_DCEF; East Tributary). Empirical flow data collected in 2016 demonstrated that flow conditions at LC_DC1 were lower than average when compared with a synthetic long-term flow record (1982 to 2016; Golder 2016) and ranged from 0.06 m^3/s to 0.4 m^3/s in Reach 1 and 2, and from 0.02 m^3/s (10% MAD) to 0.29 m^3/s (~150% MAD) in Reach 3 (Healey et al. 2016). Healey et al. (2016) reported considerable variability in low flows in Reach 3 with respect to the percentage of flow measured at the upstream hydrometric station, suggesting greater uncertainty in relation to flow at this location in Dry Creek.

To assess flow conditions in Dry Creek in 2020, Minnow evaluated mean daily, monthly, and annual flow in Dry Creek using data collected continuously by Teck from two hydrometric stations at LC_DCDS and LC_DC1 (Figure 7.4; Appendix Table F.3). Mean monthly flow rates reached their minima in March (LC_DC1: 0.07 m^3/s; LC_DCDS: 0.001 m^3/s) and maxima in May (LC_DC1: 1.98 m^3/s; LC_DCDS: 1.13 m^3/s) at both areas (Appendix Table F.3). Flow rates at both Dry Creek areas in 2020 were variable during the period associated with WCT over-wintering (January to mid-June, and October through December), with flows generally lowest from January to mid-March, then sharply increasing through April and May during spring freshet (Figure 7.4). During the periods associated with WCT spawning, incubation, and active rearing (mid-June to mid-July) flow rates steadily declined from peak rates observed in late May and early June at both areas. Flow rates continued to decrease through the period associated with WCT incubation and active rearing (mid-July to mid-August) as well as the period associated with active rearing only (mid-August to early October; Figure 7.4; Appendix Table F.3).

7.5.4 Calcite Coverage

Calcite Index (CI) was measured concurrently with benthic invertebrate community sampling in September 2020 (Table 2.4). Benthic invertebrate sampling targeted riffle habitat, and calcite measurements were taken in the immediate proximity of benthic invertebrate sampling sites. Consistent with previous years, CI values for Dry Creek LAEMP monitoring locations in 2020 varied spatially but were generally lower than values from 2019 and more similar to values from

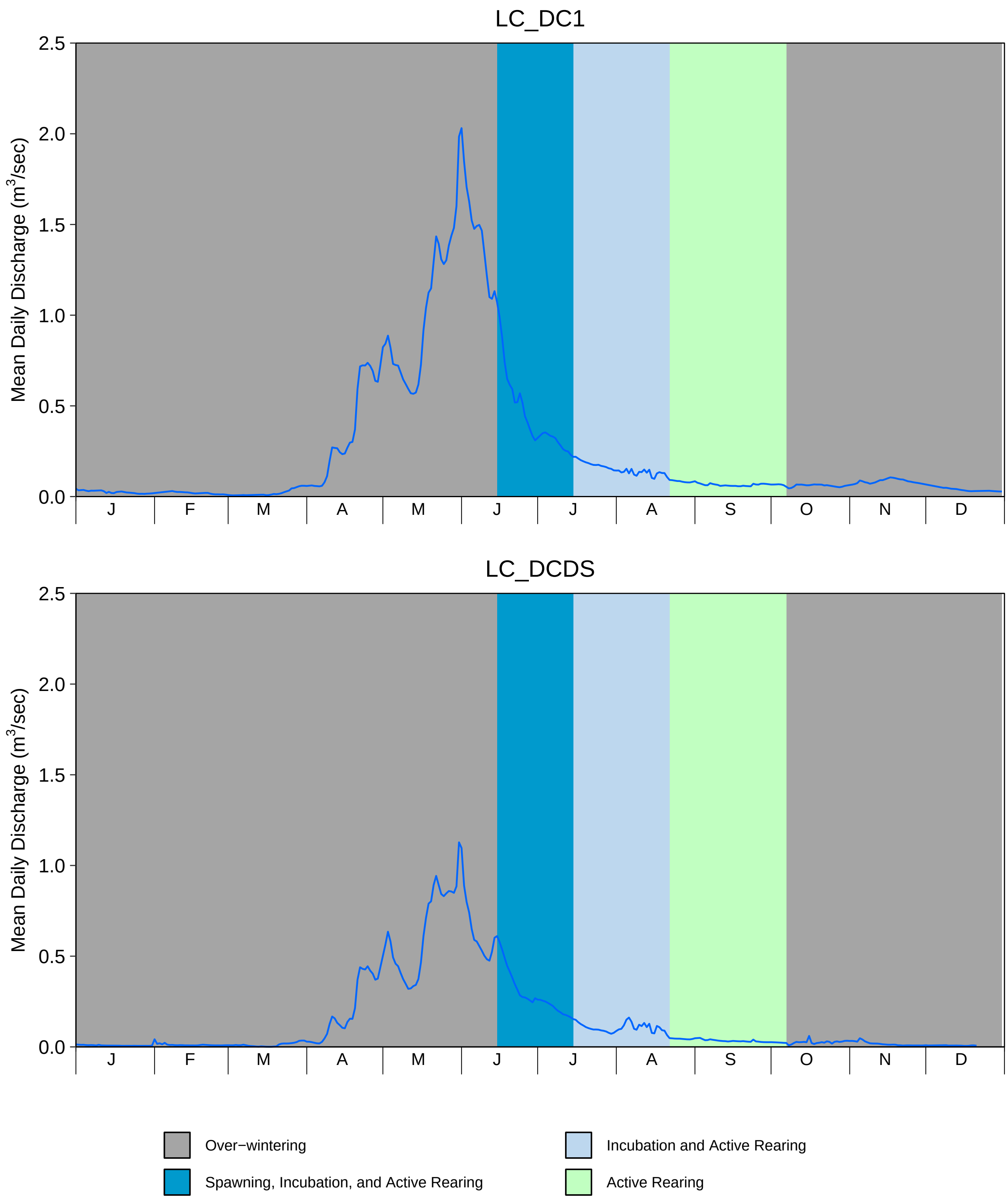

Figure 7.4: Mean Daily Discharge Rates for LC_DC1 and LC_DCDS and Westslope Cutthroat Trout Life History Activity Periods, Dry Creek LAEMP, 2020

Notes: WCT life stage period date ranges: Over-wintering - October 7th to June 15th, Spawning - June 15th to July 15th, Incubation - June 15th to August 21st, Active Rearing - June 15th to October 7th; Periodicity as developed for Westslope Cutthroat Trout in Dry Creek by the Aquatic and Riparian Task Group for use in the Dry Creek SDM process (Teck 2021b).

2018 and earlier (Table 7.5). Measuring calcite in the presence of encrusting algae is challenging and potentially error-prone. 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. Coverage estimates in 2020 were lower than 2019 at all Dry Creek areas and LC_DCEF. Dry Creek CI values were highest at LC_DC3 (0.1 to 0.62) and lowest at areas LC_DC4 and LC_SPDC (0). CI values did not exceed the normal range in any replicates from any area sampled for the Dry Creek LAEMP in September (Table 7.5; Minnow 2018a). There were no changes in calcite coverage at Dry Creek LAEMP areas indicative of increased calcite deposition in 2020 and values were all within the regional normal range, and as such, fish habitat conditions did not deteriorate between 2019 and 2020 with respect to calcite coverage.

7.6 Summary

Potential effects to fish health have been observed as a result of water quality conditions on Dry Creek in 2019 and 2020 (Sections 3.3, 4, and 6.2). Likely adverse effects on *O. mykiss* survival were identified in chronic toxicity testing at LC_DCDS in 2019, with nitrate identified as the likely cause (Section 4). Chronic toxicity testing also identified likely adverse effects on fathead minnow survival and biomass in 2020, although no water quality constituents were identified as a potential cause of those results (Section 4). Aqueous nitrate concentrations exceeded guidelines and benchmarks on Dry Creek in 2020 and have been increasing over time (Section 3.3). Nitrate concentrations were higher at LC_DCDS than LC_DC1 in 2020, with most samples taken between September and August above the BCWQG for short-term exposure. Modelling of the potential effects of increased aqueous nitrate concentrations to Dry Creek WCT early life stages indicate maximum effects are most likely to occur at LC_DCDS (Teck 2020b). Westslope Cutthroat Trout tissue selenium concentrations from fish opportunistically sampled at LC_DC2 in October 2020 were all below the lowest EVWQP benchmark. WCT tissue selenium in 2020 was not elevated relative to samples collected on the upper and lower Fording River in 2018 (Minnow 2020c) and were within the range of values for tissue samples collected on Dry Creek in 2019, indicating limited effects of elevated aqueous and tissue selenium on fish in Dry Creek. A total of six WCT redds were observed in Dry Creek in 2020, which is lower than the previous four years of sampling in support of the DCFFHMP (Ecofish 2019); heavy rain may have interfered with the red survey efforts. One recommendation for redd surveys in 2021 is to separate surveys by at least two weeks, and staff on both surveys should be kept consistent to confirm redds are not counted multiple times on successive surveys, and identification criteria are kept consistent.

With respect to fish habitat, mean daily and instantaneous water temperatures on Dry Creek were within limits for WCT rearing and survival in 2020. Growing degree days on Dry Creek in 2020,

Table 7.5: Calcite Index Values for Dry Creek, Grace Creek, and Fording River areas, LCO Dry Creek LAEMP 2015 to 2020

Area		Calcite Index									
		Sep-2015	Sep-2016	Sep-2017	Sep-2018	Nov-2018	Feb-2019	Apr-2019	May-2019	Sep-2019	Sept-2020
Dry Creek	LC_DCEF	-	-	-	-	0.11	0	-	0 0 0	*0.99* *0.96* *1.19*	0 0 0
	LC_DC3	-	-	-	-	0.11	0	0	-	*1.12* *1.16* *1.36*	0.1 0.35 0.62
	LC_SPDC	-	-	-	-	1	0.12	-	0.47	*1* *1* *1*	0 0 0
	LC_DCDS	0	0.8	0	0.6 1 1	0.8	0.15	-	0.14	*1* *1* *1*	0 0.1 0.02
	LC_DC2	-	-	-	-	0.08	-	-	0.02	*1* *1* *1*	0 0 0.03
	LC_DC4	-	-	-	-	0.57	0	-	0.17	*1* *0* *1*	0 0 0
	LC_DC1	0	0.6	0	0.92 1.1 1.1	0.88	-	-	-	*1* *1* *1*	0.12 0.19 0.41
Fording River	LC_FRUS	1	1	1	1 1 1	-	-	-	1	*1* *1* *1*	0.94 0.96 0.99
	LC_FRB	1	1.4	1.2	0.89 0.85 0.7	-	-	-	1	*1* *1* *1*	0.11 0.03 0.92
Grace Creek	LC_GRCK	-	-	-	-	-	-	-	-	0 *0.25* 0	0 0 0

Note: Shaded cells indicate Calcite Index values at or above the upper limit of the regional normal range (1.0; Minnow 2018a). *Italicized* values indicate calcite index values considered erroneous due to encrusting algae presence.

however, were the lowest reported throughout all years of DCFFHMP sampling at all monitoring stations including reference. Areas LC_SPDC, DRY-WQ01 (downstream of LC_DC1), and LC_DCEF did not met the 800 degree day recruitment threshold (LC_SPDC: 741 degree days; DRY-WQ01: 671 degree days; LC_DCEF: 0 degree days) indicating temperature was limiting for growth and recruitment of WCT at these areas. Dissolved oxygen concentrations were above the long-term chronic and instantaneous acute BCWQGs for fish life stages other than buried embryos and alevin for all samples in Dry Creek and the East Tributary in 2020. Dissolved oxygen was below long-term chronic BCWQG (11 mg/L) for embryos and alevins in July and August on Dry Creek and East Tributary (reference) in 2020, suggesting the potential for hypoxic stress in WCT embryos and alevins in July and August. However, this was also true at the reference area (LC_DCEF) indicating that the decreased DO concentrations were likely not mine-related. At area LC_DC1, (the Dry Creek area with the highest number of redds observed from 2016 to 2020) mean monthly DO concentrations ranged from 10.1 mg/L (August) to 10.7 mg/L (June) throughout the three-month period where values were lower than the BCWQG, indicating that concentrations were only intermittently slightly less than long-term guideline for DO, and that the potential for adverse effects at LC_DC1 was likely limited. With respect to flow rates, mean monthly flows on Dry Creek in 2020 were lowest in March and highest in May (LC_DC1) and June (LC_DCDS). There were no changes in calcite coverage at Dry Creek LAEMP areas in 2020 compared to previous years and values were within the regional normal range, and as such, no change in fish habitat conditions with respect to calcite coverage between 2019 and 2020 was observed. Overall, water temperatures and dissolved oxygen concentrations at LC_DC1 in particular did not exceed thresholds for WCT survival, indicating that sections of Dry Creek should support WCT survival, although conditions were suboptimal for some life stages. With respect to early life stages (e.g. fry, parr, and alevin) low temperatures and DO at some areas (including LC_DC1) may decrease recruitment and spawning success in Dry Creek and in the reference East Tributary.

8 SUMMARY

Potential effects to Dry Creek as a result of 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 concentrations of aqueous mine-related constituents including nitrate, sulphate, nickel, and total selenium have increased over time on Dry Creek (Section 3). Constituents including nitrate, total selenium, and total nickel exceeded interim screening and/or benchmark (where applicable) values at multiple areas on Dry Creek in 2020. Aqueous organoselenium (specifically DMSeO and MeSe[IV]) concentrations were elevated at areas LC_SPDC and LC_DCDS during DCWMS sedimentation pond dewatering in August 2020; however, activation of the DCWMS bypass reduced concentrations to levels lower than observed in 2019. Concentrations of mine-related constituents were generally higher at LC_DC3 (the Dry Creek area farthest upstream), LC_SPDC, LC_DCDS, and LC_DC2 (areas immediately downstream of the DCWMS) than LC_DC4 and LC_DC1, likely due to dilution with groundwater input from reference area LC_DCEF between areas LC_DC2 and LC_DC4 and increasing distance from LCOII operations. Similar trends in aqueous constituents were not detected in the Fording River downstream of Dry Creek or in Grace Creek (LC_GRCK).

Overall, assessment of Study Question #1 indicated that aqueous concentrations of mine-related constituents in Dry Creek are frequently higher than guidelines, interim screening values, benchmarks, and reference values, and are increasing over time relative to reference.

Evaluation of Study Question #2 (changes in toxicity) indicated that chronic toxicity occurring from water at LC_DCDS and acute toxicity occurring from water at LC_SPDC have not increased in 2020 relative to 2019 (Section 4). The frequency of potential adverse responses were similar between 2019 and 2020, and no acute toxicity test failures occurred in either year. Chronic toxicity test results identified nitrate as the cause of potential adverse effects in *C. dubia* and *H. azteca* in 2019 and 2020, and cause was unidentified in all other potential adverse responses.

Overall, assessment of chronic and acute toxicity indicated similar results and potential for effects between 2019 and 2020. Potential adverse effects of Dry Creek water on biota have been attributed to nitrate toxicity intermittently between 2018 and 2020 although there has been no discernable pattern. However, nitrate has been linked to potential adverse effects in LC_DCDS chronic toxicity tests every year since 2018.

Evaluation of Study Question #3 (potential effects to benthic invertebrate communities) indicated that in 2020 most benthic invertebrate community endpoints were within regional normal ranges and not changing at most Dry Creek areas (Section 5). Results for %EPT, %E, and %C were outside of normal ranges at areas upstream (LC_DC3) and immediately downstream (LC_SPDC and LC_DCDS) of the DCWMS. Temporal changes observed in Dry Creek benthic invertebrate communities included decreases in sensitive taxa (%EPT and %E) between 2019 and 2020 at areas LC_DC3, LC_DCDS, and LC_DC1. Decreases in %E and increases in %NCD were correlated with changes in aqueous mine-related constituents including nitrate, selenium, sulphate, and nickel. Changes were most commonly observed at areas LC_DC3 and LC_DCDS, areas where aqueous mine-related constituents frequently exceeded guidelines, benchmarks, and interim screening values (Section 3). Furthermore, the results of integrated effects modelling (Teck 2020b) and toxicity testing (Section 4) identified elevated nitrate as being a potential cause of adverse responses in aquatic invertebrates and community-level changes in benthic invertebrate communities. It is therefore likely that elevated nitrate concentrations on Dry Creek are related to changes to Dry Creek benthic invertebrate communities. Changes in benthic invertebrate community endpoints have been observed both upstream (LC_DC3) and downstream (LC_DCDS and LC_SPDC) of the DCWMS, whereas elevated benthic invertebrate tissue selenium concentrations are limited to areas downstream of the DCWMS (e.g. LC_DCDS, LC_SPDC, and LC_DC2) and concentrations upstream of the DCWMS at LC_DC3 have been similar to values at reference area LC_DCEF (Section 6). Therefore, changes in benthic invertebrate community structure downstream of the DCWMS are not likely being driven by elevated tissue selenium concentrations, because similar changes in community endpoints were observed at areas both upstream (LC_DC3) and downstream (LC_DCDS and LC_SPDC) of the DCWMS, despite differences in benthic invertebrate tissue selenium concentrations.

Results of CA testing indicated that seasonal variability contributes more to overall variability in Dry Creek LAEMP benthic invertebrate community data than spatial variability over the course of multiple sampling events in a given year. It is therefore worth considering how to derive value from the multi-season approach, especially given that replication in June and December sampling is too low for statistical testing, regional normal ranges were developed for September sampling, and most benthic invertebrate sampling is conducted in late summer because that is when the community is most developed.

Overall, most Dry Creek benthic invertebrate community endpoints were within normal ranges at most areas, but some changes are occurring over time that may be related to effects of increasing concentrations of mine-related constituents.

Evaluation of Study Question #4 (benthic invertebrate tissue selenium) indicated that Dry Creek benthic invertebrate tissue selenium concentrations have either been stable or have decreased in 2020 compared to 2018 and 2019 except for a temporary (and frequently non-significant) increase during DCWMS dewatering resulting from increase aqueous organoselenium concentrations (Section 6). Concentrations at most areas downstream of the DCWMS remained elevated relative to reference conditions, the regional normal range, and regional benchmarks, but they did not increase in 2020 relative to 2019. Elevated organoselenium concentrations detected during dewatering may have caused an increase in tissue concentrations downstream of the DCWMS during dewatering relative to conditions observed in June 2020, followed by a gradual (but non-significant) decrease during the DCWMS bypass period. Furthermore, the DCWMS bypass was likely effective in reducing the magnitude of the seasonal tissue selenium spike observed in late summer 2019. This indicates that changes to the DCWMS intended to mitigate the effects of organoselenium generation in the sedimentation ponds may have been effective.

Overall, Dry Creek benthic invertebrate tissue selenium concentrations are still elevated on Dry Creek but are not currently increasing, and mitigation efforts are likely having a positive effect.

Evaluation of Study Question #5 (fish health and fish habitat) indicated that tissue selenium concentrations in the 21 WCT sampled opportunistically were below the Elk Valley site-specific benchmark and were within the range of values for fish sampled in the Fording River in 2018 (Section 7). Furthermore, data indicated that WCT collected at LC_DC2 had tissue selenium concentrations reflective of feeding at LC_DC2 or farther downstream, where dietary tissue selenium concentrations were lower than at LC_DCDS. Fish collection as a part of the LAEMP was not completed in Dry Creek in 2020 in an effort to reduce the potential for stress on WCT populations, so abundance and biomass data were not available in 2020. Fewer redds were identified during 2020 surveys than in the previous four years of DCFFHMP surveys. This may be related to low temperatures on Dry Creek in 2020 (degree day recruitment thresholds not met at LC_DC1, LC_SPDC, and LC_DCEF) and intermittently low DO concentrations (below the BCWQG for buried embryos and alevin). Otherwise, fish habitat conditions on Dry Creek were generally sufficient for adult WCT survival, with temperature thresholds not exceeded and DO concentrations above BCWQGs. Flow rates on Dry Creek were highest in May and June of 2020, and lowest in March. Comparison of flow rates with IFRs was not possible for the 2020 LAEMP as development of updated IFRs is currently underway as part of an SDM process; however, the updated IFRs will be used to assess flow rates in the 2021 Dry Creek LAEMP report. There were no changes in calcite coverage at Dry Creek LAEMP areas in 2020 compared to previous years and values were within the regional normal range, and as such, no changes in fish habitat conditions with respect to calcite coverage between 2019 and 2020 were observed.

The results from the Dry Creek LAEMP provide information that supports Teck's Adaptive Management Program (Teck 2019b) 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 one sample from area LC_DC1 exceeded the %EPT biological trigger values (Table 8.2). Uncertainty remains around the cause of the change in %EPT at LC_DC1 identified by the biological triggers, and this will continue to be monitored as part of the 2021 Dry Creek LAEMP and the RAEMP. Other efforts are also currently underway (i.e., benthic invertebrate community predictive modeling) to resolve uncertainty around effects of mine-related stressors and habitat variability on benthic invertebrate community endpoints. Replicates exceeded the biological trigger values for benthic invertebrate tissue selenium at both LC_DCDS and LC_DC1 (55 of 65 and 6 of 65 replicates, respectively), with exceedances occurring during all 2020 sampling events at LC_DCDS and for all LAEMP sampling events and two supplemental sampling events at LC_DC1 (Section 2.4.3). The biological trigger exceedances for these samples are likely related to the generation of reduced selenium species in the DCWMS sedimentation ponds upstream of areas LC_DCDS and LC_DC1 (Lorax 2020, Minnow 2020a). Further investigations and mitigation activities are currently underway. 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 2021 Dry Creek LAEMP and the RAEMP. Overall, results of the biological trigger evaluation were consistent with the findings of the integrated assessment conducted under the 2020 Dry Creek LAEMP. Given that current biological triggers were sufficient to identify monitoring areas where biological responses are occurring, no additional triggers are recommended at this time.

Table 8.1: Summary of Findings, Responses, and Adjustments Related to the Dry Creek LAEMP in 2020

Key Question(s)	Data Evaluation Process	Outcome(s)	Responses & Adjustments in 2020	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 and EVWQP benchmarks (and interim screening values for total nickel). Statistical analysis of temporal trends over time and among years.	Aqueous concentrations of nitrate, sulphate, nickel, selenium, total cadmium, and other constituents increased in 2020 in Dry Creek compared to 2019. SPOs for total selenium and total cadmium were exceeded at LC_DCDS in 2020. Aqueous organoselenium concentrations increased at areas LC_DCDS and LC_SPDC in response to DCWMS sedimentation pond dewatering. Frequent guideline and benchmark exceedances on Dry Creek in 2020. Most areas' concentrations of aforementioned constituents greater than reference and normal ranges.	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. Following higher-than-expected organoselenium concentrations at LC_SPDC and LC_DCDS, additional weekly sampling was conducted at all areas downstream of the DCWMS from September 23 to November 14, 2020. Ongoing Investigation and consideration of additional mitigation options is ongoing.	2020 Study Design submitted to ENV/EMC May 31, 2020. EMC involved in SDM process for changes to DCWMS and supplemental weekly sampling programs. 2020 data delivered to EMC March 2021, Presentation with 2020 data delivered to EMC on April 7, 2021. 2020 LAEMP report delivered to EMC May 31, 2021. Written input from EMC on March draft data package received April 26, 2021. Dry Creek LAEMP study design submitted May 31, 2021
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?	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 increase in acute toxicity at LC_SPDC in 2020. No change in frequency or severity of potential adverse responses in chronic toxicity testing at LC_DCDS.	None	
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.	% E below normal ranges at LC_DC3, LC_SPDC, and LC_DCDS, %EPT below normal ranges at LC_DC3, LC_SPDC, %C above normal range at LC_SPDC and LC_DC3. %EPT decreasing at LC_DC3, LC_DCDS, LC_SPDC, %E decreasing at LC_DC3, LC_SPDC, LC_DCDS, and LC_DC1. Decrease in % E correlated with multiple aqueous constituents including nitrate.	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.	Benthic invertebrate tissue selenium concentrations greater than normal range in samples from all areas downstream of the DCWMS, most frequently close to DCWMS (LC_SPDC, LC_DCDS, LC_DC2), less frequent at LC_DC4 and LC_DC1. EVWQP level 3 benchmarks for fish and benthic invertebrates exceeded at LC_SPDC and LC_DCDS. Tissue selenium concentrations increased during sedimentation pond dewatering. EVWQP level 1 benchmark for benthic invertebrates exceeded at all areas downstream of the DCWMS.	Operational changes to DCWMS to minimize retention time in pond to reduce bioaccumulation potential. Supplemental weekly benthic invertebrate sampling conducted at all areas downstream of the DCWMS following high organoselenium concentrations during dewatering to monitor for changes in tissue selenium.	
Are changes in fish and fish habitat (including instream flow and calcite index) occurring within Dry Creek as a result of mine operations?	- Comparison of fish tissue selenium with benchmark, previous years' data, and Fording River data. Comparison with benthic invertebrate tissue selenium concentrations to assess spatial relationship with dietary selenium. - flow, temperature DO, spawner survey, and calcite data with previous years' sampling and against regional normal ranges, benchmarks, and/or literature (specifically optimal temperature, DO, and flow ranges for different WCT life stages)	WCT tissue selenium concentrations were below benchmark values and range of previous year's values, and within range of values for Fording River sampling in 2018. Mean daily discharge volumes at LC_DCDS were lower than IFR frequently in 2020. Mean daily discharge volumes were lower than IFR during under-ice period at LC_DC1. Temperature ranges indicative of limited growing seasons at LC_SPDC and downstream of LC_DC1, DO conditions indicate potential hypoxic stress on Dry Creek as well as at reference LC_DCEF	Removal of sampling area LC_SPDC to minimize potential for dietary uptake of benthic invertebrates high in selenium by WCT.	

Table 8.2: Summary of Biological Trigger Analysis for Percent EPT and Selenium Benthic Invertebrate Tissue, Dry Creek, 2020

Waterbody	Area		% EPT [a]		Selenium BIT [b]	
			Number Replicates Evaluated	Number of Replicates Reaching Biological Trigger [c]	Number Replicates Evaluated	Number of Replicates Reaching Biological Trigger [d]
Dry Creek	LC_DCDS	Mine-Exposed	6	0	65	55
	LC_DC1		6	1	30	6

Notes: % EPT = Percent EPT (Ephemeroptera ([mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]); Selenium BIT = Selenium concentrations in benthic invertebrate tissue (mg/kg dw).

[a] Biological Trigger analysis for %EPT was for the August/September sampling event.

[b] Biological Trigger analysis for Selenium BIT was for the February, May, June, August/September, and November/December LAEMP sampling events, and the supplemental weekly (September 23-November 14) sampling events.

[c] Number of Replicates Reaching Biological Trigger for % EPT refers to those replicates which were below both triggering steps (i.e., below the lower 2.5th percentile of the habitat-adjusted normal range and expectations [as based on predicted ADIT Scores]. See section H.2.2 for more details.

[d] Number of Replicates Reaching Biological Trigger for Selenium BIT refers to those replicates which were above both triggering steps (i.e., above the upper 97.5th percentile prediction limit of the regional normal range and expectations [as based on the predicted 95% percentile from the water to benthic invertebrate selenium bioaccumulation model]). See section H.2.3 for more details.

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APPENDIX A
DATA QUALITY REVIEW (DQR)

APPENDIX A DATA QUALITY REVIEW

A1 INTRODUCTION

A1.1 Background

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. The magnitude of inaccuracy and/or imprecision have the potential to affect the reliability of conclusions made from the data. Therefore, it is important to ensure that programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize variability that does not reflect natural spatial and/or temporal variability in the environment).

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 to establish a relevant basis for judging whether the data set is adequate. A Data Quality Review (DQR) involves comparisons of field and laboratory measurement performance to Data Quality Objectives (DQOs) established for a particular study, such as evaluation of Laboratory Reporting Limits (LRLs), 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 [CRMs]).

Samples for chemical analyses were sent to laboratories accredited by the Canadian Association of Laboratory Accreditation (CALA) or the National Environmental Laboratory Accreditation Program (NELAP). Data were reviewed to determine if DQOs set by the laboratory (Table A.1) were met. Programs involving many samples and analytes often yield some results that exceed DQOs. This is particularly so for multi-element scans because the analytical conditions are not necessarily optimal for every element included in the scan.

The following DQR was conducted on laboratory data reported in 2020 for samples collected in support of the Dry Creek LAEMP. In addition, benthic invertebrate community data collected in December 2019 were included in the present DQR. These data were received from the laboratory after the 2019 Dry Creek LAEMP report was submitted and therefore have not been reported on previously. Since the benthic invertebrate community data from December 2019 were incorporated into data analyses and interpretation for the present report, the following DQR included these data.

The objective of this DQR was to define the overall quality of the data, and, by extension, the confidence with which the data can be used to derive conclusions. The intent of a DQR is not to reject measurements that did not meet a laboratory's DQO, but to ensure that questionable

Table A.1: Laboratory Data Quality Objectives for the Dry Creek LAEMP, 2020

Quality Control Measure	Quality Control Sample Type/Check	Study Component			
		Water Chemistry	Selenium Speciation	Benthic Invertebrate Tissue Chemisty	Fish Tissue Chemisty
		ALS	Brooks	TrichAnalytics	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	LRL for each parameter should be at least as low as applicable guidelines and benchmarks
Blank Analysis	Field or Laboratory Blank	Concentrations measured in blank samples should be < LRL	Concentrations measured in blank samples should be < LRL	-	-
Laboratory Precision	Laboratory Duplicates	≤10% RPD (conductivity) ≤15% RPD (ORP, turbidity) ≤20% RPD (all remaining analytes)	≤20% RPD (total selenium) ≤25% RPD (selenium species)	≤60% RPD (calcium and strontium) ≤40% RPD (all remaining analytes)	≤60% RPD (calcium and strontium) ≤40% RPD (all remaining analytes)
Laboratory Accuracy	Recovery of Blank Spike	6.9 to 7.1 (pH) 60 to 140% (total silicon) 75 to 125% (TKN) 80 to 120% (orthophosphate, phosphorus, TOC, DOC, total and dissolved metals) 85 to 115% (alkalinity, ammonia, bromide, TSS, TDS, turbidity) 90 to 110% (conductivity, chloride, fluoride, nitrate, nitrite, sulfate)	75 to 125% (methylseleninic acid, selenate, selenite, selenocyanate, selenomethionine, total selenium)	-	-
	Recovery of Matrix Spike	70 to 130% (DOC, orthophosphate, total phosphorus, TKN, TOC, total and dissolved metals) 75 to 125% (ammonia, bromide, chloride, fluoride, nitrate, nitrite, sulfate)	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	80 to 120% (orthophosphate, total phosphorus) 85 to 115% (alkalinity, turbidity) 90 to 110% (conductivity) 210 to 230% (ORP) 6.9 to 7.1 (pH)	75 to 125% (total selenium)	60 to 140% (antimony, barium, boron, silver, titanium, tin) 70 to 130% (all remaining analytes) 90 to 110% (selenium)	60 to 140% (antimony, barium, boron, silver, titanium, tin) 70 to 130% (all remaining analytes) 90 to 110% (selenium)
	Laboratory Control Sample	6.9 to 7.1 (pH) 75 to 125% (TKN) 80 to 120% (ORP, DOC, TOC, total phosphorus, all metals) 85 to 115% (all remaining analytes) 90 to 110% (conductivity, fluoride, nitrate, nitrite, sulfate)	-	-	-

Notes: ALS = ALS Environmental; Brooks = Brooks Applied Laboratory; SRC = Saskatchewan Research Council; LRL = Laboratory Reporting Limit; RPD = Relative Percent Difference; DQO = Data Quality Objectives; ORP = oxidation-reduction potential; PAHs = polycyclic aromatic hydrocarbons; TKN = Total Kjeldahl Nitrogen; TOC = total organic carbon; DOC = dissolved organic carbon; TSS = total suspended solids; TDS = total dissolved solids; "-" indicates quality control method was not applied.

data received more scrutiny to determine what effects, if any, were had on interpretation of results within the context of the project.

A1.2 Laboratory Reporting Limits

A Laboratory Reporting Limit (LRL) is the lowest concentration of an analyte that can be reported with a reasonable degree of accuracy and precision and is ideally synonymous with the lower limit of quantitation (LLOQ). The LLOQ is the lowest concentration of an analyte that can be reliably measured within specific limits of precision and accuracy during routine operating conditions, which in most cases is the lowest concentration on the calibration curve. This differs from the lowest concentration that can be detected (i.e., reliably distinguished from a blank sample) which is known as the method detection limit (MDL). The LRL is typically three to ten times the method detection limit (MDL); however, some guidelines are so low the LRL is equal to the MDL to meet the guideline. Achieving satisfactory LRLs is important when comparing concentrations to guidelines for that medium. If the LRL is above the guideline, the data cannot be accurately interpreted. Consistency is also important for LRLs when taking consecutive samples. Changes in LRLs between laboratory reports can affect summary calculations and introduce confounding factors when assessing trends. For the present study, LRLs were screened against guidelines including British Columbia Water Quality Guidelines for the protection of Aquatic Life (BCWQG; BCMOECCS 2019, 2021), Elk Valley Water Quality Plan (EVWQP) benchmarks (Teck 2014), and site-specific screening values, as appropriate.

A1.3 Quality Control Samples

Typically, 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. Quality control samples collected for this project, and a description of each QC sample type, are as follows:

- **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 reflect 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). Concentrations of analytes should be below the LRL.
- **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 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 greatest extent possible in the field, split, and analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in the laboratory. These samples reflect variability introduced during the handling of samples (e.g., during collection and homogenization), both in the field and laboratory, and therefore provide a measure of field sampling and laboratory precision.
- **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, BS) are created using laboratory control materials whereas matrix spikes (MS) are created using field-collected samples. The analysis of spiked samples provides an indication of the accuracy of analytical results.
- **CRM** are commercially prepared or homogenized reference materials containing known chemical concentrations that are processed and analyzed along with batches of environmental samples. The sample results are then compared to target results to provide a measure of analytical accuracy. The results are reported as the percent of the known concentration that was recovered in the analysis.
- **LCS** are laboratory control samples 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.
- **Organism recovery checks** for benthic invertebrate community samples involve the reprocessing of previously sorted material from a randomly selected sample to determine the number of invertebrates that were not recovered during the original sample processing. The reprocessing is conducted by an analyst not involved in the original processing to reduce bias. This check allows for the determination of accuracy through assessment of recovery efficiency.

- **Sub-sampling error** is assessed for studies in which periphyton community and benthic invertebrate community samples require sub-sampling (due to excessive sample volume and/or high density). By comparing the numbers of periphyton cells or benthic invertebrates recovered between at least two sub-samples, this measure provides an evaluation of how effective the sub-sampling method was in evenly dividing the original sample. Therefore, sub-sampling error provides a measure of analytical accuracy and precision. The processing of entire periphyton or benthic invertebrate community samples in representative sample fractions also allows an evaluation of sub-sampling accuracy.

Table A.2: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Analyses

Parameter	Units	BC WQG[a]		EVWQP Level 1 Benchmarks/ Relevant Screening Values[b]	Range of LRLs	No. LRLs > Guideline[c]	No. Sample Results < LRL
		Short-term	Long-term				
Physical Tests							
Total Suspended Solids	mg/L	-	-	-	1	-	8 (34.8%)
Anions and Nutrients							
Acidity (as $CaCO_3$)	mg/L	-	-	-	1	-	20 (87.0%)
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	-	-	-	1	-	3 (13.0%)
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	-	-	-	1	-	16 (69.6%)
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	-	-	-	1	-	20 (87.0%)
Bromide (Br)	mg/L	-	-	-	0.05 to 0.25	-	23 (100%)
Chloride (Cl)	mg/L	600	150	-	0.1 to 0.5	0	3 (13.0%)
Nitrite (as N)[d]	mg/L	0.0600	0.0200	-	0.001 to 0.005	0	6 (26.1%)
Total Kjeldahl Nitrogen	mg/L	-	-	-	0.05 to 0.25	-	16 (69.6%)
Phosphorus (P) - Total	mg/L	-	-	-	0.002 to 0.02	-	1 (4.35%)
Organic / Inorganic Carbon							
Dissolved Organic Carbon	mg/L	-	-	-	0.5	-	3 (13.0%)
Total Organic Carbon	mg/L	-	-	-	0.5	-	3 (13.0%)
Total Metals							
Aluminum	mg/L	-	-	-	0.003	-	1 (4.35%)
Antimony	mg/L	-	0.00900	-	0.0001	0	2 (8.70%)
Beryllium	µg/L	-	0.130	-	0.02	0	23 (100%)
Bismuth	mg/L	-	-	-	0.00005	-	23 (100%)
Boron	mg/L	-	1.20	-	0.01	0	15 (65.2%)
Chromium[e]	mg/L	-	0.00100	-	0.0001	0	8 (34.8%)
Cobalt	µg/L	110	4.00	-	0.1	0	11 (47.8%)
Copper	mg/L	0.200	0.200	-	0.0005	0	22 (95.7%)
Iron	mg/L	1.00	-	-	0.01	0	3 (13.0%)
Lead[f]	mg/L	0.101	0.00724	-	0.00005	0	15 (65.2%)
Manganese	mg/L	2.07	1.22	-	0.0001	0	1 (4.35%)
Mercury[h]	µg/L	-	0.00125	-	0.0005	0	5 (21.7%)
Nickel[f]	mg/L	-	0.108	0.00530	0.0005	0	4 (17.4%)
Silver[f]	mg/L	0.00300	0.00150	-	0.00001	0	22 (95.7%)
Thallium	mg/L	-	0.000800	-	0.00001	0	15 (65.2%)
Tin	mg/L	-	-	-	0.0001	-	23 (100%)
Titanium	mg/L	-	-	-	0.01	0	23 (100%)
Vanadium	mg/L	-	-	-	0.0005	-	6 (26.1%)
Zinc[f]	mg/L	0.0540	0.0285	-	0.003	0	14 (60.9%)
Dissolved Metals							
Aluminum	mg/L	0.100	0.0500	-	0.003	0	16 (69.6%)
Antimony	mg/L	-	-	-	0.0001	-	3 (13.0%)
Arsenic	mg/L	-	-	-	0.0001	-	5 (21.7%)
Beryllium	µg/L	-	-	-	0.02	-	23 (100%)
Bismuth	mg/L	-	-	-	0.00005	-	23 (100%)
Boron	mg/L	-	-	-	0.01	-	16 (69.6%)
Cadmium[f]	µg/L	0.698	0.239	0.155	0.005 to 0.01	0	1 (4.35%)
Chromium	mg/L	-	-	-	0.0001	-	19 (82.6%)
Cobalt	µg/L	-	-	-	0.1	-	16 (69.6%)
Copper	mg/L	0.200	0.200	-	0.0002	0	8 (34.8%)
Iron	mg/L	0.350	-	-	0.01	0	23 (100%)
Lead[f]	mg/L	-	-	-	0.00005	-	23 (100%)
Manganese	mg/L	-	-	-	0.0001	-	1 (4.35%)
Mercury[h]	µg/L	-	-	-	0.000005	-	23 (100%)
Nickel[f]	mg/L	-	-	-	0.0005	-	5 (21.7%)
Silver[f]	mg/L	-	-	-	0.00001	-	23 (100%)
Thallium	mg/L	-	-	-	0.00001	-	18 (78.3%)
Tin	mg/L	-	-	-	0.0001	-	23 (100%)
Titanium	mg/L	-	-	-	0.01	-	23 (100%)
Vanadium	mg/L	-	-	-	0.0005	-	7 (30.4%)
Zinc[f]	mg/L	-	-	-	0.001	-	4 (17.4%)

Notes: Only analytes with one or more sample results < LRL are displayed. The total number of samples in 2020 (n) was 23. EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit, "-" indicates where no applicable guideline exists.

[a] British Columbia Water Quality Guidelines for the protection of Aquatic Life (BCMOECCS 2019 and 2020)

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

[c] The LRLs for all analytes were consistently less than the applicable EVWQP Level 1 benchmarks (Teck 2014) or screening values (Golder 2014; Teck 2020)

[d] Minimum water quality guidelines for Nitrite (as N) reported in BCMOECCS (2020) for chloride concentrations < 2 mg/L.

[e] Guideline for Chromium VI (0.001 mg/L) was selected, as this is the principal species found in surface waters.

[f] Hardness-based guidelines calculated using the minimum hardness observed for all samples (118 mg/L).

[h] The most conservative guideline (0.00125 µg/L) was applied.

Table A.3: Laboratory Reporting Limit (LRL) Evaluation for Selenium Speciation Analyses

Parameter	Units	Range of LRLs	No. Sample Results < LRL
Selenium (Se)-Total	µg/L	0.137 to 0.181	9 (100%)
Selenium (Se)-Dissolved	µg/L	0.137 to 0.181	9 (100%)
MeSe(IV) - methylseleninic acid CH3SeO2H-Dissolved	µg/L	0.01	3 (33.3%)
Se(IV) - selenite SeO3(-2)-Dissolved	µg/L	0.05	7 (77.8%)
Se(VI) - selenate SeO4(-2)-Dissolved	µg/L	0.06	9 (100%)

Notes: Only analytes with one or more sample results < LRL are displayed. The total number of samples in 2020 (n) was 44. EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit. "-" indicates that no applicable guideline exists for that analyte. No applicable BC WQG short-term guidelines exist for selenium or selenium species. All LRLs were below the EVWQP and BC WQG long-term guideline for total selenium.

Table A.4: Field Blank and Trip Blank Evaluation for Water Chemistry Analyses

Parameter	Units	Range of LRLs	No. Field Blank Sample Results > LRL	No. Trip Blank Sample Results > LRL
Ammonia, Total (as N)	mg/L	0.005	3 (100%)	2 (66.7%)

Notes: Only analytes with one or more blank results > LRL are displayed. Three field blanks and three trip blanks were analyzed. For dissolved metals, only Cd, Mg, K and Na were analyzed in trip blanks. LRL = Laboratory Reporting Limit.

A2 WATER CHEMISTRY

A2.1 Laboratory Reporting Limits

The analytical reports for water chemistry from ALS Environmental and Brooks Applied Labs (BAL; see Appendix I for laboratory reports) were examined to assess LRLs relative to applicable guidelines (Tables A.2 and A.3). The LRLs for water quality analytes were assessed relative to British Columbia Water Quality Guidelines (BCWQG; BCMOECCS 2019, 2021) for the protection of freshwater aquatic life, EVWQP Level 1 Benchmarks for water quality (Teck 2014), and relevant site-specific benchmarks. Several analytes were consistently reported below the LRL (i.e., in 100% of samples; Tables A.2 and A.3). For analytes with one or more result below the LRL, achieved LRLs were consistently lower than the BCWQG and EVWQP Level 1 Benchmarks for water quality (Teck 2014). Therefore, the achieved LRLs were appropriate for this study.

A2.2 Laboratory and Field Blanks

A total of 168 method blank samples for water chemistry (not including those for selenium speciation) were analyzed by ALS Environmental (see Appendix I for laboratory reports). These blank samples consisted of 728 individual analyte results, of which only two had detectable concentrations: total silver in one method blank sample (see laboratory report L2496943 in Appendix I) and ammonia in one method blank sample (see laboratory report L2466732 in Appendix I). The detected concentrations of both these analytes were within 2.5-times the LRL, and below both the short- and long-term BC WQGs for total silver and ammonia. Therefore, these results are expected to have negligible impacts on data interpretability.

A total of 17 laboratory blank samples were analyzed by BAL for selenium speciation, consisting of 81 individual analyte results (see Appendix I for laboratory reports). Laboratory blank results were all below the LRL, indicating no inadvertent sample contamination during analyses.

Three field blank and three trip blank samples were submitted to ALS Environmental for water chemistry analyses to assess the potential for field sampling contamination (Table A.4). 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 540 analyte results for field and trip blanks, only five (0.926%) had concentrations greater than the LRL: ammonia in all three field blank samples and in two trip blank samples (Table A.4). Field and trip blanks were not collected for selenium speciation.

Overall, the number of detectable concentrations was relatively low among lab-, trip-, and field-blank samples. These results are expected to have a negligible impact on data interpretability for this study.

A2.3 Data Accuracy and Precision

Data accuracy for water chemistry analyses completed by ALS Environmental (excluding selenium speciation) was evaluated based on results for ten Certified Reference Material (CRM) samples, 169 Laboratory Control Samples (LCS), and 17-Matrix Spike (MS) samples. Results of CRM, LCS, and MS sample analyses generally met the laboratory DQO (Table A.1), with the following exceptions:

- total strontium in one LCS sample;
- total barium in four MS samples;
- total calcium in four MS samples;
- total magnesium in four MS samples;
- total selenium in two MS samples;
- total sodium in two MS samples;
- total strontium in four MS samples;
- dissolved barium in one MS sample;
- dissolved calcium in one MS sample;
- dissolved magnesium in one MS sample;
- dissolved sodium in one MS sample; and
- dissolved strontium in one MS sample.

In the LCS sample in which the concentration of total strontium did not meet the laboratory DQO, the DQO was exceeded by less than 10% (see laboratory report L2499139 in Appendix I). For MS concentrations that did not meet the laboratory DQO, analyte concentrations were high in the background sample (i.e., the field sample used as the base for the MS sample) and the analytical laboratory was unable to accurately calculate the recovery of the spiked material. Otherwise, accuracy for all analytes in CRM, LCS, and MS samples were within the laboratory DQO. Therefore, the overall accuracy achieved by ALS Environmental was considered good.

Table A.5: Field Duplicate Results for Water Chemistry Analyses

Parameter	Units	LC_DC2_WS_2020-05-06_0900	LC_CC2_WS_2020-05-06_0930	RPD (%)	LC_DC2_WS_2020-06-25_0900	LC_CC2_WS_2020-06-25_0900	RPD (%)
Physical Tests							
Conductivity (@ 25°C)	µS/cm	337	330	2.10	381	375	1.59
Hardness (as $CaCO^3$)	mg/L	175	176	0.570	187	187	0
pH	pH	8.35	8.37	0.239	8.23	8.23	0
ORP	mV	458	480	4.69	333	398	17.8
Total Suspended Solids	mg/L	<1	<1	-	3.1	1.8	53.1
Total Dissolved Solids	mg/L	247	247	0	244	246	0.816
Turbidity	NTU	2.23	2.11	5.53	1.71	1.85	7.87
Anions and Nutrients							
Acidity (as $CaCO^3$)	mg/L	1	<1	0	<1	<1	-
Alkalinity, Bicarbonate (as $CaCO^3$)	mg/L	113	108	4.52	123	122	0.816
Alkalinity, Carbonate (as $CaCO^3$)	mg/L	5	4	22.2	<1	<1	-
Alkalinity, Hydroxide (as $CaCO^3$)	mg/L	<1	<1	-	<1	<1	-
Alkalinity, Total (as $CaCO^3$)	mg/L	118	112	5.22	123	122	0.816
Bromide (Br)	mg/L	<0.05	<0.05	-	<0.05	<0.05	-
Chloride (Cl)	mg/L	2.65	2.92	9.69	3.66	3.68	0.545
Fluoride	mg/L	0.097	0.136	33.5	0.114	0.112	1.77
Ammonia, Total (as N)	mg/L	0.0061	<0.005	19.8	0.0183	0.0115	45.6
Nitrate (as N)	mg/L	6.92	6.94	0.289	8.08	8.14	0.740
Nitrite (as N)	mg/L	0.0031	0.003	3.28	0.0175	0.0168	4.08
Total Kjeldahl Nitrogen	mg/L	<0.25	0.209	17.9	0.266	<0.05	137
Orthophosphate-Dissolved	mg/L	0.0262	0.0255	2.71	0.0152	0.0174	13.5
Phosphorus (P)-Total	mg/L	0.0225	0.0221	1.79	0.0215	0.0387	57.1
Sulfate	mg/L	42.2	42.4	0.473	53.6	54	0.743
Anion Sum	meq/L	3.8	3.7	2.67	4.26	4.26	0
Cation Sum	meq/L	3.59	3.61	0.556	3.86	3.84	0.519
Organic / Inorganic Carbon							
Dissolved Organic Carbon	mg/L	2.11	2.37	11.6	2.41	2.52	4.46
Total Organic Carbon	mg/L	2.34	2.39	2.11	2.25	2.37	5.19
Total Metals							
Aluminum	mg/L	0.0375	0.0384	2.37	0.0585	0.0245	81.9
Antimony	mg/L	0.00031	0.00029	6.67	0.00029	0.00028	3.51
Arsenic	mg/L	0.00029	0.00029	0	0.00029	0.00027	7.14
Barium	mg/L	0.169	0.169	0	0.165	0.166	0.604
Beryllium	µg/L	<0.02	<0.02	-	<0.02	<0.02	-
Bismuth	mg/L	<0.00005	<0.00005	-	<0.00005	<0.00005	-
Boron	mg/L	<0.01	<0.01	-	<0.01	<0.01	-
Cadmium	µg/L	0.0765	0.0691	10.2	0.108	0.0906	17.5
Calcium	mg/L	45.4	45.8	0.877	45.9	42.9	6.76
Chromium	mg/L	0.00013	0.00014	7.41	0.00017	0.00012	34.5
Cobalt	µg/L	0.18	0.18	0	0.15	0.11	30.8
Copper	mg/L	<0.0005	<0.0005	-	<0.0005	<0.0005	-
Iron	mg/L	0.036	0.035	2.82	0.051	0.027	61.5
Lead	mg/L	<0.00005	<0.00005	-	0.000071	<0.00005	34.7
Lithium	mg/L	0.0127	0.0131	3.10	0.0137	0.0137	0
Magnesium	mg/L	17.2	17.4	1.16	17.6	17.4	1.14
Manganese	mg/L	0.00374	0.00348	7.20	0.00365	0.00214	52.2
Mercury	µg/L	0.00167	0.00169	1.19	0.00195	0.00177	9.68
Molybdenum	mg/L	0.00202	0.00205	1.47	0.00183	0.00194	5.84
Nickel	mg/L	0.00465	0.00456	1.95	0.00599	0.00565	5.84
Potassium	mg/L	1.29	1.31	1.54	1.32	1.27	3.86
Selenium	µg/L	14.7	14.7	0	16.6	16.7	0.601
Silicon	mg/L	2.58	2.62	1.54	2.44	2.49	2.03
Silver	mg/L	<0.00001	<0.00001	-	<0.00001	<0.00001	-
Sodium	mg/L	1.65	1.66	0.604	2.06	1.98	3.96
Strontium	mg/L	0.0626	0.0635	1.43	0.0614	0.064	4.15
Thallium	mg/L	<0.00001	<0.00001	-	0.000016	<0.00001	46.2
Tin	mg/L	<0.0001	<0.0001	-	<0.0001	<0.0001	-
Titanium	mg/L	<0.01	<0.01	-	<0.01	<0.01	-
Uranium	mg/L	0.000731	0.000712	2.63	0.00082	0.000795	3.10
Vanadium	mg/L	0.0012	0.00126	4.88	0.00132	0.00115	13.8
Zinc	mg/L	0.0039	0.0032	19.7	0.0043	0.0035	20.5
Dissolved Metals							
Aluminum	mg/L	0.0033	<0.003	9.52	0.0062	<0.003	69.6
Antimony	mg/L	0.00027	0.00027	0	0.00028	0.00027	3.64
Arsenic	mg/L	0.00023	0.00024	4.26	0.00028	0.00025	11.3
Barium	mg/L	0.165	0.167	1.20	0.182	0.183	0.548
Beryllium	µg/L	<0.02	<0.02	-	<0.02	<0.02	-
Bismuth	mg/L	<0.00005	<0.00005	-	<0.00005	<0.00005	-
Boron	mg/L	<0.01	<0.01	-	<0.01	<0.01	-
Cadmium	µg/L	0.0662	0.0514	25.2	0.0704	0.0719	2.11
Calcium	mg/L	43.3	43.6	0.690	45.1	44.6	1.11
Chromium	mg/L	<0.0001	<0.0001	-	<0.0001	<0.0001	-
Cobalt	µg/L	0.14	0.13	7.41	<0.1	<0.1	-
Copper	mg/L	0.00035	0.00029	18.8	0.0006	0.00078	26.1
Iron	mg/L	<0.01	<0.01	-	<0.01	<0.01	-
Lead	mg/L	<0.00005	<0.00005	-	<0.00005	<0.00005	-
Lithium	mg/L	0.0116	0.0115	0.866	0.0139	0.0137	1.45
Magnesium	mg/L	16.2	16.3	0.615	18.1	18.3	1.10
Manganese	mg/L	0.00228	0.00218	4.48	0.00079	0.00082	3.73
Mercury	µg/L	<0.005	<0.005	-	<0.005	<0.005	-
Molybdenum	mg/L	0.00189	0.00191	1.05	0.00192	0.00193	0.519
Nickel	mg/L	0.00408	0.00423	3.61	0.00528	0.00539	2.06
Potassium	mg/L	1.25	1.26	0.797	1.33	1.32	0.755
Selenium	µg/L	12.4	12.7	2.39	19.5	19.4	0.514
Silicon	mg/L	2.23	2.2	1.35	2.46	2.49	1.21
Silver	mg/L	<0.00001	<0.00001	-	<0.00001	<0.00001	-
Sodium	mg/L	1.5	1.52	1.32	1.94	1.94	0
Strontium	mg/L	0.0603	0.0625	3.58	0.0738	0.0741	0.406
Thallium	mg/L	<0.00001	<0.00001	-	<0.00001	<0.00001	-
Tin	mg/L	<0.0001	<0.0001	-	<0.0001	<0.0001	-
Titanium	mg/L	<0.01	<0.01	-	<0.01	<0.01	-
Uranium	mg/L	0.000663	0.000667	0.602	0.000711	0.000732	2.91
Vanadium	mg/L	0.0009	0.00089	1.12	0.0009	0.00087	3.39
Zinc	mg/L	0.0028	0.0024	15.4	0.0036	0.0027	28.6

Indicates RPD exceeded 30%.

Notes: the RPD was calculated using < LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; "-"= no data/not calculated; LRL = Laboratory Reporting Limit.

Table A.5: Field Duplicate Results for Water Chemistry Analyses

Parameter	Units	LC_DC1_WS_2020-09-02_0830	LC_CC2_WS_2020-09-02_0830	RPD (%)
Physical Tests				
Conductivity (@ 25°C)	µS/cm	562	567	0.886
Hardness (as $CaCO^3$)	mg/L	299	307	2.64
pH	pH	8.32	8.33	0.120
ORP	mV	403	465	14.3
Total Suspended Solids	mg/L	1.6	2	22.2
Total Dissolved Solids	mg/L	401	385	4.07
Turbidity	NTU	0.29	0.3	3.39
Anions and Nutrients				
Acidity (as $CaCO^3$)	mg/L	<1	<1	-
Alkalinity, Bicarbonate (as $CaCO^3$)	mg/L	<1	<1	-
Alkalinity, Carbonate (as $CaCO^3$)	mg/L	<1	<1	-
Alkalinity, Hydroxide (as $CaCO^3$)	mg/L	171	171	0
Alkalinity, Total (as $CaCO^3$)	mg/L	171	171	0
Bromide (Br)	mg/L	<0.05	<0.05	-
Chloride (Cl)	mg/L	6.77	6.72	0.741
Fluoride	mg/L	0.103	0.101	1.96
Ammonia, Total (as N)	mg/L	0.011	0.0879	156
Nitrate (as N)	mg/L	15.6	15.4	1.29
Nitrite (as N)	mg/L	0.0049	0.0049	0
Total Kjeldahl Nitrogen	mg/L	<0.05	<0.05	-
Orthophosphate-Dissolved	mg/L	0.0107	0.01	6.76
Phosphorus (P)-Total	mg/L	0.017	0.018	5.71
Sulfate	mg/L	83.9	83.2	0.838
Anion Sum	meq/L	6.47	6.44	0.465
Cation Sum	meq/L	6.11	6.29	2.90
Organic / Inorganic Carbon				
Dissolved Organic Carbon	mg/L	1.2	1.34	11.0
Total Organic Carbon	mg/L	1.07	1.69	44.9
Total Metals				
Aluminum	mg/L	0.0064	0.0083	25.9
Antimony	mg/L	0.00023	0.00021	9.09
Arsenic	mg/L	0.00017	0.00015	12.5
Barium	mg/L	0.307	0.303	1.31
Beryllium	µg/L	<0.02	<0.02	-
Bismuth	mg/L	<0.00005	<0.00005	-
Boron	mg/L	<0.01	<0.01	-
Cadmium	µg/L	0.0839	0.0733	13.5
Calcium	mg/L	78.5	73.7	6.31
Chromium	mg/L	<0.0001	<0.0001	-
Cobalt	µg/L	<0.1	<0.1	-
Copper	mg/L	<0.0005	<0.0005	-
Iron	mg/L	0.013	0.013	0
Lead	mg/L	<0.00005	<0.00005	-
Lithium	mg/L	0.0169	0.0163	3.61
Magnesium	mg/L	26	25.2	3.13
Manganese	mg/L	0.00183	0.00192	4.80
Mercury	µg/L	<0.0005	<0.0005	-
Molybdenum	mg/L	0.00166	0.0017	2.38
Nickel	mg/L	0.00231	0.00227	1.75
Potassium	mg/L	1.7	1.67	1.78
Selenium	ug/L	27	26.9	0.371
Silicon	mg/L	2.96	2.88	2.74
Silver	mg/L	<0.00001	<0.00001	-
Sodium	mg/L	2.34	2.4	2.53
Strontium	mg/L	0.103	0.102	0.976
Thallium	mg/L	<0.00001	<0.00001	-
Tin	mg/L	<0.0001	<0.0001	-
Titanium	mg/L	<0.01	<0.01	-
Uranium	mg/L	0.000672	0.000708	5.22
Vanadium	mg/L	0.0006	0.00058	3.39
Zinc	mg/L	<0.003	<0.003	-
Dissolved Metals				
Aluminum	mg/L	<0.003	<0.003	-
Antimony	mg/L	0.00021	0.00021	0
Arsenic	mg/L	0.00015	0.00017	12.5
Barium	mg/L	0.266	0.286	7.25
Beryllium	µg/L	<0.02	<0.02	-
Bismuth	mg/L	<0.00005	<0.00005	-
Boron	mg/L	0.01	0.01	0
Cadmium	µg/L	0.0663	0.0723	8.66
Calcium	mg/L	77.8	78.8	1.28
Chromium	mg/L	<0.0001	<0.0001	-
Cobalt	µg/L	<0.1	<0.1	-
Copper	mg/L	<0.0002	<0.0002	-
Iron	mg/L	<0.01	<0.01	-
Lead	mg/L	<0.00005	<0.00005	-
Lithium	mg/L	0.0167	0.0169	1.19
Magnesium	mg/L	25.3	26.8	5.76
Manganese	mg/L	0.00118	0.00109	7.93
Mercury	µg/L	<0.005	<0.005	-
Molybdenum	mg/L	0.00171	0.00169	1.18
Nickel	mg/L	0.00204	0.00217	6.18
Potassium	mg/L	1.68	1.75	4.08
Selenium	µg/L	27.7	28.1	1.43
Silicon	mg/L	2.9	2.93	1.03
Silver	mg/L	<0.00001	<0.00001	-
Sodium	mg/L	2.32	2.37	2.13
Strontium	mg/L	0.101	0.0988	2.20
Thallium	mg/L	<0.00001	<0.00001	-
Tin	mg/L	<0.0001	<0.0001	-
Titanium	mg/L	<0.01	<0.01	-
Uranium	mg/L	0.000755	0.000759	0.528
Vanadium	mg/L	0.00057	0.00058	1.74
Zinc	mg/L	0.0016	0.0012	28.6

Indicates RPD exceeded 30%.

Notes: the RPD was calculated using < LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; "-"= no data/not calculated; LRL = Laboratory Reporting Limit.

Data accuracy for selenium speciation was evaluated based on eight CRM samples, three MS samples, and three Matrix Spike Duplicate (MSD) samples. All CRM, MS, and MSD samples met the laboratory DQO. Therefore, the overall accuracy achieved by BAL was considered excellent.

Analytical precision of water chemistry analyses completed by ALS Environmental (excluding selenium speciation) was evaluated by examining a total of 15 laboratory duplicate samples for a total of 209 analytes (see Appendix I for laboratory reports). For all paired samples, concentration comparisons were within the DQO set by the analytical laboratory. Analytical precision of selenium speciation analyses completed by BAL was evaluated by examining three laboratory duplicate samples for a total of 11 analytes (see Appendix I for laboratory reports). For all paired samples, concentration comparisons were within the DQO set by the analytical laboratory. Therefore, laboratory analytical precision can be considered good for both ALS Environmental and BAL results.

Five sets of field duplicate samples were collected to assess field sampling precision of water chemistry measured by ALS Environmental (excluding selenium speciation; Table A.5). Relative percent differences (RPDs) between field duplicate samples for most analytes (> 90% of detected analytes) were generally below 30%, with the exceptions of:

- total suspended solids in one set of samples (RPD = 53.1%);
- fluoride in one set of samples (RPD = 33.5);
- ammonia in two sets of samples (RPD = 45.6 to 156%);
- total Kjeldahl nitrogen in one set of samples (RPD = 137%);
- phosphorus in one set of samples (RPD = 57.1%);
- total organic carbon in one set of samples (RPD = 44.9%);
- total aluminum in one set of samples (RPD = 81.9%);
- total chromium in one set of samples (RPD = 34.5%);
- total cobalt in one set of samples (RPD = 30.8%);
- total iron in one set of samples (RPD = 61.5%);
- total lead in one set of samples (RPD = 34.7%);
- total manganese in one set of samples (RPD = 52.2%); and

- dissolved aluminum in one set of samples (RPD = 69.6%).

For three of the results listed above, the higher RPDs between paired results is due to at least one of these concentrations being detected close to (within 1.2-times) or below the LRL, where greater variability among paired results is anticipated. Eleven pairs of samples in which RPDs exceeded 30% did not have at least one result near the LRL, and of these, eight pairs of samples were from the water duplicate sample collected in June 2020, indicating lower field precision during this sampling event. As only 5.83% of all RPDs exceeded 30%, field sampling precision for water chemistry was considered acceptable for the purposes of this study.

Recommended hold times for oxidation-reduction potential (ORP) and pH were exceeded for all water chemistry samples prior to receipt of samples by the laboratory. The holding times for these analyses is 0.25 h, which is not feasible to meet while working in the field. All other recommended hold times were met for all samples.

A2.4 Data Quality Statement

Water chemistry data collected for the present study were of acceptable quality as characterized by good detectability, concentrations below LRLs in almost all method blank samples, good laboratory precision and accuracy, and good field sampling precision. Therefore, the associated data are considered acceptable for this study.

Table A.6: Sub-Sampling Percentages, Benthic Invertebrate Community Samples

Laboratory ID	Sample ID	Date	% Sampled	# Invertebrates
CC202675	LC_DC1_BIC-01_2019-12-04	04-Dec-19	5%	613
CC202676	LC_DC1_BIC-02_2019-12-04	04-Dec-19	5%	762
CC202677	LC_DC1_BIC-03_2019-12-04	04-Dec-19	5%	747
CC202678	LC_DCDS_BIC-01_2019-12-04	04-Dec-19	5%	652
CC202679	LC_DCDS_BIC-02_2019-12-04	04-Dec-19	5%	619
CC202680	LC_DCDS_BIC-03_2019-12-04	04-Dec-19	5%	551
CC210041	LC_DC3_BIC-01_2020-05-07	07-May-20	10%	329
CC210042	LC_DC3_BIC-02_2020-05-07	07-May-20	14%	345
CC210043	LC_DC3_BIC-03_2020-05-07	07-May-20	10%	361
CC210044	LC_DCEF_BIC-01_2020-05-06	06-May-20	8%	343
CC210045	LC_DCEF_BIC-02_2020-05-06	06-May-20	17%	332
CC210046	LC_DCEF_BIC-03_2020-05-06	06-May-20	11%	360
CC210047	LC_SPDC_BIC-01_2020-05-05	05-May-20	16%	314
CC210048	LC_SPDC_BIC-02_2020-05-05	05-May-20	36%	380
CC210049	LC_SPDC_BIC-03_2020-05-05	05-May-20	25%	378
CC210050	LC_DCDS_BIC-01_2020-05-05	05-May-20	8%	367
CC210051	LC_DCDS_BIC-02_2020-05-05	05-May-20	11%	382
CC210052	LC_DCDS_BIC-03_2020-05-05	05-May-20	8%	345
CC210053	LC_DC2_BIC-01_2020-05-06	06-May-20	13%	378
CC210054	LC_DC2_BIC-02_2020-05-06	06-May-20	15%	327
CC210055	LC_DC2_BIC-03_2020-05-06	06-May-20	45%	344
CC210056	LC_DC4_BIC-01_2020-05-04	04-May-20	8%	348
CC210057	LC_DC4_BIC-02_2020-05-04	04-May-20	5%	373
CC210058	LC_DC4_BIC-03_2020-05-04	04-May-20	5%	342
CC210059	LC_DC1_BIC-01_2020-05-04	04-May-20	5%	399
CC210060	LC_DC1_BIC-02_2020-05-04	04-May-20	6%	367
CC210061	LC_DC1_BIC-03_2020-05-04	04-May-20	6%	332
CC210062	LC_FRUS_BIC-01_2020-05-08	08-May-20	28%	364
CC210063	LC_FRUS_BIC-02_2020-05-08	08-May-20	32%	412
CC210064	LC_FRUS_BIC-03_2020-05-08	08-May-20	15%	341
CC210065	LC_FRB_BIC-01_2020-05-08	08-May-20	20%	525
CC210066	LC_FRB_BIC-02_2020-05-08	08-May-20	5%	349
CC210067	LC_FRB_BIC-03_2020-05-08	08-May-20	5%	330
CC210068	LC_GRCK_BIC-01_2020-05-11	11-May-20	9%	395
CC210069	LC_GRCK_BIC-02_2020-05-11	11-May-20	5%	323
CC210070	LC_GRCK_BIC-03_2020-05-11	11-May-20	5%	400
CC210071	LC_DCDS_BIC-01_2020-06-24	24-Jun-20	10%	436
CC210072	LC_DCDS_BIC-02_2020-06-24	24-Jun-20	6%	345
CC210073	LC_DCDS_BIC-03_2020-06-24	24-Jun-20	10%	475
CC210074	LC_DC1_BIC-01_2020-06-24	24-Jun-20	5%	440
CC210075	LC_DC1_BIC-02_2020-06-24	24-Jun-20	5%	542
CC210076	LC_DC1_BIC-03_2020-06-24	24-Jun-20	5%	503
CC210548	LC_FRB_BIC-01_2020-08-28	28-Aug-20	5%	529

Table A.6: Sub-Sampling Percentages, Benthic Invertebrate Community Samples

Laboratory ID	Sample ID	Date	% Sampled	# Invertebrates
CC210549	LC_FRB_BIC-02_2020-08-28	28-Aug-20	10%	580
CC210550	LC_FRB_BIC-03_2020-08-28	28-Aug-20	5%	446
CC210551	LC_FRUS_BIC-01_2020-08-28	28-Aug-20	5%	491
CC210552	LC_FRUS_BIC-02_2020-08-29	29-Aug-20	5%	456
CC210553	LC_FRUS_BIC-03_2020-08-29	29-Aug-20	5%	315
CC210554	LC_GRCK_BIC-01_2020-08-29	29-Aug-20	5%	341
CC210555	LC_GRCK_BIC-02_2020-08-29	29-Aug-20	5%	560
CC210556	LC_GRCK_BIC-03_2020-08-29	29-Aug-20	8%	318
CC210557	LC_DCDS_BIC-01_2020-09-01	01-Sep-20	5%	690
CC210558	LC_DCDS_BIC-02_2020-09-01	01-Sep-20	5%	702
CC210559	LC_DCDS_BIC-03_2020-09-01	01-Sep-20	5%	439
CC210560	LC_SPDC_BIC-01_2020-09-01	01-Sep-20	5%	2105
CC210561	LC_SPDC_BIC-02_2020-09-01	01-Sep-20	5%	525
CC210562	LC_SPDC_BIC-03_2020-09-01	01-Sep-20	23%	425
CC210563	LC_DC3_BIC-01_2020-09-02	02-Sep-20	5%	389
CC210564	LC_DC3_BIC-02_2020-09-02	02-Sep-20	5%	640
CC210565	LC_DC3_BIC-03_2020-09-02	02-Sep-20	5%	393
CC210566	LC_DC1_BIC-01_2020-09-02	02-Sep-20	5%	742
CC210567	LC_DC1_BIC-02_2020-09-02	02-Sep-20	5%	1120
CC210568	LC_DC1_BIC-03_2020-09-02	02-Sep-20	5%	650
CC210569	LC_DCEF_BIC-01_2020-09-03	03-Sep-20	6%	422
CC210570	LC_DCEF_BIC-02_2020-09-02	02-Sep-20	5%	315
CC210571	LC_DCEF_BIC-03_2020-09-02	02-Sep-20	11%	308
CC210572	LC_DC2_BIC-01_2020-09-03	03-Sep-20	5%	572
CC210573	LC_DC2_BIC-02_2020-09-03	03-Sep-20	5%	534
CC210574	LC_DC2_BIC-03_2020-09-03	03-Sep-20	5%	630
CC210575	LC_DC4_BIC-01_2020-09-03	03-Sep-20	5%	1067
CC210576	LC_DC4_BIC-02_2020-09-03	03-Sep-20	5%	609
CC210577	LC_DC4_BIC-03_2020-09-03	03-Sep-20	5%	809
CC211637	LC_DCDS_BIC-01	1-Dec-20	10%	341
CC211638	LC_DCDS_BIC-02	1-Dec-20	7%	336
CC211639	LC_DCDS_BIC-03	1-Dec-20	25%	328
CC211640	LC_DC1_BIC-01	30-Nov-20	5%	384
CC211641	LC_DC1_BIC-02	30-Nov-20	20%	329
CC211642	LC_DC1_BIC-03	30-Nov-20	6%	369

Table A.7: Summary of Subsampling Efficiency for Benthic Invertebrate Community Samples

Laboratory ID	Sample ID	# of Organisms in Subsample																				Total # of Organisms	Precision Error		Accuracy Error	
	Subsample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Min (%)	Max (%)	Min (%)	Max (%)
CC210049	LC_SPDC_BIC-03_2020-05-05	363	378	372	366	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1479	0.82	3.97	0.61	2.23
CC210043	LC_DC3_BIC-03_2020-05-07	357	354	330	392	327	341	351	347	341	355	-	-	-	-	-	-	-	-	-	-	3495	0	16.6	0.43	12.2
CC210065	LC_FRB_BIC-01_2020_05-08	494	435	472	451	475	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2327	0.63	11.9	1.42	6.53
CC210549	LC_FRB_BIC-02_2020-08-28	565	500	586	562	584	564	591	592	587	555	-	-	-	-	-	-	-	-	-	-	5686	0.17	15.5	0.63	12.1
CC210552	LC_FRUS_BIC-02_2020-08-29	457	449	440	454	455	444	457	454	437	440	405	405	463	471	441	465	424	475	424	426	8886	0	14.7	0.07	8.85
CC210561	LC_SPDC_BIC-02_2020-09-01	511	490	426	506	487	493	491	479	493	503	461	500	487	492	509	502	483	511	513	523	9860	0	18.6	0	13.6
CC210073	LC_DCDS_BIC-03_2020-06-24	450	438	433	458	495	454	448	462	459	473	-	-	-	-	-	-	-	-	-	-	4570	0.22	12.5	0.22	8.32

Notes: "-" indicates that no subsample was taken. Subsampling efficiency was not calculated for December 2019 samples.

Table A.8: Summary of Sorting Efficiency for Benthic Invertebrate Community Samples

Laboratory ID	Sample ID	Taxon	Organisms Missed	Total Organisms Found	% Efficiency
CC202677	LC_DC1_BIC-03_2019-12-04	Plecoptera	1		
		Total	1	747	100
CC210048	LC_SPDC_BIC-02_2020-05-05	Chironomidae	1		
		Total	1	380	100
CC210057	LC_DC4_BIC-02_2020-05-04	Chironomidae	2		
		Ephemeroptera	2		
		Oligochaeta	1		
		Total	5	373	99
CC210070	LC_GRCK_BIC-03_2020-05-11	Chironomidae	2		
		Ephemeroptera	2		
		Plecoptera	3		
		Oligochaeta	4		
		Total	11	400	97
CC210075	LC_DC1_BIC-02_2020-06-24	Diptera	1		
		Plecoptera	3		
		Total	4	542	99
CC210551	LC_FRUS_BIC-01_2020-08-28	Chironomidae	3		
		Ephemeroptera	2		
		Plecoptera	1		
		Trombidiformes	1		
		Total	7	491	99
CC210560	LC_SPDC_BIC-01_2020-09-01	Chironomidae	2		
		Total	2	2105	100
CC210576	LC_DC4_BIC-02_2020-09-03	Trichoptera	1		
		Total	1	609	100
Average Recovery					99.1

Notes: As sorting progressed, 10% of samples were randomly chosen by senior members of the sorting team for resorting. All sorters working on a project had at least one sample resorted by another sorter. An efficiency of 90% was expected. If 90/95% efficiency was not met, samples from that sorter were re-sorted. To calculate sorting efficiency the following formula was used: (# organisms missed / total organisms found) X 100.

Table A.9: Percent Benthic Invertebrate Community Organism Recovery

Laboratory ID	Sample ID	Taxa Identified	TIR	PDE	PTD	BCDI
CC202675	LC_DC1_BIC-01_2019-12-04	609	0	0.327	1.14	0.00818
CC210041	LC_DC3_BIC-01_2020-05-07	328	0	0.152	0.608	0.00457
CC210054	LC_DC2_BIC-02_2020-05-06	326	0	0.153	0.612	0.00459
CC210068	LC_GRCK_BIC-01_2020-05-11	393	0	0.254	2.03	0.0178
CC210072	LC_DCDS_BIC-02_2020-06-24	344	0	0.145	1.16	0.102
CC210548	LC_FRB_BIC-01_2020-08-28	527	0	0.189	0.567	0.00379
CC210555	LC_GRCK_BIC-02_2020-08-29	559	0	0.0894	0.893	0.00804
CC210570	LC_DCEF_BIC-02_2020-09-02	313	0	0.318	0.952	0.00637

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.

A3 BENTHIC INVERTEBRATE COMMUNITY

A3.1 Sub-Sampling Accuracy and Precision

The analytical reports for benthic invertebrate community structure from Cordillera Consulting Inc. (see Appendix I for laboratory reports) were examined to assess sub-sampling accuracy. Canadian Aquatic Biomonitoring Network (CABIN) protocols were followed for sub-sampling (i.e., identification of a minimum 300 invertebrates), which often resulted in only 5% of a community structure sample being assessed (Table A.6). All benthic invertebrate community structure samples (n = 78) were subject to sub-sampling. The amount of material sorted in each sample ranged from 5 to 45% of the total sample volume (Table A.6).

Sub-sampling efficiency was assessed by comparing the numbers of benthic invertebrates recovered between at least two sub-samples. The precision and accuracy of sub-sampling efficiency assessments met the laboratory's DQO in all cases (≤ 20%; Table A.7). Thus, the precision and accuracy for sub-sampling of benthic invertebrate community samples was considered excellent.

A3.2 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 an average of 99.3% for the eight community structure samples evaluated (Table A.8). Recovery in quality control samples was above the laboratory's DQO (> 95%), so organism sorting efficiency was considered excellent.

A3.3 Taxonomic Identification Accuracy

Cordillera Consulting Inc. performed an internal audit of taxonomic identification for at least 10% of all community structure samples (n = 9; Table A.9). The analysts reported a total identification error rate (TIR) of 0% for all samples evaluated, except for LC_DCDS_BIC-02 (0.30%), percent differences in enumeration (PDE) of 0.0894% to 0.327%, percent taxonomic disagreements (PTD) of 0.567% to 2.03%, and Bray Curtis Dissimilarity Indices (BCDI, a measure of the differences in identifications between different analysts) of 0.00379 to 0.102). The laboratory DQO was based on TIR as per CABIN laboratory methods (< 5% TIR; Environment Canada 2014). Since TIR was zero for all samples except one, the taxonomic accuracy of the analysis was considered excellent.

A3.4 Data Quality Statement

Benthic invertebrate community data collected for the present study were of excellent 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 for interpretation.

Table A.10: Laboratory Reporting Limit (LRL) Evaluation for Benthic Invertebrate Tissue Chemistry Analyses

Parameter	Units	Range of LRLs	No. Sample Results < LRL
Arsenic	ppm	0.203 to 0.508	34 (15.7%)
Tin	ppm	0.016 to 0.107	6 (2.76%)
Mercury	ppm	0.021 to 0.038	31 (14.3%)

Notes: Only analytes with one or more sample results < LRL are displayed. Total number of samples (n) was 217. LRL = Laboratory Reporting Limit. LRLs for selenium were below the BC WQG short-term guideline (13 mg/kg dry weight; BCMOECCS 2019 and 2020).

A4 BENTHIC INVERTEBRATE TISSUE CHEMISTRY

A4.1 Laboratory Reporting Limits

Analytical reports of benthic invertebrate tissue metal concentrations from TrichAnalytics (see Appendix I for laboratory reports) were examined to provide an inventory of analyte results below the LRL and to compare the LRLs for these analytes to available benchmarks (Table A.10). Only three analytes (arsenic, tin, and barium) had concentrations below the LRL in a small number of samples (15.7%, 2.76%, and 14.3% of samples, respectively; Table A.10). The sole focus of interpretation of benthic invertebrate tissue chemistry results for the Dry Creek LAEMP was selenium. Selenium was detectable (i.e., > LRL) in all benthic invertebrate samples, therefore comparison of the selenium LRL to the applicable benchmark (i.e., Elk Valley Water Quality Plan Level 1 benchmark for effects to invertebrates [13 mg/kg dry weight]; Teck 2014) was not necessary to assess whether adequate detectability was achieved. Overall, the detectability of selenium in all samples (i.e., > LRL) indicates that the achieved LRLs were suitable for the study.

A4.2 Data Accuracy and Precision

Data accuracy and precision were evaluated based on the analysis of 25 CRM samples consisting of 870 individual analyte results (see Appendix I for laboratory reports). Most CRM analyses met the laboratory DQO (Table A.1), and the DQO for CRM analyses was net for all selenium results. As indicated above, selenium was the sole focus of interpretation for benthic invertebrate tissue chemistry results for the Dry Creek LAEMP. As such, the DQO exceedances for the other analytes listed above would not affect data interpretation. Accuracy achieved by the laboratory in this study can therefore be considered good.

Laboratory precision was also evaluated based on 33 duplicate analyses of benthic invertebrate tissue samples (see Appendix I for laboratory reports). Most laboratory duplicate results for benthic invertebrate tissue were within the DQO set by TrichAnalytics (Table A.1), and the DQO for laboratory precision was met for all selenium results. Since selenium is the focus of benthic invertebrate tissue chemistry interpretation for the Dry Creek LAEMP, laboratory analytical precision can be considered good for this study.

A4.3 Data Quality Statement

Benthic invertebrate tissue data collected for the present study were of good quality as characterized by good detectability, appropriate LRLs, and good 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.

Table A.11: Laboratory Reporting Limit (LRL) Evaluation for Fish Tissue Chemistry Analyses

Parameter	Units	Range of LRLs	No. Sample Results < LRL
Boron	ppm	0.076	18 (85.7%)
Vanadium	ppm	0.034	21 (100%)
Arsenic	ppm	0.468	21 (100%)
Molybdenum	ppm	0.001	21 (100%)
Silver	ppm	0.001	21 (100%)
Cadmium	ppm	0.046	20 (95.2%)
Antimony	ppm	0.001	20 (95.2%)
Mercury	ppm	0.030	19 (90.5%)
Lead	ppm	0.007	20 (95.2%)
Uranium	ppm	0.001	21 (100%)

Notes: Only analytes with one or more sample results < LRL are displayed. Total number of samples (n) was 21. LRL = Laboratory Reporting Limit. LRLs for selenium were below the site-specific guideline (15 mg/kg dry weight; Nautilus Environmental and Interior Reforestation 2011).

A5 FISH TISSUE CHEMISTRY

A5.1 Laboratory Reporting Limits

Analytical laboratory reports of westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) muscle tissue metal concentrations from TrichAnalytics were examined to provide an inventory of analyte results below the LRL and to compare the LRLs for these analytes to available benchmarks (Table A.11). Several analytes had results consistently below the LRL (Table A.11). The sole focus of interpretation of westslope cutthroat trout muscle tissue chemistry results for the Dry Creek LAEMP was selenium. Selenium was detectable (i.e., > LRL) in all fish tissue samples, therefore comparison of the selenium LRL to the applicable benchmark (15 µg/g dry weight; Nautilus Environmental and Interior Reforestation 2011) was not necessary to assess whether adequate detectability was achieved. Overall, the detectability of selenium in all samples (i.e., > LRL) indicates that the achieved LRLs were suitable for the study.

A5.2 Data Accuracy and Precision

Data accuracy was evaluated based on the analysis of two CRM samples consisting of 60 individual analyte results (see Appendix I for laboratory reports). All CRM analyses met the laboratory DQO (Table A.1). Accuracy achieved by the laboratory in this study can therefore be considered excellent.

Laboratory precision was evaluated based on duplicate analysis of westslope cutthroat trout muscle tissue samples. Three duplicate tissue samples were analyzed. As all laboratory duplicate results for benthic invertebrate tissue were within the DQO set by TrichAnalytics, laboratory analytical precision can be considered excellent.

A5.3 Data Quality Statement

Westslope cutthroat trout muscle tissue data collected for the present study were of good quality as characterized by good detectability, 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.

A6 FISH AGING

A6.1 Data Accuracy

Analytical reports of fish age estimates from AAE Technical Services Inc. (AAE; see Appendix I for laboratory reports) were examined to evaluate data accuracy. To determine the accuracy of westslope cutthroat trout age estimates, each of the 15 aging structures that were analyzed by AAE were re-processed by a second analyst. The original and second analyst assigned a confidence index to each age estimate and check. A final age estimate for each fish was assigned based on the outcomes of the original analysis and the re-assessment. Original and re-assessed age estimates were in agreement for all samples, but the confidence interval assigned to the age estimate was either poor, fairly poor, or fair for 47% of samples for both the original analysis and the re-assessment. In addition, six of the otoliths submitted for analysis were deformed and one additional otolith was broken (see Appendix I). Based on the deformity or broken condition of 6 of the 15 otoliths and associated limited confidence in the accuracy of the aging analyses, the associated aging results should be used and interpreted with caution.

Table A.12: Laboratory Duplicate Results for Analysis of Periphyton Cell Densities (cells/cm²) by Species

Group	Species	Site					
		LC_DC1-03_2020-10-06	LC_DC1-03_2020-10-06 (DUP)	RPD	LC_DC2-01_2020-09-24	LC_DC2-01_2020-09-24 (DUP)	RPD
Cyanobacteria	Chlorogloea sp.	0	0	-	0	216,440	-
	Colonial Cyanobacteria	0	0	-	0	185,520	-
	Homeothrix sp.	7,884,600	9,739,800	21.1	1,236,800	4,483,400	114
	Phormidium autumnale	1,329,560	711,160	60.6	1,700,600	1,576,920	7.55
Diatom	Achnanthidium minutissimum	6,431,360	9,399,680	37.5	18,304,640	25,941,880	34.5
	Achnanthidium minutissimum var linearis	1,360,480	865,760	44.4	2,844,640	649,320	126
	Amphora sp. (pediculus)	61,840	0	200	0	0	-
	Cocconeis placentula	0	0	-	0	0	-
	Cyclotella sp.	30,920	0	200	0	0	-
	Cymbella excisiformis (Encyonema excisiformis)	216,440	309,200	35.3	278,280	61,840	127
	Cymbella sp.	618,400	432,880	35.3	0	340,120	200
	Cymbella turgida	30,920	0	200	0	0	-
	Diatoma hiemale	0	0	-	0	0	-
	Diatoma vulgare	123,680	92,760	28.6	0	30,920	200
	Encyonema silesiacum	587,480	1,113,120	61.8	309,200	340,120	9.52
	Eunotia spp.	92,760	0	200	0	0	-
	Frustulia sp.	0	0	-	0	0	-
	Gomphonema sp. Small	278,280	340,120	20.0	154,600	123,680	22.2
	Meridion anceps	0	0	-	0	0	-
	Meridion circulare	0	0	-	0	0	-
	Navicula spp.	0	0	-	0	0	-
	Staurosira construens v. ventor	0	0	-	0	0	-
	Synedra ulna	30,920	30,920	0	30,920	30,920	0
	Nitzschia spp.	3,370,280	4,390,640	26.3	0	278,280	200
	Diatoma moniliformis	371,040	216,440	52.6	0	30,920	200
Green	Ulothrix zonata	0	0	-	0	0	-
Flagellate	Flagellates (dead)	123,680	61,840	66.7	0	0	-
Total number of taxa		17	13	26.7	8	14	54.5
Total cell density		22,942,640	27,704,320	18.8	24,859,680	34,290,280	31.9

Indicates RPD exceeded 30%.

Notes: RPD = relative percent difference; DUP = duplicate sample; "-" indicates RPD could not be calculated.

Table A.12: Laboratory Duplicate Results for Analysis of Periphyton Cell Densities (cells/cm^2) by Species

Group	Species	Site					
		LC_DC4-02_2020-11-05	LC_DC4-02_2020-11-05 (DUP)	RPD	LC_DCDS-03_2020-10-21	LC_DCDS-03_2020-10-21 (DUP)	RPD
Cyanobacteria	Chlorogloea sp.	309,200	123,680	85.7	0	0	-
	Colonial Cyanobacteria	0	0	-	0	0	-
	Homeothrix sp.	9,276,000	4,019,600	79.1	6,338,600	12,831,800	67.7
	Phormidium autumnale	8,039,200	9,276,000	14.3	773,000	1,638,760	72.0
Diatom	Achnanthidium minutissimum	21,613,080	19,665,120	9.44	33,517,280	26,220,160	24.4
	Achnanthidium minutissimum var linearis	1,267,720	1,113,120	13.0	1,205,880	371,040	106
	Amphora sp. (pediculus)	0	0	-	0	30,920	200
	Cocconeis placentula	0	30,920	200	0	0	-
	Cyclotella sp.	0	0	-	0	0	-
	Cymbella excisiformis (Encyonema excisiformis)	92,760	154,600	50.0	463,800	309,200	40.0
	Cymbella sp.	556,560	432,880	25.0	371,040	494,720	28.6
	Cymbella turgida	0	0	-	0	0	-
	Diatoma hiemale	247,360	92,760	90.9	0	30,920	200
	Diatoma vulgare	30,920	30,920	0	61,840	30,920	66.7
	Encyonema silesiacum	618,400	432,880	35.3	247,360	123,680	66.7
	Eunotia spp.	0	92,760	200	0	92,760	200
	Frustulia sp.	30,920	30,920	0	0	0	-
	Gomphonema sp. Small	432,880	185,520	80.0	494,720	494,720	0
	Meridion anceps	0	30,920	200	0	0	-
	Meridion circulare	0	0	-	278,280	0	200
	Navicula spp.	154,600	0	200	309,200	494,720	46.2
	Staurosira construens v. ventor	0	0	-	0	30,920	200
	Synedra ulna	61,840	30,920	66.7	0	30,920	200
	Nitzschia spp.	3,308,440	3,772,240	13.1	1,267,720	1,205,880	5
	Diatoma moniliformis	61,840	0	200	216,440	154,600	33.3
Green	Ulothrix zonata	0	0	-	154,600	0	200
Flagellate	Flagellates (dead)	0	0	-	0	30,920	200
Total number of taxa		16	17	6.06	14	18	25.0
Total cell density		46,101,720	39,515,760	15.4	45,699,760	44,617,560	2.40

Indicates RPD exceeded 30%.

Notes: RPD = relative percent difference; DUP = duplicate sample; "-" indicates RPD could not be calculated.

Table A.13: Laboratory Duplicate Results for Analysis of Periphyton Cell Densities (cells/cm^2) by Groups

Group	Sites											
	LC_DC1-03_2020-10-06	LC_DC1-03_2020-10-06 (DUP)	RPD (%)	LC_DC2-01_2020-09-24	LC_DC2-01_2020-09-24 (DUP)	RPD (%)	LC_DC4-02_2020-11-05	LC_DC4-02_2020-11-05 (DUP)	RPD (%)	LC_DCDS-03_2020-10-21	LC_DCDS-03_2020-10-21 (DUP)	RPD (%)
Cyanobacteria	9214160	10450960	12.6	2937400	6,462,280	75	17624400	13419280	27.1	7111600	14470560	68.2
Diatom	13,604,800	17,191,520	23.3	21,922,280	27,828,000	23.7	46101720	39515760	15.4	45545160	44586640	2.13
Green	0	0	-	0	0	-	0	0	-	154,600	0	200
Flagellate	123,680	61,840	66.7	0	0	-	0	0	-	0	30,920	200
Total cell density	22,942,640	27,704,320	18.8	24,859,680	34,290,280	31.9	63,726,120	52,935,040	18.5	52,811,360	59,088,120	11.22

Indicates RPD exceeded 30%.

Notes: RPD = relative percent difference; DUP = duplicate sample; "-" indicates RPD could not be calculated.

A7 PERIPHYTON COMMUNITY

A7.1 Sub-sampling Precision

The analytical report of periphyton community structure from Larratt Aquatic Consulting Ltd. (see Appendix I for laboratory reports) was examined to assess sub-sampling precision. Sub-sampling error was evaluated based on duplicate analysis of periphyton community structure sub-samples. Four periphyton sub-samples were randomly selected for duplicate analysis of community structure by the laboratory. At the species level, sub-sampling duplicate results often had a RPD greater than 30%, with several instances of a species being found in only one of the duplicate samples (Table A.12). One RPD for total cell density was above 30% (LC_DC2-01_2020-09-24; Table A.12). One RPD for taxonomic richness was above 30% (LC_DC2-01_2020-09-24; Table A.12). At the group level, RPDs for blue-green algae were greater than 30% in two sets of samples, and RPDs for diatoms were less than 30% in all sets of duplicate samples (Table A.13).

A7.2 Data Quality Statement

These results suggest that sub-sampling error may result in certain organisms (particularly rarer taxa) falsely being reported as absent from a sample. This also suggests that laboratory sub-sampling procedures have the potential to result in false conclusions of differences in community structure, either due to incomplete homogenization of the sample, or because only a very small portion of a collected sample was assessed (e.g., 2 mL sub-sample).

Overall, these results emphasize the need for establishing quality assurance/quality control (QA/QC) procedures for periphyton community analysis which includes reporting of sub-sampling errors (such data are not routinely provided by algal taxonomists unless specifically requested).

A8 DATA QUALITY 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 2020 Dry Creek LAEMP with the exception of fish aging data which should be used and interpreted with caution due to limited accuracy of aging analyses.Overall, the quality of the data collected for this project was considered acceptable for the derivation of conclusions associated with the objectives of the 2020 Dry Creek LAEMP with the exception of fish aging data which should be used and interpreted with caution due to limited accuracy of aging analyses.

A9 REFERENCES

BCMOECCS (British Columbia Ministry of Environment and Climate Change Strategy). 2019. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture – Summary Report. Updated August 2019.

BCMOECCS. 2021. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Quality Guideline Series, WQG-08. Prov. B.C., Victoria B.C. Updated February 2021.

Environment Canada. 2014. CABIN (Canadian Aquatic Biomonitoring Network) Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples. Environment Canada. May 2014.

Nautilus Environmental and Interior Reforestation. Evaluation of the Effects of Selenium on Early Life Stage Development of Westslope Cutthroat Trout from the Elk Valley, BC. May 2009 (revised June 2011). Report submitted to Elk Valley Selenium Task Force c/o Teck Coal, Fording River Operations.

Teck (Teck Coal Limited). 2014. Elk Valley Water Quality Plan. Submitted to the British Columbia Minister of Environment for approval on July 22, 2014.

APPENDIX B

WATER QUALITY

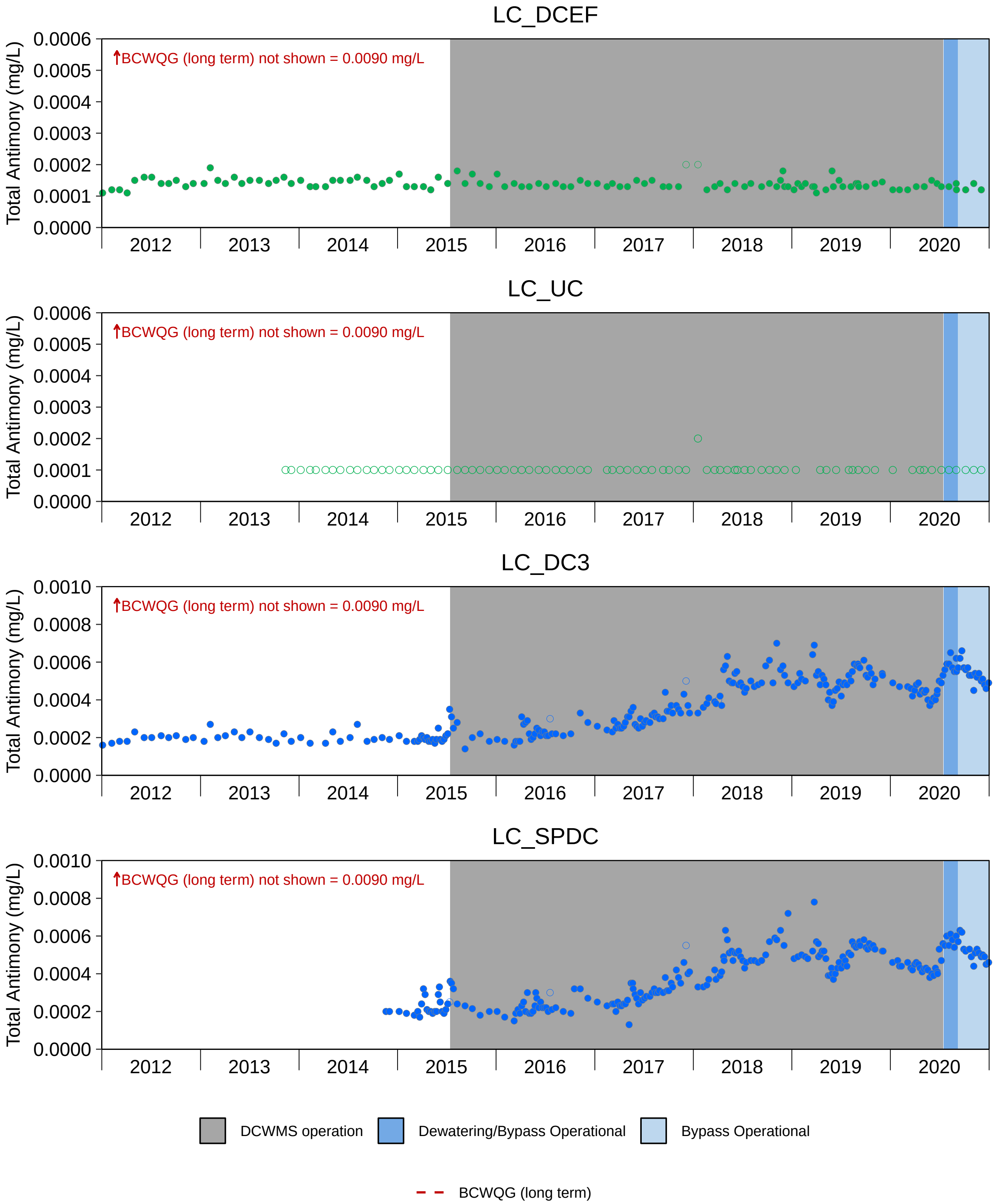

Figure B.1: Time Series Plots for Total Antimony from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

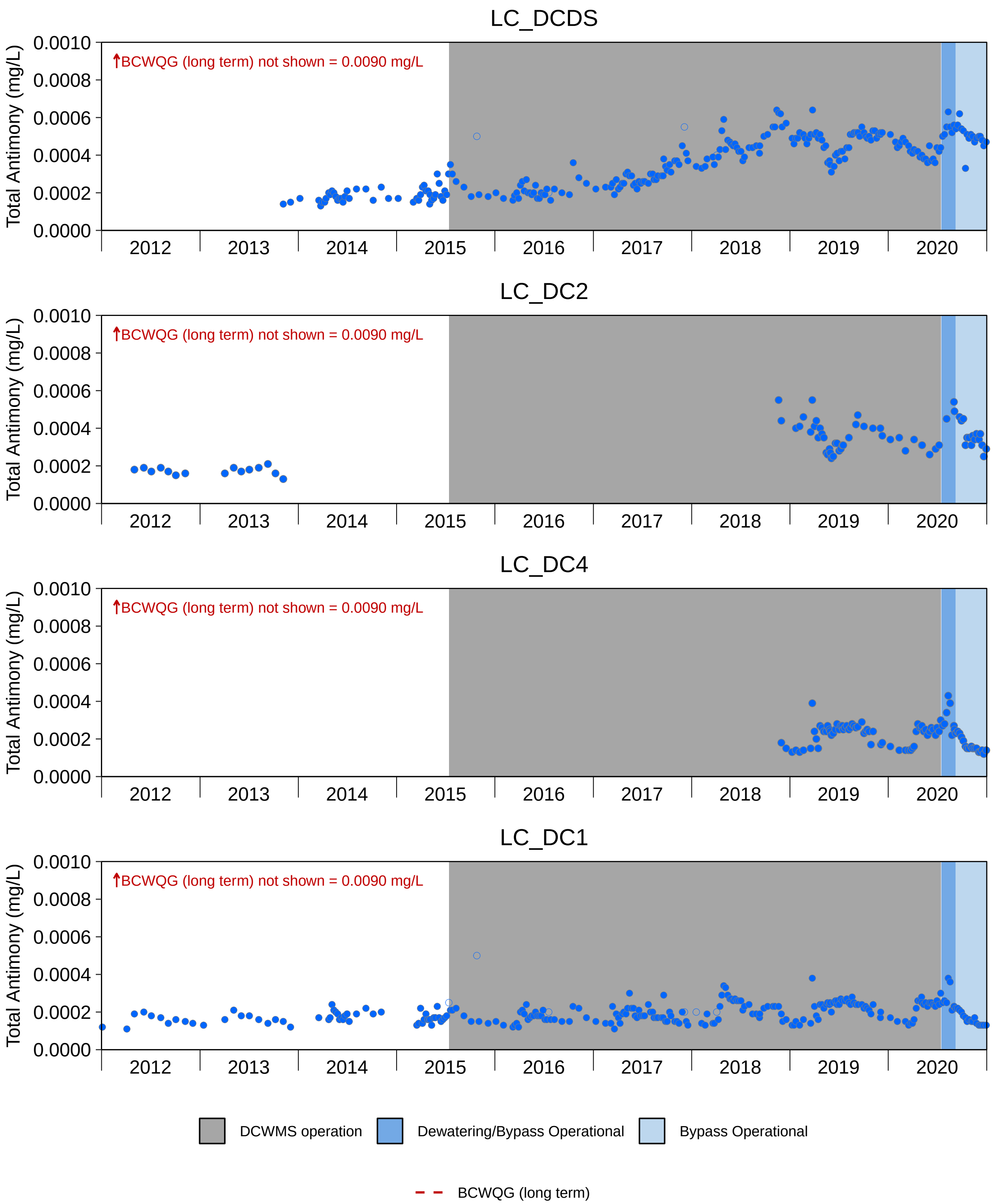

Figure B.1: Time Series Plots for Total Antimony from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

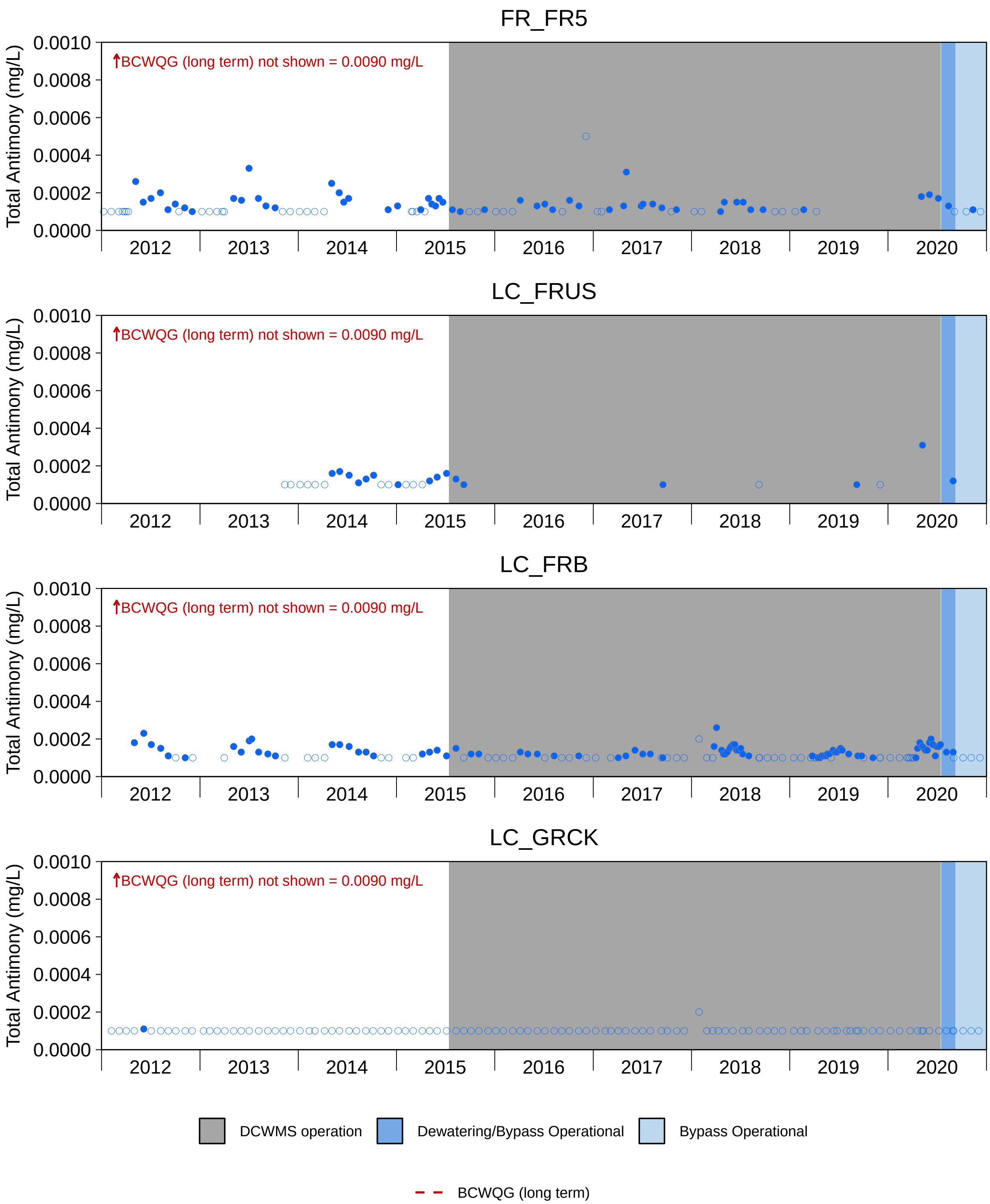

Figure B.1: Time Series Plots for Total Antimony from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

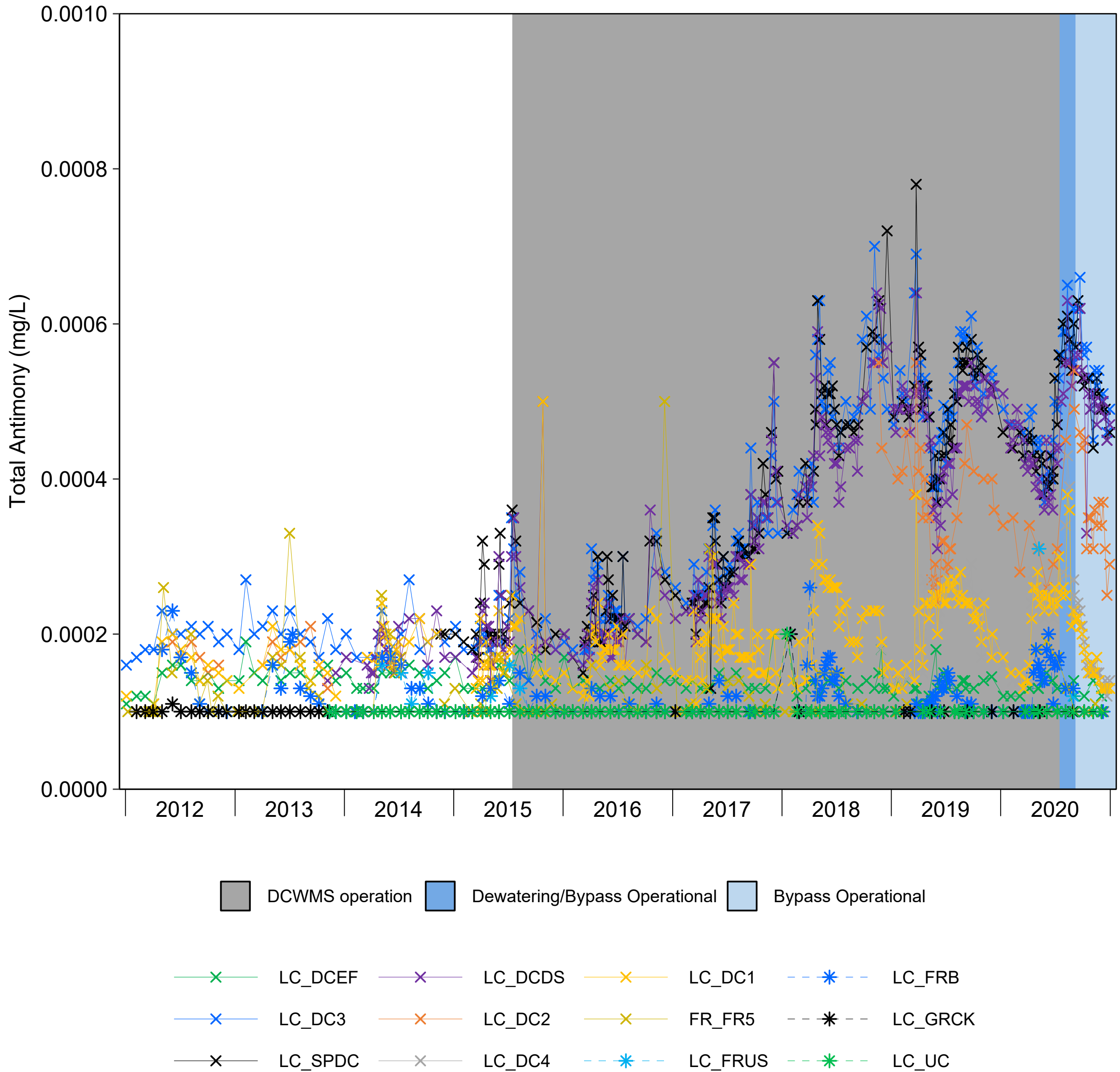

Figure B.2: Time Series Plots for Total Antimony from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.00010 and 0.00055 mg/L).

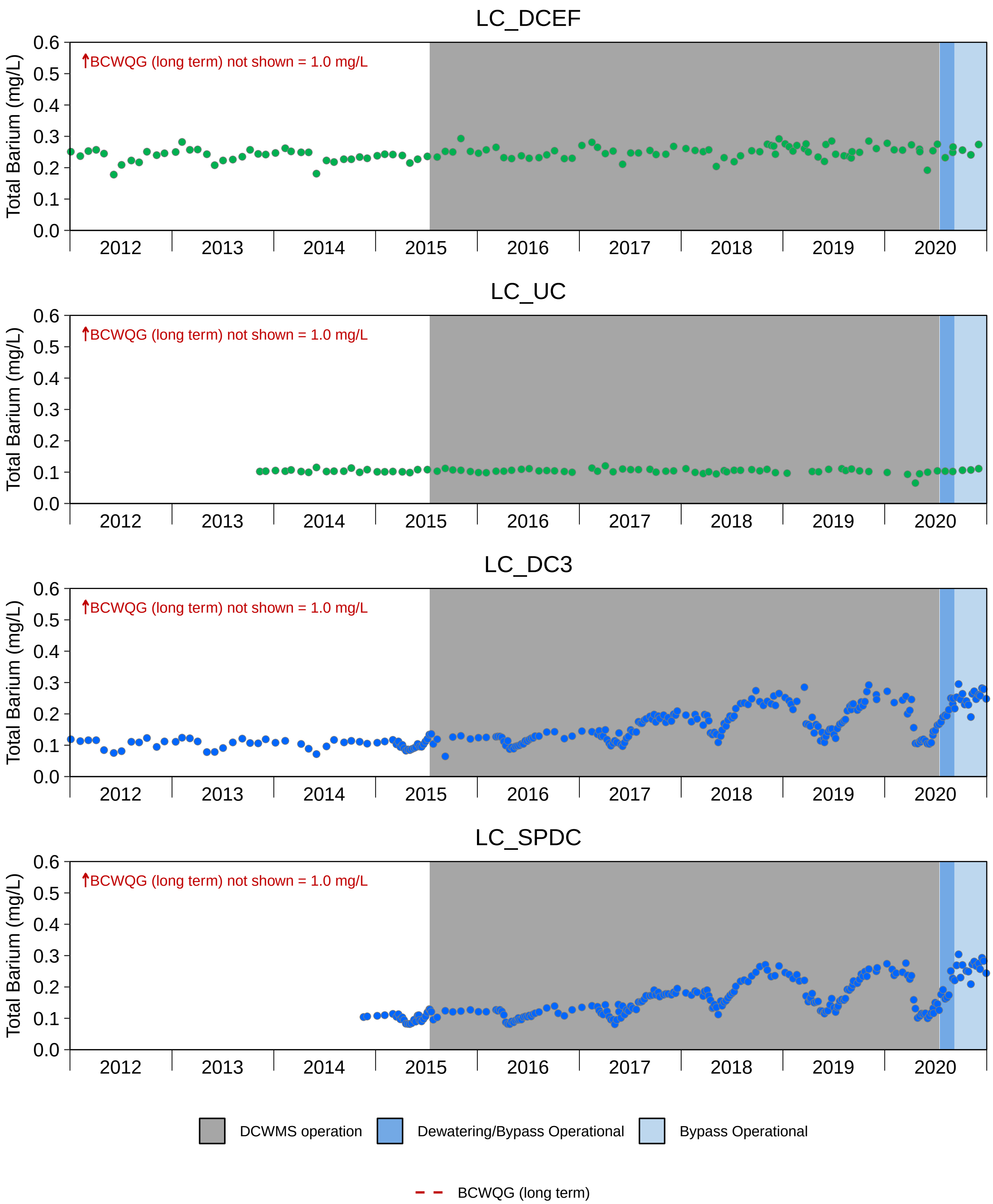

Figure B.3: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).).

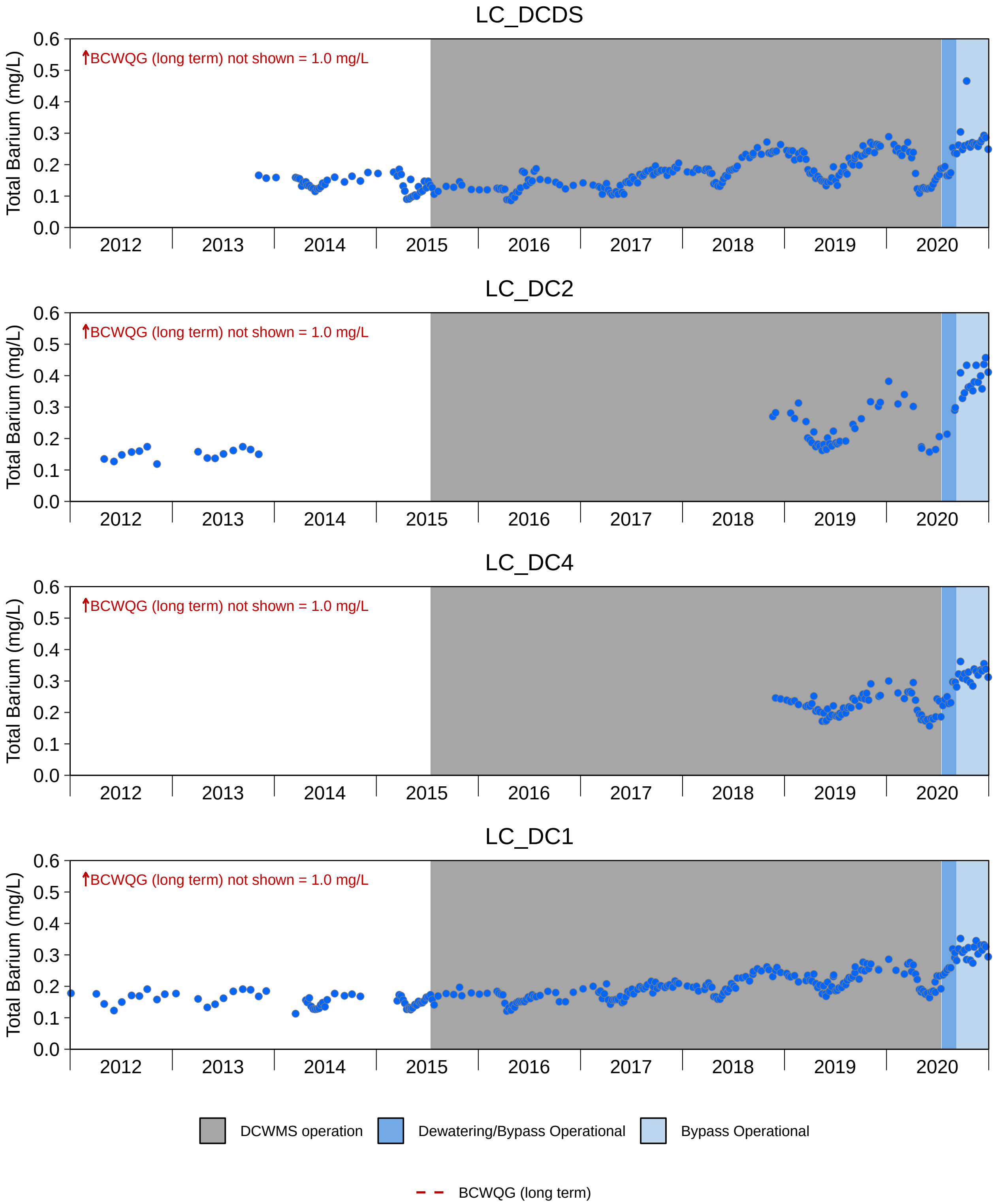

Figure B.3: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).).

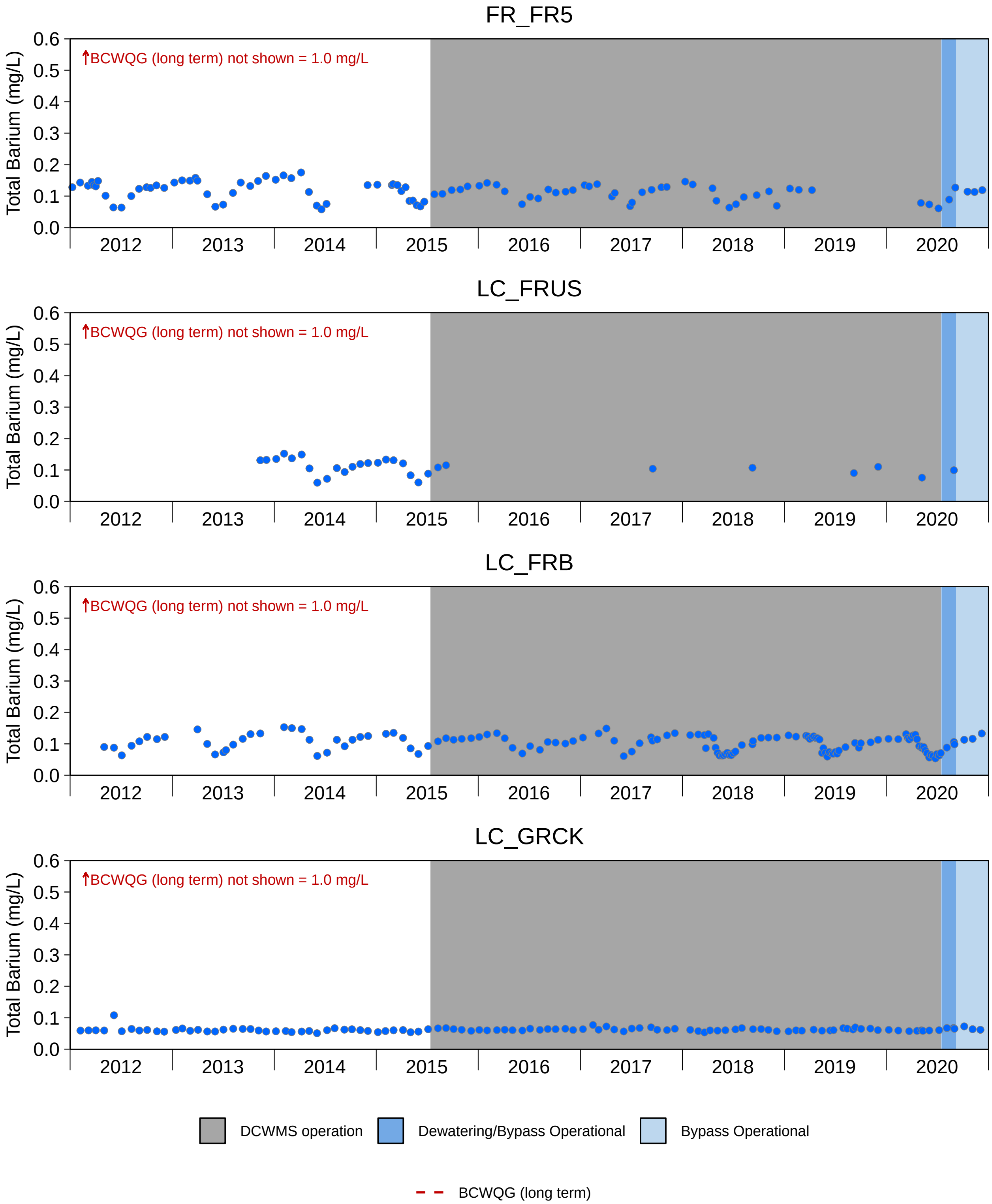

Figure B.3: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).).

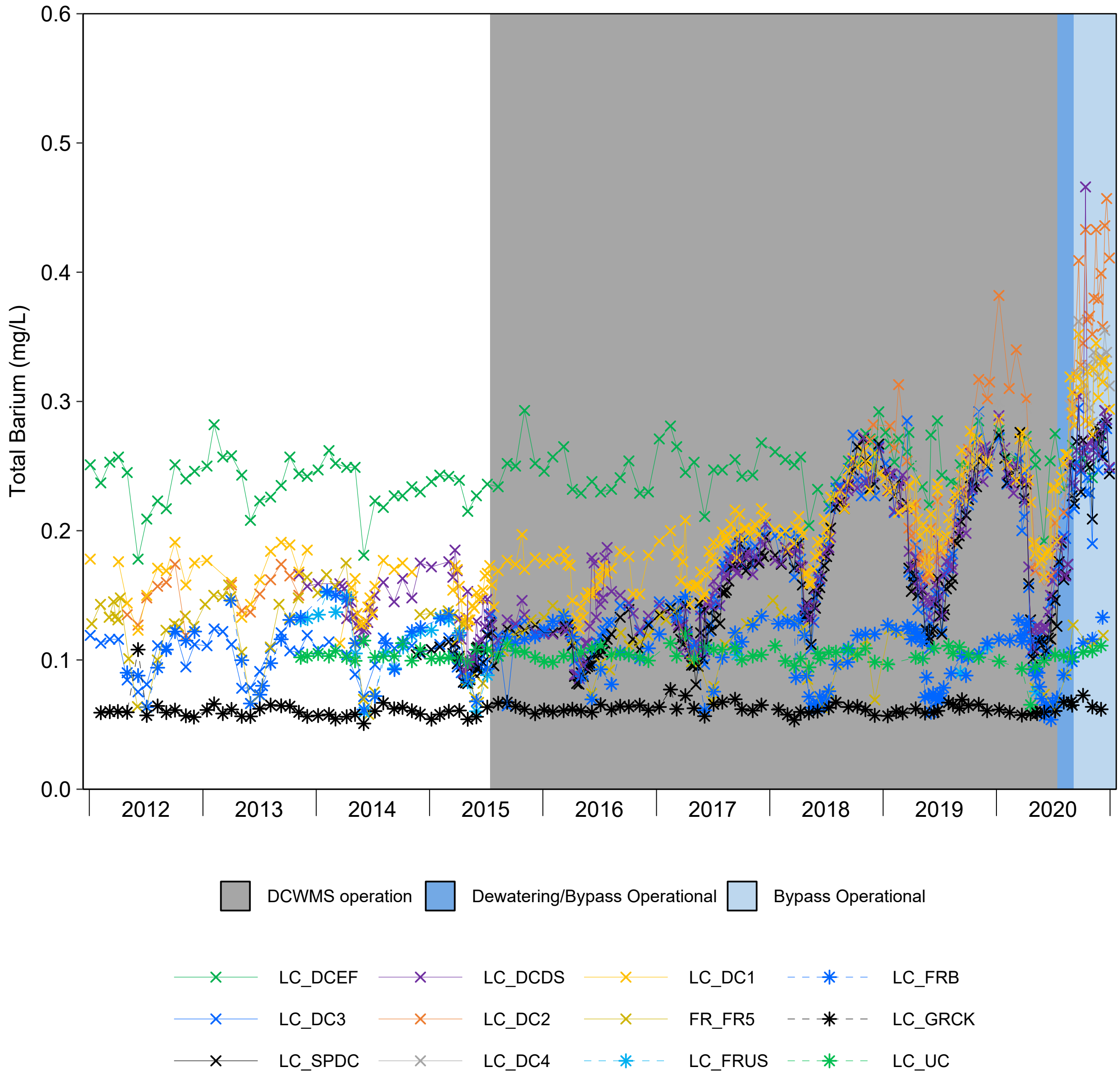

Figure B.4: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: No values below the LRL.

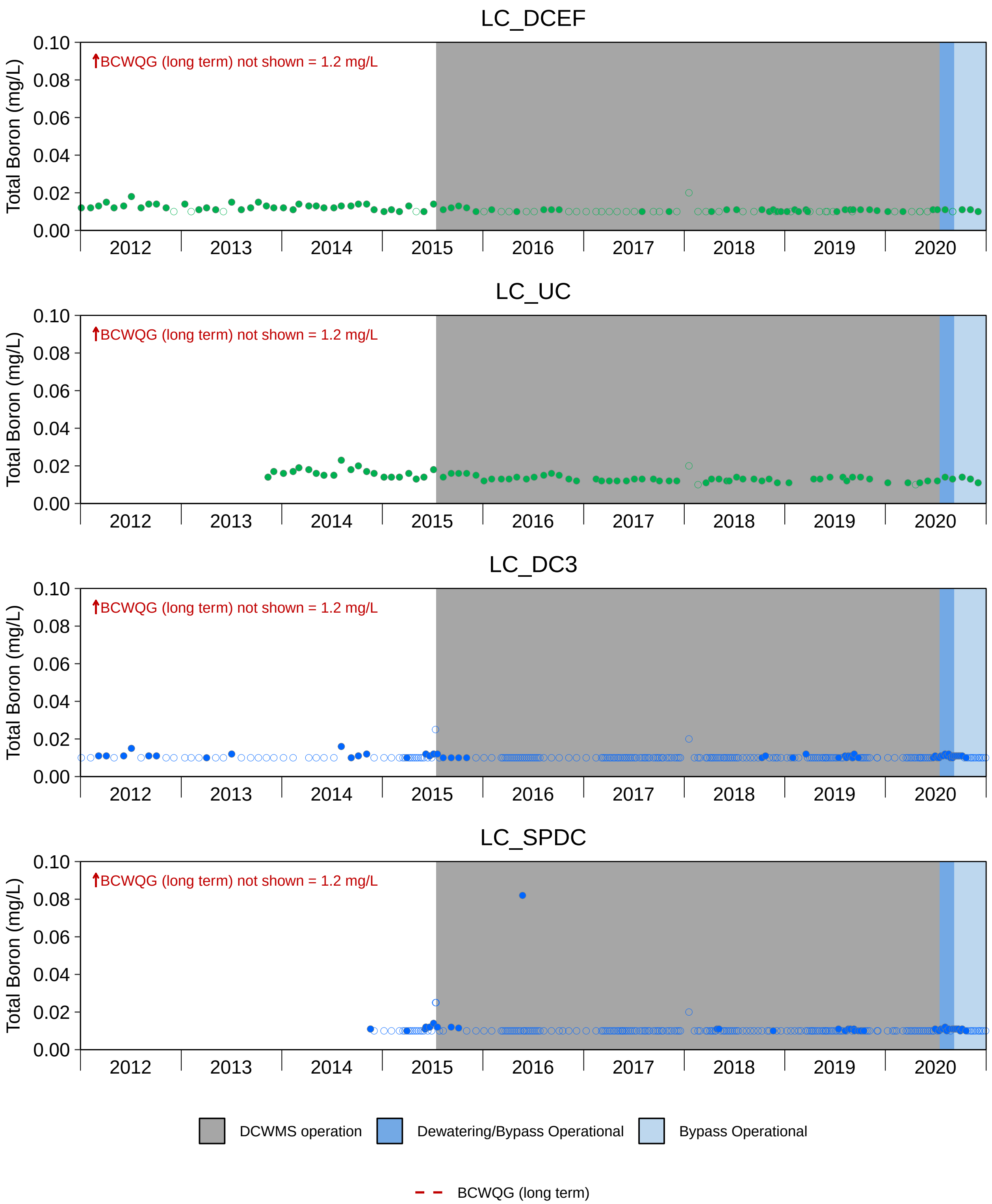

Figure B.5: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

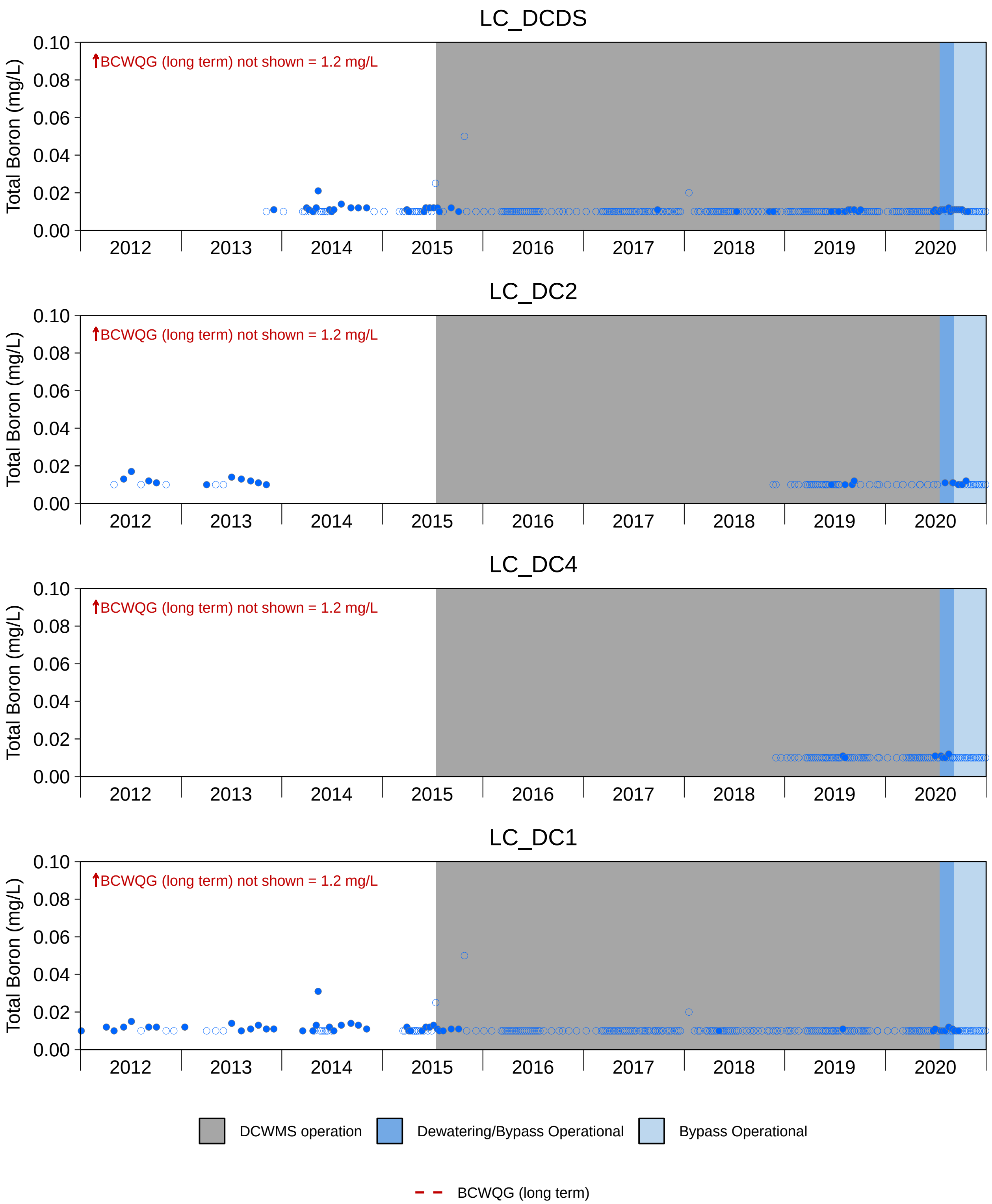

Figure B.5: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

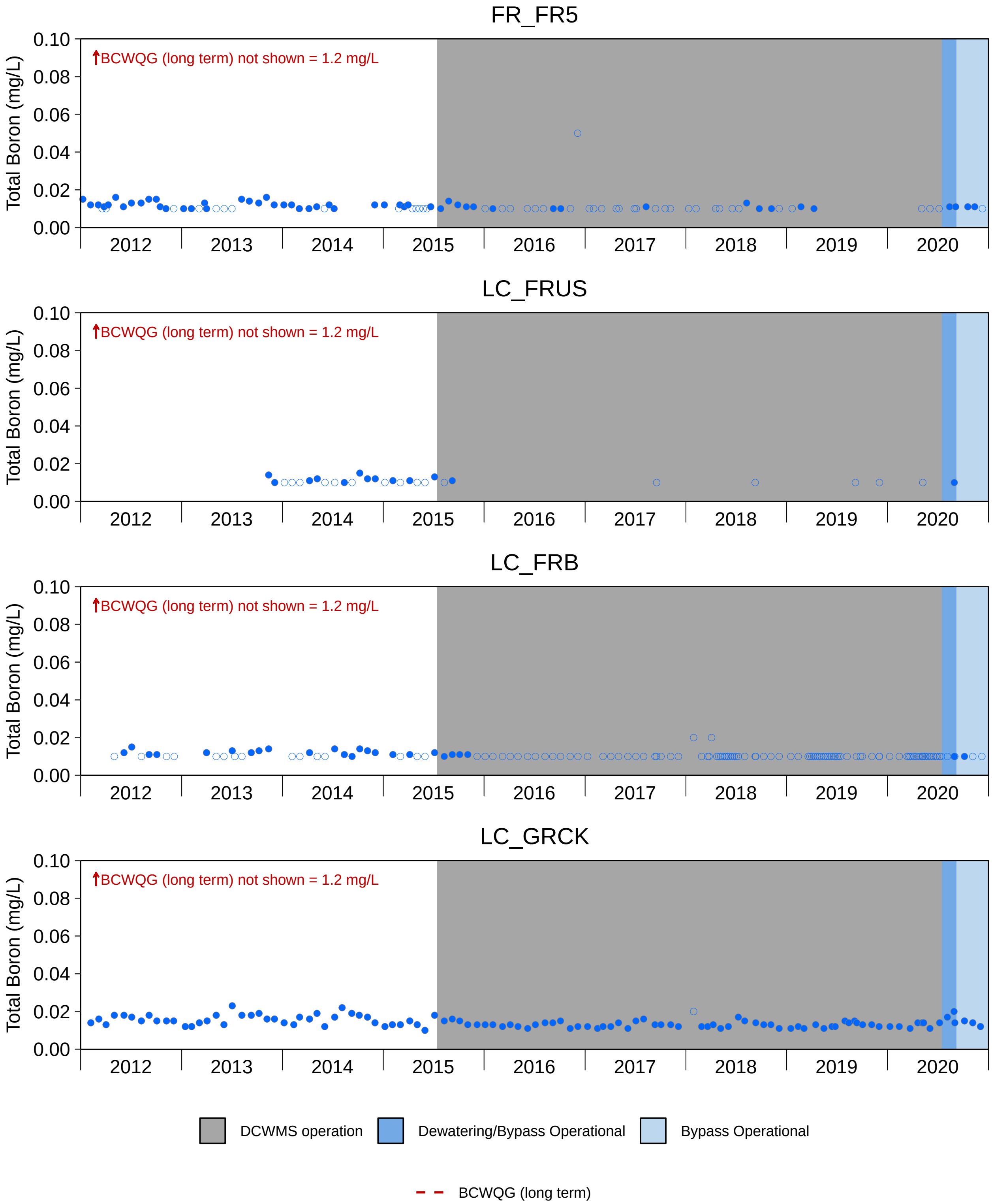

Figure B.5: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

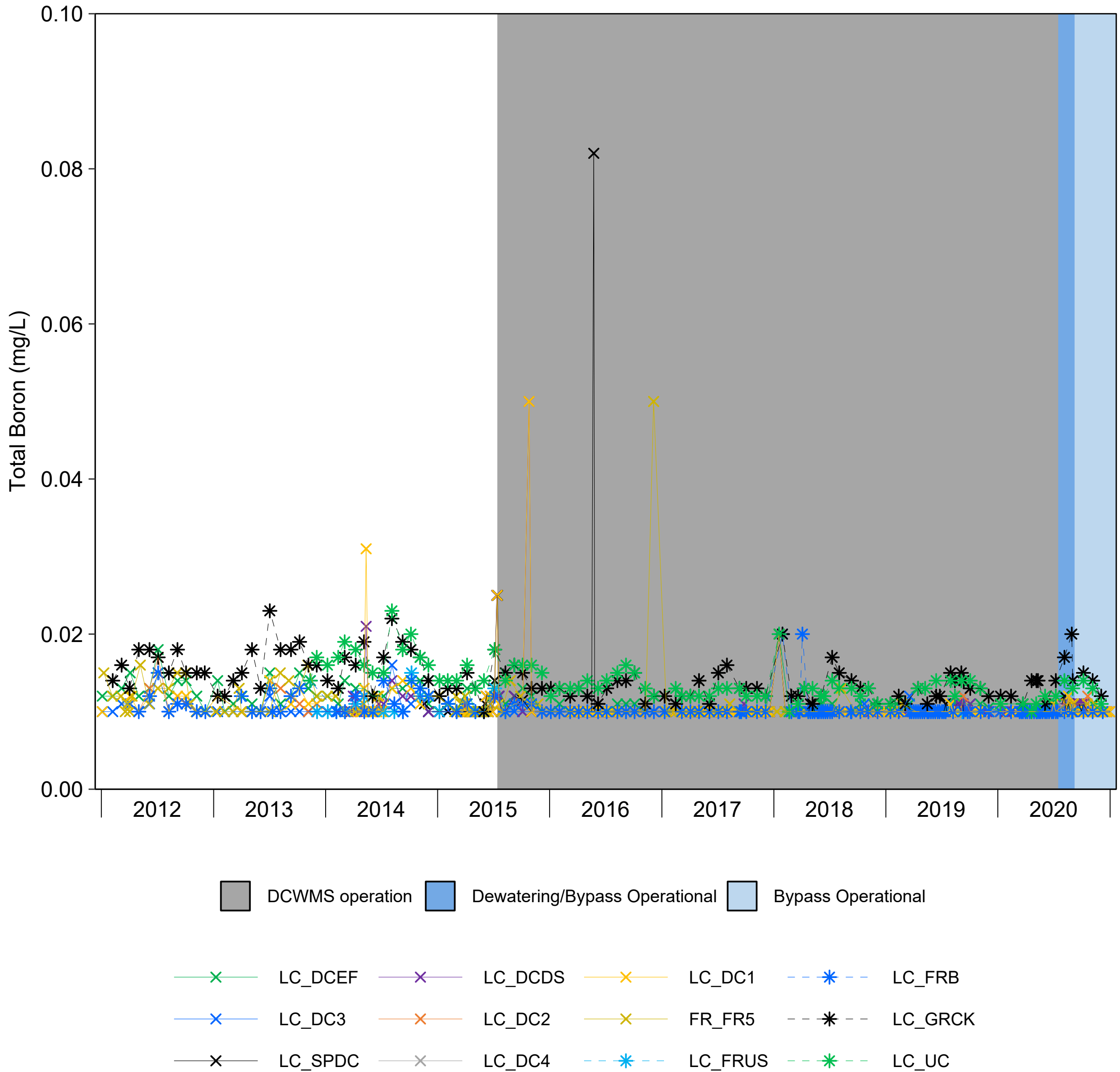

Figure B.6: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.010 and 0.050 mg/L).

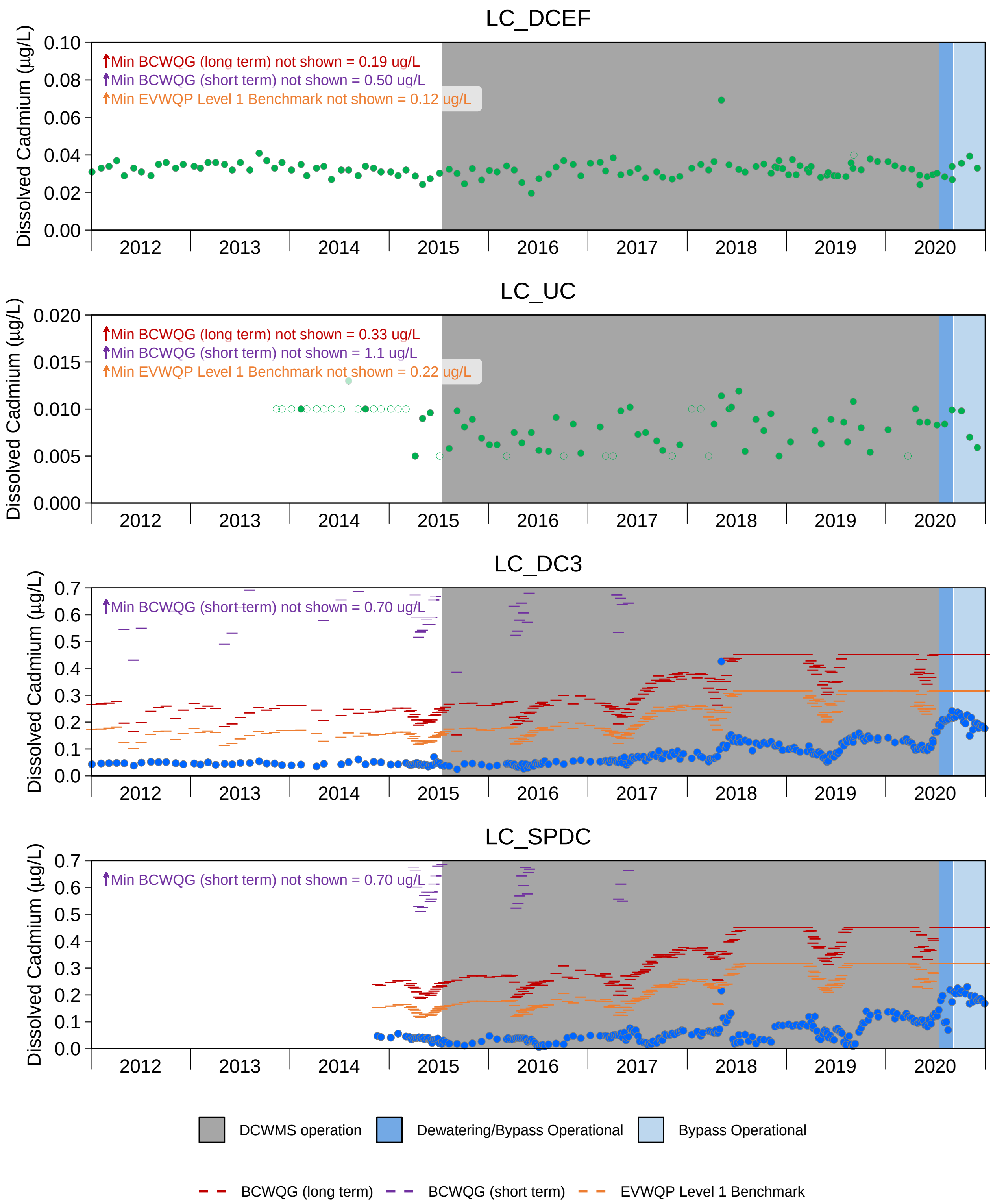

Figure B.7: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

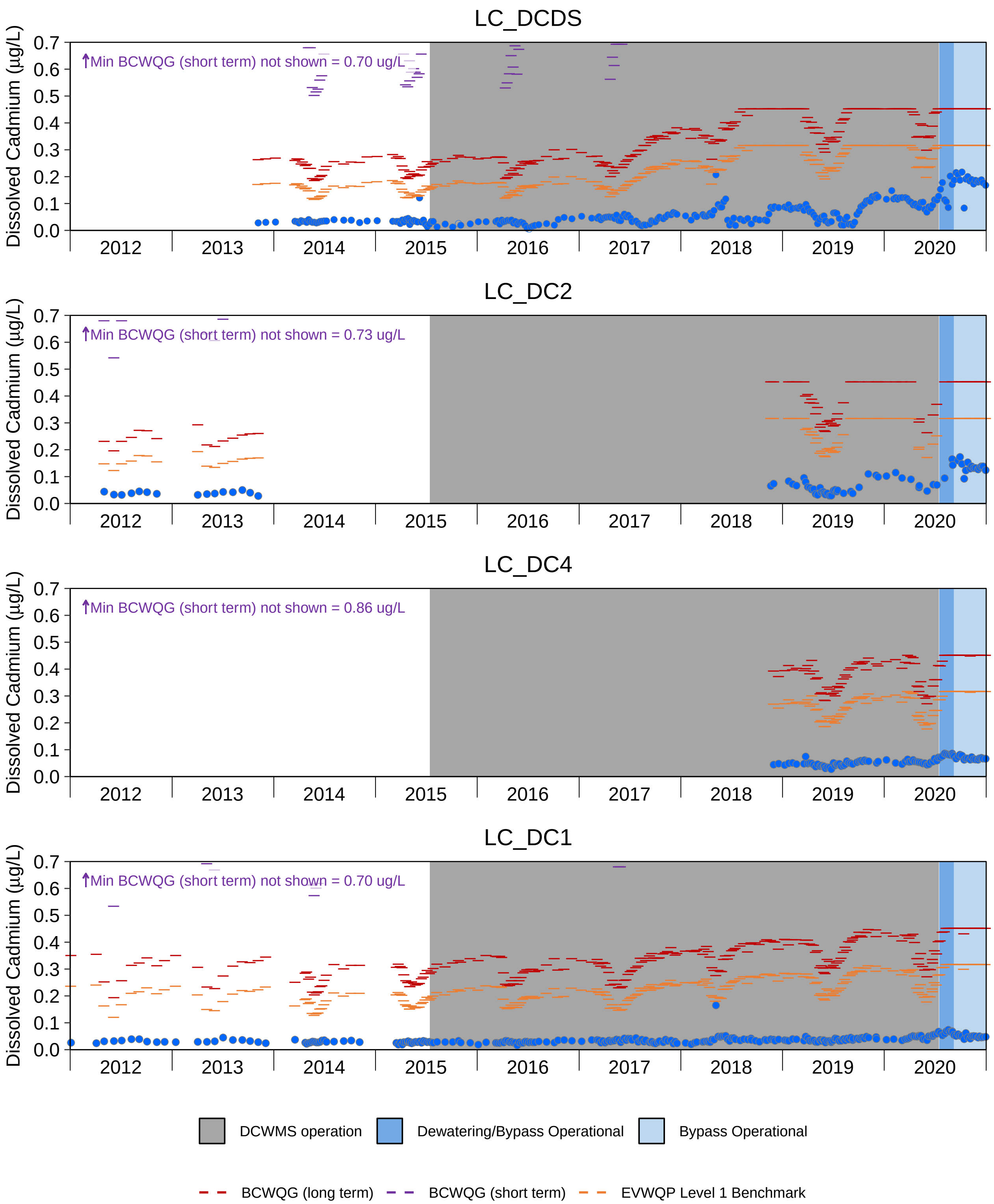

Figure B.7: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

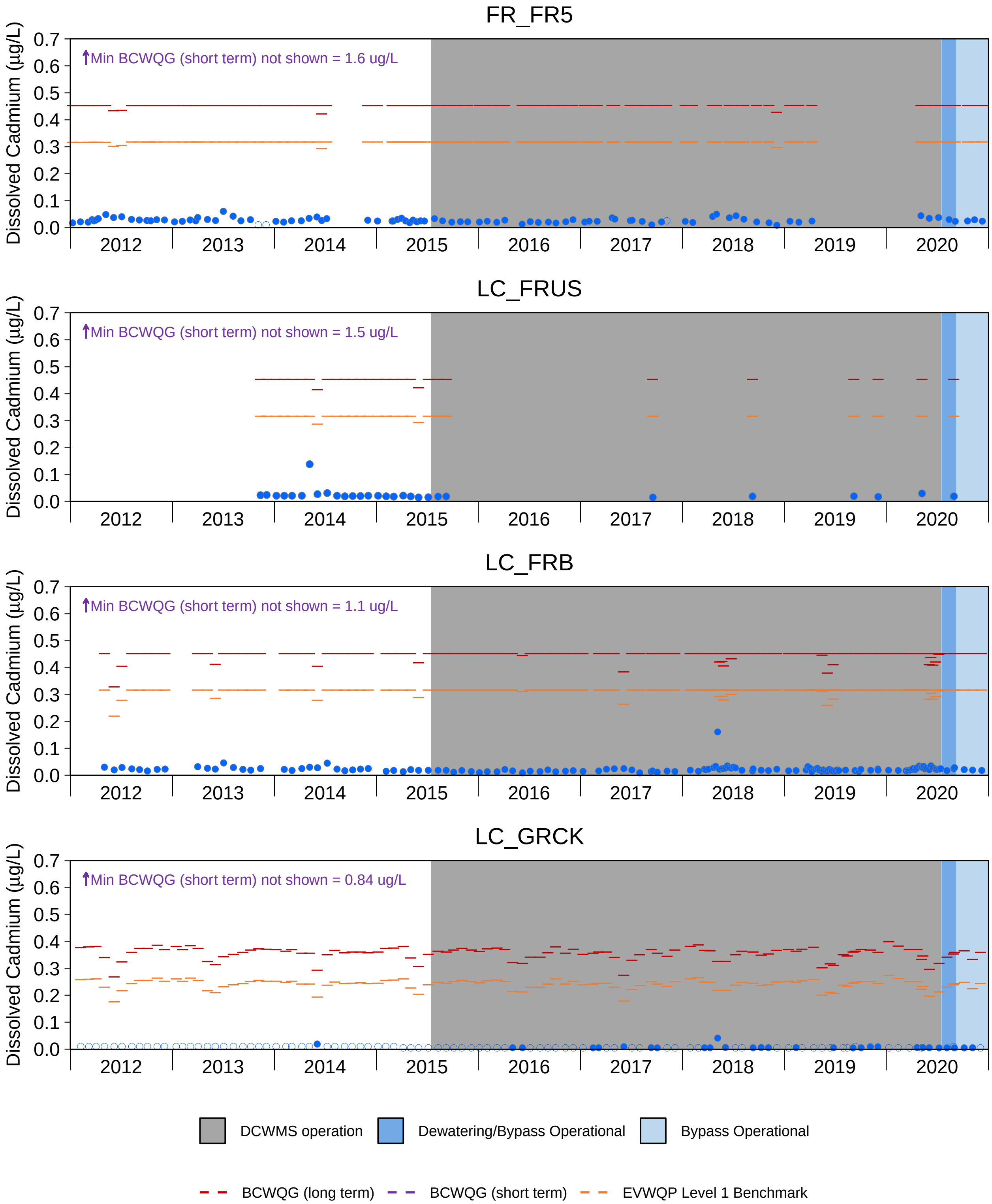

Figure B.7: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

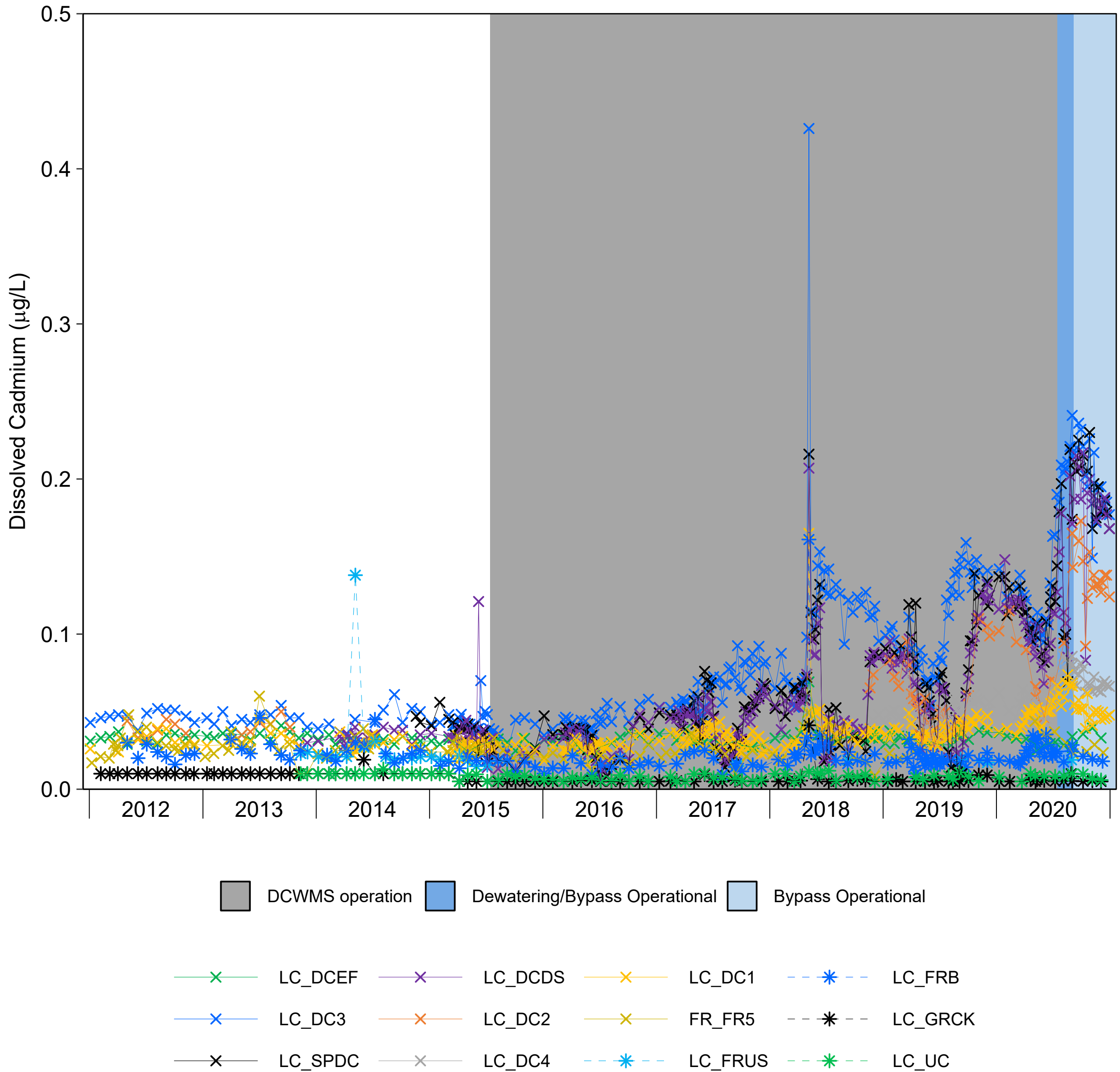

Figure B.8: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0050 and 0.040 mg/L).

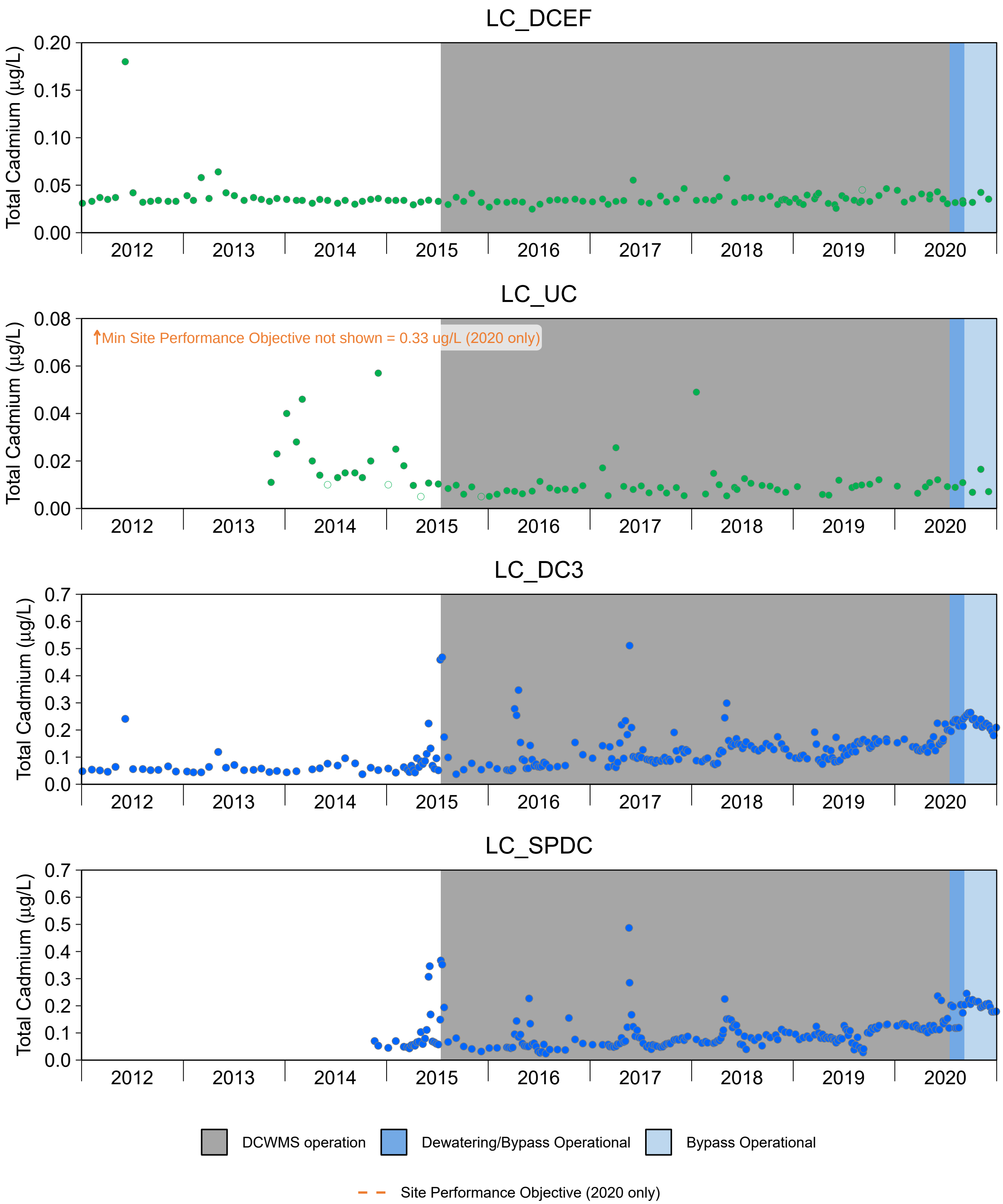

Figure B.9: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. 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).

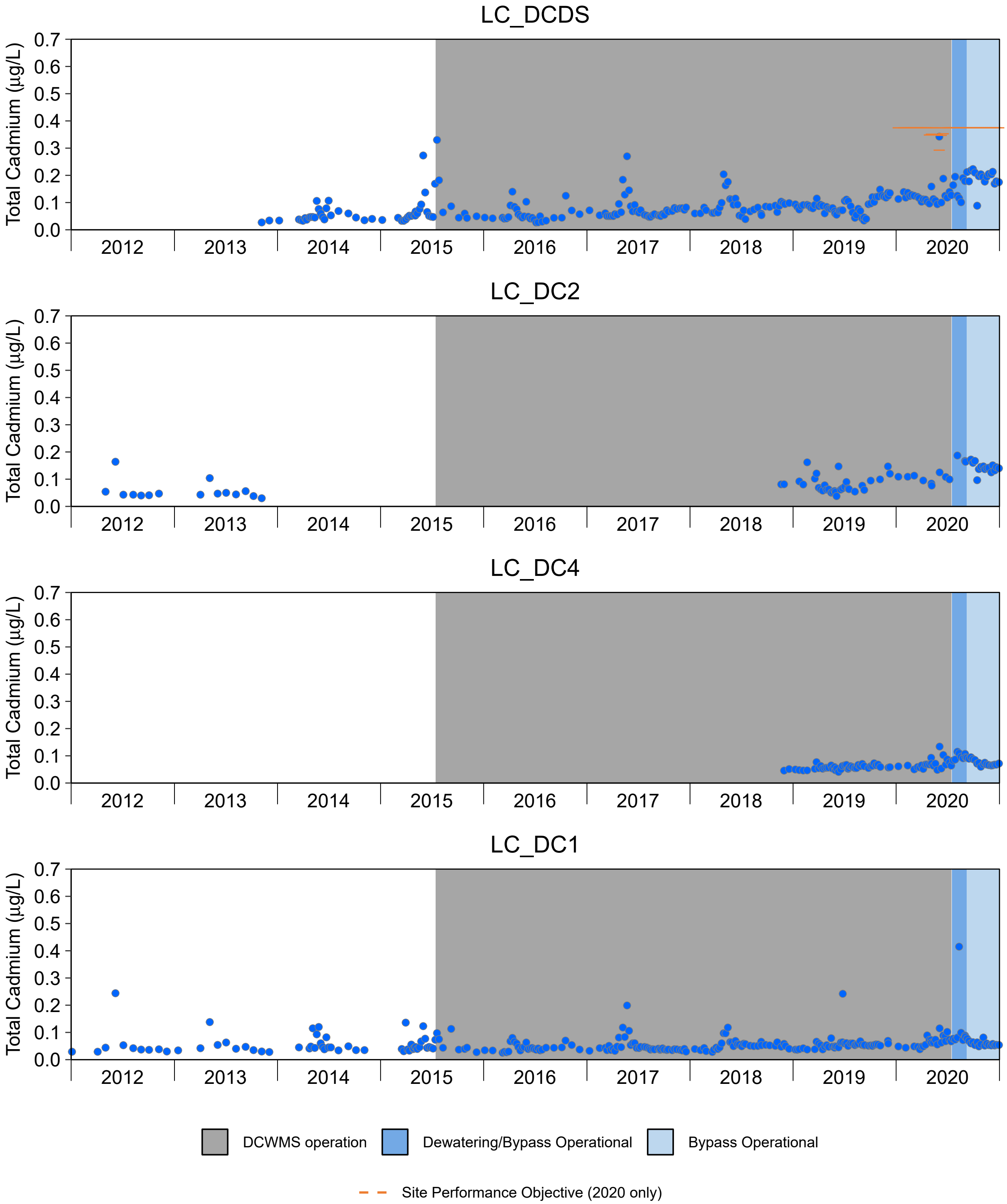

Figure B.9: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. 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).

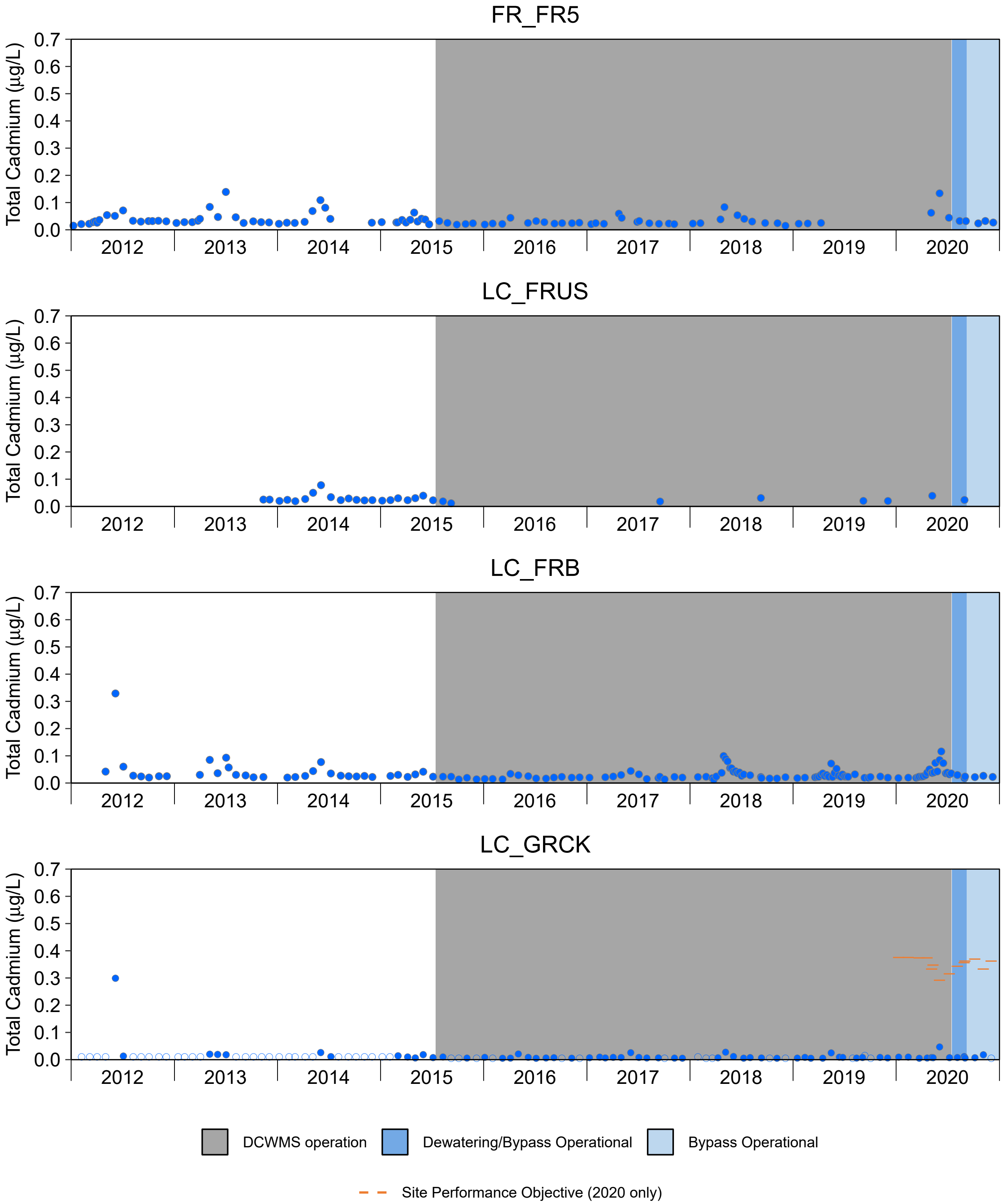

Figure B.9: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. 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).

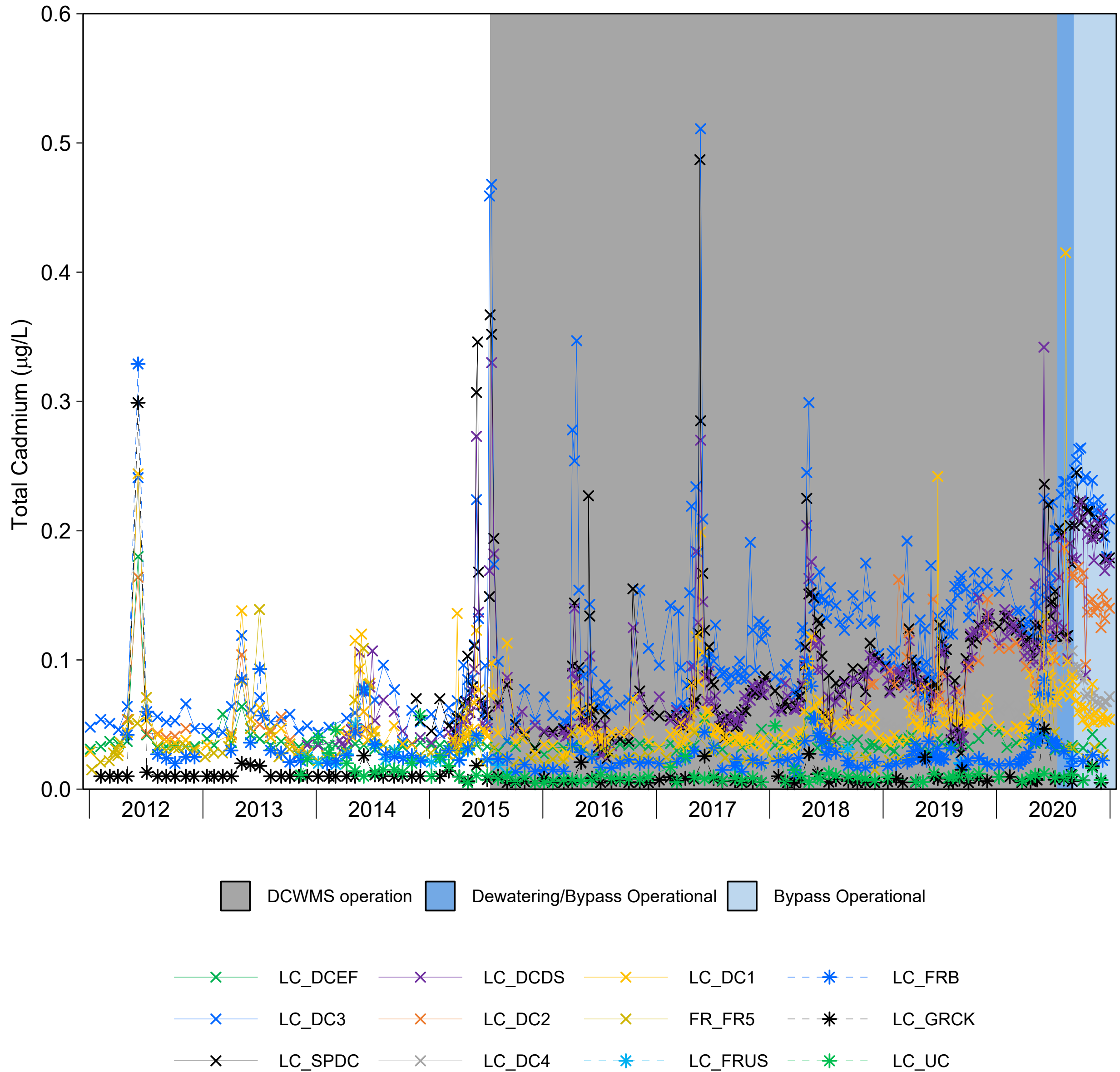

Figure B.10: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0050 and 0.045 mg/L).

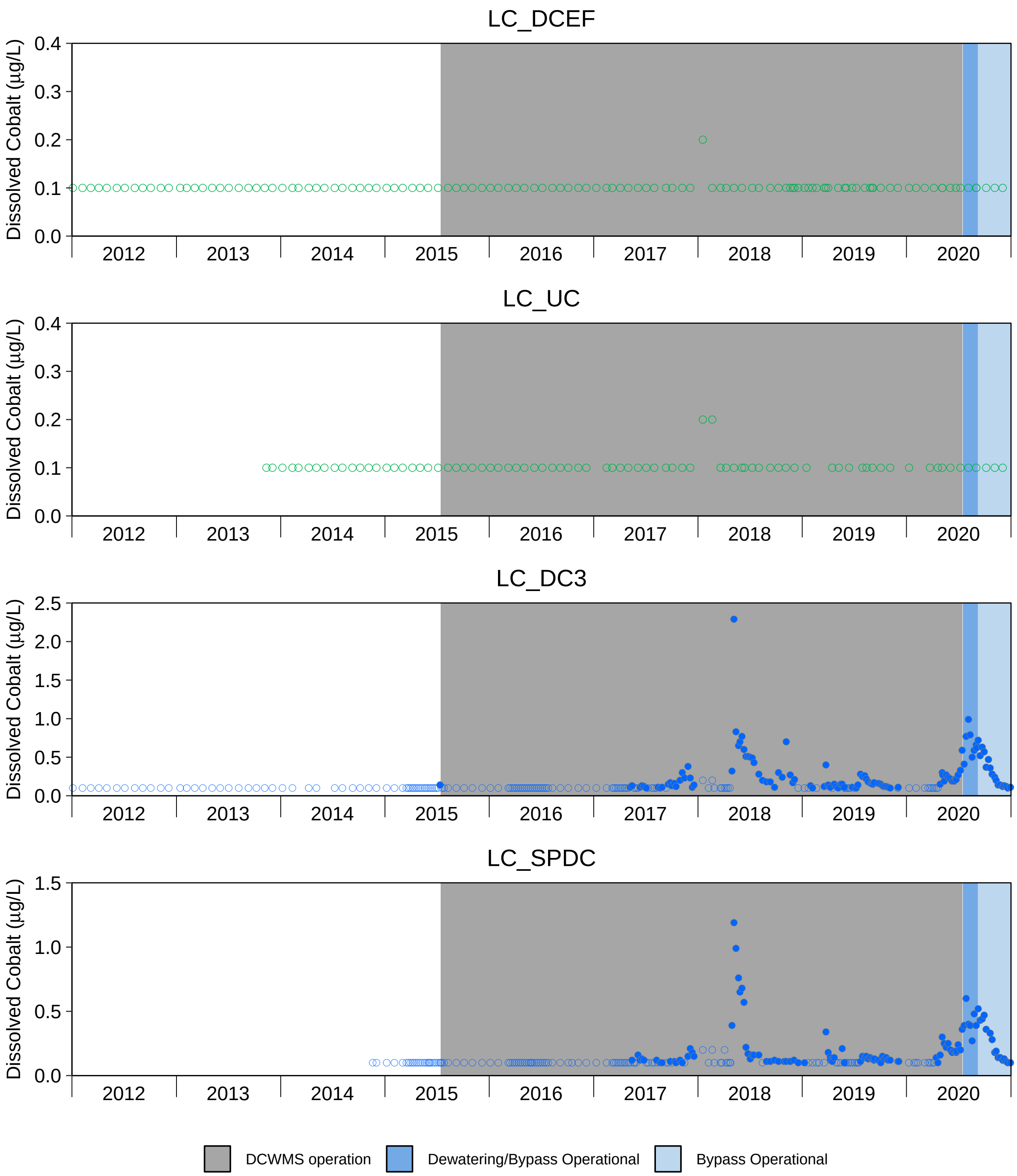

Figure B.11: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

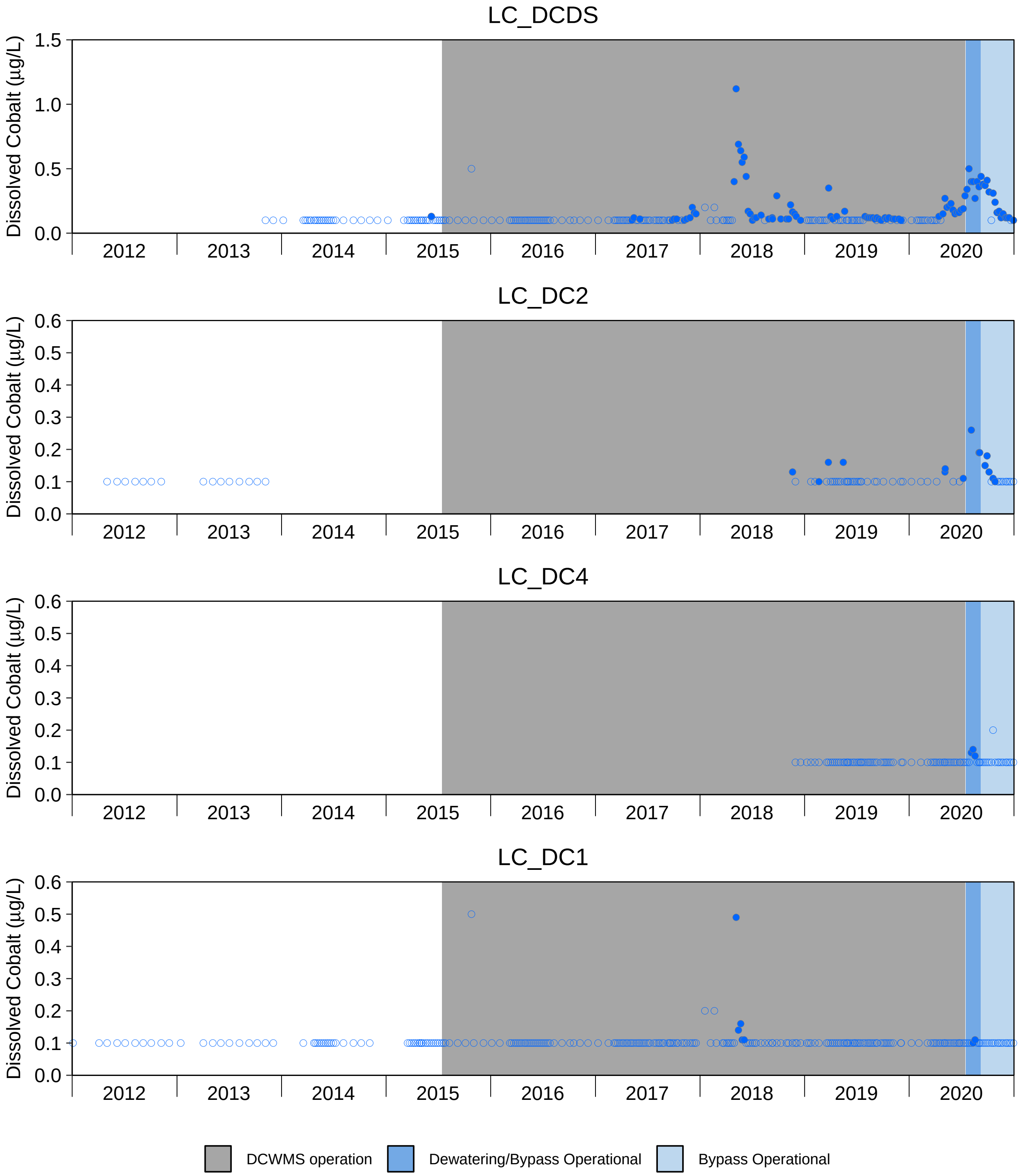

Figure B.11: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

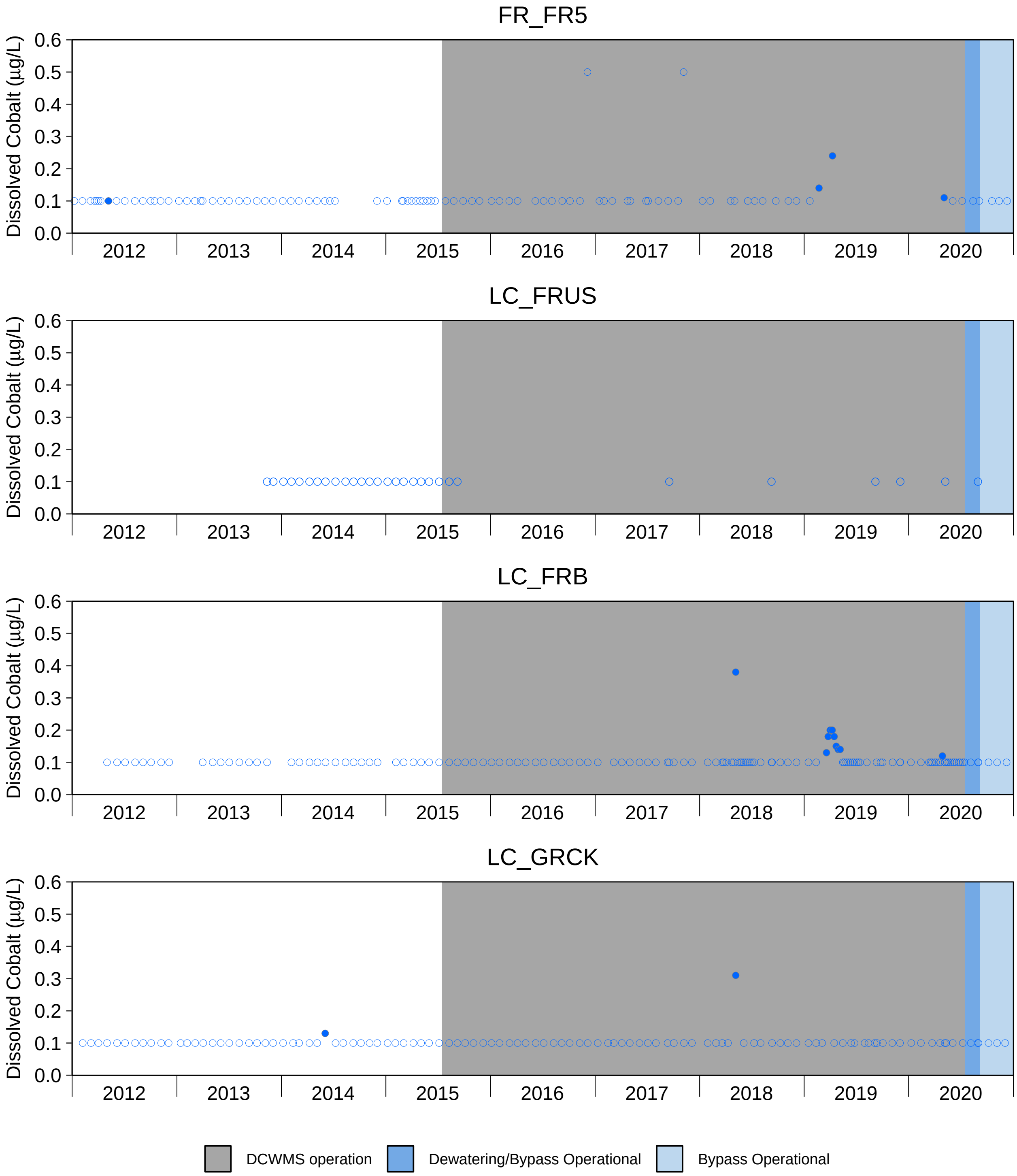

Figure B.11: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

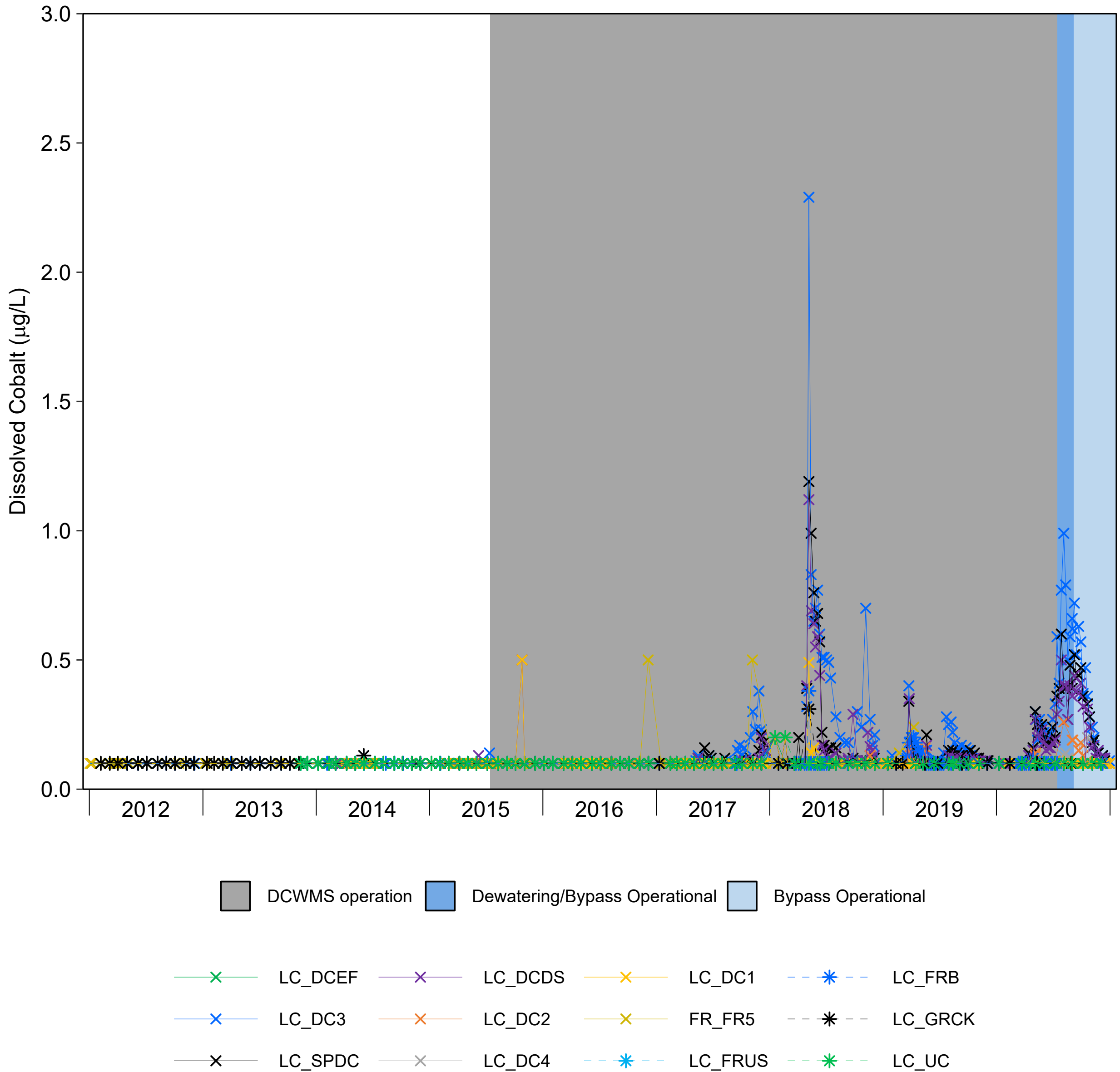

Figure B.12: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.10 and 0.50 mg/L).

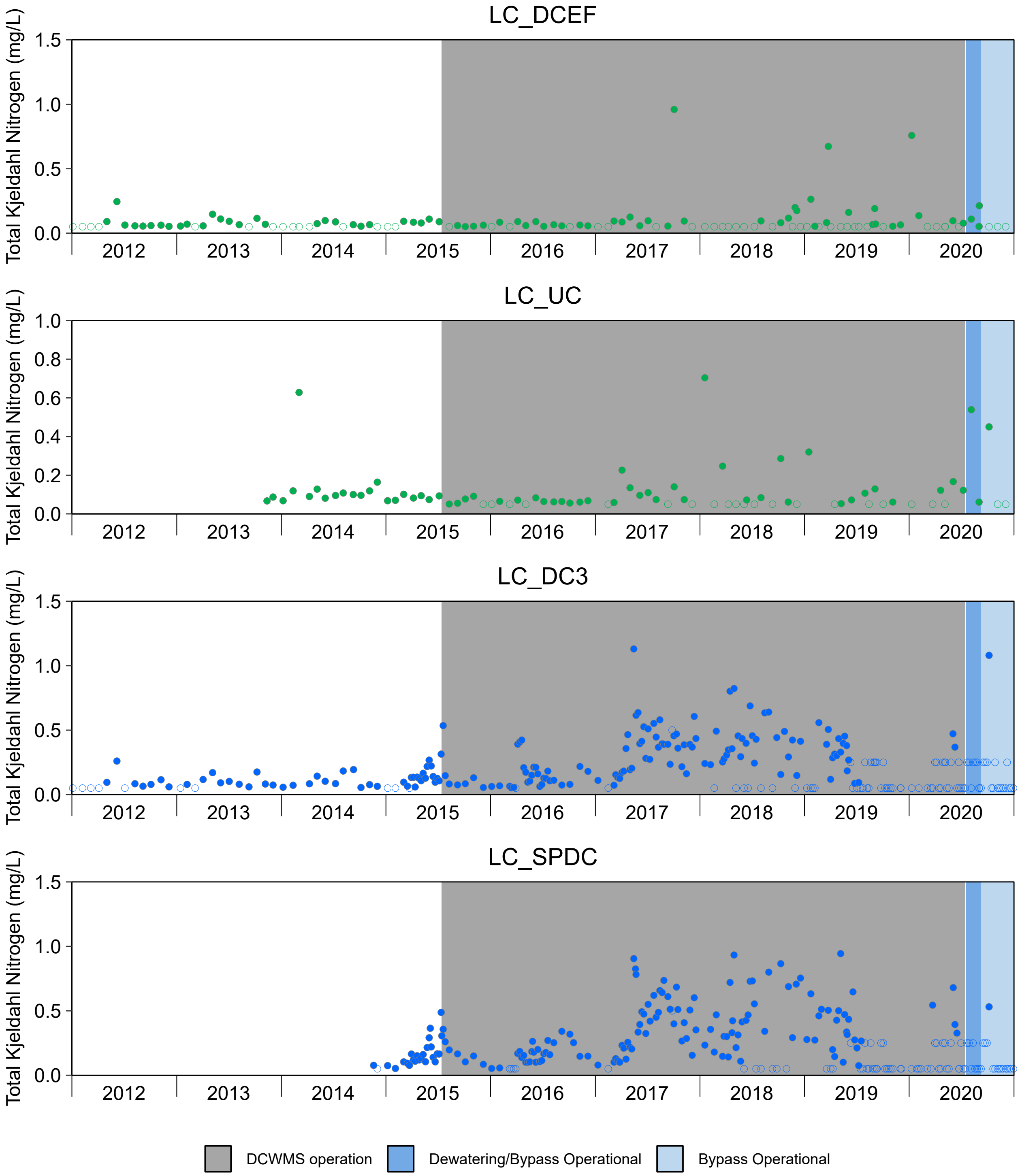

Figure B.13: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

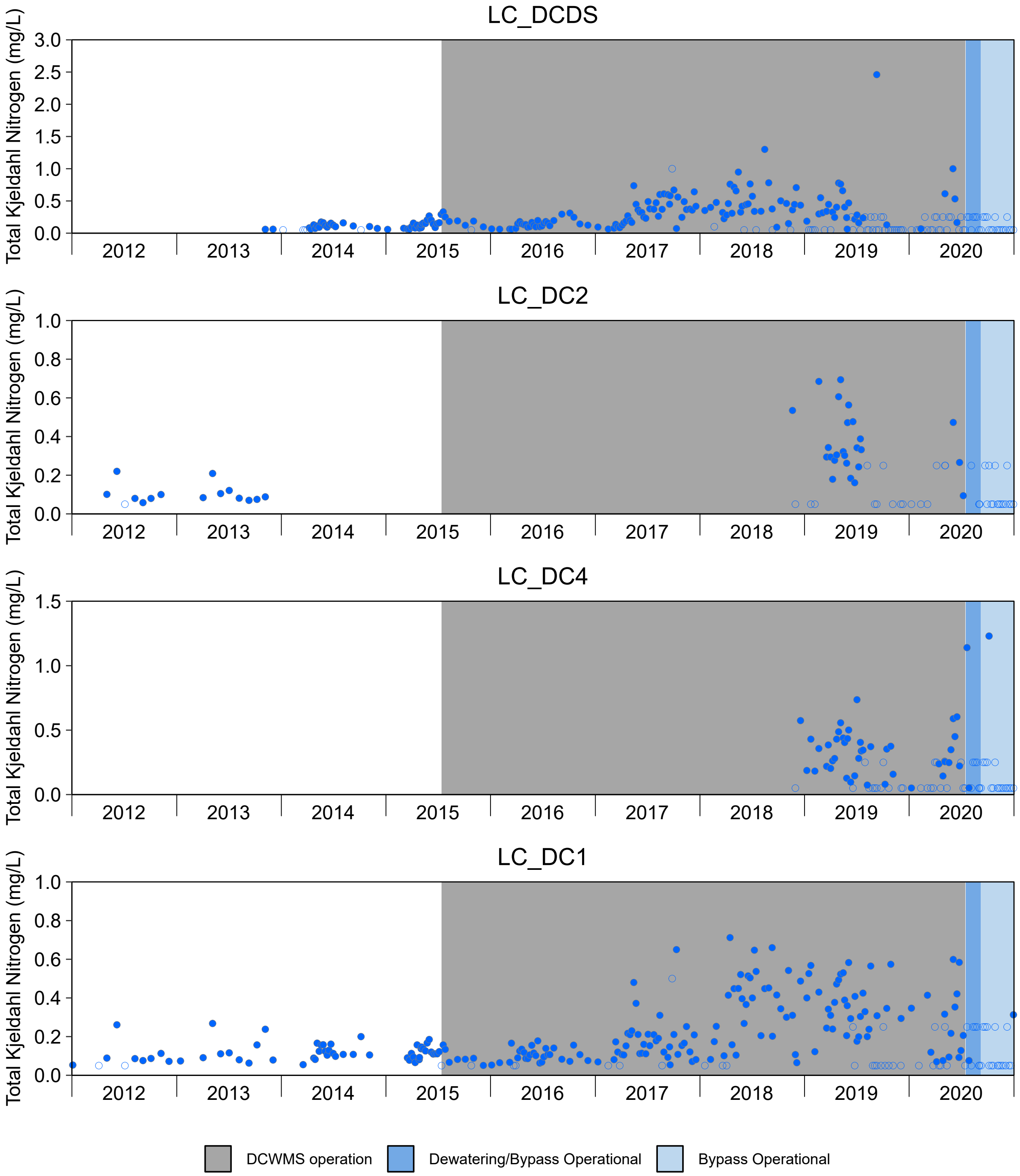

Figure B.13: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

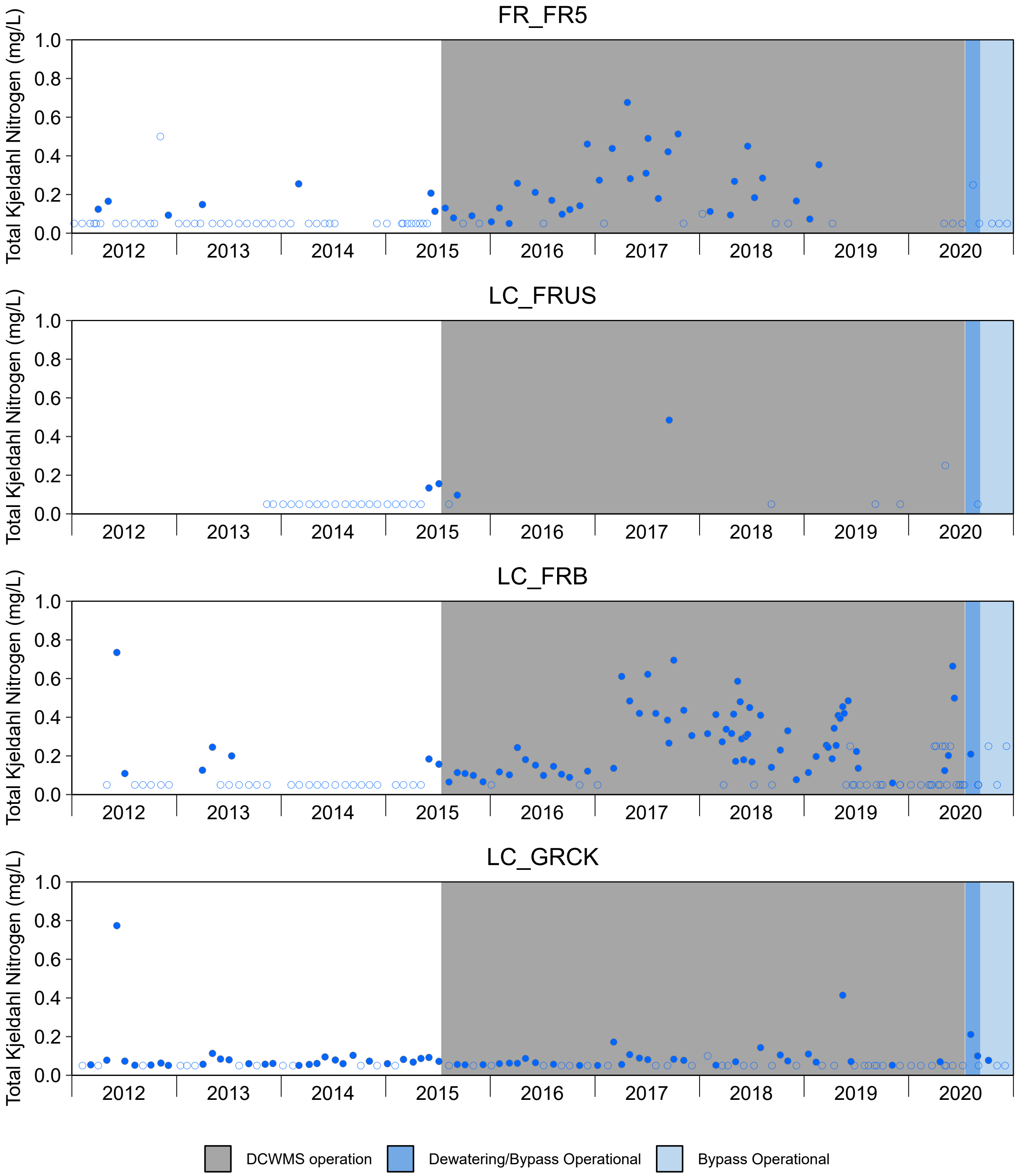

Figure B.13: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

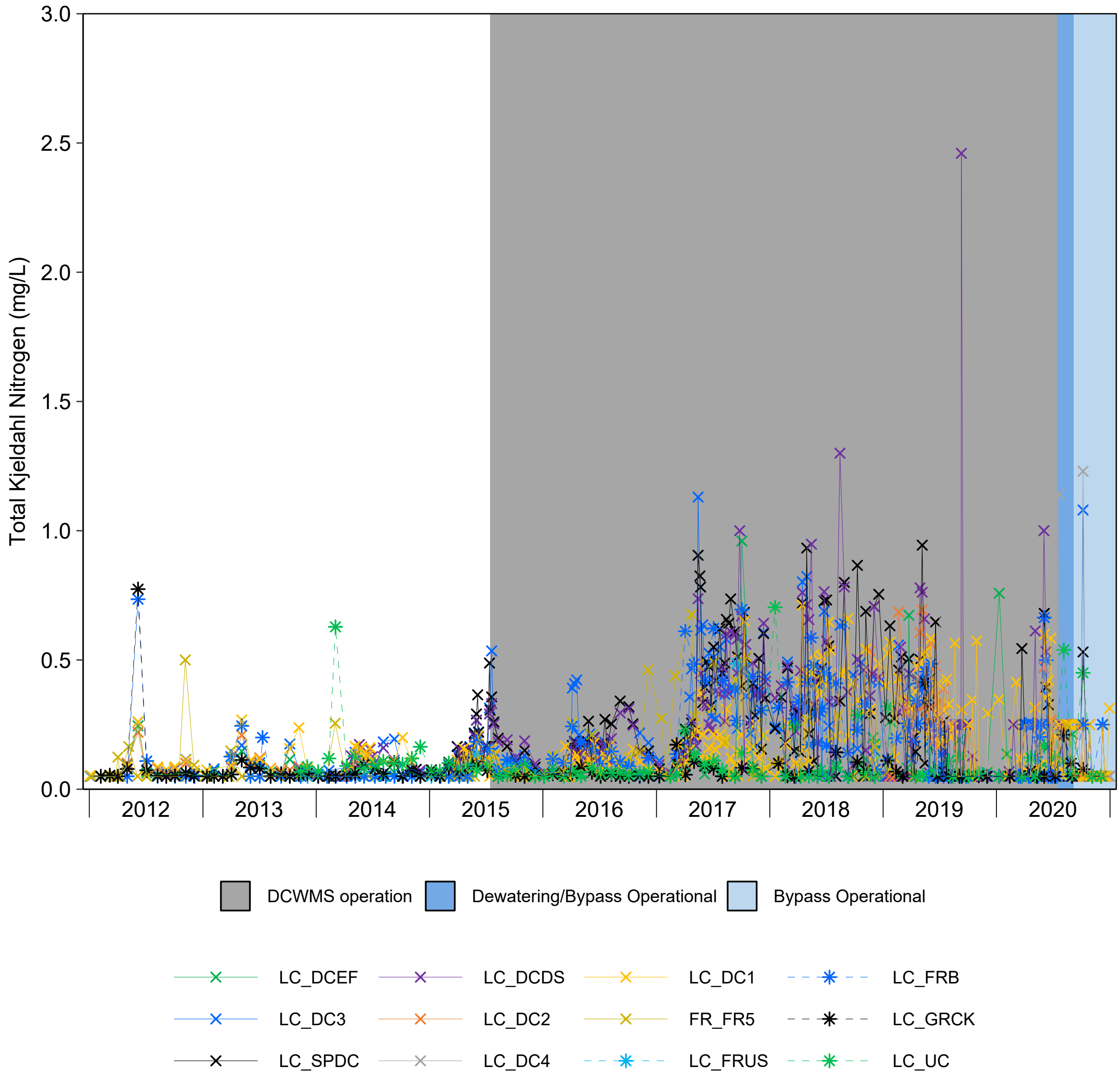

Figure B.14: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.050 and 1.0 mg/L).

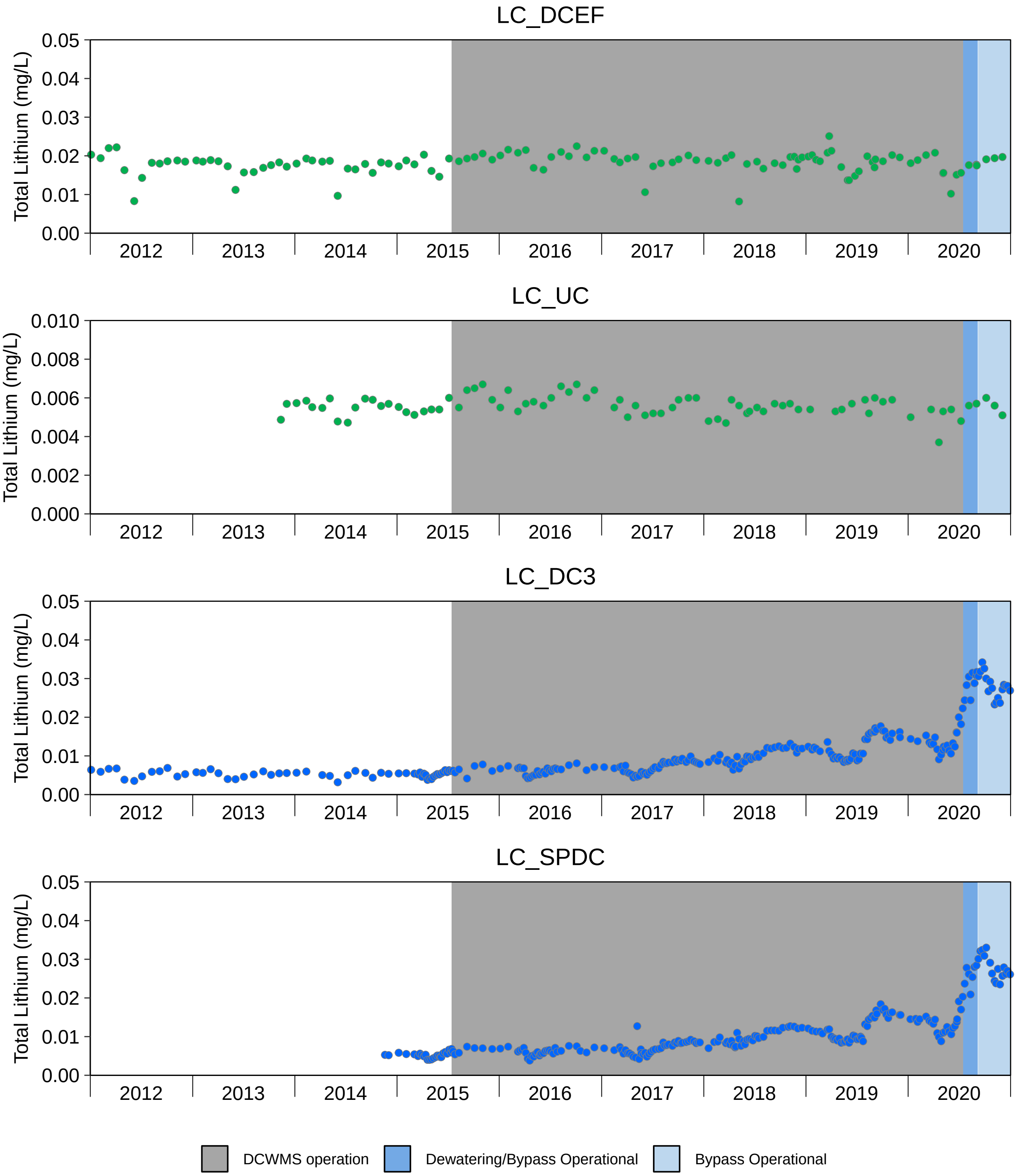

Figure B.15: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

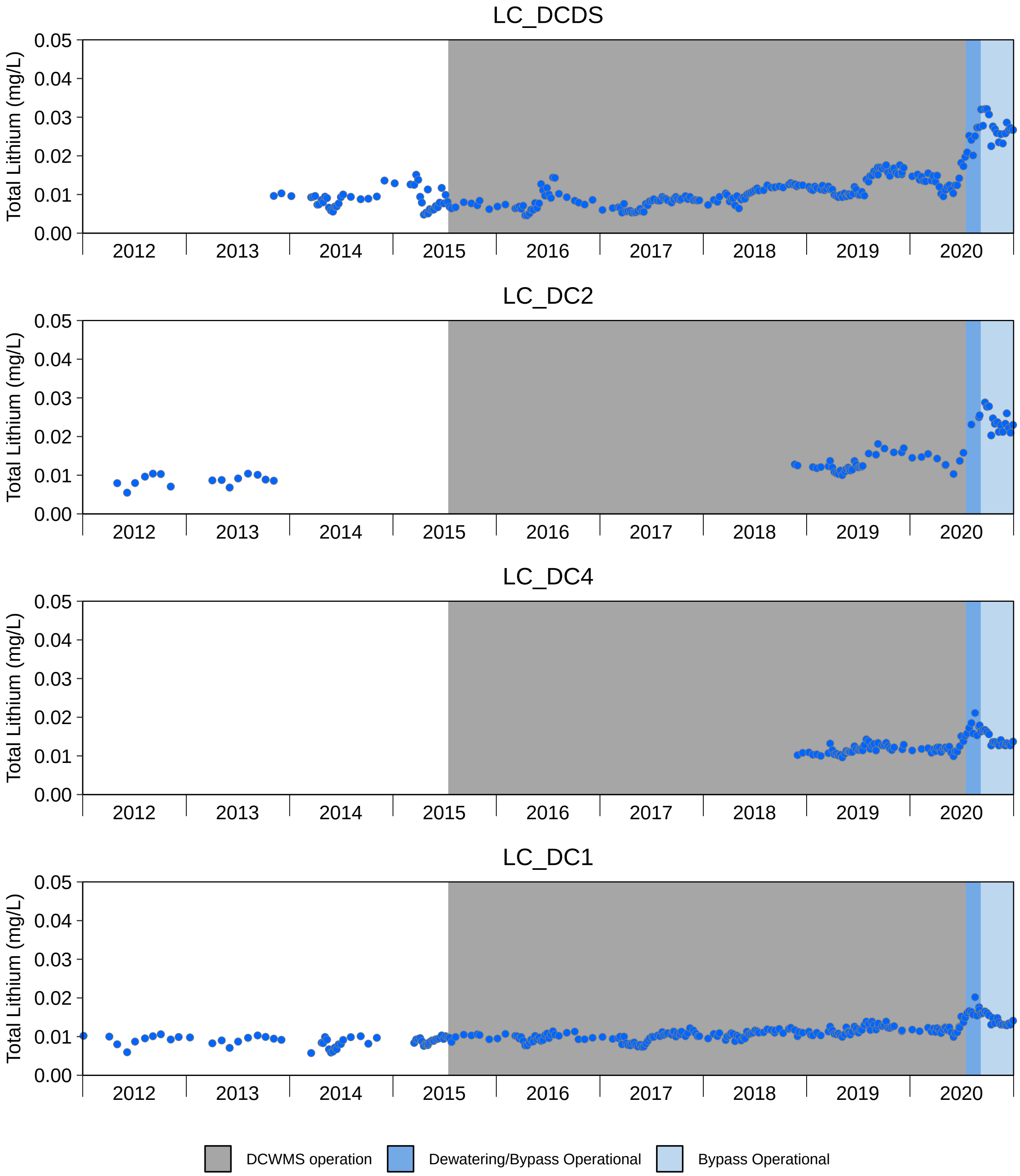

Figure B.15: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

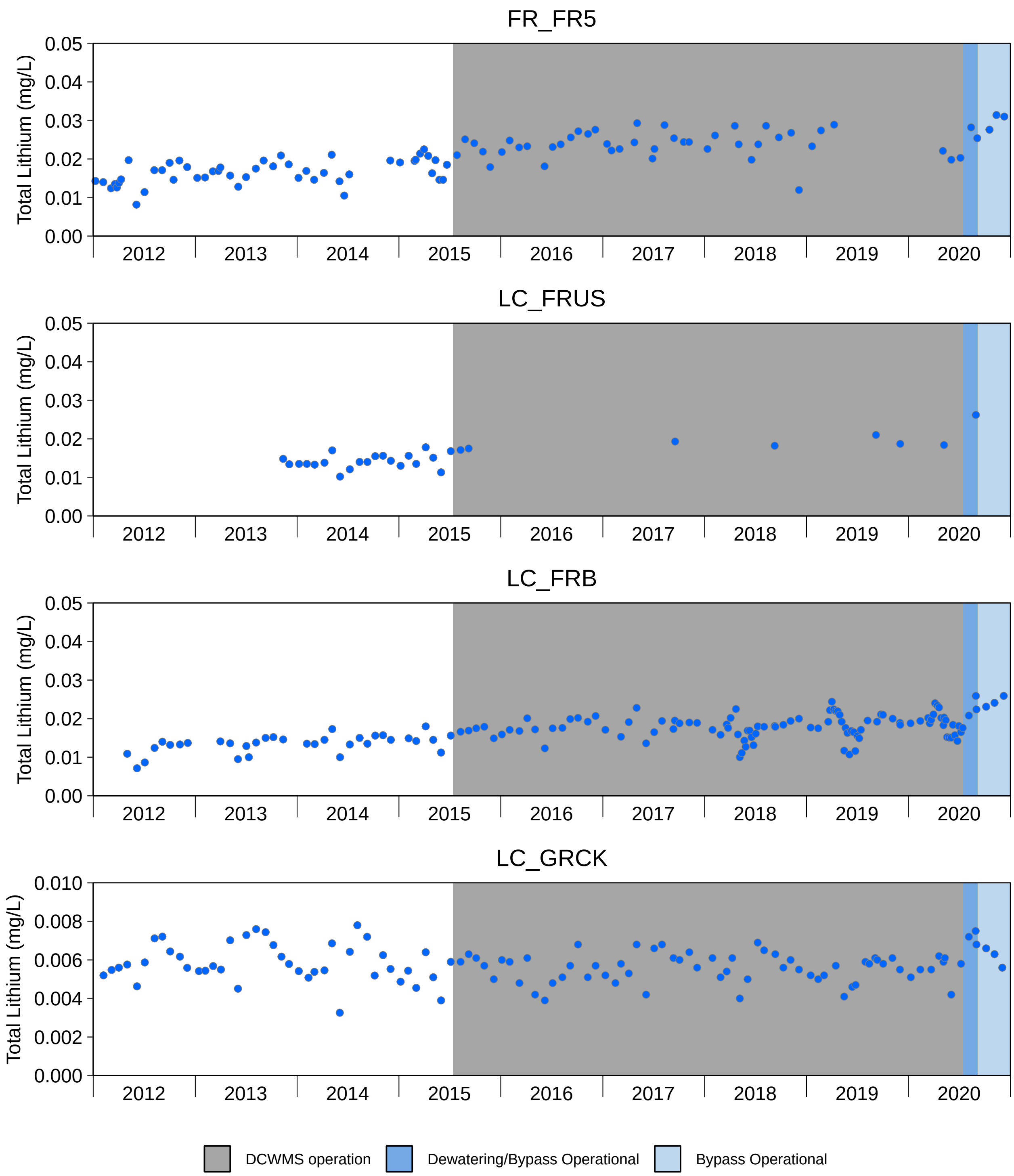

Figure B.15: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

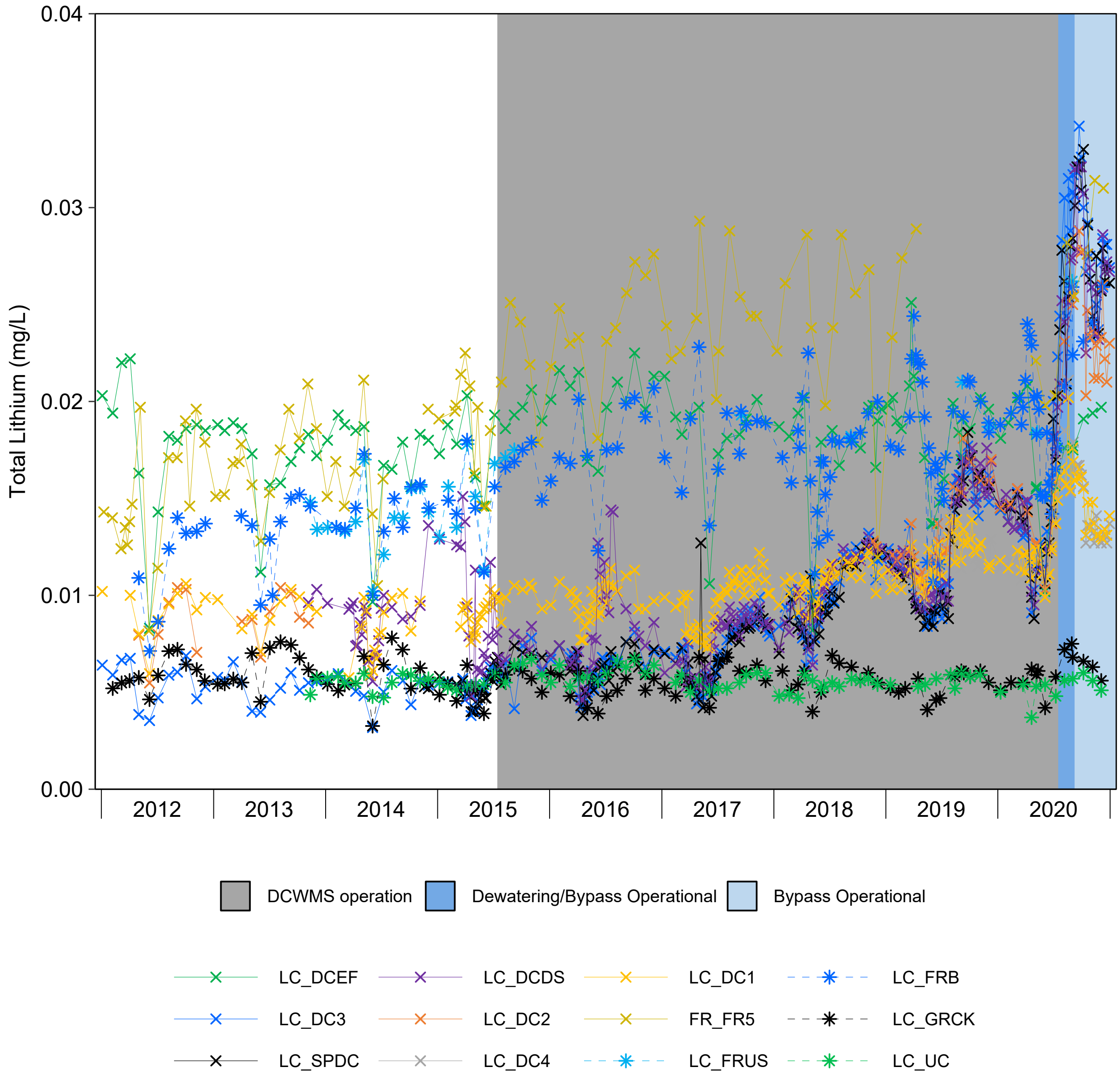

Figure B.16: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: No values below the LRL.

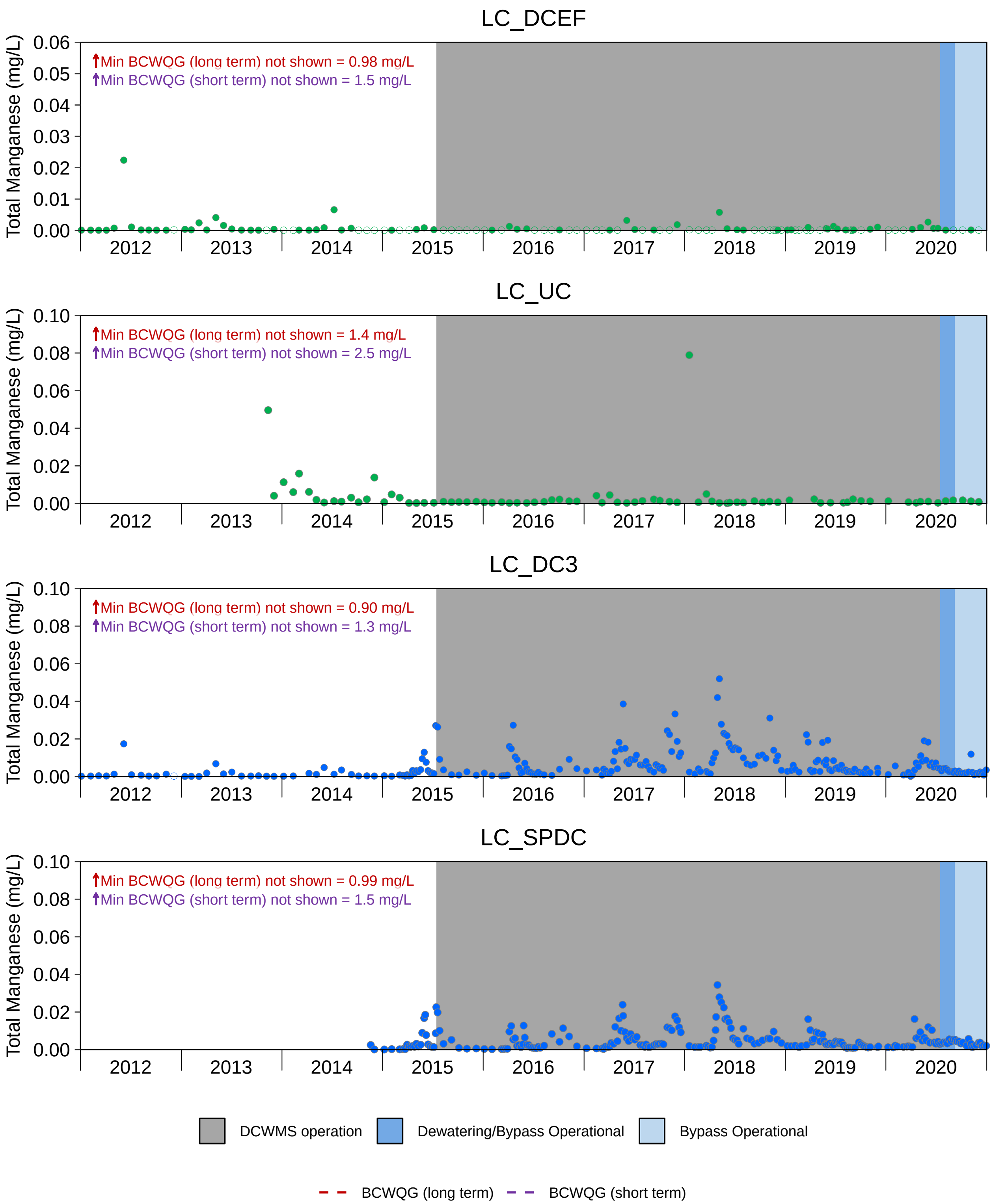

Figure B.17: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

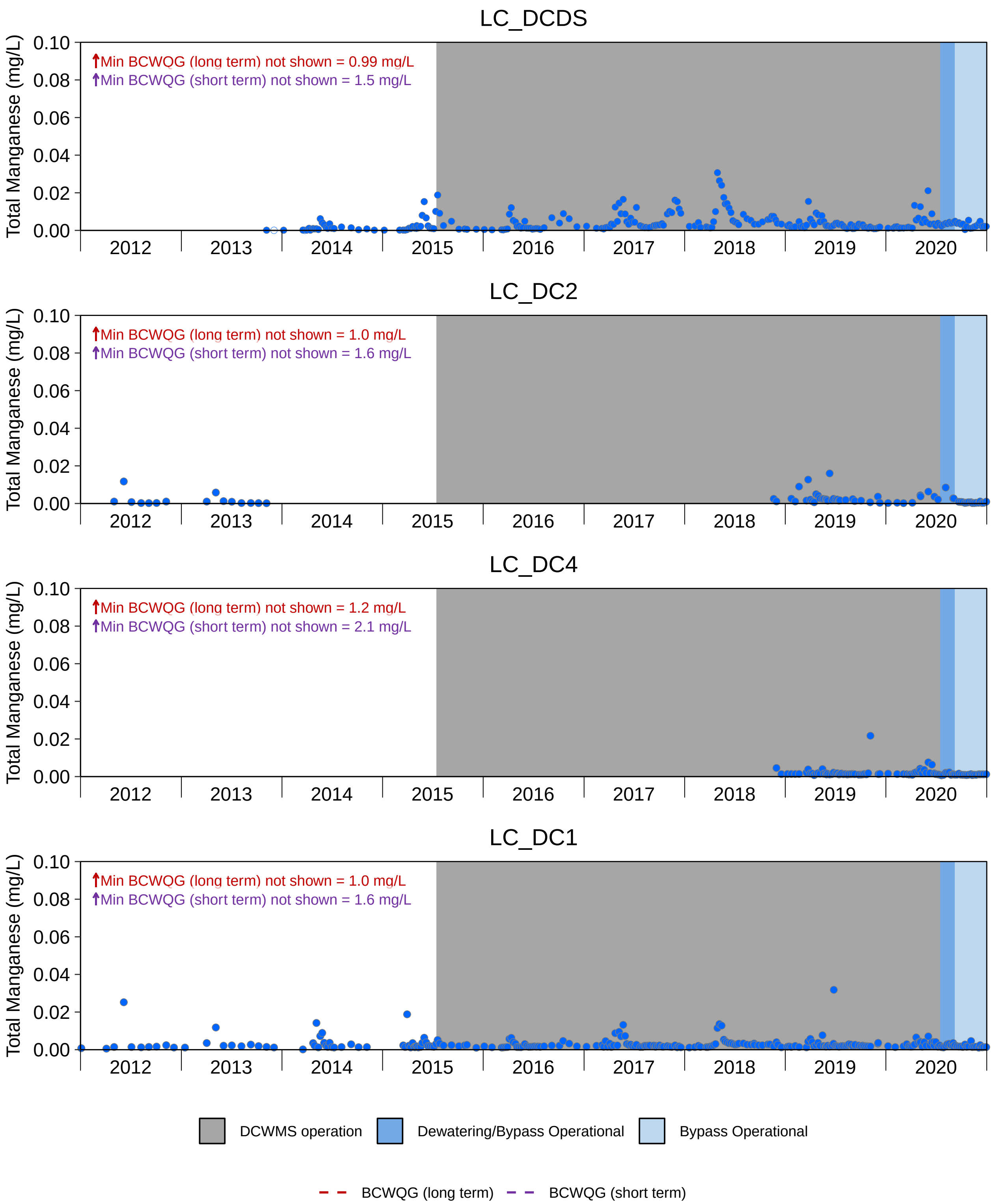

Figure B.17: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

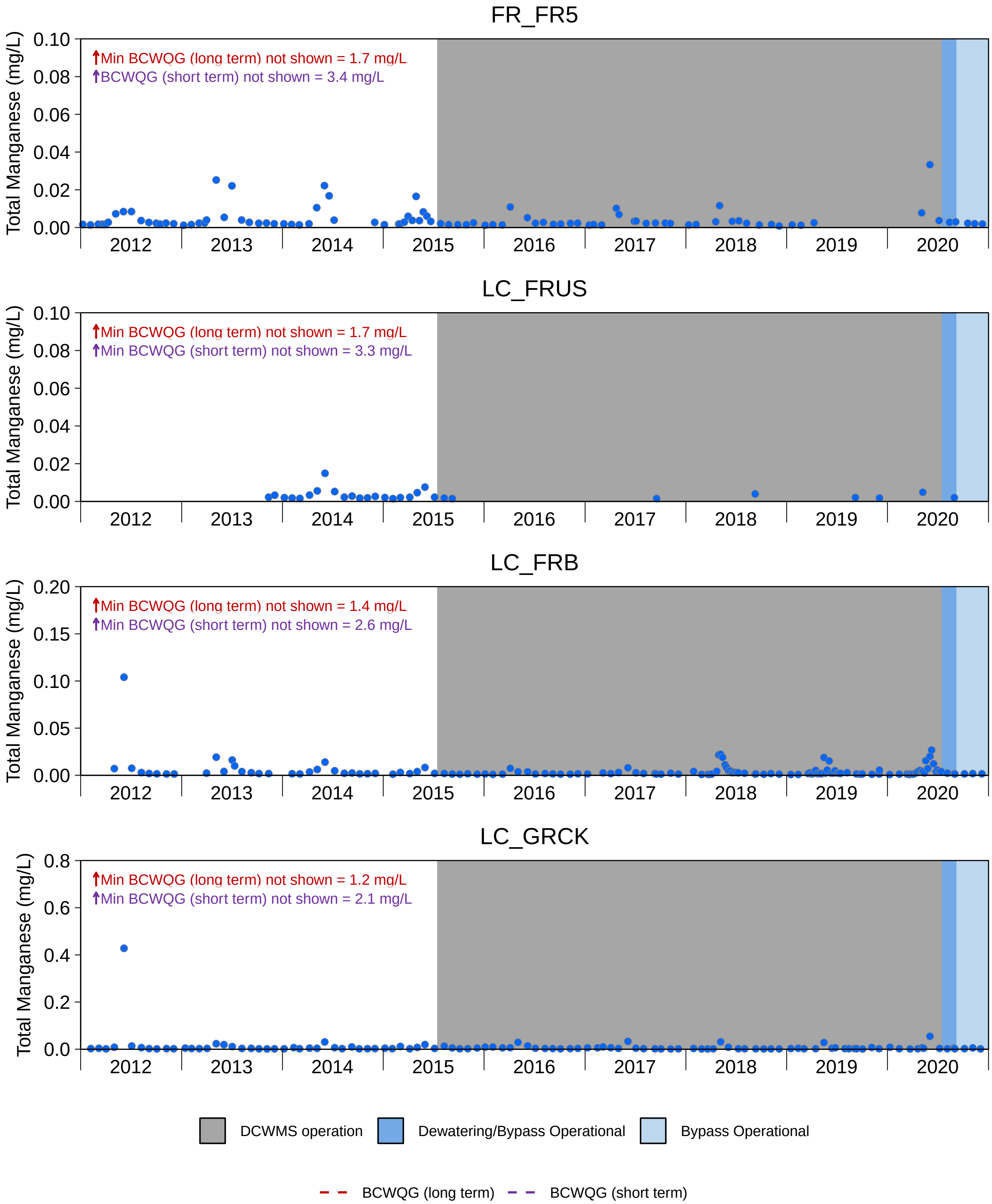

Figure B.17: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

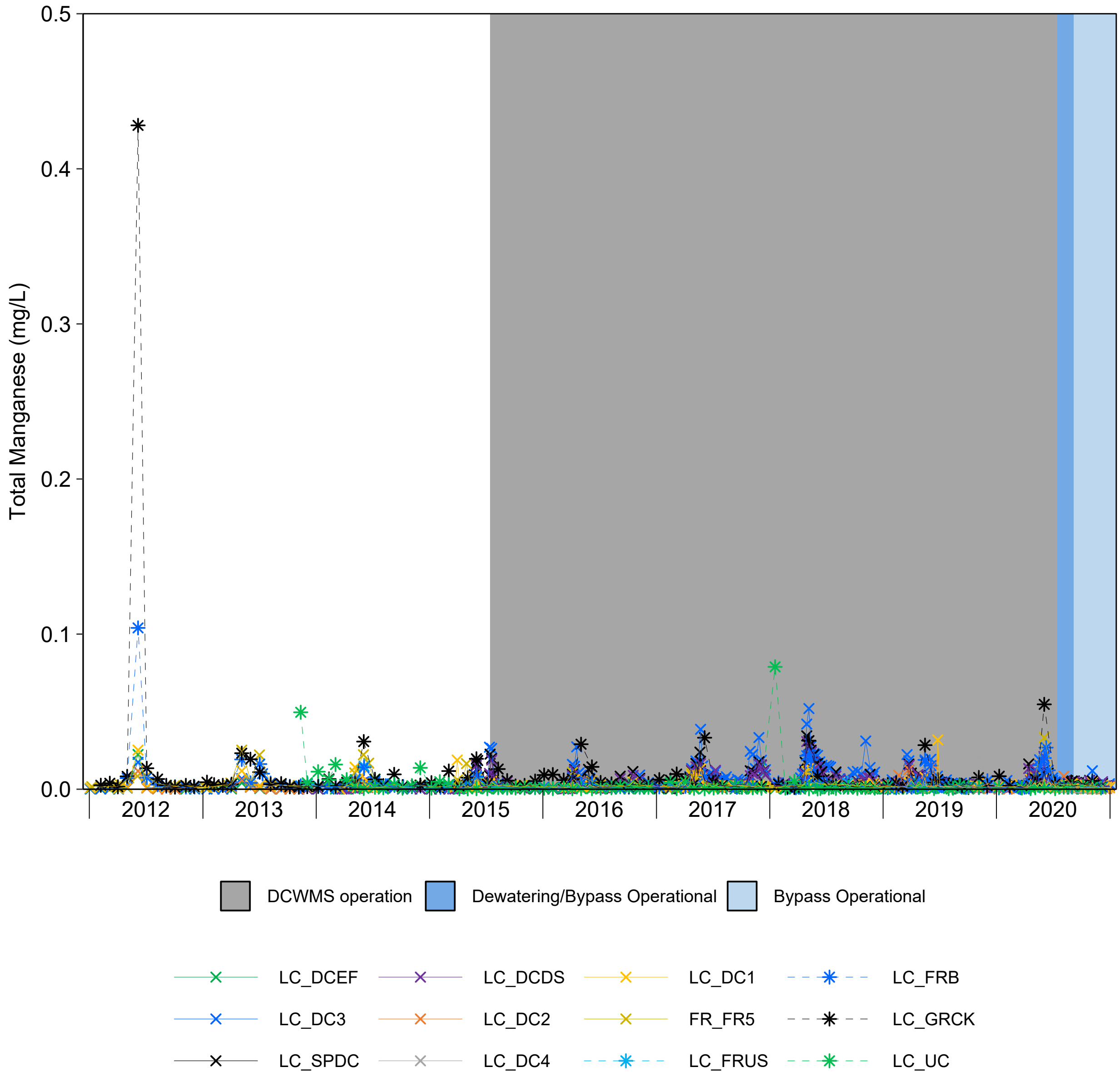

Figure B.18: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.000050 and 0.00025 mg/L).

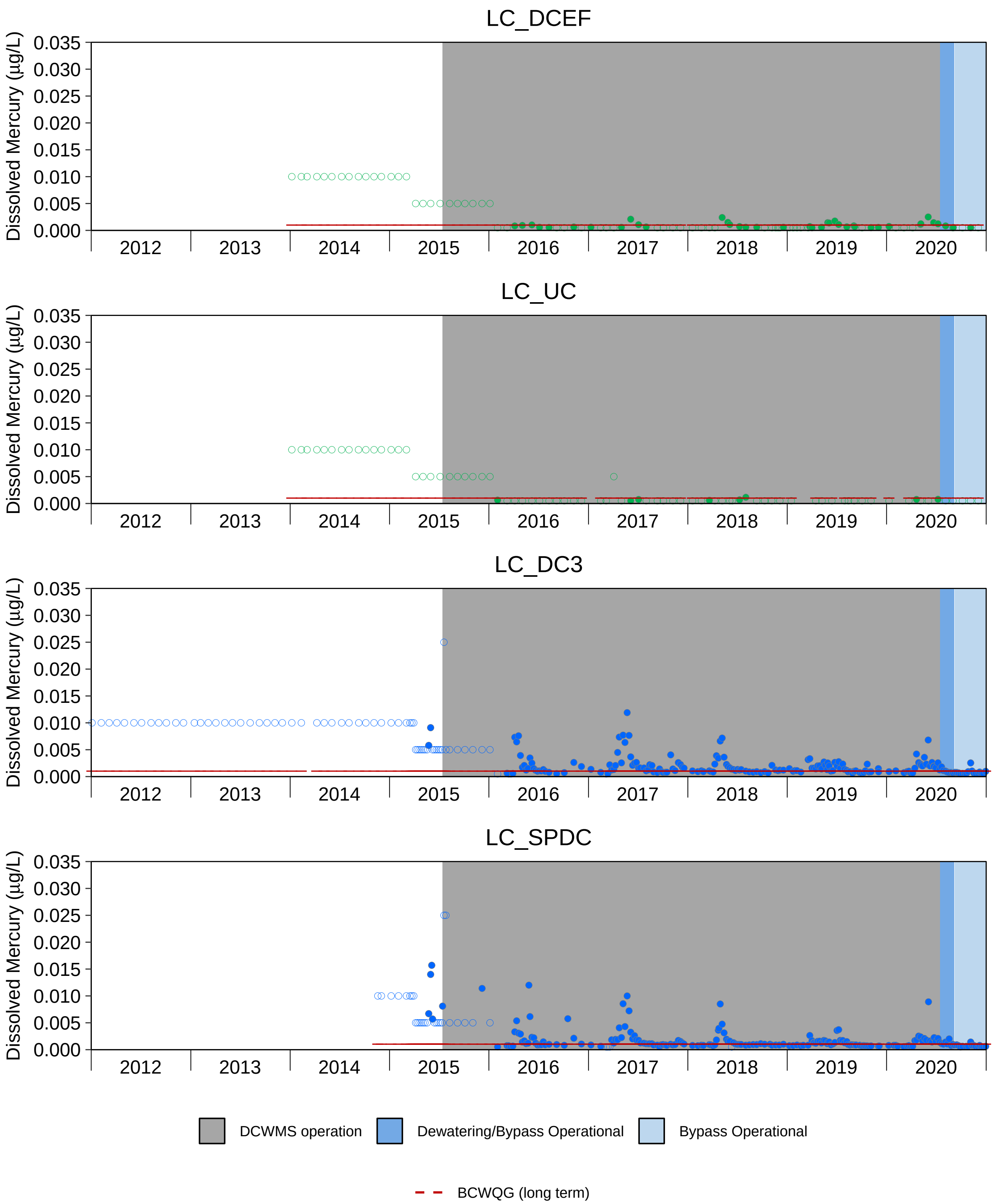

Figure B.19: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

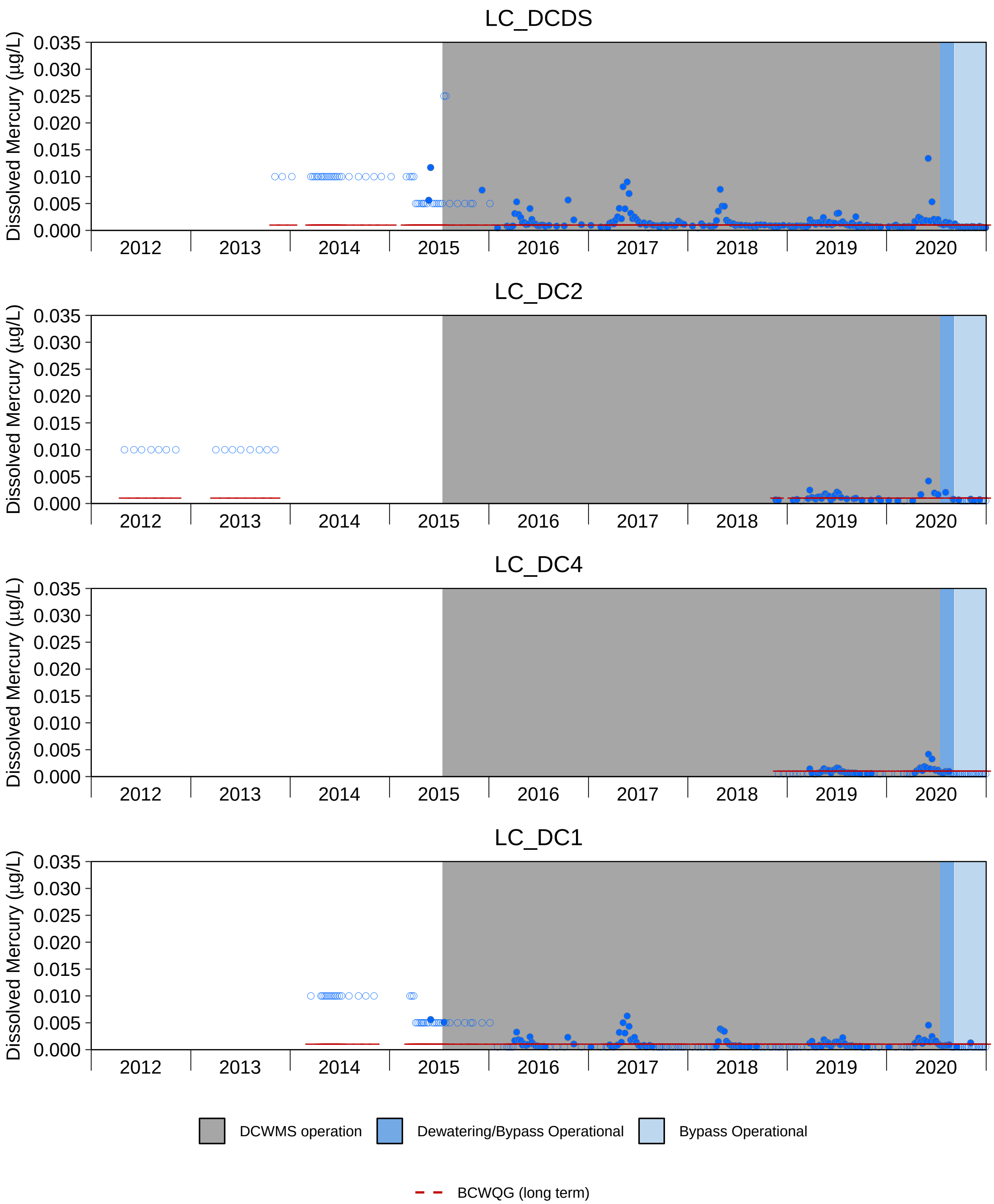

Figure B.19: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

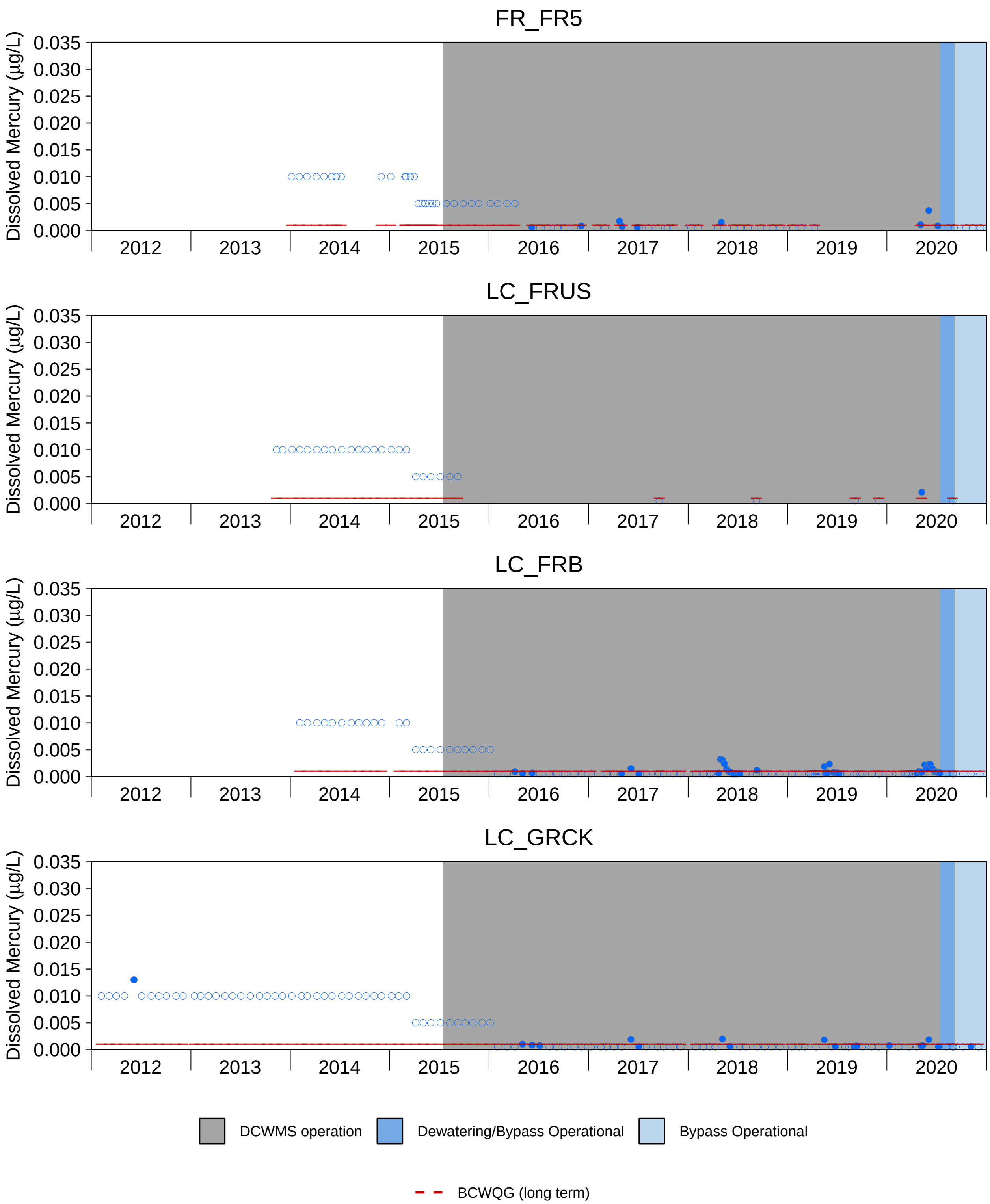

Figure B.19: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

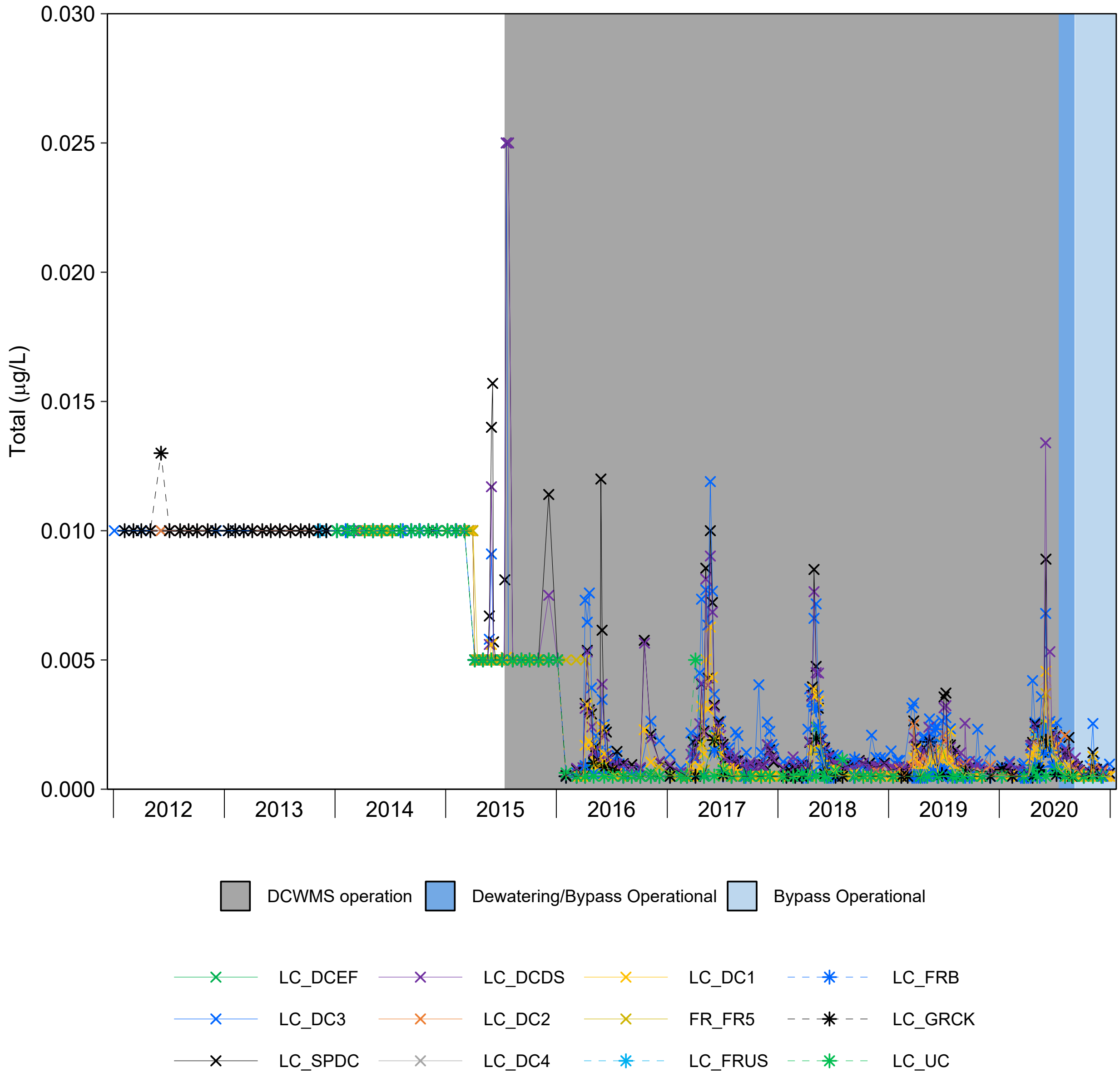

Figure B.20: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.00050 and 0.025 mg/L).

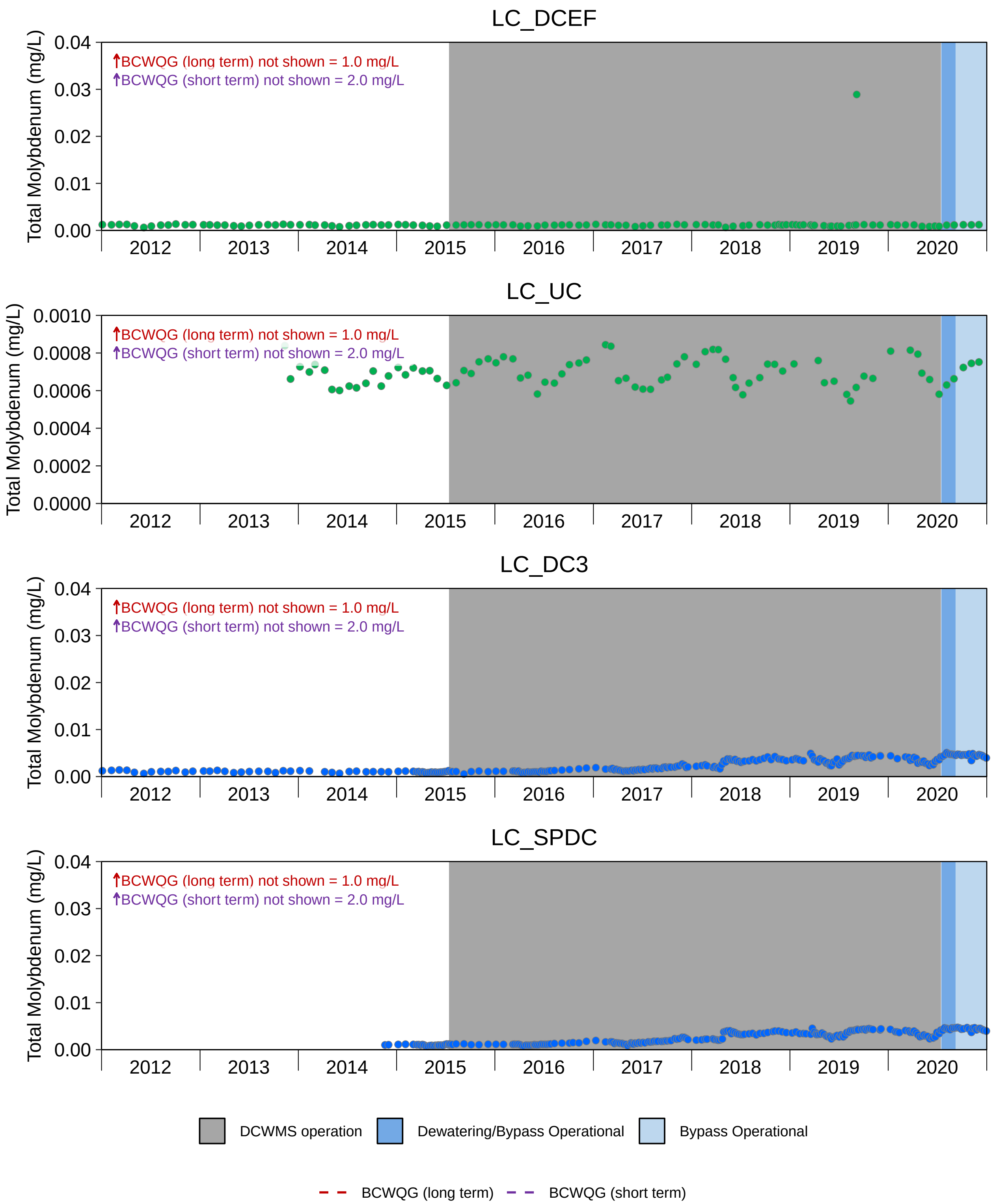

Figure B.21: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

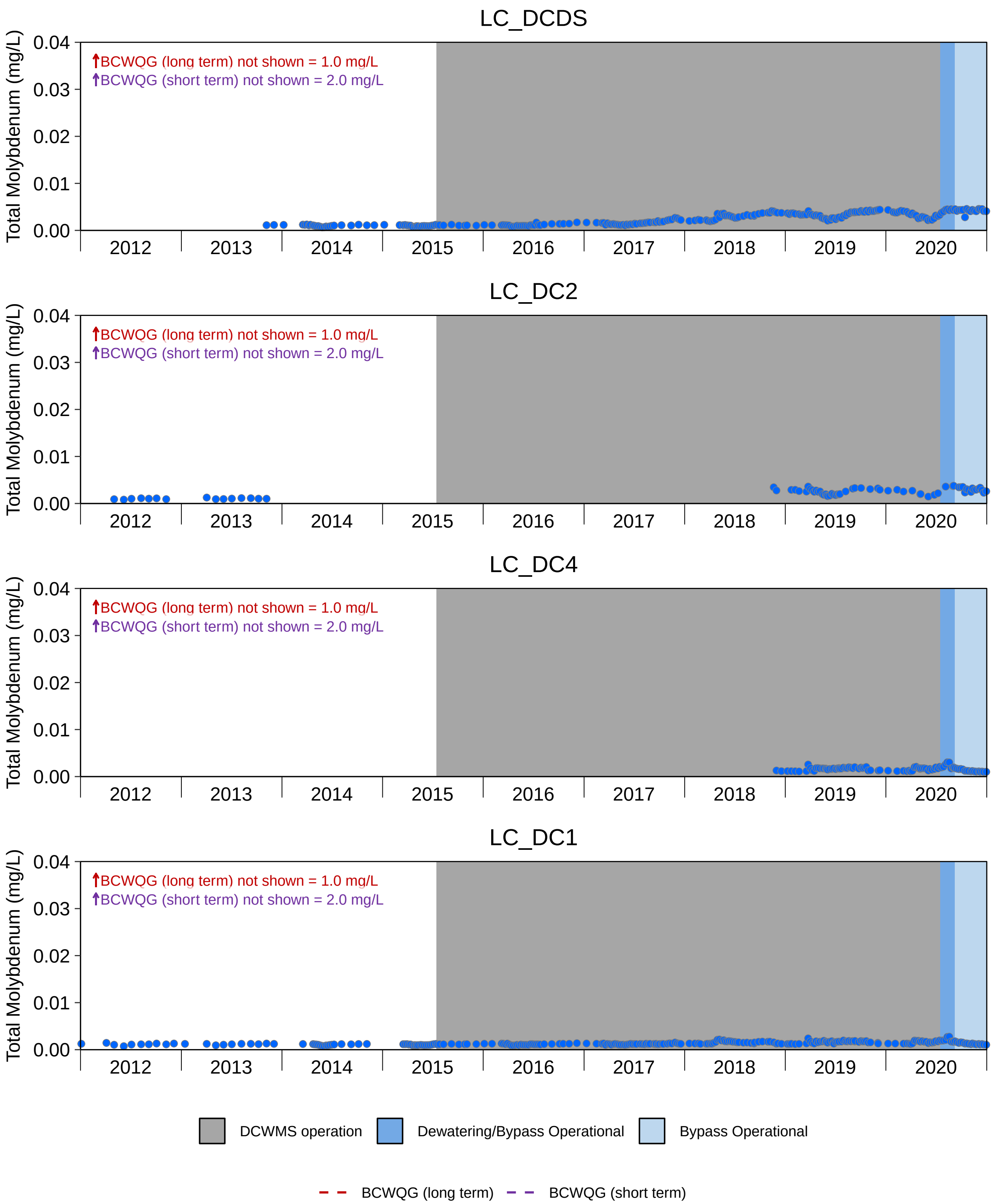

Figure B.21: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

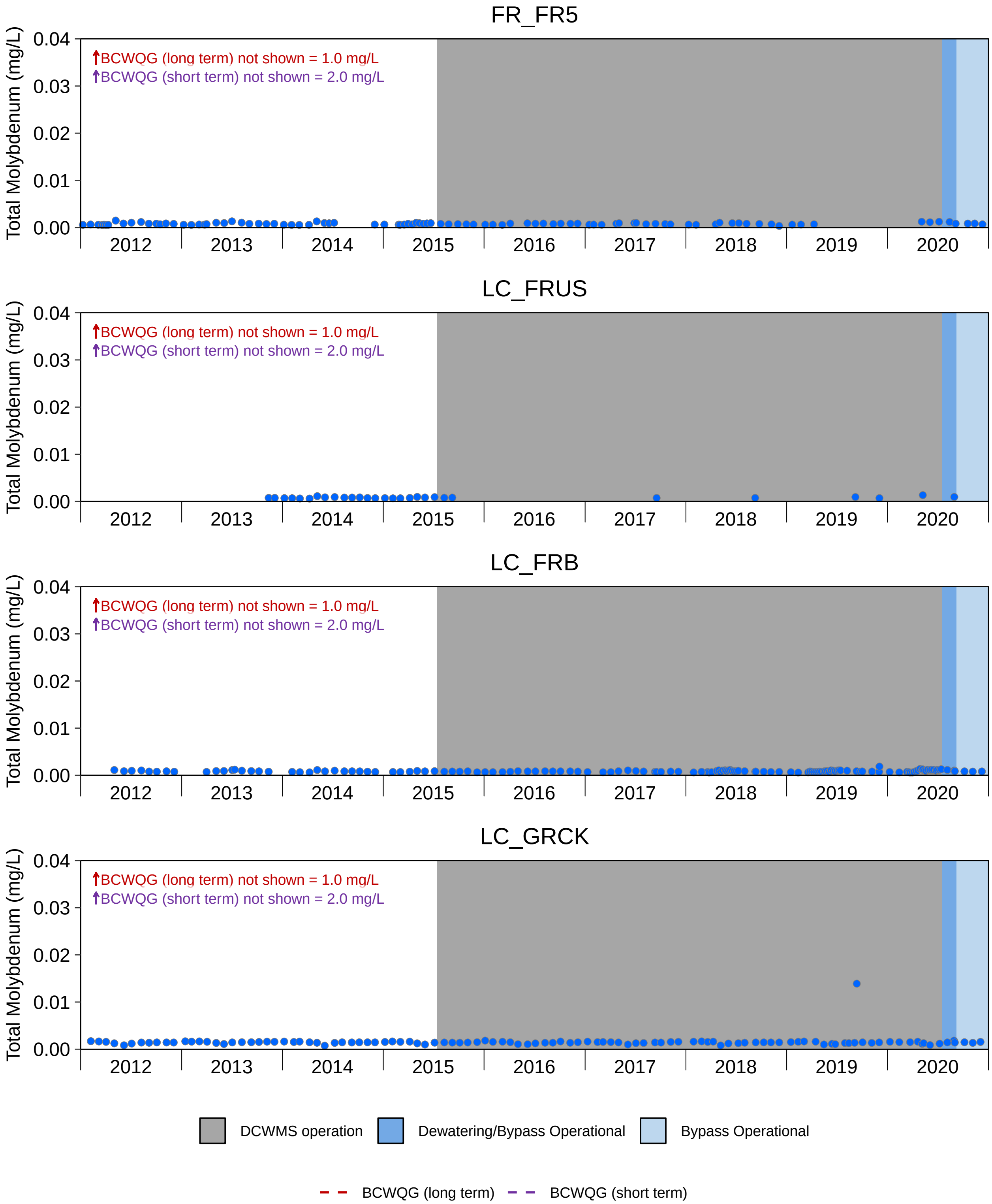

Figure B.21: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

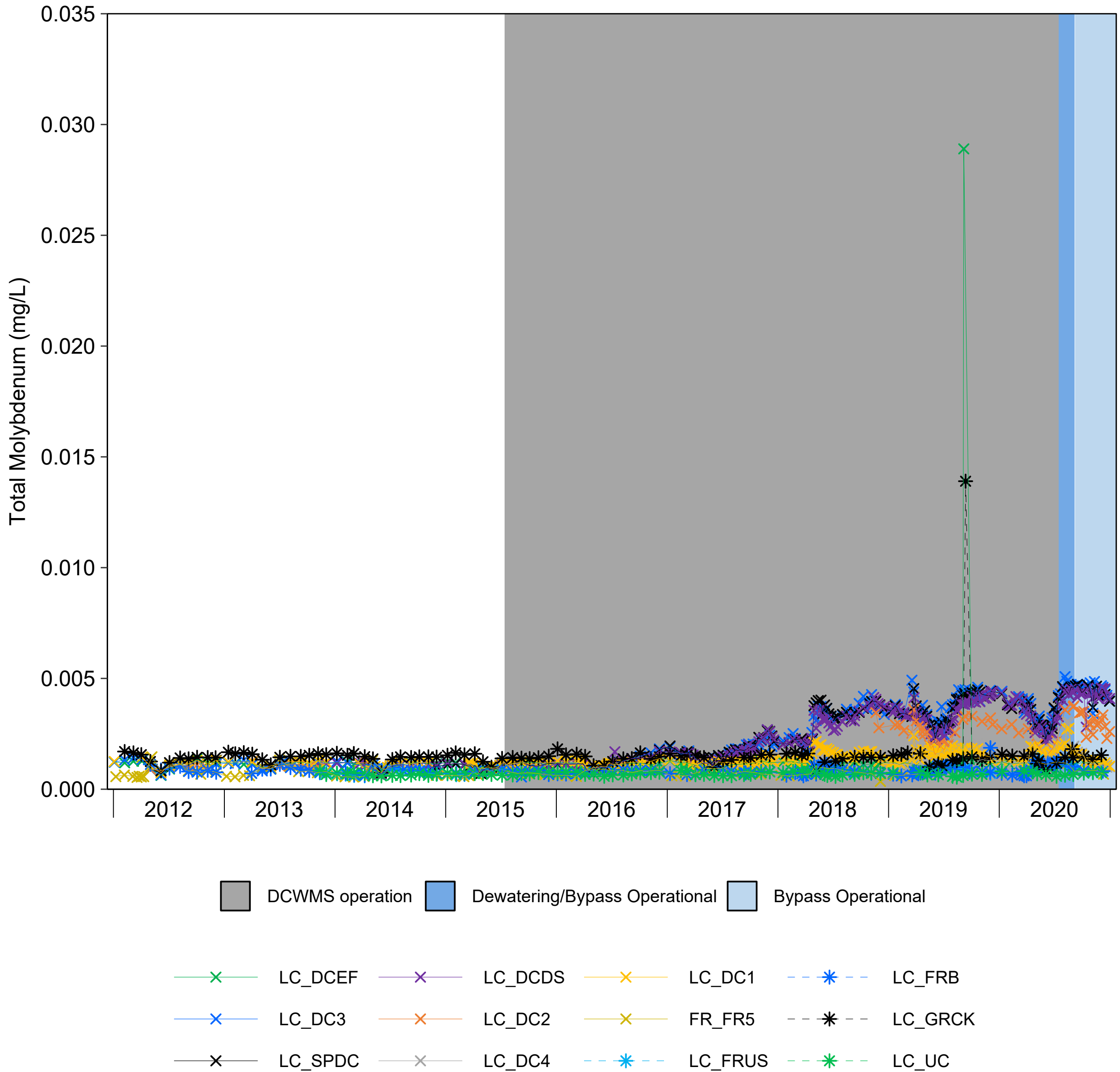

Figure B.22: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: No values below the LRL.

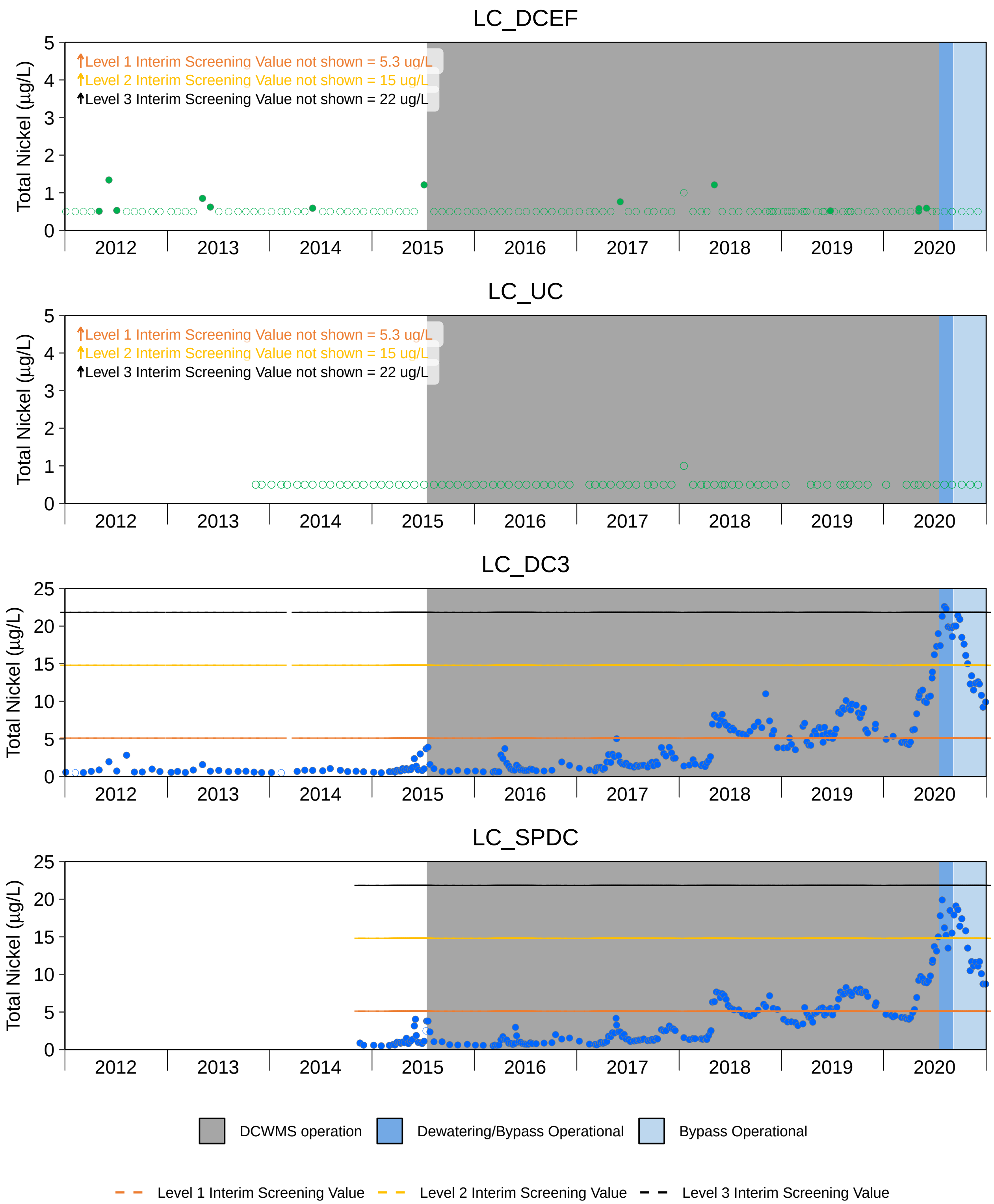

Figure B.23: Time Series Plots for Total Nickel from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

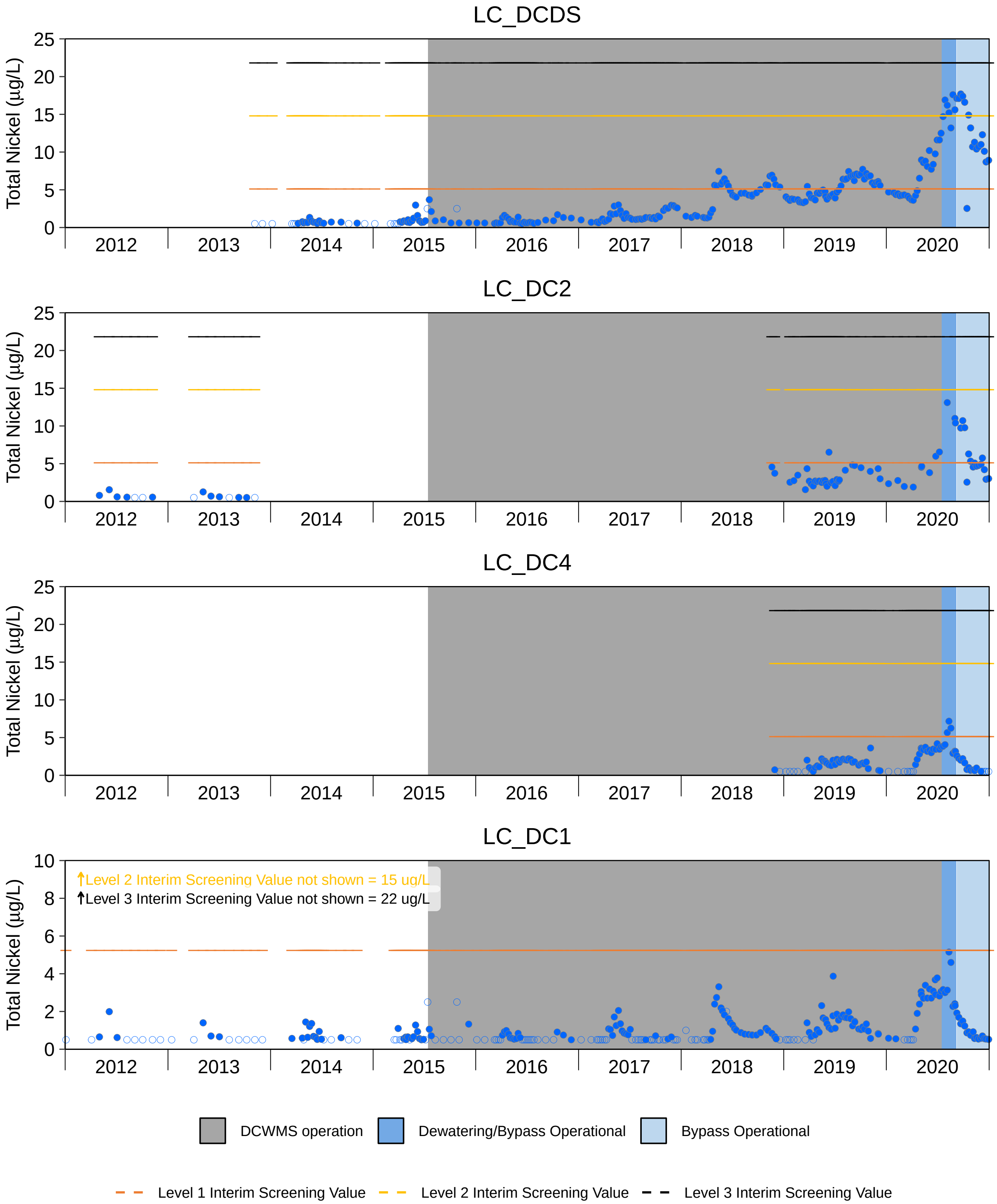

Figure B.23: Time Series Plots for Total Nickel from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

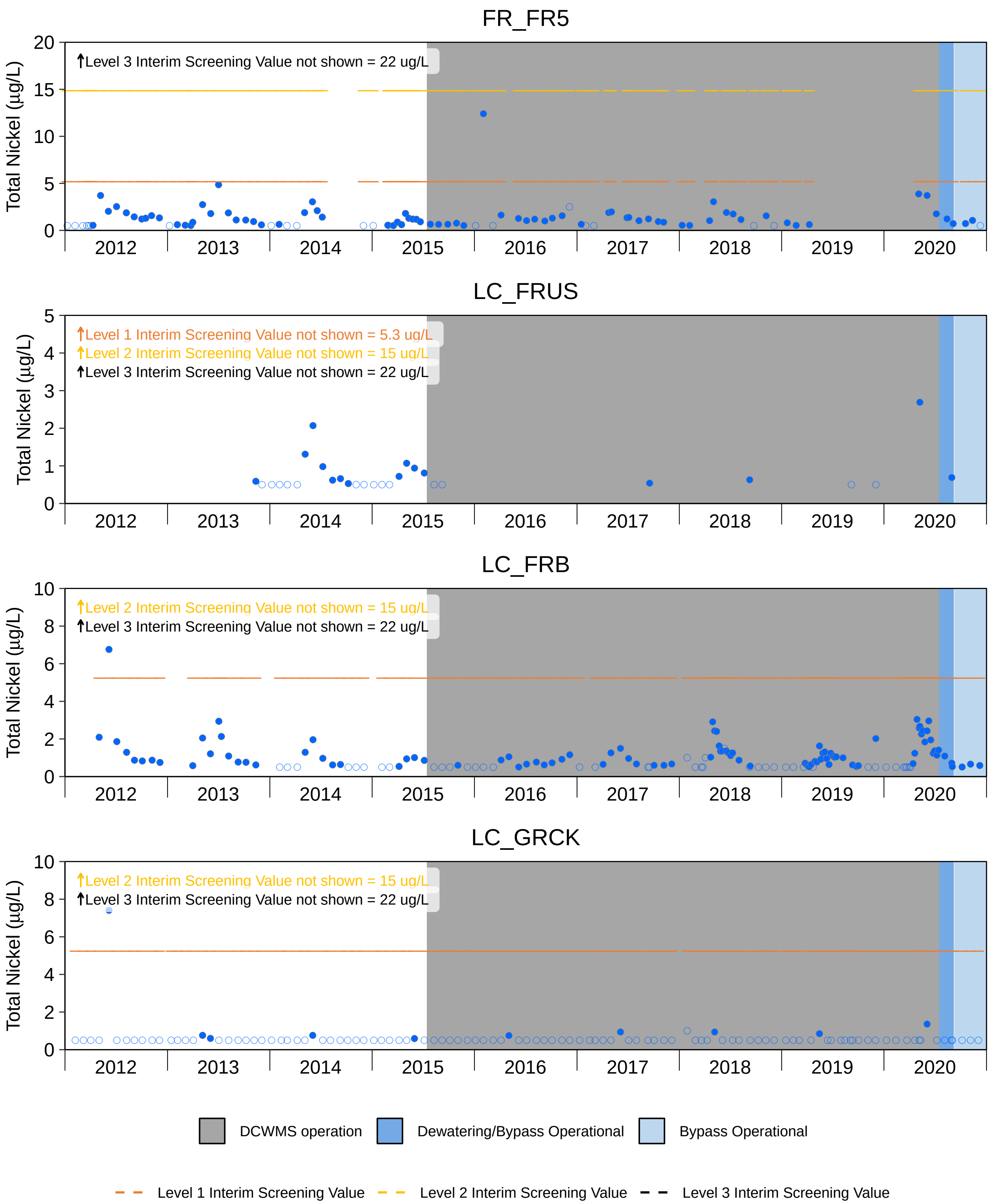

Figure B.23: Time Series Plots for Total Nickel from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

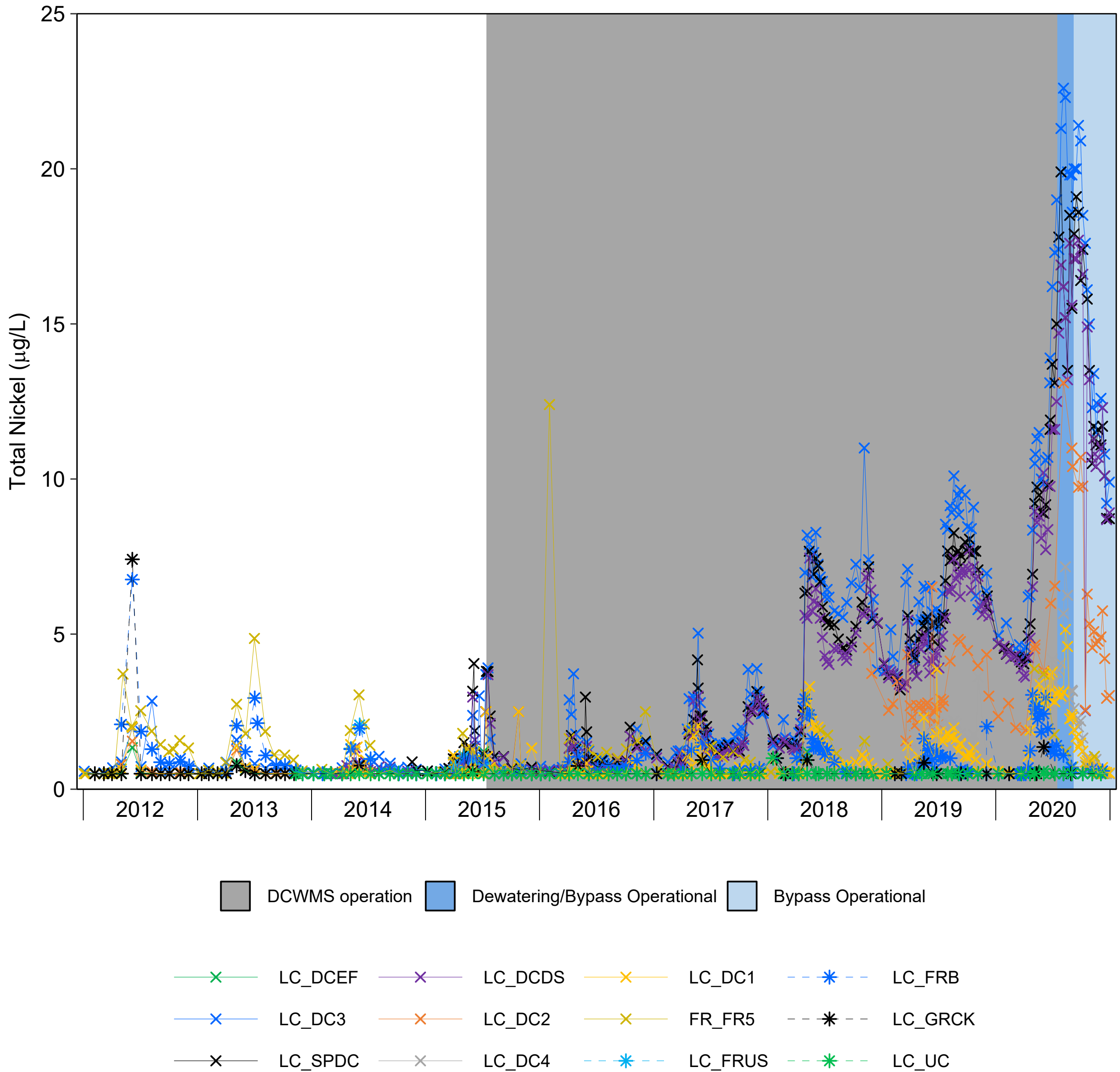

Figure B.24: Time Series Plots for Total Nickel from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.50 and 2.5 mg/L).

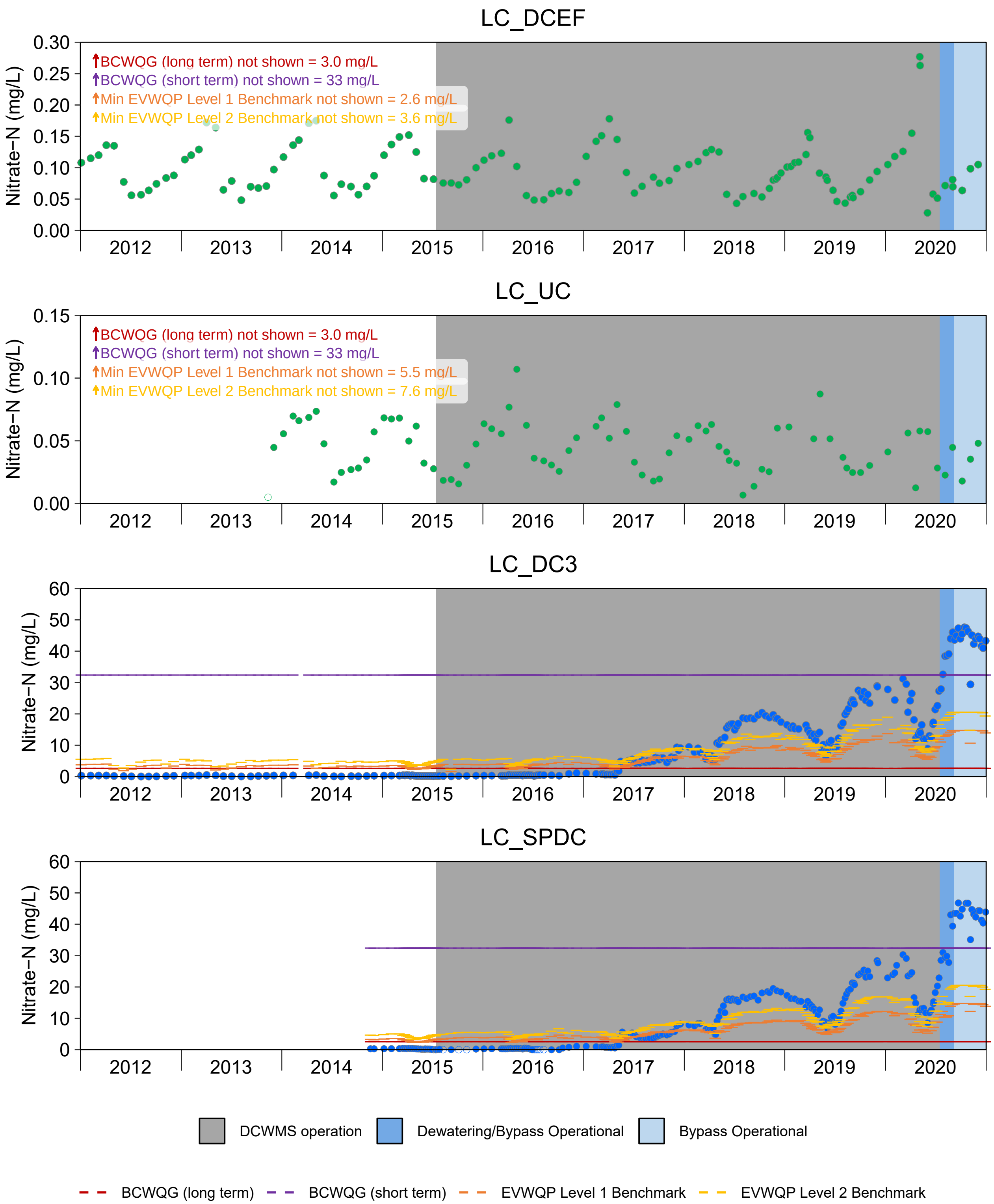

Figure B.25: Time Series Plots for Nitrate−N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

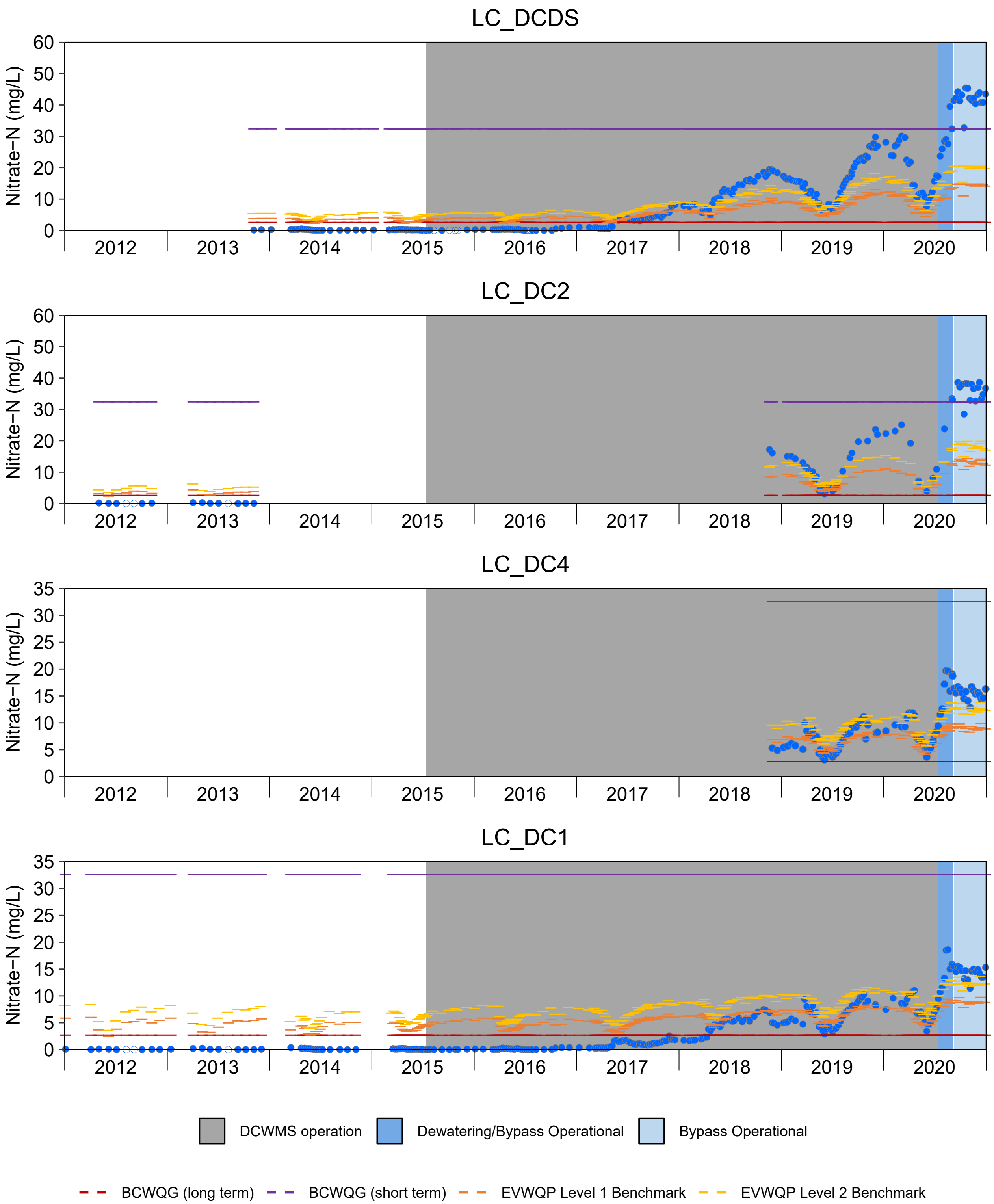

Figure B.25: Time Series Plots for Nitrate−N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

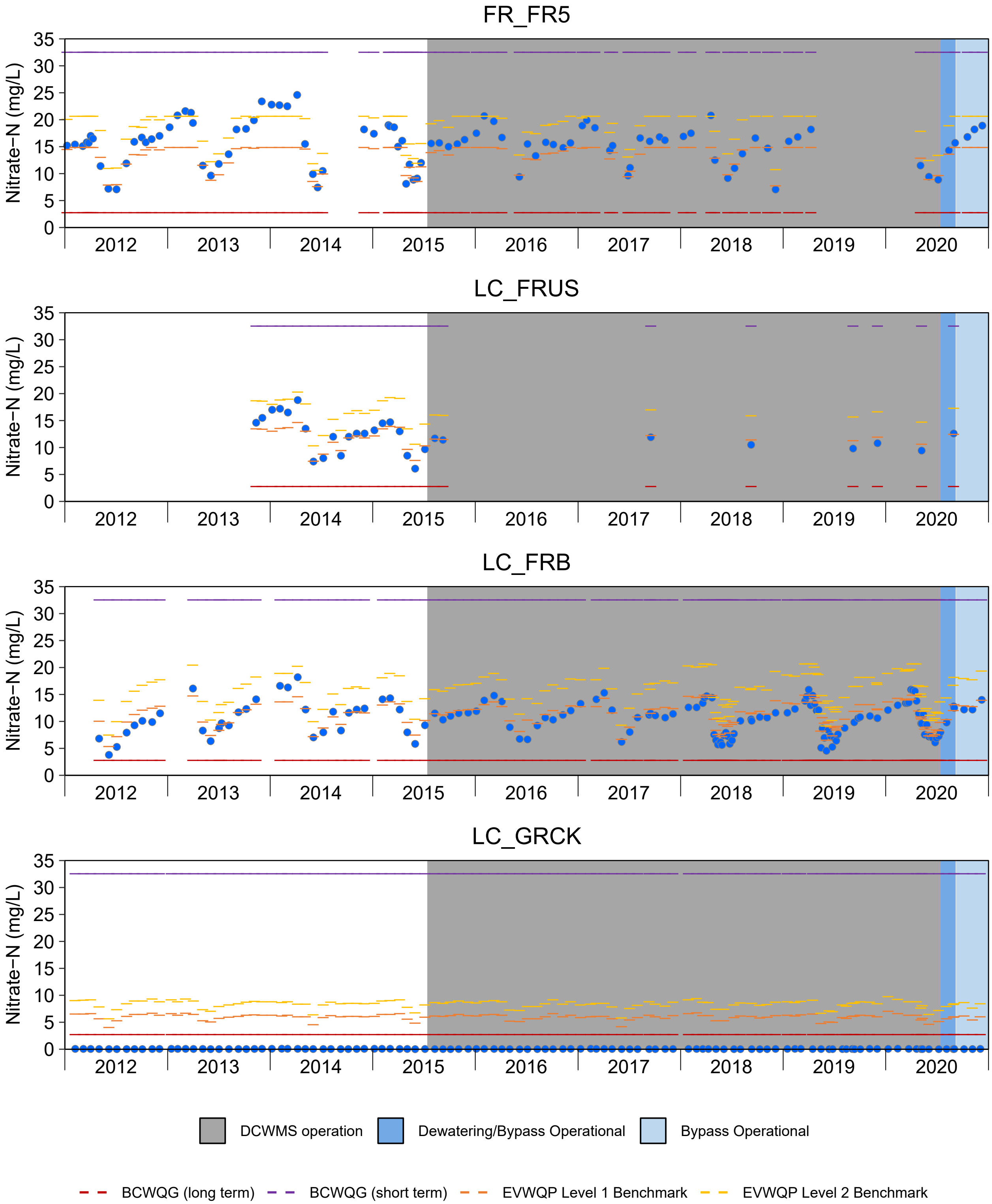

Figure B.25: Time Series Plots for Nitrate−N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

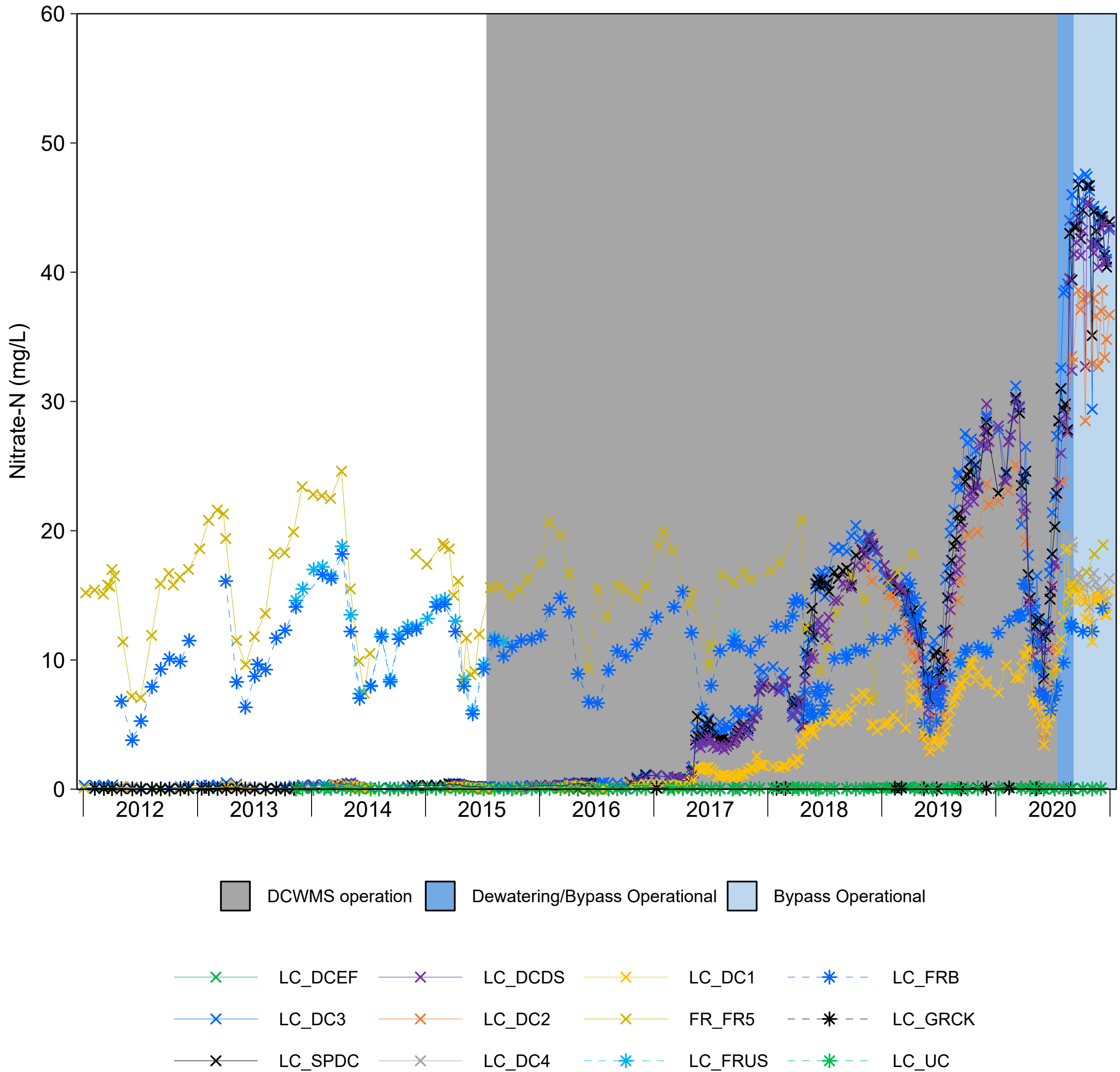

Figure B.26: Time Series Plots for Nitrate-N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0050 and 0.0050 mg/L).

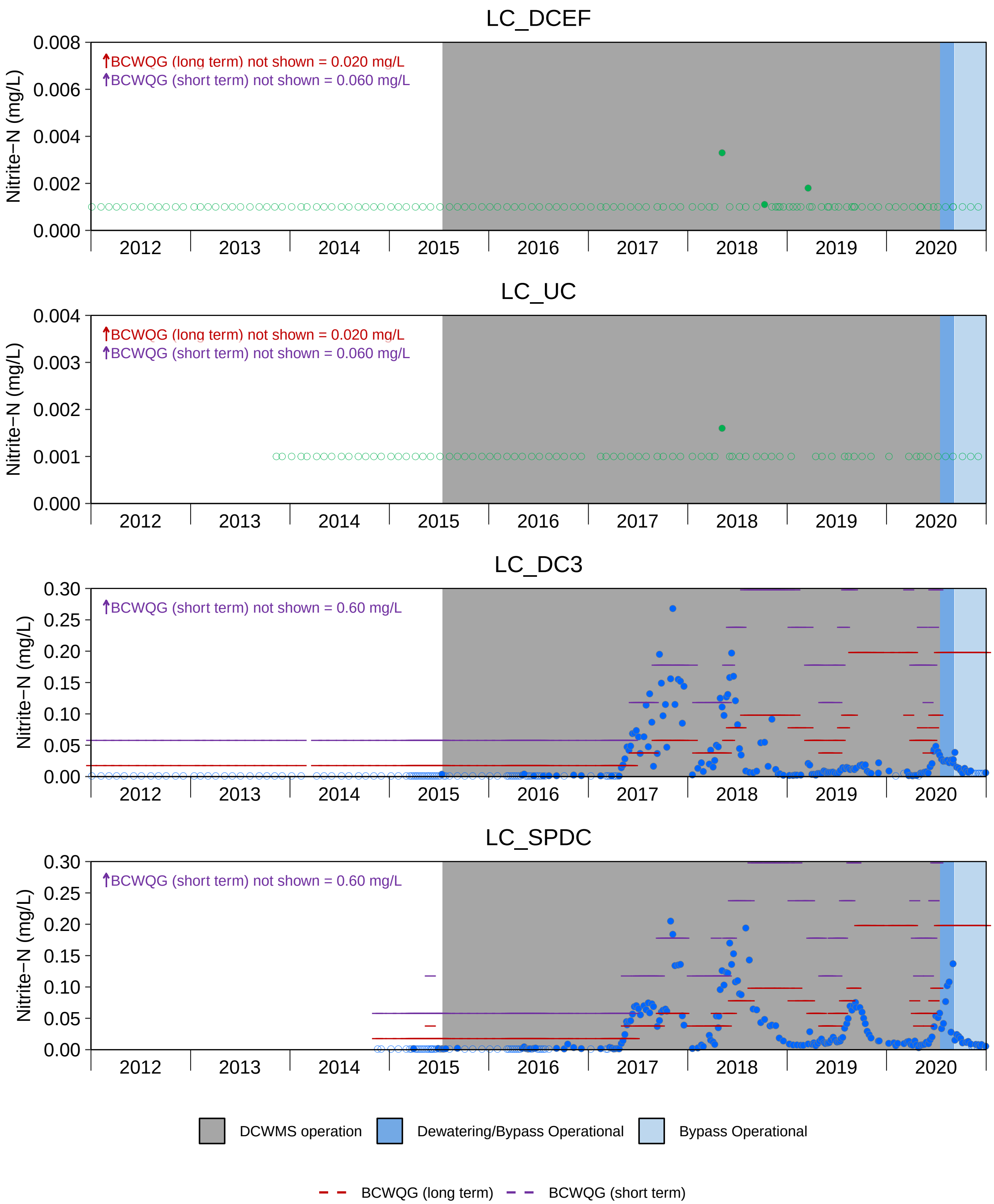

Figure B.27: Time Series Plots for Nitrite−N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

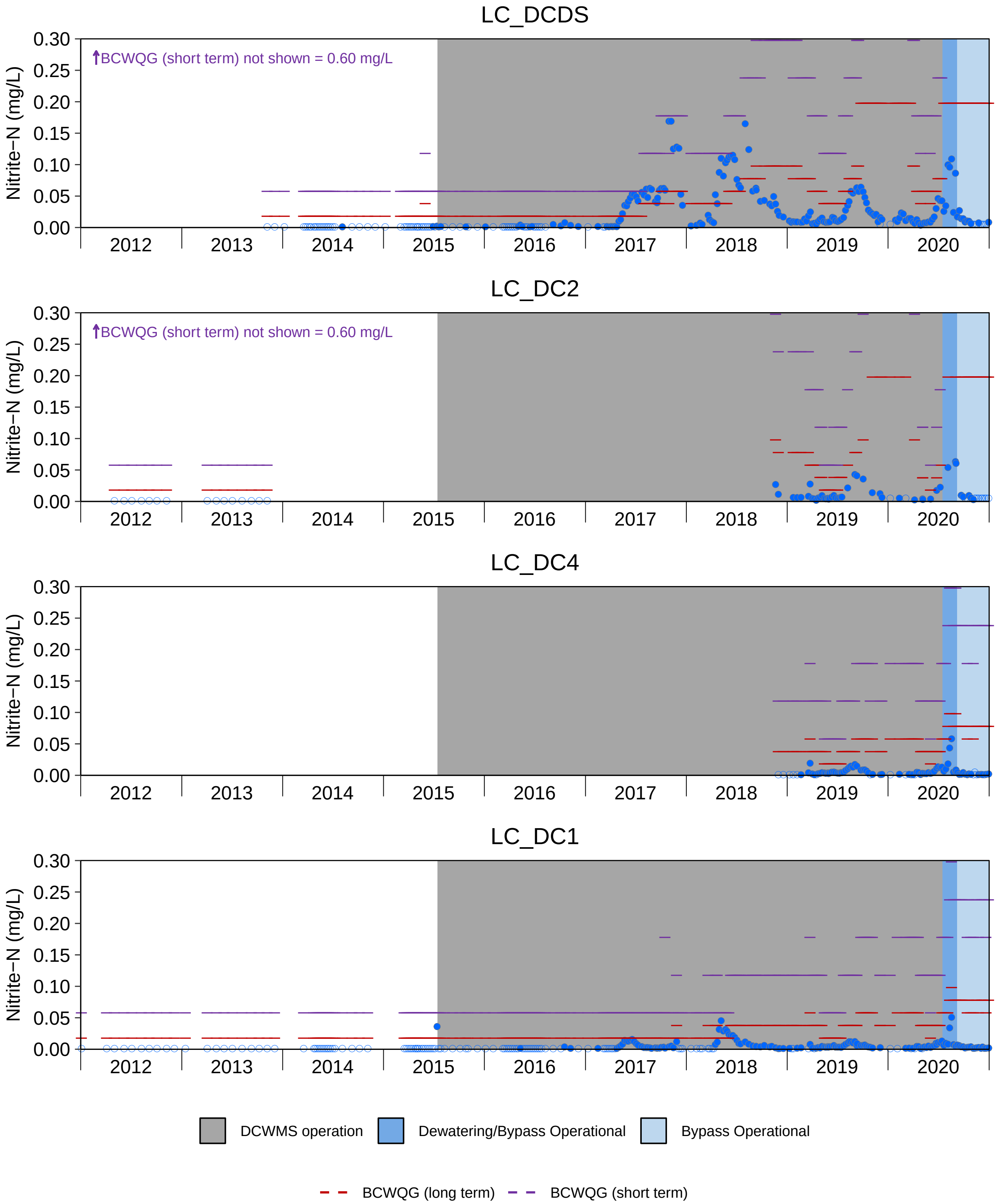

Figure B.27: Time Series Plots for Nitrite−N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

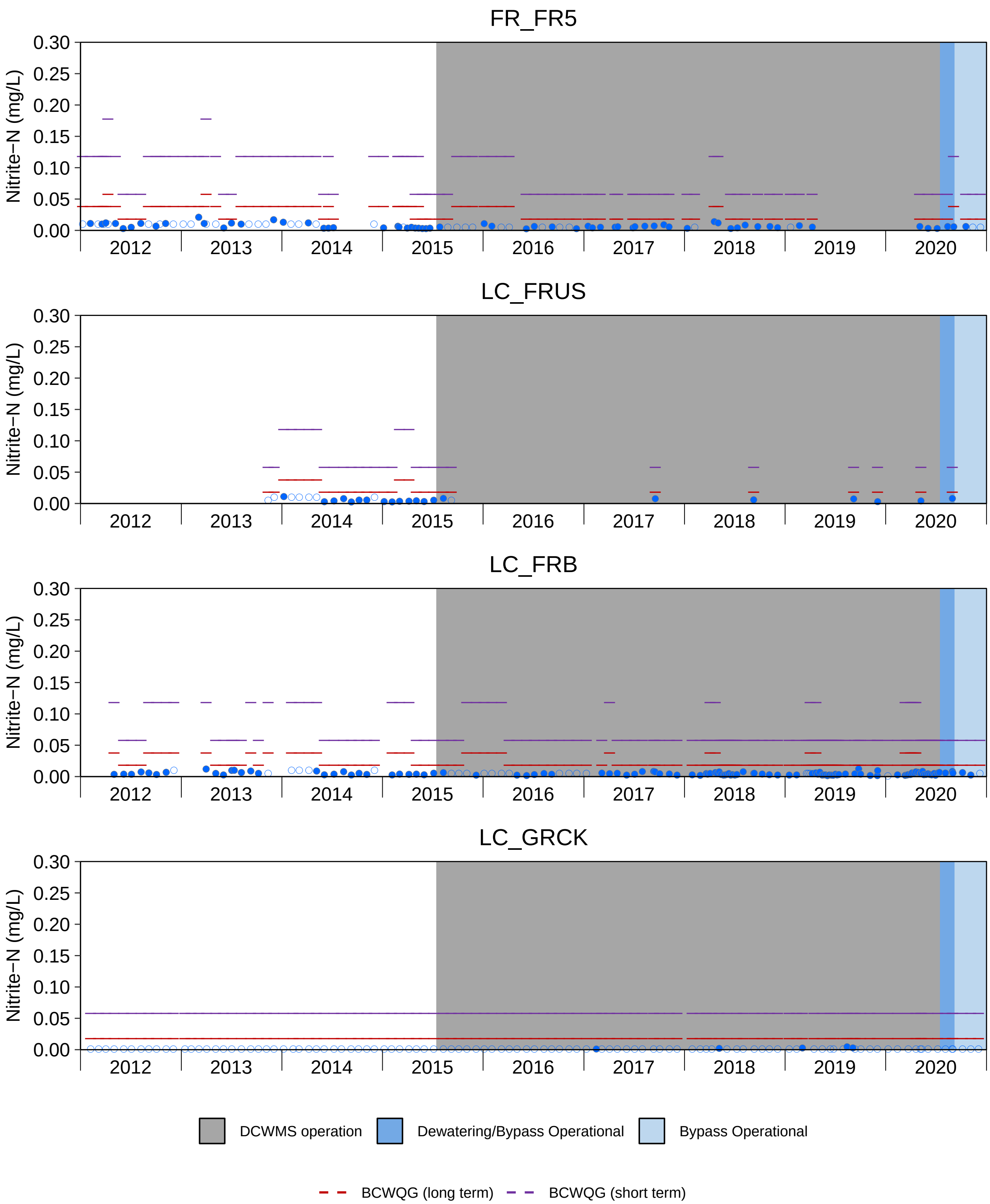

Figure B.27: Time Series Plots for Nitrite−N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: 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 2019). 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).

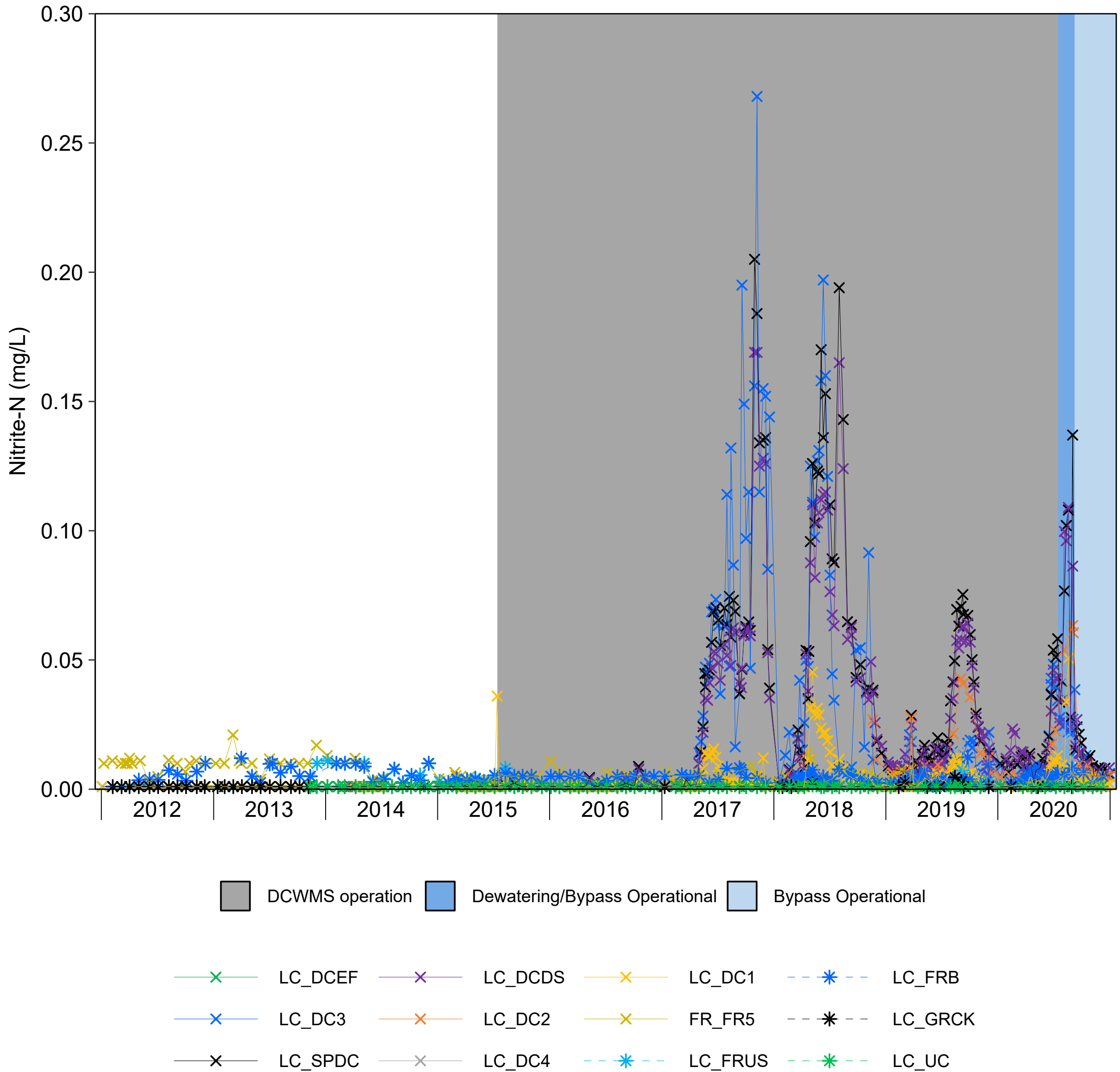

Figure B.28: Time Series Plots for Nitrite-N from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0010 and 0.010 mg/L).

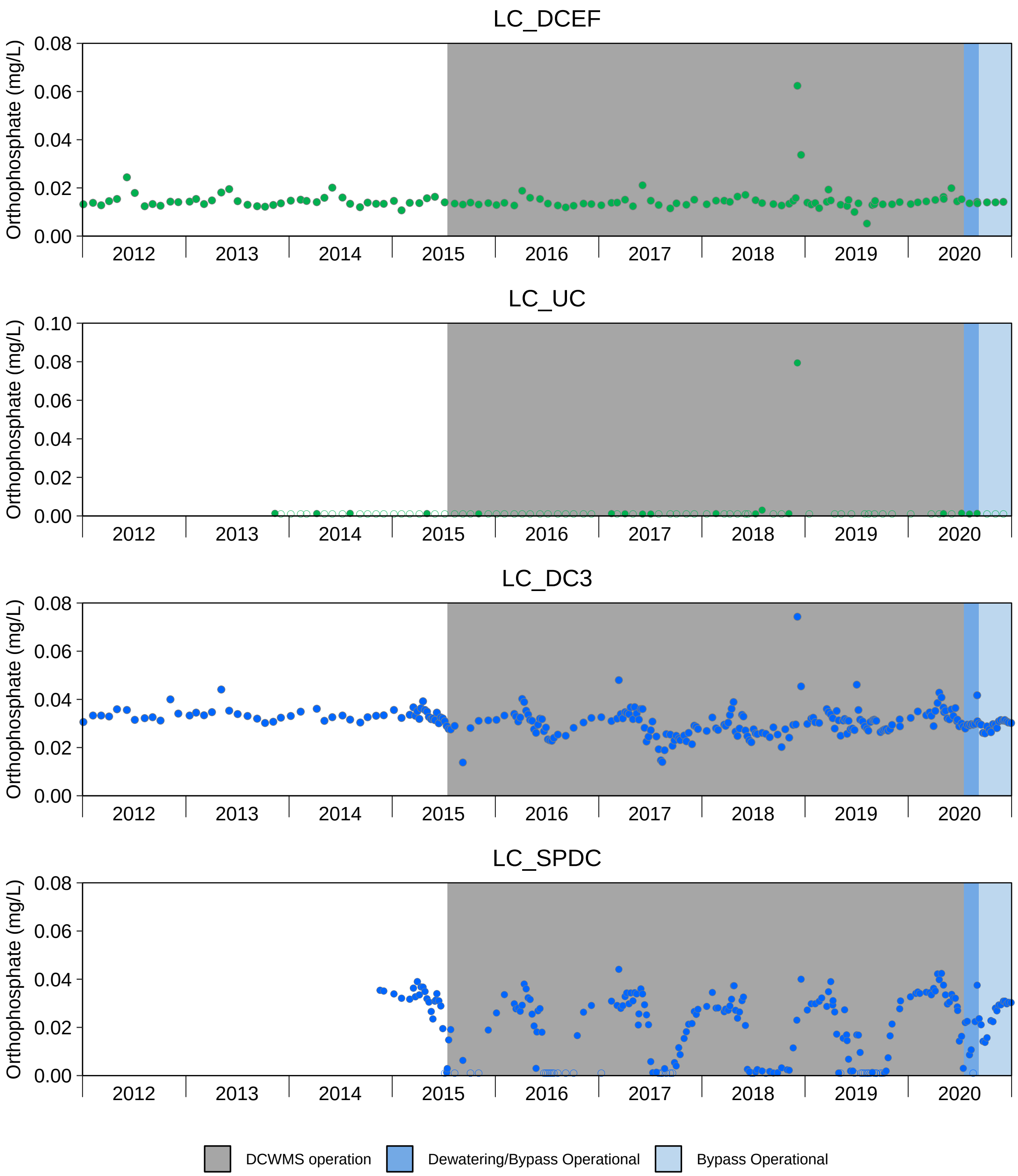

Figure B.29: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

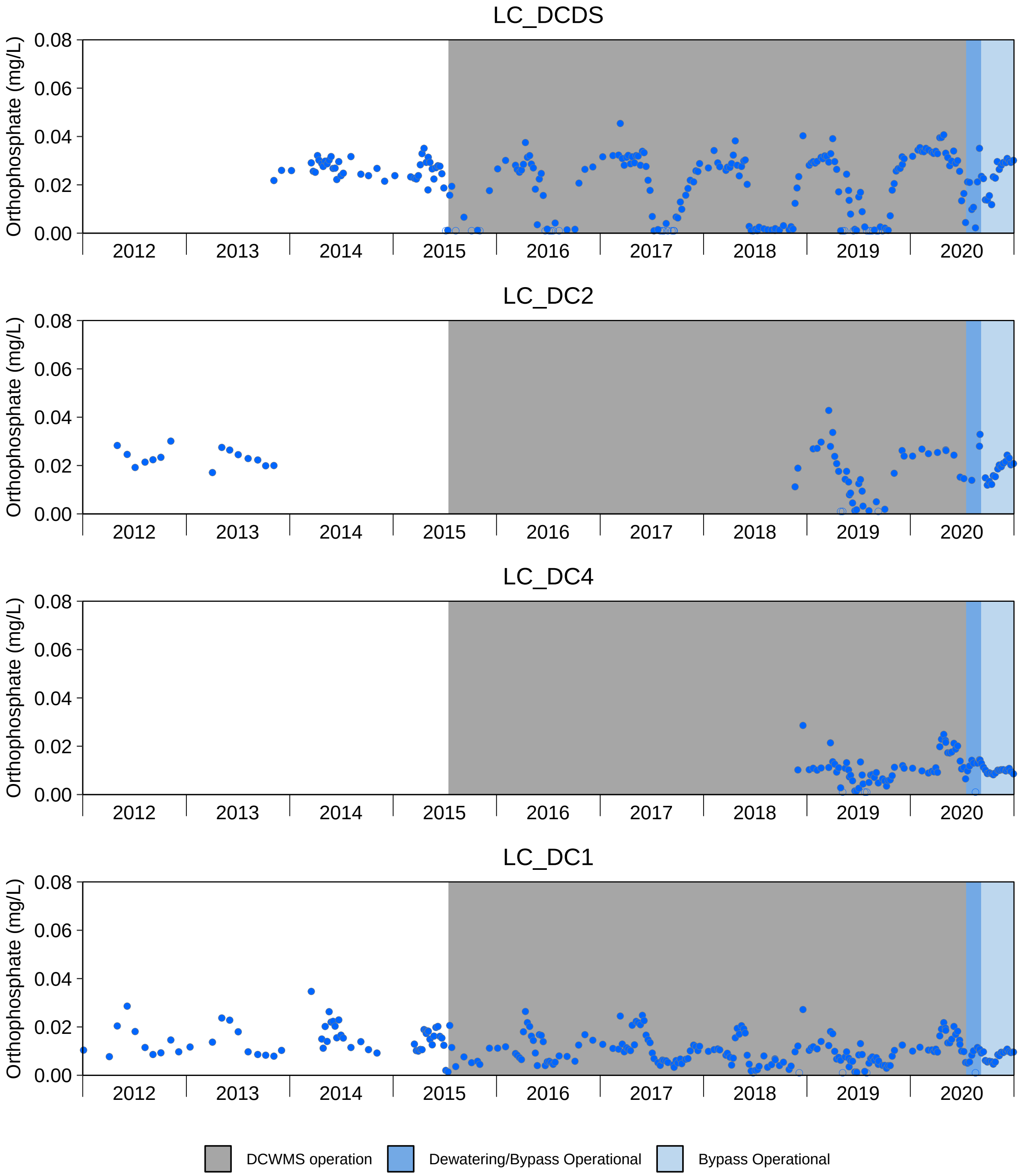

Figure B.29: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

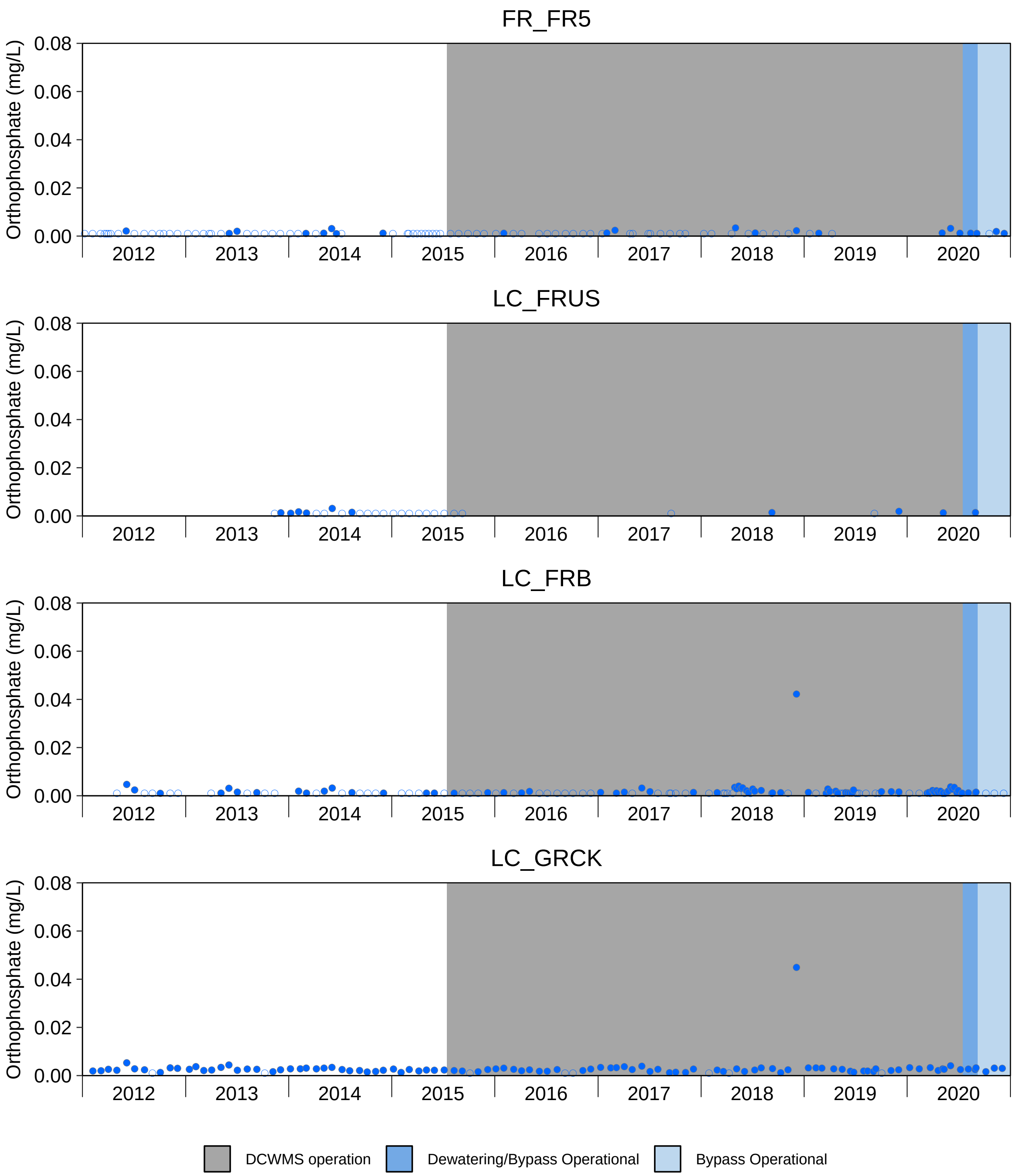

Figure B.29: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

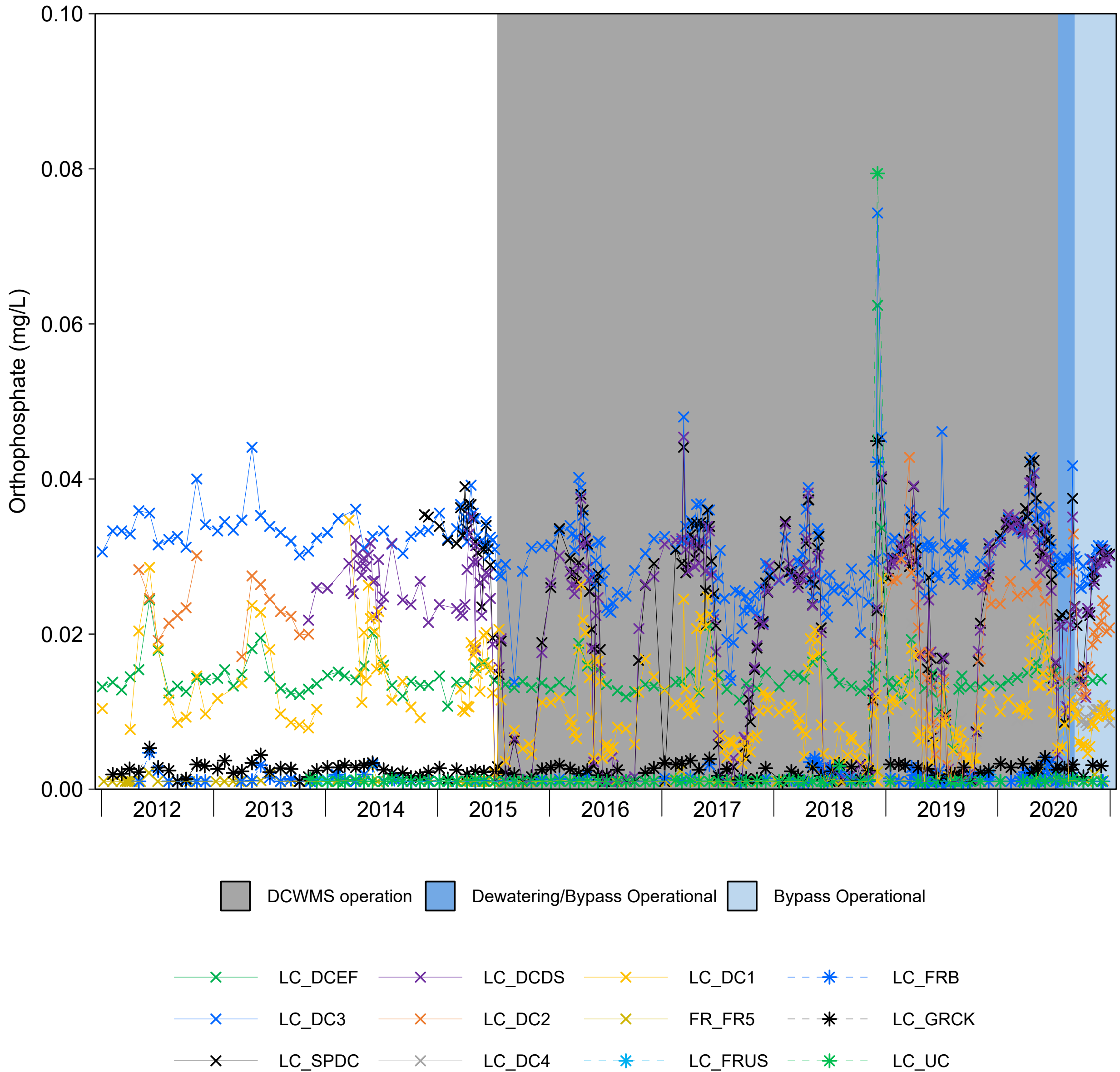

Figure B.30: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0010 and 0.0010 mg/L).

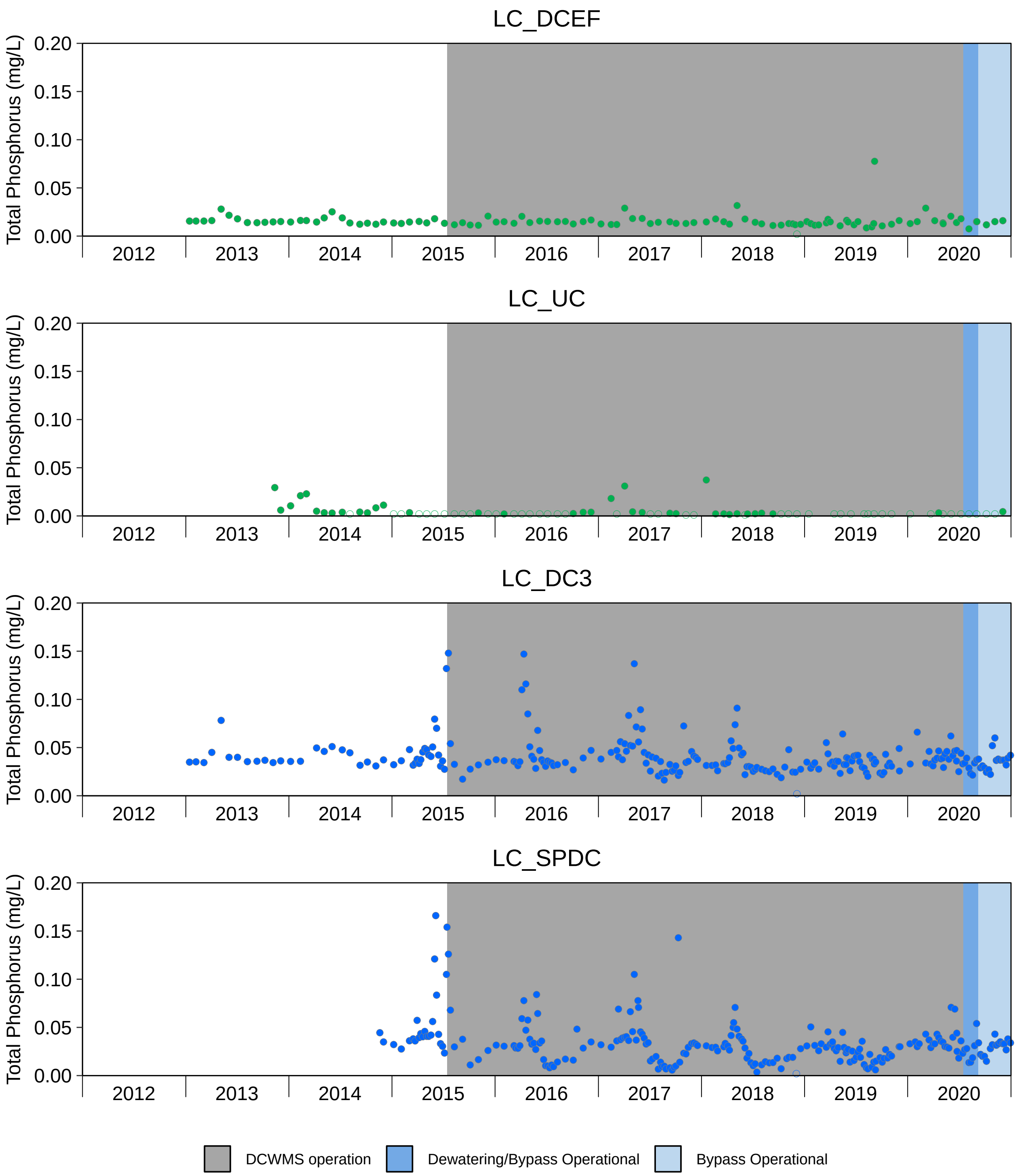

Figure B.31: Time Series Plots for Total Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. 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).

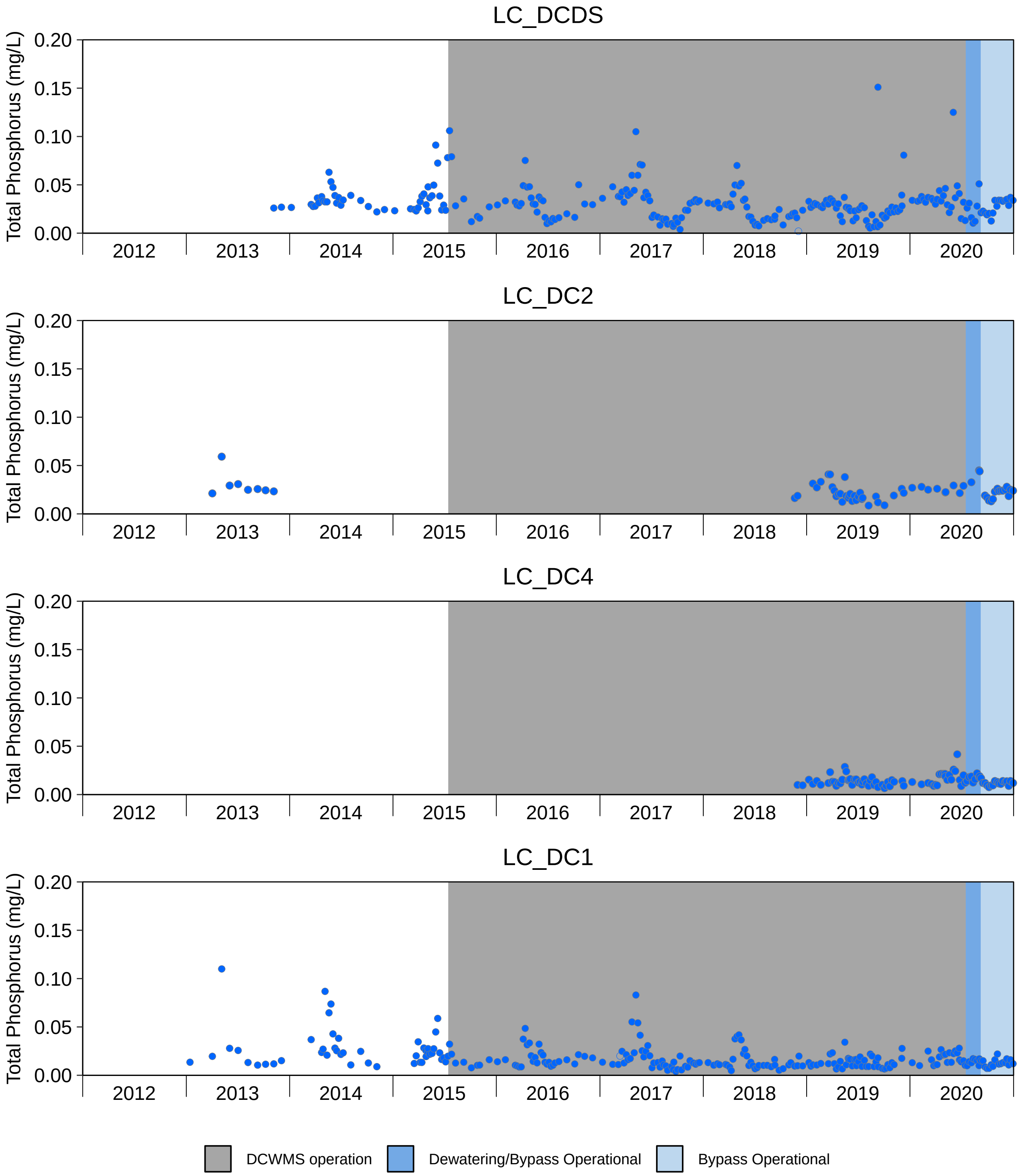

Figure B.31: Time Series Plots for Total Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. 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).

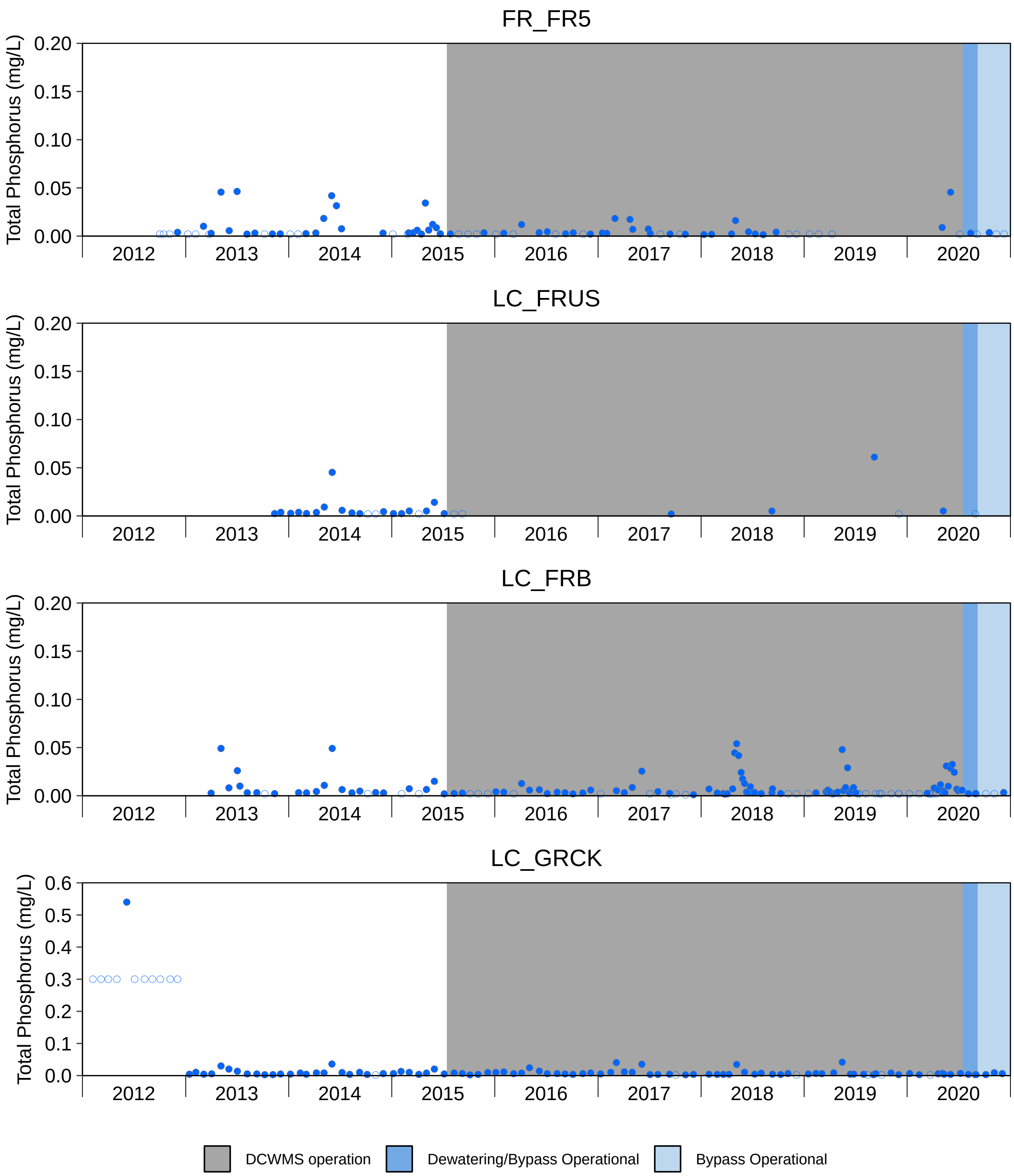

Figure B.31: Time Series Plots for Total Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. 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).

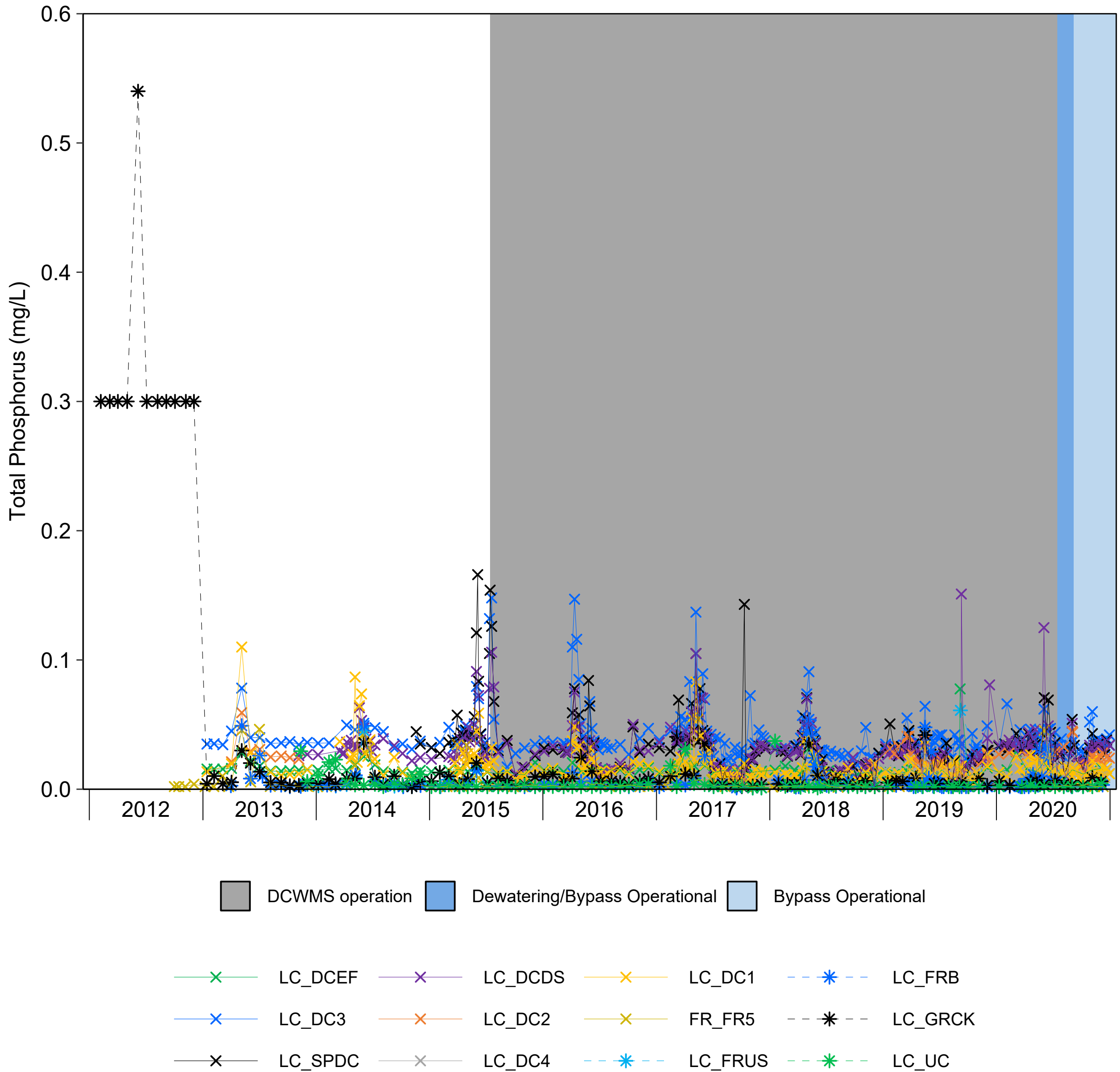

Figure B.32: Time Series Plots for Total Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0010 and 0.30 mg/L).

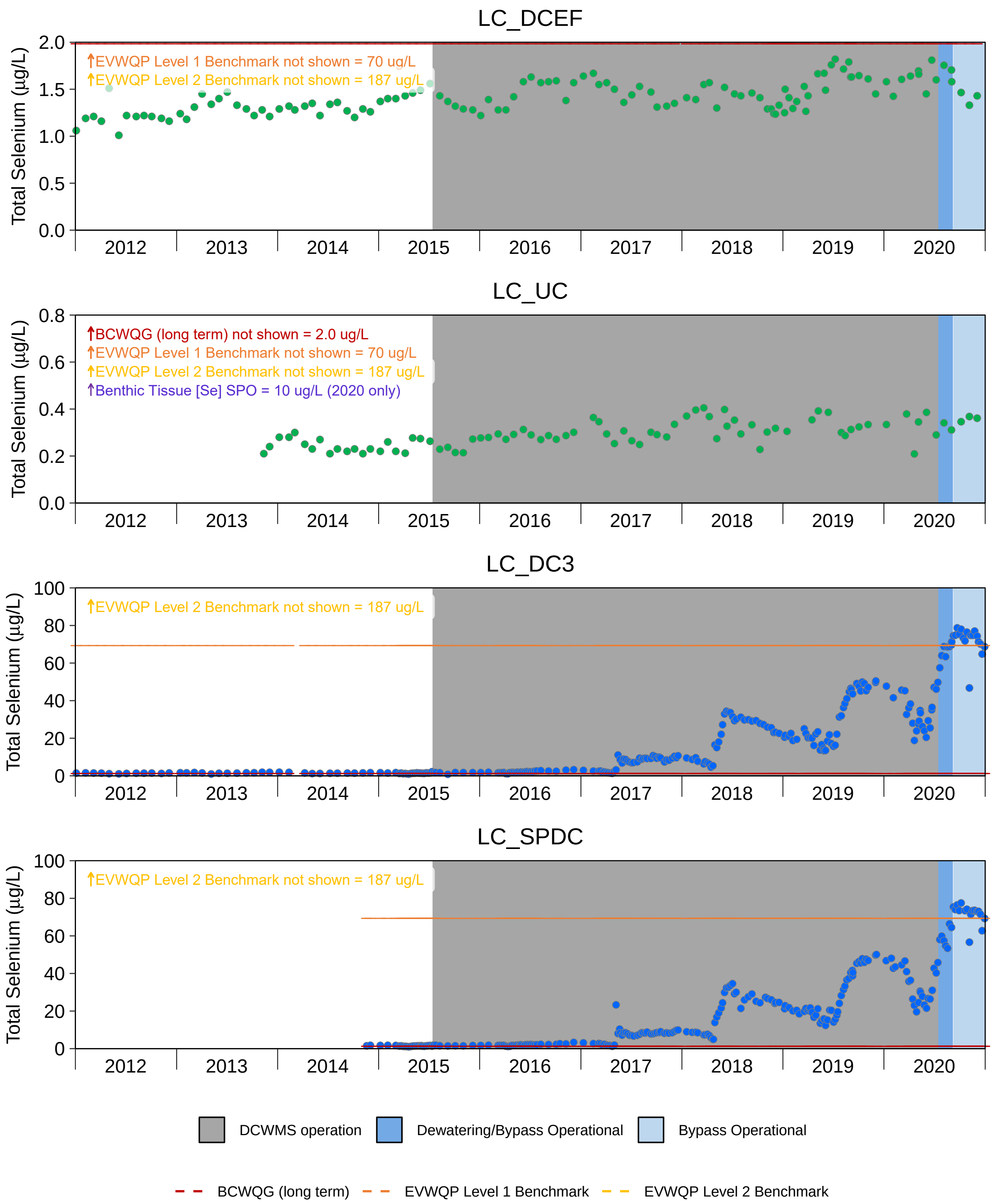

Figure B.33: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

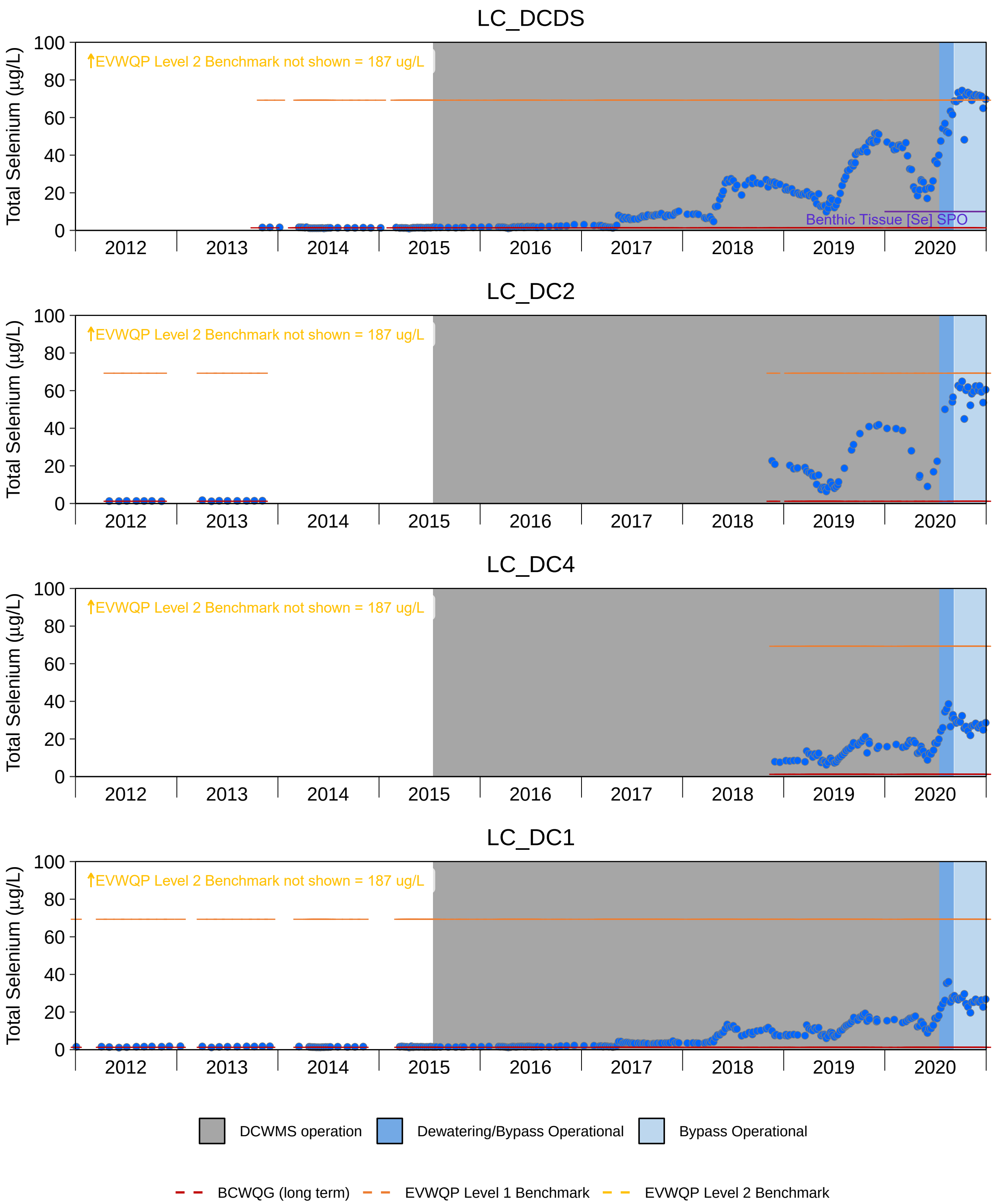

Figure B.33: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

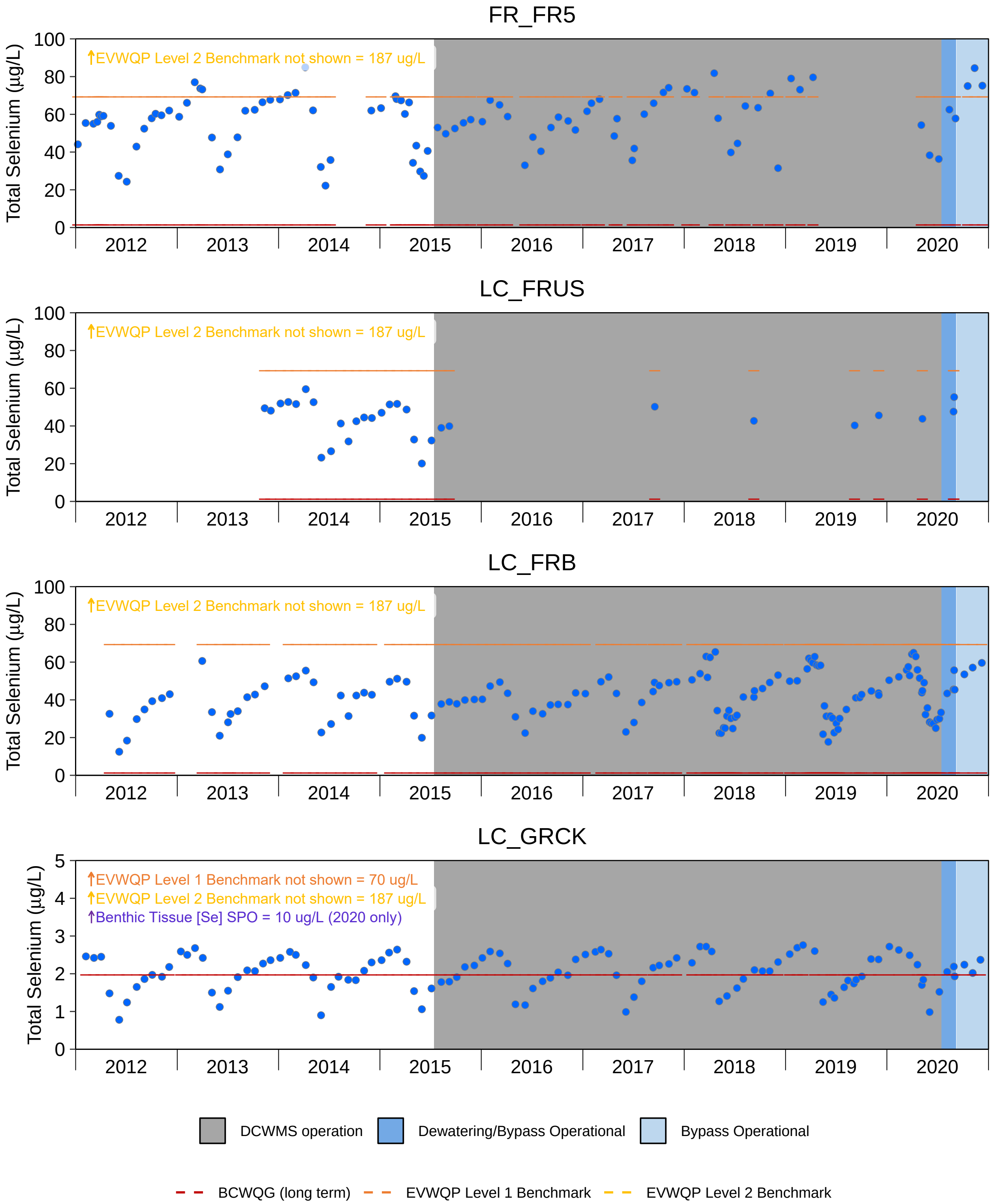

Figure B.33: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

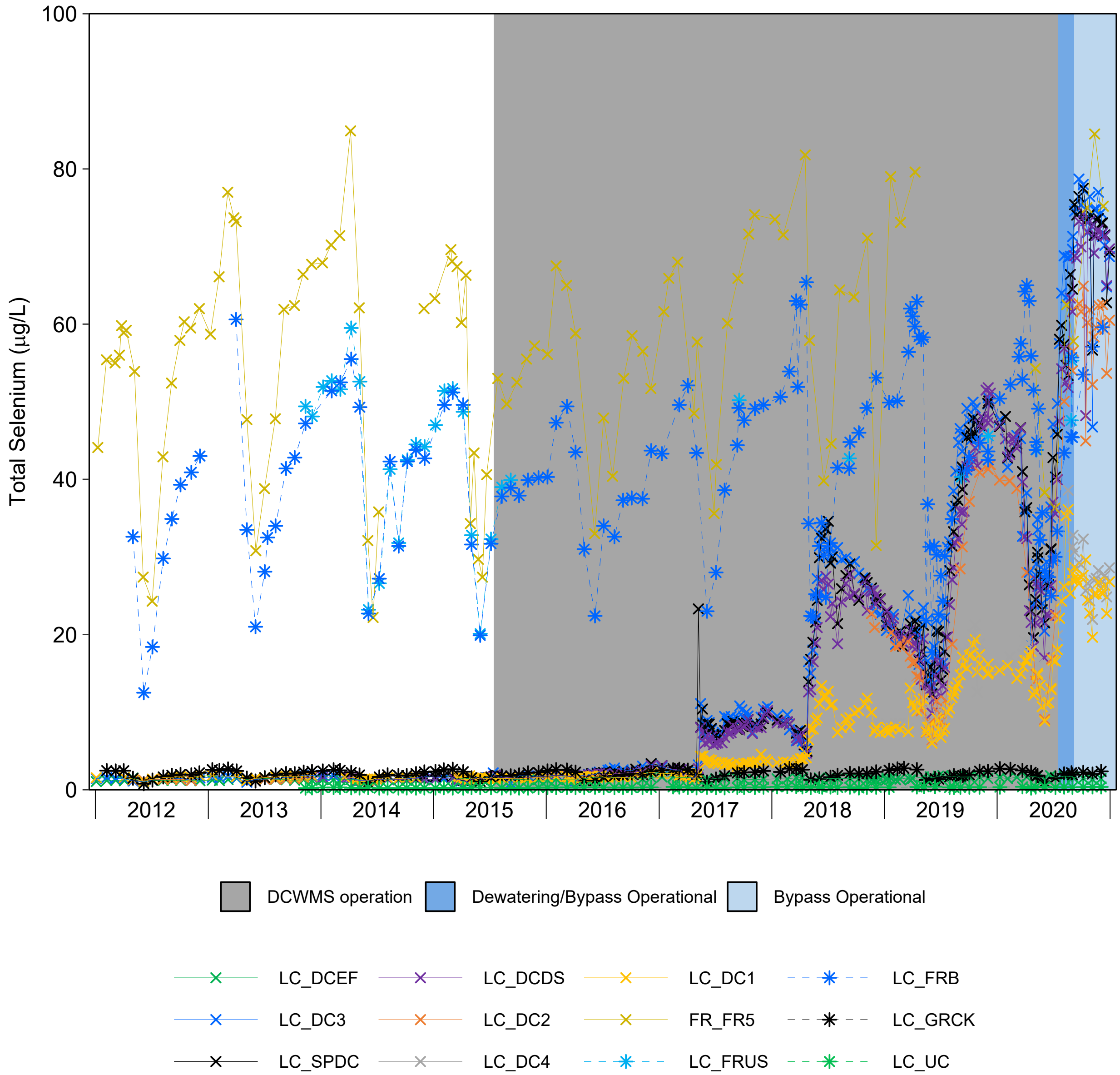

Figure B.34: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: No values below the LRL.

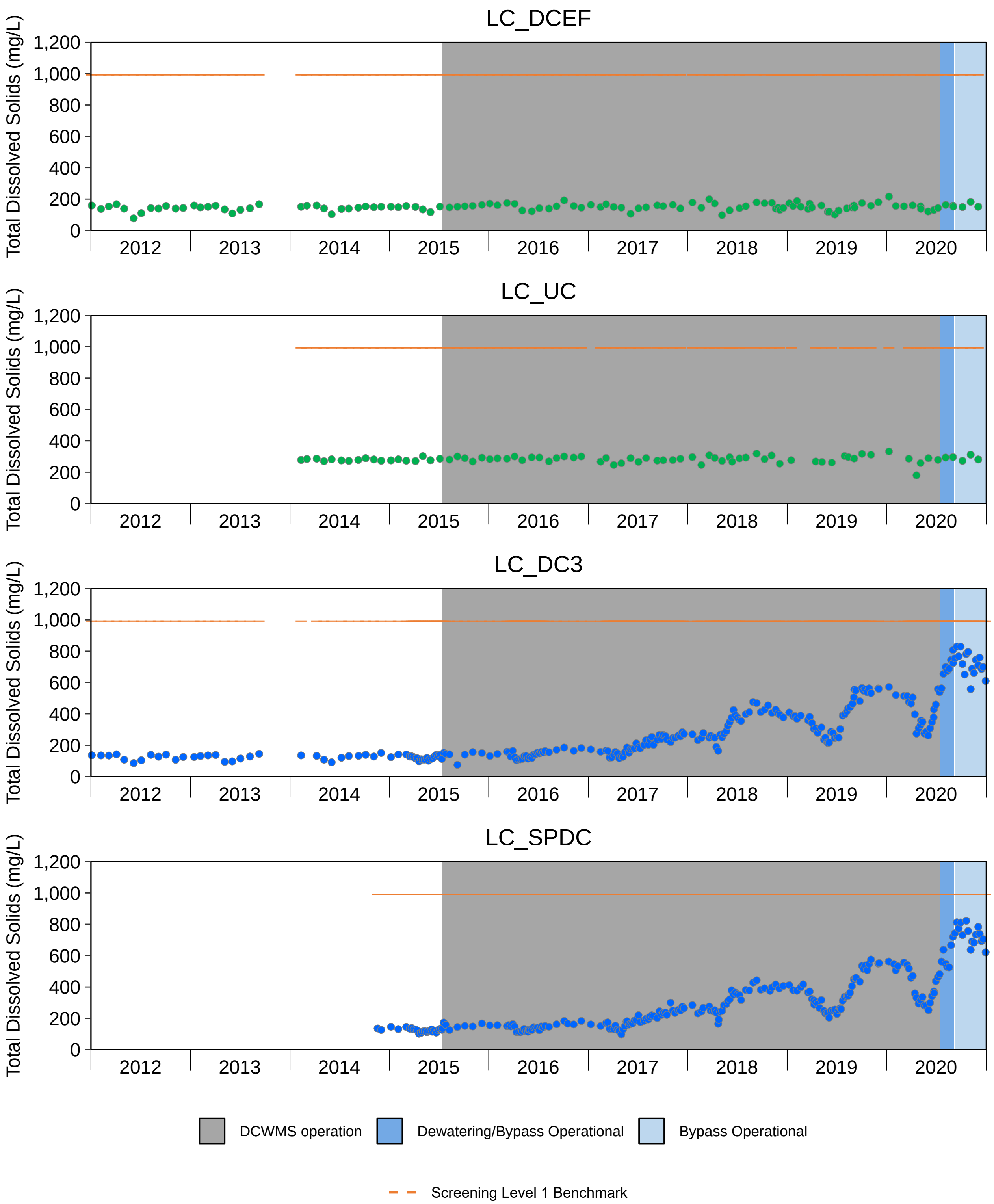

Figure B.35: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

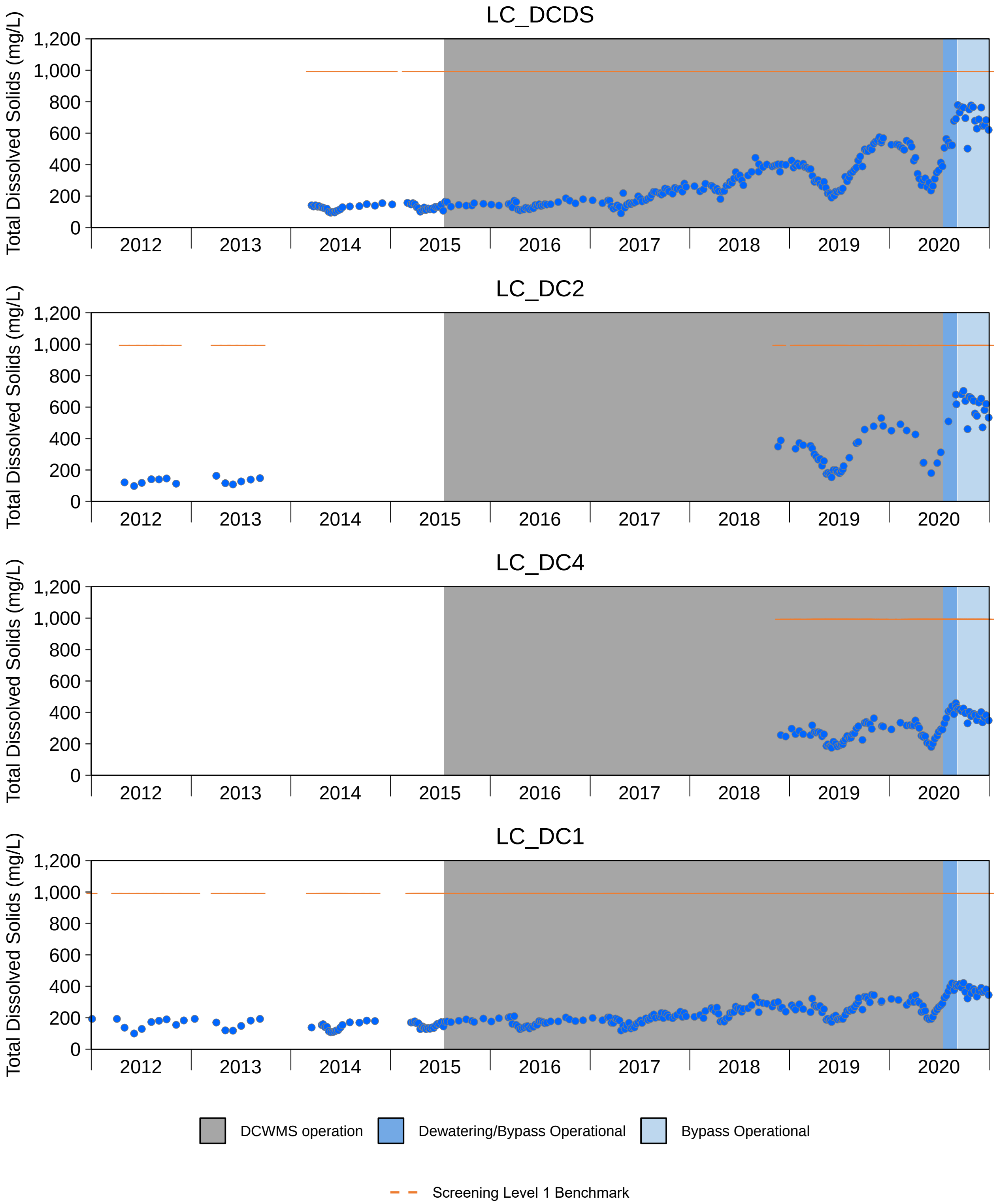

Figure B.35: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

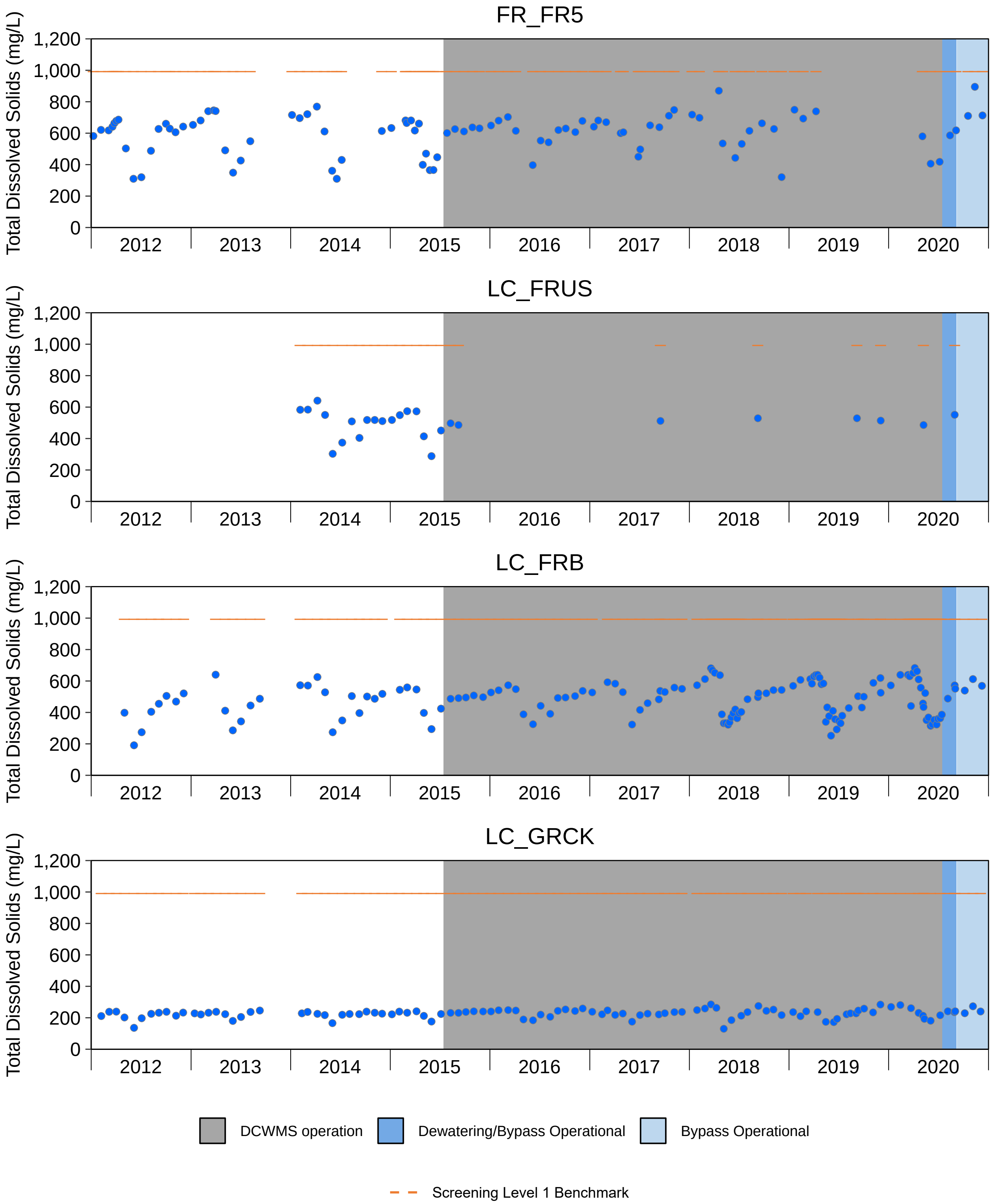

Figure B.35: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

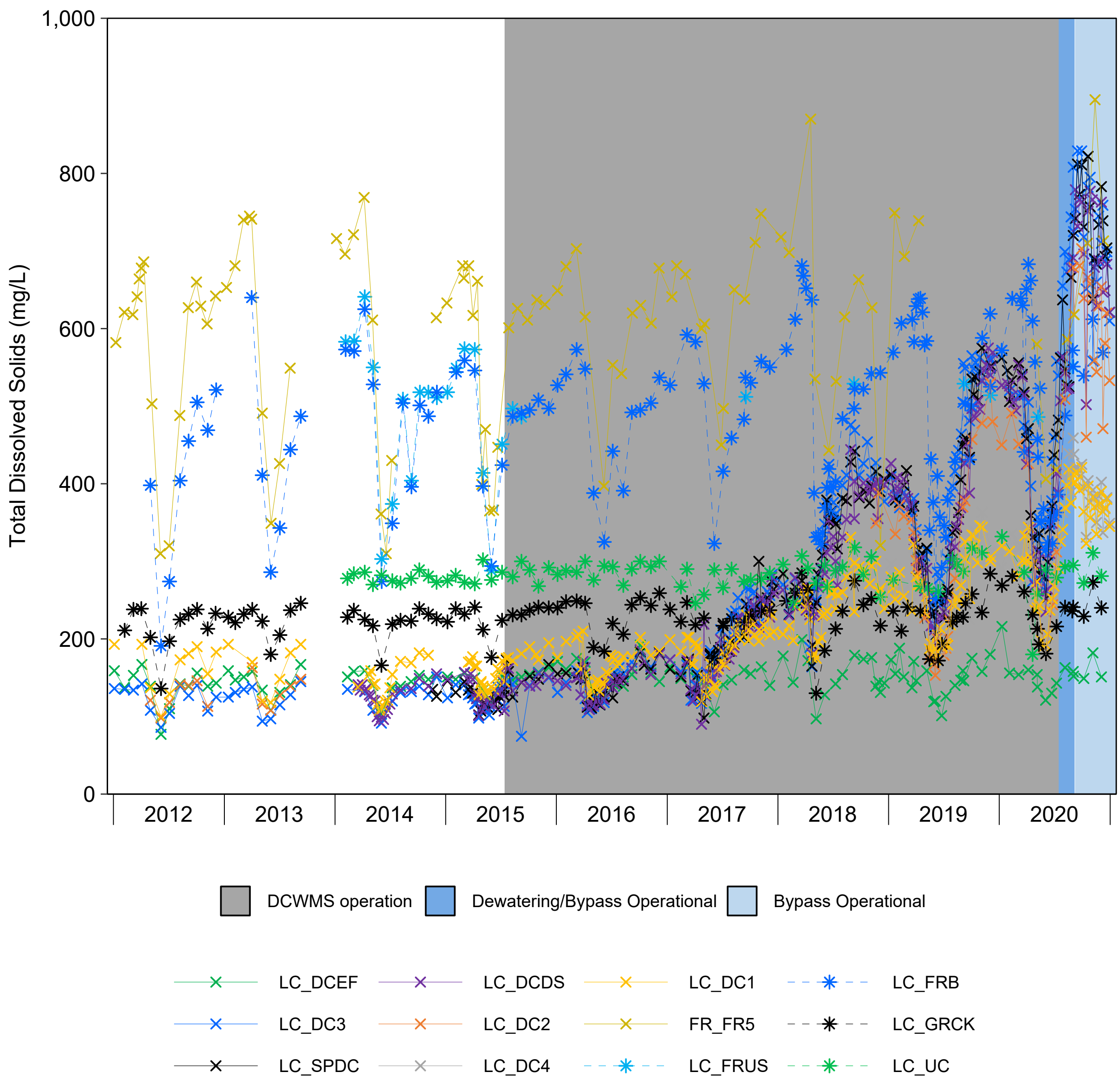

Figure B.36: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: No values below the LRL.

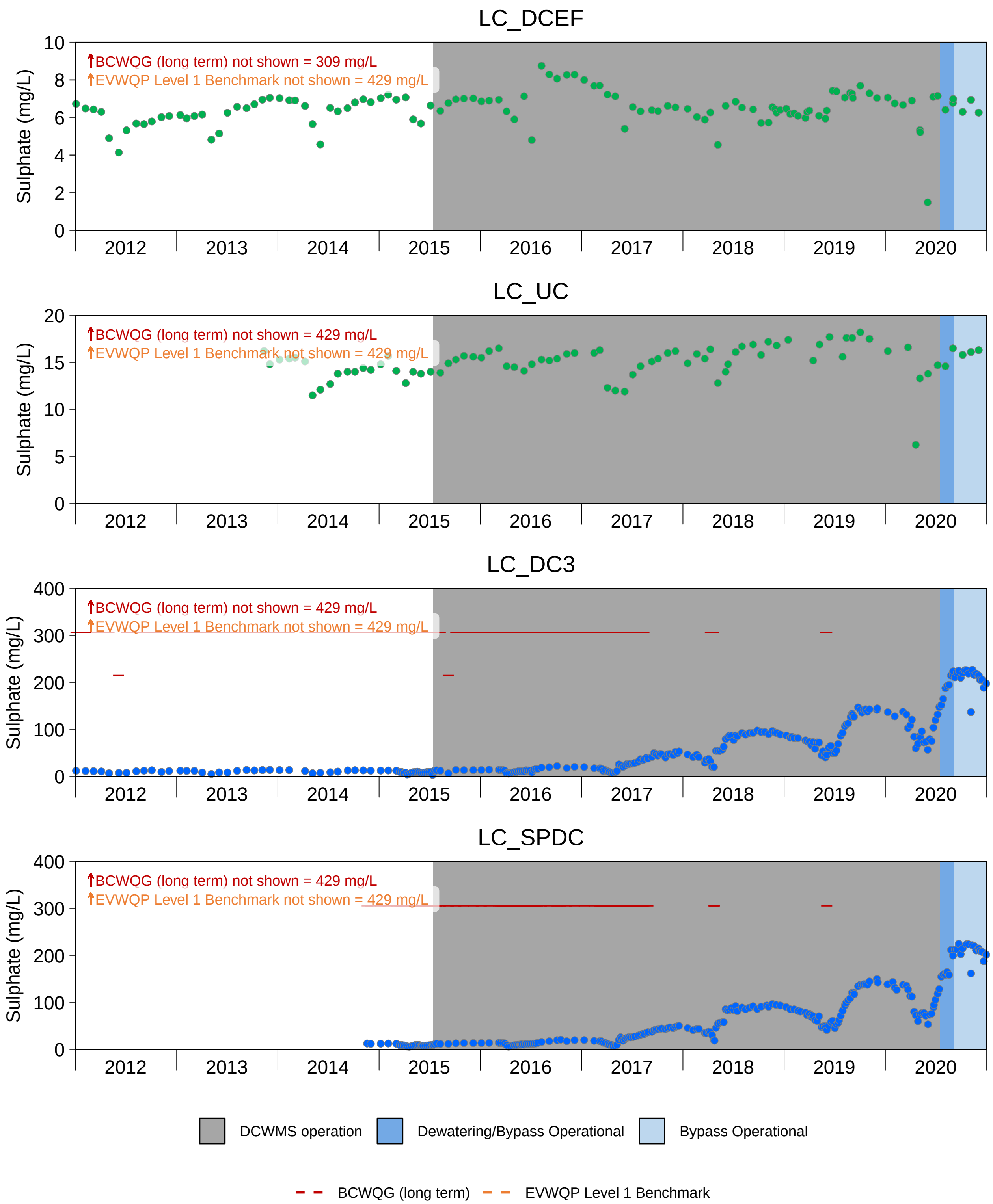

Figure B.37: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. 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).

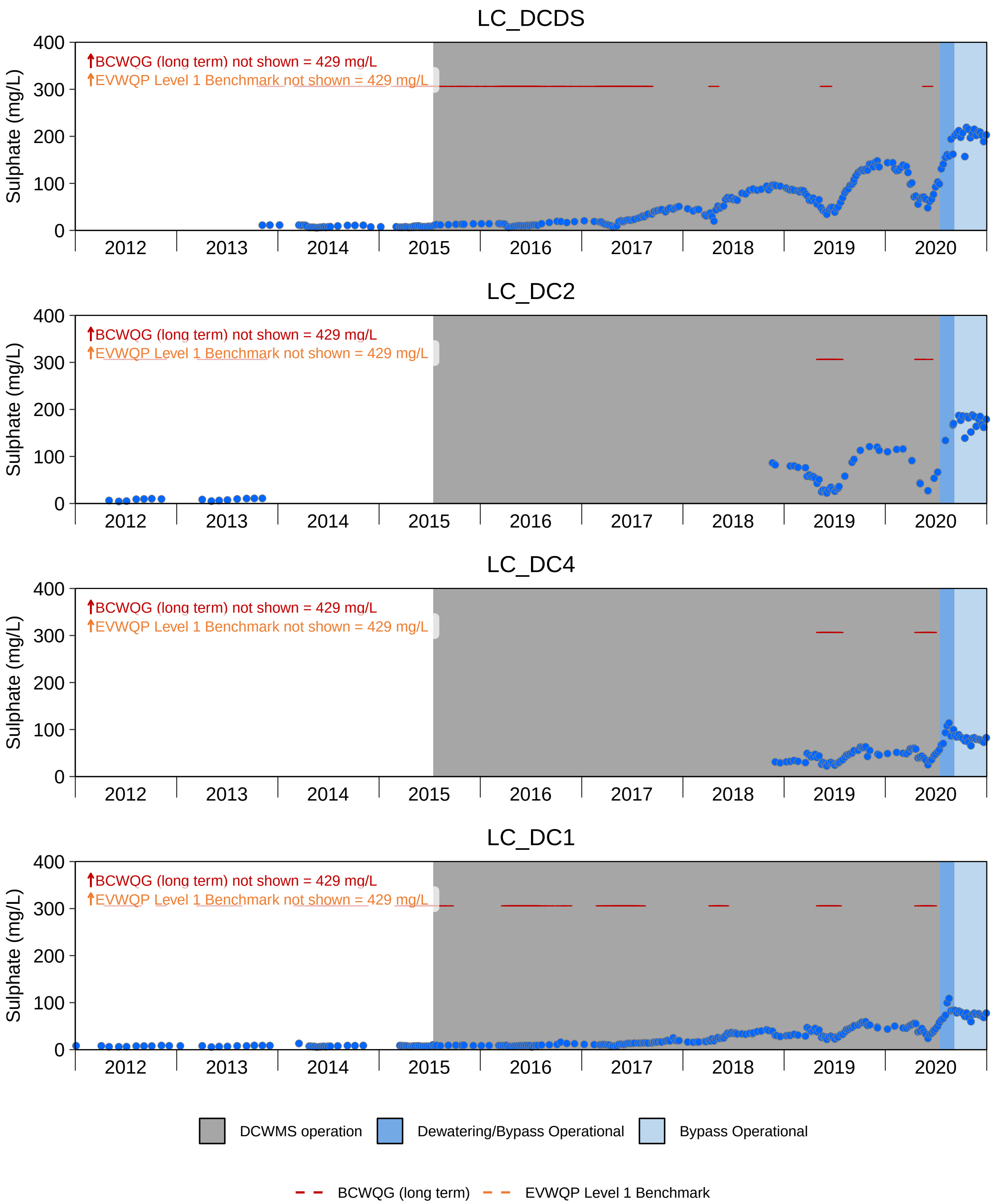

Figure B.37: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. 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).

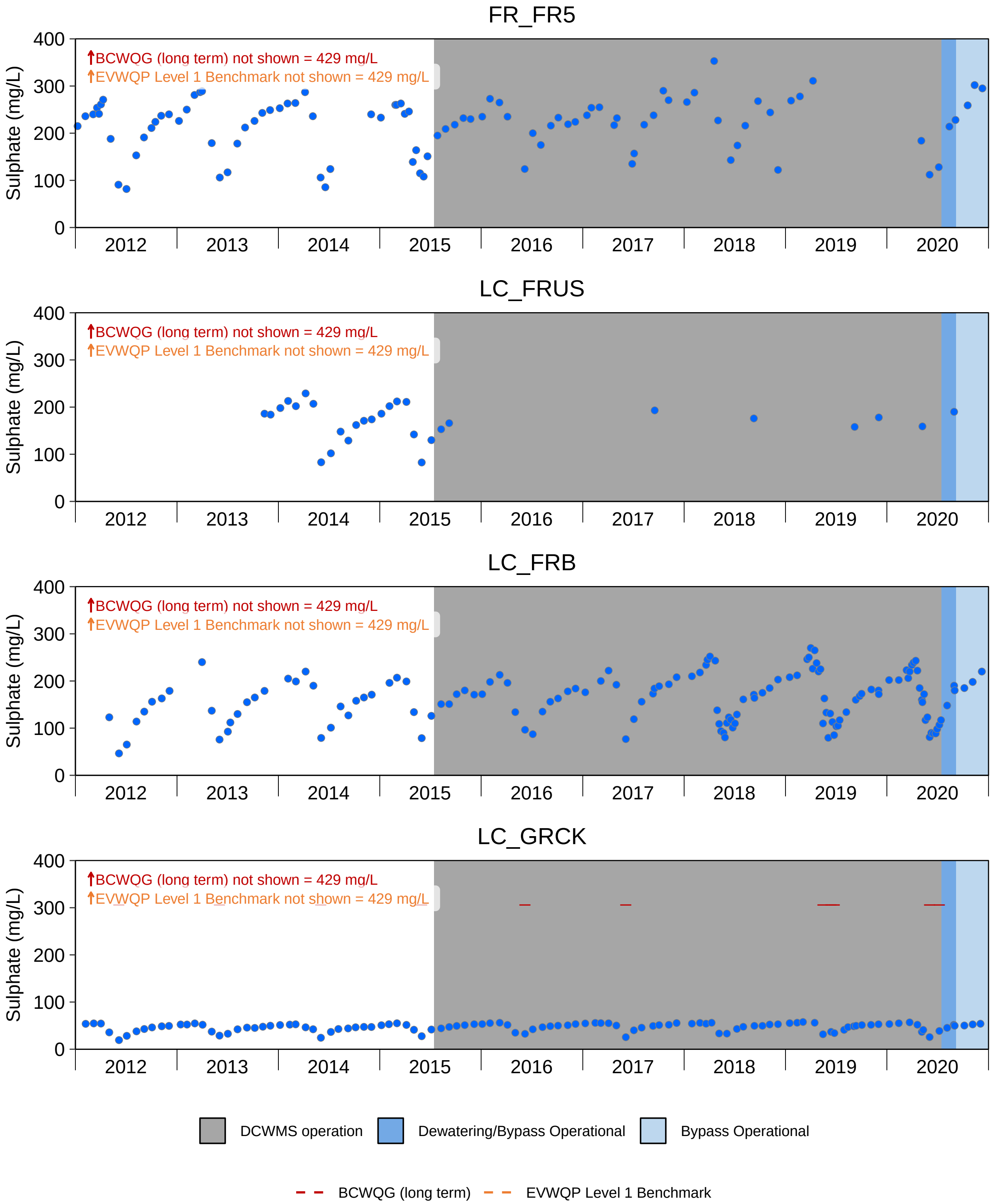

Figure B.37: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. 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).

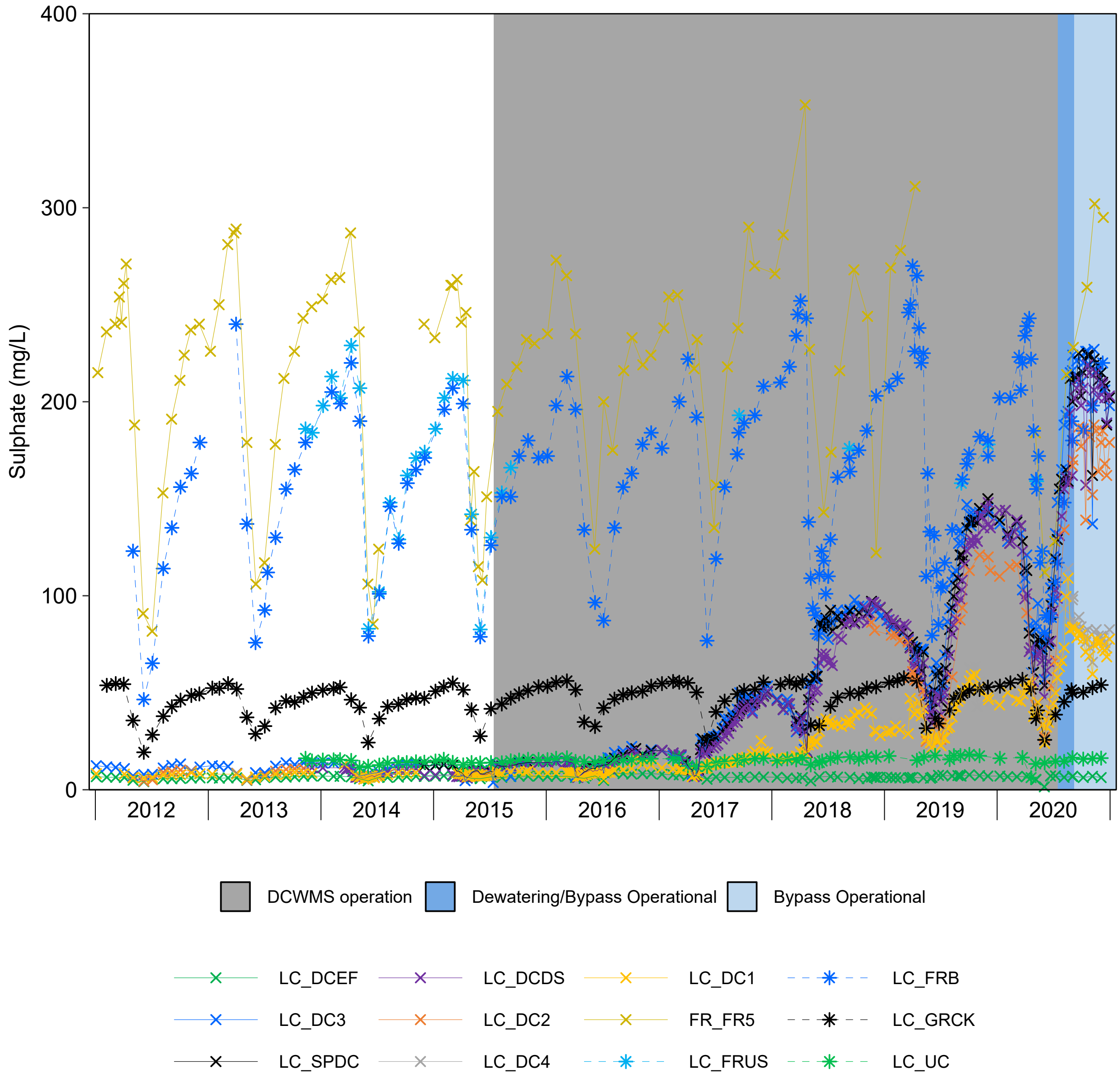

Figure B.38: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: No values below the LRL.

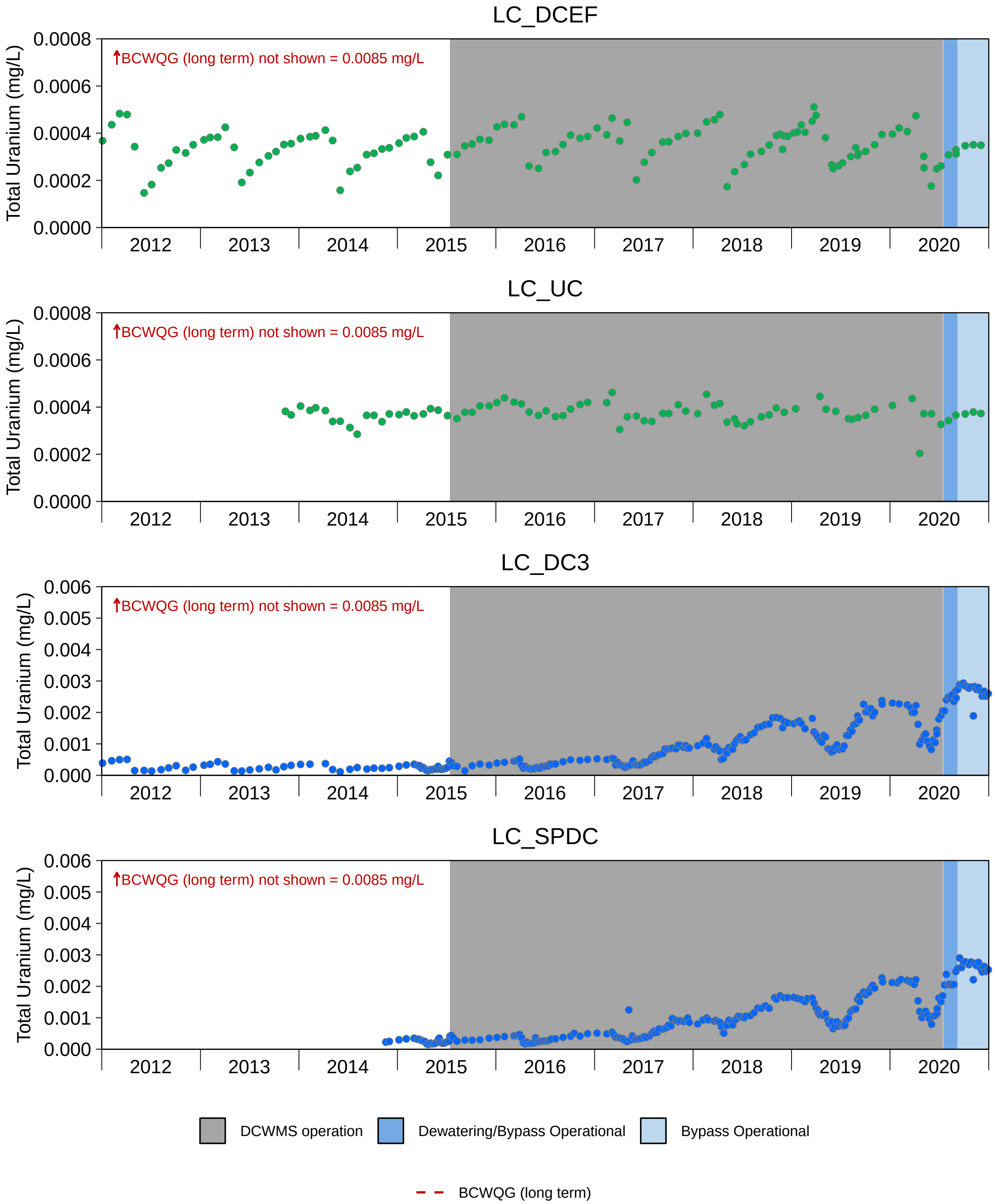

Figure B.39: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

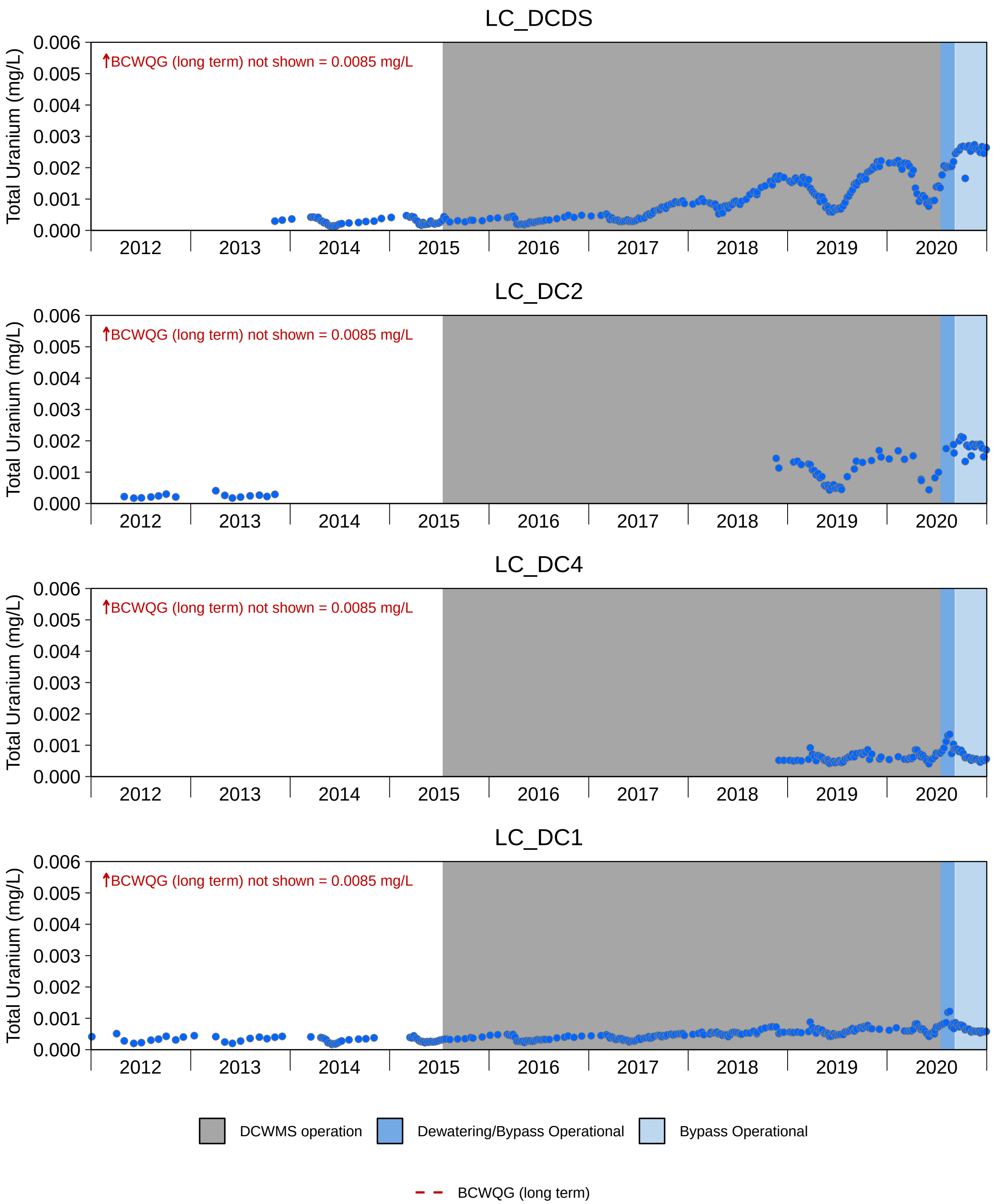

Figure B.39: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

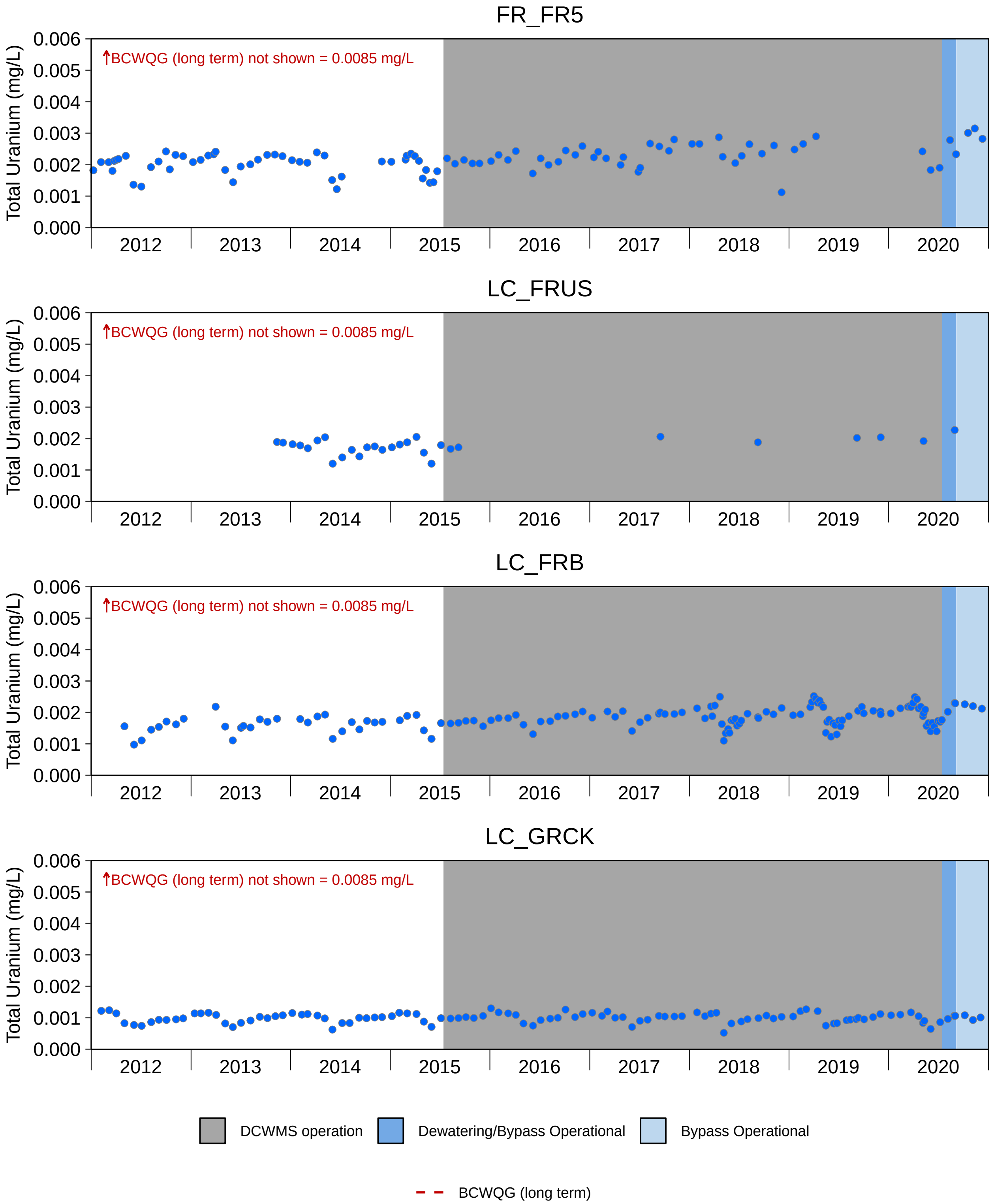

Figure B.39: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Note: 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 2019). 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).

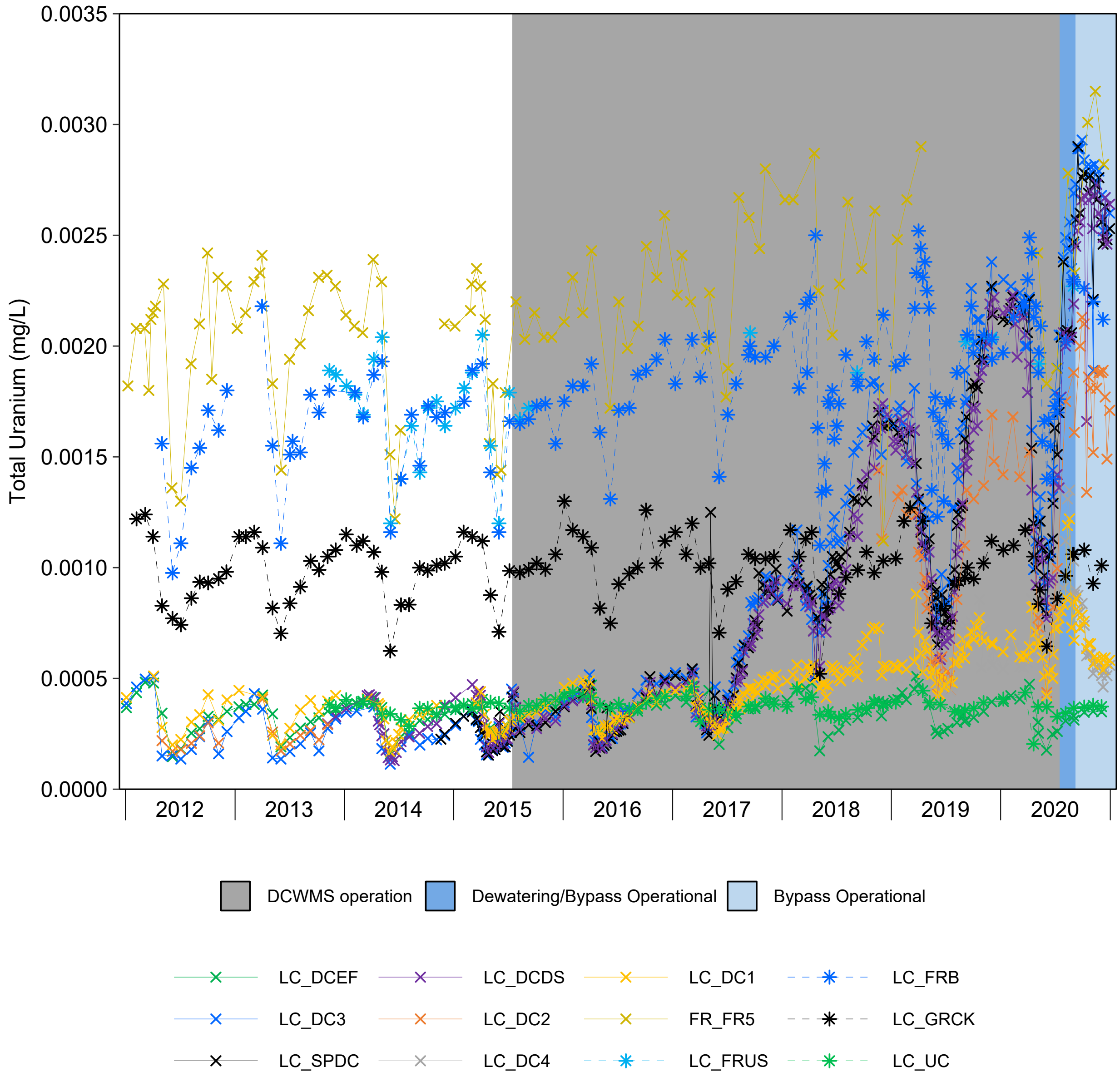

Figure B.40: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: No values below the LRL.

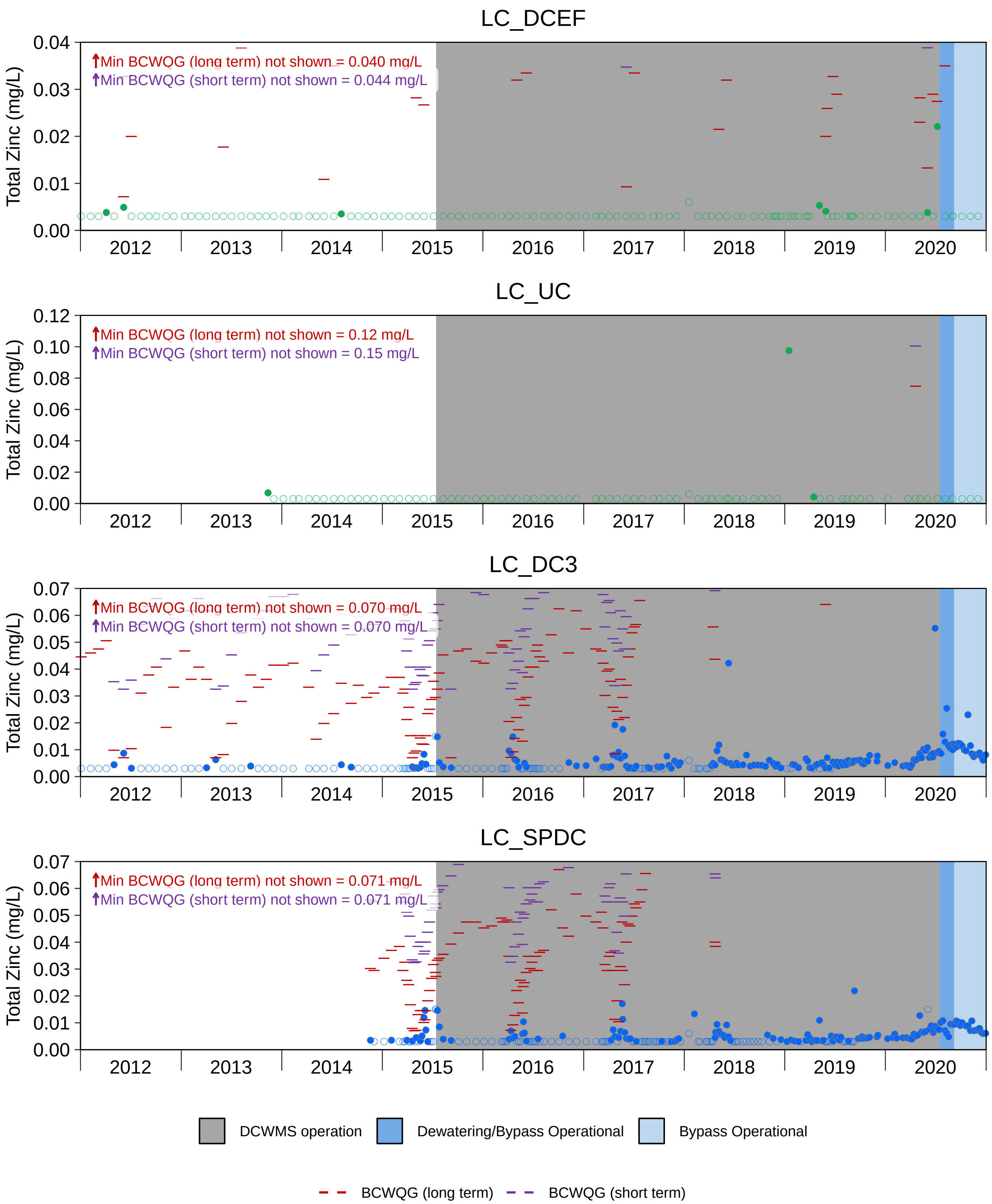

Figure B.41: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

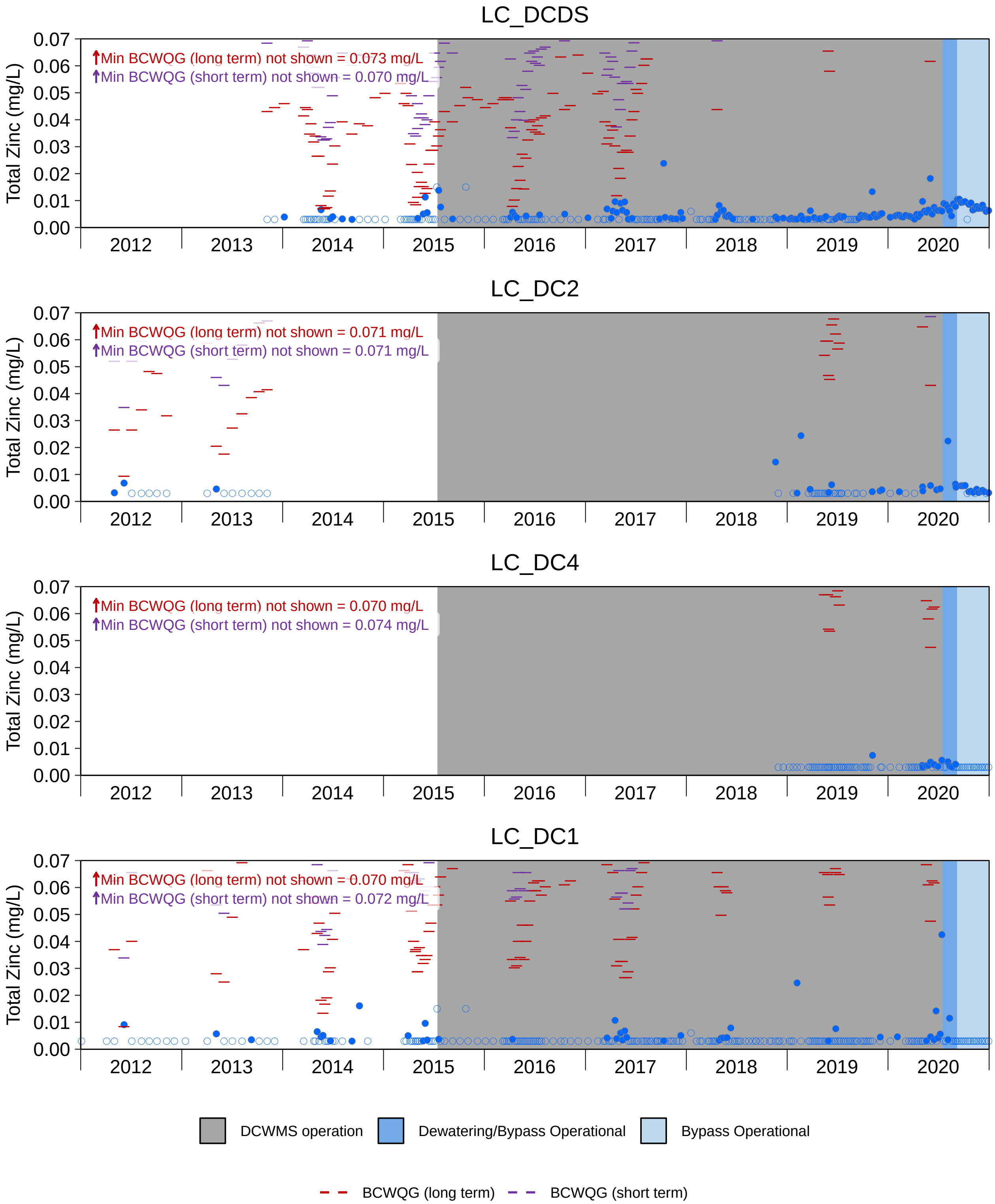

Figure B.41: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

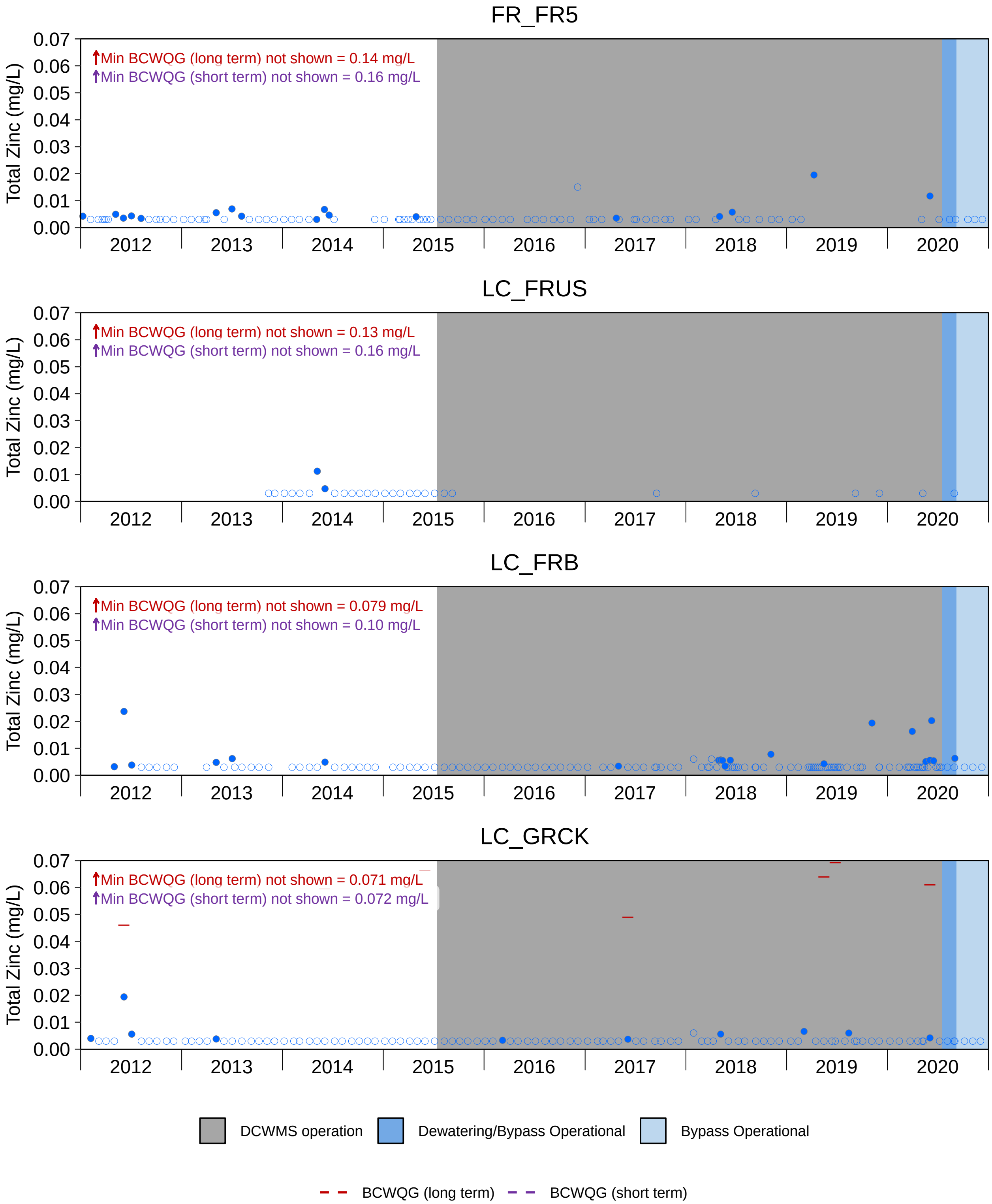

Figure B.41: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. 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 2019). 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).

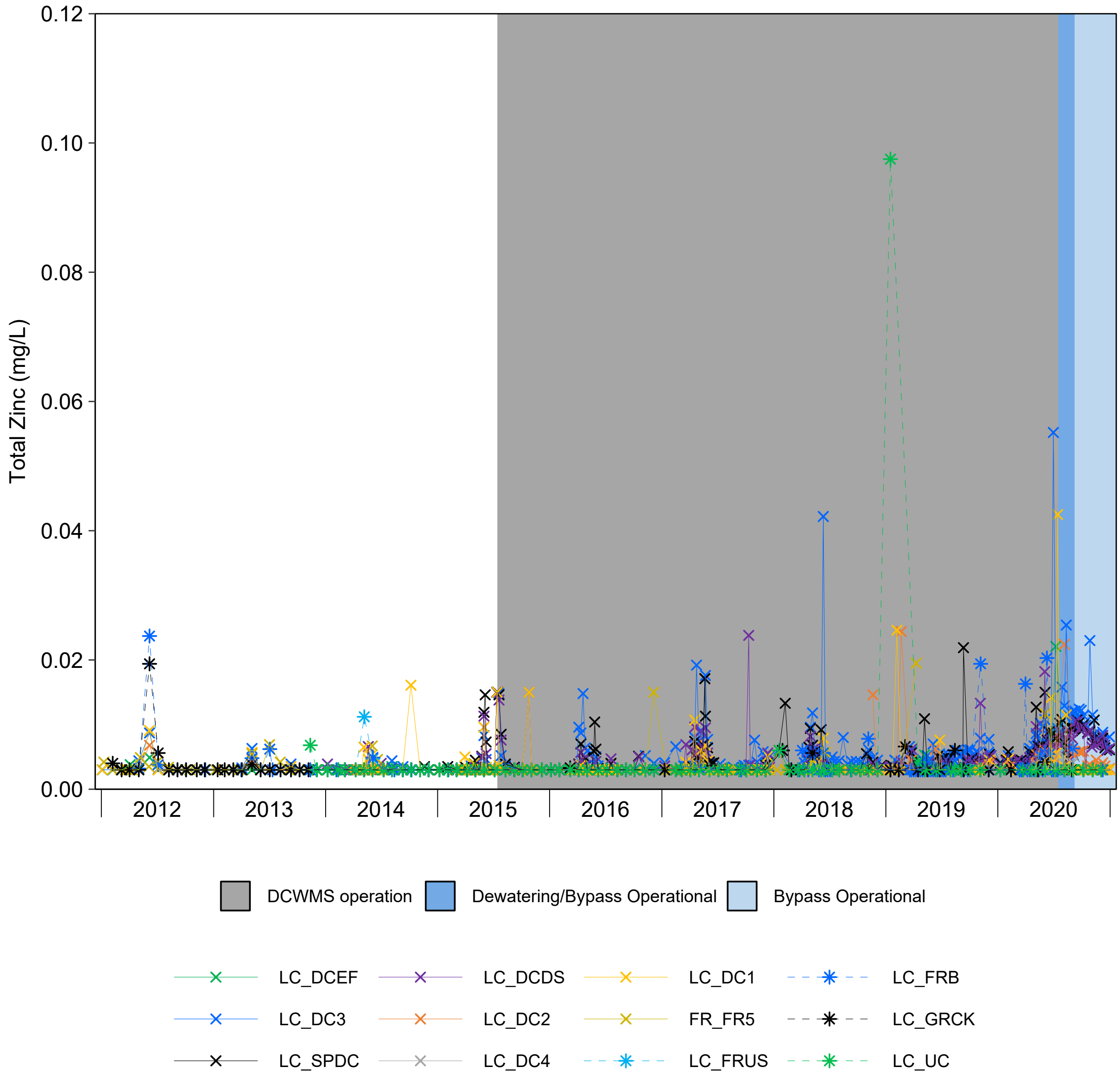

Figure B.42: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2020

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0030 and 0.015 mg/L).

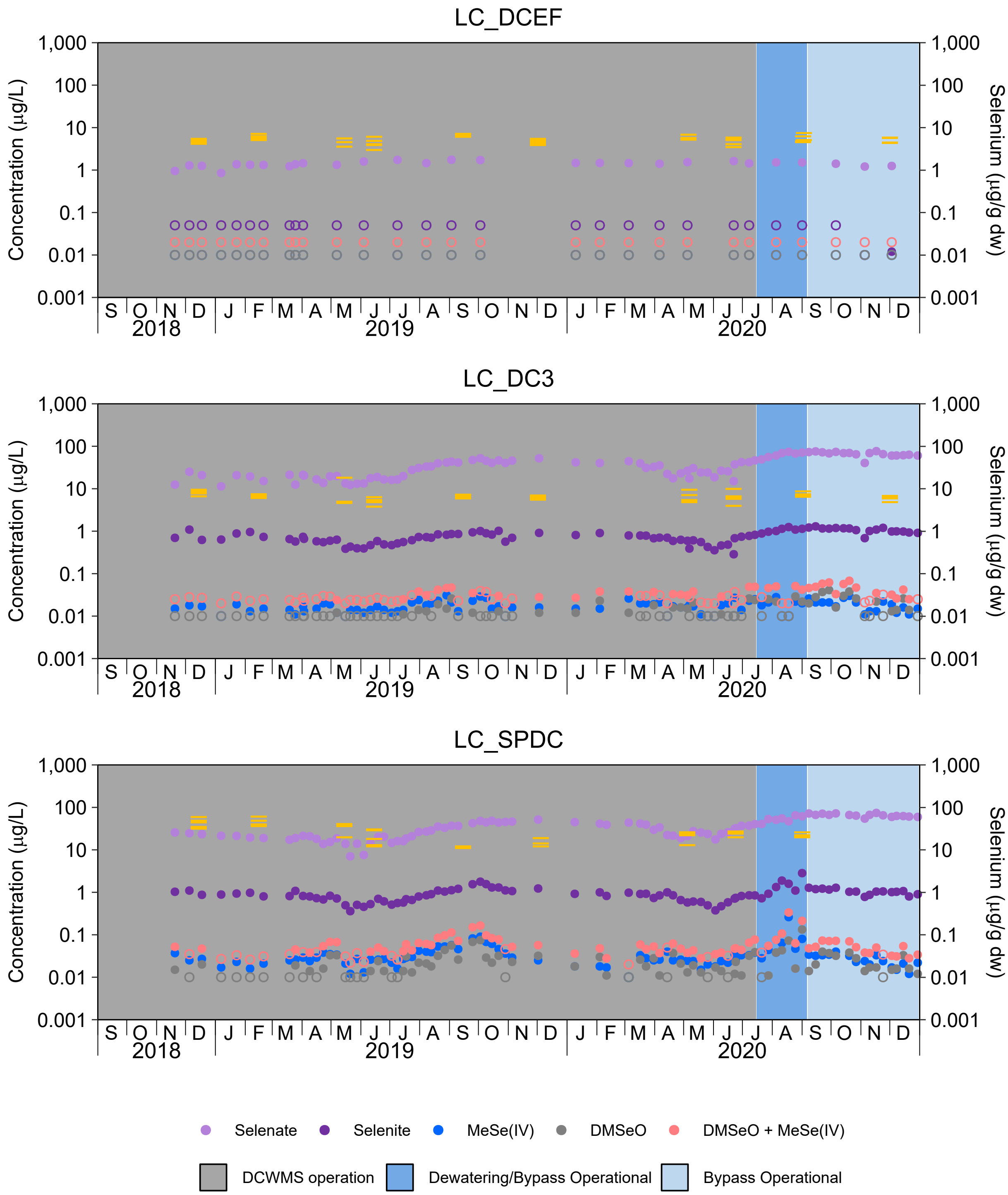

Figure B.43: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, January 2018 to December 2020

Notes: Samples at the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars.

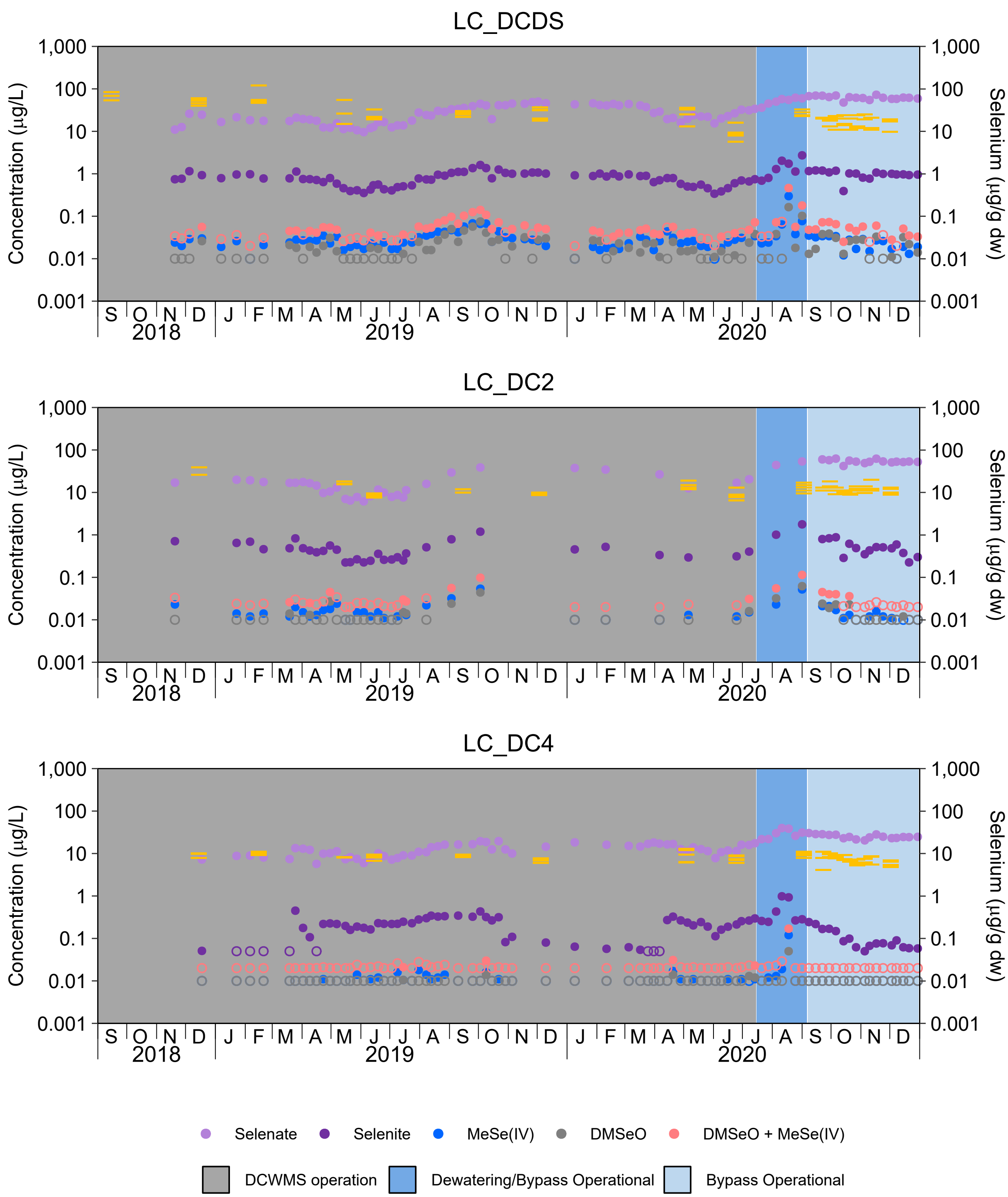

Figure B.43: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, January 2018 to December 2020

Notes: Samples at the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars.

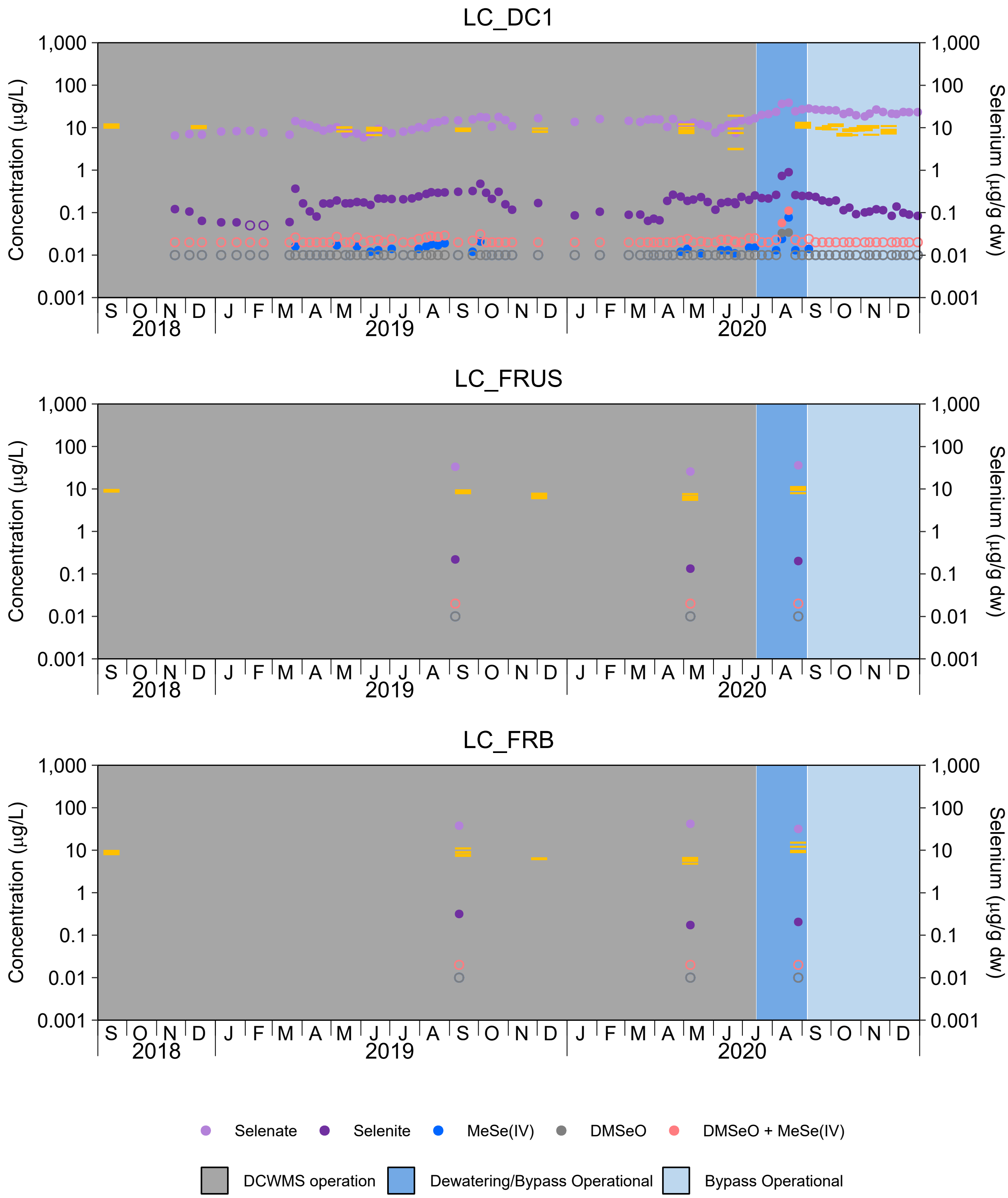

Figure B.43: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, January 2018 to December 2020

Notes: Samples at the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars.

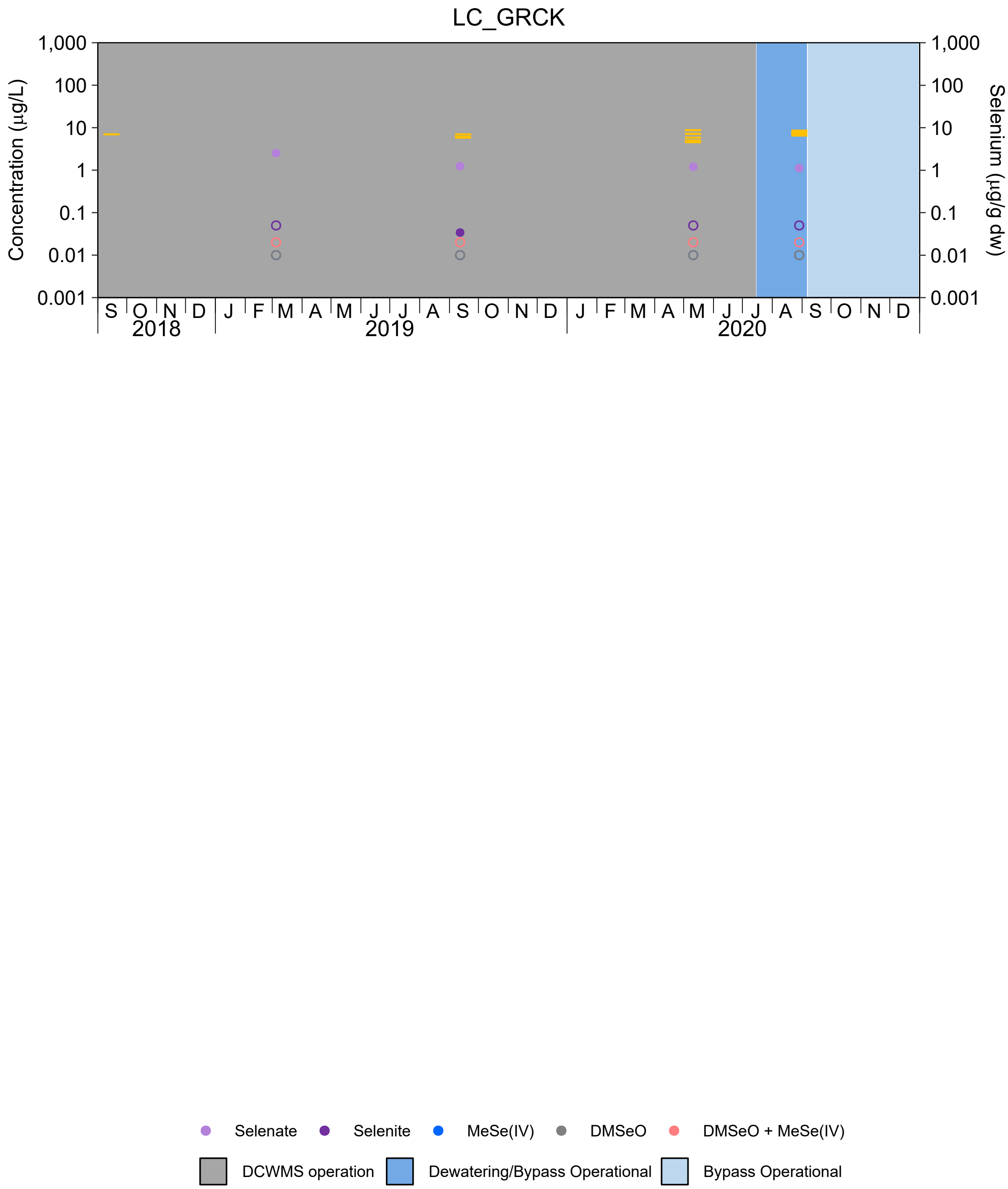

Figure B.43: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, January 2018 to December 2020

Notes: Samples at the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars.

Table B.1: British Columbia Water Quality Guidelines (BCWQG), Site-Specific Elk Valley Water Quality Plan (EVWQP) Benchmarks, and Interim Screening Values for Parameters Assessed in LCO Dry Creek LAEMP, 2020

Variable			Units	British Columbia Water Quality Guidelines[a]				Site-Specific Benchmark[b]	Dry Creek Site Performance Objective[k]
				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	-	-
Non-Metals		Unionized Ammonia[c]	mg/L	pH and Temperature dependent (tabular)	pH and Temperature dependent (tabular)	2009	Approved	-	-
Non-Metals		Chloride	mg/L	150	600	2003	Approved	-	-
Non-Metals		Fluoride	mg/L	-	For hardness ≤ 10 mg/L, BCWQG = 0.4 For hardness > 10 mg/L, BCWQG = [-51.73 + 92.57 × log10(hardness)]×0.01 Maximum applicable hardness = 385 mg/L	1990	Approved	-	-
Non-Metals		Nitrate-N	mg/L	3	33	2009	Approved	Level 1 EVWQP benchmark= $10^{1.0003[\log(hardness)]-1.52}$ Maximum applicable hardness = 500 mg/L Level 2 EVWQP benchmark= $10^{1.0003[\log(hardness)]-1.38}$ Maximum applicable hardness = 500 mg/L	-
Non-Metals		Nitrite-N[d]	mg/L	0.02 to 0.20	0.06 to 0.60	2009	Approved	-	-
Non-Metals		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	-	-
Non-Metals		pH[f]	pH units	6.5 - 9.0		1991	Approved	-	-
Non-Metals		Sulphate[g]	mg/L	128 to 429 Maximum applicable hardness = 250 mg/L	-	2013	Approved	Level 1 EVWQP Benchmark = BCWQG = 429	-
Non-Metals		Total Dissolved Solids	mg/L	-	-	-	-	Screening Level 1 Benchmark	-
Metals and Metalloids	Total	Antimony (III)	mg/L	0.009	-	2015	Working	-	-
Metals and Metalloids	Total	Arsenic	mg/L	-	0.005	2002	Approved	-	-
Metals and Metalloids	Total	Barium	mg/L	1	-	2015	Working	-	-
Metals and Metalloids	Total	Beryllium	mg/L	0.00013	-	2015	Working	-	-
Metals and Metalloids	Total	Boron	mg/L	1.2	-	2003	Approved	-	-
Metals and Metalloids	Total	Cadmium	µg/L	-	-	-	-	-	$10^{0.83(\log(hardness))-2.53}$ (Max = 0.38 µg/L; LC_GRCK, LC_UC, and LC_DCDS)
Metals and Metalloids	Total	Chromium[h]	mg/L	For Cr(VI), BCWQG = 0.001 For Cr(III), BCWQG = 0.0089	-	2015	Working	-	-
Metals and Metalloids	Total	Cobalt	mg/L	0.004	0.11	2004	Approved	-	-
Metals and Metalloids	Total	Iron	mg/L	-	1	2008	Approved	-	-
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	-	-
Metals and Metalloids	Total	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	-	-
Metals and Metalloids	Total	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	-	-
Metals and Metalloids	Total	Molybdenum	mg/L	1	2	1986	Approved	-	-
Metals and Metalloids	Total	Nickel[g]	mg/L	-	-	-	-	Level 1 Interim Screening Value = 0.0053 Level 2 Interim Screening Value = 0.015 Level 3 Interim Screening Value = 0.022	-
Metals and Metalloids	Total	Selenium	µg/L	2	-	2014	Approved	Level 1 EVWQP Benchmark = 19 Level 2 EVWQP Benchmark = 74	10 (LC_DCDS)
Metals and Metalloids	Total	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	-	-
Metals and Metalloids	Total	Thallium	mg/L	0.0008	-	1997	Working	-	-
Metals and Metalloids	Total	Uranium	mg/L	0.0085	-	2011	Working	-	-
Metals and Metalloids	Total	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	-	-
Metals and Metalloids	Dissolved	Aluminum	mg/L	When pH ≥ 6.5, BCWQG = 0.05 When pH < 6.5, BCWQG = exp[1.6 - 3.327(median pH)+ 0.402(median pH)2]	When pH ≥ 6.5, BCWQG = 0.1 When pH < 6.5, BCWQG = exp[1.209 - 2.426(pH)+ 0.286 (pH)2]	2001	Approved	-	-
Metals and Metalloids	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	-
Metals and Metalloids	Dissolved	Copper	mg/L	Biotic Ligand Model	Biotic Ligand Model	2019	Approved	-	-
Metals and Metalloids	Dissolved	Iron	mg/L	-	BCWQG = 0.35 mg/L	2008	Approved	-	-

Note: "-" = no data available.

[a] British Columbia Working (BCMOECCS 2021) or Accepted (BCMOECCS 2019) Water Quality Guidelines 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 2019)

[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.

[k] Dry Creek SPOs: Section 3.1 of Permit 106970 (ENV 2013), effective Jan 2020 (ENV 2015).

Table B.2: Seasonal Kendall Trend Analysis For Water Quality Parameters Collected at Routine Monitoring Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	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
Total Selenium (mg/L)	3.2	7	186	99	95	28	56	90	3	NS	2.9	1
Nitrate-N (mg/L)	NS	NS	571	89	114	32	56	320	NS	NS	NS	NS
Nitrite (mg/L)	NS	NS	125	31	53	24	NS	58	NS	NS	NS	26
Total Nickel (mg/L)	NS	NS	74	61	81	20	NS	15	NS	NS	NS	NS
Sulphate (mg/L)	1	2.1	88	61	81	26	43	47	2.4	NS	2.2	1.3
Total Phosphorus (mg/L)	-1.6	-19	NS	NS	NS	NS	NS	-3.8	NS	NS	NS	-4.7
Orthophosphate (mg/L)	NS	NS	-1.3	NS	NS	-4.3	NS	-5.6	5	NS	NS	NS
Total Mercury (mg/L)	5.7	NS	NS	-8.7	NS	NS	NS	NS	NS	NS	NS	NS
Total Lithium (mg/L)	NS	-1.3	16	22	14	10	11	5.1	8.2	6	6.5	NS
Total Cobalt (mg/L)	NS	NS	28	12	13	3.9	NS	NS	NS	NS	2.5	NS
Dissolved Cadmium (mg/L)	NS	NS	21	35	27	14	21	6.1	NS	NS	NS	2.3
Dissolved Cobalt (mg/L)	NS	NS	13	10	5.8	3	NS	NS	NS	NS	8	NS
Total Antimony (mg/L)	-2.4	NS	17	19	21	6.1	NS	5	NS	NS	NS	NS
Total Barium (mg/L)	1	NS	11	17	9.3	6.6	16	6.3	-1.5	NS	-1.3	0.7
Total Boron (mg/L)	-3.6	-7.7	NS	NS	NS	-1.4	NS	-2	-2.9	NS	-4	-3.8
Total Cadmium (mg/L)	NS	NS	16	20	19	9.3	20	5.5	NS	NS	NS	NS
Total Dissolved Solids (mg/L)	1.1	NS	28	32	29	14	20	10	1.8	NS	1.7	0.8
Total Kjeldahl Nitrogen (mg/L)	NS	NS	NS	NS	12	NS	NS	14	58	NS	16	NS
Total Manganese (mg/L)	NS	NS	21	NS	18	NS	NS	4.9	NS	NS	-3	-4.4
Total Molybdenum (mg/L)	NS	NS	30	30	30	7.4	NS	3.5	NS	NS	NS	NS
Total Uranium (mg/L)	1.4	NS	44	46	56	17	NS	10	3.6	NS	3.6	NS
Total Zinc (mg/L)	NS	NS	13	10	7.7	NS	NS	NS	NS	NS	NS	NS
Dimethylselenoxide	NS	-	25	NS	NS	NS	NS	NS	-	-	-	-
Methylseleninic Acid	NS	-	NS	NS	NS	NS	NS	NS	-	-	-	-
Selenite	NS	-	14	NS	NS	NS	NS	NS	-	-	-	-
Selenate	NS	-	58	65	70	76	55	47	-	-	-	-
Selenocyanate	NS	-	NS	NS	NS	NS	NS	NS	-	-	-	-
Selenosulphate	NS	-	NS	NS	NS	NS	NS	NS	-	-	-	-
Selenomethionine	NS	-	NS	NS	NS	NS	NS	NS	-	-	-	-
Unknown Selenium Species	NS	-	NS	NS	NS	NS	NS	NS	-	-	-	-

(green) 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.

(blue) 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.

Table B.3: Temporal Changes in Water Chemistry Analytes at Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	Status	Station	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] and Significance (bolded) from Base Year (b)[c]									Q2. Is the 2020 annual mean greater or less than all annual historical means (2012 - 2019) and the previous year (2019)?[c]										
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 vs. 2012-2019	2020 vs. 2019
Total Selenium	Reference	LC_DCEF	8	<0.001	b	**9.8**	8.4	**17**	**22**	**24**	**19**	**31**	**31**	E	CD	DE	BCD	AB	AB	BC	A	A	No	No
		LC_UC	6	<0.001	-	-	b	-1.5	**17**	**22**	**35**	**40**	**37**	-	-	D	D	C	BC	AB	A	AB	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	13	7.0	9.6	**64**	**307**	**1,250**	**2,004**	**3,544**	F	EF	F	F	E	D	C	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	38	**266**	**1,071**	**1,682**	**3,058**	-	-	-	E	E	D	C	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	7.1	**49**	**273**	**1,132**	**1,767**	**3,278**	-	-	F	EF	E	D	C	B	A	↑	↑
		LC_DC2	3	<0.001	b	10	-	-	-	-	-	**1,279**	**2,431**	C	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**75**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	8.1	-0.86	-1.1	18	**98**	**391**	**677**	**1,248**	E	E	E	E	E	D	C	B	A	↑	↑
		FR_FR5	7	0.001	b	18	**23**	10	8.9	**21**	**25**	-	**32**	B	AB	A	AB	AB	A	A	-	A	No	-
		LC_FRUS	1	0.148	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	**25**	**26**	17	15	**31**	**33**	**28**	**46**	D	ABC	BC	BCD	CD	ABC	AB	ABC	A	No	No
		LC_GRCK	8	0.010	b	**12**	8.2	7.7	6.9	**14**	**13**	**13**	**12**	B	A	AB	AB	AB	A	A	A	A	No	No
Nitrate-N	Reference	LC_DCEF	8	<0.001	b	4.4	8.1	13	-10	15	-10	-8.5	6.7	ABC	ABC	AB	A	C	A	C	BC	ABC	No	No
		LC_UC	6	0.011	-	-	b	-14	16	-1.5	-21	6.4	-16	-	-	AB	AB	A	AB	B	AB	AB	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	46	32	61	**211**	**1,851**	**8,920**	**11,610**	**19,466**	E	E	E	DE	D	C	B	AB	A	No	No
		LC_SPDC	5	<0.001	-	-	-	b	100	**4,163**	**20,082**	**25,812**	**43,108**	-	-	-	C	C	B	A	A	A	No	No
		LC_DCDS	6	<0.001	-	-	b	-61	21	**2,015**	**9,927**	**12,843**	**21,868**	-	-	C	C	C	B	A	A	A	No	No
		LC_DC2	3	<0.001	b	106	-	-	-	-	-	**41,027**	**73,311**	B	B	-	-	-	-	-	A	A	No	No
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**65**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	91	147	106	**371**	**3,657**	**17,644**	**27,776**	**45,390**	D	CD	CD	CD	C	B	A	A	A	No	No
		FR_FR5	7	0.001	b	**25**	**32**	13	15	16	3.8	-	14	C	AB	A	ABC	ABC	ABC	BC	-	ABC	No	-
		LC_FRUS	1	0.022	-	-	b	**-12**	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	**35**	**38**	**25**	**22**	**31**	**18**	**18**	**32**	C	AB	A	AB	AB	AB	B	B	AB	No	No
		LC_GRCK	8	<0.001	b	20	**42**	19	11	27	-2.5	32	10	BC	ABC	A	ABC	ABC	ABC	C	AB	ABC	No	No
Nitrite	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	4	<0.001	-	-	-	-	b	**2,899**	**3,880**	**1,079**	**1,025**	-	-	-	-	C	AB	A	B	B	No	No
		LC_SPDC	5	<0.001	-	-	-	b	93	**3,859**	**7,215**	**3,772**	**3,158**	-	-	-	B	B	A	A	A	A	No	No
		LC_DCDS	5	<0.001	-	-	-	b	249	**4,710**	**9,405**	**4,871**	**4,114**	-	-	-	B	B	A	A	A	A	No	No
		LC_DC2	1	0.031	-	-	-	-	-	-	-	b	-36	-	-	-	-	-	-	-	A	A	No	No
		LC_DC4	1	0.394	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	4	<0.001	-	-	-	-	b	**391**	**763**	**675**	**545**	-	-	-	-	B	A	A	A	A	No	No
		FR_FR5	7	<0.001	b	9.8	-12	**-49**	**-41**	-26	-25	-	-37	AB	A	ABC	C	C	ABC	ABC	-	BC	No	-
		LC_FRUS	1	0.171	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	0.004	b	25	-5.0	-19	-41	-0.81	-9.8	-14	-7.6	AB	A	AB	AB	B	A	AB	AB	AB	No	No
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Nickel	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	8	<0.001	b	-11	-17	9.4	26	**114**	**438**	**680**	**1,217**	D	D	D	D	D	C	B	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	3.4	**58**	**314**	**494**	**895**	-	-	-	E	E	D	C	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	46	**69**	**174**	**607**	**898**	**1,604**	-	-	E	DE	D	C	B	B	A	↑	↑
		LC_DC2	3	<0.001	b	-7.6	-	-	-	-	-	**577**	**807**	B	B	-	-	-	-	-	A	A	No	No
		LC_DC4	1	0.659	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	8	<0.001	b	-3.9	19	29	18	34	**115**	**161**	**252**	C	C	BC	BC	C	BC	AB	A	A	No	No
		FR_FR5	7	0.042	b	-0.46	-40	-43	16	-19	-19	-	-10	AB	AB	AB	B	A	AB	AB	-	AB	No	-
		LC_FRUS	1	0.033	-	-	b	-24	-	-	-	-	-	-	-	A	A	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	-28	**-54**	**-62**	**-45**	**-47**	**-43**	**-40**	-32	A	AB	BC	C	BC	BC	BC	BC	AB	No	No
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(grey)	P-value < 0.05 (annual variation).
(light green)	> 20% Decrease in concentration.
(green)	> 33% Decrease in concentration.
(medium green)	> 43% Decrease in concentration.
(dark green)	> 50% Decrease in concentration.
(light blue)	> 25% Increase in concentration.
(blue)	> 50% Increase in concentration.
(medium blue)	> 75% Increase in concentration.
(dark blue)	> 100% Increase in concentration.
*Bold	Significant increase or decrease from base year [b].

[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 minus the concentration in the first year divided by the concentration in the fist year × 100.

[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

[d] "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.

Table B.3: Temporal Changes in Water Chemistry Analytes at Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	Status	Station	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] and Significance (bolded) from Base Year (b)[c]									Q2. Is the 2020 annual mean greater or less than all annual historical means (2012 - 2019) and the previous year (2019)?[c]										
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 vs. 2012-2019	2020 vs. 2019
Sulphate	Reference	LC_DCEF	8	<0.001	b	7.2	12	**17**	**24**	**18**	6.6	**18**	10	C	BC	ABC	AB	A	AB	BC	AB	ABC	No	No
		LC_UC	6	<0.001	-	-	b	4.2	9.9	3.6	13	**25**	2.1	-	-	B	B	AB	B	AB	A	B	No	↓
	Mine-exposed	LC_DC3	8	<0.001	b	3.8	4.9	0.97	**42**	**154**	**525**	**770**	**1,270**	F	F	F	F	E	D	C	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	**29**	**136**	**486**	**700**	**1,155**	-	-	-	F	E	D	C	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	11	**51**	**180**	**588**	**831**	**1,385**	-	-	F	F	E	D	C	B	A	↑	↑
		LC_DC2	3	<0.001	b	14	-	-	-	-	-	**690**	**1,186**	C	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**53**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	2.9	8.9	12	**34**	**83**	**272**	**429**	**695**	F	F	EF	EF	E	D	C	B	A	↑	↑
		FR_FR5	7	0.037	b	10	15	11	14	21	**23**	-	21	B	AB	AB	AB	AB	AB	A	-	AB	No	-
		LC_FRUS	1	0.993	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	**23**	**23**	**24**	**21**	**35**	**33**	**34**	**36**	B	A	A	A	A	A	A	A	A	No	No
		LC_GRCK	8	<0.001	b	6.5	5.0	**12**	**14**	**16**	**15**	**15**	**13**	C	ABC	BC	AB	AB	A	AB	A	AB	No	No
Total Phosphorus	Reference	LC_DCEF	7	0.651	-	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	3	0.002	-	-	b	-	**-80**	-52	**-61**	-	-	-	-	A	-	B	AB	AB	-	-	-	-
	Mine-exposed	LC_DC3	7	0.010	-	b	1.5	-5.8	1.7	4.6	**-24**	-12	-3.5	-	A	A	AB	A	A	B	AB	AB	No	No
		LC_SPDC	5	0.012	-	-	-	b	-22	-18	**-40**	-32	-8.8	-	-	-	A	AB	AB	B	AB	AB	No	No
		LC_DCDS	6	0.040	-	-	b	-3.9	-15	-12	**-35**	-20	-4.3	-	-	A	AB	AB	AB	B	AB	AB	No	No
		LC_DC2	2	<0.001	-	b	-	-	-	-	-	**-39**	-20	-	A	-	-	-	-	-	B	A	No	↑
		LC_DC4	1	0.131	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	7	0.001	-	b	15	-12	-12	-22	**-32**	-28	-23	-	AB	A	ABC	ABC	ABC	C	BC	BC	No	No
		FR_FR5	6	0.621	-	ns	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	1	<0.001	-	-	b	**-40**	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-
		LC_FRB	7	0.019	-	b	0.53	-50	-15	-46	-7.2	-49	-38	-	A	A	A	A	A	A	A	A	No	No
		LC_GRCK	7	0.121	-	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
Orthophosphate	Reference	LC_DCEF	8	0.096	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	2	0.303	-	-	-	-	-	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	8	<0.001	b	0.90	-1.1	-11	-12	**-17**	-13	-8.9	-4.9	A	A	A	AB	AB	B	AB	AB	AB	No	No
		LC_SPDC	5	0.010	-	-	-	b	0.46	11	-2.6	4.2	**185**	-	-	-	B	B	AB	B	B	A	No	↑
		LC_DCDS	6	<0.001	-	-	b	**-70**	**-63**	-51	**-68**	**-64**	-11	-	-	A	B	B	AB	B	B	A	No	↑
		LC_DC2	3	<0.001	b	-12	-	-	-	-	-	**-72**	-41	A	A	-	-	-	-	-	B	A	No	↑
		LC_DC4	1	0.003	-	-	-	-	-	-	-	b	**40**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	-2.2	21	-31	-21	-25	**-45**	**-42**	-25	AB	AB	A	BC	ABC	BC	C	C	BC	No	No
		FR_FR5	2	0.270	-	-	ns	-	-	-	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	0.020	b	2.7	4.6	-35	-34	6.8	93	19	7.8	AB	AB	AB	B	B	AB	A	AB	AB	No	No
		LC_GRCK	8	0.399	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
Total Mercury	Reference	LC_DCEF	4	0.211	-	-	-	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	4	0.017	-	-	-	-	b	**51**	10	16	-0.42	-	-	-	-	B	A	AB	AB	B	No	No
		LC_SPDC	5	<0.001	-	-	-	b	**-66**	**-69**	**-73**	**-75**	**-75**	-	-	-	A	B	B	B	B	B	No	No
		LC_DCDS	5	<0.001	-	-	-	b	**-63**	**-60**	**-67**	**-69**	**-69**	-	-	-	A	B	B	B	B	B	No	No
		LC_DC2	1	0.385	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC4	1	0.713	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	4	0.678	-	-	-	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	1	0.003	-	-	-	-	-	b	-	-	**212**	-	-	-	-	-	B	-	-	A	↑	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	4	0.110	-	-	-	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	2	0.491	-	-	-	-	ns	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-

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[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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[d] "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.

Table B.3: Temporal Changes in Water Chemistry Analytes at Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	Status	Station	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] and Significance (bolded) from Base Year (b)[c]									Q2. Is the 2020 annual mean greater or less than all annual historical means (2012 - 2019) and the previous year (2019)?[c]										
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 vs. 2012-2019	2020 vs. 2019
Total Lithium	Reference	LC_DCEF	8	0.004	b	-3.0	-2.9	5.4	**15**	3.9	-1.0	6.3	2.0	B	B	B	AB	A	AB	B	AB	AB	No	No
		LC_UC	6	<0.001	-	-	b	3.4	**8.4**	-0.71	-3.5	1.1	-6.3	-	-	BC	AB	A	BC	BC	ABC	C	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	-3.6	-6.4	4.8	20	**30**	**85**	**131**	**250**	EF	F	F	EF	DE	D	C	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	9.0	**21**	**68**	**110**	**217**	-	-	-	E	DE	D	C	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	-10	-9.6	-18	15	**42**	**105**	-	-	CD	D	D	D	BC	B	A	↑	↑
		LC_DC2	3	<0.001	b	10	-	-	-	-	-	**73**	**123**	C	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**14**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	-0.26	-8.5	5.4	9.5	7.8	**19**	**31**	**47**	DE	DE	E	D	CD	CD	BC	B	A	↑	↑
		FR_FR5	7	<0.001	b	13	16	**35**	**62**	**63**	**56**	-	**68**	D	D	CD	BC	A	A	AB	-	A	No	-
		LC_FRUS	1	<0.001	-	-	b	**13**	-	-	-	-	-	-	-	B	A	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	**16**	**24**	**36**	**56**	**58**	**52**	**63**	**83**	E	D	CD	C	B	B	B	B	A	↑	↑
		LC_GRCK	8	0.003	b	5.1	-2.6	-8.0	-9.7	-1.8	-3.3	-7.9	0.16	AB	A	AB	B	B	AB	AB	B	AB	No	No
Total Cobalt	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	5	<0.001	-	-	-	b	12	**114**	**276**	**177**	**293**	-	-	-	D	CD	BC	AB	AB	A	No	No
		LC_SPDC	5	<0.001	-	-	-	b	-5.9	47	**133**	63	**127**	-	-	-	B	B	AB	A	AB	A	No	No
		LC_DCDS	5	<0.001	-	-	-	b	-14	45	**137**	58	**127**	-	-	-	BC	C	ABC	A	AB	A	No	No
		LC_DC2	1	0.774	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC4	1	0.853	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	3	0.577	-	-	-	ns	-	-	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	2	0.540	ns	-	ns	-	-	-	-	-	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	3	0.440	ns	ns	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Cadmium	Reference	LC_DCEF	8	<0.001	b	6.4	-3.8	-12	-8.6	-5.0	8.7	-1.6	-2.1	AB	A	AB	B	B	AB	A	AB	AB	No	No
		LC_UC	6	0.017	-	-	b	-16	-25	-22	-4.3	-15	-2.8	-	-	AB	AB	B	AB	AB	AB	A	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	-2.3	-3.9	-13	-6.0	**38**	**122**	**127**	**233**	D	D	D	D	D	C	B	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	2.1	**58**	**94**	**144**	**407**	-	-	-	D	D	C	BC	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	-24	-15	28	**59**	**85**	**289**	-	-	DE	E	E	CD	BC	B	A	↑	↑
		LC_DC2	3	<0.001	b	-0.41	-	-	-	-	-	**39**	**131**	C	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**30**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	1.6	-4.4	-13	-7.9	6.2	19	**25**	**60**	CDE	CDE	DE	E	DE	BCD	BC	B	A	↑	↑
		FR_FR5	7	0.039	b	-14	-11	-18	-26	-25	-11	-	3.1	A	A	A	A	A	A	A	-	A	No	-
		LC_FRUS	1	0.005	-	-	b	**-34**	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	15	7.8	**-26**	**-33**	**-26**	5.1	-14	-0.34	AB	A	AB	CD	D	CD	AB	BC	AB	No	No
		LC_GRCK	3	0.501	-	-	-	-	-	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
Dissolved Cobalt	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	3	0.004	-	-	-	-	-	b	**125**	40	**104**	-	-	-	-	-	B	A	AB	A	No	No
		LC_SPDC	3	0.006	-	-	-	-	-	b	64	32	**111**	-	-	-	-	-	B	AB	AB	A	No	No
		LC_DCDS	3	<0.001	-	-	-	-	-	b	**83**	23	**114**	-	-	-	-	-	C	AB	BC	A	No	↑
		LC_DC2	1	0.050	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Table B.3: Temporal Changes in Water Chemistry Analytes at Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	Status	Station	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] and Significance (bolded) from Base Year (b)[c]									Q2. Is the 2020 annual mean greater or less than all annual historical means (2012 - 2019) and the previous year (2019)?[c]										
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 vs. 2012-2019	2020 vs. 2019
Total Antimony	Reference	LC_DCEF	8	<0.001	b	**12**	6.1	6.7	2.3	0.96	-0.74	-0.69	-5.2	BC	A	AB	AB	ABC	ABC	BC	BC	C	No	No
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	8	<0.001	b	6.1	0.94	4.3	16	**55**	**144**	**168**	**157**	C	C	C	C	C	B	A	A	A	No	No
		LC_SPDC	5	<0.001	-	-	-	b	2.7	**33**	**116**	**131**	**120**	-	-	-	C	C	B	A	A	A	No	No
		LC_DCDS	6	<0.001	-	-	b	11	**18**	**55**	**146**	**162**	**157**	-	-	D	CD	C	B	A	A	A	No	No
		LC_DC2	3	<0.001	b	-0.051	-	-	-	-	-	**115**	**96**	B	B	-	-	-	-	-	A	A	No	No
		LC_DC4	1	0.051	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	8	<0.001	b	2.4	17	8.8	13	17	**37**	**45**	**31**	D	D	BCD	D	CD	BCD	AB	A	ABC	No	No
		FR_FR5	7	0.363	ns	ns	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	1	0.176	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	0.016	b	-11	-10	-15	**-26**	**-26**	-12	-19	-14	A	AB	AB	AB	B	B	AB	AB	AB	No	No
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Barium	Reference	LC_DCEF	8	<0.001	b	4.4	-0.20	4.3	3.1	**8.1**	5.7	**9.8**	**9.9**	B	AB	B	AB	AB	A	AB	A	A	No	No
		LC_UC	6	0.030	-	-	b	-0.78	-1.3	2.0	-2.0	-0.87	-6.9	-	-	AB	AB	AB	A	AB	AB	B	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	2.0	-0.24	2.5	**18**	**46**	**93**	**95**	**95**	D	CD	D	CD	C	B	A	A	A	No	No
		LC_SPDC	5	<0.001	-	-	-	b	4.4	**31**	**79**	**76**	**84**	-	-	-	C	C	B	A	A	A	No	No
		LC_DCDS	6	<0.001	-	-	b	-12	-12	0.26	**33**	**37**	**44**	-	-	B	B	B	B	A	A	A	No	No
		LC_DC2	3	<0.001	b	6.0	-	-	-	-	-	**46**	**78**	C	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**15**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	3.6	-4.4	0.98	1.8	**16**	**32**	**40**	**60**	D	D	D	D	D	C	B	B	A	↑	↑
		FR_FR5	7	<0.001	b	11	13	0.60	-1.0	-0.14	-10	-	-7.5	AB	A	A	AB	AB	AB	B	-	B	No	-
		LC_FRUS	1	0.359	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	6.1	3.8	1.0	-5.1	3.3	-7.0	-7.4	-7.2	AB	A	AB	AB	AB	AB	B	B	B	No	No
		LC_GRCK	8	0.070	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
Total Boron	Reference	LC_DCEF	7	<0.001	b	-7.3	-2.3	**-13**	**-24**	-	**-24**	**-21**	**-22**	A	AB	A	BC	D	-	D	CD	CD	No	No
		LC_UC	6	<0.001	-	-	b	**-14**	**-22**	**-30**	**-30**	**-26**	**-32**	-	-	A	B	C	D	D	CD	D	No	No
	Mine-exposed	LC_DC3	4	0.285	ns	-	ns	ns	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_SPDC	3	0.032	-	-	-	b	-	-	**-7.6**	**-8.1**	-4.9	-	-	-	A	-	-	B	B	AB	No	No
		LC_DCDS	3	<0.001	-	-	b	**-10**	-	-	-	**-16**	**-14**	-	-	A	B	-	-	-	B	B	No	No
		LC_DC2	3	0.007	b	-1.2	-	-	-	-	-	**-19**	-18	A	AB	-	-	-	-	-	B	AB	No	No
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	4	0.001	b	-0.22	7.3	-6.0	-	-	-	-	**-16**	A	A	A	AB	-	-	-	-	B	No	-
		FR_FR5	6	<0.001	b	-7.3	-5.0	-12	**-30**	-	**-26**	-	**-23**	A	AB	A	ABC	D	-	CD	-	BCD	No	-
		LC_FRUS	1	0.267	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	3	0.359	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	8	<0.001	b	2.0	4.5	**-12**	**-18**	**-18**	**-18**	**-19**	**-14**	A	A	A	B	B	B	B	B	B	No	No
Total Cadmium	Reference	LC_DCEF	8	0.076	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	6	<0.001	-	-	b	**-56**	**-63**	**-55**	**-50**	**-55**	**-53**	-	-	A	B	B	B	B	B	B	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	-7.0	-4.7	20	38	**89**	**106**	**111**	**200**	DE	E	DE	DE	CD	BC	AB	AB	A	No	No
		LC_SPDC	5	<0.001	-	-	-	b	-18	2.0	25	28	**125**	-	-	-	BC	C	BC	B	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	28	6.1	42	**64**	**76**	**204**	-	-	C	BC	C	BC	B	B	A	↑	↑
		LC_DC2	3	<0.001	b	-7.8	-	-	-	-	-	50	**116**	BC	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**28**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	0.004	b	2.0	-1.1	15	-0.91	3.4	18	26	**53**	B	B	B	AB	B	B	AB	AB	A	No	No
		FR_FR5	7	0.002	b	18	0.62	-18	-17	-19	-7.3	-	16	AB	A	AB	B	B	B	AB	-	AB	No	-
		LC_FRUS	1	0.004	-	-	b	**-24**	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	-16	-25	**-40**	**-47**	**-41**	-30	**-36**	-27	A	AB	ABC	BC	C	BC	ABC	BC	ABC	No	No
		LC_GRCK	6	0.227	-	ns	-	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-

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[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year minus the concentration in the first year divided by the concentration in the fist year × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.
[d] "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.

Table B.3: Temporal Changes in Water Chemistry Analytes at Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	Status	Station	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] and Significance (bolded) from Base Year (b)[c]									Q2. Is the 2020 annual mean greater or less than all annual historical means (2012 - 2019) and the previous year (2019)?[c]										
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 vs. 2012-2019	2020 vs. 2019
Total Dissolved Solids	Reference	LC_DCEF	8	0.003	b	7.0	6.5	8.7	**13**	8.9	**12**	10	**15**	B	AB	AB	AB	A	AB	A	AB	A	No	No
		LC_UC	6	0.449	-	-	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	8	<0.001	b	6.2	1.6	3.2	**22**	**58**	**174**	**220**	**345**	E	DE	DE	DE	D	C	B	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	10	**37**	**139**	**176**	**289**	-	-	-	E	E	D	C	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	5.7	14	**42**	**141**	**178**	**287**	-	-	D	D	D	C	B	B	A	↑	↑
		LC_DC2	3	<0.001	b	17	-	-	-	-	-	**133**	**224**	C	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**23**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_DC1	8	<0.001	b	3.7	-3.7	4.3	8.0	**18**	**54**	**64**	**100**	D	CD	D	D	CD	C	B	B	A	↑	↑
		FR_FR5	7	0.099	ns	ns	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	1	0.496	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	14	**14**	**14**	**14**	**22**	**20**	**19**	**25**	B	AB	A	A	A	A	A	A	A	No	No
		LC_GRCK	8	0.116	ns	ns	ns	ns	ns	ns	ns	ns	**ns**	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	Reference	LC_DCEF	8	0.576	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	6	0.215	-	-	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	7	<0.001	b	34	50	49	91	**340**	**412**	47	-	B	B	B	B	B	A	A	B	-	-	-
		LC_SPDC	5	<0.001	-	-	-	b	2.9	**109**	**142**	-6.3	**-70**	-	-	-	A	A	A	A	A	B	↓	↓
		LC_DCDS	6	<0.001	-	-	b	67	74	**244**	**416**	94	-43	-	-	CD	BC	BC	AB	A	BC	D	No	↓
		LC_DC2	2	0.097	ns	ns	-	-	-	-	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		LC_DC4	1	<0.001	-	-	-	-	-	-	-	b	**-60**	-	-	-	-	-	-	-	A	B	↓	↓
		LC_DC1	8	<0.001	b	45	37	14	29	82	**249**	**219**	19	B	B	B	B	B	AB	A	A	B	No	↓
		FR_FR5	4	<0.001	b	-	-	48	**350**	**806**	**295**	-	-	C	-	-	BC	A	A	AB	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	7	<0.001	b	-0.47	-	52	140	**687**	**448**	132	-7.4	C	C	-	C	BC	A	AB	BC	C	No	No
		LC_GRCK	8	0.659	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
Total Manganese	Reference	LC_DCEF	8	0.013	b	49	-46	-79	-56	-51	-57	5.3	-40	AB	A	AB	B	AB	AB	AB	AB	AB	No	No
		LC_UC	6	<0.001	-	-	b	**-74**	**-74**	-58	-60	-62	**-66**	-	-	A	B	B	AB	AB	AB	B	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	-29	26	150	**270**	**1,067**	**1,307**	**624**	**432**	EF	F	EF	DE	CD	AB	A	ABC	BCD	No	No
		LC_SPDC	5	<0.001	-	-	-	b	42	**148**	**255**	74	**129**	-	-	-	C	BC	AB	A	ABC	AB	No	No
		LC_DCDS	6	<0.001	-	-	b	117	**215**	**605**	**782**	**359**	**444**	-	-	D	CD	BC	AB	A	ABC	AB	No	No
		LC_DC2	3	<0.001	b	-20	-	-	-	-	-	**290**	59	B	B	-	-	-	-	-	A	B	No	↓
		LC_DC4	1	0.213	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	8	0.106	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	7	0.075	ns	ns	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	1	<0.001	-	-	b	**-28**	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-
		LC_FRB	8	0.026	b	-10	-26	-46	-48	-44	-33	-42	-38	A	A	A	A	A	A	A	A	A	No	No
		LC_GRCK	8	0.086	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
Total Molybdenum	Reference	LC_DCEF	8	0.448	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	6	<0.001	-	-	b	5.5	6.0	5.5	**8.5**	1.0	**8.3**	-	-	B	AB	AB	AB	A	B	A	No	↑
	Mine-exposed	LC_DC3	8	<0.001	b	-1.4	-6.5	-9.6	13	**55**	**180**	**247**	**266**	DE	DE	DE	E	D	C	B	A	A	No	No
		LC_SPDC	5	<0.001	-	-	-	b	15	**60**	**187**	**240**	**262**	-	-	-	D	D	C	B	A	A	No	No
		LC_DCDS	6	<0.001	-	-	b	0.11	16	**57**	**177**	**226**	**253**	-	-	D	D	D	C	B	A	A	No	No
		LC_DC2	3	<0.001	b	6.3	-	-	-	-	-	**158**	**159**	B	B	-	-	-	-	-	A	A	No	No
		LC_DC4	1	0.274	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	8	<0.001	b	2.7	-3.8	-2.7	4.8	8.2	**33**	**40**	**33**	B	B	B	B	B	B	A	A	A	No	No
		FR_FR5	7	0.002	b	0.35	-7.4	-11	-0.65	-7.0	-13	-	10	AB	AB	AB	B	AB	AB	B	-	A	No	-
		LC_FRUS	1	0.980	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	0.027	b	0.79	-3.7	-5.7	-2.9	-5.7	-3.1	1.8	7.6	AB	AB	AB	B	AB	B	AB	AB	A	No	No
		LC_GRCK	8	0.525	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-

- 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].

[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 minus the concentration in the first year divided by the concentration in the fist year × 100.
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[d] "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.

Table B.3: Temporal Changes in Water Chemistry Analytes at Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	Status	Station	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] and Significance (bolded) from Base Year (b) [c]									Q2. Is the 2020 annual mean greater or less than all annual historical means (2012 - 2019) and the previous year (2019)?[c]										
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 vs. 2012-2019	2020 vs. 2019
Total Uranium	Reference	LC_DCEF	8	0.003	b	2.7	0.40	7.8	**16**	15	8.1	13	7.7	B	AB	B	AB	A	AB	AB	AB	AB	No	No
		LC_UC	6	0.023	-	-	b	6.3	**11**	5.3	4.5	9.6	0.31	-	-	B	AB	A	AB	AB	AB	AB	No	No
	Mine-exposed	LC_DC3	8	<0.001	b	-4.3	-7.5	3.4	**45**	**112**	**359**	**480**	**713**	E	E	E	E	D	C	B	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	**25**	**93**	**288**	**390**	**607**	-	-	-	F	E	D	C	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	10	**27**	**81**	**277**	**372**	**576**	-	-	F	EF	E	D	C	B	A	↑	↑
		LC_DC2	3	<0.001	b	13	-	-	-	-	-	**301**	**453**	C	C	-	-	-	-	-	B	A	↑	↑
		LC_DC4	1	0.039	-	-	-	-	-	-	-	b	12	-	-	-	-	-	-	-	A	A	No	No
		LC_DC1	8	<0.001	b	3.9	-3.5	0.090	11	**20**	**64**	**80**	**103**	D	CD	D	D	CD	C	B	AB	A	No	No
		FR_FR5	7	<0.001	b	7.0	5.2	2.9	13	16	**19**	-	**31**	C	BC	BC	BC	ABC	ABC	AB	-	A	No	-
		LC_FRUS	1	0.291	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	8	<0.001	b	11	9.4	9.9	**19**	**25**	**26**	**30**	**37**	D	CD	CD	CD	BC	AB	AB	AB	A	No	No
		LC_GRCK	8	0.249	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
Total Zinc	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	7	<0.001	b	-4.4	-	19	23	**94**	**89**	**110**	**256**	D	D	-	CD	BCD	BC	BC	B	A	↑	↑
		LC_SPDC	5	<0.001	-	-	-	b	-21	-12	0.31	17	**92**	-	-	-	BC	C	BC	BC	B	A	↑	↑
		LC_DCDS	6	<0.001	-	-	b	4.1	-8.1	38	6.8	33	**124**	-	-	B	B	B	B	B	B	A	↑	↑
		LC_DC2	2	0.041	b	-	-	-	-	-	-	45	114	A	-	-	-	-	-	-	A	A	No	No
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	5	0.609	-	-	ns	ns	-	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	2	0.397	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	3	0.684	ns	ns	-	-	-	-	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenite	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	1	<0.001	-	-	-	-	-	-	-	b	**21**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_SPDC	1	0.292	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DCDS	1	0.172	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC2	1	0.988	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC4	1	0.348	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	1	0.735	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylseleninic Acid	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	1	0.044	-	-	-	-	-	-	-	b	8.8	-	-	-	-	-	-	-	A	A	No	No
		LC_SPDC	1	0.353	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DCDS	1	0.548	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC2	1	0.003	-	-	-	-	-	-	-	b	**-30**	-	-	-	-	-	-	-	A	B	↓	↓
		LC_DC4	1	0.423	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	1	0.969	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

P-value < 0.05 (annual variation).
\> 20% Decrease in concentration.
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[d] "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.

Table B.3: Temporal Changes in Water Chemistry Analytes at Stations, Dry Creek LAEMP, 2012 to 2020

Parameter	Status	Station	Annual Variation [a]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring?									Q2. Is the 2020 annual mean greater or less than all annual historical means (2012 - 2019) and the previous year (2019)?[c]										
					Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]																			
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 vs. 2012-2019	2020 vs. 2019
Dimethylseleneoxide	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mine-exposed	LC_DC3	1	<0.001	-	-	-	-	-	-	-	b	**75**	-	-	-	-	-	-	-	B	A	↑	↑
		LC_SPDC	1	0.115	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DCDS	1	0.125	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC2	1	0.751	-	-	-	-	-	-	-	ns	ns	-	-	-	-	-	-	-	-	-	-	-
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_DC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

P-value < 0.05 (annual variation).
> 20% Decrease in concentration.
> 33% Decrease in concentration.
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[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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[c] Significance between each year determined using all pairwise comparisons with Tukey correction.
[d] "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.

Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	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 Antimony (mg/L)	Total Arsenic (mg/L)
LC_DCEF	n	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	Annual Minimum	121	7.18	7.80	9.60	104	0.0280	<0.001	<0.005	0.00750	0.0133	1.49	0.190	<0.02	0.000120	0.000160
	Annual Maximum	216	8.39	8.63	12.4	159	0.277	<0.001	0.0854	0.0290	0.0199	7.15	0.500	0.135	0.000150	0.000280
	Annual Mean	155	8.21	7.98	10.9	136	0.111	<0.001	0.0169	0.0155	0.0148	6.22	0.263	0.103	0.000129	0.000191
	Annual Median	154	8.29	7.94	10.7	142	0.0984	<0.001	0.00870	0.0150	0.0142	6.75	0.220	0.111	0.000130	0.000180
	% < LRL	0%	0%	0%	0%	0%	0%	100%	33%	0%	0%	0%	60%	7%	0%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_DC3	n	48	48	49	49	48	48	48	48	48	48	48	48	48	48	48
	Annual Minimum	262	7.77	7.71	9.51	100	8.89	<0.001	<0.005	0.0214	0.0259	56.9	3.82	0.0610	0.000370	0.000310
	Annual Maximum	829	8.36	8.61	17.6	160	47.6	0.0483	0.0909	0.0660	0.0428	227	18.7	0.150	0.000660	0.000600
	Annual Mean	567	8.20	8.09	11.5	135	31.1	0.0135	0.0125	0.0375	0.0318	155	12.5	0.0988	0.000502	0.000389
	Annual Median	568	8.20	8.11	11.7	141	30.4	0.00770	0.00580	0.0370	0.0309	150	13.4	0.0995	0.000490	0.000385
	% < LRL	0%	0%	0%	0%	0%	0%	21%	48%	0%	0%	0%	0%	27%	0%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	46%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	100%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	100%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_SPDC	n	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
	Annual Minimum	252	8.03	7.78	8.60	99.4	8.54	0.00320	<0.005	0.0135	<0.001	53.7	3.30	0.0650	0.000380	0.000290
	Annual Maximum	822	8.37	8.75	13.9	173	46.8	0.137	0.135	0.0708	0.0424	225	19.2	0.150	0.000630	0.000570
	Annual Mean	549	8.22	8.17	11.1	134	29.2	0.0239	0.0268	0.0327	0.0272	149	12.3	0.0951	0.000486	0.000372
	Annual Median	546	8.22	8.17	11.5	142	28.5	0.0117	0.0160	0.0330	0.0298	144	13.0	0.0860	0.000470	0.000360
	% < LRL	0%	0%	0%	0%	0%	0.0%	6%	9%	0%	2%	0%	0%	30%	0%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	38%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	100%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	100%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_DCDS	n	49	49	50	50	49	49	49	49	49	49	49	49	49	49	49
	Annual Minimum	235	7.84	7.80	8.53	102	7.57	0.00380	<0.005	0.0103	0.00220	47.9	3.13	0.0390	0.000330	0.000210
	Annual Maximum	779	8.39	8.77	13.3	160	45.4	0.109	0.0884	0.125	0.0407	219	21.7	0.140	0.000630	0.000820
	Annual Mean	528	8.22	8.18	11.2	136	28.2	0.0208	0.0184	0.0321	0.0265	142	11.9	0.0899	0.000468	0.000366
	Annual Median	526	8.23	8.18	11.7	145	28.1	0.0109	0.0112	0.0330	0.0293	141	12.8	0.0830	0.000470	0.000350
	% < LRL	0%	0%	0%	0%	0%	0.0%	16%	8%	0%	0%	0%	0%	35%	0%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	35%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark[c]	0%	-	-	-	-	100%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	100%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_DC2	n	27	27	26	26	27	27	27	27	27	27	27	27	27	27	27
	Annual Minimum	180	7.85	7.66	8.84	106	3.90	0.00250	<0.005	0.0130	0.0119	27.1	1.48	0.0610	0.000250	0.000190
	Annual Maximum	703	8.38	8.62	12.3	154	38.6	0.0633	0.0951	0.0450	0.0329	188	15.6	0.130	0.000540	0.000490
	Annual Mean	514	8.19	8.06	11.4	138	28.0	0.0115	0.0124	0.0249	0.0206	139	11.4	0.0913	0.000354	0.000280
	Annual Median	544	8.19	8.04	11.7	142	33.0	0.00380	0.00610	0.0240	0.0208	164	13.2	0.0970	0.000340	0.000280
	% < LRL	0%	0%	0%	0%	0%	0%	44%	33%	0%	0%	0%	0%	52%	0%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	56%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	96%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	93%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 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: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. 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.

Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	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 Antimony (mg/L)	Total Arsenic (mg/L)
	n	47	47	46	46	47	47	47	47	47	47	47	47	47	47	47
	Annual Minimum	180	8.02	7.79	9.12	115	3.63	<0.001	<0.005	0.00770	<0.001	24.9	1.40	0.0620	0.000120	0.000110
	Annual Maximum	459	8.47	8.52	12.4	193	19.7	0.0581	0.108	0.0417	0.0249	114	8.87	0.147	0.000430	0.000360
	Annual Mean	335	8.27	8.05	11.0	158	12.3	0.00608	0.0122	0.0153	0.0126	66.3	5.30	0.0938	0.000215	0.000200
	Annual Median	337	8.27	8.04	11.0	168	12.6	0.00270	0.00640	0.0140	0.0108	67.5	5.61	0.0920	0.000220	0.000200
LC_DC4	% < LRL	0%	0%	0%	0%	0%	0.0%	17%	36%	0%	2%	0%	0%	2%	0%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	96%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	62%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
	Annual Minimum	190	8.12	7.90	9.45	110	3.42	<0.001	<0.005	0.00710	<0.001	23.9	1.31	0.0680	0.000130	0.000130
	Annual Maximum	421	8.49	828	12.6	193	18.6	0.0507	0.0398	0.0280	0.0218	109	8.42	0.126	0.000380	0.000350
	Annual Mean	324	8.33	25.4	11.3	162	11.2	0.00570	0.0116	0.0154	0.0108	61.3	4.86	0.0996	0.000208	0.000203
	Annual Median	334	8.32	8.28	11.5	172	11.2	0.00350	0.00860	0.0145	0.0100	61.5	4.99	0.102	0.000220	0.000195
LC_DC1	% < LRL	0%	0%	0%	0%	0%	0.0%	10%	17%	0%	2%	0%	0%	0%	0%	0%
	% > BCWQG[a]	-	0%	2%	0%	0%	100%	0%	4%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	4%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	92%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	50%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Annual Minimum	406	8.14	7.82	9.18	171	8.86	0.00310	<0.005	<0.002	<0.001	112	0.960	0.110	<0.0001	<0.0001
	Annual Maximum	895	8.45	8.69	12.2	214	18.9	0.00630	0.0234	0.0455	0.00320	302	2.28	0.172	0.000190	0.000380
	Annual Mean	616	8.29	8.31	10.5	196	14.2	0.00466	0.00895	0.00864	0.00150	215	1.54	0.147	0.000135	0.000152
	Annual Median	602	8.28	8.28	10.7	201	15.0	0.00455	0.00610	0.00255	0.00120	221	1.50	0.152	0.000120	0.000130
FR_FR5	% < LRL	0%	0%	0%	0%	0%	0.0%	25%	38%	50%	13%	0%	0%	0%	38%	25%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	75%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Annual Minimum	486	8.43	8.63	9.65	180	9.43	0.00420	0.0105	<0.002	0.00130	159	1.22	0.150	0.000120	0.000120
	Annual Maximum	551	8.44	8.66	12.5	203	12.6	0.00800	0.0498	0.00510	0.00140	190	1.45	0.184	0.000310	0.000240
	Annual Mean	518	8.43	8.64	11.1	192	11.0	0.00610	0.0302	0.00355	0.00135	174	1.34	0.167	0.000215	0.000180
	Annual Median	518	8.43	8.64	11.1	192	11.0	0.00610	0.0302	0.00355	0.00135	174	1.34	0.167	0.000215	0.000180
LC_FRUS	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	0%	50%	0%	0%	0%	0%	0%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	28	28	27	27	28	28	28	28	28	28	28	28	28	28	28
	Annual Minimum	315	7.54	8.04	9.89	142	6.09	<0.001	<0.005	<0.002	<0.001	81.0	0.540	0.0890	<0.0001	<0.0001
	Annual Maximum	683	8.50	8.84	964	226	15.9	0.00830	0.0458	0.0326	0.00370	243	2.75	0.197	0.000200	0.000330
	Annual Mean	499	8.30	8.23	46.6	186	11.0	0.00456	0.0126	0.00768	0.00155	168	1.47	0.148	0.000132	0.000153
	Annual Median	531	8.34	8.22	11.2	190	11.8	0.00490	0.00905	0.00320	0.00120	182	1.50	0.144	0.000130	0.000135
LC_FRB	% < LRL	0%	0%	0%	0%	0%	0.0%	7%	29%	32%	32%	0%	0%	4%	39%	21%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	18%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
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Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. 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.

Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	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 Antimony (mg/L)	Total Arsenic (mg/L)
LC_GRCK	n	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Annual Minimum	181	7.61	8.00	2.25	141	0.0141	<0.001	<0.005	<0.002	0.00160	25.7	0.190	0.0720	<0.0001	<0.0001
	Annual Maximum	281	8.48	8.79	13.1	185	0.106	<0.001	0.0309	0.00890	0.00410	56.9	0.640	0.165	<0.0001	0.000340
	Annual Mean	236	8.31	8.33	10.9	165	0.0424	<0.001	0.0101	0.00471	0.00283	47.3	0.244	0.128	<0.0001	0.000147
	Annual Median	238	8.37	8.32	11.6	166	0.0355	<0.001	<0.005	0.00385	0.00280	50.8	0.200	0.130	<0.0001	0.000125
	% < LRL	0%	0%	0%	0%	0%	0.0%	100%	57%	7%	0%	0%	57%	0%	100%	14%
	% > BCWQG[a]	-	0%	0%	7%	0%	0%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	7%	-	0%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark[c]	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_UC	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	180	8.08	7.91	9.76	176	0.0125	<0.001	<0.005	<0.002	<0.001	6.24	0.110	0.103	<0.0001	<0.0001
	Annual Maximum	332	8.54	8.24	12.0	261	0.0578	<0.001	0.0221	0.00440	0.00140	16.6	<0.5	0.179	<0.0001	0.000140
	Annual Mean	280	8.39	8.05	11.0	248	0.0383	<0.001	0.00953	0.00233	0.00108	14.6	0.140	0.147	<0.0001	0.000110
	Annual Median	286	8.42	8.04	11.0	257	0.0411	<0.001	<0.005	<0.002	<0.001	15.8	0.145	0.152	<0.0001	<0.0001
	% < LRL	0%	0%	0%	0%	0%	0.0%	100%	55%	82%	64%	0%	64%	0%	100%	55%
	% > BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%	-	-	0%	0%	-	0%	-
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-	0%
	% > Level 1 Benchmark[c]	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. 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.

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[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.

Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	Summary Statistic	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Cadmium (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/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 (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)
LC_DCEF	n	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	Annual Minimum	0.192	<0.00002	<0.01	0.0000305	<0.0001	<0.0001	<0.01	<0.00005	0.0102	<0.0001	<0.0000005	0.000832	<0.0005	0.00133	<0.00001
	Annual Maximum	0.278	<0.00002	0.0110	0.0000446	0.000160	<0.0001	0.0470	<0.00005	0.0208	0.00265	0.00000250	0.00123	0.000590	0.00181	<0.00001
	Annual Mean	0.254	<0.00002	0.0103	0.0000362	0.000104	<0.0001	0.0140	<0.00005	0.0174	0.000474	0.000000881	0.00107	0.000512	0.00158	<0.00001
	Annual Median	0.256	<0.00002	0.0100	0.0000354	<0.0001	<0.0001	<0.01	<0.00005	0.0177	0.000110	0.000000550	0.00114	<0.0005	0.00160	<0.00001
	% < LRL	0%	100%	47%	0%	80%	100%	67%	100%	0%	47%	40%	0%	80%	0%	100%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	13%	0%	-	0%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
LC_DC3	n	48	48	48	48	48	48	48	48	48	48	48	48	48	49	48
	Annual Minimum	0.104	<0.00002	<0.01	0.000118	<0.0001	<0.0001	<0.01	<0.00005	0.00910	0.000160	0.000000550	0.00234	0.00424	0.0188	<0.00001
	Annual Maximum	0.295	0.0000220	0.0120	0.000264	0.00148	0.00106	0.376	0.000404	0.0342	0.0190	0.00000680	0.00508	0.0226	0.0787	0.0000150
	Annual Mean	0.201	0.0000200	0.0103	0.000192	0.000173	0.000417	0.0497	0.0000671	0.0214	0.00446	0.00000144	0.00399	0.0132	0.0527	0.0000102
	Annual Median	0.215	<0.00002	<0.01	0.000203	0.000100	0.000365	0.0180	<0.00005	0.0235	0.00291	0.000000955	0.00422	0.0124	0.0498	<0.00001
	% < LRL	0%	96%	60%	0%	46%	2%	15%	65%	0%	0%	0%	0%	0%	0%	92%
	% > BCWQG[a]	0%	0%	0%	-	2%	0%	-	0%	-	0%	35%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	88%	31%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	38%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	4%	-	-
LC_SPDC	n	47	47	47	47	47	47	47	47	47	47	47	47	47	48	47
	Annual Minimum	0.0998	<0.00002	<0.01	0.000101	<0.0001	<0.0001	<0.01	<0.00005	0.00880	0.00124	0.000000520	0.00231	0.00404	0.0196	<0.00001
	Annual Maximum	0.304	0.0000280	0.0120	0.000245	0.000810	0.000650	0.328	0.000517	0.0330	0.0163	0.00000890	0.00472	0.0199	0.0775	0.0000150
	Annual Mean	0.204	0.0000203	0.0102	0.000161	0.000150	0.000275	0.0328	0.0000699	0.0202	0.00412	0.00000132	0.00387	0.0110	0.0504	0.0000102
	Annual Median	0.227	<0.00002	<0.01	0.000145	0.000110	0.000240	<0.01	<0.00005	0.0203	0.00369	0.000000850	0.00407	0.0111	0.0474	<0.00001
	% < LRL	0%	96%	70%	0%	47%	17%	53%	83%	0%	0%	0%	0%	0%	0%	96%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	38%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	79%	27%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	26%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
LC_DCDS	n	49	49	49	49	49	49	49	49	49	49	49	49	49	51	49
	Annual Minimum	0.109	<0.00002	<0.01	0.0000884	<0.0001	<0.0001	<0.01	<0.00005	0.00950	0.000460	0.000000520	0.00216	0.00253	0.0170	<0.00001
	Annual Maximum	0.466	0.0000700	0.0120	0.000342	0.00131	0.000850	0.967	0.00108	0.0321	0.0211	0.0000134	0.00456	0.0177	0.0744	0.0000410
	Annual Mean	0.221	0.0000210	0.0102	0.000154	0.000150	0.000255	0.0430	0.0000795	0.0199	0.00384	0.00000139	0.00374	0.00996	0.0484	0.0000107
	Annual Median	0.239	<0.00002	<0.01	0.000139	<0.0001	0.000200	<0.01	<0.00005	0.0197	0.00325	0.000000760	0.00401	0.0101	0.0466	<0.00001
	% < LRL	0%	98%	65%	0%	55%	20%	57%	86%	0%	0%	0%	0%	0%	0%	96%
	% > BCWQG[a]	0%	0%	0%	-	2%	0%	-	0%	-	0%	33%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark[c]	-	-	-	2%	-	-	-	-	-	-	-	-	71%	20%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	20%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
LC_DC2	n	27	27	27	27	27	27	27	27	27	27	27	27	27	28	27
	Annual Minimum	0.157	<0.00002	<0.01	0.0000765	<0.0001	<0.0001	<0.01	<0.00005	0.0103	0.000210	<0.0000005	0.00147	0.00190	0.00906	<0.00001
	Annual Maximum	0.457	0.0000610	0.0120	0.000187	0.000350	0.000550	0.171	0.000216	0.0288	0.00848	0.00000418	0.00376	0.0131	0.0649	0.0000100
	Annual Mean	0.328	0.0000215	0.0102	0.000132	0.000130	0.000153	0.0234	0.0000610	0.0205	0.00162	0.000000934	0.00281	0.00568	0.0467	0.0000100
	Annual Median	0.352	<0.00002	<0.01	0.000137	<0.0001	0.000100	<0.01	<0.00005	0.0222	0.000650	0.000000550	0.00290	0.00477	0.0538	<0.00001
	% < LRL	0%	96%	78%	0%	63%	44%	67%	78%	0%	0%	41%	0%	0%	0%	96%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	22%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	41%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	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: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. 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.

Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	Summary Statistic	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Cadmium (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/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 (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)
LC_DC4	n	47	47	47	47	47	47	47	47	47	47	47	47	47	48	47
	Annual Minimum	0.157	<0.00002	<0.01	0.0000482	<0.0001	<0.0001	<0.01	<0.00005	0.00990	0.000680	<0.0000005	0.000996	<0.0005	0.00882	<0.00001
	Annual Maximum	0.362	<0.00002	0.0120	0.000134	0.000355	0.000230	0.157	0.000387	0.0211	0.00758	0.00000416	0.00304	0.00717	0.0386	<0.00001
	Annual Mean	0.262	<0.00002	0.0101	0.0000765	0.000123	0.000114	0.0209	0.0000627	0.0137	0.00171	0.000000895	0.00158	0.00227	0.0222	<0.00001
	Annual Median	0.265	<0.00002	<0.01	0.0000711	<0.0001	<0.0001	0.0100	<0.00005	0.0129	0.00124	<0.0000005	0.00160	0.00220	0.0231	<0.00001
	% < LRL	0%	100%	89%	0%	62%	81%	45%	91%	0%	0%	57%	0%	26%	0%	100%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	19%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	6%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
LC_DC1	n	48	48	48	48	48	48	48	48	48	48	48	48	48	49	48
	Annual Minimum	0.164	<0.00002	<0.01	0.0000380	<0.0001	<0.0001	<0.01	<0.00005	0.00990	0.00106	<0.0000005	0.00104	<0.0005	0.00884	<0.00001
	Annual Maximum	0.352	<0.00002	0.0120	0.000415	0.000420	0.000210	0.177	0.000207	0.0202	0.00707	0.00000456	0.00275	0.00515	0.0361	0.0000100
	Annual Mean	0.260	<0.00002	0.0101	0.0000734	0.000133	0.000109	0.0324	0.0000575	0.0136	0.00248	0.000000955	0.00157	0.00189	0.0205	0.0000100
	Annual Median	0.264	<0.00002	<0.01	0.0000628	<0.0001	<0.0001	0.0195	<0.00005	0.0131	0.00194	0.000000515	0.00156	0.00180	0.0196	<0.00001
	% < LRL	0%	100%	81%	0%	54%	77%	6%	85%	0%	0%	50%	0%	10%	0%	98%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	27%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
FR_FR5	n	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Annual Minimum	0.0609	<0.00002	<0.01	0.0000235	<0.0001	<0.0001	<0.01	<0.00005	0.0198	0.00185	<0.0000005	0.000678	<0.0005	0.0363	<0.00001
	Annual Maximum	0.127	0.0000310	0.0110	0.000134	0.000730	0.000420	0.720	0.000563	0.0314	0.0333	0.00000370	0.00123	0.00388	0.0845	0.0000130
	Annual Mean	0.0968	0.0000214	0.0105	0.0000484	0.000210	0.000148	0.114	0.000117	0.0257	0.00709	0.00000101	0.000992	0.00170	0.0605	0.0000104
	Annual Median	0.101	<0.00002	0.0105	0.0000322	0.000125	<0.0001	0.0190	<0.00005	0.0265	0.00289	<0.0000005	0.000985	0.00114	0.0602	<0.00001
	% < LRL	0%	88%	50%	0%	25%	75%	38%	75%	0%	0%	63%	0%	13%	0%	88%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	13%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	38%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
LC_FRUS	n	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
	Annual Minimum	0.0756	<0.00002	<0.01	0.0000236	0.000120	<0.0001	0.0100	<0.00005	0.0184	0.00202	<0.0000005	0.000947	0.000690	0.0438	<0.00001
	Annual Maximum	0.0992	<0.00002	0.0100	0.0000390	0.000210	0.000140	0.0680	<0.00005	0.0262	0.00485	0.00000210	0.00133	0.00269	0.0553	0.0000130
	Annual Mean	0.0874	<0.00002	0.0100	0.0000313	0.000165	0.000120	0.0390	<0.00005	0.0223	0.00344	0.00000130	0.00114	0.00169	0.0489	0.0000115
	Annual Median	0.0874	<0.00002	0.0100	0.0000313	0.000165	0.000120	0.0390	<0.00005	0.0223	0.00344	0.00000130	0.00114	0.00169	0.0476	0.0000115
	% < LRL	0%	100%	50%	0%	0%	50%	0%	100%	0%	0%	50%	0%	0%	0%	50%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	50%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
LC_FRB	n	28	28	28	28	28	28	28	28	28	28	28	28	28	29	28
	Annual Minimum	0.0538	<0.00002	<0.01	0.0000177	<0.0001	<0.0001	<0.01	<0.00005	0.0142	0.000880	<0.0000005	0.000605	<0.0005	0.0250	<0.00001
	Annual Maximum	0.133	0.000416	0.0100	0.000116	0.000690	0.000320	0.489	0.000433	0.0259	0.0268	0.00000229	0.00134	0.00304	0.0650	<0.00001
	Annual Mean	0.0961	0.0000344	0.0100	0.0000376	0.000209	0.000124	0.0793	0.0000850	0.0198	0.00505	0.000000841	0.000971	0.00132	0.0460	<0.00001
	Annual Median	0.0958	<0.00002	<0.01	0.0000306	0.000145	<0.0001	0.0240	<0.00005	0.0196	0.00266	<0.0000005	0.00102	0.00112	0.0491	<0.00001
	% < LRL	0%	93%	93%	0%	7%	61%	21%	71%	0%	0%	54%	0%	25%	0%	100%
	% > BCWQG[a]	0%	4%	0%	-	0%	0%	-	0%	-	0%	18%	0%	-	100%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	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: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. 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.

Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	Summary Statistic	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Cadmium (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/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 (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)
LC_GRCK	n	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Annual Minimum	0.0573	<0.00002	0.0110	<0.000005	0.000150	<0.0001	<0.01	<0.00005	0.00420	0.00121	<0.0000005	0.000877	<0.0005	0.000984	<0.00001
	Annual Maximum	0.0726	0.0000340	0.0200	0.0000466	0.000870	0.000420	0.616	0.000472	0.00750	0.0547	0.00000186	0.00181	0.00136	0.00272	<0.00001
	Annual Mean	0.0624	0.0000210	0.0139	0.0000110	0.000266	0.000123	0.0764	0.0000824	0.00602	0.00716	0.000000657	0.00141	0.000561	0.00207	<0.00001
	Annual Median	0.0610	<0.00002	0.0140	0.00000755	0.000210	<0.0001	0.0285	<0.00005	0.00600	0.00288	<0.0000005	0.00146	<0.0005	0.00212	<0.00001
	% < LRL	0%	93%	0%	7%	0%	93%	7%	71%	0%	0%	57%	0%	93%	0%	100%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	7%	0%	-	64%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark[c]	-	-	-	0%	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	-	-
LC_UC	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	0.0653	<0.00002	<0.01	0.00000640	<0.0001	<0.0001	<0.01	<0.00005	0.00370	0.000400	<0.0000005	0.000581	<0.0005	0.000209	<0.00001
	Annual Maximum	0.111	<0.00002	0.0140	0.0000165	0.000130	<0.0001	<0.01	<0.00005	0.00600	0.00169	0.000000780	0.000815	<0.0005	0.000386	<0.00001
	Annual Mean	0.0986	<0.00002	0.0120	0.00000975	0.000103	<0.0001	<0.01	<0.00005	0.00524	0.00106	0.000000549	0.000715	<0.0005	0.000334	<0.00001
	Annual Median	0.102	<0.00002	0.0120	0.00000920	<0.0001	<0.0001	<0.01	<0.00005	0.00540	0.00109	<0.0000005	0.000723	<0.0005	0.000345	<0.00001
	% < LRL	0%	100%	9%	0%	82%	100%	100%	100%	0%	0%	82%	0%	100%	0%	100%
	% > BCWQG[a]	0%	0%	0%	-	0%	0%	-	0%	-	0%	0%	0%	-	0%	0%
	% > BCWQG[b]	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-	-	0%
	% > Level 1 Benchmark[c]	-	-	-	0%	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	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: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. 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.

Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	Summary Statistic	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
LC_DCEF	n	15	15	15	15	15	15	15
	Annual Minimum	<0.00001	0.000176	<0.003	<0.003	0.0000242	<0.0002	<0.01
	Annual Maximum	<0.00001	0.000474	0.0221	<0.003	0.0000394	0.000670	<0.01
	Annual Mean	<0.00001	0.000329	0.00433	<0.003	0.0000317	0.000260	<0.01
	Annual Median	<0.00001	0.000330	<0.003	<0.003	0.0000324	0.000210	<0.01
	% < LRL	100%	0%	87%	100%	0%	40%	100%
	% > BCWQG[a]	0%	0%	0%	0%	0%	7%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
LC_DC3	n	48	48	48	48	48	48	48
	Annual Minimum	<0.00001	0.000819	0.00340	<0.003	0.0000948	<0.0002	<0.01
	Annual Maximum	0.0000270	0.00293	0.0552	0.0155	0.000241	0.00105	0.0300
	Annual Mean	0.0000171	0.00211	0.0102	0.00366	0.000165	0.000250	0.0106
	Annual Median	0.0000180	0.00228	0.00860	<0.003	0.000174	0.000210	<0.01
	% < LRL	2%	0%	0%	67%	0%	44%	96%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
LC_SPDC	n	47	47	47	47	47	47	47
	Annual Minimum	<0.00001	0.000791	0.00390	<0.003	0.0000693	<0.0002	<0.01
	Annual Maximum	0.0000310	0.00290	<0.015	0.0434	0.000230	0.000630	0.0220
	Annual Mean	0.0000160	0.00202	0.00726	0.00506	0.000147	0.000263	0.0103
	Annual Median	0.0000160	0.00213	0.00710	<0.003	0.000131	0.000230	<0.01
	% < LRL	6%	0%	2%	57%	0%	26%	98%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
LC_DCDS	n	49	49	49	49	49	49	49
	Annual Minimum	<0.00001	0.000769	<0.003	<0.003	0.0000680	<0.0002	<0.01
	Annual Maximum	0.0000560	0.00273	0.0182	0.0275	0.000217	0.000680	0.0230
	Annual Mean	0.0000154	0.00195	0.00668	0.00463	0.000139	0.000258	0.0103
	Annual Median	0.0000140	0.00206	0.00640	<0.003	0.000122	0.000230	<0.01
	% < LRL	16%	0%	2%	67%	0%	37%	94%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark[c]	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
LC_DC2	n	27	27	27	27	27	27	27
	Annual Minimum	<0.00001	0.000436	<0.003	<0.003	0.0000462	<0.0002	<0.01
	Annual Maximum	0.0000200	0.00213	0.0224	0.0223	0.000173	0.000600	0.0190
	Annual Mean	0.0000114	0.00156	0.00484	0.00399	0.000117	0.000251	0.0103
	Annual Median	<0.00001	0.00171	0.00380	<0.003	0.000127	<0.0002	<0.01
	% < LRL	74%	0%	22%	81%	0%	63%	96%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-

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Table B.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2020

Station	Summary Statistic	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
	n	47	47	47	47	47	47	47
	Annual Minimum	<0.00001	0.000407	<0.003	<0.003	0.0000439	<0.0002	<0.01
	Annual Maximum	0.0000120	0.00135	0.00560	0.00760	0.0000859	0.000770	<0.02
	Annual Mean	0.0000101	0.000699	0.00324	0.00338	0.0000645	0.000239	0.0101
	Annual Median	<0.00001	0.000633	<0.003	<0.003	0.0000640	<0.0002	<0.01
LC_DC4	% < LRL	94%	0%	74%	85%	0%	66%	98%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
	n	48	48	48	48	48	48	48
	Annual Minimum	<0.00001	0.000421	<0.003	<0.003	0.0000345	<0.0002	<0.01
	Annual Maximum	0.0000110	0.00122	0.0425	0.00620	0.0000738	0.000430	0.0610
	Annual Mean	0.0000100	0.000684	0.00440	0.00317	0.0000510	0.000229	0.0111
	Annual Median	<0.00001	0.000650	<0.003	<0.003	0.0000501	<0.0002	<0.01
LC_DC1	% < LRL	94%	0%	79%	90%	0%	63%	98%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
	n	8	8	8	8	8	8	8
	Annual Minimum	<0.00001	0.00183	<0.003	<0.003	0.0000229	<0.0002	<0.01
	Annual Maximum	0.0000210	0.00315	0.0117	0.00590	0.0000438	0.000330	0.0100
	Annual Mean	0.0000114	0.00253	0.00409	0.00336	0.0000305	0.000222	0.0100
	Annual Median	<0.00001	0.00260	<0.003	<0.003	0.0000292	<0.0002	<0.01
FR_FR5	% < LRL	88%	0%	88%	88%	0%	63%	88%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
	n	2	2	2	2	2	2	2
	Annual Minimum	<0.00001	0.00192	<0.003	<0.003	0.0000189	<0.0002	<0.01
	Annual Maximum	<0.00001	0.00227	<0.003	<0.003	0.0000296	0.000330	<0.01
	Annual Mean	<0.00001	0.00209	<0.003	<0.003	0.0000242	0.000265	<0.01
	Annual Median	<0.00001	0.00209	<0.003	<0.003	0.0000242	0.000265	<0.01
LC_FRUS	% < LRL	100%	0%	100%	100%	0%	50%	100%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
	n	28	28	28	28	28	28	28
	Annual Minimum	<0.00001	0.00140	<0.003	<0.003	0.0000162	<0.0002	<0.01
	Annual Maximum	0.0000160	0.00249	0.0203	0.00440	0.0000353	0.000430	<0.01
	Annual Mean	0.0000104	0.00199	0.00446	0.00305	0.0000239	0.000212	<0.01
	Annual Median	<0.00001	0.00210	<0.003	<0.003	0.0000230	<0.0002	<0.01
LC_FRB	% < LRL	86%	0%	79%	96%	0%	75%	100%
	% > BCWQG[a]	0%	0%	0%	0%	0%	4%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-

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Station	Summary Statistic	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
LC_GRCK	n	14	14	14	14	14	14	14
	Annual Minimum	<0.00001	0.000645	<0.003	<0.003	<0.000005	<0.0002	<0.01
	Annual Maximum	0.0000160	0.00117	0.00420	0.00340	<0.00001	0.000540	0.0120
	Annual Mean	0.0000104	0.000982	0.00309	0.00303	0.00000535	0.000229	0.0101
	Annual Median	<0.00001	0.00103	<0.003	<0.003	0.00000510	<0.0002	<0.01
	% < LRL	93%	0%	93%	93%	43%	86%	93%
	% > BCWQG[a]	0%	0%	0%	0%	0%	7%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark[c]	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-
LC_UC	n	11	11	11	11	11	11	11
	Annual Minimum	<0.00001	0.000204	<0.003	<0.003	<0.000005	<0.0002	<0.01
	Annual Maximum	<0.00001	0.000436	<0.003	<0.003	0.0000100	0.00100	<0.01
	Annual Mean	<0.00001	0.000359	<0.003	<0.003	0.00000812	0.000302	<0.01
	Annual Median	<0.00001	0.000372	<0.003	<0.003	0.00000840	<0.0002	<0.01
	% < LRL	100%	0%	100%	100%	9%	82%	100%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	-
	% > BCWQG[b]	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark[c]	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-

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Table B.5: Concentrations of Selenium Species Measured in Water Samples from Dry Creek, Fording River, and Grace Creek, January to December, 2020

Water-body		Teck Water Station Code	Sample Date	Selenium Species (µg/L)									
				Dimethylselenoxide	Methylseleninic Acid	Selenite	Selenate	Selenocyanate	Selenosulphate	Selenomethionine	Unknown Species	Methaneselenonic Acid	Sum of Species
Dry Creek East Tributary	Reference	LC_DCEF	10-Jan-20	<0.01	<0.01	<0.05	1.47	<0.04	<0.06	<0.01	<0.06	<0.01	1.47
		LC_DCEF	4-Feb-20	<0.01	<0.01	<0.05	1.47	<0.04	<0.06	<0.01	<0.06	<0.01	1.47
		LC_DCEF	5-Mar-20	<0.01	<0.01	<0.05	1.46	<0.04	<0.01	<0.01	<0.06	<0.01	1.46
		LC_DCEF	6-Apr-20	<0.01	<0.01	<0.05	1.41	<0.04	<0.06	<0.01	<0.06	<0.01	1.41
		LC_DCEF	5-May-20	<0.01	<0.01	<0.05	1.54	<0.04	<0.06	<0.01	<0.06	<0.01	1.54
		LC_DCEF	22-Jun-20	<0.01	<0.01	<0.05	1.63	<0.04	<0.06	<0.01	<0.06	<0.01	1.63
		LC_DCEF	8-Jul-20	<0.01	<0.01	<0.05	1.44	<0.04	<0.06	<0.01	<0.06	<0.01	1.44
		LC_DCEF	5-Aug-20	<0.01	<0.01	<0.05	1.52	<0.04	<0.06	<0.01	<0.06	<0.01	1.52
		LC_DCEF	1-Sep-20	<0.01	<0.01	<0.05	1.51	<0.04	<0.06	<0.01	<0.06	<0.01	1.51
		LC_DCEF	6-Oct-20	<0.01	<0.01	<0.05	1.41	<0.04	<0.06	<0.01	<0.06	<0.01	1.41
		LC_DCEF	5-Nov-20	<0.01	<0.01	<0.01	1.21	<0.01	<0.01	<0.01	<0.01	<0.01	1.21
		LC_DCEF	3-Dec-20	<0.01	<0.01	0.012	1.25	<0.01	<0.01	<0.01	<0.01	<0.01	1.26
Grace Creek	Mine-exposed	LC_GRCK	11-May-20	<0.01	<0.01	<0.05	1.2	<0.04	<0.06	<0.01	<0.06	<0.01	1.20
		LC_GRCK	29-Aug-20	<0.01	<0.01	<0.05	1.12	<0.04	<0.06	<0.01	<0.06	<0.01	1.12
Dry Creek		LC_SPDC	9-Jan-20	0.018	0.018	0.92	45	<0.04	<0.06	<0.01	<0.06	<0.01	46.0
		LC_SPDC	4-Feb-20	0.03	0.018	0.998	41.4	<0.04	<0.06	<0.01	<0.06	<0.01	42.4
		LC_SPDC	11-Feb-20	0.011	0.017	0.822	39	<0.04	<0.06	<0.01	<0.06	<0.01	39.9
		LC_SPDC	5-Mar-20	<0.01	<0.01	0.98	43.8	<0.04	<0.01	<0.01	<0.06	<0.01	44.8
		LC_SPDC	17-Mar-20	0.026	0.033	0.914	41.6	<0.04	<0.06	<0.01	<0.06	<0.01	42.6
		LC_SPDC	23-Mar-20	0.018	0.028	0.924	39.2	<0.04	<0.06	<0.01	<0.06	<0.01	40.2
		LC_SPDC	31-Mar-20	0.028	0.025	0.735	29.6	<0.04	<0.06	<0.01	<0.06	<0.01	30.4
		LC_SPDC	6-Apr-20	0.011	0.026	0.847	33.8	<0.04	<0.06	<0.01	<0.06	<0.01	34.7
		LC_SPDC	14-Apr-20	<0.01	0.04	1	22.3	<0.04	<0.06	<0.01	<0.06	<0.01	23.3
		LC_SPDC	20-Apr-20	0.037	0.025	0.851	21.6	<0.04	<0.06	<0.01	<0.06	<0.01	22.5
		LC_SPDC	28-Apr-20	0.021	0.026	0.657	18.9	<0.04	<0.06	<0.01	<0.06	<0.01	19.6
		LC_SPDC	5-May-20	0.013	0.0245	0.5765	21.05	<0.04	<0.06	<0.01	<0.06	<0.01	21.7
		LC_SPDC	11-May-20	0.019	0.024	0.607	27.6	<0.04	<0.06	<0.01	<0.06	<0.01	28.3
		LC_SPDC	19-May-20	0.013	0.015	0.594	25.6	<0.04	<0.06	<0.01	<0.06	<0.01	26.2
		LC_SPDC	26-May-20	<0.01	0.02	0.493	23.7	<0.04	<0.06	<0.01	<0.06	<0.01	24.2
		LC_SPDC	3-Jun-20	0.017	0.018	0.376	17.6	<0.04	<0.06	<0.01	<0.06	<0.01	18.0
		LC_SPDC	9-Jun-20	0.014	0.024	0.47	23.8	<0.04	<0.06	<0.01	<0.06	<0.01	24.3
		LC_SPDC	16-Jun-20	<0.01	0.022	0.582	26.1	<0.04	<0.06	<0.01	<0.06	<0.01	26.7
		LC_SPDC	23-Jun-20	0.012	0.035	0.712	31.6	<0.04	<0.06	<0.01	<0.06	<0.01	32.4
		LC_SPDC	24-Jun-20	0.023	0.025	0.74	32.5	<0.04	<0.06	<0.01	<0.06	<0.01	33.3
		LC_SPDC	30-Jun-20	0.011	0.033	0.82	37	<0.04	<0.06	<0.01	<0.06	<0.01	37.9
		LC_SPDC	8-Jul-20	0.032	0.033	0.85	37.3	<0.04	<0.06	<0.01	<0.06	<0.01	38.2
		LC_SPDC	14-Jul-20	0.039	0.038	0.846	40.4	<0.04	<0.06	<0.01	<0.06	<0.01	41.3
		LC_SPDC	21-Jul-20	<0.01	0.028	0.723	40.7	<0.04	<0.06	<0.01	<0.06	<0.01	41.5
		LC_SPDC	28-Jul-20	0.011	0.044	0.925	53.1	<0.04	<0.06	<0.01	<0.06	<0.01	54.1
		LC_SPDC	5-Aug-20	0.038	0.038	1.33	50.8	<0.04	<0.06	<0.01	<0.06	<0.01	52.2
		LC_SPDC	11-Aug-20	0.043	0.064	1.89	55.1	<0.04	<0.06	<0.01	<0.06	<0.01	57.1
		LC_SPDC	18-Aug-20	0.073	0.261	1.59	47.1	<0.04	<0.06	<0.01	<0.06	<0.01	49.0
		LC_SPDC	25-Aug-20	0.016	0.047	1.1	65.1	<0.04	<0.06	<0.01	<0.06	<0.01	66.3
		LC_SPDC	1-Sep-20	0.133	0.08	2.83	61.6	<0.04	<0.06	<0.01	<0.06	<0.01	64.6
		LC_SPDC	8-Sep-20	0.014	0.034	1.28	71.9	<0.04	<0.06	<0.01	<0.06	<0.01	73.2
		LC_SPDC	15-Sep-20	0.02	0.032	1.19	66.6	<0.04	<0.06	<0.01	<0.06	<0.01	67.8
		LC_SPDC	22-Sep-20	0.04	0.033	1.22	71	<0.04	<0.06	<0.01	<0.06	<0.01	72.3
		LC_SPDC	29-Sep-20	0.037	0.034	1.16	66.7	<0.04	<0.06	<0.01	<0.06	<0.01	67.9
		LC_SPDC	6-Oct-20	0.032	0.04	1.28	72.2	<0.04	<0.06	<0.01	<0.06	<0.01	73.6
		LC_SPDC	20-Oct-20	0.038	0.032	1.03	66.3	<0.04	<0.06	<0.01	<0.06	<0.01	67.4
		LC_SPDC	27-Oct-20	0.028	0.023	1.04	63.9	<0.04	<0.06	<0.01	<0.06	<0.01	65.0
		LC_SPDC	5-Nov-20	0.014	0.024	0.78	54.4	<0.01	<0.01	<0.01	<0.01	<0.01	55.2
		LC_SPDC	10-Nov-20	0.017	0.02	0.871	66.7	<0.01	<0.01	<0.01	<0.01	<0.01	67.6
		LC_SPDC	17-Nov-20	0.017	0.033	1.04	74	<0.01	<0.01	<0.01	<0.01	<0.01	75.1
		LC_SPDC	24-Nov-20	<0.01	0.024	1.05	65.1	<0.01	<0.01	<0.01	<0.01	<0.01	66.2
		LC_SPDC	3-Dec-20	0.015	0.017	1.01	59.7	<0.01	<0.01	<0.01	<0.01	<0.01	60.7
		LC_SPDC	8-Dec-20	0.016	0.015	1.03	62.9	<0.01	<0.01	<0.01	<0.01	<0.01	64.0
		LC_SPDC	15-Dec-20	0.033	0.021	1.07	62.4	<0.01	<0.01	<0.01	<0.01	<0.01	63.5
		LC_SPDC	21-Dec-20	0.016	0.012	0.799	60.7	<0.01	<0.01	<0.01	<0.01	<0.01	61.5
		LC_SPDC	30-Dec-20	0.012	0.022	0.901	59.6	<0.01	<0.01	<0.01	<0.01	<0.01	60.5
		LC_DCDS	9-Jan-20	<0.01	<0.01	0.92	43.2	<0.04	<0.06	<0.01	<0.06	<0.01	44.1
		LC_DCDS	28-Jan-20	0.027	0.019	0.886	45.7	<0.04	<0.06	<0.01	<0.06	<0.01	46.6
		LC_DCDS	4-Feb-20	0.026	0.016	1.01	41.6	<0.04	<0.06	<0.01	<0.06	<0.01	42.7
		LC_DCDS	11-Feb-20	<0.01	0.018	0.863	40.7	<0.04	<0.06	<0.01	<0.06	<0.01	41.6
		LC_DCDS	18-Feb-20	0.015	0.018	1	44.3	<0.04	<0.06	<0.01	<0.06	<0.01	45.3
		LC_DCDS	24-Feb-20	0.023	0.017	0.867	40.9	<0.04	<0.06	<0.01	<0.06	<0.01	41.8
		LC_DCDS	5-Mar-20	0.018	0.023	0.969	44	<0.04	<0.01	<0.01	<0.06	<0.01	45.0
		LC_DCDS	17-Mar-20	0.014	0.033	0.884	40.9	<0.04	<0.06	<0.01	<0.06	<0.01	41.8
		LC_DCDS	23-Mar-20	0.023	0.028	0.896	37.3	<0.04	<0.06	<0.01	<0.06	<0.01	38.2
		LC_DCDS	31-Mar-20	0.023	0.016	0.636	27.1	<0.04	<0.06	<0.01	<0.06	<0.01	27.8
		LC_DCDS	6-Apr-20	0.011	0.026	0.705	29.2	<0.04	<0.06	<0.01	<0.06	<0.01	29.9
		LC_DCDS	14-Apr-20	<0.01	0.044	0.792	19.4	<0.04	<0.06	<0.01	<0.06	<0.01	20.2
		LC_DCDS	20-Apr-20	0.025	0.031	0.792	20.7	<0.04	<0.06	<0.01	<0.06	<0.01	21.5
		LC_DCDS	28-Apr-20	0.015	0.023	0.579	16.2	<0.04	<0.06	<0.01	<0.06	<0.01	16.8
		LC_DCDS	5-May-20	0.015	0.025	0.502	19.7	<0.04	<0.06	<0.01	<0.06	<0.01	20.2
		LC_DCDS	11-May-20	0.016	0.026	0.49	23.8	<0.04	<0.06	<0.01	<0.06	<0.01	24.3
		LC_DCDS	19-May-20	<0.01	0.02	0.555	22.4	<0.04	<0.06	<0.01	<0.06	<0.01	23.0
		LC_DCDS	26-May-20	<0.01	0.019	0.457	22	<0.04	<0.06	<0.01	<0.06	<0.01	22.5
		LC_DCDS	2-Jun-20	0.011	<0.01	0.339	15.4	<0.04	<0.06	<0.01	<0.06	<0.01	15.8
		LC_DCDS	9-Jun-20	0.015	0.018	0.385	20.1	<0.04	<0.06	<0.01	<0.06	<0.01	20.5
		LC_DCDS	16-Jun-20	<0.01	0.024	0.459	22.9	<0.04	<0.06	<0.01	<0.06	<0.01	23.4
		LC_DCDS	23-Jun-20	0.012	0.028	0.599	26.6	<0.04	<0.06	<0.01	<0.06	<0.01	27.2
		LC_DCDS	30-Jun-20	<0.01	0.031	0.696	32.3	<0.04	<0.06	<0.01	<0.06	<0.01	33.0
		LC_DCDS	8-Jul-20	0.024	0.024	0.661	31.3	<0.04	<0.06	<0.01	<0.06	<0.01	32.0
		LC_DCDS	14-Jul-20	0.038	0.034	0.745	33.9	<0.04	<0.06	<0.01	<0.06	<0.01	34.7
		LC_DCDS	21-Jul-20	<0.01	0.023	0.688	36	<0.04	<0.06	<0.01	<0.06	<0.01	36.7
		LC_DCDS	28-Jul-20	<0.01	0.024	0.8	45.2	<0.04	<0.06	<0.01	<0.06	<0.01	46.0
		LC_DCDS	5-Aug-20	0.038	0.034	1.29	50	<0.04	<0.06	<0.01	<0.06	<0.01	51.4
		LC_DCDS	11-Aug-20	<0.01	0.064	2.03	57.5	<0.04	<0.06	<0.01	<0.06	<0.01	59.6
		LC_DCDS	18-Aug-20	0.164	0.298	1.73	55	<0.04	<0.06	<0.01	<0.06	<0.01	57.2
		LC_DCDS	25-Aug-20	0.018	0.038	1.13	61.9	<0.04	<0.06	<0.01	<0.06	<0.01	63.1
		LC_DCDS	1-Sep-20	0.102	0.077	2.72	59.8	<0.04	<0.06	<0.01	<0.06	<0.01	62.7
		LC_DCDS	8-Sep-20	0.013	0.035	1.16	67.4	<0.04	<0.06	<0.01	<0.06	<0.01	68.6
		LC_DCDS	15-Sep-20	0.017	0.032	1.2	69.4	<0.04	<0.06	<0.01	<0.06	<0.01	70.6
		LC_DCDS	22-Sep-20	0.038	0.034	1.19	69.1	<0.04	<0.06	<0.01	<0.06	<0.01	70.4
		LC_DCDS	29-Sep-20	0.039	0.034	1.08	64.2	<0.04	<0.06	<0.01	<0.06	<0.01	65.4

Table B.5: Concentrations of Selenium Species Measured in Water Samples from Dry Creek, Fording River, and Grace Creek, January to December, 2020

Water-body		Teck Water Station Code	Sample Date	Selenium Species (µg/L) Dimethylselenoxide	Methylseleninic Acid	Selenite	Selenate	Selenocyanate	Selenosulphate	Selenomethionine	Unknown Species	Methaneselenonic Acid	Sum of Species
Dry Creek	Mine-exposed	LC_DCDS	6-Oct-20	0.031	0.034	1.18	69.7	<0.04	<0.06	<0.01	<0.06	<0.01	70.9
		LC_DCDS	14-Oct-20	0.013	0.012	0.392	47.7	<0.04	<0.06	<0.01	<0.06	<0.01	48.1
		LC_DCDS	20-Oct-20	0.026	0.028	1.02	63.9	<0.04	<0.06	<0.01	<0.06	<0.01	65.0
		LC_DCDS	27-Oct-20	0.028	0.017	1.01	61.8	<0.04	<0.06	<0.01	<0.06	<0.01	62.9
		LC_DCDS	3-Nov-20	0.028	0.029	0.812	60.8	<0.01	<0.01	<0.01	<0.01	<0.01	61.7
		LC_DCDS	10-Nov-20	<0.01	0.015	0.77	54.7	<0.01	<0.01	<0.01	<0.01	<0.01	55.5
		LC_DCDS	17-Nov-20	0.033	0.027	1.07	72.7	<0.01	<0.01	<0.01	<0.01	<0.01	73.8
		LC_DCDS	24-Nov-20	<0.01	0.026	0.994	61.8	<0.01	<0.01	<0.01	<0.01	<0.01	62.8
		LC_DCDS	3-Dec-20	0.011	0.017	0.999	58.2	<0.01	<0.01	<0.01	<0.01	<0.01	59.2
		LC_DCDS	8-Dec-20	<0.01	<0.01	0.965	58.2	<0.01	<0.01	<0.01	<0.01	<0.01	59.2
		LC_DCDS	15-Dec-20	0.032	0.019	0.969	62.4	<0.01	<0.01	<0.01	<0.01	<0.01	63.4
		LC_DCDS	21-Dec-20	0.022	0.013	0.932	61.7	<0.01	<0.01	<0.01	<0.01	<0.01	62.7
		LC_DCDS	30-Dec-20	0.014	0.019	0.957	59.2	<0.01	<0.01	<0.01	<0.01	<0.01	60.2
		LC_DC3	10-Jan-20	0.012	0.015	0.811	41.9	<0.04	<0.06	<0.01	<0.06	<0.01	42.7
		LC_DC3	4-Feb-20	0.023	0.015	0.905	40.3	<0.04	<0.06	<0.01	<0.06	<0.01	41.2
		LC_DC3	5-Mar-20	0.012	0.026	0.793	44.6	<0.04	<0.01	<0.01	<0.06	<0.01	45.4
		LC_DC3	17-Mar-20	<0.01	0.02	0.792	39.8	<0.04	<0.06	<0.01	<0.06	<0.01	40.6
		LC_DC3	23-Mar-20	<0.01	0.02	0.785	31	<0.04	<0.06	<0.01	<0.06	<0.01	31.8
		LC_DC3	31-Mar-20	0.018	0.019	0.68	32.8	<0.04	<0.06	<0.01	<0.06	<0.01	33.5
		LC_DC3	6-Apr-20	<0.01	0.021	0.704	35.4	<0.04	<0.06	<0.01	<0.06	<0.01	36.1
		LC_DC3	14-Apr-20	<0.01	<0.01	0.702	22.3	<0.04	<0.06	<0.01	<0.06	<0.01	23.0
		LC_DC3	20-Apr-20	0.016	0.017	0.59	17.6	<0.04	<0.06	<0.01	<0.06	<0.01	18.2
		LC_DC3	28-Apr-20	0.016	0.016	0.627	23	<0.04	<0.06	<0.01	<0.06	<0.01	23.7
		LC_DC3	5-May-20	0.015	0.016	0.594	26.5	<0.04	<0.06	<0.01	<0.06	<0.01	27.1
		LC_DC3	7-May-20	<0.01	0.018	0.39	17.4	<0.04	<0.06	<0.01	<0.06	<0.01	17.8
		LC_DC3	11-May-20	0.021	0.017	0.609	30.6	<0.04	<0.06	<0.01	<0.06	<0.01	31.2
		LC_DC3	19-May-20	<0.01	0.011	0.555	24.1	<0.04	<0.06	<0.01	<0.06	<0.01	24.7
		LC_DC3	26-May-20	<0.01	<0.01	0.426	24.1	<0.04	<0.06	<0.01	<0.06	<0.01	24.5
		LC_DC3	2-Jun-20	<0.01	<0.01	0.356	18.6	<0.04	<0.06	<0.01	<0.06	<0.01	19.0
		LC_DC3	9-Jun-20	0.011	0.018	0.461	26.6	<0.04	<0.06	<0.01	<0.06	<0.01	27.1
		LC_DC3	16-Jun-20	<0.01	0.02	0.482	25.7	<0.04	<0.06	<0.01	<0.06	<0.01	26.2
		LC_DC3	22-Jun-20	<0.01	<0.01	0.286	15.1	<0.04	<0.06	<0.01	<0.06	<0.01	15.4
		LC_DC3	23-Jun-20	<0.01	0.027	0.683	37.4	<0.04	<0.06	<0.01	<0.06	<0.01	38.1
		LC_DC3	30-Jun-20	<0.01	0.014	0.742	42.3	<0.04	<0.06	<0.01	<0.06	<0.01	43.1
		LC_DC3	8-Jul-20	0.026	0.023	0.776	42.4	<0.04	<0.06	<0.01	<0.06	<0.01	43.2
		LC_DC3	14-Jul-20	0.024	0.025	0.821	46.5	<0.04	<0.06	<0.01	<0.06	<0.01	47.4
		LC_DC3	21-Jul-20	<0.01	0.018	0.882	49	<0.04	<0.06	<0.01	<0.06	<0.01	49.9
		LC_DC3	28-Jul-20	0.025	0.021	0.972	55.9	<0.04	<0.06	<0.01	<0.06	<0.01	56.9
		LC_DC3	5-Aug-20	0.022	0.028	1.01	60.5	<0.04	<0.06	<0.01	<0.06	<0.01	61.6
		LC_DC3	11-Aug-20	<0.01	<0.01	1.14	69	<0.04	<0.06	<0.01	<0.06	<0.01	70.1
		LC_DC3	18-Aug-20	<0.01	<0.01	1.25	74	<0.04	<0.06	<0.01	<0.06	<0.01	75.3
		LC_DC3	25-Aug-20	0.029	0.022	1.09	67.3	<0.04	<0.06	<0.01	<0.06	<0.01	68.4
		LC_DC3	1-Sep-20	0.022	0.02	1.14	71.1	<0.04	<0.06	<0.01	<0.06	<0.01	72.3
		LC_DC3	8-Sep-20	0.02	0.026	1.22	73	<0.04	<0.06	<0.01	<0.06	<0.01	74.3
		LC_DC3	15-Sep-20	0.028	0.021	1.3	75.7	<0.04	<0.06	<0.01	<0.06	<0.01	77.0
		LC_DC3	22-Sep-20	0.037	0.021	1.16	72.1	<0.04	<0.06	<0.01	<0.06	<0.01	73.3
		LC_DC3	29-Sep-20	0.041	0.021	1.15	68	<0.04	<0.06	<0.01	<0.06	<0.01	69.2
		LC_DC3	6-Oct-20	0.016	0.017	1.19	73.8	<0.04	<0.06	<0.01	<0.06	<0.01	75.0
		LC_DC3	14-Oct-20	0.03	0.027	1.17	68.9	<0.04	<0.06	<0.01	<0.06	<0.01	70.1
		LC_DC3	20-Oct-20	0.038	0.03	1.16	69.6	<0.04	<0.06	<0.01	<0.06	<0.01	70.8
		LC_DC3	27-Oct-20	0.026	0.021	1.06	64.7	<0.04	<0.06	<0.01	<0.06	<0.01	65.8
		LC_DC3	5-Nov-20	<0.01	0.011	0.686	40.4	<0.01	<0.01	<0.01	<0.01	<0.01	41.1
		LC_DC3	10-Nov-20	<0.01	0.013	1.01	69.1	<0.01	<0.01	<0.01	<0.01	<0.01	70.1
		LC_DC3	17-Nov-20	0.022	0.013	1.09	76.8	<0.01	<0.01	<0.01	<0.01	<0.01	77.9
		LC_DC3	24-Nov-20	<0.01	0.022	1.2	65.4	<0.01	<0.01	<0.01	<0.01	<0.01	66.6
		LC_DC3	3-Dec-20	0.013	0.019	0.986	60.3	<0.01	<0.01	<0.01	<0.01	<0.01	61.3
		LC_DC3	8-Dec-20	0.014	0.012	0.993	60.7	<0.01	<0.01	<0.01	<0.01	<0.01	61.7
		LC_DC3	15-Dec-20	0.026	0.016	0.983	61.5	<0.01	<0.01	<0.01	<0.01	<0.01	62.5
		LC_DC3	21-Dec-20	0.014	0.011	0.932	63.2	<0.01	<0.01	<0.01	<0.01	<0.01	64.2
		LC_DC3	30-Dec-20	<0.01	0.015	0.913	60.5	<0.01	<0.01	<0.01	<0.01	<0.01	61.4
		LC_DC2	9-Jan-20	<0.01	<0.01	0.455	37.6	<0.04	<0.06	<0.01	<0.06	<0.01	38.1
		LC_DC2	10-Feb-20	<0.01	<0.01	0.522	34.5	<0.04	<0.06	<0.01	<0.06	<0.01	35.0
		LC_DC2	6-Apr-20	<0.01	<0.01	0.335	26.6	<0.04	<0.06	<0.01	<0.06	<0.01	26.9
		LC_DC2	6-May-20	<0.01	0.013	0.294	12.5	<0.04	<0.06	<0.01	<0.06	<0.01	12.8
		LC_DC2	25-Jun-20	<0.01	0.012	0.313	16.9	<0.04	<0.06	<0.01	<0.06	<0.01	17.2
		LC_DC2	8-Jul-20	0.016	0.015	0.404	20.4	<0.04	<0.06	<0.01	<0.06	<0.01	20.8
		LC_DC2	5-Aug-20	0.032	0.023	1.01	44.2	<0.04	<0.06	<0.01	<0.06	<0.01	45.3
		LC_DC2	1-Sep-20	0.062	0.052	1.77	53.6	<0.04	<0.06	<0.01	<0.06	<0.01	55.5
		LC_DC2	22-Sep-20	0.024	0.021	0.797	60	<0.04	<0.06	<0.01	<0.06	<0.01	60.8
		LC_DC2	29-Sep-20	0.019	0.021	0.831	57.5	<0.04	<0.06	<0.01	<0.06	<0.01	58.4
		LC_DC2	6-Oct-20	0.023	0.017	0.878	62.5	<0.04	<0.06	<0.01	<0.06	<0.01	63.4
		LC_DC2	14-Oct-20	<0.01	0.011	0.287	41.9	<0.04	<0.06	<0.01	<0.06	<0.01	42.2
		LC_DC2	20-Oct-20	0.023	0.013	0.618	56.2	<0.04	<0.06	<0.01	<0.06	<0.01	56.9
		LC_DC2	27-Oct-20	<0.01	<0.01	0.489	53.1	<0.04	<0.06	<0.01	<0.06	<0.01	53.6
		LC_DC2	5-Nov-20	<0.01	<0.01	0.35	49	<0.01	<0.01	<0.01	<0.01	<0.01	49.4
		LC_DC2	10-Nov-20	<0.01	0.012	0.432	52.7	<0.01	<0.01	<0.01	<0.01	<0.01	53.1
		LC_DC2	17-Nov-20	<0.01	0.016	0.516	62.3	<0.01	<0.01	<0.01	<0.01	<0.01	62.8
		LC_DC2	24-Nov-20	<0.01	0.012	0.509	53.7	<0.01	<0.01	<0.01	<0.01	<0.01	54.2
		LC_DC2	3-Dec-20	<0.01	0.011	0.483	51	<0.01	<0.01	<0.01	<0.01	<0.01	51.5
		LC_DC2	8-Dec-20	<0.01	<0.01	0.594	53	<0.01	<0.01	<0.01	<0.01	<0.01	53.6
		LC_DC2	15-Dec-20	0.012	<0.01	0.375	51.9	<0.01	<0.01	<0.01	<0.01	<0.01	52.3
		LC_DC2	21-Dec-20	<0.01	<0.01	0.225	53.4	<0.01	<0.01	<0.01	<0.01	<0.01	53.6
		LC_DC2	30-Dec-20	<0.01	<0.01	0.3	52.4	<0.01	<0.01	<0.01	<0.01	<0.01	52.7
		LC_DC4	9-Jan-20	<0.01	<0.01	0.064	18.3	<0.04	<0.06	<0.01	<0.06	<0.01	18.4
		LC_DC4	11-Feb-20	<0.01	<0.01	0.057	16.1	<0.04	<0.06	<0.01	<0.06	<0.01	16.2
		LC_DC4	5-Mar-20	<0.01	<0.01	0.062	15.2	<0.04	<0.01	<0.01	<0.06	<0.01	15.3
		LC_DC4	17-Mar-20	<0.01	<0.01	0.054	14.6	<0.04	<0.06	<0.01	<0.06	<0.01	14.7
		LC_DC4	25-Mar-20	<0.01	<0.01	<0.05	16.9	<0.04	<0.06	<0.01	<0.06	<0.01	16.9
		LC_DC4	31-Mar-20	<0.01	<0.01	<0.05	18.2	<0.04	<0.06	<0.01	<0.06	<0.01	18.2
		LC_DC4	6-Apr-20	<0.01	<0.01	<0.05	17.1	<0.04	<0.06	<0.01	<0.06	<0.01	17.1
		LC_DC4	14-Apr-20	<0.01	<0.01	0.271	16.4	<0.04	<0.06	<0.01	<0.06	<0.01	16.7
		LC_DC4	20-Apr-20	0.014	0.017	0.326	16.8	<0.04	<0.06	<0.01	<0.06	<0.01	17.2
		LC_DC4	28-Apr-20	<0.01	0.011	0.266	12.7	<0.04	<0.06	<0.01	<0.06	<0.01	13.0
		LC_DC4	5-May-20	<0.01	<0.01	0.236	11.5	<0.04	<0.06	<0.01	<0.06	<0.01	11.7
		LC_DC4	11-May-20	<0.01	0.011	0.203	14	<0.04	<0.06	<0.01	<0.06	<0.01	14.2
		LC_DC4	19-May-20	<0.01	<0.01	0.243	12.7	<0.04	<0.06	<0.01	<0.06	<0.01	12.9

Table B.5: Concentrations of Selenium Species Measured in Water Samples from Dry Creek, Fording River, and Grace Creek, January to December, 2020

Water-body		Teck Water Station Code	Sample Date	Selenium Species (µg/L)									
				Dimethylselenoxide	Methylseleninic Acid	Selenite	Selenate	Selenocyanate	Selenosulphate	Selenomethionine	Unknown Species	Methaneselenonic Acid	Sum of Species
Dry Creek	Mine-exposed	LC_DC4	26-May-20	<0.01	<0.01	0.19	11.4	<0.04	<0.06	<0.01	<0.06	<0.01	11.6
		LC_DC4	3-Jun-20	<0.01	<0.01	0.113	7.8	<0.04	<0.06	<0.01	<0.06	<0.01	7.91
		LC_DC4	9-Jun-20	<0.01	<0.01	0.161	10.8	<0.04	<0.06	<0.01	<0.06	<0.01	11.0
		LC_DC4	16-Jun-20	<0.01	0.011	0.189	11.8	<0.04	<0.06	<0.01	<0.06	<0.01	12.0
		LC_DC4	25-Jun-20	<0.01	<0.01	0.213	11.455	<0.04	<0.06	<0.01	<0.06	<0.01	11.7
		LC_DC4	30-Jun-20	<0.01	0.011	0.255	16.1	<0.04	<0.06	<0.01	<0.06	<0.01	16.4
		LC_DC4	8-Jul-20	0.013	<0.01	0.264	15.9	<0.04	<0.06	<0.01	<0.06	<0.01	16.2
		LC_DC4	14-Jul-20	0.012	0.011	0.296	17.5	<0.04	<0.06	<0.01	<0.06	<0.01	17.8
		LC_DC4	21-Jul-20	<0.01	<0.01	0.258	21.8	<0.04	<0.06	<0.01	<0.06	<0.01	22.1
		LC_DC4	28-Jul-20	<0.01	0.012	0.246	22	<0.04	<0.06	<0.01	<0.06	<0.01	22.3
		LC_DC4	5-Aug-20	<0.01	0.013	0.43	30.2	<0.04	<0.06	<0.01	<0.06	<0.01	30.6
		LC_DC4	11-Aug-20	<0.01	0.019	0.983	39.8	<0.04	<0.06	<0.01	<0.06	<0.01	40.8
		LC_DC4	18-Aug-20	0.05	0.12	0.929	38.5	<0.04	<0.06	<0.01	<0.06	<0.01	39.6
		LC_DC4	25-Aug-20	<0.01	<0.01	0.266	26.1	<0.04	<0.06	<0.01	<0.06	<0.01	26.4
		LC_DC4	1-Sep-20	<0.01	<0.01	0.283	31.1	<0.04	<0.06	<0.01	<0.06	<0.01	31.4
		LC_DC4	8-Sep-20	<0.01	<0.01	0.243	30.3	<0.04	<0.06	<0.01	<0.06	<0.01	30.5
		LC_DC4	15-Sep-20	<0.01	<0.01	0.218	28.7	<0.04	<0.06	<0.01	<0.06	<0.01	28.9
		LC_DC4	22-Sep-20	<0.01	<0.01	0.167	28.5	<0.04	<0.06	<0.01	<0.06	<0.01	28.7
		LC_DC4	29-Sep-20	<0.01	<0.01	0.169	27.4	<0.04	<0.06	<0.01	<0.06	<0.01	27.6
		LC_DC4	6-Oct-20	<0.01	<0.01	0.149	27.7	<0.04	<0.06	<0.01	<0.06	<0.01	27.8
		LC_DC4	14-Oct-20	<0.01	<0.01	0.086	22.9	<0.04	<0.06	<0.01	<0.06	<0.01	23.0
		LC_DC4	20-Oct-20	<0.01	<0.01	0.099	24.6	<0.04	<0.06	<0.01	<0.06	<0.01	24.7
		LC_DC4	27-Oct-20	<0.01	<0.01	0.062	21.5	<0.04	<0.06	<0.01	<0.06	<0.01	21.6
		LC_DC4	5-Nov-20	<0.01	<0.01	0.05	20.4	<0.01	<0.01	<0.01	<0.01	<0.01	20.5
		LC_DC4	10-Nov-20	<0.01	<0.01	0.067	24	<0.01	<0.01	<0.01	<0.01	<0.01	24.1
		LC_DC4	17-Nov-20	<0.01	<0.01	0.076	28.2	<0.01	<0.01	<0.01	<0.01	<0.01	28.3
		LC_DC4	24-Nov-20	<0.01	<0.01	0.077	24.9	<0.01	<0.01	<0.01	<0.01	<0.01	25.0
		LC_DC4	3-Dec-20	<0.01	<0.01	0.069	23	<0.01	<0.01	<0.01	<0.01	<0.01	23.1
		LC_DC4	8-Dec-20	<0.01	<0.01	0.09	23.3	<0.01	<0.01	<0.01	<0.01	<0.01	23.4
		LC_DC4	15-Dec-20	<0.01	<0.01	0.062	24.5	<0.01	<0.01	<0.01	<0.01	<0.01	24.6
		LC_DC4	21-Dec-20	<0.01	<0.01	0.059	24.3	<0.01	<0.01	<0.01	<0.01	<0.01	24.4
		LC_DC4	30-Dec-20	<0.01	<0.01	0.058	24.7	<0.01	<0.01	<0.01	<0.01	<0.01	24.8
		LC_DC1	9-Jan-20	<0.01	<0.01	0.086	13.7	<0.04	<0.06	<0.01	<0.06	<0.01	13.8
		LC_DC1	4-Feb-20	<0.01	<0.01	0.105	16	<0.04	<0.06	<0.01	<0.06	<0.01	16.1
		LC_DC1	5-Mar-20	<0.01	<0.01	0.089	14.5	<0.04	<0.01	<0.01	<0.06	<0.01	14.6
		LC_DC1	17-Mar-20	<0.01	<0.01	0.09	13.7	<0.04	<0.06	<0.01	<0.06	<0.01	13.8
		LC_DC1	25-Mar-20	<0.01	<0.01	0.064	15.5	<0.04	<0.06	<0.01	<0.06	<0.01	15.6
		LC_DC1	31-Mar-20	<0.01	<0.01	0.072	15.8	<0.04	<0.06	<0.01	<0.06	<0.01	15.9
		LC_DC1	6-Apr-20	<0.01	<0.01	0.066	15.6	<0.04	<0.06	<0.01	<0.06	<0.01	15.7
		LC_DC1	14-Apr-20	<0.01	<0.01	0.189	10.4	<0.04	<0.06	<0.01	<0.06	<0.01	10.6
		LC_DC1	20-Apr-20	<0.01	<0.01	0.264	16.1	<0.04	<0.06	<0.01	<0.06	<0.01	16.4
		LC_DC1	28-Apr-20	<0.01	0.012	0.238	11.7	<0.04	<0.06	<0.01	<0.06	<0.01	12.0
		LC_DC1	5-May-20	<0.01	0.014	0.189	11.6	<0.04	<0.06	<0.01	<0.06	<0.01	11.8
		LC_DC1	11-May-20	<0.01	<0.01	0.203	13.2	<0.04	<0.06	<0.01	<0.06	<0.01	13.4
		LC_DC1	19-May-20	<0.01	0.011	0.232	12	<0.04	<0.06	<0.01	<0.06	<0.01	12.2
		LC_DC1	26-May-20	<0.01	<0.01	0.178	10.9	<0.04	<0.06	<0.01	<0.06	<0.01	11.1
		LC_DC1	3-Jun-20	<0.01	<0.01	0.117	7.61	<0.04	<0.06	<0.01	<0.06	<0.01	7.73
		LC_DC1	9-Jun-20	<0.01	0.013	0.168	9.83	<0.04	<0.06	<0.01	<0.06	<0.01	10.0
		LC_DC1	16-Jun-20	<0.01	0.013	0.178	11.5	<0.04	<0.06	<0.01	<0.06	<0.01	11.7
		LC_DC1	23-Jun-20	<0.01	0.011	0.174	12.8	<0.04	<0.06	<0.01	<0.06	<0.01	13.0
		LC_DC1	24-Jun-20	<0.01	<0.01	0.159	7.45	<0.04	<0.06	<0.01	<0.06	<0.01	7.61
		LC_DC1	30-Jun-20	<0.01	<0.01	0.235	14.9	<0.04	<0.06	<0.01	<0.06	<0.01	15.1
		LC_DC1	8-Jul-20	<0.01	0.015	0.199	14.7	<0.04	<0.06	<0.01	<0.06	<0.01	14.9
		LC_DC1	14-Jul-20	<0.01	0.015	0.254	16.6	<0.04	<0.06	<0.01	<0.06	<0.01	16.9
		LC_DC1	21-Jul-20	<0.01	<0.01	0.22	20	<0.04	<0.06	<0.01	<0.06	<0.01	20.2
		LC_DC1	28-Jul-20	<0.01	<0.01	0.215	20.8	<0.04	<0.06	<0.01	<0.06	<0.01	21.0
		LC_DC1	5-Aug-20	<0.01	0.013	0.262	23.6	<0.04	<0.06	<0.01	<0.06	<0.01	23.9
		LC_DC1	11-Aug-20	0.033	0.024	0.731	36.4	<0.04	<0.06	<0.01	<0.06	<0.01	37.2
		LC_DC1	18-Aug-20	0.034	0.077	0.895	38.7	<0.04	<0.06	<0.01	<0.06	<0.01	39.7
		LC_DC1	25-Aug-20	<0.01	0.013	0.26	24.3	<0.04	<0.06	<0.01	<0.06	<0.01	24.6
		LC_DC1	1-Sep-20	<0.01	<0.01	0.247	27	<0.04	<0.06	<0.01	<0.06	<0.01	27.2
		LC_DC1	8-Sep-20	<0.01	0.014	0.248	28.3	<0.04	<0.06	<0.01	<0.06	<0.01	28.6
		LC_DC1	15-Sep-20	<0.01	<0.01	0.234	26.8	<0.04	<0.06	<0.01	<0.06	<0.01	27.0
		LC_DC1	22-Sep-20	<0.01	<0.01	0.193	26.2	<0.04	<0.06	<0.01	<0.06	<0.01	26.4
		LC_DC1	29-Sep-20	<0.01	<0.01	0.178	25.7	<0.04	<0.06	<0.01	<0.06	<0.01	25.9
		LC_DC1	6-Oct-20	<0.01	<0.01	0.193	25.5	<0.04	<0.06	<0.01	<0.06	<0.01	25.7
		LC_DC1	14-Oct-20	<0.01	<0.01	0.114	21	<0.04	<0.06	<0.01	<0.06	<0.01	21.1
		LC_DC1	20-Oct-20	<0.01	<0.01	0.131	23.2	<0.04	<0.06	<0.01	<0.06	<0.01	23.3
		LC_DC1	27-Oct-20	<0.01	<0.01	0.092	19.6	<0.04	<0.06	<0.01	<0.06	<0.01	19.7
		LC_DC1	5-Nov-20	<0.01	<0.01	0.101	18.4	<0.01	<0.01	<0.01	<0.01	<0.01	18.5
		LC_DC1	10-Nov-20	<0.01	<0.01	0.106	21.4	<0.01	<0.01	<0.01	<0.01	<0.01	21.5
		LC_DC1	17-Nov-20	<0.01	<0.01	0.12	26.7	<0.01	<0.01	<0.01	<0.01	<0.01	26.8
		LC_DC1	24-Nov-20	<0.01	<0.01	0.114	23.4	<0.01	<0.01	<0.01	<0.01	<0.01	23.5
		LC_DC1	3-Dec-20	<0.01	<0.01	0.084	21.4	<0.01	<0.01	<0.01	<0.01	<0.01	21.5
		LC_DC1	8-Dec-20	<0.01	<0.01	0.139	20.9	<0.01	<0.01	<0.01	<0.01	<0.01	21.0
		LC_DC1	15-Dec-20	<0.01	<0.01	0.099	23.4	<0.01	<0.01	<0.01	<0.01	<0.01	23.5
		LC_DC1	21-Dec-20	<0.01	<0.01	0.09	23.1	<0.01	<0.01	<0.01	<0.01	<0.01	23.2
		LC_DC1	30-Dec-20	<0.01	<0.01	0.084	23.2	<0.01	<0.01	<0.01	<0.01	<0.01	23.3
Fording River	Mine-exposed	LC_FRB	8-May-20	<0.01	<0.01	0.173	41.8	<0.04	<0.06	<0.01	<0.06	<0.01	42.0
		LC_FRB	28-Aug-20	<0.01	<0.01	0.205	31.7	<0.04	<0.06	<0.01	<0.06	<0.01	31.9
		LC_FRUS	8-May-20	<0.01	<0.01	0.133	25.7	<0.04	<0.06	<0.01	<0.06	<0.01	25.8
		LC_FRUS	28-Aug-20	<0.01	<0.01	0.201	36	<0.04	<0.06	<0.01	<0.06	<0.01	36.2

Notes: The sum of species was calculated using zero for values reported as < LRL "-" indicates no data available. The selenium species methaneselenonic acid is identified as an "unknown" selenium species (Se_Unknown; see Appendix I) eluting between methylseleninic acid and selenomethionine in laboratory reports associated with the LCO Dry Creek LAEMP. For the present report, these "unknown' species results have been identified exclusively as methaneselenonic acid throughout 2020 results to maintain consistency in data interpretation of selenium speciation results.

APPENDIX C
TOXICITY

Table C.1: Summary of 2020 LC_SPDC Acute Toxicity Results

EMS ID	Location Code	Sample Date	Endpoint	Result 96-Hour Rainbow Trout	Result 48-Hour Daphnia magna
E295211	LC_SPDC	2020-02-04	% Mortality	0	0
		2020-04-06		0	0
		2020-04-14		0	0
		2020-04-20		0	3
		2020-04-28		0	0
		2020-05-05		0	0
		2020-05-12		0	0
		2020-05-19		10	3
		2020-05-26		0	0
		2020-06-03		0	0
		2020-06-09		0	0
		2020-06-16		0	0
		2020-06-23		0	0
		2020-06-30		10	0
		2020-07-08		0	0
		2020-07-14		0	3
		2020-10-06		0	13

APPENDIX D

BENTHIC INVERTEBRATE COMMUNITY

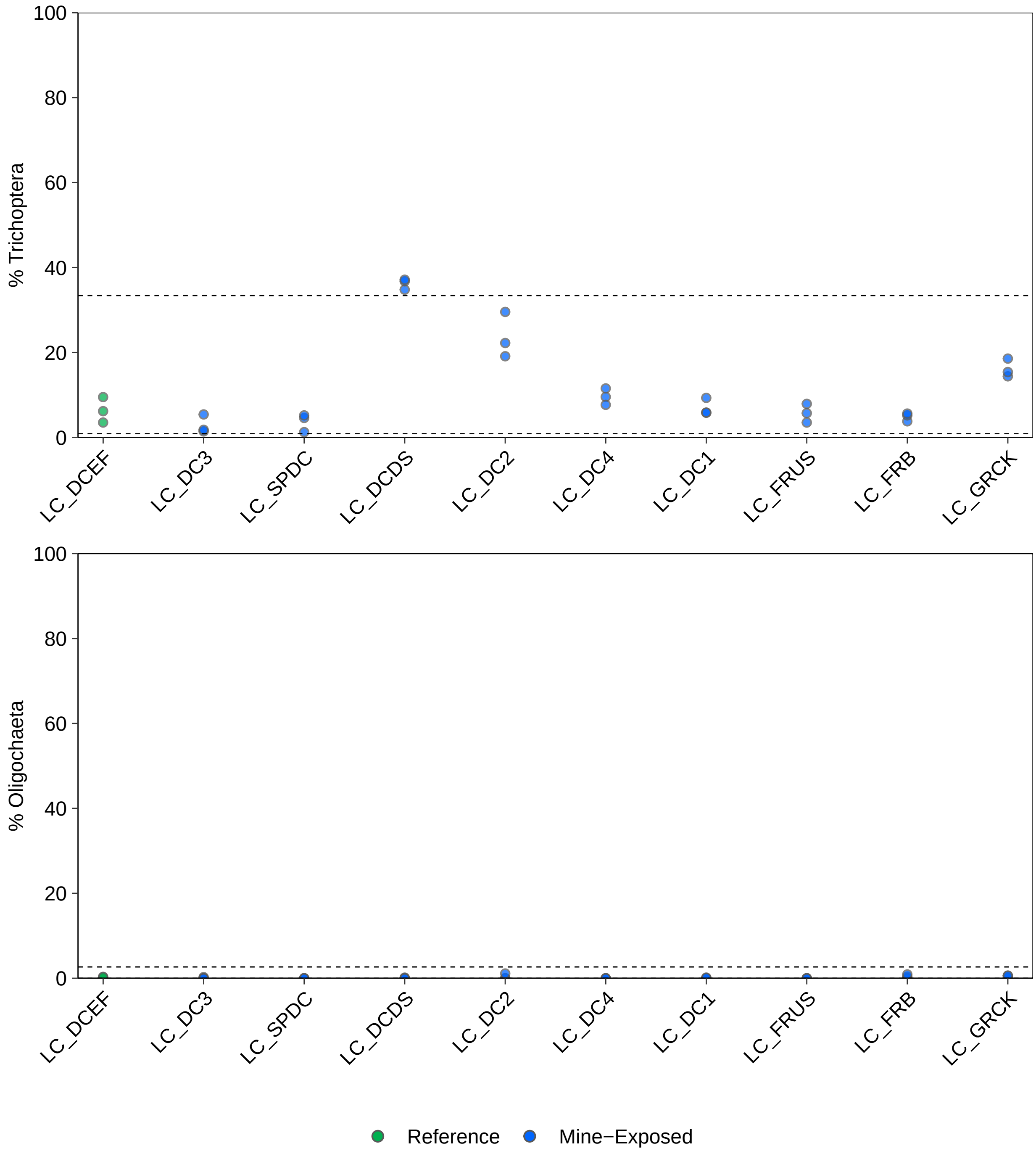

Figure D.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2020.

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.

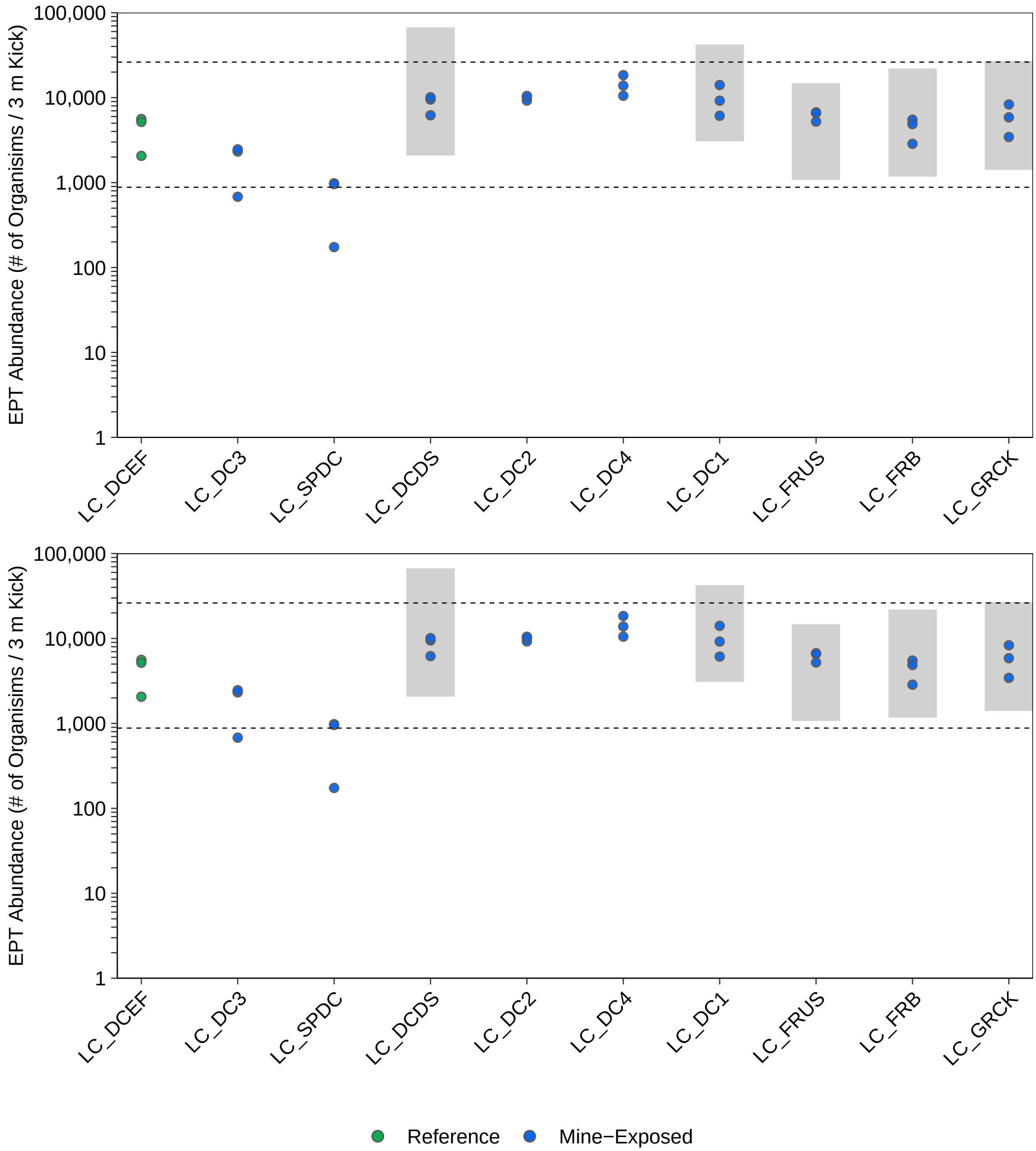

Figure D.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2020.

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.

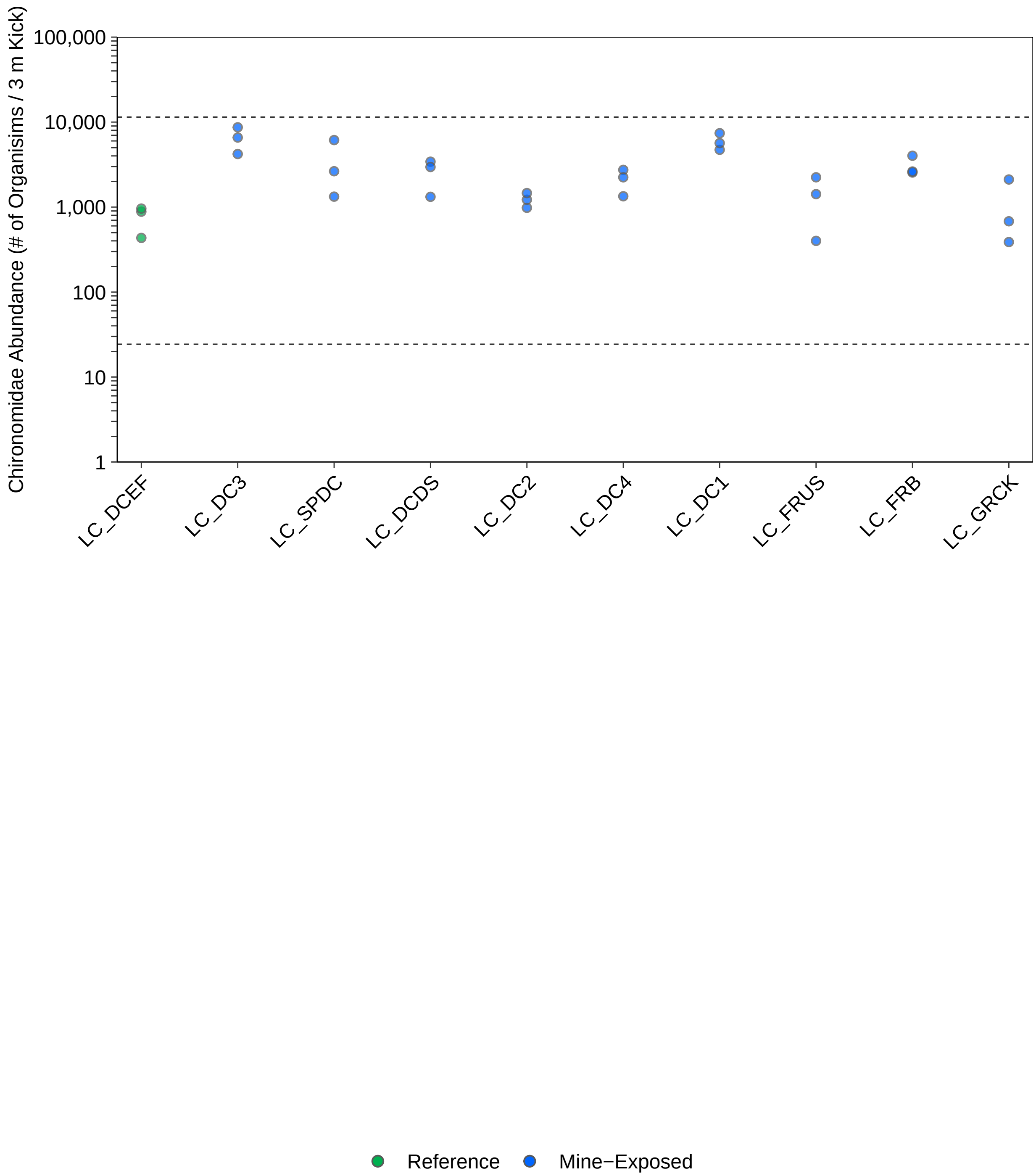

Figure D.1: **Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2020.**

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.

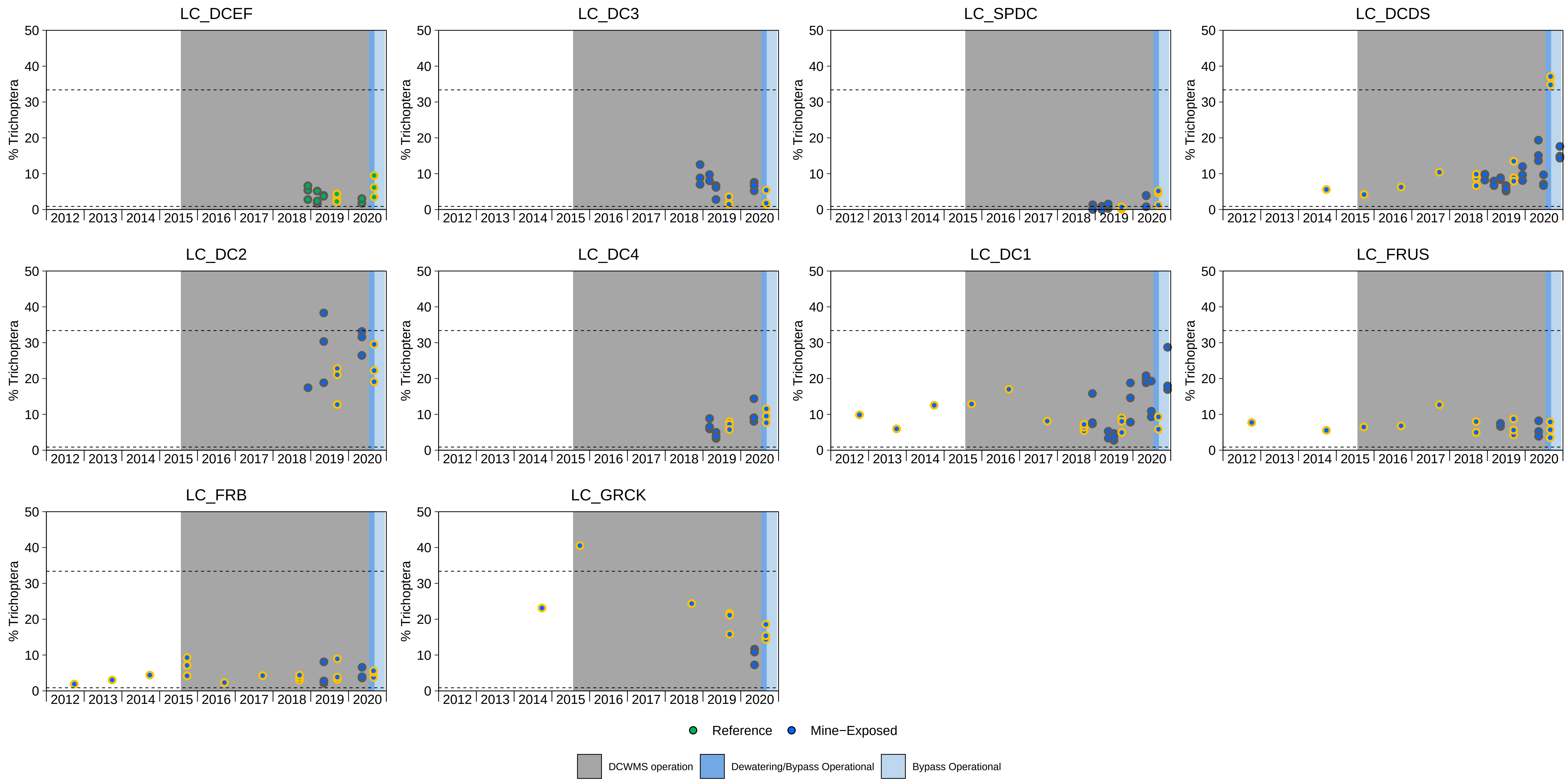

Figure D.2: Benthic Invertebrate Community Percent Trichoptera from Dry Creek LAEMP Sampling Areas, 2012 to 2020

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling.

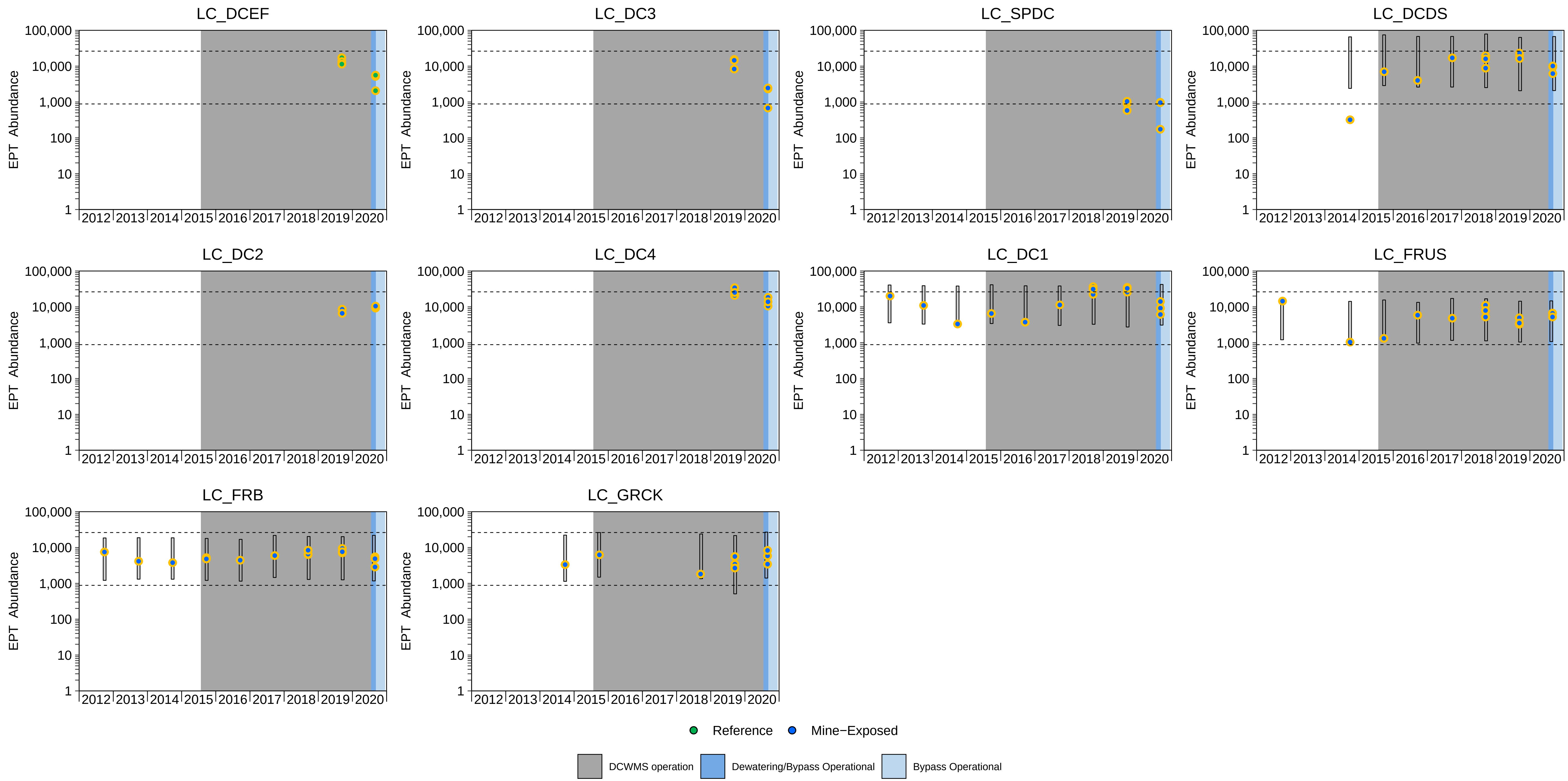

Figure D.3: Benthic Invertebrate Community EPT Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2020

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.

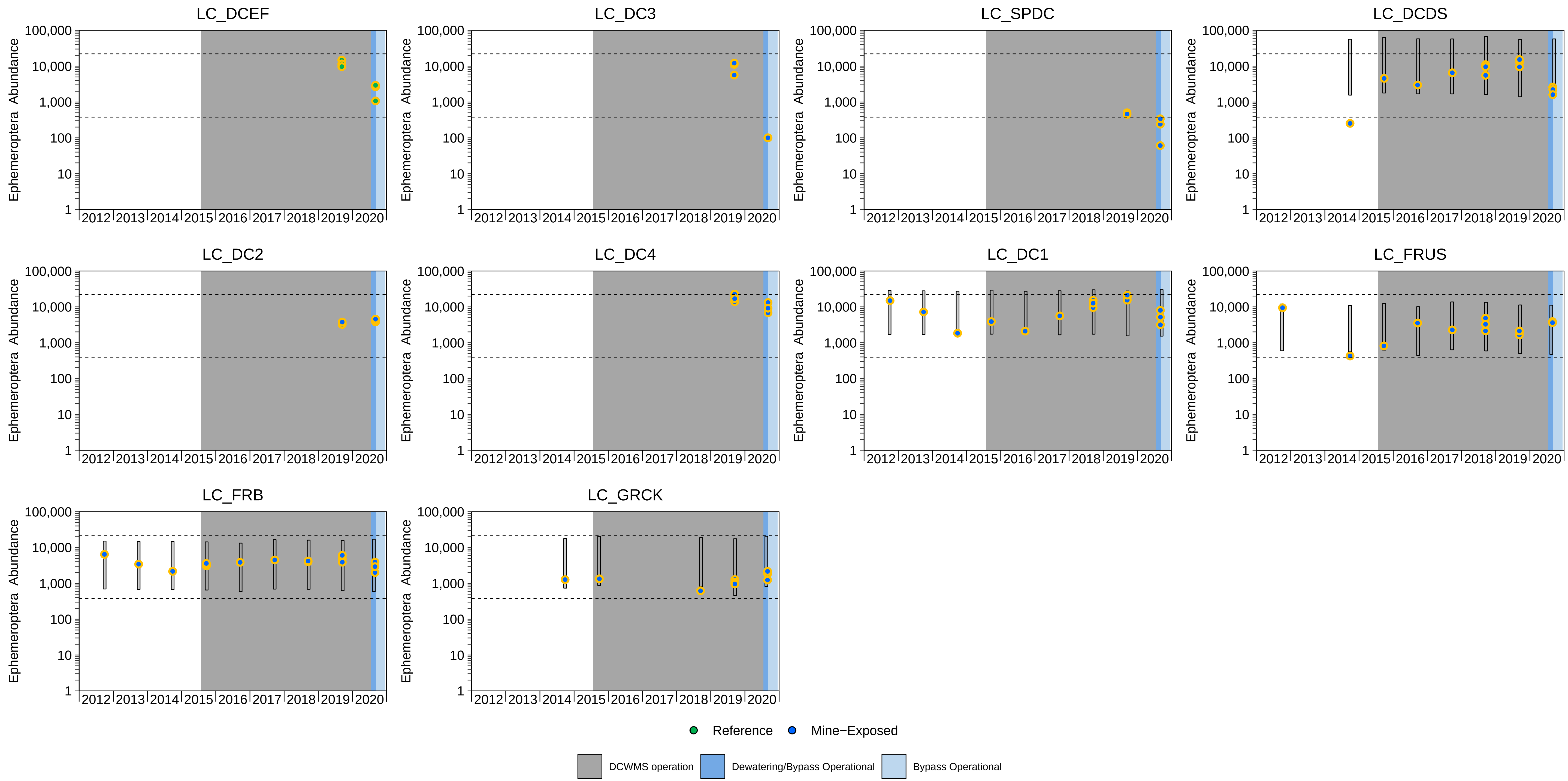

Figure D.4: Benthic Invertebrate Community Ephemeroptera Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2020

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.

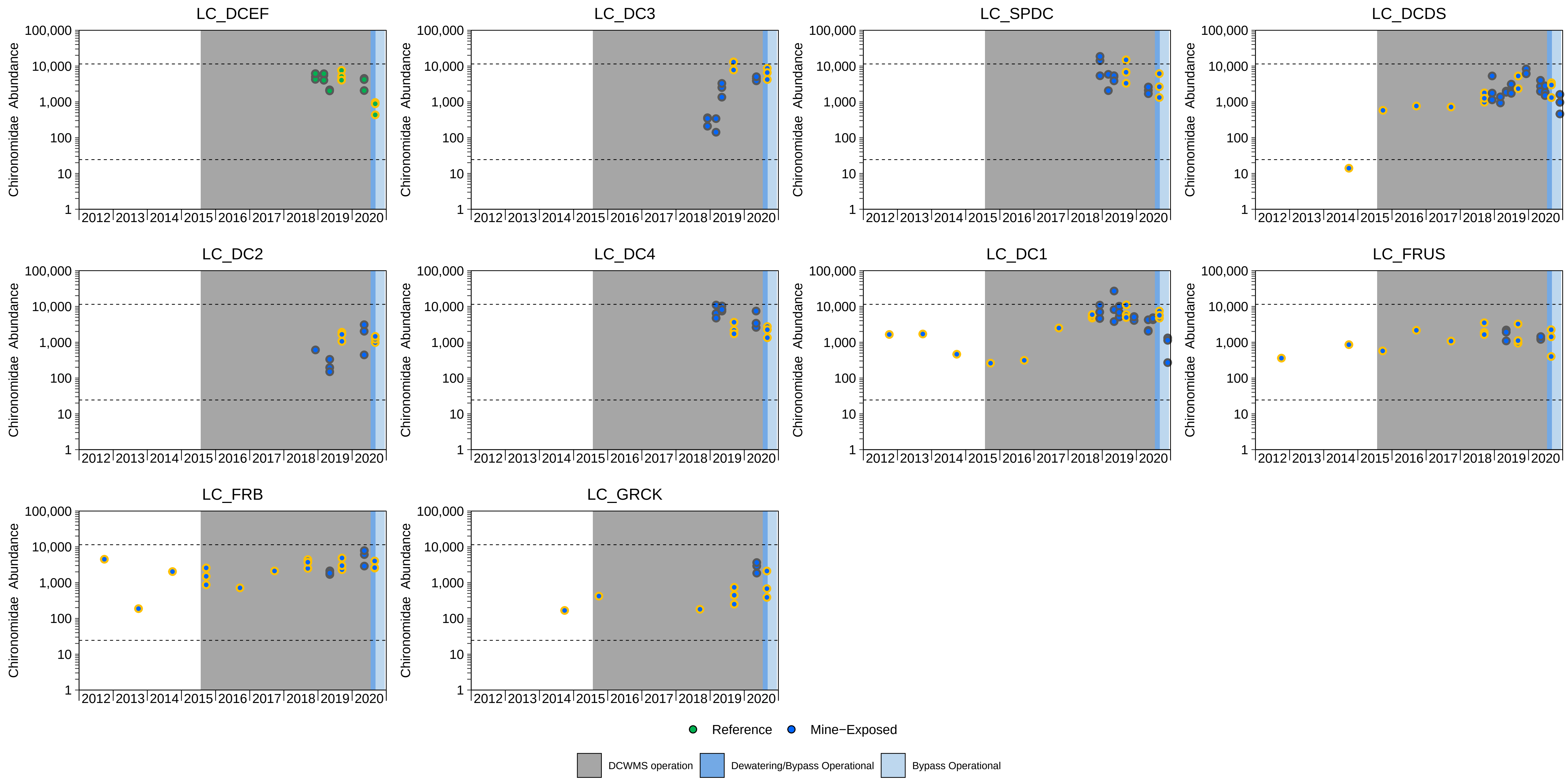

Figure D.5: Benthic Invertebrate Community Chironomidae Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2020

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling.

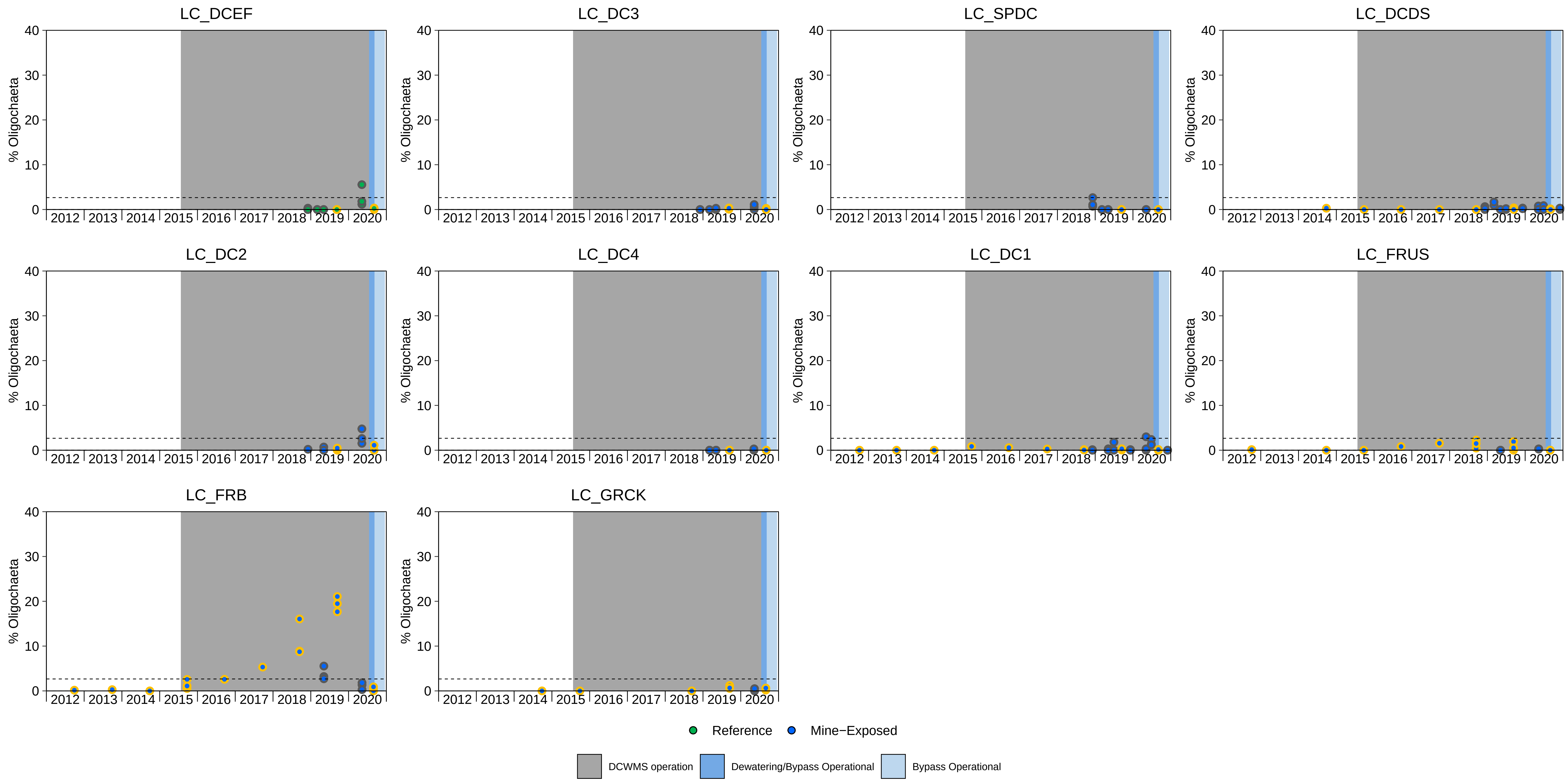

Figure D.6: Benthic Invertebrate Community Percent Oligochaeta from Dry Creek LAEMP Sampling Areas, 2012 to 2020

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling.

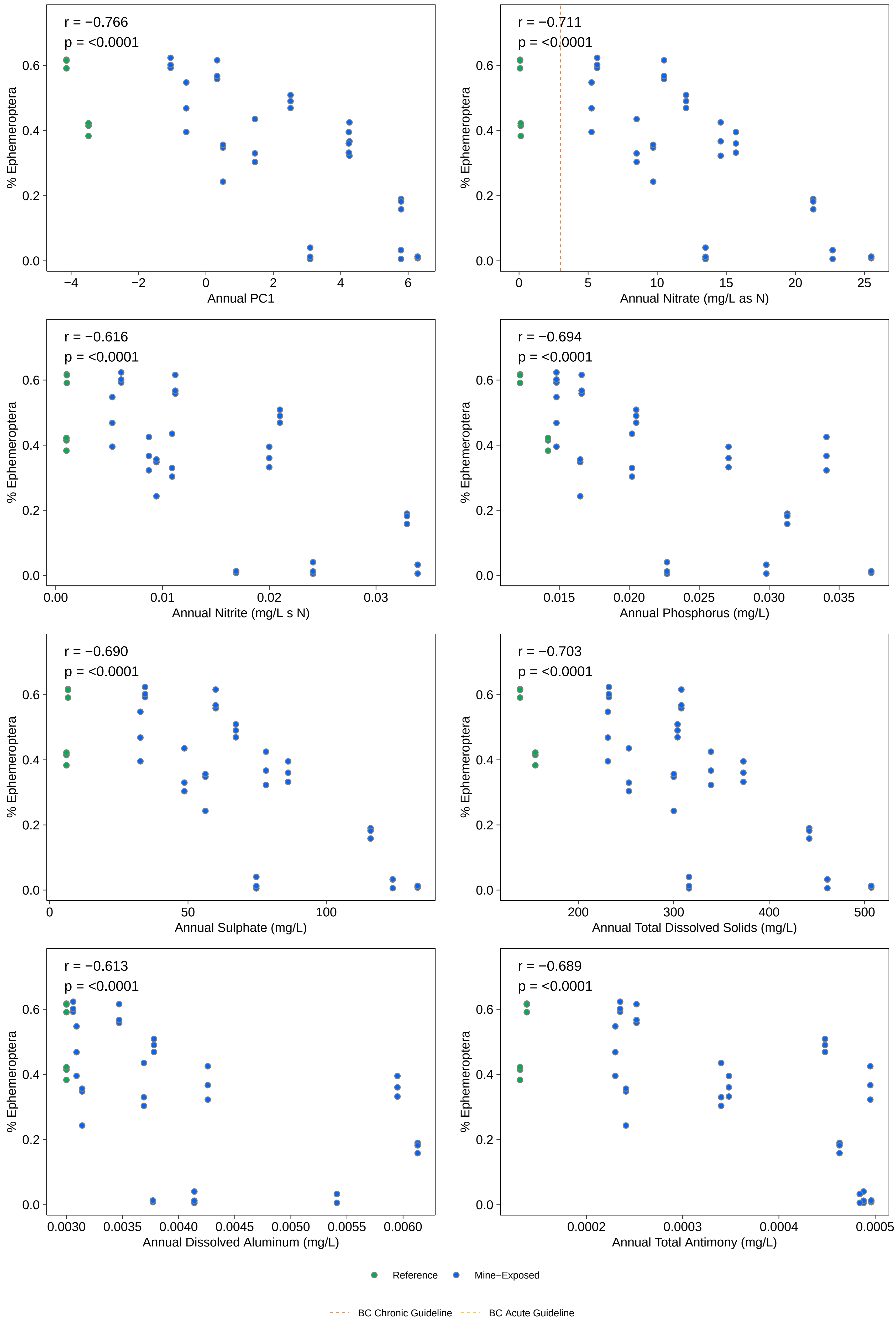

Figure D.7: Scatterplots of Spearman's Correlation Relationships (r > 0.6 or r < −0.6) Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, Dry Creek, 2019 to 2020

Notes: Annual = Averaged mean based on the previus year of waster quality sampling. See methods for details.

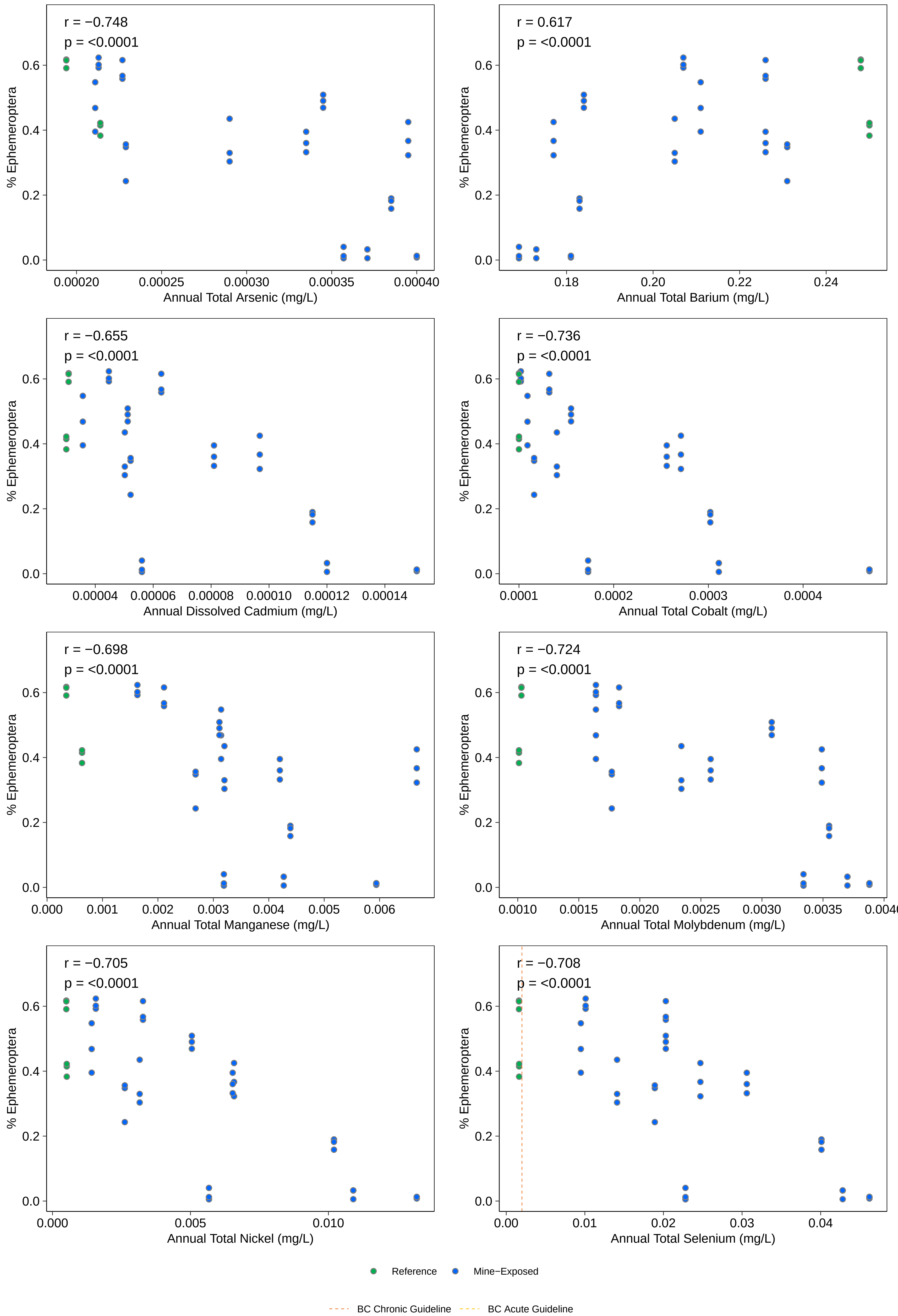

Figure D.7: Scatterplots of Spearman's Correlation Relationships (r > 0.6 or r < −0.6) Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, Dry Creek, 2019 to 2020

Notes: Annual = Averaged mean based on the previus year of waster quality sampling. See methods for details.

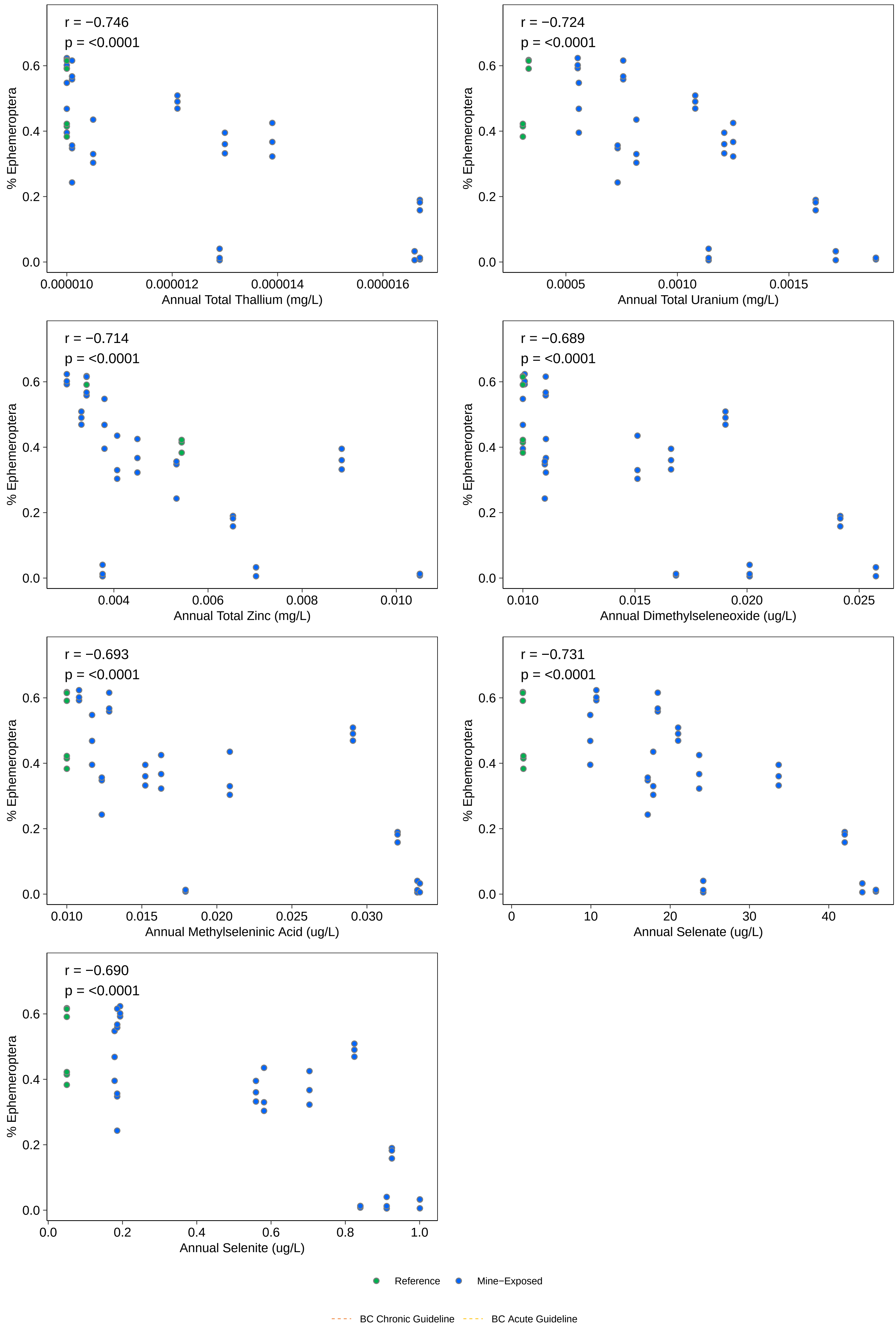

Figure D.7: Scatterplots of Spearman's Correlation Relationships (r > 0.6 or r < −0.6) Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, Dry Creek, 2019 to 2020

Notes: Annual = Averaged mean based on the previus year of waster quality sampling. See methods for details.

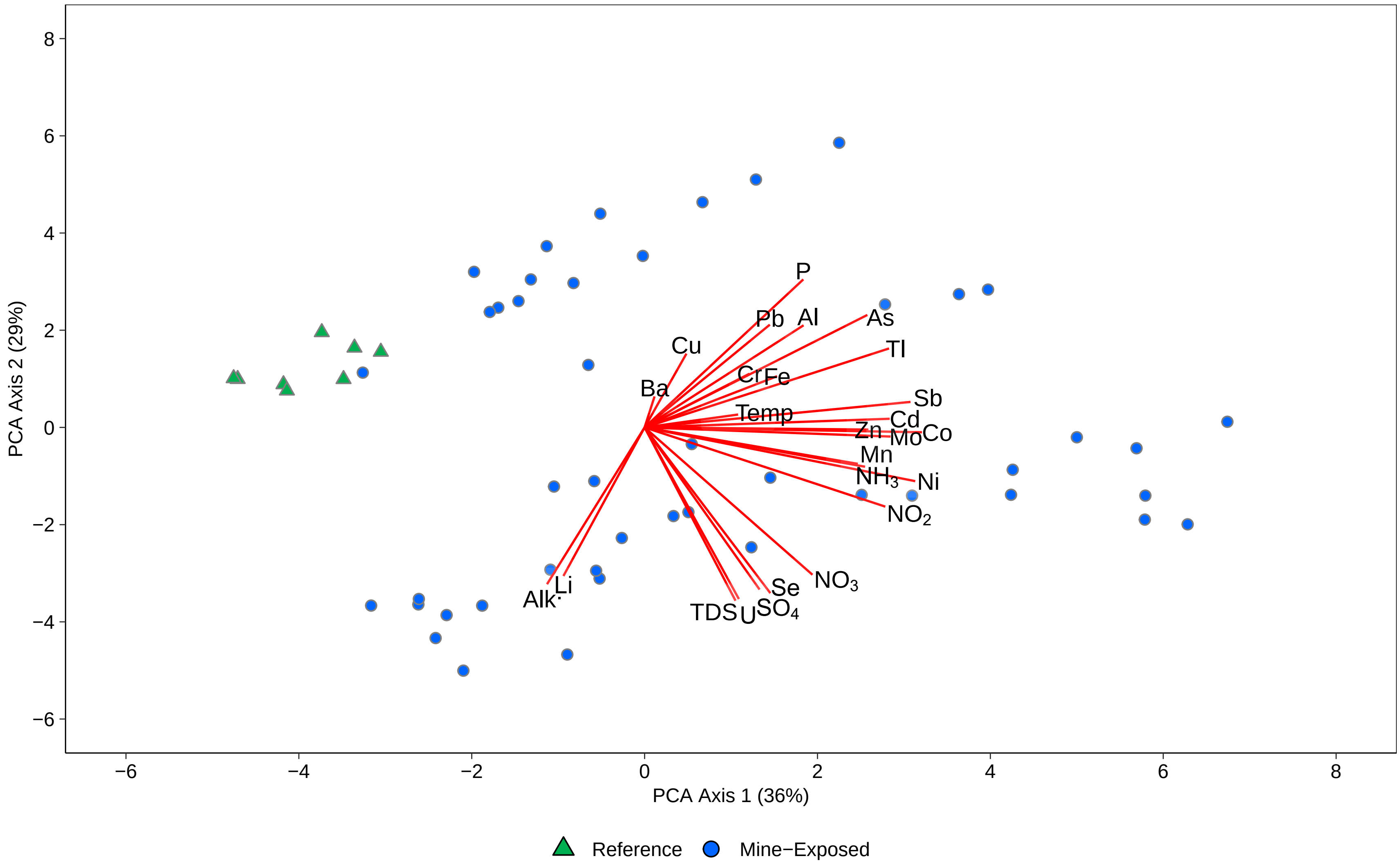

Figure D.8: Principal Components for Water Chemistry, Dry Creek LAEMP, 2013 to 2020

Table D.1: Summary of Benthic Invertebrate Endpoints Collected by 3-Minute Kick and Sweep Sampling at Dry Creek, Fording River, and Grace Creek, May, and June 2020

Area		Biological Area Code	Station	Month	Abundance (# org/ 3-min kick)	LPL Richness (# of taxa)	EPT		Ephemeroptera		Chironomidae		Non-Chironomidae Diptera		Oligochaeta		Trichoptera		Plecoptera	
							Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)
Dry Creek	Reference	LC_DCEF	DCEF-1	May	8,575	22	3,850	45	2,125	25	4,525	53	75	1	100	1	150	2	1,575	18
			DCEF-2		3,906	33	1,659	42	1,176	30	2,071	53	59	2	71	2	71	2	412	11
			DCEF-3		6,545	36	1,800	28	764	12	4,200	64	73	1	364	6	200	3	836	13
	Mine-exposed	LC_DC3	DC3-1	May	6,580	26	1,780	27	60	1	4,460	68	300	5	0	0	500	8	1,220	19
			DC3-2	May	4,929	25	814	17	29	1	3,871	79	200	4	29	1	257	5	529	11
			DC3-3	May	7,220	28	1,620	22	20	0	5,039	70	401	6	80	1	480	7	1,120	16
		LC_SPDC	SPDC-1	May	3,925	17	363	9	50	1	2,100	54	1,463	37	0	0	150	4	163	4
			SPDC-2	May	2,111	18	178	8	17	1	1,694	80	239	11	0	0	83	4	78	4
			SPDC-3	May	3,024	13	72	2	0	0	2,608	86	336	11	0	0	24	1	48	2
		LC_DCDS	DCDS-1	May	9,175	36	6,250	68	2,200	24	2,725	30	100	1	25	0	1,775	19	2,275	25
			DCDS-2	May	6,945	34	4,745	68	1,873	27	1,964	28	127	2	55	1	945	14	1,927	28
			DCDS-3	May	8,625	30	4,450	52	2,075	24	4,000	46	150	2	0	0	1,300	15	1,075	12
			DCDS-1	June	4,360	40	2,370	54	1,610	37	1,850	42	80	2	10	0	310	7	450	10
			DCDS-2	June	5,750	36	2,817	49	1,750	30	2,800	49	83	1	50	1	383	7	683	12
			DCDS-3	June	4,750	37	3,010	63	1,890	40	1,500	32	230	5	0	0	460	10	660	14
		LC_DC2	DC2-1	May	5,815	26	2,292	39	169	3	3,092	53	123	2	277	5	1,538	26	585	10
			DC2-2	May	4,347	31	1,973	45	53	1	2,027	47	40	1	67	2	1,373	32	547	13
			DC2-3	May	1,529	42	884	58	58	4	443	29	143	9	40	3	507	33	320	21
		LC_DC4	DC4-1	May	8,700	29	5,900	68	3,800	44	2,600	30	200	2	0	0	1,250	14	850	10
			DC4-2	May	14,920	31	7,040	47	4,400	29	7,440	50	400	3	0	0	1,200	8	1,440	10
			DC4-3	May	13,680	29	9,920	73	6,600	48	3,400	25	320	2	40	0	1,240	9	2,080	15
		LC_DC1	DC1-1	May	15,960	31	11,080	69	4,560	29	4,240	27	600	4	0	0	3,160	20	3,360	21
			DC1-2	May	12,233	27	9,367	77	3,900	32	2,133	17	300	2	367	3	2,300	19	3,167	26
			DC1-3	May	11,067	31	8,467	77	3,000	27	2,033	18	500	5	33	0	2,300	21	3,167	29
			DC1-1	June	8,800	39	3,680	42	1,520	17	4,840	55	120	1	120	1	820	9	1,340	15
			DC1-2	June	10,840	42	6,160	57	2,760	25	4,260	39	140	1	260	2	1,180	11	2,220	20
			DC1-3	June	10,060	36	5,120	51	1,760	17	4,680	47	140	1	120	1	1,940	19	1,420	14
Fording River		LC_FRUS	FRUS-1	May	2,600	42	1,129	43	164	6	1,286	49	86	3	7	0	136	5	829	32
			FRUS-2	May	2,575	44	1,206	47	406	16	1,200	47	44	2	6	0	100	4	700	27
			FRUS-3	May	4,547	45	2,867	63	440	10	1,440	32	53	1	13	0	373	8	2,053	45
		LC_FRB	FRB-1	May	5,250	47	2,020	38	1,060	20	2,899	55	131	3	70	1	190	4	770	15
			FRB-2	May	13,960	49	6,320	45	2,400	17	6,075	44	845	6	40	0	920	7	3,000	21
			FRB-3	May	13,200	36	3,360	25	760	6	7,840	59	1,000	8	240	2	520	4	2,080	16
Grace Creek		LC_GRCK	GRCK-1	May	8,778	31	6,578	75	3,200	36	1,844	21	311	4	0	0	1,022	12	2,356	27
			GRCK-2	May	12,920	34	9,640	75	5,520	43	2,920	23	280	2	0	0	1,400	11	2,720	21
			GRCK-3	May	16,000	34	11,760	74	6,800	43	3,640	23	520	3	80	1	1,160	7	3,800	24

Notes: LPL= Lowest Practical Level; EPT= Ephemeroptera, Plecoptera, and Trichoptera.

Table D.2: Summary of Benthic Invertebrate Endpoints Collected by 3-Minute Kick and Sweep Sampling at Dry Creek, Fording River, and Grace Creek, September 2020

Area		Biological Area Code	Station	Abundance (# org/ 3-min kick)	LPL Richness (# of taxa)	EPT		Ephemeroptera		Chironomidae		Non-Chironomidae Diptera		Oligochaeta		Trichoptera		Plecoptera	
						Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)
Dry Creek	Reference	LC_DCEF	DCEF-1	7,033	37	5,600	80	2,917	41	883	13	333	5	17	0	667	9	2,017	29
			DCEF-2	6,300	31	5,180	82	2,660	42	960	15	100	2	0	0	220	3	2,300	37
			DCEF-3	2,800	33	2,064	74	1,073	38	433	15	203	7	9	0	173	6	818	29
	Mine-exposed	LC_DC3	DC3-1	7,780	41	2,320	30	100	1	4,210	54	890	11	20	0	420	5	1,800	23
			DC3-2	12,800	39	2,460	19	100	1	8,678	68	1,082	8	0	0	180	1	2,180	17
			DC3-3	7,860	30	680	9	100	1	6,580	84	440	6	0	0	140	2	440	6
		LC_SPDC	SPDC-1	42,100	20	980	2	240	1	6,140	15	34,980	83	0	0	520	1	220	1
			SPDC-2	10,500	24	960	9	340	3	2,640	25	6,880	66	0	0	480	5	140	1
			SPDC-3	1,848	22	174	9	61	3	1,326	72	243	13	0	0	96	5	17	1
		LC_DCDS	DCDS-1	13,800	42	9,500	69	2,620	19	3,420	25	800	6	20	0	4,800	35	2,080	15
			DCDS-2	14,040	35	10,100	72	2,220	16	2,960	21	900	6	0	0	5,160	37	2,720	19
			DCDS-3	8,780	30	6,200	71	1,600	18	1,320	15	1,260	14	0	0	3,260	37	1,340	15
		LC_DC2	DC2-1	11,440	32	10,020	88	3,800	33	980	9	440	4	0	0	3,380	30	2,840	25
			DC2-2	10,680	30	9,240	87	4,220	40	1,220	11	200	2	0	0	2,040	19	2,980	28
			DC2-3	12,600	36	10,480	83	4,540	36	1,460	12	500	4	140	1	2,800	22	3,140	25
		LC_DC4	DC4-1	21,340	35	18,380	86	13,140	62	2,740	13	160	1	0	0	2,460	12	2,780	13
			DC4-2	12,180	39	10,520	86	6,800	56	1,340	11	300	2	0	0	1,160	10	2,560	21
			DC4-3	16,180	43	13,840	86	9,180	57	2,239	14	61	0	0	0	1,240	8	3,420	21
		LC_DC1	DC1-1	14,840	37	9,200	62	5,160	35	4,720	32	880	6	0	0	1,380	9	2,660	18
			DC1-2	22,400	48	14,080	63	7,980	36	7,400	33	900	4	0	0	1,300	6	4,800	21
			DC1-3	13,000	35	6,120	47	3,160	24	5,660	44	1,160	9	20	0	760	6	2,200	17
Fording River		LC_FRUS	FRUS-1	9,820	43	6,700	68	3,660	37	2,240	23	360	4	0	0	560	6	2,480	25
			FRUS-2	9,120	43	6,600	72	3,880	43	1,420	16	260	3	0	0	720	8	2,000	22
			FRUS-3	6,300	36	5,220	83	3,620	57	400	6	120	2	0	0	220	3	1,380	22
		LC_FRB	FRB-1	10,580	42	5,500	52	3,920	37	4,020	38	460	4	40	0	400	4	1,180	11
			FRB-2	5,800	38	2,860	49	2,010	35	2,550	44	180	3	0	0	300	5	550	9
			FRB-3	8,920	43	4,880	55	2,920	33	2,620	29	440	5	80	1	500	6	1,460	16
Grace Creek		LC_GRCK	GRCK-1	6,820	39	5,860	86	1,860	27	680	10	180	3	40	1	980	14	3,020	44
			GRCK-2	11,180	47	8,320	74	2,160	19	2,111	19	589	5	20	0	1,720	15	4,440	40
			GRCK-3	3,975	35	3,438	86	1,238	31	388	10	75	2	25	1	738	19	1,463	37

Notes: LPL= Lowest Practical Level; EPT= Ephemeroptera, Plecoptera, and Trichoptera.

Table D.3: Summary of Benthic Invertebrate Endpoints Collected by 3-Minute Kick and Sweep Sampling at Dry Creek, Fording River, and Grace Creek, December 2020

Area		Biological Area Code	Station	Abundance (# org/ 3-min kick)	LPL Richness (# of taxa)	EPT		Ephemeroptera		Chironomidae		Non-Chironomidae Diptera		Oligochaeta		Trichoptera		Plecoptera	
						Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)
Dry Creek	Mine-Exposed	LC_DCDS	DCDS-1	3,410	33	2,320	68.0	160	4.69	970	28.4	100	2.9	10	0.293	600	17.6	1,560	45.7
			DCDS-2	4,800	36	3,057	63.7	114	2.38	1,614	33.6	86	1.8	0	0	714	14.9	2,229	46.4
			DCDS-3	1,312	30	840	64.0	124	9.45	460	35.1	8	0.6	4	0.305	188	14.3	528	40.2
		LC_DC1	DC1-1	7,680	29	5,600	72.9	2,200	28.6	1,320	17.2	720	9.4	0	0	1,300	16.9	2,100	27.3
			DC1-2	1,645	25	1,230	74.8	455	27.7	270	16.4	135	8.2	0	0	295	17.9	480	29.2
			DC1-3	6,150	27	4,667	75.9	1,483	24.1	1,133	18.4	350	5.7	0	0	1,767	28.7	1,417	23.0

Notes: LPL= Lowest Practical Level; EPT= Ephemeroptera, Plecoptera, and Trichoptera.

Table D.4: Statistical Comparison of Benthic Invertebrate Community Endpoints in Dry Creek, September 2019 to 2020

Endpoint	Transformation	Year	Area	Year:Area	Area		Do endpoints differ between years for each area?[a]	Do endpoints for exposed areas differ from the reference area within each year?[b]	
								2019	2020
Abundance	rank	<0.001	0.005	0.133	Reference	LC_DCEF	-1.0	nc	
					Mine-Exposed	LC_DC3		ns	
						LC_SPDC		ns	
						LC_DCDS		ns	
						LC_DC2		ns	
						LC_DC4		ns	
						LC_DC1		1.8	
LPL Richness	none	0.047	<0.001	0.017	Reference	LC_DCEF	ns	nc	nc
					Mine-Exposed	LC_DC3	-7.9	5.6	ns
						LC_SPDC	2.6	-9.5	-3.8
						LC_DCDS	ns	ns	ns
						LC_DC2	ns	ns	ns
						LC_DC4	ns	ns	ns
						LC_DC1	ns	ns	ns
% EPT	none	<0.001	<0.001	<0.001	Reference	LC_DCEF	4.0	nc	nc
					Mine-Exposed	LC_DC3	-17	-11	-14
						LC_SPDC	ns	-36	-16
						LC_DCDS	-1.5	ns	ns
						LC_DC2	ns	ns	ns
						LC_DC4	ns	10	ns
						LC_DC1	-4.0	ns	-4.9
% Ephemeroptera	none	<0.001	<0.001	<0.001	Reference	LC_DCEF	-14	nc	nc
					Mine-Exposed	LC_DC3	-7.0	-16	-19
						LC_SPDC	ns	-40	-18
						LC_DCDS	-16	-8.1	-11
						LC_DC2	ns	-17	ns
						LC_DC4	ns	ns	8.4
						LC_DC1	-2.0	-9.4	-4.4
% Plecoptera	rank	0.189	<0.001	<0.001	Reference	LC_DCEF	62	nc	nc
					Mine-Exposed	LC_DC3	ns	ns	-15
						LC_SPDC	ns	ns	-35
						LC_DCDS	ns	31	-17
						LC_DC2	ns	60	ns
						LC_DC4	-3.1	43	-10
						LC_DC1	-12	50	-14
% Trichoptera	none	<0.001	<0.001	<0.001	Reference	LC_DCEF	ns	nc	nc
					Mine-Exposed	LC_DC3	ns	ns	ns
						LC_SPDC	ns	ns	ns
						LC_DCDS	8.8	6.5	10
						LC_DC2	0.88	15	5.7
						LC_DC4	ns	ns	ns
						LC_DC1	ns	ns	ns
% Oligochaeta	rank	0.187	0.061	0.166	Reference	LC_DCEF	ns	nc	
					Mine-Exposed	LC_DC3		ns	
						LC_SPDC		ns	
						LC_DCDS		ns	
						LC_DC2		ns	
						LC_DC4		ns	
						LC_DC1		ns	
% Chironomidae	rank	0.51	<0.001	0.003	Reference	LC_DCEF	-4.9	nc	nc
					Mine-Exposed	LC_DC3	ns	ns	146
						LC_SPDC	ns	ns	ns
						LC_DCDS	ns	ns	ns
						LC_DC2	-2.8	ns	ns
						LC_DC4	ns	-7.3	ns
						LC_DC1	1.9	ns	49
% Non-Chironomidae Diptera	log10	0.007	<0.001	0.026	Reference	LC_DCEF	4.1	nc	nc
					Mine-Exposed	LC_DC3	ns	4.3	ns
						LC_SPDC	ns	12	3.1
						LC_DCDS	ns	4.6	ns
						LC_DC2	ns	3.1	ns
						LC_DC4	ns	ns	-1.9
						LC_DC1	3.7	3.2	ns
EPT Abundance	none	<0.001	<0.001	<0.001	Reference	LC_DCEF	-3.3	nc	nc
					Mine-Exposed	LC_DC3	-2.8	ns	ns
						LC_SPDC	ns	-4.5	ns
						LC_DCDS	-3.3	ns	ns
						LC_DC2	ns	ns	ns
						LC_DC4	-1.8	4.3	5.2
						LC_DC1	-4.4	5.8	ns
Ephemeroptera Abundance	rank	<0.001	<0.001	<0.001	Reference	LC_DCEF	-3.2	nc	nc
					Mine-Exposed	LC_DC3	-8.2	ns	-6.7
						LC_SPDC	ns	-4.0	-6.4
						LC_DCDS	-2.8	ns	ns
						LC_DC2	ns	-3.0	4.1
						LC_DC4	-1.8	ns	17
						LC_DC1	-3.5	2.5	6.6
Chironomidae Abundance	log10	<0.001	<0.001	0.014	Reference	LC_DCEF	-6.4	nc	nc
					Mine-Exposed	LC_DC3	ns	ns	4.9
						LC_SPDC	-1.2	ns	3.1
						LC_DCDS	ns	ns	2.7
						LC_DC2	ns	-4.0	ns
						LC_DC4	ns	ns	ns
						LC_DC1	ns	ns	4.8

P-value < 0.1.

MOD > 2.

MOD < -2.

Notes: "nc" = no relevant comparison. "ns" = not significant.

[a] MOD = MCT_{2020}-MCT_{2019}/SD_{2019} where MCT is the mean for untransformed data, geometric mean for log10 transformed data and median for rank transformed data.

[b] MOD = MCT_{stn}-MCT_{LC_DCEF}/SD_{LC_DCEF} where MCT is the mean for untransformed data, geometric mean for log10 transformed data and median for rank transformed data.

Table D.5: Statistical Comparison of Benthic Invertebrate Community Endpoints in Fording River, September 2018 to 2020

Endpoint	Transformation	Year	Area	Year:Area	Area		Do endpoints differ among years for each area?[a]			Do concentrations differ from LC_FRUS within a year?[b]		
							2018 vs 2019	2018 vs 2020	2019 vs 2020	2018	2019	2020
Abundance	none	0.045	0.015	0.022	Upstream	LC_FRUS	-1.2	ns	ns	nc	nc	nc
					Downstream	LC_FRB	ns	ns	-4.1	ns	4.3	ns
LPL Richness	none	0.306	0.899	0.35	Upstream	LC_FRUS	ns	ns	ns	nc		
					Downstream	LC_FRB				ns		
% EPT	log10	0.034	<0.001	0.233	Upstream	LC_FRUS	ns	ns	1.3	nc		
					Downstream	LC_FRB				-1.9		
% Ephemeroptera	none	0.037	0.49	0.224	Upstream	LC_FRUS	ns	2.4	1.3	nc		
					Downstream	LC_FRB				ns		
% Plecoptera	log10	0.012	<0.001	0.766	Upstream	LC_FRUS	-0.98	-1.1	ns	nc		
					Downstream	LC_FRB				-2.3		
% Trichoptera	log10	0.777	0.141	0.699	Upstream	LC_FRUS	ns	ns	ns	nc		
					Downstream	LC_FRB				ns		
% Oligochaeta	rank	<0.001	<0.001	0.071	Upstream	LC_FRUS	ns	-1.3	ns	nc	nc	nc
					Downstream	LC_FRB	ns	-42	-8.1	6.5	25	ns
% Chrinomidae	log10	0.967	0.04	0.05	Upstream	LC_FRUS	ns	ns	ns	nc	nc	nc
					Downstream	LC_FRB	ns	ns	ns	ns	ns	1.6
% Non-Chironomidae Diptera	none	0.022	0.518	0.087	Upstream	LC_FRUS	ns	-1.9	-3.2	nc	nc	nc
					Downstream	LC_FRB	ns	ns	ns	ns	-1.8	ns
EPT Abundance	none	0.07	0.535	0.014	Upstream	LC_FRUS	-1.4	ns	ns	nc	nc	nc
					Downstream	LC_FRB	ns	ns	-3.0	ns	4.6	ns
Ephemeroptera Abundance	log10	0.414	0.018	0.003	Upstream	LC_FRUS	-1.3	ns	5.4	nc	nc	nc
					Downstream	LC_FRB	ns	ns	-2.4	ns	7.5	ns
Chironomidae Abundance	log10	0.41	0.012	0.658	Upstream	LC_FRUS	ns	ns	ns	nc	nc	nc
					Downstream	LC_FRB	ns	ns	ns	1.1	1.1	1.1

P-value < 0.1.

MOD > 2.

MOD < -2.

Notes: "nc" = no relevant comparison. "ns" = not significant.

[a] MOD = MCT_{2020}-MCT_{2019}/SD_{2019} where MCT is the mean for untransformed data, geometric mean for log10 transformed data and median for rank transformed data.

[b] MOD = MCT_{stn}-MCT_{LC_DCEF}/SD_{LC_DCEF} where MCT is the mean for untransformed data, geometric mean for log10 transformed data and median for rank transformed data.

Table D.6: Biological Monitoring Area Scores from Correspondence Analysis on Lowest-Practical-Level Benthic Invertebrate Communities from the Dry Creek, 2019 to 2020

Season	Status	Area	Year	CA1 (17.0%)	CA2 (11.9%)	CA3 (9.6%)
February	Reference	LC_DCEF	2019	0.259	-0.838	-0.228
				0.273	-0.747	-0.570
				0.204	-0.650	-0.302
	Mine-Exposed	LC_DC3	2019	0.287	-0.0813	-0.242
				0.382	-0.281	-0.0587
		LC_SPDC	2019	-3.50	-0.115	-0.491
				-2.14	-0.364	-0.924
		LC_DCDS	2019	0.0138	-0.299	0.330
				0.0231	-0.321	0.184
		LC_DC4	2019	0.236	-0.665	0.107
				0.270	-0.679	-0.0421
				0.0930	-0.442	-0.00886
May	Mine-Exposed	LC_DCEF	2019	0.332	-0.801	-0.361
				0.288	-0.872	-0.421
			2020	0.157	-1.12	-0.0884
				0.283	-0.995	-0.684
				0.0835	-0.926	-0.551
		LC_DC3	2019	0.186	-0.421	-0.561
				-0.0563	-0.387	-0.519
				-0.239	-0.650	-0.524
			2020	-0.707	-0.391	-0.557
				-0.461	-0.599	-0.639
				-0.579	-0.463	-0.790
		LC_SPDC	2019	-2.93	-0.475	-0.359
				-3.22	-0.166	-0.117
				-2.83	-0.266	-0.320
			2020	-2.39	-0.0572	-0.0154
				-1.60	-0.217	-0.272
				-2.20	-0.0289	-0.665
		LC_DCDS	2019	-0.397	-0.350	0.478
				-0.317	-0.543	0.268
			2020	-0.0940	-0.264	0.480
				-0.199	-0.703	0.274
				-0.331	-0.652	0.384
		LC_DC2	2019	-0.0861	-0.546	-0.175
				-0.255	-0.743	0.110
				0.328	-0.320	0.154
			2020	0.101	-0.983	0.393
				0.00735	-0.770	0.455
				0.206	-0.748	0.533
		LC_DC4	2019	0.181	-0.385	-0.0366
				0.202	-0.566	-0.255
				0.195	-0.360	0.0881
			2020	0.142	-0.529	0.0895
				0.372	-0.722	0.194
				0.174	-0.458	0.0751
		LC_DC1	2019	-0.655	-0.421	0.128
				0.166	-0.639	-0.0274
				-0.0408	-0.308	0.229
			2020	0.190	-0.576	0.679
				0.365	-0.673	0.631
				0.223	-0.391	0.445
		LC_FRB	2019	0.276	-0.0305	-1.12
				0.173	-0.0930	-0.704
				0.340	0.199	-0.894
			2020	0.169	-0.555	-0.850
				0.309	0.00956	-0.933
				0.253	-0.334	-1.07
		LC_FRUS	2019	0.464	0.296	-1.21
				-0.0160	0.125	-0.961
				0.414	0.318	-1.46
			2020	-0.283	-0.589	-0.506
				0.399	-0.539	-0.887
				-0.0806	-0.237	-0.564

Table D.6: Biological Monitoring Area Scores from Correspondence Analysis on Lowest Practicable Level Benthic Invertebrate Communities from the Dry Creek, 2019 to 2020

Season	Status	Area	Year	CA1 (17.0%)	CA2 (11.9%)	CA3 (9.6%)
June	Mine-Exposed	LC_DCDS	2019	0.0939	-0.522	0.0181
				0.144	-0.374	0.130
				-0.0179	-0.723	-0.0815
			2020	0.230	-0.939	-0.0283
				0.209	-0.958	0.0811
				0.252	-0.799	0.245
		LC_DC1	2019	0.252	-0.288	0.0346
				0.218	-0.494	0.300
				0.0549	-0.540	0.306
			2020	0.193	-0.780	0.311
				0.340	-0.884	0.340
				0.0755	-0.730	0.477
September	Reference	LC_DCEF	2019	0.0772	0.340	-0.218
				0.140	-0.0335	-0.399
				0.300	0.00221	-0.320
			2020	0.425	0.219	-0.350
				0.425	0.0316	-0.0616
				0.460	0.129	-0.221
	Mine-Exposed	LC_DC3	2019	-0.0839	0.734	-0.318
				-0.0909	0.724	-0.210
				-0.198	0.651	-0.252
			2020	-0.130	0.758	-0.662
				-0.216	0.783	-0.752
				-0.505	0.980	-0.715
		LC_SPDC	2019	-3.87	0.533	-0.266
				-3.47	0.705	-0.0579
				-3.00	0.597	-0.126
			2020	-3.21	0.835	-0.0806
				-2.14	0.844	0.156
				-1.65	0.891	-0.305
		LC_DCDS	2019	-0.272	0.575	0.719
				-0.181	0.599	0.805
				-0.0656	0.772	0.699
			2020	-0.368	0.910	0.700
				-0.382	1.01	0.831
				-0.588	1.07	0.926
		LC_DC2	2019	0.332	0.658	0.706
				0.260	0.390	0.857
				0.128	0.447	0.567
			2020	0.213	0.732	0.995
				0.494	0.907	0.928
				0.324	0.830	0.807
		LC_DC4	2019	0.460	0.739	0.545
				0.452	0.745	0.506
				0.447	0.696	0.498
			2020	0.494	1.01	0.430
				0.454	0.830	0.458
				0.485	0.794	0.402
		LC_DC1	2019	0.0707	0.454	0.678
				-0.0491	0.437	0.741
				0.250	0.650	0.619
			2020	0.0971	0.653	0.384
				0.191	0.668	0.404
				-0.170	0.579	0.347
		LC_FRB	2019	0.578	0.806	-0.878
				0.546	0.740	-0.848
				0.404	0.570	-0.818
			2020	0.265	0.742	-0.751
				0.345	0.797	-0.725
				0.524	0.805	-0.875
		LC_FRUS	2019	0.523	0.641	-0.962
				0.452	0.782	-0.802
				0.555	0.797	-0.991
			2020	0.349	0.908	-0.573
				0.551	0.960	-0.728
				0.743	0.834	-0.809

Table D.6: Biological Monitoring Area Scores from Correspondence Analysis on Lowest-Practical-Level Benthic Invertebrate Communities from the Dry Creek, 2019 to 2020

Season	Status	Area	Year	CA1 (17.0%)	CA2 (11.9%)	CA3 (9.6%)
December	Mine-Exposed	LC_DCDS	2019	-0.582	-0.429	0.133
				-0.448	-0.151	0.561
				-0.0580	-0.270	0.737
			2020	0.147	-0.0753	0.471
				0.0509	0.146	0.464
				0.140	-0.0544	0.635
		LC_DC1	2019	0.358	-0.287	0.591
				0.244	-0.244	0.783
				0.0933	-0.302	0.845
			2020	0.267	0.0753	0.785
				0.308	0.0259	0.658
				0.267	0.0972	0.852

Table D.7: Pearson Correlations of Annual Water Analytes and PCA Axis Scores, Dry Creek LAEMP, 2013 to 2020

Variable	PCA1 (36%)		PCA2 (29%)	
	P-value	r_s	P-value	r_s
Temperature (C)	0.022	0.312	0.622	0.0686
Total Dissolved Solids (mg/L)	0.026	0.303	<0.001	-0.922
Alkalinity (mg/L as CaCO3)	0.016	-0.325	<0.001	-0.834
Nitrate (mg/L)	<0.001	0.560	<0.001	-0.784
Nitrite (mg/L)	<0.001	0.803	0.001	-0.422
Ammonia (mg/L)	<0.001	0.711	0.16	-0.194
Phosphorus (mg/L)	<0.001	0.529	<0.001	0.788
Sulphate (mg/L)	0.004	0.383	<0.001	-0.863
Dissolved Aluminum (mg/L)	<0.001	0.530	<0.001	0.544
Total Antimony (mg/L)	<0.001	0.887	0.328	0.136
Total Arsenic (mg/L)	<0.001	0.743	<0.001	0.599
Total Barium (mg/L)	0.812	0.0331	0.233	0.165
Dissolved Cadmium (mg/L)	<0.001	0.817	0.74	0.0461
Total Chromium (mg/L)	0.01	0.350	0.036	0.286
Total Cobalt (mg/L)	<0.001	0.925	0.854	-0.0257
Total Copper (mg/L)	0.315	0.139	0.003	0.393
Total Iron (mg/L)	<0.001	0.442	0.046	0.273
Total Lead (mg/L)	0.002	0.418	<0.001	0.547
Total Lithium (mg/L)	0.048	-0.271	<0.001	-0.791
Total Manganese (mg/L)	<0.001	0.735	0.129	-0.209
Total Molybdenum (mg/L)	<0.001	0.820	0.727	-0.0486
Total Nickel (mg/L)	<0.001	0.902	0.036	-0.286
Total Selenium (mg/L)	0.002	0.419	<0.001	-0.882
Total Thallium (mg/L)	<0.001	0.815	0.002	0.420
Total Uranium (mg/L)	0.021	0.314	<0.001	-0.913
Total Zinc (mg/L)	<0.001	0.746	0.934	-0.0115

$r_s \geq 0.6$ or ≤ -0.6.

significant correlation (p-value < 0.05).

Table D.8: PCA Axis Scores for Annual Water Analytes, Dry Creek LAEMP, 2013 to 2020

Year	Station	PCA1 (36%)	PCA 2 (29%)
2013	LC_DC1	-1.46	2.60
	LC_DC3	-0.513	4.40
	LC_DCEF	-3.36	1.64
	FR_FR5	1.24	-2.47
2014	LC_FRUS	-0.521	-3.11
	LC_DC1	-1.32	3.04
	LC_DC3	-1.13	3.73
	LC_DCDS	-1.97	3.20
	LC_DCEF	-3.73	1.96
	LC_FRB	-1.09	-2.93
2015	LC_SPDC	2.25	5.86
	LC_FRUS	-2.62	-3.64
	LC_DC1	-1.69	2.46
	LC_DC3	1.29	5.10
	LC_DCDS	0.670	4.63
	LC_DCEF	-4.71	0.995
	FR_FR5	-2.42	-4.33
	LC_FRB	-2.61	-3.53
2016	LC_SPDC	-0.021	3.53
	LC_DC1	-3.26	1.13
	LC_DC3	-0.823	2.97
	LC_DCDS	-1.79	2.38
	LC_DCEF	-4.75	1.01
	LC_FRB	-3.16	-3.67
2017	LC_SPDC	3.64	2.74
	LC_DC1	-0.651	1.29
	LC_DC3	3.97	2.84
	LC_DCDS	2.78	2.53
	LC_DCEF	-4.18	0.887
	FR_FR5	-2.10	-5.00
	LC_FRB	-2.29	-3.86
2018	LC_SPDC	5.69	-0.429
	LC_DC1	0.546	-0.343
	LC_DC3	6.74	0.116
	LC_DCDS	5.00	-0.203
	LC_DCEF	-3.05	1.56
	FR_FR5	-0.894	-4.67
	LC_FRB	-0.264	-2.28
2019	LC_SPDC	3.09	-1.40
	LC_DC1	-0.583	-1.10
	LC_DC2	1.45	-1.03
	LC_DC3	4.26	-0.871
	LC_DC4	-1.05	-1.22
	LC_DCDS	2.51	-1.39
	LC_DCEF	-4.14	0.758
	RG_FRB	-1.88	-3.67
2020	LC_SPDC	5.79	-1.90
	LC_DC1	0.507	-1.74
	LC_DC2	4.24	-1.39
	LC_DC3	6.28	-1.99
	LC_DC4	0.334	-1.82
	LC_DCDS	5.79	-1.40
	LC_DCEF	-3.48	0.994
	LC_FRB	-0.561	-2.95

APPENDIX E
BENTHIC INVERTEBRATE TISSUE CHEMISTRY

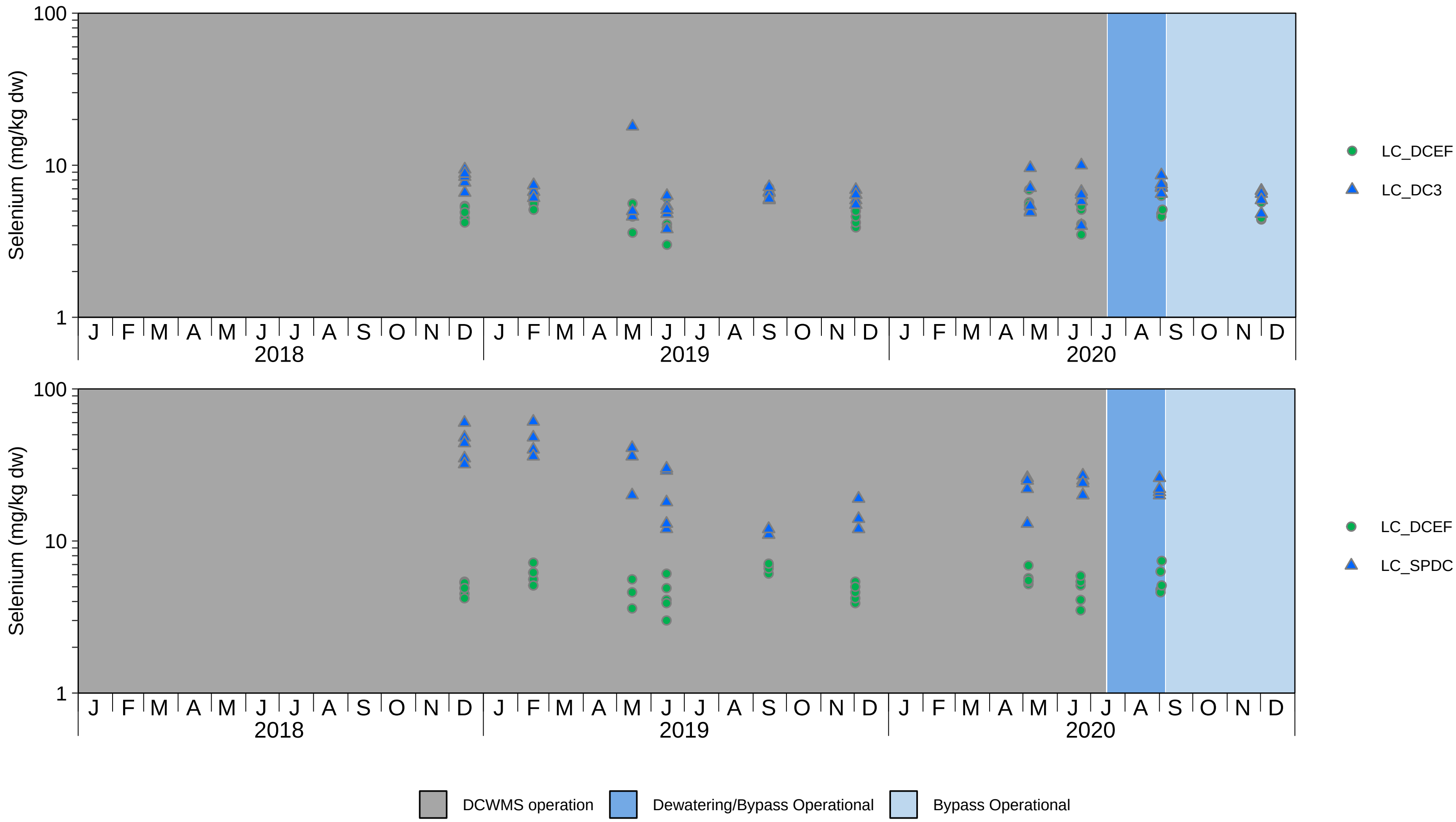

Figure E.1: Benthic Invertebrate Selenium Concentrations, for LC_DC3 and LC_SPDC (Mine−exposed Areas) Relative to LC_DCEF (Reference Area), 2018 to 2020

Notes: Only data collected simultaneously at both stations are displayed.

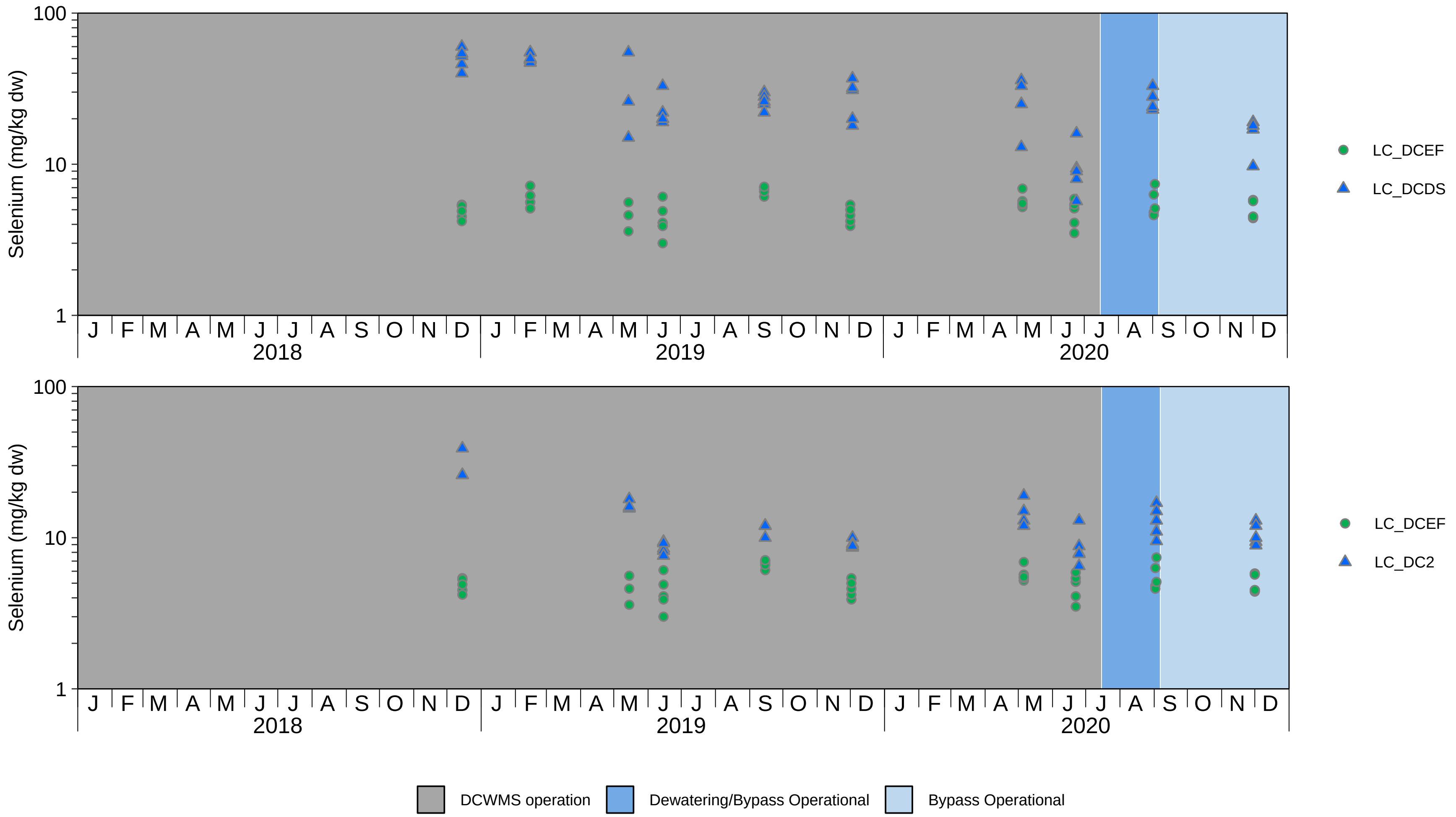

Figure E.1: Benthic Invertebrate Selenium Concentrations, for LC_DCDS and LC_DC2 (Mine−exposed Areas) Relative to LC_DCEF (Reference Area), 2018 to 2020

Notes: Only data collected simultaneously at both stations are displayed.

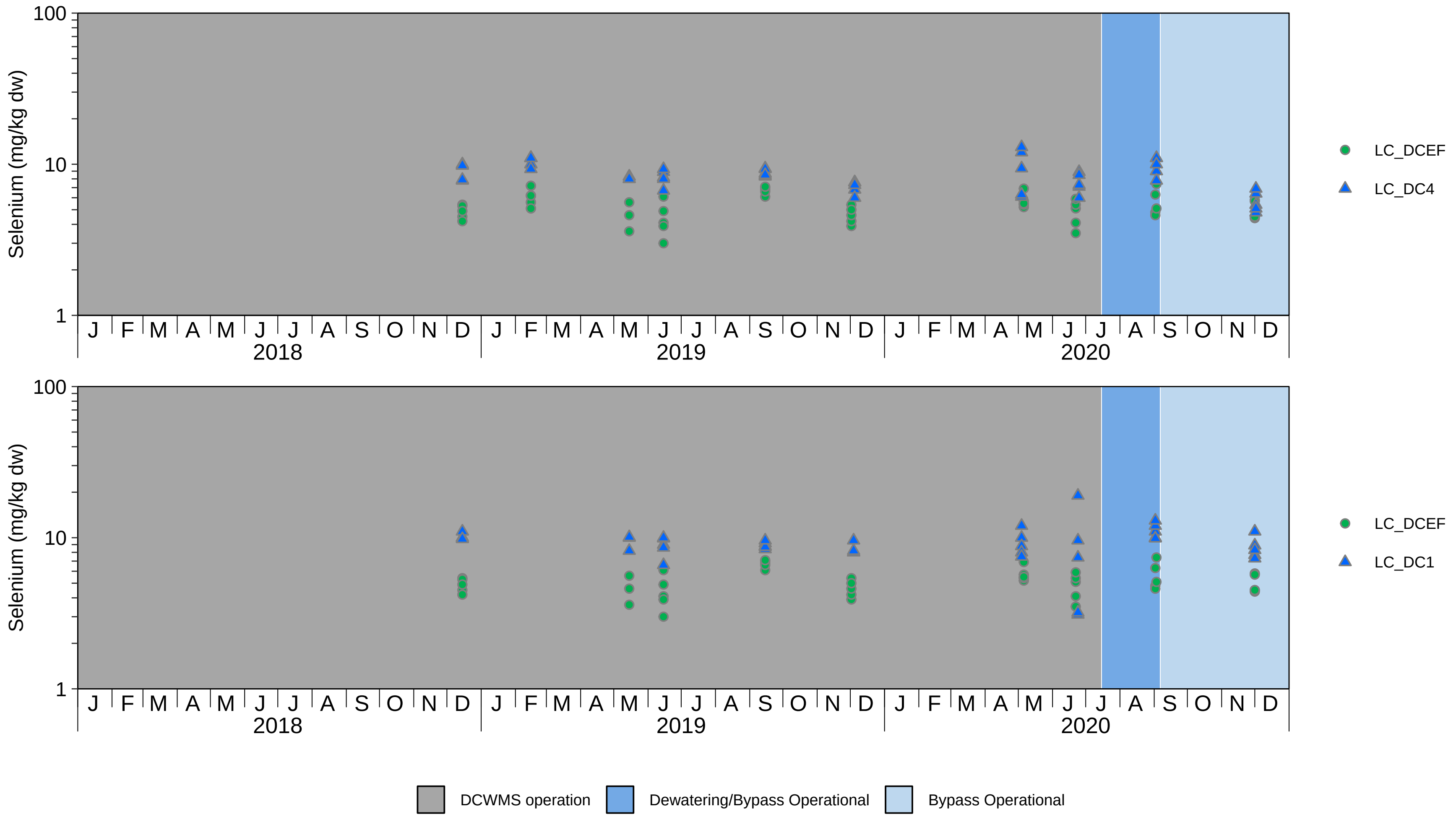

Figure E.1: Benthic Invertebrate Selenium Concentrations, for LC_DC4 and LC_DC1 (Mine−exposed Areas) Relative to LC_DCEF (Reference Area), 2018 to 2020

Notes: Only data collected simultaneously at both stations are displayed.

Table E.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 E.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Dry Creek, Fording River, and Grace Creek, Dry Creek LAEMP, January to December 2020

Waterbody		Sample Code	Sample Date	Selenium Concentration (mg/kg dw) Sample	Area Mean	Area Median	Area Minimum	Area Maximum	Area Standard Deviation
Dry Creek	Mine-exposed	LC_DC3_INV-01	7-May-20	5.0	6.4	5.4	4.9	9.6	2.0
		LC_DC3_INV-02	7-May-20	7.1					
		LC_DC3_INV-03	7-May-20	4.9					
		LC_DC3_INV-04	7-May-20	9.6					
		LC_DC3_INV-05	7-May-20	5.4					
		LC_SPDC_INV-01	5-May-20	25	22	25	13	26	5.4
		LC_SPDC_INV-02	5-May-20	26					
		LC_SPDC_INV-03	5-May-20	22					
		LC_SPDC_INV-04	5-May-20	13					
		LC_SPDC_INV-05	5-May-20	25					
		LC_DCDS_INV-01	5-May-20	13	26	25	13	36	8.9
		LC_DCDS_INV-02	5-May-20	36					
		LC_DCDS_INV-03	5-May-20	33					
		LC_DCDS_INV-04	5-May-20	25					
		LC_DCDS_INV-05	5-May-20	25					
		LC_DC4_INV-01	4-May-20	12	9.4	9.4	6.1	13	3.2
		LC_DC4_INV-02	4-May-20	13					
		LC_DC4_INV-03	4-May-20	6.1					
		LC_DC4_INV-04	4-May-20	6.3					
		LC_DC4_INV-05	4-May-20	9.4					
		LC_DC2_INV-01	6-May-20	15	14	13	12	19	2.9
		LC_DC2_INV-02	6-May-20	13					
		LC_DC2_INV-03	6-May-20	19					
		LC_DC2_INV-04	6-May-20	12					
		LC_DC2_INV-05	6-May-20	12					
		LC_DC1_INV-01	4-May-20	12	9.3	8.8	7.5	12	1.8
		LC_DC1_INV-02	4-May-20	10					
		LC_DC1_INV-03	4-May-20	8.8					
		LC_DC1_INV-04	4-May-20	8.0					
		LC_DC1_INV-05	4-May-20	7.5					
		LC_DC3_INV-01	22-Jun-20	5.8	6.6	6.4	4.0	10	2.2
		LC_DC3_INV-02	22-Jun-20	6.7					
		LC_DC3_INV-03	22-Jun-20	10					
		LC_DC3_INV-04	22-Jun-20	4.0					
		LC_DC3_INV-05	22-Jun-20	6.4					
		LC_SPDC_INV-01	24-Jun-20	25	23	24	20	27	3.1
		LC_SPDC_INV-02	24-Jun-20	27					
		LC_SPDC_INV-03	24-Jun-20	24					
		LC_SPDC_INV-04	24-Jun-20	20					
		LC_SPDC_INV-05	24-Jun-20	20					
		LC_DCDS_INV-01	24-Jun-20	8.0	9.6	9.0	5.7	16	3.8
		LC_DCDS_INV-02	24-Jun-20	9.4					
		LC_DCDS_INV-03	24-Jun-20	5.7					
		LC_DCDS_INV-04	24-Jun-20	9.0					
		LC_DCDS_INV-05	24-Jun-20	16					
		LC_DC4_INV-01	25-Jun-20	8.9	7.6	7.3	6.0	8.9	1.2
		LC_DC4_INV-02	25-Jun-20	8.5					
		LC_DC4_INV-03	25-Jun-20	7.1					
		LC_DC4_INV-04	25-Jun-20	6.0					
		LC_DC4_INV-05	25-Jun-20	7.3					
		LC_DC2_INV-01	25-Jun-20	8.8	8.8	7.9	6.5	13	2.5
		LC_DC2_INV-02	25-Jun-20	6.5					
		LC_DC2_INV-03	25-Jun-20	7.9					
		LC_DC2_INV-04	25-Jun-20	13					
		LC_DC2_INV-05	25-Jun-20	7.8					
		LC_DC1_INV-01	24-Jun-20	9.6	8.5	7.4	3.1	19	6.5
		LC_DC1_INV-02	24-Jun-20	7.4					
		LC_DC1_INV-03	24-Jun-20	3.1					
		LC_DC1_INV-04	24-Jun-20	3.2					
		LC_DC1_INV-05	24-Jun-20	19					
		LC_DC3_INV-1	2-Sep-20	7.2	7.4	7.2	6.5	8.6	0.77
		LC_DC3_INV-2	2-Sep-20	7.1					
		LC_DC3_INV-3	2-Sep-20	6.5					
		LC_DC3_INV-4	2-Sep-20	7.5					
		LC_DC3_INV-5	2-Sep-20	8.6					
		LC_SPDC_INV-1	1-Sep-20	26	22	21	20	26	2.3
		LC_SPDC_INV-2	1-Sep-20	20					
		LC_SPDC_INV-3	1-Sep-20	21					
		LC_SPDC_INV-4	1-Sep-20	21					
		LC_SPDC_INV-5	1-Sep-20	22					
		LC_DCDS_INV-1	1-Sep-20	28	26	24	23	33	4.3
		LC_DCDS_INV-2	1-Sep-20	23					
		LC_DCDS_INV-3	1-Sep-20	33					
		LC_DCDS_INV-4	1-Sep-20	23					
		LC_DCDS_INV-5	1-Sep-20	24					
		LC_DCDS_INV-1	23-Sep-20	20	20	20	20	21	0.58
		LC_DCDS_INV-2	23-Sep-20	20					
		LC_DCDS_INV-3	23-Sep-20	21					
		LC_DCDS_INV-01	30-Sep-20	18	17	18	13	21	4.0
		LC_DCDS_INV-02	30-Sep-20	21					
		LC_DCDS_INV-03	30-Sep-20	13					
		LC_DC4_INV-1	3-Sep-20	11	9.8	10	7.8	11	1.4
		LC_DC4_INV-2	3-Sep-20	9.0					
		LC_DC4_INV-3	3-Sep-20	11					
		LC_DC4_INV-4	3-Sep-20	7.8					
		LC_DC4_INV-5	3-Sep-20	10					
		LC_DC4_INV-1	23-Sep-20	11	7.7	7.9	4.1	11	3.5
		LC_DC4_INV-2	23-Sep-20	4.1					
		LC_DC4_INV-3	23-Sep-20	7.9					
		LC_DC4_INV-01	30-Sep-20	10	9.3	9.7	8.3	10	0.91
		LC_DC4_INV-02	30-Sep-20	9.7					
		LC_DC4_INV-03	30-Sep-20	8.3					
		LC_DC2_INV-1	3-Sep-20	13	13	13	9.5	17	3.0
		LC_DC2_INV-2	3-Sep-20	17					
		LC_DC2_INV-3	3-Sep-20	15					
		LC_DC2_INV-4	3-Sep-20	11					
		LC_DC2_INV-5	3-Sep-20	9.5					
		LC_DC2_INV-1	23-Sep-20	11	12	13	11	13	1.2
		LC_DC2_INV-2	23-Sep-20	13					
		LC_DC2_INV-3	23-Sep-20	13					
		LC_DC2_INV-01	30-Sep-20	11	14	14	11	18	3.5
		LC_DC2_INV-02	30-Sep-20	18					
		LC_DC2_INV-03	30-Sep-20	14					

Table E.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Dry Creek, Fording River, and Grace Creek, Dry Creek LAEMP, January to December 2020

Waterbody		Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
				Sample	Area Mean	Area Median	Area Minimum	Area Maximum	Area Standard Deviation
Dry Creek	Mine-exposed	LC_DC1_INV-1	2-Sep-20	10	11	11	9.9	13	1.3
		LC_DC1_INV-2	2-Sep-20	11					
		LC_DC1_INV-3	2-Sep-20	9.9					
		LC_DC1_INV-4	2-Sep-20	12					
		LC_DC1_INV-5	2-Sep-20	13					
		LC_DC1_INV-1	23-Sep-20	10	9.8	10	9.4	10	0.35
		LC_DC1_INV-2	23-Sep-20	10					
		LC_DC1_INV-3	23-Sep-20	9.4					
		LC_DC1_INV-01	30-Sep-20	11	10	11	9.1	11	1.1
		LC_DC1_INV-02	30-Sep-20	9.1					
		LC_DC1_INV-03	30-Sep-20	11					
		LC_DCDS_INV-01	6-Oct-20	11	18	20	11	23	6.2
		LC_DCDS_INV-02	6-Oct-20	23					
		LC_DCDS_INV-03	6-Oct-20	20					
		LC_DCDS_INV-01	15-Oct-20	24	18	15	14	24	5.5
		LC_DCDS_INV-02	15-Oct-20	14					
		LC_DCDS_INV-03	15-Oct-20	15					
		LC_DCDS_INV-01	21-Oct-20	11	17	20	11	20	5.2
		LC_DCDS_INV-02	21-Oct-20	20					
		LC_DCDS_INV-03	21-Oct-20	20					
		LC_DCDS_INV-01	28-Oct-20	13	16	13	12	24	6.7
		LC_DCDS_INV-02	28-Oct-20	24					
		LC_DCDS_INV-03	28-Oct-20	12					
		LC_DC4_INV-01	6-Oct-20	8.4	8.2	8.4	7.7	8.5	0.44
		LC_DC4_INV-02	6-Oct-20	7.7					
		LC_DC4_INV-03	6-Oct-20	8.5					
		LC_DC4_INV-01	15-Oct-20	7.0	7.8	7.3	7.0	9.2	1.2
		LC_DC4_INV-02	15-Oct-20	9.2					
		LC_DC4_INV-03	15-Oct-20	7.3					
		LC_DC4_INV-01	21-Oct-20	6.5	6.5	6.5	6.4	6.7	0.15
		LC_DC4_INV-02	21-Oct-20	6.7					
		LC_DC4_INV-03	21-Oct-20	6.4					
		LC_DC4_INV-01	28-Oct-20	5.9	6.1	5.9	5.3	7.2	1.0
		LC_DC4_INV-02	28-Oct-20	7.2					
		LC_DC4_INV-03	28-Oct-20	5.3					
		LC_DC2_INV-01	6-Oct-20	13	12	13	9.0	13	2.3
		LC_DC2_INV-02	6-Oct-20	13					
		LC_DC2_INV-03	6-Oct-20	9.0					
		LC_DC2_INV-01	15-Oct-20	10	11	11	10	11	0.58
		LC_DC2_INV-02	15-Oct-20	11					
		LC_DC2_INV-03	15-Oct-20	11					
		LC_DC2_INV-01	21-Oct-20	9.5	9.8	9.5	8.8	11	1.1
		LC_DC2_INV-02	21-Oct-20	11					
		LC_DC2_INV-03	21-Oct-20	8.8					
		LC_DC2_INV-01	28-Oct-20	11	12	12	11	14	1.5
		LC_DC2_INV-02	28-Oct-20	14					
		LC_DC2_INV-03	28-Oct-20	12					
		LC_DC1_INV-01	6-Oct-20	11	11	11	11	12	0.58
		LC_DC1_INV-02	6-Oct-20	12					
		LC_DC1_INV-03	6-Oct-20	11					
		LC_DC1_INV-01	15-Oct-20	7.2	6.8	6.6	6.5	7.2	0.38
		LC_DC1_INV-02	15-Oct-20	6.6					
		LC_DC1_INV-03	15-Oct-20	6.5					
		LC_DC1_INV-01	21-Oct-20	8.4	8.1	8.4	6.7	9.2	1.3
		LC_DC1_INV-02	21-Oct-20	9.2					
		LC_DC1_INV-03	21-Oct-20	6.7					
		LC_DC1_INV-01	28-Oct-20	9.8	9.1	9.1	8.5	9.8	0.65
		LC_DC1_INV-02	28-Oct-20	9.1					
		LC_DC1_INV-03	28-Oct-20	8.5					
		LC_DCDS_INV-01	5-Nov-20	19	21	19	19	25	3.5
		LC_DCDS_INV-02	5-Nov-20	25					
		LC_DCDS_INV-03	5-Nov-20	19					
		LC_DCDS_INV-01	12-Nov-20	11	15	12	11	21	5.5
		LC_DCDS_INV-02	12-Nov-20	21					
		LC_DCDS_INV-03	12-Nov-20	12					
		LC_DC4_INV-01	5-Nov-20	7.6	6.5	6.2	5.8	7.6	0.95
		LC_DC4_INV-02	5-Nov-20	6.2					
		LC_DC4_INV-03	5-Nov-20	5.8					
		LC_DC4_INV-01	12-Nov-20	5.5	7.5	8.5	5.5	8.6	1.8
		LC_DC4_INV-02	12-Nov-20	8.6					
		LC_DC4_INV-03	12-Nov-20	8.5					
		LC_DC2_INV-01	5-Nov-20	11	12	11	9.6	14	2.2
		LC_DC2_INV-02	5-Nov-20	14					
		LC_DC2_INV-03	5-Nov-20	9.6					
		LC_DC2_INV-01	12-Nov-20	12	14	12	11	20	4.9
		LC_DC2_INV-02	12-Nov-20	20					
		LC_DC2_INV-03	12-Nov-20	11					
		LC_DC1_INV-01	30-Nov-20	11	8.6	8.3	7.3	11	1.5
		LC_DC1_INV-02	30-Nov-20	8.9					
		LC_DC1_INV-03	30-Nov-20	7.7					
		LC_DC1_INV-04	30-Nov-20	7.3					
		LC_DC1_INV-05	30-Nov-20	8.3					
		LC_DC1_INV-01	5-Nov-20	8.7	9.6	9.1	8.7	11	1.2
		LC_DC1_INV-02	5-Nov-20	11					
		LC_DC1_INV-03	5-Nov-20	9.1					
		LC_DC1_INV-01	12-Nov-20	11	9.3	10	6.8	11	2.2
		LC_DC1_INV-02	12-Nov-20	10					
		LC_DC1_INV-03	12-Nov-20	6.8					
		LC_DC1_INV-01	1-Dec-20	7.6	7.5	8	6.5	9	0.8
		LC_DC1_INV-02	1-Dec-20	7.9					
		LC_DC1_INV-03	1-Dec-20	7.1					
		LC_DC1_INV-04	1-Dec-20	8.5					
		LC_DC1_INV-05	1-Dec-20	6.5					
		LC_DC3_INV-01	1-Dec-20	6.8	6.2	6.5	4.8	6.8	0.84
		LC_DC3_INV-02	1-Dec-20	6.8					
		LC_DC3_INV-03	1-Dec-20	4.8					
		LC_DC3_INV-04	1-Dec-20	6.5					
		LC_DC3_INV-05	1-Dec-20	5.9					
		LC_DCDS_INV-01	1-Dec-20	19	16	17	9.7	19	3.7
		LC_DCDS_INV-02	1-Dec-20	17					
		LC_DCDS_INV-03	1-Dec-20	17					
		LC_DCDS_INV-04	1-Dec-20	9.7					
		LC_DCDS_INV-05	1-Dec-20	18					

Table E.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Dry Creek, Fording River, and Grace Creek, Dry Creek LAEMP, January to December 2020

Waterbody		Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
				Sample	Area Mean	Area Median	Area Minimum	Area Maximum	Area Standard Deviation
Dry Creek	Mine-exposed	LC_DC4_INV-01	2-Dec-20	5.4	5.7	5.4	4.8	6.9	0.89
		LC_DC4_INV-02	2-Dec-20	6.4					
		LC_DC4_INV-03	2-Dec-20	6.9					
		LC_DC4_INV-04	2-Dec-20	4.8					
		LC_DC4_INV-05	2-Dec-20	5.1					
		LC_DC2_INV-01	2-Dec-20	9.4	11	10	8.9	13	1.8
		LC_DC2_INV-02	2-Dec-20	8.9					
		LC_DC2_INV-03	2-Dec-20	13					
		LC_DC2_INV-04	2-Dec-20	12					
		LC_DC2_INV-05	2-Dec-20	10					
Fording River		LC_FRUS_INV-01	8-May-20	7.6	6.5	6.5	5.5	7.6	0.76
		LC_FRUS_INV-02	8-May-20	6.2					
		LC_FRUS_INV-03	8-May-20	6.6					
		LC_FRUS_INV-04	8-May-20	5.5					
		LC_FRUS_INV-05	8-May-20	6.5					
		LC_FRB_INV-01	8-May-20	5.9	5.8	5.9	4.8	6.6	0.69
		LC_FRB_INV-02	8-May-20	6.3					
		LC_FRB_INV-03	8-May-20	5.6					
		LC_FRB_INV-04	8-May-20	4.8					
		LC_FRB_INV-05	8-May-20	6.6					
		LC_FRUS_INV-1	28-Aug-20	9.9	9.6	9.8	7.9	11	1.1
		LC_FRUS_INV-2	28-Aug-20	9.4					
		LC_FRUS_INV-3	28-Aug-20	7.9					
		LC_FRUS_INV-4	28-Aug-20	9.8					
		LC_FRUS_INV-5	28-Aug-20	11					
		LC_FRB_INV-1	28-Aug-20	12	11	9.7	9.1	15	2.5
		LC_FRB_INV-2	28-Aug-20	15					
		LC_FRB_INV-3	28-Aug-20	9.7					
		LC_FRB_INV-4	28-Aug-20	9.2					
		LC_FRB_INV-5	28-Aug-20	9.1					
Dry Creek East Tributary	Reference	LC_DCEF_INV-01	6-May-20	6.9	5.7	5.5	5.2	6.9	0.67
		LC_DCEF_INV-02	6-May-20	5.2					
		LC_DCEF_INV-03	6-May-20	5.7					
		LC_DCEF_INV-04	6-May-20	5.4					
		LC_DCEF_INV-05	6-May-20	5.5					
		LC_DCEF_INV-01	22-Jun-20	3.5	4.8	5.1	3.5	5.9	1.0
		LC_DCEF_INV-02	22-Jun-20	4.1					
		LC_DCEF_INV-03	22-Jun-20	5.1					
		LC_DCEF_INV-04	22-Jun-20	5.4					
		LC_DCEF_INV-05	22-Jun-20	5.9					
		LC_DCEF_INV-1	2-Sep-20	6.3	5.6	5.1	4.6	7.4	1.2
		LC_DCEF_INV-2	2-Sep-20	4.8					
		LC_DCEF_INV-3	2-Sep-20	4.6					
		LC_DCEF_INV-4	3-Sep-20	7.4					
		LC_DCEF_INV-5	3-Sep-20	5.1					
		LC_DCEF_INV-01	1-Dec-20	5.8	5.0	4.5	4.4	5.8	0.70
		LC_DCEF_INV-02	1-Dec-20	4.4					
		LC_DCEF_INV-03	1-Dec-20	5.7					
		LC_DCEF_INV-04	1-Dec-20	4.5					
		LC_DCEF_INV-05	1-Dec-20	4.5					
Grace Creek		LC_GRCK_INV-01	11-May-20	5.0	6.3	5.8	4.6	8.8	1.7
		LC_GRCK_INV-02	11-May-20	5.8					
		LC_GRCK_INV-03	11-May-20	8.8					
		LC_GRCK_INV-04	11-May-20	4.6					
		LC_GRCK_INV-05	11-May-20	7.2					
		LC_GRCK_INV-1	29-Aug-20	7.6	7.5	7.6	6.5	8.5	0.76
		LC_GRCK_INV-2	29-Aug-20	7.9					
		LC_GRCK_INV-3	29-Aug-20	7.1					
		LC_GRCK_INV-4	29-Aug-20	8.5					
		LC_GRCK_INV-5	29-Aug-20	6.5					

Appendix Table E.3: Selenium Species Bioaccumulation Tool[a] Predicted Benthic Invertebrate Tissue Selenium Concentrations Compared with Field Measurements, Dry Creek, 2020

Area	B-tool Prediction		Field Measurements	
	Date	Predicted benthic invertebrate tissue selenium concentration	Date	Mean benthic invertebrate tissue selenium concentration
		µg/g dw		µg/g dw
LC_DCEF	2020-05-05	10.5	2020-05-06	5.7
	2020-06-22	9.7	2020-06-22	4.8
	2020-09-01	9.7	2020-09-02	5.6
	2020-12-03	9.4	2020-12-01	5
LC_DC3	2020-05-05	11.5	2020-05-07	6.4
	2020-06-22	7.2	2020-06-22	6.6
	2020-09-01	12.5	2020-09-02	7.4
	2020-12-03	11.3	2020-12-01	6.2
LC_SPDC	2020-05-05	11.9	2020-05-05	22
	2020-06-24	13.1	2020-06-24	23
	2020-09-01	27.9	2020-09-01	22
LC_DCDS	2020-05-05	12.2	2020-05-05	26
	2020-06-23	12.5	2020-06-24	9.6
	2020-09-01	25.6	2020-09-01	26
	2020-09-22	15.0	2020-09-23	20
	2020-09-29	14.9	2020-09-30	17
	2020-10-06	14.5	2020-10-06	18
	2020-10-14	10.1	2020-10-15	18
	2020-10-20	13.1	2020-10-21	17
	2020-10-27	12.4	2020-10-28	16
	2020-11-03	13.2	2020-11-05	21
	2020-11-10	9.6	2020-11-12	15
	2020-12-03	11.0	2020-12-01	16
LC_DC2	2020-05-06	10.1	2020-05-06	14
	2020-06-25	9.9	2020-06-25	8.8
	2020-09-22	12.3	2020-09-23	12
	2020-09-29	12.1	2020-09-30	14
	2020-10-06	12.1	2020-10-06	12
	2020-10-14	8.9	2020-10-15	11
	2020-10-20	11.3	2020-10-21	9.8
	2020-10-27	8.2	2020-10-28	12
	2020-11-05	8.2	2020-11-05	12
	2020-11-10	8.9	2020-11-12	14
	2020-12-03	9.0	2020-12-02	11

Appendix Table E.3: Selenium Species Bioaccumulation Tool[a] Predicted Benthic Invertebrate Tissue Selenium Concentrations Compared with Field Measurements, Dry Creek, 2020

Area	B-tool Prediction		Field Measurements	
	Date	Predicted benthic invertebrate tissue selenium concentration	Date	Mean benthic invertebrate tissue selenium concentration
		µg/g dw		µg/g dw
LC_DC4	2020-05-05	8.8	2020-05-04	9.4
	2020-06-25	8.6	2020-06-25	7.6
	2020-09-01	8.4	2020-09-03	9.8
	2020-09-22	8.2	2020-09-23	7.7
	2020-09-29	8.3	2020-09-30	9.3
	2020-10-06	8.4	2020-10-06	8.2
	2020-10-14	8.1	2020-10-15	7.8
	2020-10-20	8.0	2020-10-21	6.5
	2020-10-27	8.0	2020-10-28	6.1
	2020-11-05	8.1	2020-11-05	6.5
	2020-11-10	7.9	2020-11-12	7.5
	2020-12-03	7.9	2020-12-02	5.7
LC_DC1	2020-05-05	9.9	2020-05-04	9.3
	2020-06-23	10.0	2020-06-24	8.5
	2020-09-01	8.5	2020-09-02	11
	2020-09-22	8.4	2020-09-23	9.8
	2020-09-29	8.4	2020-09-30	10
	2020-10-06	8.5	2020-10-06	11
	2020-10-14	8.2	2020-10-15	6.8
	2020-10-20	8.2	2020-10-21	8.1
	2020-10-27	8.1	2020-10-28	9.1
	2020-11-05	8.4	2020-11-05	9.6
	2020-11-10	8.1	2020-11-12	9.3
	2020-11-24	8.2	2020-11-30	8.6
LC_GRCK	2020-05-11	5.3	2020-05-11	6.3
	2020-08-29	4.9	2020-08-29	7.5
LC_FRB	2020-05-08	7.5	2020-05-08	5.8
	2020-08-28	6.8	2020-08-28	11
LC_FRUS	2020-05-08	6.7	2020-05-08	6.5
	2020-08-28	7.0	2020-08-28	9.6

[a] Values derived from Bruyn and Luoma (2021) using selenium speciation data and sulphate concentrations for each area on each date to predict benthic invertebrate tissue selenium concentrations.

Table E.4. Spatial and Temporal Comparisons of Benthic Invertebrate Tissue Selenium Concentration Among Months, Dry Creek Sampling Areas, 2020

ANOVA Model[a]				Station		Do concentrations differ among months for each areas?[b]						Do concentrations differ between reference (LC_DCEF) and exposed stations within months?[c]			
Trans	Area	Month	Month x Area			May vs June	May vs September	May vs December	June vs September	June vs December	September vs December	May	June	September	December
log10	< 0.001	< 0.001	0.002	Reference	LC_DCEF	-17	-2.9	-13	18	4.8	-11	nc	nc	nc	nc
				Mine-exposed	LC_DC3	2.0	19	-1.1	17	-3.1	-17	8.2	34	32	24
					LC_SPDC	6.9	1.7	-	-4.9	-	-	277	388	295	-
					LC_DCDS	-64	4.0	-37	186	73	-39	337	93	368	218
					LC_DC2	-39	-8.3	-25	50	23	-18	145	81	131	113
					LC_DC4	-16	8.6	-36	29	-24	-41	56	59	75	15
					LC_DC1	-27	22	-6.3	66	28	-23	60	42	100	73

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 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 (geometric mean due to log_{10} transformation; MCT) related to the statistics.

[c] Magnitude of Difference (MOD) was calculated as $(MCT_{exp} - MCT_{ref})/MCT_{ref}$ *100 using the measure of central tendency (geometric mean due to log10 transformation) related to statistics.

Table E.5: Spatial and Temporal Comparisons of Benthic Invertebrate Tissue Selenium Concentration Among Weeks, Dry Creek Sampling Areas, September to November, 2020

ANOVA Model[a]				Do concentrations differ among weeks?[b]							Do concentrations differ among areas?[c]					
Trans	Area	Week	Week x Area	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	LC_DC1 vs LC_DCDS	LC_DC1 vs LC_DC2	LC_DC1 vs LC_DC4	LC_DC4 vs LC_DCDS	LC_DC4 vs LC_DC2	LC_DC2 vs LC_DCDS
log10	<0.001	0.077	0.57	ns	ns	ns	ns	ns	ns	ns	87	30	-20	135	64	44

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: "ns"=not-significant.

[a] P-values from Analysis of Variance (ANOVA) including the terms Area, Week and Area x Week

[b] Magnitude of Difference (MOD) was calculated as $(MCT_{weekn} - MCT_{week1})/MCT_{week1} * 100$ using the measure of central tendency (geometric mean due to $\log_{10}$ transformation; MCT) related to the statistics.

[c] Magnitude of Difference (MOD) was calculated as $(MCT_{station2} - MCT_{station1})/MCT_{station1} * 100$ using the measure of central tendency (geometric mean due to log10 transformation).

Table E.6: ANOVA Table for the Asymmetric Two-way ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the DCWMS Operation Period, Dewatering/Bypass Operational and Bypass Operational Periods for the LC_DC3 Area Relative to the Reference Area (LC_DCEF)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.022	0.011	1.4	0.255
CI	1	0.24	0.24	30	<0.001
Period×CI	2	0.0017	0.00086	0.11	0.898
Time(Period)	7	0.19	0.027	3.4	0.003
Time(Period)×CI	7	0.12	0.017	2.2	0.047
Error	82	-			

Within Period Differences (P-value and Magnitude of Difference[c])

Period 1	**Period 2**		**P-value**	**MOD**
2018_12	2020_9		ns	-
2019_2			ns	-
2019_5			ns	-
2019_6			ns	-
2019_9			ns	-
2019_12			ns	-
2020_5			ns	-
2020_6			ns	-
2018_12	2020_12		ns	-
2019_2			ns	-
2019_5			ns	-
2019_6			ns	-
2019_9			ns	-
2019_12			ns	-
2020_5			ns	-
2020_6			ns	-

P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.

Contrast P-value < 0.1/16 and in an increasing direction.

Contrast P-value < 0.1/16 and in a decreasing direction.

Notes: "-" = not relevant.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table E.7 : ANOVA Table for the Asymmetric Two-way ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the DCWMS Operation Period, Dewatering/Bypass Operational and Bypass Operational Periods for the LC_SPDC Area Relative to the Reference Area (LC_DCEF)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	1	0.00011	0.00011	0.014	0.907
CI	1	9.3	9.3	1,121	<0.001
Period×CI	1	0.0086	0.0086	1.0	0.313
Time(Period)	7	0.70	0.10	12	<0.001
Time(Period)×CI	7	0.92	0.13	16	<0.001
Error	72	-			

Within Period Differences (P-value and Magnitude of Difference[c])

Period 1	Period 2		P-value	MOD
2018_12	2020_9		<0.001	-3.8 SD
2019_2			<0.001	-3.1 SD
2019_5			ns	-
2019_6			ns	-
2019_9			<0.001	4.0 SD
2019_12			ns	-
2020_5			ns	-
2020_6			ns	-

P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.

Contrast P-value < 0.1/7 and in an increasing direction.

Contrast P-value < 0.1/7 and in a decreasing direction.

Notes: "-" = not relevant.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table E.8: ANOVA Table for the Asymmetric Two-way ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the DCWMS Operation Period, Dewatering/Bypass Operational and Bypass Operational Periods for the LC_DCDS Area Relative to the Reference Area (LC_DCEF)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.20	0.10	8.4	<0.001
CI	1	14	14	1,132	<0.001
Period×CI	2	0.15	0.074	6.1	0.003
Time(Period)	7	1.7	0.24	20	<0.001
Time(Period)×CI	7	1.1	0.16	13	<0.001
Error	86	-			

Within Period Differences (P-value and Magnitude of Difference[c])				
Period 1	**Period 2**		**P-value**	**MOD**
2018_12	2020_9		<0.001	-3.1 SD
2019_2			<0.001	-3.0 SD
2019_5			ns	-
2019_6			ns	-
2019_9			ns	-
2019_12			ns	-
2020_5			ns	-
2020_6			<0.001	3.5 SD
2018_12	2020_12		<0.001	-4.6 SD
2019_2			<0.001	-4.5 SD
2019_5			ns	-
2019_6			ns	-
2019_9			ns	-
2019_12			ns	-
2020_5			ns	-
2020_6			ns	-

P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.

Contrast P-value < 0.1/16 and in an increasing direction.

Contrast P-value < 0.1/16 and in a decreasing direction.

Notes: "-" = not relevant.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table E.9: ANOVA Table for the Asymmetric Two-way ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the DCWMS Operation Period, Dewatering/Bypass Operational and Bypass Operational Periods for the LC_DC2 Area Relative to the Reference Area (LC_DCEF)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.023	0.012	2.1	0.127
CI	1	2.9	2.9	527	<0.001
Period×CI	2	0.0056	0.0028	0.51	0.603
Time(Period)	6	0.49	0.082	15	<0.001
Time(Period)×CI	6	0.49	0.081	15	<0.001
Error	66	-			

Within Period Differences (P-value and Magnitude of Difference[c])				
Period 1	**Period 2**		**P-value**	**MOD**
2018_12	2020_9		<0.001	-5.8 SD
2019_5			ns	-
2019_6			ns	-
2019_9			ns	-
2019_12			ns	-
2020_5			ns	-
2020_6			ns	-
2018_12	2020_12		<0.001	-6.2 SD
2019_5			0.003	-3.1 SD
2019_6			ns	-
2019_9			ns	-
2019_12			ns	-
2020_5			ns	-
2020_6			ns	-

P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.

Contrast P-value < 0.1/14 and in an increasing direction.

Contrast P-value < 0.1/14 and in a decreasing direction.

Notes: "-" = not relevant.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table E.10: ANOVA Table for the Asymmetric Two-way ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the DCWMS Operation Period, Dewatering/Bypass Operational and Bypass Operational Periods for the LC_DC4 Area Relative to the Reference Area

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.12	0.060	13	<0.001
CI	1	1.1	1.1	242	<0.001
Period×CI	2	0.060	0.030	6.5	0.002
Time(Period)	7	0.27	0.039	8.3	<0.001
Time(Period)×CI	7	0.050	0.0071	1.5	0.166
Error	86	-			

Within Period Differences (P-value and Magnitude of Difference[c])

Period 1	**Period 2**		**P-value**	**MOD**
DCWMS	Dewatering/Bypass Operational		ns	-
DCWMS	Bypass Operational		<0.001	-2.3 SD

(grey)	P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.
(blue)	Contrast P-value < 0.1/2 and in an increasing direction.
(green)	Contrast P-value < 0.1/2 and in a decreasing direction.

Notes: "-" = not relevant.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table E.11: ANOVA Table for the Asymmetric Two-way ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the DCWMS Operation Period and Dewatering/Bypass Operational Periods for the LC_DC1 Area Relative to the Reference Area (LC_DCEF)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.052	0.026	2.4	0.094
CI	1	1.3	1.3	121	<0.001
Period×CI	2	0.0094	0.0047	0.44	0.643
Time(Period)	6	0.14	0.023	2.2	0.056
Time(Period)×CI	6	0.095	0.016	1.5	0.196
Error	68	-			

P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.

Notes: "-" = not relevant.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

Table E.12: ANOVA Table for the Asymmetric Two-way ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the DCWMS Operation Period, Dewatering/Bypass Operational and Bypass Operational Periods for the LC_FRB Area Relative to LC_FRUS

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	1	0.16	0.16	57	<0.001
CI	1	0.00091	0.00091	0.33	0.570
Period×CI	1	0.011	0.011	4.1	0.050
Time(Period)	8	0.21	0.026	9.5	<0.001
Time(Period)×CI	8	0.010	0.0013	0.47	0.869
Error	36	-			

Within Period Differences (P-value and Magnitude of Difference[c])			
Period 1	**Period 2**		**MOD**
DCWMS	Dewatering/Bypass Operational		1.4 SD

P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.

Contrast P-value < 0.1/14 and in an increasing direction.

Contrast P-value < 0.1/14 and in a decreasing direction.

Notes: "-" = not relevant.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

APPENDIX F
DRY CREEK FISH AND FISH HABITAT MONITORING PROGRAM

Table F.1: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Dry Creek, 2012 to 2020

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

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 F.1: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Dry Creek, 2012 to 2020

Year	Month	LC_DCEF	LC_SPDC	LC_DCDS	LC_DC2	LC_DC4	LC_DC1
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
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

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 F.2: Growing Season Statistics, Dry Creek Fish and Fish Habitat Monitoring Program, 2020[a]

Nupqu Station Name	Location	Growing Season Dates & Length			Accumulated Thermal Units (Degree Days)
		Start Date	End Date	Days	
FRD-WQ01	Fording River below Dry Creek mouth (u/s of LC_FRB)	07-Jun	10-Oct	126	909
DRY-WQ01	Dry Creek near Fording River (d/s of LC_DC1)	09-Jun	08-Oct	122	671
LC_DCDS	Dry Creek below decant channel (LC_DCDS)	09-Jun	08-Oct	122	852
LC_SPDC	Decant channel (LC_SPDC)	23-May	7-Oct[b]	138	741
DRY-WQ02	Dry Creek d/s of confluence with East Tributary	Growing season did not start (weekly average stream temperature never exceeded 5°C)			
DRY-WQ04	Dry Creek u/s of confluence with East Tributary	25-May	08-Oct	137	901
LC_DCEF	East Tributary (LC_DCEF)	Growing season did not start (weekly average stream temperature never exceeded 5°C)			

[a] Adapted from Nupqu and AJM (2021).

[b] October 7 was the day the two temperature loggers were removed from the decant channel pre-construction.

Table F.3: Monthly Summary Statistics for Daily Discharge (m^3/sec) at areas LC_DC1 and LC_DCDS, Dry Creek LAEMP, 2020

Station	Month	n	Mean	SD	SE	Min	Median	Max
LC_DC1	January	29	0.025	0.008	0.001	0.015	0.025	0.043
	February	19	0.019	0.006	0.001	0.011	0.020	0.031
	March	24	0.023	0.019	0.004	0.007	0.014	0.060
	April	29	0.359	0.261	0.049	0.056	0.269	0.737
	May	31	1.010	0.378	0.068	0.567	0.887	1.980
	June	30	1.000	0.507	0.093	0.310	1.030	2.030
	July	29	0.230	0.068	0.013	0.145	0.210	0.354
	August	31	0.116	0.026	0.005	0.078	0.128	0.154
	September	30	0.065	0.007	0.001	0.057	0.064	0.085
	October	27	0.061	0.007	0.001	0.045	0.063	0.068
	November	26	0.085	0.012	0.002	0.064	0.083	0.106
	December	19	0.035	0.007	0.002	0.028	0.032	0.049
LC_DCDS	January	27	0.008	0.002	0.000	0.006	0.007	0.014
	February	26	0.012	0.007	0.001	0.008	0.009	0.042
	March	31	0.012	0.010	0.002	0.001	0.009	0.035
	April	29	0.191	0.158	0.029	0.019	0.137	0.444
	May	30	0.640	0.237	0.043	0.320	0.623	1.130
	June	30	0.500	0.203	0.037	0.246	0.497	1.100
	July	31	0.155	0.064	0.011	0.072	0.149	0.260
	August	31	0.088	0.037	0.007	0.041	0.092	0.162
	September	30	0.034	0.007	0.001	0.026	0.032	0.050
	October	31	0.026	0.008	0.002	0.008	0.026	0.061
	November	30	0.018	0.011	0.002	0.007	0.013	0.048
	December	15	0.007	0.001	0.000	0.006	0.007	0.009

Note: Data collected from hydrometric monitoring stations at LC_DC1 and LC_DCDS using staff gauge measurements with an established staff-discharge relationship as presented in Kerr Wood Leidal (2021).

APPENDIX F
NUPQU AND AJM 2021

DRY CREEK

Fish and Fish Habitat Monitoring Program 2020

Prepared for:

Teck Coal Limited- Line Creek Operations
R.R. #1, Highway #3 Sparwood, B.C. Canada
V0B 2G1

Prepared by:
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February 2021

Nupqu LIMITED PARTNERSHIP

AJM ENVIRONMENTAL INC

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Teck Coal Limited
R.R. #1, Highway #3
Sparwood, BC V0B 2G1

February 9, 2021

Attention: Brenna Fossum, Teck Coal Ltd

Re: 2020 Dry Creek Fish and Fish Habitat Monitoring Program: Spawner Surveys and Stream Temperature Monitoring

Dear Julia,

Nupqu Limited Partnership (Nupqu) is pleased to submit this letter-style summary document (memo), in support of Nupqu's Scope of Work under the Dry Creek Fish and Fish Habitat Monitoring Program (DCFFHMP) with Teck Coal Limited (Teck). This report includes recommendations from a Qualified Professional (QP) specific to ongoing stream temperature monitoring and spawner/3ed surveys on Dry Creek based on conditions observed during these surveys conducted June 30 and July 7, 2020 and analysis of temperature data provided by AJM Environmental.

We appreciate the opportunity to work with you on this Project, and we trust that this report meets your requirements. Please feel free to contact the undersigned by phone or email regarding any questions or further information that you may require.

Report prepared by:
Nupqu Limited Partnership and AJM Environmental.

Mark Fjeld
Aquatic Biologist/Project Manager
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1.0 PROJECT OVERVIEW

1.1 INTRODUCTION

The LCO Environmental Management Act (EMA) Permit PE-106970 requires annual aquatic work to be conducted in Dry Creek. Ecofish Research Ltd. (Ecofish) developed the DCFFHMP and completed monitoring annually between 2016 and 2019. In 2020 the Elk Valley Fish and Fish Habitat Committee (EVFFHC) provided guidance to minimize electrofishing and fish handling activities throughout the Fording River watershed, hence reducing the 2020 LCO DCFFHP to include ongoing temperature monitoring (seven stream sites and two air sites) and spawner/redd surveys. To complete these tasks, Teck provided Nupqu with a Scope of Work to complete this work, requesting a crew that included a QP and Nupqu's Senior Technician (Dominique Nicholas). AJM Environmental Inc (AJM) was retained by Nupqu to provide QP fisheries biologist support in 2020, accompanying Nupqu during redd surveys, analysing temperature data, and preparing a memo presenting and summarizing data collected in 2020.

1.2 PROJECT DESCRIPTION

Nupqu Limited Partnership was retained to complete the following three Project Tasks:

Task 1: Oversee spawner/redd surveys (i.e., distribution and counts of spawning fish and their redds) at two different times in June/July, upstream of the Fording Road.

Task 2: Analysis of temperature monitoring data at seven stream sites and two ambient air sites using the same methods as used in previous years by Ecofish.

Task 3: Prepare a memo presenting and summarizing 2020 data in comparison to equivalent data collected by Ecofish between 2016 and 2019. As a component of Task 3, spawner/redd surveys data obtained by Nupqu from Westslope Fisheries Ltd. (Westslope) for the 2020 season for the portion of Reach 1 of Dry Creek downstream of the Fording Road, was also included in the summary.

This memo (Task 3) summarises the results of the stream temperature monitoring (Task 2) and spawner surveys (Task 1) and makes recommendations for ongoing monitoring as part of the DCFFHMP.

1.3 STUDY AREA

The Project study area is the Dry Creek watershed (see Faulkner et al. 2019, Map 1). Dry Creek drains into the Fording River upstream of Josephine Falls, a 25-meter (m) waterfall that limits the upstream passage of fish (Cope et al. 2016).

Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) are the only fish species present above Josephine Falls and the only fish species in Dry Creek and its tributaries (Cope et al. 2016). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has listed the British Columbia Westslope Cutthroat Trout population as being of Special Concern (COSEWIC 2016). This population is also listed as being of Special Concern under Schedule 1 of the Species at Risk Act, SC 2002, c. 29. Provincially, Westslope Cutthroat Trout is ranked as "S2/S3 (imperiled/vulnerable)" by the Conservation Data Centre (CDC) and is on the provincial Blue list (BC MOE 2018).

Dry Creek was previously subdivided into five study reaches (Reach 1-5) by Ecofish Research, with reach 1 starting at the Fording River. While the coordinates of the reach breaks were not provided to Nupqu by Teck and are not reported by Ecofish (Faulkner et al. 2019), approximate locations were interpolated from the maps provided, exact locations were delineated and mapped to the best approximation, so that spawning redds observed in 2020 could be reported by reach, as done previously (Appendix B, Figure 3).

2.0 METHODS

2.1 TASK 1 – SPAWNER/REDD SURVEYS

Spawner/redd surveys on Dry Creek occurred on June 30 and July 7, 2020 near the end of the spawning season to allow for a complete assessment of 5ed numbers. Surveys on both days were completed by Dominique Nicholas (Nupqu) and Matthew Coombs (AJM). As directed in the Scope of Work, both surveys commenced at the railway immediately upstream from the Fording Road (UTM Zone 11U 656420E 5544749N), which is approximately a third of the length of Reach 1 upstream of the confluence with the Fording River. The ongoing Upper Fording River (UFR) spawning surveys complete by Lotic Environmental (Lotic) in 2020 covered the lower section North of the Fording River Road of Reach 1. These data were retrieved from Lotic upon completion of the UFR redd surveys completed in 2020, hence eliminating overlap of redd data. Data from the UFR surveys confirmed a single redd observed on July 2, 2020.

On June 30, the survey extended upstream to a point in Reach 4 (11U 657822E 5541902N) approximately 200 m above where the decant channel from the settling ponds discharged to Dry Creek. The full length of Reach 4 was not surveyed this day due to the need to leave the site at the same time as the LCO safety check-in left the site.

On July 7, the survey extended upstream to the end of Reach 4 at the East Tributary confluence. The East Tributary was also surveyed from its confluence with Dry Creek upstream to the bridge on July 7. Spawner/redd survey methods followed were those outlined in the Westslope Cutthroat Trout East Kootenay Redd Survey protocol included in the Scope of Work that Teck provided.

Additional redd surveys were not completed as redds that were discovered during both surveys (June 30 and July 7) were redds constructed prior to the initial survey indicating spawning in Dry Creek had peaked in mid-late June. Furthermore, as no adult fish were observed either staging or utilizing previously delineated spawning habitat in Dry Creek nor was there any evidence of new redd construction activity after the initial survey completed on June 30, additional surveys were not conducted.

2.2 TASK 2 – TEMPERATURE DATA ANALYSIS

Temperature records from seven stream monitoring sites and two air monitoring sites were provided to AJM by Nupqu (Table 1). These records came from temperature loggers previously deployed by Ecofish in June and September 2016, with the exception of one logger installed by Nupqu (see below). Temperature monitoring site locations (UTM coordinates) and maps are provided in Faulkner et al. 2019. To streamline efforts in future years to identify site locations that temperature datafiles are associated with, site IDs and serial numbers of all loggers at these sites are provided in Appendix A.

Table 1. Summary of Dry Creek temperature monitoring during 2020.

Waterbody	Site Name	Description	Data available	Loggers
Fording River	FRD-WQ01	~20 m downstream of Dry confluence	29-10-2019 to 29-10-2020	1
Dry Creek	DRY-WQ01	~100 m upstream from Fording River	29-10-2019 to 29-10-2020	2
Dry Creek	DRY-WQ05	~40 m downstream from decant	29-10-2019 to 29-10-2020	1
Decant channel	DRY-WQ06	~20 m upstream channel from creek	29-10-2019 to 29-10-2020	2 removed
Dry Creek	DRY-WQ02	~80 m downstream of East Tributary	29-10-2019 to 29-10-2020	2
Dry Creek	DRY-WQ04	~50 m upstream of East Tributary	29-10-2019 to 29-10-2020	2
East Tributary	DRY-WQ03	At East Tributary bridge	29-10-2019 to 29-10-2020	2
Air near river	DRY-AT01	~100 m upstream from Fording River	30-06-2020 to 27-10-2020	1 new
Air near ponds	DRY-AT02	~50 m upstream of East Tributary	29-10-2019 to 11-07-2020	1

**each location is equipped with a single logger and back up redundant logger*

At each aquatic monitoring station under DCFFMP, Ecofish has previously installed two HOBO Tidbit V2 loggers (main and backup loggers) providing redundant data if main logger malfunction was to occur. Data from the back up loggers at (FRD-WQ01), (DRY-WQ05) and (FRD-WQ05) could not be successfully downloaded during the dates of record. The two temperature loggers deployed in the decant channel (DRY-WQ06) were removed by Teck on October 7, 2020 in advance of the discharge pipe being extended to the Dry Creek channel and subsequent backfilling of the decant channel. This work was completed in fall 2020. The loggers that were removed from this site were given to Nupqu for data retrieval and subsequently returned to LCO. Teck Coal may consider utilizing the Tidbit v2 loggers removed from DRY-WQ06 as redundant logger replacements at each FRD-WQ01 and DRY-WQ05 respectively.

Only one logger was installed in 2016 at the two air temperature monitoring sites. The logger at the site near the river (DRY-AT01) was not functioning during the field data download. Nupqu installed a new Bluetooth-enabled logger (HOBO MX 2303 and RS2 Shield) at this location on June 30, 2020 and left the existing non-functional logger in place. In the upper watershed, the air temperature logger near the settling ponds (DRY-AT02) was functioning until June 11, 2020, when the temperature record ends. Data were not downloaded from this logger until October 27, and at that time a new logger was not installed.

Analysis of the temperature records from the seven stream monitoring sites started with using Onset Computer Corporation HOBOware Pro software to export temperature records from each datalogger file as comma-separated values (CSV). These were then imported into a Microsoft Excel spreadsheet for Quality Assurance/Quality Control (QA/QC) and subsequent analysis. Outliers in each temperature profile were then identified by plotting the data, comparing values from two loggers installed at the same site at the same time (where possible), and removing any clearly erroneous values (e.g., rapid short-term changes to extreme values that were not reflected in the other corresponding logger or inconsistent with daily trends).These values may be influenced by changes in flow during winter months resulting in logger potentially remaining out of the water for a period of time.

Where data from two loggers was available at the same site, temperature profiles were then combined by averaging the values recorded at the same time from each logger. Where data could only be retrieved from one logger, data from the single logger was for water temperature analysis. A total number of days for each aquatic monitoring site with erroneous or negative values are provide in Section 3.2.

The same water temperature metrics and calculation methods used in the data analysis from 2016-2019 were followed in 2020 (see Table 2 in Faulkner et al. 2019). As in previous years, temperature was analysed on a 15-minute interval, with hourly rates of change calculated as per the provincial guideline for the protection of aquatic life (Oliver and Fidler 2001). Air temperature data were not analysed. Instead, these data were used in the QA/QC process to ensure the stream temperature profiles reflected ambient conditions.

3.0 RESULTS

Assessment results specific to Task 1 and Task 2 are detailed below.

3.1 TASK 1 – SPAWNER/REDD SURVEYS

A summary of the locations of the six Westslope Cutthroat Trout redds were observed during the spawner/redd surveys on Dry Creek in 2020, locations are provided in Table 2 including a map (Appendix B, Figure 5). No fish were observed during the spawner/redd surveys either in Dry Creek or the confluence section of the Fording River. As Reach 1 redd surveys were covered by the Upper Fording River (UFR) redd surveys counts in 2020 under a different program, inquiries were completed with Lotic (pers comm. Mike Robinson) as to redd survey results from Reach 1 of DCFFHP. A single redd was observed by Lotic at the same distinct UTM location as the June 30,2020 redd recorded by Nupqu. This red location was considered the same location due to geographical location and similar timing of construction.

Table 2. Locations of six Westslope Cutthroat Trout redds observed in Dry Creek during the 2020 spawner/redd surveys including observations from Fording River redd counts.

Survey Date	Reach No.	UTM Zone	UTM Easting	UTM Northing
June 30, 2020	1	11U	655995	5544864
June 30, 2020	2	11U	657098	5543377
June 30, 2020	3	11U	657372	5542907
June 30, 2020	3	11U	657433	5542593
June 30, 2020	3	11U	657481	5542531
July 07, 2020	3	11U	657433	5542593

During the June 30, 2020 spawner/redd survey, 1: redd was identified in Reach 1, 1 redd in Reach 2 and 3 redds in Reach 3. Only 1 additional redd was observed during the July 7, 2020 spawner/redd survey, and it was located immediately beside one of the redds observed on June 30. This can be noted in Table 2 where two redds have the same UTM location. The second redd observed on July 7 did not appear to be any more recently constructed than the adjacent redd observed on June 30, suggesting it was present on June 30 and simply missed by the surveyors due to the heavy rain fall that occurred on June 30, reducing visibility.

The Reach 1 redd in Table 2 was outside of the section of Reach 1 identified by Teck to be surveyed in the Scope of Work provided to Nupqu. It was observed while installing a new temperature logger at the air monitoring site near the Fording River (DRY-AT01). The redd was approximately 30 m upstream from the monitoring site. As directed to by Teck in the Scope of Work, when Nupqu followed up with Westslope regarding redd survey results from the spring snorkel surveys in the portion of Reach 1 of Dry Creek downstream from the Fording Road, Nupqu's request was forwarded on to Lotic, who is now managing these data. Lotic reported to Nupqu only a single redd observed in Reach 1 downstream of the Fording Road. This redd was observed on July 2, 2020 and the location reported by Lotic (UTM 11U 656033 5544860) was approximately 40 m east of the Dry Creek channel where the redd in Table 2 is noted. The redd Lotic observed on June 2, 2020 is understood to be the same redd that Nupqu and AJM observed on June 30,2020 due to the proximity of UTM`s and being the only observable red observed in Reach 1 by both Nupqu and Lotic.

Figure 1 shows Dry Creek redd counts by stream reach between 2016 and 2020. To date, no redds have been observed in Reach 4.

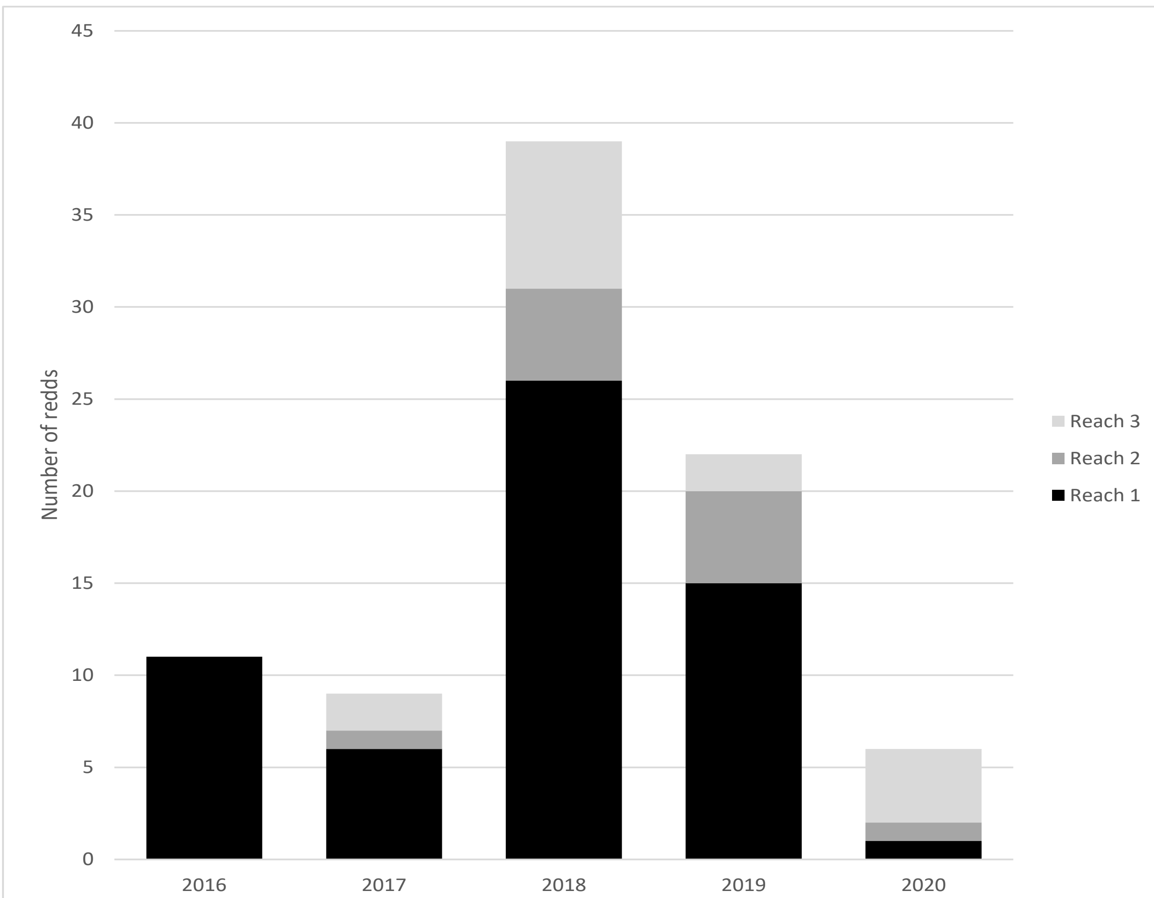

Figure 1. Number of Westslope Cutthroat Trout redds observed in Reaches 1-3 of Dry Creek between 2016 and 2020. No redds have been observed in Reach 4.

3.2 TASK 2 - TEMPERATURE DATA ANALYSIS

Table 1 (above) presents the period of record for the 2020 temperature analysis for each site. Table 3 (below) presents monthly summary statistics and Figure 2 presents trends in average daily temperature for this time period.

Table 3. Summary statistics for average, minimum, and maximum water temperatures (°C) at the seven monitoring sites in the 2020 Dry Creek Fish and Fish Habitat Monitoring Program. "Avg", "Min", and "Max" denote the monthly average, maximum, and minimum temperatures. Coloured highlighting depicts the overall maximum (orange), minimum (light blue), and average maximum (red) and average minimum (dark blue) temperatures for each site for the period of record.

Month	DRY-WQ03 East Tributary			DRY-WQ04 Dry Creek above East Tributary			DRY-WQ02 Dry Creek below East Tributary			DRY-WQ06 Settling pond decant channel			DRY-WQ05 Dry Creek below decant			DRY-WQ01 Dry Creek near Fording River			FRD-WQ01 Fording River below Dry Creek		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Nov-2019	2.8	2.0	3.3	0.1	0.0	0.1	1.4	0.0	2.6	0.8	0.3	1.7	0.6	-0.1	1.3	1.3	0.3	2.6	1.0	0.0	3.3
Dec-2019	2.4	1.8	3.0	0.3	0.0	0.9	0.8	0.0	2.0	0.4	0.2	0.6	0.1	-0.1	0.5	1.1	0.3	2.2	0.5	0.0	1.9
Jan-2020	2.2	1.4	2.7	0.0	0.0	0.1	0.6	0.0	1.3	0.3	0.1	0.4	0.1	-0.1	0.3	1.0	0.2	1.7	0.3	0.0	1.5
Feb-2020	1.9	1.3	2.6	0.1	0.0	0.1	0.3	-0.1	1.2	0.2	0.1	0.5	0.1	-0.1	0.4	0.8	0.2	1.7	0.2	0.0	1.6
Mar-2020	1.9	1.1	2.5	0.0	0.0	0.1	0.5	-0.1	1.8	0.3	0.1	0.6	0.1	-0.1	0.4	0.9	0.2	1.9	0.5	-0.1	2.9
Apr-2020	1.8	0.6	2.7	0.0	-0.1	0.1	1.3	0.0	2.6	1.1	0.2	3.4	0.9	-0.1	3.2	1.4	0.2	3.7	1.8	0.0	5.1
May-2020	2.4	1.3	4.8	0.4	-0.2	2.2	2.4	1.2	4.8	4.4	2.3	7.6	3.3	1.5	6.0	3.4	1.3	7.0	3.8	1.6	6.9
Jun-2020	3.8	1.8	6.1	2.9	1.1	6.1	3.8	1.8	6.2	7.2	4.8	11.9	5.5	3.0	10.2	5.2	3.1	8.4	5.6	3.4	8.8
Jul-2020	4.2	3.0	5.6	5.4	3.1	8.3	4.5	3.0	5.9	8.9	6.2	12.0	7.3	4.9	11.5	5.9	3.8	8.7	7.8	4.7	11.9
Aug-2020	3.9	3.4	4.4	7.1	4.9	9.5	4.6	3.5	5.8	9.3	6.6	14.9	8.6	5.4	15.6	6.0	3.7	9.8	8.5	5.4	12.2
Sep-2020	3.8	3.3	4.4	8.0	6.2	9.7	4.3	2.9	5.7	6.6	3.7	9.2	6.2	3.4	9.5	4.9	2.9	7.1	6.6	3.6	10.0
Oct-2020	3.3	2.1	4.2	6.5	4.2	8.3	3.0	0.0	6.1	-	-	-	3.0	0.0	8.8	3.5	1.2	5.6	3.8	0.0	8.0

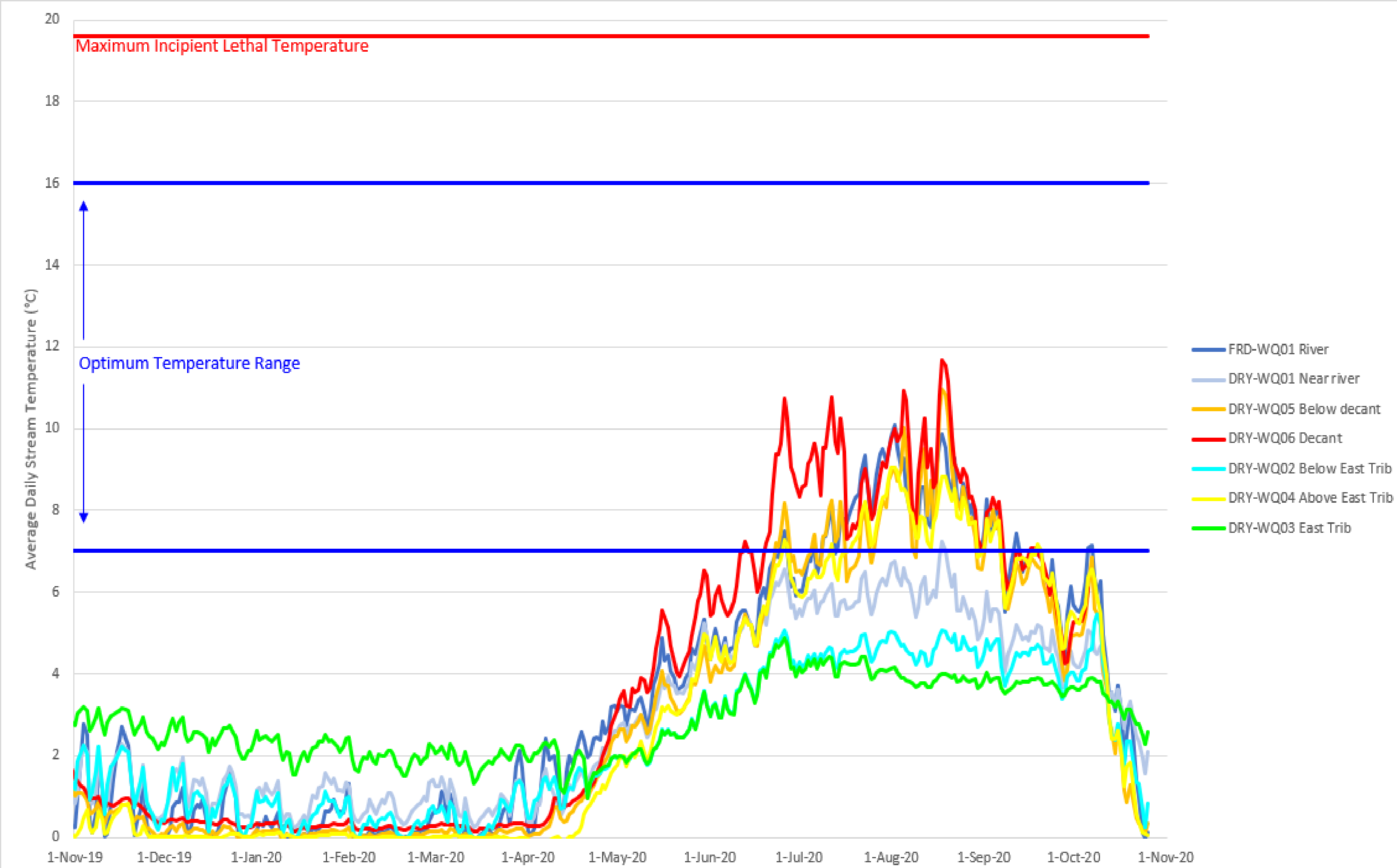

Figure 2. Daily continuous stream water temperatures recorded at seven monitoring sites within the LCO Dry Creek Fish and Fish Habitat Monitoring Program area. Optimal water temperature for WCT range from 8°c-16°c with an incipient (lethal) water temperature of 20°c. When two loggers were downloaded at a single site, temperature data was averaged between both logger

As reported in the previous four years of data collection by Fidler et al. 2019, the temperature regime differs somewhat among sites within Dry Creek. The East Tributary site and the Dry Creek site immediately downstream of it (DRY-WQ02 and DRY-WQ03) were again cooler in the summer, showed smaller daily fluctuations in temperature during the summer, and were slightly warmer in winter. During the winter months, the East Tributary site was consistently warmer than the Dry Creek downstream of the confluence East Tributary Creek, furthermore, both sites showed the greatest stability in stream temperature of all seven stream sites over the course of the period of record.

The opposite pattern was also again observed in 2020 within the decant channel (DRY-WQ06) and Dry Creek immediately downstream of the decant channel (DRY-WQ05). These sites were warmer in the summer, showed larger daily fluctuations in temperature during the summer, and were cooler in winter with temperatures staying stable and close to freezing. Over the period of record several data points had associated null or negative temperatures recorded, particularly at DRY-WQ04 with 37 dates with sub zero water temperature readings on January 14-16, February 5-11 & 18-28, and finally March 14-April 14. Both FRD-WQ01 and DRY-WQ05 recorded <10 specific sub-zero readings within the specific date ranges of December 27-30, January 13-15, February 13-14 and March 14-15. All data presented was averaged with these readings within the data presented in Figure 2, Table 3.

Winter temperatures at the Fording River site (FRD-WQ01) and the Dry Creek site near the Fording River (DRY-WQ01) were generally warmer than the near-freezing temperatures in the decant channel and in Dry Creek immediately downstream of it. During the summer, both sites showed larger daily fluctuations in temperature than all three sites upstream from the decant channel, but the fluctuations were not as large as in the decant channel itself or in Dry Creek. Throughout the summer months, the Fording River site was consistently warmer than the Dry Creek site just upstream from the Fording River in Reach 1. During the winter this difference was reversed and less significant; Dry Creek location in reach 1 upstream of the Fording River was slightly warmer than the Fording River.

During the 2020 temperature analysis period, average daily temperatures and instantaneous measurements did not exceed 18°C at any sites (Table 4). This temperature is less than the 19°C provincial maximum daily temperature limit for protection of aquatic life (Oliver and Fidler 2001) and less than an upper incipient lethal temperature of 19.6°C reported for Westslope Cutthroat Trout specifically (Bear et al. 2007). Temperature has not been reported to exceed 18°C at any of the seven stream temperature monitoring sites that are part of the DCFFHM Program since monitoring began in 2016. Optimal water temperature guidelines for Westslope Cutthroat Trout rearing range from 7°C to an upper threshold of 16°C during the fish growing season (Oliver and Fidler 2001). Water temperatures recorded during this period of monitoring at no time exceeded the upper threshold limit for rearing Westslope Cutthroat Trout, recording the highest maximum temperature in August 2020 at DRY-WQ05 (15.6°C). As mean weekly maximum water temperature (MWMxT) remains a vital indicator for rearing Westslope Cutthroat Trout, the MWMxT is used to express long term exposure of prolonged periods of warmer water temperatures experienced by fish opposed to single temperature shifts or events. During the initial three years of monitoring under DCFFHMP, the upper threshold optimal for rearing was sporadically exceeded in the summer months of 2017 and 2018 (9.6% of data in 2017 and 12.1% in 2018) in the settling ponds decant channel, whereas the data collected in 2017 and 2018 represent that exceedances of >1°C optimal ranges of were recorded for 3.9% of 2017 data and 4.3% in 2018. There were no exceedances of the thermal optimum (17°C) in 2019 or 2020 downstream of the settling ponds decant channel as indicated.

Building on water temperature monitoring data logged during this period of record indicates that sub-optimal high temperatures are a localized effect of the Dry Creek settling ponds decant channel presented by Faulkner et al. 2019 within the DCFFHMP Year 4 report. In comparison, other monitoring locations downstream of the East Tributary confluence and East Tributary, indicate cool sub optimal conditions for the majority of the growing season over the entirety of monitoring record.

Temperatures less than 1°C have been reported every year since monitoring began, indicating the lower temperature limit reported for aquatic life (Oliver and Fidler 2001). As in previous years, the site with the highest number of mean daily temperatures less than 1°C was Dry Creek upstream from the East Tributary (DRY-WQ04), followed by Dry Creek below the decant channel (DRY-WQ05) and the decant channel itself (DRY-WQ06). The East Tributary site (DRY-WQ03) again had the fewest daily mean less than 1°C.

Table 4. Number of days with extreme daily mean water temperatures (<1°C, >18°C) for the seven monitoring sites within the 2020 Dry Creek Fish and Fish Habitat Monitoring Program.

Site	Location	Record Length (days)	Days mean temperature	
			<1°C	>18°C
FRD-WQ01	Fording River below Dry Creek	363	138	0
DRY-WQ01	Dry Creek near Fording River	363	90	0
DRY-WQ05	Dry Creek below decant channel	363	175	0
DRY-WQ06	Decant channel	343	165	0
DRY-WQ02	Dry Creek below East Tributary	363	122	0
DRY-WQ04	Dry Creek above East Tributary	363	182	0
DRY-WQ03	East Tributary	363	1	0

Hourly rates of change in water temperature at the monitoring sites are summarized in Table 5. The largest temperature changes were observed in Dry Creek below the decant channel with increases of up to 5.6°C/hr and decreases of up to -4.3°C/hr. While other sites showed few temperature changes greater than 1°C/hr (8 occurrences or less over the period of record), the decant channel had 120 occurrences and Dry Creek below decant channel had more than twice this (247 occurrences).

Table 5. Number of days with extreme daily mean water temperatures (<1°C, >18°C) for the seven monitoring sites within the 2020 DCFFHMP.

Site	Location	Occurrences of rates >1°C/hr	Maximum increase (°C/hr)	Maximum decrease (°C/hr)
FRDWQ01	Fording River below Dry Creek	7	1.5	-1.5
DRYWQ01	Dry Creek near Fording River	8	1.1	-
DRYWQ05	Dry Creek below decant channel	247	5.6	-4.3
DRYWQ06	decant channel	120	2.4	-2.1
DRYWQ02	Dry Creek below East Tributary	1	-	-1.0
DRYWQ04	Dry Creek above East Tributary	1	1.1	1.1
DRYWQ03	East Tributary	2	-	-1.1

As reported by Faulkner et al. 2019, the length of the growing season and the number of degree days in the growing season was also determined for the seven water temperature monitoring stations in DCFFHMP. As defined in Coleman and Fausch (2007), the growing season was determined to begin when the weekly average stream temperature exceeded and remained above 5°C, and the growing season was determined to end when the weekly average stream temperature first dropped below 4°C. Degree days are further defined as the sum of daily average water temperatures over the entire growing season (i.e., first day of the first week to last day of the last week). Statistics describing the growing season for the seven monitoring sites during the 2020 reporting period are shown in Table 6. Coleman and Fausch (2007) found recruitment and growth, as measured by the density and size of age-0 cutthroat trout in north-central Colorado, were limited by the number of Accumulated Thermal Units (degree days) during the growing season. Data from six headwater streams suggested that streams with less than 800-degree days are unlikely to be able to sustain populations, that streams with 800–900 degree days were likely to suffer from recruitment failures in some years, and that streams with 900-1,200 degree days were most likely to sustain populations. Data from 15 streams in the upper Oldman River watershed, which is adjacent to Dry Creek to the East, suggest that while Westslope Cutthroat Trout populations can persist at low densities where degree days are less than 800, increases in thermal suitability of streams, as measured by cutthroat density, are greatest between 800- and 1,200-degree days (ACA 2020).

Table 6. Statistics describing the growing season (defined in the text) for the seven monitoring sites within the 2020 DCFFHMP.

Site	Location	Growing Season Dates & Length			Accumulated Thermal Units (Degree Days)
		Start Date	End Date	Days	
FRDWQ01	Fording River below Dry Creek	Jun-07	Oct-10	126	909
DRYWQ01	Dry Creek near Fording River	Jun-09	Oct-08	122	671
DRYWQ05	Dry Creek below decant channel	Jun-09	Oct-08	122	852
DRYWQ06	Decant channel	May-23	Oct-07[1]	138	741
DRYWQ02	Dry Creek below East Tributary	Growing season did not start (weekly average stream temperature never exceeded 5°C)			
DRYWQ04	Dry Creek above East Tributary	May-25	Oct-08	137	901
DRYWQ03	East Tributary	Growing season did not start (weekly average stream temperature never exceeded 5°C)			

[1]Note October 7 was the day the two temperature loggers were removed from the decant channel pre-construction

4.0 SUMMARY

4.1 TASK 1 - SPAWNER/REDD SURVEYS

A total of six Westslope Cutthroat Trout redds were observed in Dry Creek during two distinct spawner/redd surveys in 2020 (Table 7). This is the lowest number of redds observed since 2016. During previous years survey effort from 2016-2019, Faulkner et al. 2019 completed redd counts ranging from a peak count in 2018 (n=39) to a low of (n=9) in 2017 accompanied by equal survey effort completed in 2020. No fish were observed during the two surveys in

2020. Most redds have previously been observed in Reach 1 of Dry Creek (Faulkner et al. 2019), which showed the largest decrease in the number of redds observed in 2020 relative to the previous 4 years of survey, including the single redd observed by Lotic in Reach 1 during UFR redd surveys on July 2,2020.

Table 7. Summary of spawner surveys conducted in Dry Creek from 2016-2019 by Ecofish Research Ltd. Results from 2020 redd surveys totalled six redds over two individual surveys.

Month	Reach	Redd Observations				
		2016	2017	2018	2019	*2020
June	1	8	3	20	9	1
	2	0	1	4	3	1
	3	0	1	7	0	3
	4	0	-	0	0	0
June Total		***8***	***5***	***31***	***12***	***5***
July	1	0	3	6	6	0
	2	3	0	1	2	0
	3	0	1	1	2	1
	4	-	-	0	0	0
July Total		***3***	***4***	***8***	***10***	***1***
Grand Total		***11***	***9***	***39***	***22***	***6***

*Note-in 2020 the first survey was completed June 30. In 2016,2017 and 2018 the first survey was completed late June with 2019 conducted on July 6.

4.2 TASK 2 - TEMPERATURE DATA ANALYSIS

Patterns observed in stream temperatures in the DCFFHMP area during the 2020 monitoring period were similar to those observed in previous years.

At all sites, daily maximum temperatures remained well below the upper incipient lethal temperature for Westslope Cutthroat Trout (19.6°C, 95% CI = 19.1–19.9°C) and generally below the maximum daily temperature limit for suitable thermal habitat (15°C), both reported by Bear et al. (2007). Only in the decant channel and Dry Creek immediately below this decant channel was the optimal water temperature upper limit for rearing Westslope Cutthroat Trout of 16°C (Oliver and Fidler 2001) approached or exceeded, furthermore the elevated water temperatures were only present over a short temporal period in August of two days. The two highest instantaneous temperatures (Table 1) occurred at Dry Creek immediately below the decant channel (15.6°C) and in the decant channel (14.9°C). The average daily temperatures remained the highest for the longest period of time in the decant channel, Dry Creek below the decant channel, and Dry Creek upstream of the East Tributary (Figure 1).

At the opposite end of the optimal temperature range, all temperature monitoring sites in the DCFFHMP area dropped below 1°C for at least short periods of time, which is considered to be the lower limit for the protection of aquatic life (Oliver and Fidler 2001). Temperatures dropped below 1°C for longer periods of time in the decant channel, Dry Creek below the decant channel, and Dry Creek upstream of the East Tributary.

The number and size of temperature changes >1°C/hr were the greatest in the decant channel and Dry Creek downstream of the decant channel, with the creek downstream of the decant channel having approximately twice as many of these events and the maximum increases and decreases in temperature being twice as large as in the decant channel (Table 5).

All together, the temperature monitoring results are consistent with a discharge channel downstream of sedimentation ponds. Changes in stream temperature could put Westslope Cutthroat Trout in Dry Creek at risk if the fish were unable to move to more optimal temperatures.

5.0 RECOMMENDATIONS AND CIOSURE

Recommendations contained within this report are based on review of the 2020 spawner/redd survey data provided to AJM and comparison and interpretation of a 2019 Ecofish Research Ltd report (Faulkner et al. 2019). Continued monitoring of stream temperatures is recommended now that the decant channel has been eliminated. Temperature monitoring of decant water discharging from the settling ponds to Dry Creek will need to be re-established near DRY-WQ06 to monitor the temperature of discharge water before it mixes with water in Dry Creek, to gauge how it may be affecting the temperature of fish habitat in the creek, and an additional monitoring station further downstream of the decant below DRY-WQ05 may be considered to assess how far downstream from this point the potential thermal effects of the settling pond discharge may occur. It is recommended that spawner/redd surveys continue in 2021, and that additional non-invasive methods (i.e., eDNA) are explored to document and evaluate changes in the distribution and abundance of Westslope Cutthroat Trout spawners and recruits throughout the Dry Creek watershed. For continued monitoring of fish and fish habitat in the Dry Creek watershed, it is recommended that further QP input be sought to ensure appropriate features and characteristics are assessed.

Nupqu Limited Partnership was pleased to provide services under DCFFHMP, and we look forward to future collaborative opportunities. If you have any questions related to this report, please contact the undersigned.

Sincerely,

Mark Fjeld BSc, EP, BIT
Fisheries Biologist
Nupqu Limited Partnership

Mathew Coombs, MSc, R.P.Bio
Senior Aquatics Biologist
AJM Environmental Inc.

6.0 REFERENCES

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PERSONAL COMMUNICATION

Robinson, Mike. Principal Biologist, Fisheries Data Focus. Lotic Environmental, Cranbrook British Columbia. October 2020.

APPENDIX A

TEMPERATURE LOGGER SITE IDENTIFICATION, SITE DESCRIPTIONS, AND SERIAL NUMBERS

Appendix A. Serial numbers of temperature loggers installed in the Dry Creek watershed and associated site IDs and locations. All loggers were installed by Ecofish, except as noted.

Site	Location	Temperature Logger Serial Numbers
FRD-WQ01	Fording River below Dry Creek	10916113
DRY-WQ01	Dry Creek near Fording River	10916118, 10916121
DRY-AT01	Dry Creek near Fording River	10916112 (Nupqu also installed 20575225)
DRY-WQ05	Dry Creek below decant	10916111
DRY-WQ06	Settling pond decant channel	10916105, 10916112
DRY-WQ02	Dry Creek below East Tributary	20244534, 10910044
DRY-WQ04	Dry Creek above East Tributary	10916109, 10910046
DRY-WQ03	East Tributary	10916107, 10916120

APPENDIX B

DRY CREEK LOCATION MAPS OF REDDS, SURVEY REACH EXTENTS AND AMBIENT AND WATER TEMPERATURE MONITORING EQUIPMENT

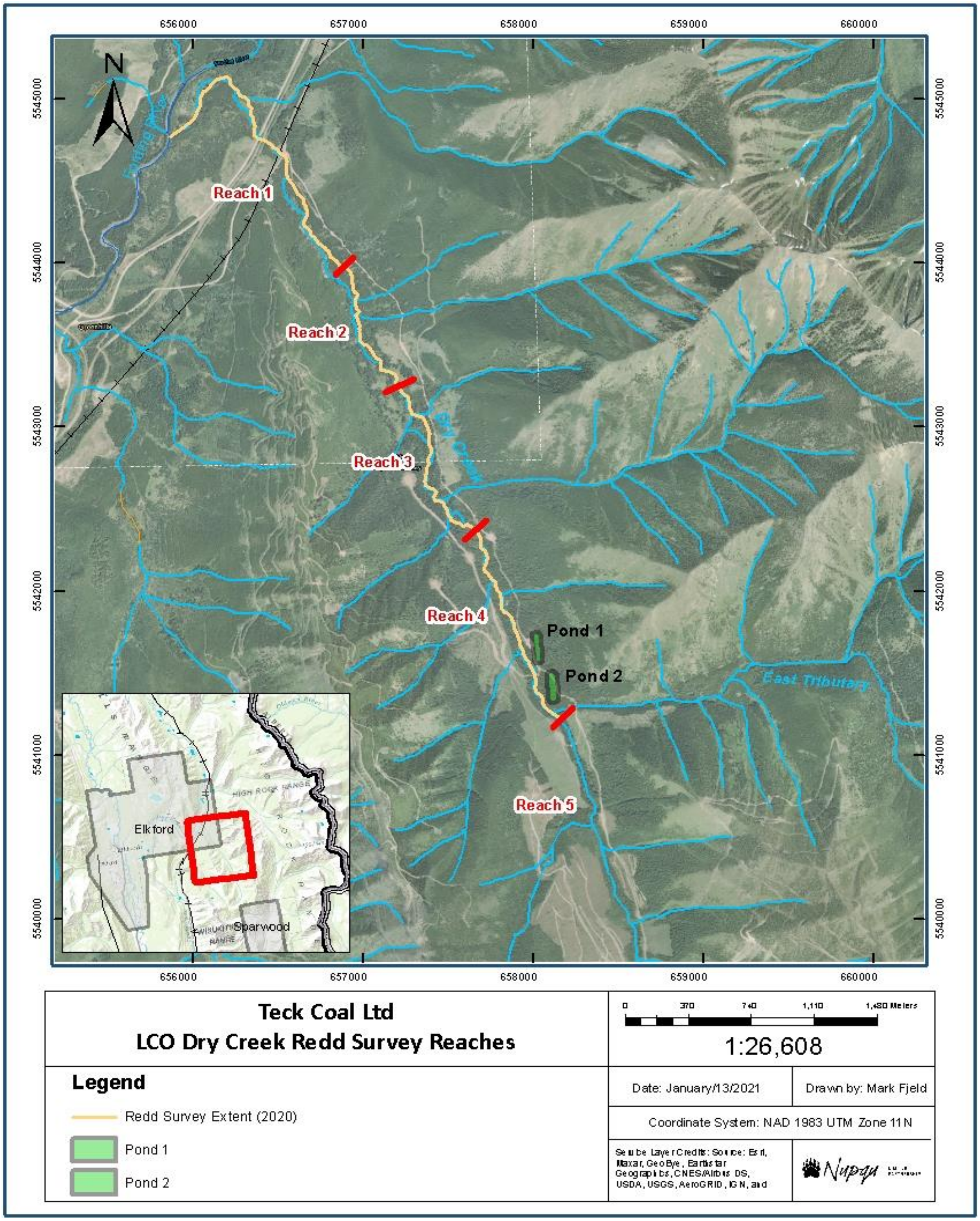

Figure 3. LCO Dry Creek redd survey map depicting reach locations in 2020. In total 5 reaches were delineated by Ecofish in 2016 starting from the Fording River upstream to a terminus in the upper Dry Creek reach.

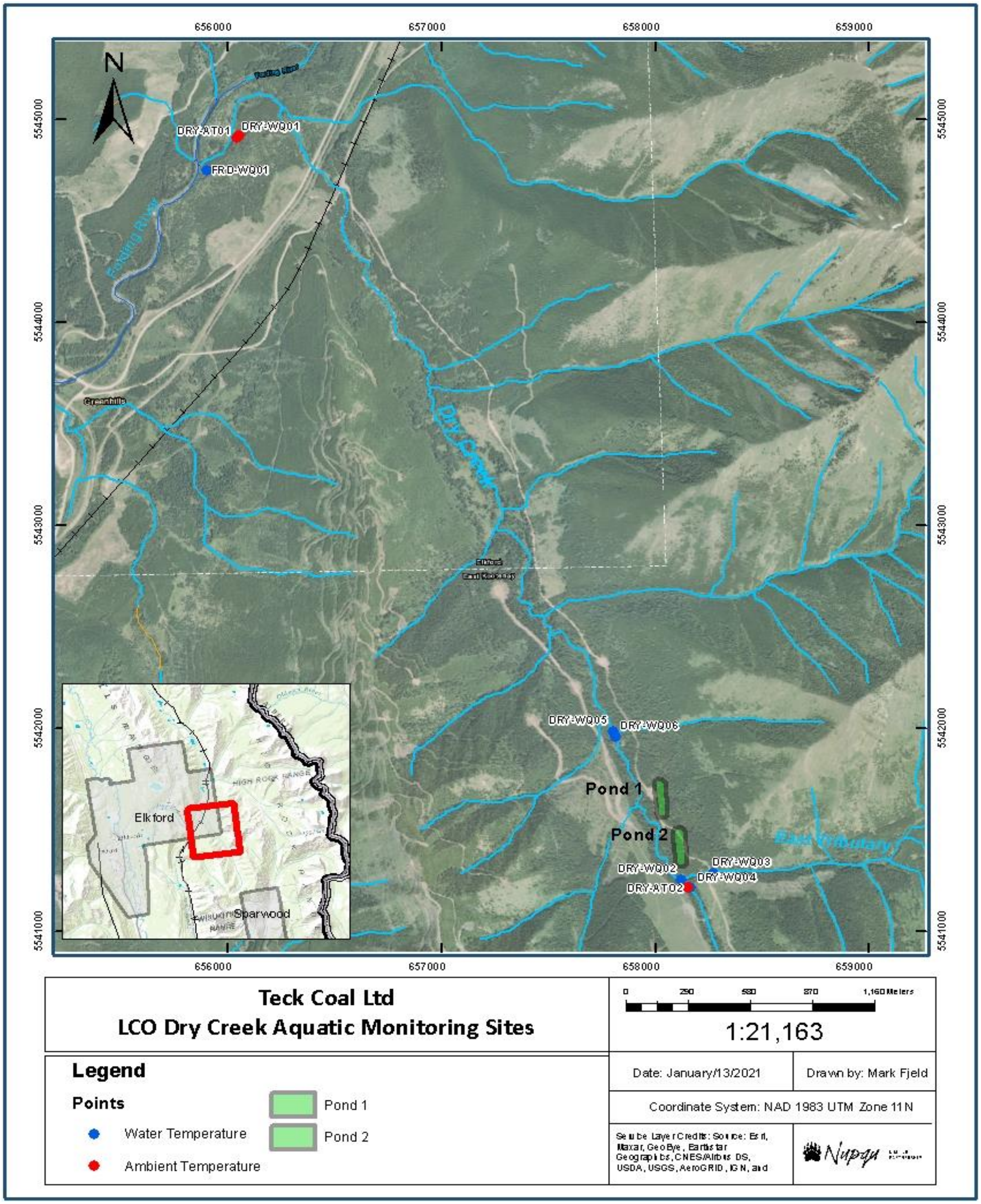

Figure 4. LCO Dry Creek temperature loggers map depicting locations in 2020. In total 7 unique water temperature stations along with 2 ambient temperature loggers are situated from the settling ponds downstream to the Fording River confluence.

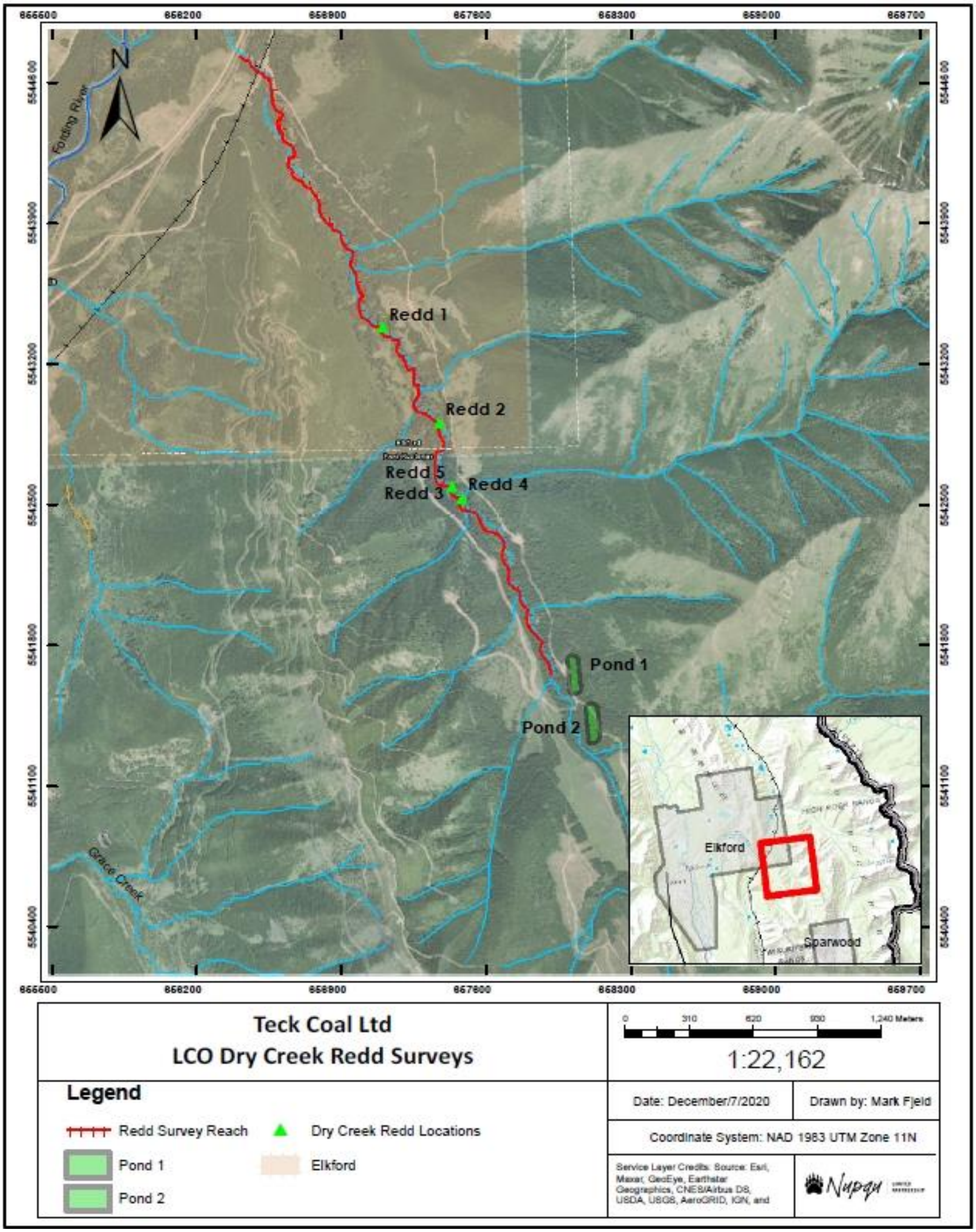

Figure 5. LCO Dry Creek redd survey map depicting redd locations in 2020. In total 5 redds were discovered in reaches 1-4 with an additional redd outside of the survey area recorded by Westslope Fisheries.

APPENDIX C
PHOTO LOG COLLECTED DURING FIELD EVENTS

Photo 1: Redd #1 discovered on June 30,2020 during initial survey effort.

Photo 2: Redd #2 discovered on June 30, 2020 during initial survey effort.

Photo 3: Redd #3 discovered on June 30, 2020 during initial survey effort.

Photo 4: Redd #4 discovered on June 30, 2020 during initial survey effort.

Photo 5: Redd #5 discovered June 30,2020 upstream of Fording River confluence.

Photo 6: Redd location from 2019 with no evidence of use in 2020.

Photo 7: **Suitable spawning substrate observed within the Dry Creek mainstem.**

Photo 8: **Suitable spawning substrate observed within the Dry Creek mainstem.**

Photo 9: **Dry Creek looking upstream of from Fording River Road.**

Photo 10: **Installed HOBO loggers at locations where existing units malfunctioned.**

Photo 11: **Natural turbidity source documented June 30,2020 along Dry Creek Reach 3.**

Photo 12: **View of instream LWD with a current HOBO Tidbit V2 logger situated in the creek.**

APPENDIX G
SUPPLEMENTAL WEEKLY SAMPLING
PERIPHYTON MEMO

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February 10, 2021

Teck Coal Limited
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Re: LCO Dry Creek LAEMP Supplemental Sampling Periphyton Community Results Summary

1. Introductory Summary

Results of laboratory analysis of periphyton samples collected during the 2020 supplemental sampling are summarized herein and compared with available historical data (2015) for LCO Dry Creek LAEMP sampling areas. Periphyton biomass and abundance both appear to have increased on Dry Creek between 2015 and 2020. Increases have not manifested as observable changes in periphyton coverage, as conditions in the field appeared similar comparing years. In 2020 there were no appearances of nuisance algae or noticeable increases in standing crops compared with 2015 (Figure 1.1). Efforts were made to confirm this change or identify any variability in collection or analytical protocols, however none were identified. Periphyton communities were generally consistent between 2015 and 2020 with respect to proportions of major algal ecological groupings.

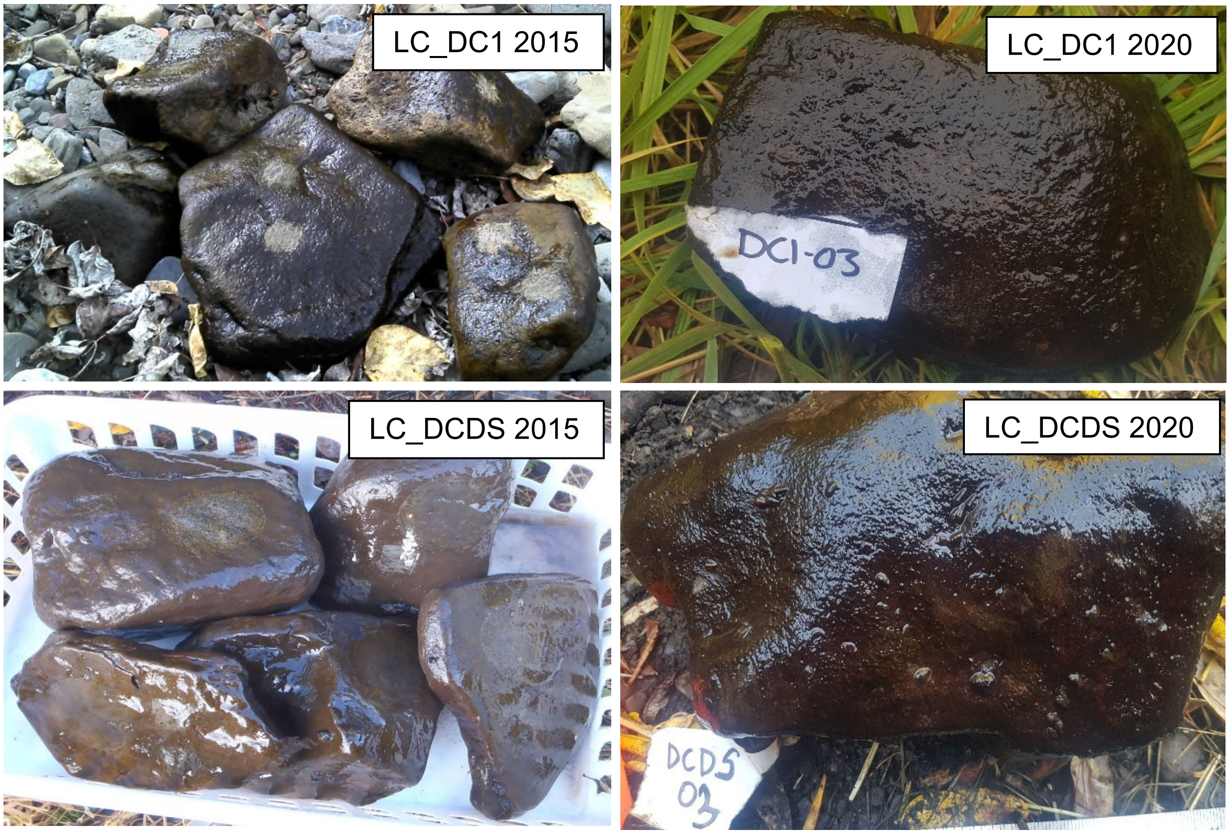

Figure 1.1: Periphyton coverage at areas LC_DC1 and LC_DCDS, 2015 and 2020

2. Methods

2.1 Field Collection

Periphyton sampling was conducted during supplemental weekly sampling events and this monitoring was outside of the scope of the 2020 LCO Dry Creek LAEMP study design (Minnow 2020) and therefore is not linked to the LAEMP study questions. The rationale for adding periphyton community and tissue chemistry monitoring in 2020 in Dry Creek was to better understand selenium bioaccumulation in Dry Creek by assessing primary production and periphyton community composition and to field validate our understanding of selenium in aquatic environments. Periphyton community and tissue chemistry samples were collected biweekly from September 23rd to November 14th (Table 2.1).

Table 2.1: Periphyton Community Sampling for Dry Creek Supplemental Sampling, 2020

Area		23-Sep-20	6-Oct-20	21-Oct-20	5-Nov-20
Mine-exposed	LC_DCDS	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
	LC_DC2	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
	LC_DC4	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)
	LC_DC1	n=3 (√)	n=3 (√)	n=3 (√)	n=3 (√)

Notes: "-" Indicates area was not sampled. "√" = target sample size was met.
[a] Supplemental sampling was implemented in response to increased aqueous organoselenium concentrations at LC_DCDS and LC_SPDC during sedimentation pond dewatering.

Triplicate samples were collected at each area during every second supplemental sampling (LC_DCDS, LC_DC2, LC_DC4, and LC_DC1; Table 2.1). Each sample was collected at each station (n=3 per area) by selecting five representative submerged rocks (excluding those that were too small, highly angular, or uncharacteristic in surface texture) that were taken to shore for processing as described below. A concerted effort was made to ensure that habitat characteristics (water depth, velocity, and substrate characteristics) were comparable among sampling stations and areas in order to minimize natural influences on the variability of productivity and tissue chemistry endpoints.

Periphyton community samples were collected by firmly placing a thin acetate template with a 2x2 cm (4 cm^2) opening in the middle of each selected rock and scraping off the periphyton within this area using a stainless-steel razor blade or scalpel. Each single composite sample represented a 0.002 m^2 (5 x 4 cm^2) surface area per endpoint. Sample material scraped from each of the five rocks was then transferred from the razor blade or scalpel to an opaque 40 mL sample cup, diluted with site water, and preserved with Lugol's iodine solution. Samples were stored at room temperature prior to shipment to the laboratory for taxonomic analysis.

Periphyton community monitoring in 2015 was identical to 2020 protocols in terms of sampling effort and targeted substrate, depth, and flow characteristics. In 2015, a 19 cm^2 cylinder fitted with a flexible rubber gasket (internal diameter reached by scrub brush = 14.9 cm^2) was held firmly in place on the rock surface, then a scalpel, modified toothbrushes and a squirt bottle filled with river water was used to remove all the periphyton within the sampler diameter into a pre-labelled sample jar, to a total volume of 100 mL (Barbour et al. 1999). This process was repeated for all five rocks in each sample, resulting in a final sample volume of 500 mL per composite sample.

Three replicate periphyton samples for tissue chemistry analysis were collected from the same rocks as community sampling, and samples were a composite of scrapings from those five rocks. Samples were collected using the same protocols as community sampling, except that samples were transferred to a 20 mL plastic vial and frozen following collection. Periphyton tissue chemistry samples from Dry Creek in 2020 are currently in frozen storage pending ratification of an analysis protocol.

2.2 Laboratory Analysis

Taxonomic identification and enumeration of periphyton community samples in 2015 and 2020 was completed by Larratt Aquatic Consulting Ltd. in Kelowna, BC. Laboratory. Analysis methods were identical in both years. Briefly, in both years samples were agitated before a 10 mL subsample was extracted and settled in a Utermohl settling chamber for 24 hours. The samples were quickly previewed at 100x to ensure that large clumps or anomalies were assessed accurately and to make sure that algae concentrations were about 10 – 30 cells/field of view. The original sample was then diluted or concentrated if necessary, to achieve desirable cell density for further viewing. Viewing continued until 300 cells were counted and cell counts had stabilized (i.e. ratios of taxa identified were not changing and new taxa were not being identified), or 80-100 fields had been assessed. Live and dead (no cell contents) diatoms were counted separately. Periphyton were identified to the lowest practicable level (LPL), genus or species wherever possible and 10% of samples are re-analyzed as part to assess QA/QC. Notes were kept on the amount (as a %) of other materials (silt, moss, detritus, periphyton stalks, invertebrates, etc.) encountered in each sample. Voucher photography was also taken for each sample. Cell dimensions were collected for representative samples from each area for every sampling effort to aid in taxonomy and to allow biovolume calculations. For colonial algae, each colony was counted as one algal unit per 10 by 10 micrometer area, or in the case of filaments, each 10 µm length was counted as one algal unit for purposes of tallying 300 counting units in a count. Methods used were compatible with United States Environmental Protection Agency (USEPA; Barbour et al 1999), the National Institute of Water and Atmospheric Research (NIWA; Biggs and Kilroy 2000), and Ontario Ministry of Environment (OMOE 2011).

2.3 Data Analysis

In 2020 and 2015, periphyton communities were evaluated using the metrics of organism density, taxonomic richness, biomass (inferred from biovolume estimates) and the relative density of ecological groupings. These metrics were calculated using LPL taxonomy. Relative density was calculated as the density of each respective taxon divided by the total density expressed as a percent. Taxonomic groups evaluated included the following major ecological groups: Diatoms, green algae (Chlorophytes), blue-green algae (Cyanobacteria), golden algae (Chrysophytes), and Dinoflagellates. Total density, relative densities, and biomass were plotted as raw values alongside historic data where available (i.e., LC_DC1 and LC_DCDS in 2015; Minnow and Larratt 2016). Periphyton community sampling in 2015 included 3 replicates each collected at areas LC_DC1 and LC_DCDS as well as three other LCO Dry Creek LAEMP areas (LC_GRCK, LC_FRUS, and LC_FRB) not included in the 2020 supplemental sampling efforts.

Periphyton sampling was conducted at Dry Creek area LC_SPDC in 2018 in response to a bloom of the invasive diatom *Didymosphenia geminate* in the LC_SPDC discharge channel. The 2018 data collection method was targeted grabs of the stalked diatom present in the discharge channel for taxonomic identification of that taxon, as opposed to a full community collection. Those data were therefore not able to be presented in an entirely quantitative format and are not comparable to 2020 data. Area LC_SPDC was not sampled for periphyton community in 2020 or 2015, and LC_SPDC substrate was artificial, whereas all areas sampled in 2020 were natural substrate.

3. Results

3.1 Total Abundance and Biomass

Total periphyton abundance values for 2015 sampling at Dry Creek LAEMP areas (LC_DCDS and LC_DC1), Grace Creek (LC_GRCK) and Fording River (LC_FRUS and LC_FRB) ranged from 25,380 cells/cm^2 (LC_GRCK) to 3,454,936 cells/cm^2 (LC_FRB; Figure 3.1). Total periphyton abundance values for Dry Creek areas sampled in 2020 ranged from 22,076,880 cells/cm^2 (LC_DC2) to 44,504,187 cells/cm^2 (LC_DC4). Total periphyton abundance at area LC_DC1 was much lower in 2015 (824,568 cells/cm^2) than 2020 (24,066,067 cells/cm^2 to 37,475,040 cells/cm^2) as was the case at area LC_DCDS between 2015 (1,094,160 cells/cm^2) and 2020 (28,827,747 cells/cm^2 to 40,381,520 cells/cm^2). LC_DC1 and LC_DCDS are the only direct comparisons of changes over time in periphyton abundance within a given area on Dry Creek, however the difference in abundances was consistent in general for Dry Creek sampling areas between years. The lack of replication in 2015 and generally low total number of samples for both years precludes a statistical comparison between years although the difference appears to be consistent.

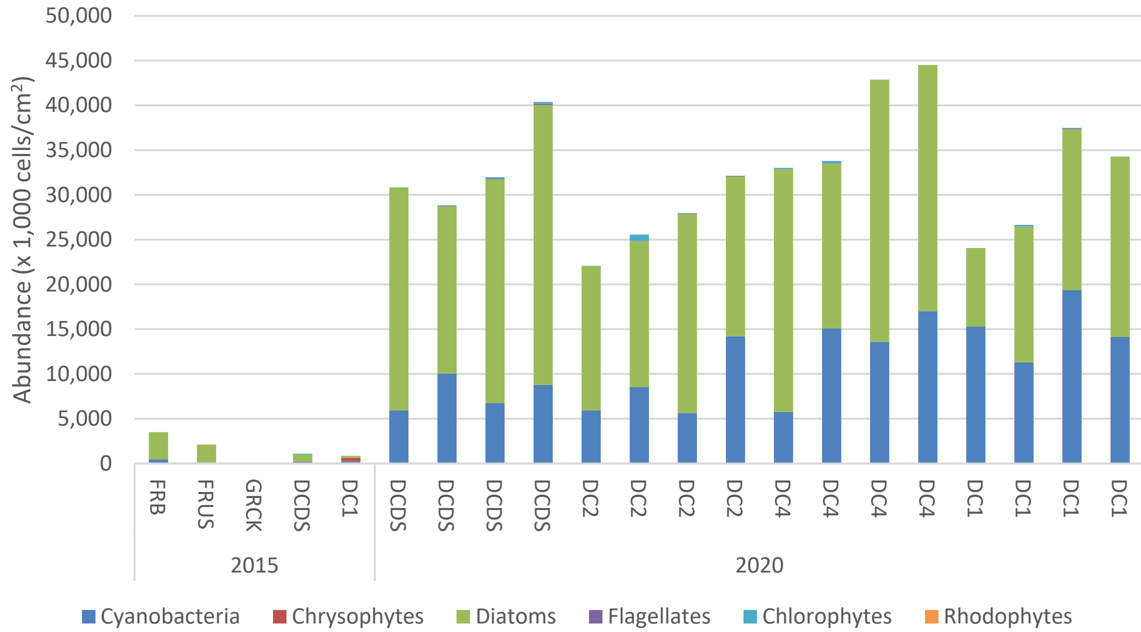

Figure 3.1: Total Periphyton Abundance, Dry Creek LAEMP Areas, 2015 and 2020

Total biomass also increased between 2015 and 2020. Total biomass values for 2015 sampling at Dry Creek LAEMP areas ranged from 10.1 µg/cm^2 (LC_GRCK) to 1423.2 µg/cm^2 (LC_FRUS) and in 2020 ranged from 1259.4 µg/cm^2 (LC_DC2) to 3790.1 µg/cm^2 (LC_DCDS; Figure 3.2). The difference between years for all areas sampled was not as pronounced for biomass estimates as it was for abundance. Total periphyton biomass at area LC_DC1 was much lower in 2015 (239.1 µg/cm^2) than 2020 (1414.2 µg/cm^2 to 2104.1 µg/cm^2) as was the case at area LC_DCDS between 2015 (416.1 µg/cm^2) and 2020 (1992.0 µg/cm^2 to 3790.1 µg/cm^2). In general, the magnitude of difference in biomass values between years was lower than for abundance, however the general result of much higher biomass values on Dry Creek in 2020 compared with 2015 is the same, which is increased periphyton coverage in Dry Creek. This result may be related to an increase in aqueous concentrations of nitrate and/or the change in nutrient regime (i.e. the shift from nitrogen and phosphorus co-limited to phosphorus-limited) on Dry Creek (Minnow 2020 and 2021). This trend is also consistent with data indicating trophic status on Dry Creek is shifting from oligotrophic to either mesotrophic or meso-eutrophic conditions (Minnow 2020).

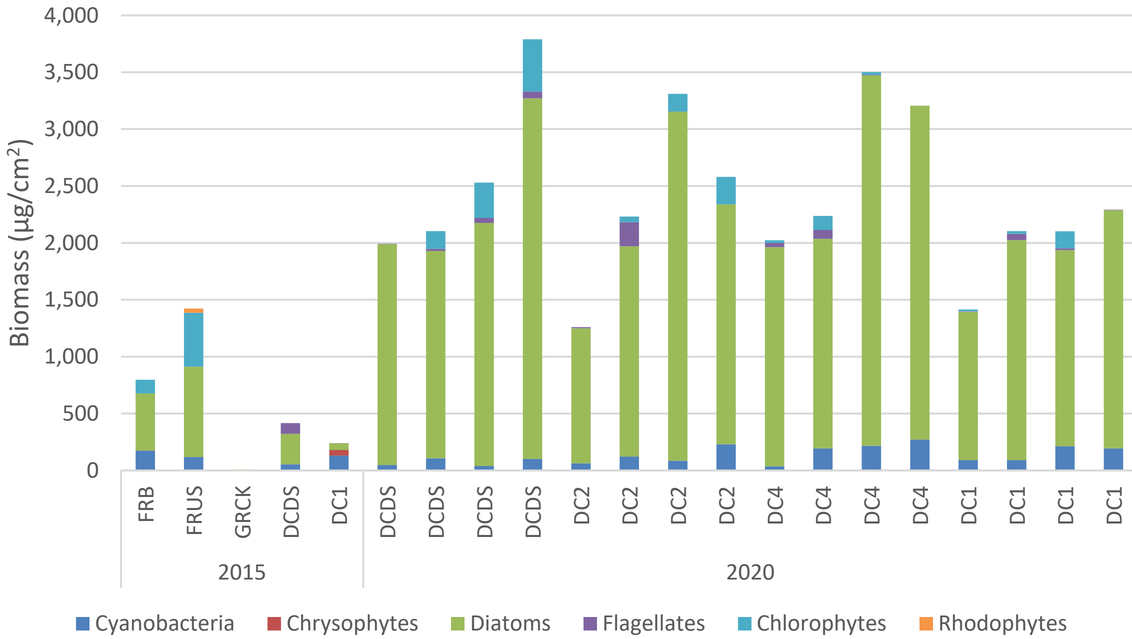

Figure 3.2: Total Periphyton Biomass, Dry Creek LAEMP Areas, 2015 and 2020

3.1 Community Composition

Dry Creek periphyton communities in 2015 and throughout 2020 sampling were generally dominated by diatoms, with *Achnanthidium minutissimum*, Nitzschia, and *Cyclotella* the most common taxa in 2015, and *Achnanthidium minutissimum* most common in 2020. Cyanobacteria were co-dominant in some replicates, particularly at area LC_DC1, and the most common taxa in 2015 were *Phormidium*, *Heteroleibleinia,* and *Chroococcus*. The most common cyanobacteria in 2020 were *Homeothrix* and *Phormidium.* Dry Creek periphyton communities were generally dominated by diatoms in terms of biomass except for in one replicate from LC_DC1 in 2015 where chrysosphytes were dominant, and one replicate from LC_DCDS in 2015 where diatoms and euglenoids were co-dominant. In general, Dry Creek periphyton communities do not appear to have demonstrated any major changes between 2015 and 2020 or throughout the 2020 supplemental sampling period.

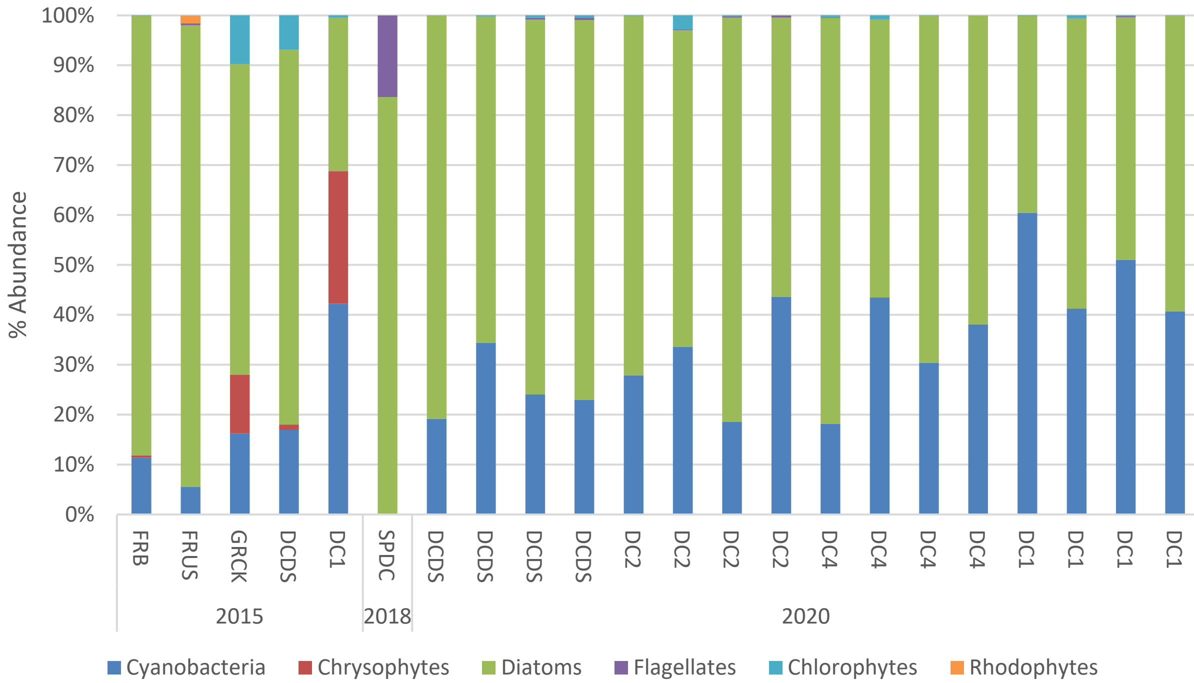

Figure 3.3: Periphyton Mean Proportional Abundance, Dry Creek LAEMP Areas, 2015 and 2020

The periphyton community at Area LC_DC1 was co-dominated by diatoms and Cyanobacteria in 2015 and 2020, except in one replicate from 2015 (2015.Fall.LC_DC1.NAT.Rep 3) where the chrysophyte *Hydrurus* was dominant (80%). The other two periphyton replicates collected at area LC_DC1 in 2015 were co-dominated by the cyanobacteria *Heteroleibleinia* (13% and 29%), *Chroococcus* (0% and 15%) and *Phormidium* (both 21%) and the diatom *Achnanthidium minutissimum* (14% and 21%). In 2020, periphyton communities were co-dominated by the filamentous Cyanobacteria *Homeothrix* and *Phormidium* and the diatom *Achnanthidium minutissimum*. *Hydrurus* was not identified in any samples across all areas in 2020. Periphyton community composition at area LC_DC1 has been mostly consistent across all sampling events in 2015 and 2020, with Cyanobacteria and diatom *Achnanthidium minutissimum* co-dominant.

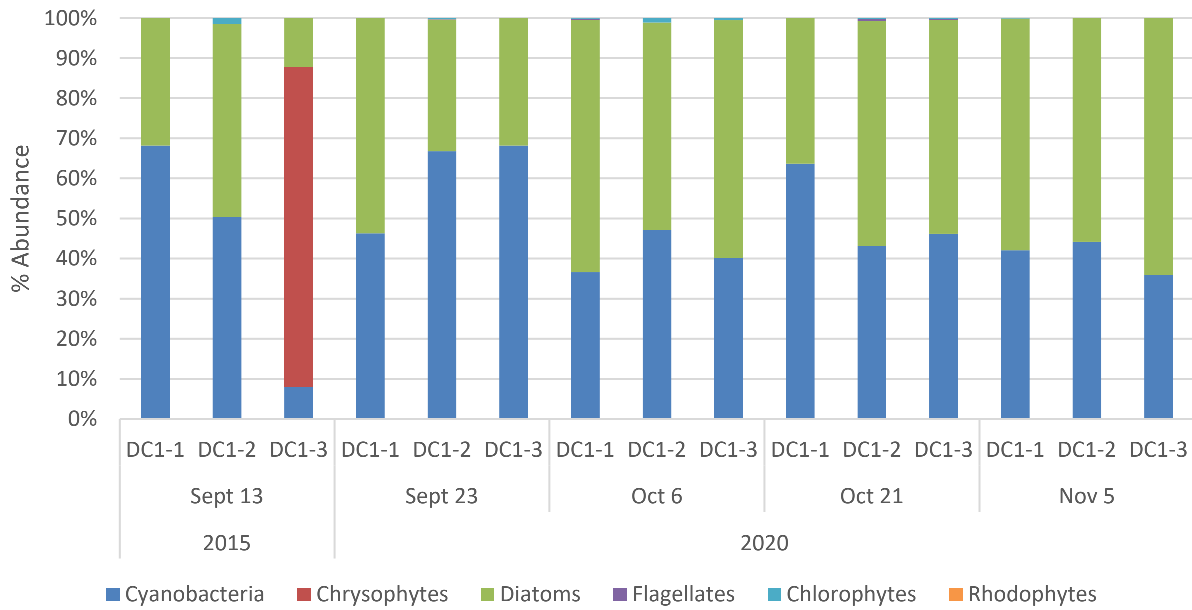

Figure 3.4: Periphyton Proportional Abundance, Dry Creek Area LC_DC1, 2015 and 2020

Periphyton community composition at area LC_DCDS was dominated by diatoms in 2015 and 2020 across all replicates (2015: 72-26%, 2020: 51-86%). The dominant diatom taxa in 2015 were *Nitzschia* (25-53%) and *Cyclotella* (17-30%) whereas in 2020 the diatom *Achnanthidium minutissimum* was the dominant taxon across all samples (30-73%). The filamentous cyanobacterium *Homeothrix* was also common at area LC_DCDS and was found in all samples in varying proportions (6-44%). *Phormidium* was identified in all but two replicates (LC_DCDS-01_2020-10-21-1 and LC_DCDS-01_2020-11-05-1) collected at area LC_DCDS in 2015 (1-3%) and 2020 (0-15%).

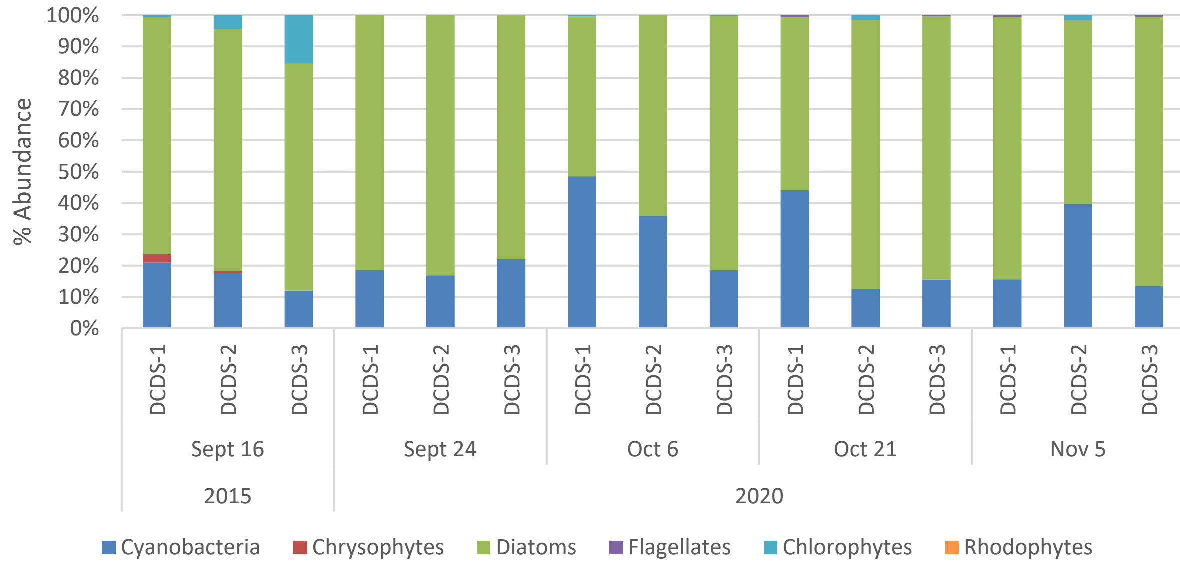

Figure 3.5: Periphyton Proportional Abundance, Dry Creek Area LC_DCDS, 2015 and 2020

Periphyton communities at Dry Creek areas LC_DC4 and LC_DC2 were similar to those upstream (LC_DCDS) and downstream (LC_DC1) in 2020, generally dominated by diatoms with some co-dominated by diatoms and cyanobacteria (specifically, LC_DC4-02_2020-10-06-2 and LC_DC2-02_2020-11-05-2). The dominant diatom taxon at areas LC_DC4 and LC_DC2 in 2020 was *Achnanthidium minutissimum* (35-84% and 33-74%, respectively). The most common cyanobacteria at areas LC_DC4 and LC_DC2 in 2020 were *Homeothrix* and *Phormidium*.

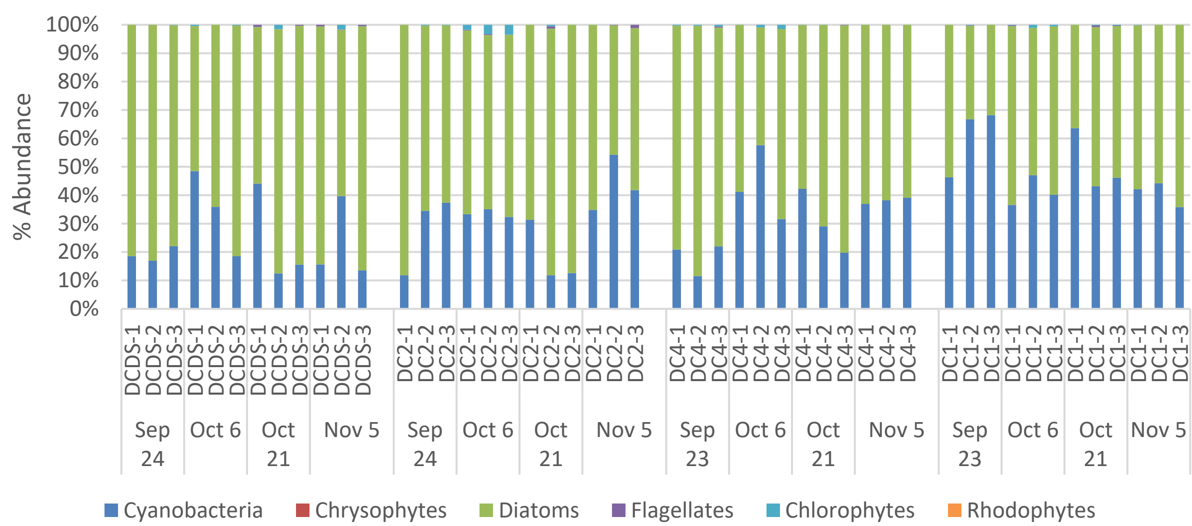

Figure 3.6: Periphyton Proportional Abundance, Dry Creek Area LC_DCDS, 2015 and 2020

4. Summary

Periphyton abundance and biomass appear to have increased between 2015 and 2020 on Dry Creek, however this comparison is limited by a lack of replication for 2015 sampling and data gaps (i.e. only two areas sampled) in 2015 data. Given the increases in nitrate concentrations and coinciding changes in trophic status and nutrient limitation over that period, it is possible that periphyton coverage has increased significantly over that period (Minnow 2020, Minnow 2021).

Periphyton communities in Dry Creek did not demonstrate meaningful changes in community composition over the course of the 2020 supplemental sampling period (Sept 23 to Nov 5). Furthermore, they generally resemble communities sampled in 2015 in terms of dominant taxa and community composition. The few exceptions to the similarities between 2015 and 2020 conditions were limited to area LC_DC1 and one replicate from LC_DCDS and are not indicative of habitat degradation or creek-wide changes over time and may have resulted from differences in sampling protocols between years. Proportions of *Phormidium* also do not appear to be increasing over time and are comparable between 2015 and 2020.

High variability is common in and among periphyton datasets, the sources of which can include changes in taxonomists and/or field sampling practices, field sampling error, patchy distribution of algal colonies, laboratory analytical variability, and natural variability among communities. Following the receipt of 2020 Dry Creek periphyton data and comparison with 2015 data, efforts were made to confirm consistency between field and laboratory methods between years in order to confirm the differences between years (specifically increased abundance and biomass). No sources of variability were identified and therefore these data are assumed to be reliable. However, further sampling including collection of samples at LC_GRCK (an area where changes in aqueous constituents has not occurred to the extent they have on Dry Creek) could be used to further verify this result.

5. References

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Sincerely,

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APPENDIX H
BIOLOGICAL TRIGGERS

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H1. INTRODUCTION

H1.1 Background

Biological triggers for potential monitoring and management action are required as part of Teck's Adaptive Management Plan (AMP; Teck 2018). Generally, triggers are intended as a simple way to identify potential unexpected monitoring results that may require management action. Additionally, information provided from the analysis of biological triggers may lead to responses under the AMP response framework if necessary, and as such would be reported within the annual AMP report. Draft biological triggers were developed in the 2018 AMP (Teck 2018) under Management Question 5 for three measurement endpoints:

- Percent EPT (% EPT; Ephemeroptera, Plecoptera, and Trichoptera) – based on travelling kick samples (CABIN protocol), generally three replicates per location per sampling event.
- Benthic invertebrate tissue selenium (BIT Se) – generally several replicates collected per location per sampling event, where each replicate is a composite sample of invertebrates.
- Westslope cutthroat trout muscle tissue selenium (WCT Se) – generally 8 replicates collected per location per sampling event, where each replicate corresponds to a sample from a single fish.

These three endpoints are evaluated (where data are available) in other sections of the Local Aquatic Effects Monitoring Program (LAEMP) and the Regional Aquatic Effects Monitoring Program (RAEMP) reports, and therefore there is some degree of redundancy in the analysis of biological triggers. Data collected during the RAEMP is incorporated into the aquatic data integration tool (ADIT), which together is used to characterize the state of the aquatic environment. Biological trigger analyses are not identical to the evaluations in the LAEMP, RAEMP and, by extension, the ADIT, and are expected to be complementary to these other analyses. The methods applied for biological trigger analyses in this report reflect refinements made in consultation with the EMC since the draft triggers were developed in the 2018 AMP (Teck 2018). The 2020 LCO Dry Creek LAEMP represents the first time that biological triggers have been evaluated and reported (i.e., implemented) as part of this LAEMP report. Through future iterative biological trigger evaluations, the process and/or biological triggers may adjust over time.

H2. METHODS

H2.1 Overview

As outlined in Section E1.1, analyses for biological triggers are meant to be complementary to other analyses conducted in the LAEMPs and RAEMP. For the 2020 LCO Dry Creek LAEMP, biological trigger analyses only included two of the three measurement endpoints (%EPT and BIT Se) as fish tissue sampling (which was conducted at LC_DC2) did not meet the criteria for analysis in 2020[1].

For the purpose of application of the biological triggers, expectations for the endpoints evaluated (both the %EPT and BIT Se for the 2020 LCO Dry Creek LAEMP) 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 are 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[2], which for this study was LC_DCDS and LC_DC1. Although data for other areas studied under the LCO Dry Creek LAEMP (LC_DCEF, LC_DC3, LC_SPDC, LC_DC2, LC_DC4, LC_FRUS, LC_FRB, and LC_GRCK) were not available to be evaluated relative to biological triggers, these areas were assessed elsewhere as part of the main LCO Dry Creek LAEMP report.

Methodological details are discussed for each of the biological trigger metrics below.

H2.2 Percent EPT

Data for percent EPT were compared to:

- Normal range: The lower limit of habitat-adjusted normal range (2.5th percentile).
- Expectations: The %EPT corresponding to the predicted 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,

[1] Opportunistic fish tissue sampling was conducted at LC_DC2 in 2020. Projected water quality data is not available for this area, and thus the application of biotriggers for the Westslope cutthroat trout muscle tissue selenium endpoint could not be employed.

[2] Biological triggers have not been developed for lentic habitats, because water quality projections are not generally available for lentic locations. For two of the three endpoints (BIT Se and WCT Se; %EPT not relevant in lentic areas), if projections become available for lentic habitats then triggers could be developed in future, using the available lentic bioaccumulation model from water to invertebrates (updated in 2020), and the invertebrate to fish bioaccumulation model (which should be applicable to both lotic and lentic habitats).

sulphate and cadmium)[3] and invertebrate toxicity endpoints originally developed for the EVWQP (Teck 2014). A predicted ADIT score of 3 corresponds to 50% or greater effects to reproduction of the water flea *Ceriodaphnia dubia*, 2 corresponds to 20 to 50% effects, 1 corresponds to 10 to 20% effects, and 0 corresponds to effect levels of 10% or less. Once %EPT is actually measured, the measured results are converted to a measured ADIT score in relation to 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; 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. In summary, this component of the biological trigger for %EPT asks whether the measured 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 (August/September) for the 2020 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 regional normal range (97.5th percentile).
- Expectations: The upper limit of the 95% prediction interval based on the water to BIT bioaccumulation model. The model was originally developed in the EVWQP (Golder 2014) was updated (Golder 2020) and the updated best fit relationship is $log_{10}[Se]_{inv} = 0.720 + 0.071 \times log_{10}[Se]_{aq}$. Prediction intervals were estimated for BIT Se for individual replicates, taking into account that the data points for the original model were based on geometric means rather than individual replicates (Azimuth 2021, In Preparation).

Benthic invertebrate tissue selenium data from sampling events completed throughout 2020 for the LCO Dry Creek LAEMP (May, June, August/September, October, and

[3] Notes: (a) Selenium not included because selenium effects on BIC endpoints were not expected. (b) Projections were based on the highest maximum monthly mean across all flow scenarios (low, average, high).

November/December) were included in the biological trigger analysis although normal range information is based on fall (September) information.

Although effects benchmarks are not part of the trigger, they are relevant for interpreting potential significance and responses. Consequently, the level 1, 2 and 3 benchmarks for the most sensitive receptor (juvenile fish via dietary exposure) are included in 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 August/September sampling period (Appendix Table H.1 and Appendix Figure H.1). Of the three replicates evaluated during this sampling period at LC_DCDS, none were below the biological trigger values, while one of the three replicates at LC_DC1 was below the trigger (Appendix Table H.1 and Appendix Figure H.1). The one replicate that did exceed the biological trigger had a %EPT value of 47.0%.

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 trigger for individual replicates from each of the five sampling events (May, June, August/September, October, and November/December; Appendix Table H.2 and Appendix Figure H.2). At least one replicate in each of the five sampling events for both LC_DCDS and LC_DC1 exceeded the biological trigger for benthic invertebrate tissue selenium concentrations, excluding the November/December sampling event for LC_DC1 (0 of 14 replicates). Of the 65 replicates evaluated in 2020 at LC_DCDS, 55 exceeded the biological trigger (11.7 mg/kg dw) with benthic invertebrate tissue concentrations ranging from 12 to 36 mg/kg dw. In contrast, only six out of 65 replicates (with concentrations of those six replicates ranging from 12 to 19 mg/kg dw) exceeded the biological trigger for LC_DC1.

H4. SUMMARY

As discussed above, one replicate (of three) at LC_DC1 was below the %EPT biological trigger, while all replicates had %EPT above the biological trigger at LC_DCDS. The one replicate that was below the biological trigger was also below the regional normal range and site-specific normal range as outlined in the main body of the report (see Figure 5.4), which was different than other two replicates which were above the biological trigger, were within the regional normal range, and were also within site-specific normal ranges. Uncertainty remains around the cause of the observed %EPT response for this one replicate. 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, as discussed with the EMC in February 2021. Uncertainties are expected to be reduced through this modelling effort, and additional monitoring or potential management responses will continue to be assessed through the adaptive management process.

At least one individual replicate at LC_DC1 and LC_DCDS exceeded benthic invertebrate tissue selenium concentrations for each of the five sampling events (with the exception of LC_DC1 during November/December). As noted above (as well as in the report), the higher frequency and magnitude of exceedances at LC_DCDS is likely related to its proximity to the DCWMS discharge, while areas farther downstream, such as LC_DC1, benthic invertebrate tissue selenium concentrations either did not reach or were only slightly above the biological trigger values. As noted in the main report, the biological trigger exceedance for benthic invertebrate tissue selenium concentrations for 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 (as well as additional monitoring efforts) were implemented in 2020 to address the elevated benthic invertebrate tissue selenium concentrations for the LCO Dry Creek LAEMP. 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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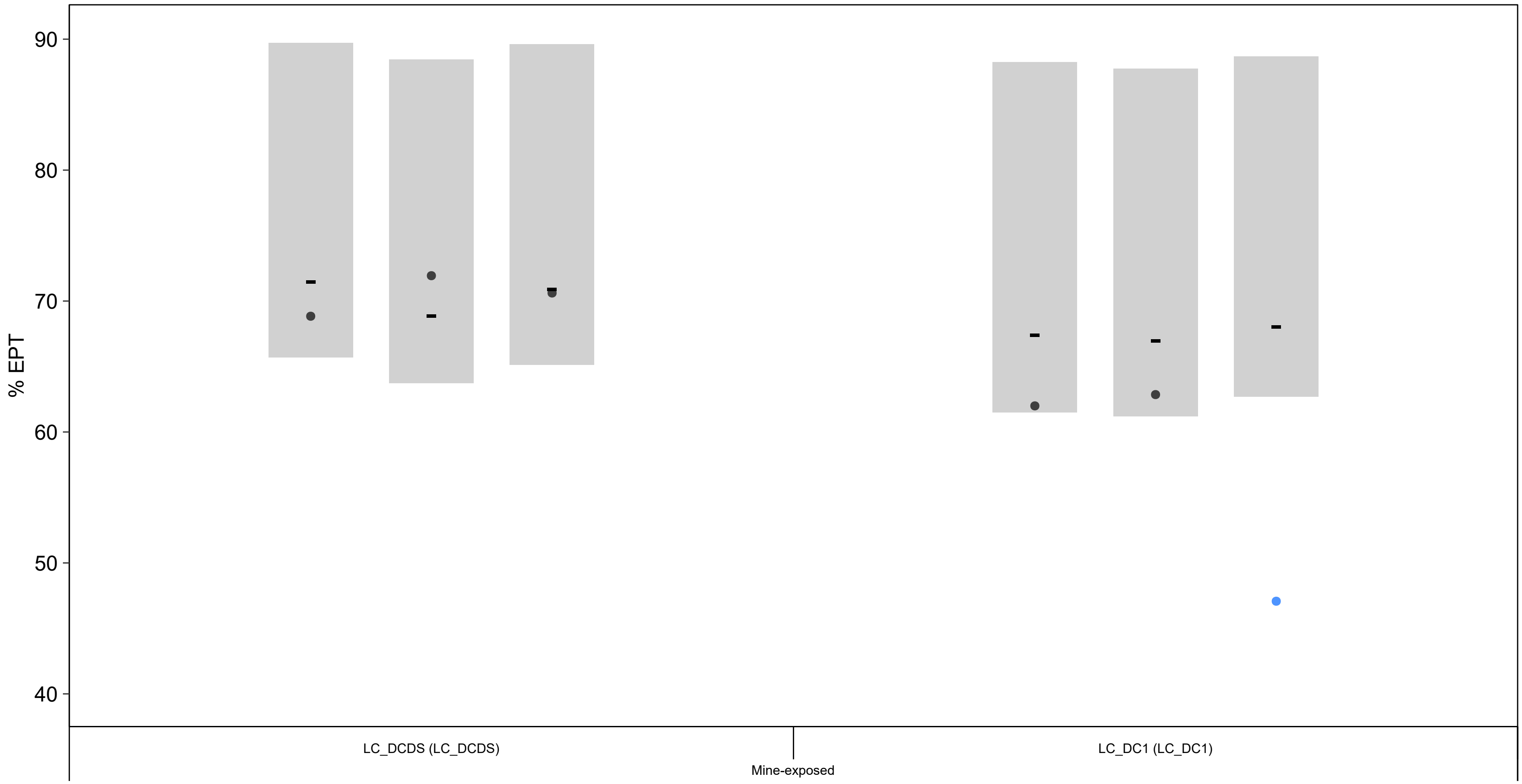

Figure H.1: Biological Trigger Analysis for %EPT in LCO Dry Creek, August/September 2020

Notes: Black bars indicate the lower limit of the predicted ADIT score for the area. Blue dots represent values exceeding the trigger (below the 2.5th percentile of habitat-adjusted normal range and below lower limit of predicted ADIT score). Gray shading represents the habitat-adjusted normal range for each replicate (Minnow 2020). T = Tributary, M = Mainstem.

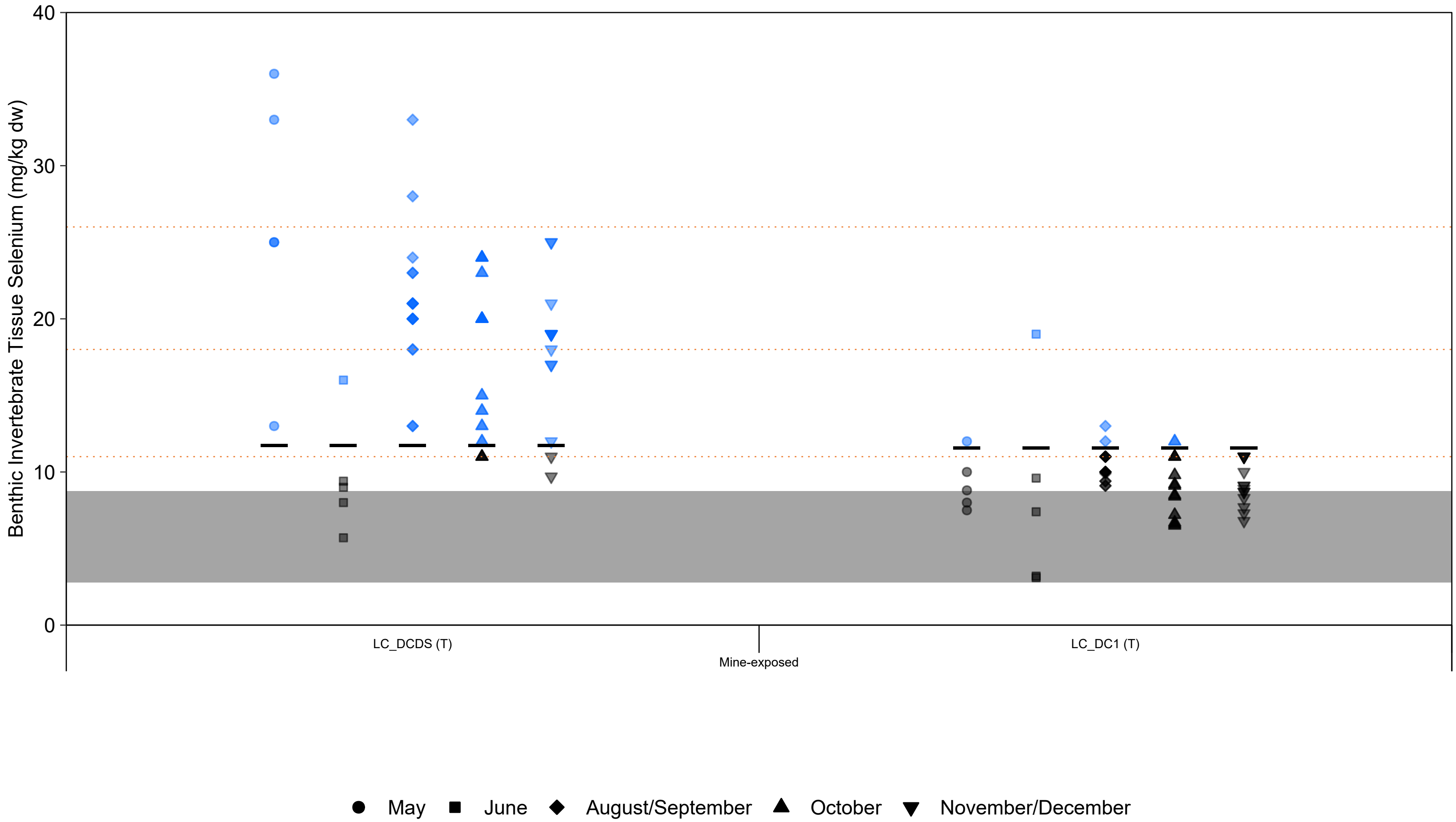

Figure H.2: Biological Trigger Analysis for Selenium Concentrations in Benthic Invertebrate Tissue in LCO Dry Creek, 2020

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 (Minnow 2020). T = Tributary, M = Mainstem.

Table H.1: Biological trigger analysis for %EPT in LCO Dry Creek, August/September 2020

Waterbody		Area	Stream Type	Replicate	Reported Value (%)	Lower 2.5th Percentile of the Habitat Adjusted Normal Range	ADIT Value [a]
Dry Creek	Mine-exposed	LC_DCDS	T	1	68.8	65.7	71.5
		LC_DCDS	T	2	71.9	63.7	68.9
		LC_DCDS	T	3	70.6	65.1	70.9
		LC_DC1	T	1	62.0	61.5	67.4
		LC_DC1	T	2	62.9	61.2	66.9
		LC_DC1	T	3	47.1	62.7	68.0

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

Notes: M= Mainstem and T = Tributary.

[a] Information pertaining to the calculation of the ADIT value is shown in Section G3.1. In short, all LCO Dry Creek areas evaluated had an ADIT score of 0, which corresponds to the 80% lower limit of the expected %EPT (as based on water quality projections).

Table H.2: **Biological Trigger Analysis for Selenium Concentrations in Benthic Invertebrate Tissue in LCO Dry Creek, 2020**

Waterbody		Stream Type	Area	Date	Replicate	Predicted Selenium Water Concentration (mg/L)	Benthic Invertebrate Selenium Tissue: Upper 95% Prediction Limit (mg/kg dw)	Benthic Invertebrate Selenium Tissue: Upper 97.5th Percentile of Normal Range (mg/kg dw)	Benthic Invertebrate Selenium Tissue: Reported Concentration (mg/kg dw)
Dry Creek	Mine-exposed	T	LC_DCDS	05-May-20	1	4.3	11.7	8.7	13
		T	LC_DCDS	05-May-20	2	4.3	11.7	8.7	36
		T	LC_DCDS	05-May-20	3	4.3	11.7	8.7	33
		T	LC_DCDS	05-May-20	4	4.3	11.7	8.7	25
		T	LC_DCDS	05-May-20	5	4.3	11.7	8.7	25
		T	LC_DCDS	24-Jun-20	1	4.3	11.7	8.7	8
		T	LC_DCDS	24-Jun-20	2	4.3	11.7	8.7	9.4
		T	LC_DCDS	24-Jun-20	3	4.3	11.7	8.7	5.7
		T	LC_DCDS	24-Jun-20	4	4.3	11.7	8.7	9
		T	LC_DCDS	24-Jun-20	5	4.3	11.7	8.7	16
		T	LC_DCDS	01-Sep-20	1	4.3	11.7	8.7	28
		T	LC_DCDS	01-Sep-20	2	4.3	11.7	8.7	23
		T	LC_DCDS	01-Sep-20	3	4.3	11.7	8.7	33
		T	LC_DCDS	01-Sep-20	4	4.3	11.7	8.7	23
		T	LC_DCDS	01-Sep-20	5	4.3	11.7	8.7	24
		T	LC_DCDS	23-Sep-20	1	4.3	11.7	8.7	20
		T	LC_DCDS	23-Sep-20	2	4.3	11.7	8.7	20
		T	LC_DCDS	23-Sep-20	3	4.3	11.7	8.7	21
		T	LC_DCDS	30-Sep-20	1	4.3	11.7	8.7	18
		T	LC_DCDS	30-Sep-20	2	4.3	11.7	8.7	21
		T	LC_DCDS	30-Sep-20	3	4.3	11.7	8.7	13
		T	LC_DCDS	23-Sep-20	1	4.3	11.7	8.7	20
		T	LC_DCDS	23-Sep-20	2	4.3	11.7	8.7	20
		T	LC_DCDS	23-Sep-20	3	4.3	11.7	8.7	21
		T	LC_DCDS	30-Sep-20	1	4.3	11.7	8.7	18
		T	LC_DCDS	30-Sep-20	2	4.3	11.7	8.7	21
		T	LC_DCDS	30-Sep-20	3	4.3	11.7	8.7	13
		T	LC_DCDS	06-Oct-20	1	4.3	11.7	8.7	11
		T	LC_DCDS	06-Oct-20	2	4.3	11.7	8.7	23
		T	LC_DCDS	06-Oct-20	3	4.3	11.7	8.7	20
		T	LC_DCDS	15-Oct-20	1	4.3	11.7	8.7	24
		T	LC_DCDS	15-Oct-20	2	4.3	11.7	8.7	14
		T	LC_DCDS	15-Oct-20	3	4.3	11.7	8.7	15
		T	LC_DCDS	21-Oct-20	1	4.3	11.7	8.7	11
		T	LC_DCDS	21-Oct-20	2	4.3	11.7	8.7	20
		T	LC_DCDS	21-Oct-20	3	4.3	11.7	8.7	20
		T	LC_DCDS	28-Oct-20	1	4.3	11.7	8.7	13
		T	LC_DCDS	28-Oct-20	2	4.3	11.7	8.7	24
		T	LC_DCDS	28-Oct-20	3	4.3	11.7	8.7	12
		T	LC_DCDS	06-Oct-20	1	4.3	11.7	8.7	11
		T	LC_DCDS	06-Oct-20	2	4.3	11.7	8.7	23
		T	LC_DCDS	06-Oct-20	3	4.3	11.7	8.7	20
		T	LC_DCDS	15-Oct-20	1	4.3	11.7	8.7	24
		T	LC_DCDS	15-Oct-20	2	4.3	11.7	8.7	14
		T	LC_DCDS	15-Oct-20	3	4.3	11.7	8.7	15
		T	LC_DCDS	21-Oct-20	1	4.3	11.7	8.7	11
		T	LC_DCDS	21-Oct-20	2	4.3	11.7	8.7	20
		T	LC_DCDS	21-Oct-20	3	4.3	11.7	8.7	20
		T	LC_DCDS	28-Oct-20	1	4.3	11.7	8.7	13
		T	LC_DCDS	28-Oct-20	2	4.3	11.7	8.7	24
		T	LC_DCDS	28-Oct-20	3	4.3	11.7	8.7	12
		T	LC_DCDS	05-Nov-20	1	4.3	11.7	8.7	19
		T	LC_DCDS	05-Nov-20	2	4.3	11.7	8.7	25
		T	LC_DCDS	05-Nov-20	3	4.3	11.7	8.7	19
		T	LC_DCDS	12-Nov-20	1	4.3	11.7	8.7	11
		T	LC_DCDS	12-Nov-20	2	4.3	11.7	8.7	21
		T	LC_DCDS	12-Nov-20	3	4.3	11.7	8.7	12
		T	LC_DCDS	05-Nov-20	1	4.3	11.7	8.7	19
		T	LC_DCDS	05-Nov-20	2	4.3	11.7	8.7	25
		T	LC_DCDS	05-Nov-20	3	4.3	11.7	8.7	19
		T	LC_DCDS	01-Dec-20	1	4.3	11.7	8.7	19
		T	LC_DCDS	01-Dec-20	2	4.3	11.7	8.7	17
		T	LC_DCDS	01-Dec-20	3	4.3	11.7	8.7	17
		T	LC_DCDS	01-Dec-20	4	4.3	11.7	8.7	9.7
		T	LC_DCDS	01-Dec-20	5	4.3	11.7	8.7	18
		T	LC_DC1	04-May-20	1	3.5	11.6	8.7	12
		T	LC_DC1	04-May-20	2	3.5	11.6	8.7	10
		T	LC_DC1	04-May-20	3	3.5	11.6	8.7	8.8
		T	LC_DC1	04-May-20	4	3.5	11.6	8.7	8
		T	LC_DC1	04-May-20	5	3.5	11.6	8.7	7.5
		T	LC_DC1	24-Jun-20	1	3.5	11.6	8.7	9.6
		T	LC_DC1	24-Jun-20	2	3.5	11.6	8.7	7.4
		T	LC_DC1	24-Jun-20	3	3.5	11.6	8.7	3.1
		T	LC_DC1	24-Jun-20	4	3.5	11.6	8.7	3.2
		T	LC_DC1	24-Jun-20	5	3.5	11.6	8.7	19
		T	LC_DC1	02-Sep-20	1	3.5	11.6	8.7	10
		T	LC_DC1	02-Sep-20	2	3.5	11.6	8.7	11
		T	LC_DC1	02-Sep-20	3	3.5	11.6	8.7	9.9
		T	LC_DC1	02-Sep-20	4	3.5	11.6	8.7	12
		T	LC_DC1	02-Sep-20	5	3.5	11.6	8.7	13

Table H.2: Biological Trigger Analysis for Selenium Concentrations in Benthic Invertebrate Tissue in LCO Dry Creek, 2020

Waterbody		Stream Type	Area	Date	Replicate	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)
Line Creek	Mine-exposed	T	LC_DC1	23-Sep-20	1	3.5	11.6	8.7	10
		T	LC_DC1	23-Sep-20	2	3.5	11.6	8.7	10
		T	LC_DC1	23-Sep-20	3	3.5	11.6	8.7	9.4
		T	LC_DC1	30-Sep-20	1	3.5	11.6	8.7	11
		T	LC_DC1	30-Sep-20	2	3.5	11.6	8.7	9.1
		T	LC_DC1	30-Sep-20	3	3.5	11.6	8.7	11
		T	LC_DC1	23-Sep-20	1	3.5	11.6	8.7	10
		T	LC_DC1	23-Sep-20	2	3.5	11.6	8.7	10
		T	LC_DC1	23-Sep-20	3	3.5	11.6	8.7	9.4
		T	LC_DC1	30-Sep-20	1	3.5	11.6	8.7	11
		T	LC_DC1	30-Sep-20	2	3.5	11.6	8.7	9.1
		T	LC_DC1	30-Sep-20	3	3.5	11.6	8.7	11
		T	LC_DC1	06-Oct-20	1	3.5	11.6	8.7	11
		T	LC_DC1	06-Oct-20	2	3.5	11.6	8.7	12
		T	LC_DC1	06-Oct-20	3	3.5	11.6	8.7	11
		T	LC_DC1	15-Oct-20	1	3.5	11.6	8.7	7.2
		T	LC_DC1	15-Oct-20	2	3.5	11.6	8.7	6.6
		T	LC_DC1	15-Oct-20	3	3.5	11.6	8.7	6.5
		T	LC_DC1	21-Oct-20	1	3.5	11.6	8.7	8.4
		T	LC_DC1	21-Oct-20	2	3.5	11.6	8.7	9.2
		T	LC_DC1	21-Oct-20	3	3.5	11.6	8.7	6.7
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		T	LC_DC1	06-Oct-20	2	3.5	11.6	8.7	12
		T	LC_DC1	06-Oct-20	3	3.5	11.6	8.7	11
		T	LC_DC1	15-Oct-20	1	3.5	11.6	8.7	7.2
		T	LC_DC1	15-Oct-20	2	3.5	11.6	8.7	6.6
		T	LC_DC1	15-Oct-20	3	3.5	11.6	8.7	6.5
		T	LC_DC1	21-Oct-20	1	3.5	11.6	8.7	8.4
		T	LC_DC1	21-Oct-20	2	3.5	11.6	8.7	9.2
		T	LC_DC1	21-Oct-20	3	3.5	11.6	8.7	6.7
		T	LC_DC1	28-Oct-20	1	3.5	11.6	8.7	9.8
		T	LC_DC1	28-Oct-20	2	3.5	11.6	8.7	9.1
		T	LC_DC1	28-Oct-20	3	3.5	11.6	8.7	8.5
		T	LC_DC1	05-Nov-20	1	3.5	11.6	8.7	8.7
		T	LC_DC1	05-Nov-20	2	3.5	11.6	8.7	11
		T	LC_DC1	05-Nov-20	3	3.5	11.6	8.7	9.1
		T	LC_DC1	12-Nov-20	1	3.5	11.6	8.7	11
		T	LC_DC1	12-Nov-20	2	3.5	11.6	8.7	10
		T	LC_DC1	12-Nov-20	3	3.5	11.6	8.7	6.8
		T	LC_DC1	05-Nov-20	1	3.5	11.6	8.7	8.7
		T	LC_DC1	05-Nov-20	2	3.5	11.6	8.7	11
		T	LC_DC1	05-Nov-20	3	3.5	11.6	8.7	9.1
		T	LC_DC1	30-Nov-20	1	3.5	11.6	8.7	11
		T	LC_DC1	30-Nov-20	2	3.5	11.6	8.7	8.9
		T	LC_DC1	30-Nov-20	3	3.5	11.6	8.7	7.7
		T	LC_DC1	30-Nov-20	4	3.5	11.6	8.7	7.3
		T	LC_DC1	30-Nov-20	5	3.5	11.6	8.7	8.3

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).

Notes: M= Mainstem and T = Tributary.

APPENDIX I

LABORATORY REPORTS

Routine Water Quality
Laboratory Reports (ALS)

Teck Coal Ltd.
ATTN: Cait Good
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 06-MAY-20
Report Date: 13-MAY-20 17:02 (MT)
Version: FINAL

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2444730

Project P.O. #: VPO00692629
Job Reference: LINE CREEK OPERATIONS
C of C Numbers: Regional Effects Pro
Legal Site Desc:

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2444730-1	L2444730-2	L2444730-3		
	Description	WS	WS	WS		
	Sampled Date	04-MAY-20	04-MAY-20	05-MAY-20		
	Sampled Time	13:00	09:30	09:30		
	Client ID	LC_DC1_WS_2020-05-04_1300	LC_DC4_WS_2020-05-04_0930	LC_SPDC_WS_2020-05-05_0930		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (@ 25C) (uS/cm)	330	322	411		
	Hardness (as CaCO3) (mg/L)	194	190	231		
	pH (pH)	8.28	8.27	8.23		
	ORP (mV)	317	291	238		
	Total Suspended Solids (mg/L)	4.6	2.1	3.1		
	Total Dissolved Solids (mg/L)	274	255	333		
	Turbidity (NTU)	2.04	2.06	5.33		
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	122	120	108		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)	122	120	108		
	Ammonia as N (mg/L)	0.0284	0.0153	0.0160		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	2.65	2.68	4.71		
	Fluoride (F) (mg/L)	0.106	0.097	0.102		
	Ion Balance (%)	105	102	99.2		
	Nitrate (as N) (mg/L)	6.53	6.87	12.6		
	Nitrite (as N) (mg/L)	<0.0010	0.0028	0.0070		
	Total Kjeldahl Nitrogen (mg/L)	0.316 TKNI	0.259 TKNI	<0.25 TKNI		
	Orthophosphate-Dissolved (as P) (mg/L)	0.0195	0.0224	0.0370		
	Phosphorus (P)-Total (mg/L)	0.0213	0.0214	0.0333		
	Sulfate (SO4) (mg/L)	38.7	40.2	74.6		
	Anion Sum (meq/L)	3.78	3.81	4.75		
	Cation Sum (meq/L)	3.98	3.88	4.71		
	Cation - Anion Balance (%)	2.5	0.9	-0.4		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.76	1.86	2.55		
	Total Organic Carbon (mg/L)	1.85	2.12	2.65		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0481	0.0501	0.0716		
	Antimony (Sb)-Total (mg/L)	0.00028	0.00026	0.00042		
	Arsenic (As)-Total (mg/L)	0.00027	0.00029	0.00043		
	Barium (Ba)-Total (mg/L)	0.182	0.177	0.107		
	Beryllium (Be)-Total (ug/L)	<0.020	<0.020	<0.020		
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Total (ug/L)	0.0721	0.0929	0.130		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2444730-1	L2444730-2	L2444730-3		
	Description	WS	WS	WS		
	Sampled Date	04-MAY-20	04-MAY-20	05-MAY-20		
	Sampled Time	13:00	09:30	09:30		
	Client ID	LC_DC1_WS_2020-05-04_1300	LC_DC4_WS_2020-05-04_0930	LC_SPDC_WS_2020-05-05_0930		
Grouping	**Analyte**					
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	46.4	46.0	55.5		
	Chromium (Cr)-Total (mg/L)	0.00014	0.00016	0.00022		
	Cobalt (Co)-Total (ug/L)	0.13	0.18	0.43		
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Iron (Fe)-Total (mg/L)	0.054	0.057	0.068		
	Lead (Pb)-Total (mg/L)	0.000055	0.000066	0.000067		
	Lithium (Li)-Total (mg/L)	0.0124	0.0121	0.0111		
	Magnesium (Mg)-Total (mg/L)	18.1	17.7	21.7		
	Manganese (Mn)-Total (mg/L)	0.00428	0.00421	0.00920		
	Mercury (Hg)-Total (ug/L)	0.00156	0.00164	0.00242		
	Molybdenum (Mo)-Total (mg/L)	0.00177	0.00165	0.00290		
	Nickel (Ni)-Total (mg/L)	0.00305	0.00360	0.00923		
	Potassium (K)-Total (mg/L)	1.33	1.29	1.71		
	Selenium (Se)-Total (ug/L)	12.6	12.7	24.6		
	Silicon (Si)-Total (mg/L)	2.76	2.61	2.79		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	1.48	1.47	1.31		
	Strontium (Sr)-Total (mg/L)	0.0596	0.0586	0.0761		
	Thallium (Tl)-Total (mg/L)	0.000011	<0.000010	0.000016		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.000642	0.000634	0.00107		
	Vanadium (V)-Total (mg/L)	0.00115	0.00121	0.00182		
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0037	0.0066		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	<0.0030	0.0033	0.0060		
	Antimony (Sb)-Dissolved (mg/L)	0.00025	0.00026	0.00041		
	Arsenic (As)-Dissolved (mg/L)	0.00025	0.00022	0.00040		
	Barium (Ba)-Dissolved (mg/L)	0.203	0.213	0.101		
	Beryllium (Be)-Dissolved (ug/L)	<0.020	<0.020	<0.020		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (ug/L)	0.0516	0.0536	0.104		
	Calcium (Ca)-Dissolved (mg/L)	48.2	46.5	55.7		
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Cobalt (Co)-Dissolved (ug/L)	<0.10	<0.10	0.30		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2444730-1	L2444730-2	L2444730-3		
	Description	WS	WS	WS		
	Sampled Date	04-MAY-20	04-MAY-20	05-MAY-20		
	Sampled Time	13:00	09:30	09:30		
	Client ID	LC_DC1_WS_2020-05-04_1300	LC_DC4_WS_2020-05-04_0930	LC_SPDC_WS_2020-05-05_0930		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	0.00027	0.00030	0.00030		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	0.0112	0.0114	0.0103		
	Magnesium (Mg)-Dissolved (mg/L)	18.0	17.9	22.3		
	Manganese (Mn)-Dissolved (mg/L)	0.00121	0.00147	0.00621		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	0.00167	0.00170	0.00279		
	Nickel (Ni)-Dissolved (mg/L)	0.00247	0.00291	0.00822		
	Potassium (K)-Dissolved (mg/L)	1.23	1.20	1.62		
	Selenium (Se)-Dissolved (ug/L)	14.0	13.8	26.1		
	Silicon (Si)-Dissolved (mg/L)	2.42	2.39	2.44		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	1.39	1.42	1.26		
	Strontium (Sr)-Dissolved (mg/L)	0.0654	0.0672	0.0806		
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	0.000012		
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.000666	0.000656	0.00109		
	Vanadium (V)-Dissolved (mg/L)	0.00073	0.00077	0.00137		
	Zinc (Zn)-Dissolved (mg/L)	0.0020	0.0037	0.0054		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2444730-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2444730-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2444730-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2444730-1, -2, -3
Matrix Spike	Barium (Ba)-Total	MS-B	L2444730-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L2444730-1, -2, -3
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2444730-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L2444730-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L2444730-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
TKNI	TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ACIDITY-PCT-CL	Water	Acidity by Automatic Titration	APHA 2310 Acidity

This analysis is carried out using procedures adapted from APHA Method 2310 "Acidity". Acidity is determined by potentiometric titration to a specified endpoint.

ALK-MAN-CL	Water	Alkalinity (Species) by Manual Titration	APHA 2320 ALKALINITY

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". 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.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

BR-L-IC-N-CL	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

C-DIS-ORG-LOW-CL	Water	Dissolved Organic Carbon	APHA 5310 B-Instrumental

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

C-TOT-ORG-LOW-CL	Water	Total Organic Carbon	APHA 5310 TOTAL ORGANIC CARBON (TOC)

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Reference Information

EC-L-PCT-CL	Water	Electrical Conductivity (EC)	APHA 2510B

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 25C.

F-IC-N-CL	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-BC-CL	Water	Ion Balance Calculation	APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-L-F-CL	Water	Ammonia, Total (as N)	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ORP-CL	Water	Oxidation redution potential by elect.	ASTM D1498

This analysis is carried out in accordance with the procedure described in the "ASTM" method D1498 "Oxidation-Reduction Potential of Water" published by the American Society for Testing and Materials (ASTM). Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

P-T-L-COL-CL	Water	Phosphorus (P)-Total	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-CL	Water	pH	APHA 4500 H-Electrode

pH is determined in the laboratory using a pH electrode. All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PO4-DO-L-COL-CL	Water	Orthophosphate-Dissolved (as P)	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Reference Information

SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-CL	Water	Total Dissolved Solids	APHA 2540 C

A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).

TECKCOAL-IONBAL-CL	Water	Ion Balance Calculation	APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

TKN-L-F-CL	Water	Total Kjeldahl Nitrogen	APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-L-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

TURBIDITY-CL	Water	Turbidity	APHA 2130 B-Nephelometer

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Regional Effects Pro

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0
Contact: Cait Good

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ACIDITY-PCT-CL	**Water**							
Batch R5080586								
WG3320490-2 LCS								
Acidity (as CaCO3)			104.2		%		85-115	08-MAY-20
WG3320490-1 MB								
Acidity (as CaCO3)			1.2		mg/L		2	08-MAY-20
ALK-MAN-CL	**Water**							
Batch R5080598								
WG3320496-14 LCS								
Alkalinity, Total (as CaCO3)			98.6		%		85-115	08-MAY-20
WG3320496-13 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	08-MAY-20
BE-D-L-CCMS-VA	**Water**							
Batch R5081919								
WG3321624-2 LCS								
Beryllium (Be)-Dissolved			96.9		%		80-120	12-MAY-20
WG3321624-1 MB		**NP**						
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	12-MAY-20
BE-T-L-CCMS-VA	**Water**							
Batch R5081919								
WG3321299-2 LCS								
Beryllium (Be)-Total			97.8		%		80-120	12-MAY-20
WG3321299-1 MB								
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	12-MAY-20
BR-L-IC-N-CL	**Water**							
Batch R5080285								
WG3320076-14 LCS								
Bromide (Br)			103.5		%		85-115	07-MAY-20
WG3320076-13 MB								
Bromide (Br)			<0.050		mg/L		0.05	07-MAY-20
C-DIS-ORG-LOW-CL	**Water**							
Batch R5082208								
WG3321977-6 LCS								
Dissolved Organic Carbon			93.9		%		80-120	13-MAY-20
WG3321977-5 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	13-MAY-20
C-TOT-ORG-LOW-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TOT-ORG-LOW-CL	**Water**							
Batch R5082208								
WG3321977-6 LCS								
Total Organic Carbon			92.1		%		80-120	11-MAY-20
WG3321977-5 MB								
Total Organic Carbon			<0.50		mg/L		0.5	11-MAY-20
CL-IC-N-CL	**Water**							
Batch R5080285								
WG3320076-14 LCS								
Chloride (Cl)			109.4		%		90-110	07-MAY-20
WG3320076-13 MB								
Chloride (Cl)			<0.50		mg/L		0.5	07-MAY-20
EC-L-PCT-CL	**Water**							
Batch R5080598								
WG3320496-14 LCS								
Conductivity (@ 25C)			95.9		%		90-110	08-MAY-20
WG3320496-13 MB								
Conductivity (@ 25C)			<2.0		uS/cm		2	08-MAY-20
F-IC-N-CL	**Water**							
Batch R5080285								
WG3320076-14 LCS								
Fluoride (F)			101.4		%		90-110	07-MAY-20
WG3320076-13 MB								
Fluoride (F)			<0.020		mg/L		0.02	07-MAY-20
HG-D-CVAA-VA	**Water**							
Batch R5082193								
WG3322325-10 LCS								
Mercury (Hg)-Dissolved			102.3		%		80-120	13-MAY-20
WG3322325-9 MB		**NP**						
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	13-MAY-20
HG-T-U-CVAF-VA	**Water**							
Batch R5081851								
WG3321962-2 LCS								
Mercury (Hg)-Total			87.6		%		80-120	12-MAY-20
WG3321962-1 MB								
Mercury (Hg)-Total			<0.00050		ug/L		0.0005	12-MAY-20
WG3321962-6 MS		**L2444730-2**						
Mercury (Hg)-Total			86.2		%		70-130	12-MAY-20
MET-D-CCMS-VA	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5081919								
WG3321624-2 LCS								
Aluminum (Al)-Dissolved			102.5		%		80-120	12-MAY-20
Antimony (Sb)-Dissolved			95.9		%		80-120	12-MAY-20
Arsenic (As)-Dissolved			99.6		%		80-120	12-MAY-20
Barium (Ba)-Dissolved			101.3		%		80-120	12-MAY-20
Bismuth (Bi)-Dissolved			116.5		%		80-120	12-MAY-20
Boron (B)-Dissolved			88.4		%		80-120	12-MAY-20
Cadmium (Cd)-Dissolved			97.8		%		80-120	12-MAY-20
Calcium (Ca)-Dissolved			94.1		%		80-120	12-MAY-20
Chromium (Cr)-Dissolved			100.2		%		80-120	12-MAY-20
Cobalt (Co)-Dissolved			101.8		%		80-120	12-MAY-20
Copper (Cu)-Dissolved			100.4		%		80-120	12-MAY-20
Iron (Fe)-Dissolved			85.0		%		80-120	12-MAY-20
Lead (Pb)-Dissolved			99.6		%		80-120	12-MAY-20
Lithium (Li)-Dissolved			99.2		%		80-120	12-MAY-20
Magnesium (Mg)-Dissolved			99.6		%		80-120	12-MAY-20
Manganese (Mn)-Dissolved			105.9		%		80-120	12-MAY-20
Molybdenum (Mo)-Dissolved			97.2		%		80-120	12-MAY-20
Nickel (Ni)-Dissolved			99.7		%		80-120	12-MAY-20
Potassium (K)-Dissolved			101.5		%		80-120	12-MAY-20
Selenium (Se)-Dissolved			99.99		%		80-120	12-MAY-20
Silicon (Si)-Dissolved			100.8		%		60-140	12-MAY-20
Silver (Ag)-Dissolved			97.3		%		80-120	12-MAY-20
Sodium (Na)-Dissolved			109.9		%		80-120	12-MAY-20
Strontium (Sr)-Dissolved			97.6		%		80-120	12-MAY-20
Thallium (Tl)-Dissolved			117.3		%		80-120	12-MAY-20
Tin (Sn)-Dissolved			97.4		%		80-120	12-MAY-20
Titanium (Ti)-Dissolved			91.9		%		80-120	12-MAY-20
Uranium (U)-Dissolved			107.9		%		80-120	12-MAY-20
Vanadium (V)-Dissolved			102.2		%		80-120	12-MAY-20
Zinc (Zn)-Dissolved			95.0		%		80-120	12-MAY-20
WG3321624-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	12-MAY-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-MAY-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5081919								
WG3321624-1 MB		**NP**						
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	12-MAY-20
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-MAY-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	12-MAY-20
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	12-MAY-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	12-MAY-20
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	12-MAY-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	12-MAY-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	12-MAY-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	12-MAY-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	12-MAY-20
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	12-MAY-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	12-MAY-20
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	12-MAY-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	12-MAY-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	12-MAY-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	12-MAY-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	12-MAY-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	12-MAY-20
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	12-MAY-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	12-MAY-20
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	12-MAY-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	12-MAY-20
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	12-MAY-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	12-MAY-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	12-MAY-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	12-MAY-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	12-MAY-20
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321299-2 LCS								
Aluminum (Al)-Total			102.0		%		80-120	12-MAY-20
Antimony (Sb)-Total			111.9		%		80-120	12-MAY-20
Arsenic (As)-Total			105.2		%		80-120	12-MAY-20
Barium (Ba)-Total			102.9		%		80-120	12-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321299-2 LCS								
Bismuth (Bi)-Total			107.8		%		80-120	12-MAY-20
Boron (B)-Total			91.7		%		80-120	12-MAY-20
Cadmium (Cd)-Total			102.4		%		80-120	12-MAY-20
Calcium (Ca)-Total			96.3		%		80-120	12-MAY-20
Chromium (Cr)-Total			103.1		%		80-120	12-MAY-20
Cobalt (Co)-Total			103.4		%		80-120	12-MAY-20
Copper (Cu)-Total			104.2		%		80-120	12-MAY-20
Iron (Fe)-Total			92.6		%		80-120	12-MAY-20
Lead (Pb)-Total			108.0		%		80-120	12-MAY-20
Lithium (Li)-Total			100.9		%		80-120	12-MAY-20
Magnesium (Mg)-Total			101.3		%		80-120	12-MAY-20
Manganese (Mn)-Total			104.0		%		80-120	12-MAY-20
Molybdenum (Mo)-Total			98.9		%		80-120	12-MAY-20
Nickel (Ni)-Total			100.7		%		80-120	12-MAY-20
Potassium (K)-Total			104.3		%		80-120	12-MAY-20
Selenium (Se)-Total			98.5		%		80-120	12-MAY-20
Silicon (Si)-Total			102.9		%		80-120	12-MAY-20
Silver (Ag)-Total			97.8		%		80-120	12-MAY-20
Sodium (Na)-Total			111.4		%		80-120	12-MAY-20
Strontium (Sr)-Total			97.8		%		80-120	12-MAY-20
Thallium (Tl)-Total			110.6		%		80-120	12-MAY-20
Tin (Sn)-Total			98.8		%		80-120	12-MAY-20
Titanium (Ti)-Total			98.4		%		80-120	12-MAY-20
Uranium (U)-Total			102.8		%		80-120	12-MAY-20
Vanadium (V)-Total			104.8		%		80-120	12-MAY-20
Zinc (Zn)-Total			107.0		%		80-120	12-MAY-20
WG3321299-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	12-MAY-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Barium (Ba)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Boron (B)-Total			<0.010		mg/L		0.01	12-MAY-20
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	12-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321299-1 MB								
Calcium (Ca)-Total			<0.050		mg/L		0.05	12-MAY-20
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	12-MAY-20
Iron (Fe)-Total			<0.010		mg/L		0.01	12-MAY-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Lithium (Li)-Total			<0.0010		mg/L		0.001	12-MAY-20
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	12-MAY-20
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	12-MAY-20
Potassium (K)-Total			<0.050		mg/L		0.05	12-MAY-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Silicon (Si)-Total			<0.10		mg/L		0.1	12-MAY-20
Silver (Ag)-Total			<0.000010		mg/L		0.00001	12-MAY-20
Sodium (Na)-Total			<0.050		mg/L		0.05	12-MAY-20
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	12-MAY-20
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	12-MAY-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	12-MAY-20
Uranium (U)-Total			<0.000010		mg/L		0.00001	12-MAY-20
Vanadium (V)-Total			<0.00050		mg/L		0.0005	12-MAY-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	12-MAY-20
NH3-L-F-CL	**Water**							
Batch R5081870								
WG3321989-2 LCS								
Ammonia as N			104.4		%		85-115	12-MAY-20
WG3321989-1 MB								
Ammonia as N			<0.0050		mg/L		0.005	12-MAY-20
NO2-L-IC-N-CL	**Water**							
Batch R5080285								
WG3320076-14 LCS								
Nitrite (as N)			108.0		%		90-110	07-MAY-20
WG3320076-13 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	07-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-L-IC-N-CL	**Water**							
Batch R5080285								
WG3320076-14 LCS								
Nitrate (as N)			106.3		%		90-110	07-MAY-20
WG3320076-13 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	07-MAY-20
ORP-CL	**Water**							
Batch R5082421								
WG3322688-1 CRM		**CL-ORP**						
ORP			225		mV		210-230	13-MAY-20
WG3322688-2 DUP		**L2444730-3**						
ORP		238	229	J	mV	9.2	15	13-MAY-20
P-T-L-COL-CL	**Water**							
Batch R5081272								
WG3321157-34 LCS								
Phosphorus (P)-Total			106.6		%		80-120	11-MAY-20
WG3321157-33 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	11-MAY-20
PH-CL	**Water**							
Batch R5080598								
WG3320496-14 LCS								
pH			6.97		pH		6.9-7.1	08-MAY-20
PO4-DO-L-COL-CL	**Water**							
Batch R5080230								
WG3319597-21 LCS								
Orthophosphate-Dissolved (as P)			101.8		%		80-120	07-MAY-20
WG3319597-5 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	07-MAY-20
WG3319597-23 MS		**L2444730-2**						
Orthophosphate-Dissolved (as P)			100.3		%		70-130	07-MAY-20
SO4-IC-N-CL	**Water**							
Batch R5080285								
WG3320076-14 LCS								
Sulfate (SO4)			108.1		%		90-110	07-MAY-20
WG3320076-13 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	07-MAY-20
SOLIDS-TDS-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TDS-CL	**Water**							
Batch R5080632								
WG3319540-14 LCS								
Total Dissolved Solids			88.3		%		85-115	08-MAY-20
WG3319540-13 MB								
Total Dissolved Solids			<10		mg/L		10	08-MAY-20
TKN-L-F-CL	**Water**							
Batch R5082618								
WG3322870-10 LCS								
Total Kjeldahl Nitrogen			107.0		%		75-125	13-MAY-20
WG3322870-2 LCS								
Total Kjeldahl Nitrogen			96.5		%		75-125	13-MAY-20
WG3322870-6 LCS								
Total Kjeldahl Nitrogen			117.0		%		75-125	13-MAY-20
WG3322870-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	13-MAY-20
WG3322870-5 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	13-MAY-20
WG3322870-9 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	13-MAY-20
TSS-L-CL	**Water**							
Batch R5080599								
WG3319984-23 LCS								
Total Suspended Solids			93.4		%		85-115	08-MAY-20
WG3319984-22 MB								
Total Suspended Solids			<1.0		mg/L		1	08-MAY-20
TURBIDITY-CL	**Water**							
Batch R5080000								
WG3319762-26 LCS								
Turbidity			104.5		%		85-115	07-MAY-20
WG3319762-25 MB								
Turbidity			<0.10		NTU		0.1	07-MAY-20

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Oxidation redution potential by elect.							
	1	04-MAY-20 13:00	13-MAY-20 08:00	0.25	211	hours	EHTR-FM
	2	04-MAY-20 09:30	13-MAY-20 08:00	0.25	215	hours	EHTR-FM
	3	05-MAY-20 09:30	13-MAY-20 08:00	0.25	191	hours	EHTR-FM
pH							
	1	04-MAY-20 13:00	08-MAY-20 13:00	0.25	96	hours	EHTR-FM
	2	04-MAY-20 09:30	08-MAY-20 13:00	0.25	100	hours	EHTR-FM
	3	05-MAY-20 09:30	08-MAY-20 13:00	0.25	76	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2444730 were received on 06-MAY-20 08:40.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

COC ID:	Regional Effects Program	TURNAROUND TIME:	Regular

PROJECT/CLIENT INFO

Facility Name / Job#	Dry Creek May 2020 (207202.0024)
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LABORATORY

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OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
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Email 5:	dhasek@minnow.ca	X	X	X

PO number [redacted] 692629 [redacted]

SAMPLE DETAILS

L2444730-COFC

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.	HG-T-U-CVAF-VA	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-D-CVAF-VA	TECKCOAL-MET-D-VA	TECKCOAL-MET-T-VA	TECKCOAL-ROUTINE-VA
Filtered								N	F	N	F	F	N	N
Preservative								NONE	NONE	H2SO4	NONE	NONE	HNO3	NONE
LC_DC1_WS_2020-05-04_1300	LC_DC1	WS	No	4-May-20	13:00:00	G	7	1	1	1	1	1	1	1
LC_DC4_WS_2020-05-04_0930	LC_DC4	WS	No	4-May-20	9:30:00	G	7	1	1	1	1	1	1	1
LC_SPDC_WS_2020-05-05_0930	LC_SPDC	WS	No	5-May-20	9:30:00	G	7	1	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
VPO00692629			[signature]	5/6 900

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	Maddy Stokes	Mobile #	647-522-0672
Sampler's Signature	MS	Date/Time	May 5, 2020

10

Teck Coal Ltd.
ATTN: Cait Good
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 08-MAY-20
Report Date: 16-MAY-20 15:22 (MT)
Version: FINAL

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2445409
Project P.O. #: VPO00692629
Job Reference: LINE CREEK OPERATIONS
C of C Numbers: Regional Effects
Legal Site Desc:

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445409-1	L2445409-2	L2445409-3	L2445409-4	L2445409-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	06-MAY-20	06-MAY-20	06-MAY-20	06-MAY-20	06-MAY-20
	Sampled Time	09:00	09:30	09:30	09:30	12:30
	Client ID	LC_DC2_WS_2020-05-06_0900	LC_MT2_WS_2020-05-06_0930	LC_CC2_WS_2020-05-06_0930	LC_RD2_WS_2020-05-06_0930	LC_DCEF_WS_2020-05-06_1230
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (@ 25C) (uS/cm)	337	<2.0	330	<2.0	212
	Hardness (as CaCO3) (mg/L)	175	<0.50	176		118
	pH (pH)	8.35	5.49	8.37	5.41	8.39
	ORP (mV)	458	420	480	450	447
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	247 DLHC	<10	247 DLHC	<10	138 DLHC
	Turbidity (NTU)	2.23	<0.10	2.11	<0.10	0.14
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	1.0	1.4	<1.0	1.3	<1.0
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	113	<1.0	108	<1.0	108
	Alkalinity, Carbonate (as CaCO3) (mg/L)	5.0	<1.0	4.0	<1.0	4.8
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	118	<1.0	112	<1.0	113
	Ammonia as N (mg/L)	0.0061	0.0094 RRV	<0.0050	0.0884 RRV	0.0065
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	2.65	<0.50	2.92	<0.50	<0.50
	Fluoride (F) (mg/L)	0.097	<0.020	0.136	<0.020	0.096
	Ion Balance (%)	94.5	0.0	97.6	0.0	103
	Nitrate (as N) (mg/L)	6.92	<0.0050	6.94	<0.0050	0.263
	Nitrite (as N) (mg/L)	0.0031	<0.0010	0.0030	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	<0.25 TKNI	<0.050	0.209 TKNI	<0.050	<0.050
	Orthophosphate-Dissolved (as P) (mg/L)	0.0262	<0.0010	0.0255	<0.0010	0.0154
	Phosphorus (P)-Total (mg/L)	0.0225	<0.0020	0.0221	<0.0020	0.0128
	Sulfate (SO4) (mg/L)	42.2	<0.30	42.4	<0.30	5.22
	Anion Sum (meq/L)	3.80	<0.10	3.70	<0.10	2.39
	Cation Sum (meq/L)	3.59	<0.10	3.61	<0.10	2.47
	Cation - Anion Balance (%)	-2.8	0.0	-1.2	0.0	1.5
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.11	<0.50	2.37		2.32
	Total Organic Carbon (mg/L)	2.34	<0.50	2.39	<0.50	2.34
Total Metals	Aluminum (Al)-Total (mg/L)	0.0375	<0.0030	0.0384	<0.0030	0.0054
	Antimony (Sb)-Total (mg/L)	0.00031	<0.00010	0.00029	<0.00010	0.00013
	Arsenic (As)-Total (mg/L)	0.00029	<0.00010	0.00029	<0.00010	0.00019
	Barium (Ba)-Total (mg/L)	0.169	<0.00010	0.169	<0.00010	0.251
	Beryllium (Be)-Total (ug/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (ug/L)	0.0765	<0.0050	0.0691	<0.0050	0.0398

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445409-6					
	Description	WS					
	Sampled Date	07-MAY-20					
	Sampled Time	10:30					
	Client ID	LC_DC3_WS_2020-05-07_1030					
Grouping	**Analyte**						
WATER							
Physical Tests	Conductivity (@ 25C) (uS/cm)	462					
	Hardness (as CaCO3) (mg/L)	240					
	pH (pH)	8.34					
	ORP (mV)	453					
	Total Suspended Solids (mg/L)	4.0					
	Total Dissolved Solids (mg/L)	DLHC 357					
	Turbidity (NTU)	2.70					
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	<1.0					
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	105					
	Alkalinity, Carbonate (as CaCO3) (mg/L)	3.8					
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0					
	Alkalinity, Total (as CaCO3) (mg/L)	108					
	Ammonia as N (mg/L)	0.0120					
	Bromide (Br) (mg/L)	<0.050					
	Chloride (Cl) (mg/L)	5.40					
	Fluoride (F) (mg/L)	0.098					
	Ion Balance (%)	97.4					
	Nitrate (as N) (mg/L)	13.9					
	Nitrite (as N) (mg/L)	0.0039					
	Total Kjeldahl Nitrogen (mg/L)	TKNI <0.25					
	Orthophosphate-Dissolved (as P) (mg/L)	0.0347					
	Phosphorus (P)-Total (mg/L)	0.0293					
	Sulfate (SO4) (mg/L)	82.5					
	Anion Sum (meq/L)	5.03					
	Cation Sum (meq/L)	4.90					
	Cation - Anion Balance (%)	-1.3					
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.56					
	Total Organic Carbon (mg/L)	2.67					
Total Metals	Aluminum (Al)-Total (mg/L)	0.0608					
	Antimony (Sb)-Total (mg/L)	0.00044					
	Arsenic (As)-Total (mg/L)	0.00041					
	Barium (Ba)-Total (mg/L)	0.110					
	Beryllium (Be)-Total (ug/L)	<0.020					
	Bismuth (Bi)-Total (mg/L)	<0.000050					
	Boron (B)-Total (mg/L)	<0.010					
	Cadmium (Cd)-Total (ug/L)	0.153					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445409-1	L2445409-2	L2445409-3	L2445409-4	L2445409-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	06-MAY-20	06-MAY-20	06-MAY-20	06-MAY-20	06-MAY-20
	Sampled Time	09:00	09:30	09:30	09:30	12:30
	Client ID	LC_DC2_WS_2020-05-06_0900	LC_MT2_WS_2020-05-06_0930	LC_CC2_WS_2020-05-06_0930	LC_RD2_WS_2020-05-06_0930	LC_DCEF_WS_2020-05-06_1230
Grouping	**Analyte**					
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	45.4	<0.050	45.8	<0.050	29.1
	Chromium (Cr)-Total (mg/L)	0.00013	<0.00010	0.00014	<0.00010	<0.00010
	Cobalt (Co)-Total (ug/L)	0.18	<0.10	0.18	<0.10	<0.10
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00070
	Iron (Fe)-Total (mg/L)	0.036	<0.010	0.035	<0.010	0.017
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.0127	<0.0010	0.0131	<0.0010	0.0156
	Magnesium (Mg)-Total (mg/L)	17.2	<0.10	17.4	<0.10	11.6
	Manganese (Mn)-Total (mg/L)	0.00374	<0.00010	0.00348	<0.00010	0.00093
	Mercury (Hg)-Total (ug/L)	0.00167	<0.00050	0.00169	<0.00050	0.00123
	Molybdenum (Mo)-Total (mg/L)	0.00202	<0.000050	0.00205	<0.000050	0.000861
	Nickel (Ni)-Total (mg/L)	0.00465	<0.00050	0.00456	<0.00050	0.00058
	Potassium (K)-Total (mg/L)	1.29	<0.050	1.31	<0.050	0.816
	Selenium (Se)-Total (ug/L)	14.7	<0.050	14.7	<0.050	1.66
	Silicon (Si)-Total (mg/L)	2.58	<0.10	2.62	<0.10	2.36
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.65	<0.050	1.66	<0.050	1.92
	Strontium (Sr)-Total (mg/L)	0.0626	<0.00020	0.0635	<0.00020	0.0430
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000731	<0.000010	0.000712	<0.000010	0.000253
	Vanadium (V)-Total (mg/L)	0.00120	<0.00050	0.00126	<0.00050	0.00050
	Zinc (Zn)-Total (mg/L)	0.0039	<0.0030	0.0032	<0.0030	<0.0030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	LAB	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0033	<0.0030	<0.0030		<0.0030
	Antimony (Sb)-Dissolved (mg/L)	0.00027	<0.00010	0.00027		0.00012
	Arsenic (As)-Dissolved (mg/L)	0.00023	<0.00010	0.00024		0.00015
	Barium (Ba)-Dissolved (mg/L)	0.165	<0.00010	0.167		0.252
	Beryllium (Be)-Dissolved (ug/L)	<0.020	<0.020	<0.020		<0.020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		<0.010
	Cadmium (Cd)-Dissolved (ug/L)	0.0662	<0.0050	0.0514		0.0242
	Calcium (Ca)-Dissolved (mg/L)	43.3	<0.050	43.6	<0.050	28.8
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Cobalt (Co)-Dissolved (ug/L)	0.14	<0.10	0.13		<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445409-6
	Description	WS
	Sampled Date	07-MAY-20
	Sampled Time	10:30
	Client ID	LC_DC3_WS_2020-05-07_1030
Grouping	**Analyte**	
WATER		
Total Metals	Calcium (Ca)-Total (mg/L)	60.8
	Chromium (Cr)-Total (mg/L)	0.00019
	Cobalt (Co)-Total (ug/L)	0.44
	Copper (Cu)-Total (mg/L)	<0.00050
	Iron (Fe)-Total (mg/L)	0.080
	Lead (Pb)-Total (mg/L)	0.000055
	Lithium (Li)-Total (mg/L)	0.0124
	Magnesium (Mg)-Total (mg/L)	23.1
	Manganese (Mn)-Total (mg/L)	0.0111
	Mercury (Hg)-Total (ug/L)	0.00214
	Molybdenum (Mo)-Total (mg/L)	0.00304
	Nickel (Ni)-Total (mg/L)	0.0108
	Potassium (K)-Total (mg/L)	1.76
	Selenium (Se)-Total (ug/L)	28.6
	Silicon (Si)-Total (mg/L)	2.70
	Silver (Ag)-Total (mg/L)	<0.000010
	Sodium (Na)-Total (mg/L)	1.45
	Strontium (Sr)-Total (mg/L)	0.0843
	Thallium (Tl)-Total (mg/L)	0.000016
	Tin (Sn)-Total (mg/L)	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.010
	Uranium (U)-Total (mg/L)	0.00121
	Vanadium (V)-Total (mg/L)	0.00175
	Zinc (Zn)-Total (mg/L)	0.0081
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD
	Dissolved Metals Filtration Location	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0040
	Antimony (Sb)-Dissolved (mg/L)	0.00041
	Arsenic (As)-Dissolved (mg/L)	0.00031
	Barium (Ba)-Dissolved (mg/L)	0.106
	Beryllium (Be)-Dissolved (ug/L)	<0.020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010
	Cadmium (Cd)-Dissolved (ug/L)	0.105
	Calcium (Ca)-Dissolved (mg/L)	60.0
	Chromium (Cr)-Dissolved (mg/L)	<0.00010
	Cobalt (Co)-Dissolved (ug/L)	0.27

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445409-1	L2445409-2	L2445409-3	L2445409-4	L2445409-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	06-MAY-20	06-MAY-20	06-MAY-20	06-MAY-20	06-MAY-20
	Sampled Time	09:00	09:30	09:30	09:30	12:30
	Client ID	LC_DC2_WS_2020-05-06_0900	LC_MT2_WS_2020-05-06_0930	LC_CC2_WS_2020-05-06_0930	LC_RD2_WS_2020-05-06_0930	LC_DCEF_WS_2020-05-06_1230
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	0.00035	<0.00020	0.00029		0.00031
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0116	<0.0010	0.0115		0.0142
	Magnesium (Mg)-Dissolved (mg/L)	16.2	<0.10	16.3	<0.0050	11.3
	Manganese (Mn)-Dissolved (mg/L)	0.00228	<0.00010	0.00218		0.00021
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00189	<0.000050	0.00191		0.000848
	Nickel (Ni)-Dissolved (mg/L)	0.00408	<0.00050	0.00423		<0.00050
	Potassium (K)-Dissolved (mg/L)	1.25	<0.050	1.26	<0.050	0.799
	Selenium (Se)-Dissolved (ug/L)	12.4	<0.050	12.7		1.53
	Silicon (Si)-Dissolved (mg/L)	2.23	<0.050	2.20		2.11
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		<0.000010
	Sodium (Na)-Dissolved (mg/L)	1.50	<0.050	1.52	<0.050	1.86
	Strontium (Sr)-Dissolved (mg/L)	0.0603	<0.00020	0.0625		0.0424
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010		<0.010
	Uranium (U)-Dissolved (mg/L)	0.000663	<0.000010	0.000667		0.000236
	Vanadium (V)-Dissolved (mg/L)	0.00090	<0.00050	0.00089		<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0028	<0.0010	0.0024		<0.0010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445409-6				
	Description	WS				
	Sampled Date	07-MAY-20				
	Sampled Time	10:30				
	Client ID	LC_DC3_WS_2020-05-07_1030				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	0.00031				
	Iron (Fe)-Dissolved (mg/L)	<0.010				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.0115				
	Magnesium (Mg)-Dissolved (mg/L)	21.9				
	Manganese (Mn)-Dissolved (mg/L)	0.00365				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	0.00296				
	Nickel (Ni)-Dissolved (mg/L)	0.00978				
	Potassium (K)-Dissolved (mg/L)	1.71				
	Selenium (Se)-Dissolved (ug/L)	25.6				
	Silicon (Si)-Dissolved (mg/L)	2.30				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	1.38				
	Strontium (Sr)-Dissolved (mg/L)	0.0799				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.010				
	Uranium (U)-Dissolved (mg/L)	0.00111				
	Vanadium (V)-Dissolved (mg/L)	0.00124				
	Zinc (Zn)-Dissolved (mg/L)	0.0055				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
SFPL	Sample was Filtered and Preserved at the laboratory - -4 D-CATIONS SUBSAMPLED/FILTERED/PRESERVED AT THE LAB

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2445409-4
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2445409-4
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2445409-4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2445409-4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2445409-1, -2, -3, -5, -6
Matrix Spike	Ammonia as N	MS-B	L2445409-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis
TKNI	TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ACIDITY-PCT-CL	Water	Acidity by Automatic Titration	APHA 2310 Acidity

This analysis is carried out using procedures adapted from APHA Method 2310 "Acidity". Acidity is determined by potentiometric titration to a specified endpoint.

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-MAN-CL	Water	Alkalinity (Species) by Manual Titration	APHA 2320 ALKALINITY

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". 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.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-L-IC-N-CL	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
C-DIS-ORG-LOW-CL	Water	Dissolved Organic Carbon	APHA 5310 B-Instrumental

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

Reference Information

C-TOT-ORG-LOW-CL Water Total Organic Carbon APHA 5310 TOTAL ORGANIC CARBON (TOC)

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-IC-N-CL Water Chloride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-L-PCT-CL Water Electrical Conductivity (EC) APHA 2510B

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 25C.

F-IC-N-CL Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-U-CVAF-VA Water Total Mercury in Water by CVAFS (Ultra) EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-BC-CL Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-CL Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-L-F-CL Water Ammonia, Total (as N) J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ORP-CL	Water	Oxidation redution potential by elect.	ASTM D1498

This analysis is carried out in accordance with the procedure described in the "ASTM" method D1498 "Oxidation-Reduction Potential of Water" published by the American Society for Testing and Materials (ASTM). Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

P-T-L-COL-CL	Water	Phosphorus (P)-Total	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-CL	Water	pH	APHA 4500 H-Electrode

pH is determined in the laboratory using a pH electrode. All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PO4-DO-L-COL-CL	Water	Orthophosphate-Dissolved (as P)	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-CL	Water	Total Dissolved Solids	APHA 2540 C

A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).

TECKCOAL-IONBAL-CL	Water	Ion Balance Calculation	APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

TKN-L-F-CL	Water	Total Kjeldahl Nitrogen	APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-L-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

TURBIDITY-CL	Water	Turbidity	APHA 2130 B-Nephelometer

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Regional Effects

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0

Contact: Cait Good

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ACIDITY-PCT-CL	**Water**							
Batch R5080766								
WG3320680-6 DUP		**L2445409-3**						
Acidity (as CaCO3)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	09-MAY-20
WG3320680-5 LCS								
Acidity (as CaCO3)			103.1		%		85-115	09-MAY-20
WG3320680-4 MB								
Acidity (as CaCO3)			1.5		mg/L		2	09-MAY-20
ALK-MAN-CL	**Water**							
Batch R5080775								
WG3320683-17 LCS								
Alkalinity, Total (as CaCO3)			98.5		%		85-115	09-MAY-20
WG3320683-16 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	09-MAY-20
BE-D-L-CCMS-VA	**Water**							
Batch R5081373								
WG3320746-2 LCS								
Beryllium (Be)-Dissolved			91.0		%		80-120	11-MAY-20
WG3320746-1 MB		**NP**						
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	11-MAY-20
BE-T-L-CCMS-VA	**Water**							
Batch R5081919								
WG3321296-3 DUP		**L2445409-1**						
Beryllium (Be)-Total		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	12-MAY-20
WG3321296-2 LCS								
Beryllium (Be)-Total			96.7		%		80-120	12-MAY-20
WG3321296-1 MB								
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	12-MAY-20
WG3321296-4 MS		**L2445409-2**						
Beryllium (Be)-Total			101.9		%		70-130	12-MAY-20
BR-L-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-6 LCS								
Bromide (Br)			95.6		%		85-115	09-MAY-20
WG3320752-5 MB								
Bromide (Br)			<0.050		mg/L		0.05	09-MAY-20
C-DIS-ORG-LOW-CL	**Water**							

ALS Environmental

Quality Control Report

Workorder: L2445409 Report Date: 16-MAY-20

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-LOW-CL	**Water**							
Batch R5086916								
WG3324232-2 LCS								
Dissolved Organic Carbon			98.3		%		80-120	15-MAY-20
WG3324232-1 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	15-MAY-20
C-TOT-ORG-LOW-CL	**Water**							
Batch R5086916								
WG3324232-2 LCS								
Total Organic Carbon			97.6		%		80-120	15-MAY-20
WG3324232-1 MB								
Total Organic Carbon			<0.50		mg/L		0.5	15-MAY-20
CL-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-6 LCS								
Chloride (Cl)			102.7		%		90-110	09-MAY-20
WG3320752-5 MB								
Chloride (Cl)			<0.50		mg/L		0.5	09-MAY-20
EC-L-PCT-CL	**Water**							
Batch R5080775								
WG3320683-17 LCS								
Conductivity (@ 25C)			100.3		%		90-110	09-MAY-20
WG3320683-16 MB								
Conductivity (@ 25C)			<2.0		uS/cm		2	09-MAY-20
F-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-6 LCS								
Fluoride (F)			108.5		%		90-110	09-MAY-20
WG3320752-5 MB								
Fluoride (F)			<0.020		mg/L		0.02	09-MAY-20
HG-D-CVAA-VA	**Water**							
Batch R5081532								
WG3321566-6 LCS								
Mercury (Hg)-Dissolved			102.9		%		80-120	12-MAY-20
WG3321566-5 MB		**NP**						
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	12-MAY-20
HG-T-U-CVAF-VA	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-T-U-CVAF-VA	**Water**							
Batch R5084464								
WG3323606-2 LCS								
Mercury (Hg)-Total			100.6		%		80-120	14-MAY-20
WG3323606-1 MB								
Mercury (Hg)-Total			<0.00050		ug/L		0.0005	14-MAY-20
WG3323606-6 MS		**L2445409-1**						
Mercury (Hg)-Total			105.8		%		70-130	14-MAY-20
MET-D-CCMS-CL	**Water**							
Batch R5081274								
WG3321257-2 LCS		**TMRM**						
Calcium (Ca)-Dissolved			107.7		%		80-120	11-MAY-20
Magnesium (Mg)-Dissolved			111.7		%		80-120	11-MAY-20
Potassium (K)-Dissolved			107.6		%		80-120	11-MAY-20
Sodium (Na)-Dissolved			101.1		%		80-120	11-MAY-20
WG3321257-1 MB								
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	11-MAY-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	11-MAY-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	11-MAY-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	11-MAY-20
MET-D-CCMS-VA	**Water**							
Batch R5081373								
WG3320746-2 LCS								
Aluminum (Al)-Dissolved			90.5		%		80-120	11-MAY-20
Antimony (Sb)-Dissolved			97.4		%		80-120	11-MAY-20
Arsenic (As)-Dissolved			91.1		%		80-120	11-MAY-20
Barium (Ba)-Dissolved			92.1		%		80-120	11-MAY-20
Bismuth (Bi)-Dissolved			92.6		%		80-120	11-MAY-20
Boron (B)-Dissolved			83.8		%		80-120	11-MAY-20
Cadmium (Cd)-Dissolved			90.6		%		80-120	11-MAY-20
Calcium (Ca)-Dissolved			93.9		%		80-120	11-MAY-20
Chromium (Cr)-Dissolved			94.5		%		80-120	11-MAY-20
Cobalt (Co)-Dissolved			93.2		%		80-120	11-MAY-20
Copper (Cu)-Dissolved			93.1		%		80-120	11-MAY-20
Iron (Fe)-Dissolved			92.4		%		80-120	11-MAY-20
Lead (Pb)-Dissolved			89.6		%		80-120	11-MAY-20
Lithium (Li)-Dissolved			90.3		%		80-120	11-MAY-20
Magnesium (Mg)-Dissolved			94.7		%		80-120	11-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5081373								
WG3320746-2 LCS								
Manganese (Mn)-Dissolved			97.0		%		80-120	11-MAY-20
Molybdenum (Mo)-Dissolved			94.0		%		80-120	11-MAY-20
Nickel (Ni)-Dissolved			92.8		%		80-120	11-MAY-20
Potassium (K)-Dissolved			94.0		%		80-120	11-MAY-20
Selenium (Se)-Dissolved			92.0		%		80-120	11-MAY-20
Silicon (Si)-Dissolved			94.2		%		60-140	11-MAY-20
Silver (Ag)-Dissolved			99.3		%		80-120	11-MAY-20
Sodium (Na)-Dissolved			96.3		%		80-120	11-MAY-20
Strontium (Sr)-Dissolved			91.3		%		80-120	11-MAY-20
Thallium (Tl)-Dissolved			94.0		%		80-120	11-MAY-20
Tin (Sn)-Dissolved			93.3		%		80-120	11-MAY-20
Titanium (Ti)-Dissolved			91.0		%		80-120	11-MAY-20
Uranium (U)-Dissolved			86.9		%		80-120	11-MAY-20
Vanadium (V)-Dissolved			93.1		%		80-120	11-MAY-20
Zinc (Zn)-Dissolved			90.3		%		80-120	11-MAY-20
WG3320746-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	11-MAY-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	11-MAY-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	11-MAY-20
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	11-MAY-20
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	11-MAY-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	11-MAY-20
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	11-MAY-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	11-MAY-20
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	11-MAY-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	11-MAY-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	11-MAY-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	11-MAY-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	11-MAY-20
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	11-MAY-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	11-MAY-20
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	11-MAY-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	11-MAY-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	11-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5081373								
WG3320746-1 MB		**NP**						
Potassium (K)-Dissolved			<0.050		mg/L		0.05	11-MAY-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	11-MAY-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	11-MAY-20
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	11-MAY-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	11-MAY-20
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	11-MAY-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	11-MAY-20
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	11-MAY-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	11-MAY-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	11-MAY-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	11-MAY-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	11-MAY-20
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321296-3 DUP		**L2445409-1**						
Aluminum (Al)-Total		0.0375	0.0409		mg/L	8.6	20	12-MAY-20
Antimony (Sb)-Total		0.00031	0.00029		mg/L	5.1	20	12-MAY-20
Arsenic (As)-Total		0.00029	0.00030		mg/L	3.5	20	12-MAY-20
Barium (Ba)-Total		0.169	0.168		mg/L	0.6	20	12-MAY-20
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-MAY-20
Boron (B)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	12-MAY-20
Cadmium (Cd)-Total		0.0000765	0.0000873		mg/L	13	20	12-MAY-20
Calcium (Ca)-Total		45.4	45.9		mg/L	1.2	20	12-MAY-20
Chromium (Cr)-Total		0.00013	0.00015		mg/L	13	20	12-MAY-20
Cobalt (Co)-Total		0.00018	0.00018		mg/L	1.5	20	12-MAY-20
Copper (Cu)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-MAY-20
Iron (Fe)-Total		0.036	0.035		mg/L	3.2	20	12-MAY-20
Lead (Pb)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-MAY-20
Lithium (Li)-Total		0.0127	0.0132		mg/L	3.4	20	12-MAY-20
Magnesium (Mg)-Total		17.2	16.9		mg/L	1.6	20	12-MAY-20
Manganese (Mn)-Total		0.00374	0.00373		mg/L	0.2	20	12-MAY-20
Molybdenum (Mo)-Total		0.00202	0.00200		mg/L	0.8	20	12-MAY-20
Nickel (Ni)-Total		0.00465	0.00461		mg/L	0.9	20	12-MAY-20
Potassium (K)-Total		1.29	1.30		mg/L	0.8	20	12-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321296-3 DUP		**L2445409-1**						
Selenium (Se)-Total		0.0147	0.0143		mg/L	2.6	20	12-MAY-20
Silicon (Si)-Total		2.58	2.66		mg/L	2.7	20	12-MAY-20
Silver (Ag)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	12-MAY-20
Sodium (Na)-Total		1.65	1.62		mg/L	1.6	20	12-MAY-20
Strontium (Sr)-Total		0.0626	0.0616		mg/L	1.6	20	12-MAY-20
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	12-MAY-20
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-MAY-20
Titanium (Ti)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	12-MAY-20
Uranium (U)-Total		0.000731	0.000722		mg/L	1.2	20	12-MAY-20
Vanadium (V)-Total		0.00120	0.00122		mg/L	1.9	20	12-MAY-20
Zinc (Zn)-Total		0.0039	0.0038		mg/L	1.2	20	12-MAY-20
WG3321296-2 LCS								
Aluminum (Al)-Total			103.4		%		80-120	12-MAY-20
Antimony (Sb)-Total			101.8		%		80-120	12-MAY-20
Arsenic (As)-Total			103.1		%		80-120	12-MAY-20
Barium (Ba)-Total			105.0		%		80-120	12-MAY-20
Bismuth (Bi)-Total			103.8		%		80-120	12-MAY-20
Boron (B)-Total			91.1		%		80-120	12-MAY-20
Cadmium (Cd)-Total			100.1		%		80-120	12-MAY-20
Calcium (Ca)-Total			100.6		%		80-120	12-MAY-20
Chromium (Cr)-Total			102.4		%		80-120	12-MAY-20
Cobalt (Co)-Total			104.1		%		80-120	12-MAY-20
Copper (Cu)-Total			104.7		%		80-120	12-MAY-20
Iron (Fe)-Total			95.4		%		80-120	12-MAY-20
Lead (Pb)-Total			104.9		%		80-120	12-MAY-20
Lithium (Li)-Total			99.9		%		80-120	12-MAY-20
Magnesium (Mg)-Total			101.4		%		80-120	12-MAY-20
Manganese (Mn)-Total			106.7		%		80-120	12-MAY-20
Molybdenum (Mo)-Total			98.1		%		80-120	12-MAY-20
Nickel (Ni)-Total			101.8		%		80-120	12-MAY-20
Potassium (K)-Total			101.7		%		80-120	12-MAY-20
Selenium (Se)-Total			96.3		%		80-120	12-MAY-20
Silicon (Si)-Total			100.1		%		80-120	12-MAY-20
Silver (Ag)-Total			97.7		%		80-120	12-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321296-2 LCS								
Sodium (Na)-Total			105.5		%		80-120	12-MAY-20
Strontium (Sr)-Total			97.5		%		80-120	12-MAY-20
Thallium (Tl)-Total			102.9		%		80-120	12-MAY-20
Tin (Sn)-Total			98.8		%		80-120	12-MAY-20
Titanium (Ti)-Total			96.5		%		80-120	12-MAY-20
Uranium (U)-Total			108.9		%		80-120	12-MAY-20
Vanadium (V)-Total			105.2		%		80-120	12-MAY-20
Zinc (Zn)-Total			99.3		%		80-120	12-MAY-20
WG3321296-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	12-MAY-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Barium (Ba)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Boron (B)-Total			<0.010		mg/L		0.01	12-MAY-20
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	12-MAY-20
Calcium (Ca)-Total			<0.050		mg/L		0.05	12-MAY-20
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	12-MAY-20
Iron (Fe)-Total			<0.010		mg/L		0.01	12-MAY-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Lithium (Li)-Total			<0.0010		mg/L		0.001	12-MAY-20
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	12-MAY-20
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	12-MAY-20
Potassium (K)-Total			<0.050		mg/L		0.05	12-MAY-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	12-MAY-20
Silicon (Si)-Total			<0.10		mg/L		0.1	12-MAY-20
Silver (Ag)-Total			<0.000010		mg/L		0.00001	12-MAY-20
Sodium (Na)-Total			<0.050		mg/L		0.05	12-MAY-20
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	12-MAY-20
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	12-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321296-1 MB								
Tin (Sn)-Total			<0.00010		mg/L		0.0001	12-MAY-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	12-MAY-20
Uranium (U)-Total			<0.000010		mg/L		0.00001	12-MAY-20
Vanadium (V)-Total			<0.00050		mg/L		0.0005	12-MAY-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	12-MAY-20
WG3321296-4 MS		**L2445409-2**						
Aluminum (Al)-Total			99.97		%		70-130	12-MAY-20
Antimony (Sb)-Total			98.9		%		70-130	12-MAY-20
Arsenic (As)-Total			99.6		%		70-130	12-MAY-20
Barium (Ba)-Total			99.98		%		70-130	12-MAY-20
Bismuth (Bi)-Total			99.1		%		70-130	12-MAY-20
Boron (B)-Total			99.2		%		70-130	12-MAY-20
Cadmium (Cd)-Total			99.8		%		70-130	12-MAY-20
Calcium (Ca)-Total			99.2		%		70-130	12-MAY-20
Chromium (Cr)-Total			99.99		%		70-130	12-MAY-20
Cobalt (Co)-Total			100.8		%		70-130	12-MAY-20
Copper (Cu)-Total			102.4		%		70-130	12-MAY-20
Iron (Fe)-Total			98.5		%		70-130	12-MAY-20
Lead (Pb)-Total			98.5		%		70-130	12-MAY-20
Lithium (Li)-Total			98.5		%		70-130	12-MAY-20
Magnesium (Mg)-Total			98.3		%		70-130	12-MAY-20
Manganese (Mn)-Total			101.9		%		70-130	12-MAY-20
Molybdenum (Mo)-Total			97.1		%		70-130	12-MAY-20
Nickel (Ni)-Total			98.2		%		70-130	12-MAY-20
Potassium (K)-Total			98.8		%		70-130	12-MAY-20
Selenium (Se)-Total			97.1		%		70-130	12-MAY-20
Silicon (Si)-Total			94.1		%		70-130	12-MAY-20
Silver (Ag)-Total			102.1		%		70-130	12-MAY-20
Sodium (Na)-Total			102.1		%		70-130	12-MAY-20
Strontium (Sr)-Total			98.1		%		70-130	12-MAY-20
Thallium (Tl)-Total			98.0		%		70-130	12-MAY-20
Tin (Sn)-Total			97.4		%		70-130	12-MAY-20
Titanium (Ti)-Total			96.2		%		70-130	12-MAY-20
Uranium (U)-Total			96.1		%		70-130	12-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5081919								
WG3321296-4 MS		**L2445409-2**						
Vanadium (V)-Total			100.8		%		70-130	12-MAY-20
Zinc (Zn)-Total			103.8		%		70-130	12-MAY-20
NH3-L-F-CL	**Water**							
Batch R5084856								
WG3323703-27 DUP		**L2445409-6**						
Ammonia as N		0.0120	0.0137		mg/L	13	20	14-MAY-20
WG3323703-22 LCS								
Ammonia as N			103.4		%		85-115	14-MAY-20
WG3323703-26 LCS								
Ammonia as N			96.5		%		85-115	14-MAY-20
WG3323703-21 MB								
Ammonia as N			<0.0050		mg/L		0.005	14-MAY-20
WG3323703-25 MB								
Ammonia as N			<0.0050		mg/L		0.005	14-MAY-20
WG3323703-28 MS		**L2445409-6**						
Ammonia as N			88.6		%		75-125	14-MAY-20
NO2-L-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-6 LCS								
Nitrite (as N)			100.1		%		90-110	09-MAY-20
WG3320752-5 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	09-MAY-20
NO3-L-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-6 LCS								
Nitrate (as N)			104.4		%		90-110	09-MAY-20
WG3320752-5 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	09-MAY-20
ORP-CL	**Water**							
Batch R5085738								
WG3323834-5 CRM		**CL-ORP**						
ORP			225		mV		210-230	14-MAY-20
WG3323834-7 CRM		**CL-ORP**						
ORP			219		mV		210-230	14-MAY-20
WG3323834-8 DUP		**L2445409-6**						
ORP		453	455	J	mV	1.9	15	14-MAY-20

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-L-COL-CL	**Water**							
Batch R5082438								
WG3322703-10 LCS								
Phosphorus (P)-Total			107.0		%		80-120	13-MAY-20
WG3322703-9 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	13-MAY-20
PH-CL	**Water**							
Batch R5080775								
WG3320683-17 LCS								
pH			6.98		pH		6.9-7.1	09-MAY-20
PO4-DO-L-COL-CL	**Water**							
Batch R5080554								
WG3320281-19 LCS								
Orthophosphate-Dissolved (as P)			103.9		%		80-120	08-MAY-20
WG3320281-22 LCS								
Orthophosphate-Dissolved (as P)			106.2		%		80-120	08-MAY-20
WG3320281-5 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	08-MAY-20
WG3320281-6 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	08-MAY-20
WG3320281-24 MS		**L2445409-4**						
Orthophosphate-Dissolved (as P)			95.5		%		70-130	08-MAY-20
SO4-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-6 LCS								
Sulfate (SO4)			106.8		%		90-110	09-MAY-20
WG3320752-5 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	09-MAY-20
SOLIDS-TDS-CL	**Water**							
Batch R5082692								
WG3321444-17 LCS								
Total Dissolved Solids			101.1		%		85-115	12-MAY-20
WG3321444-16 MB								
Total Dissolved Solids			<10		mg/L		10	12-MAY-20
Batch R5084537								
WG3322449-14 LCS								
Total Dissolved Solids			105.1		%		85-115	13-MAY-20
WG3322449-13 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TDS-CL	**Water**							
Batch R5084537								
WG3322449-13 MB								
Total Dissolved Solids			<10		mg/L		10	13-MAY-20
TKN-L-F-CL	**Water**							
Batch R5087496								
WG3324249-10 LCS								
Total Kjeldahl Nitrogen			88.5		%		75-125	14-MAY-20
WG3324249-2 LCS								
Total Kjeldahl Nitrogen			89.0		%		75-125	14-MAY-20
WG3324249-6 LCS								
Total Kjeldahl Nitrogen			90.0		%		75-125	14-MAY-20
WG3324249-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	14-MAY-20
WG3324249-5 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	14-MAY-20
WG3324249-9 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	14-MAY-20
TSS-L-CL	**Water**							
Batch R5082635								
WG3321881-14 LCS								
Total Suspended Solids			92.9		%		85-115	12-MAY-20
WG3321881-16 LCS								
Total Suspended Solids			111.4		%		85-115	12-MAY-20
WG3321881-13 MB								
Total Suspended Solids			<1.0		mg/L		1	12-MAY-20
WG3321881-15 MB								
Total Suspended Solids			<1.0		mg/L		1	12-MAY-20
TURBIDITY-CL	**Water**							
Batch R5080558								
WG3320026-21 DUP		**L2445409-6**						
Turbidity		2.70	2.56		NTU	5.3	15	08-MAY-20
WG3320026-20 LCS								
Turbidity			104.0		%		85-115	08-MAY-20
WG3320026-19 MB								
Turbidity			<0.10		NTU		0.1	08-MAY-20

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Oxidation redution potential by elect.							
	1	06-MAY-20 09:00	14-MAY-20 21:00	0.25	204	hours	EHTR-FM
	2	06-MAY-20 09:30	14-MAY-20 21:00	0.25	204	hours	EHTR-FM
	3	06-MAY-20 09:30	14-MAY-20 21:00	0.25	204	hours	EHTR-FM
	4	06-MAY-20 09:30	14-MAY-20 21:00	0.25	204	hours	EHTR-FM
	5	06-MAY-20 12:30	14-MAY-20 21:00	0.25	200	hours	EHTR-FM
	6	07-MAY-20 10:30	14-MAY-20 21:00	0.25	179	hours	EHTR-FM
pH							
	1	06-MAY-20 09:00	09-MAY-20 13:00	0.25	76	hours	EHTR-FM
	2	06-MAY-20 09:30	09-MAY-20 13:00	0.25	76	hours	EHTR-FM
	3	06-MAY-20 09:30	09-MAY-20 13:00	0.25	76	hours	EHTR-FM
	4	06-MAY-20 09:30	09-MAY-20 13:00	0.25	76	hours	EHTR-FM
	5	06-MAY-20 12:30	09-MAY-20 13:00	0.25	72	hours	EHTR-FM
	6	07-MAY-20 10:30	09-MAY-20 13:00	0.25	50	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2445409 were received on 08-MAY-20 08:45.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

COC ID:	Regional Effects Program	TURNAROUND TIME:	Regular

PROJECT INFORMATION

Facility Name / Job#	Dry Creek May 2020 (207202.0024)
Project Manager	Cait Good
Email	cait.good@teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250-425-8202

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyuda Shvets
Email	Lyudmyla.Shvets@ALSGlobal.com
Address	2559 29 Street NE
City	Calgary
Province	AB
Postal Code	T1Y 7B5
Country	Canada
Phone Number	403-407-1800

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	cait.good@teck.com	x	x	x
Email 2:	carlie.meyer@teck.com	x	x	x
Email 3:	[redacted]	x	x	x
Email 4:	teckcoal@equisonline.com			x
Email 5:	dhasek@minnow.ca	x	x	x

PO number [redacted] 692629

L2445409-COFC

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	HG-T-U-CVAF-VA (N, NONE)	ALS_Package-DOC (F, NONE)	ALS_Package-TKN/TOC (N, H2SO4)	HG-D-CVAF-VA (F, NONE)	TECKCOAL-MET-D-VA (F, NONE)	TECKCOAL-MET-T-VA (N, HNO3)	TECKCOAL-ROUTINE-VA (N, NONE)
LC_DC2_WS_2020-05-06_0900	LC_DC2	WS	No	6-May-20	9:00:00	G	7	1	1	1	1	1	1	1
LC_MT2_WS_2020-05-06_0930	LC_MT2	WS	No	6-May-20	9:30:00	G	7	1	1	1	1	1	1	1
LC_CC2_WS_2020-05-06_0930	LC_CC2	WS	No	6-May-20	9:30:00	G	7	1	1	1	1	1	1	1
LC_RD2_WS_2020-05-06_0930	LC_RD2	WS	No	6-May-20	9:30:00	G	4	1		1			1	1
LC_DCEF_WS_2020-05-06_1230	LC_DCEF	WS	No	6-May-20	12:30:00	G	7	1	1	1	1	1	1	1
LC_DC3_WS_2020-05-07_1030	LC_DC3	WS	No	7-May-20	10:30:00	G	7	1	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

VPO00692629

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			5/8 8:45

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	Maddy Stokes	Mobile #	647-522-0672
Sampler's Signature	MS	Date/Time	May 7, 2020

Teck Coal Ltd.
ATTN: Cait Good
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 09-MAY-20
Report Date: 19-MAY-20 14:56 (MT)
Version: FINAL

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2445542

Project P.O. #: VPO00692629
Job Reference: LINE CREEK OPERATIONS
C of C Numbers: Regional Effects
Legal Site Desc:

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445542-1	L2445542-2			
	Description	WS	WS			
	Sampled Date	08-MAY-20	08-MAY-20			
	Sampled Time	08:30	12:30			
	Client ID	LC_FRUS_WS_2020-05-08_0830	LC_FRB_WS_2020-05-08_1230			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (@ 25C) (uS/cm)	651	642			
	Hardness (as CaCO3) (mg/L)	359	355			
	pH (pH)	8.43	8.47			
	ORP (mV)	357	449			
	Total Suspended Solids (mg/L)	5.5	4.4			
	Total Dissolved Solids (mg/L)	486 DLHC	434 DLHC			
	Turbidity (NTU)	2.32	2.14			
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	3.6	<1.0			
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	169	163			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	10.8	13.8			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	180	177			
	Ammonia as N (mg/L)	0.0498	0.0153			
	Bromide (Br) (mg/L)	<0.050	<0.050			
	Chloride (Cl) (mg/L)	1.45	1.51			
	Fluoride (F) (mg/L)	0.150	0.153			
	Ion Balance (%)	95.3	96.1			
	Nitrate (as N) (mg/L)	9.43	9.61			
	Nitrite (as N) (mg/L)	0.0042	0.0055			
	Total Kjeldahl Nitrogen (mg/L)	<0.25 TKNI	<0.25 TKNI			
	Orthophosphate-Dissolved (as P) (mg/L)	0.0013	0.0012			
	Phosphorus (P)-Total (mg/L)	0.0051	0.0049			
	Sulfate (SO4) (mg/L)	159	155			
	Anion Sum (meq/L)	7.63	7.49			
	Cation Sum (meq/L)	7.27	7.19			
	Cation - Anion Balance (%)	-2.4	-2.0			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.30	1.21			
	Total Organic Carbon (mg/L)	1.41	1.39			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0947	0.0508			
	Antimony (Sb)-Total (mg/L)	0.00031	0.00016			
	Arsenic (As)-Total (mg/L)	0.00024	0.00016			
	Barium (Ba)-Total (mg/L)	0.0756	0.0913			
	Beryllium (Be)-Total (ug/L)	<0.020	<0.020			
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050			
	Boron (B)-Total (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Total (ug/L)	0.0390	0.0369			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2445542-1	L2445542-2			
	Description	WS	WS			
	Sampled Date	08-MAY-20	08-MAY-20			
	Sampled Time	08:30	12:30			
	Client ID	LC_FRUS_WS_2020-05-08_0830	LC_FRB_WS_2020-05-08_1230			
Grouping	**Analyte**					
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	92.3	89.0			
	Chromium (Cr)-Total (mg/L)	0.00021	0.00018			
	Cobalt (Co)-Total (ug/L)	0.14	0.11			
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050			
	Iron (Fe)-Total (mg/L)	0.068	0.058			
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050			
	Lithium (Li)-Total (mg/L)	0.0184	0.0203			
	Magnesium (Mg)-Total (mg/L)	35.9	37.6			
	Manganese (Mn)-Total (mg/L)	0.00485	0.00417			
	Mercury (Hg)-Total (ug/L)	0.00210	0.00085			
	Molybdenum (Mo)-Total (mg/L)	0.00133	0.00125			
	Nickel (Ni)-Total (mg/L)	0.00269	0.00267			
	Potassium (K)-Total (mg/L)	1.25	1.31			
	Selenium (Se)-Total (ug/L)	43.5	42.2			
	Silicon (Si)-Total (mg/L)	1.90	2.06			
	Silver (Ag)-Total (mg/L)	0.000013	<0.000010			
	Sodium (Na)-Total (mg/L)	1.70	1.79			
	Strontium (Sr)-Total (mg/L)	0.137	0.130			
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010			
	Uranium (U)-Total (mg/L)	0.00192	0.00197			
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030			
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD			
	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	<0.0030	<0.0030			
	Antimony (Sb)-Dissolved (mg/L)	0.00016	0.00017			
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00011			
	Barium (Ba)-Dissolved (mg/L)	0.0702	0.0781			
	Beryllium (Be)-Dissolved (ug/L)	<0.020	<0.020			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Dissolved (ug/L)	0.0296	0.0300			
	Calcium (Ca)-Dissolved (mg/L)	86.4	85.7			
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010			
	Cobalt (Co)-Dissolved (ug/L)	<0.10	<0.10			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2445542-1 WS 08-MAY-20 08:30 LC_FRUS_WS_2020-05-08_0830	L2445542-2 WS 08-MAY-20 12:30 LC_FRB_WS_2020-05-08_1230			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	0.00033	<0.00020			
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0177	0.0178			
	Magnesium (Mg)-Dissolved (mg/L)	34.8	34.1			
	Manganese (Mn)-Dissolved (mg/L)	0.00220	0.00208			
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00119	0.00129			
	Nickel (Ni)-Dissolved (mg/L)	0.00255	0.00249			
	Potassium (K)-Dissolved (mg/L)	1.21	1.26			
	Selenium (Se)-Dissolved (ug/L)	47.4	45.0			
	Silicon (Si)-Dissolved (mg/L)	1.81	1.76			
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010			
	Sodium (Na)-Dissolved (mg/L)	1.69	1.70			
	Strontium (Sr)-Dissolved (mg/L)	0.122	0.118			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.00197	0.00197			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0023	0.0017			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2445542-1, -2
Matrix Spike	Barium (Ba)-Total	MS-B	L2445542-1, -2
Matrix Spike	Barium (Ba)-Total	MS-B	L2445542-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L2445542-1, -2
Matrix Spike	Calcium (Ca)-Total	MS-B	L2445542-1
Matrix Spike	Lithium (Li)-Total	MS-B	L2445542-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2445542-1, -2
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2445542-1
Matrix Spike	Nickel (Ni)-Total	MS-B	L2445542-1
Matrix Spike	Potassium (K)-Total	MS-B	L2445542-1
Matrix Spike	Selenium (Se)-Total	MS-B	L2445542-1, -2
Matrix Spike	Selenium (Se)-Total	MS-B	L2445542-1
Matrix Spike	Sodium (Na)-Total	MS-B	L2445542-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L2445542-1, -2
Matrix Spike	Strontium (Sr)-Total	MS-B	L2445542-1
Matrix Spike	Uranium (U)-Total	MS-B	L2445542-1
Matrix Spike	Ammonia as N	MS-B	L2445542-1, -2
Matrix Spike	Nitrate (as N)	MS-B	L2445542-1, -2
Matrix Spike	Sulfate (SO4)	MS-B	L2445542-1, -2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
TKNI	TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ACIDITY-PCT-CL	Water	Acidity by Automatic Titration	APHA 2310 Acidity

This analysis is carried out using procedures adapted from APHA Method 2310 "Acidity". Acidity is determined by potentiometric titration to a specified endpoint.

ALK-MAN-CL	Water	Alkalinity (Species) by Manual Titration	APHA 2320 ALKALINITY

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". 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.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

BR-L-IC-N-CL	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Reference Information

C-DIS-ORG-LOW-CL Water Dissolved Organic Carbon APHA 5310 B-Instrumental

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

C-TOT-ORG-LOW-CL Water Total Organic Carbon APHA 5310 TOTAL ORGANIC CARBON (TOC)

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-IC-N-CL Water Chloride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-L-PCT-CL Water Electrical Conductivity (EC) APHA 2510B

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 25C.

F-IC-N-CL Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-U-CVAF-VA Water Total Mercury in Water by CVAFS (Ultra) EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-BC-CL Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-L-F-CL Water Ammonia, Total (as N) J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

Reference Information

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ORP-CL	Water	Oxidation redution potential by elect.	ASTM D1498

This analysis is carried out in accordance with the procedure described in the "ASTM" method D1498 "Oxidation-Reduction Potential of Water" published by the American Society for Testing and Materials (ASTM). Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

P-T-L-COL-CL	Water	Phosphorus (P)-Total	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-CL	Water	pH	APHA 4500 H-Electrode

pH is determined in the laboratory using a pH electrode. All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PO4-DO-L-COL-CL	Water	Orthophosphate-Dissolved (as P)	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-CL	Water	Total Dissolved Solids	APHA 2540 C

A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).

TECKCOAL-IONBAL-CL	Water	Ion Balance Calculation	APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

TKN-L-F-CL	Water	Total Kjeldahl Nitrogen	APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-L-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

TURBIDITY-CL	Water	Turbidity	APHA 2130 B-Nephelometer

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

Regional Effects

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2445542 Report Date: 19-MAY-20

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0
Contact: Cait Good

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ACIDITY-PCT-CL	**Water**							
Batch R5080766								
WG3320680-5 LCS								
Acidity (as CaCO3)			103.1		%		85-115	09-MAY-20
WG3320680-4 MB								
Acidity (as CaCO3)			1.5		mg/L		2	09-MAY-20
ALK-MAN-CL	**Water**							
Batch R5080856								
WG3320770-2 LCS								
Alkalinity, Total (as CaCO3)			100.8		%		85-115	10-MAY-20
WG3320770-1 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	10-MAY-20
BE-D-L-CCMS-VA	**Water**							
Batch R5083338								
WG3323584-2 LCS								
Beryllium (Be)-Dissolved			100.1		%		80-120	14-MAY-20
WG3323584-1 MB		**NP**						
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	14-MAY-20
BE-T-L-CCMS-VA	**Water**							
Batch R5086478								
WG3323266-2 LCS								
Beryllium (Be)-Total			95.3		%		80-120	14-MAY-20
WG3323266-1 MB								
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	14-MAY-20
WG3323266-4 MS		**L2445542-2**						
Beryllium (Be)-Total			91.6		%		70-130	14-MAY-20
Batch R5087656								
WG3323266-3 DUP		**L2445542-1**						
Beryllium (Be)-Total		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	15-MAY-20
BR-L-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-10 LCS								
Bromide (Br)			94.7		%		85-115	09-MAY-20
WG3320752-14 LCS								
Bromide (Br)			90.3		%		85-115	09-MAY-20
WG3320752-13 MB								
Bromide (Br)			<0.050		mg/L		0.05	09-MAY-20
WG3320752-9 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BR-L-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-9 MB								
Bromide (Br)			<0.050		mg/L		0.05	09-MAY-20
C-DIS-ORG-LOW-CL	**Water**							
Batch R5089656								
WG3324838-6 LCS								
Dissolved Organic Carbon			84.9		%		80-120	16-MAY-20
WG3324838-5 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	16-MAY-20
C-TOT-ORG-LOW-CL	**Water**							
Batch R5089656								
WG3324838-6 LCS								
Total Organic Carbon			93.2		%		80-120	16-MAY-20
WG3324838-5 MB								
Total Organic Carbon			<0.50		mg/L		0.5	16-MAY-20
CL-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-10 LCS								
Chloride (Cl)			100.7		%		90-110	09-MAY-20
WG3320752-14 LCS								
Chloride (Cl)			100.1		%		90-110	09-MAY-20
WG3320752-13 MB								
Chloride (Cl)			<0.50		mg/L		0.5	09-MAY-20
WG3320752-9 MB								
Chloride (Cl)			<0.50		mg/L		0.5	09-MAY-20
EC-L-PCT-CL	**Water**							
Batch R5080856								
WG3320770-2 LCS								
Conductivity (@ 25C)			97.4		%		90-110	10-MAY-20
WG3320770-1 MB								
Conductivity (@ 25C)			<2.0		uS/cm		2	10-MAY-20
F-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-10 LCS								
Fluoride (F)			107.1		%		90-110	09-MAY-20
WG3320752-14 LCS								
Fluoride (F)			107.2		%		90-110	09-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-13 MB								
Fluoride (F)			<0.020		mg/L		0.02	09-MAY-20
WG3320752-9 MB								
Fluoride (F)			<0.020		mg/L		0.02	09-MAY-20
HG-D-CVAA-VA	**Water**							
Batch R5085901								
WG3323804-2 LCS								
Mercury (Hg)-Dissolved			104.0		%		80-120	15-MAY-20
WG3323804-1 MB		**NP**						
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	15-MAY-20
HG-T-U-CVAF-VA	**Water**							
Batch R5088822								
WG3324697-3 DUP		**L2445542-2**						
Mercury (Hg)-Total		0.00085	0.00091		ug/L	6.4	20	16-MAY-20
WG3324697-2 LCS								
Mercury (Hg)-Total			107.4		%		80-120	16-MAY-20
WG3324697-1 MB								
Mercury (Hg)-Total			<0.00050		ug/L		0.0005	16-MAY-20
MET-D-CCMS-VA	**Water**							
Batch R5083338								
WG3323584-2 LCS								
Aluminum (Al)-Dissolved			103.1		%		80-120	14-MAY-20
Antimony (Sb)-Dissolved			101.7		%		80-120	14-MAY-20
Arsenic (As)-Dissolved			100.2		%		80-120	14-MAY-20
Barium (Ba)-Dissolved			98.1		%		80-120	14-MAY-20
Bismuth (Bi)-Dissolved			92.7		%		80-120	14-MAY-20
Boron (B)-Dissolved			93.9		%		80-120	14-MAY-20
Cadmium (Cd)-Dissolved			103.0		%		80-120	14-MAY-20
Calcium (Ca)-Dissolved			104.1		%		80-120	14-MAY-20
Chromium (Cr)-Dissolved			101.4		%		80-120	14-MAY-20
Cobalt (Co)-Dissolved			100.4		%		80-120	14-MAY-20
Copper (Cu)-Dissolved			101.4		%		80-120	14-MAY-20
Iron (Fe)-Dissolved			105.4		%		80-120	14-MAY-20
Lead (Pb)-Dissolved			102.1		%		80-120	14-MAY-20
Lithium (Li)-Dissolved			104.5		%		80-120	14-MAY-20
Magnesium (Mg)-Dissolved			102.8		%		80-120	14-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5083338								
WG3323584-2 LCS								
Manganese (Mn)-Dissolved			104.6		%		80-120	14-MAY-20
Molybdenum (Mo)-Dissolved			103.5		%		80-120	14-MAY-20
Nickel (Ni)-Dissolved			101.0		%		80-120	14-MAY-20
Potassium (K)-Dissolved			103.6		%		80-120	14-MAY-20
Selenium (Se)-Dissolved			105.3		%		80-120	14-MAY-20
Silicon (Si)-Dissolved			103.4		%		60-140	14-MAY-20
Silver (Ag)-Dissolved			102.6		%		80-120	14-MAY-20
Sodium (Na)-Dissolved			100.5		%		80-120	14-MAY-20
Strontium (Sr)-Dissolved			102.5		%		80-120	14-MAY-20
Thallium (Tl)-Dissolved			98.4		%		80-120	14-MAY-20
Tin (Sn)-Dissolved			104.0		%		80-120	14-MAY-20
Titanium (Ti)-Dissolved			103.5		%		80-120	14-MAY-20
Uranium (U)-Dissolved			106.7		%		80-120	14-MAY-20
Vanadium (V)-Dissolved			100.1		%		80-120	14-MAY-20
Zinc (Zn)-Dissolved			105.7		%		80-120	14-MAY-20
WG3323584-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	14-MAY-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	14-MAY-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	14-MAY-20
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	14-MAY-20
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	14-MAY-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	14-MAY-20
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	14-MAY-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	14-MAY-20
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	14-MAY-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	14-MAY-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	14-MAY-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	14-MAY-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	14-MAY-20
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	14-MAY-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	14-MAY-20
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	14-MAY-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	14-MAY-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	14-MAY-20

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5083338								
WG3323584-1 MB		**NP**						
Potassium (K)-Dissolved			<0.050		mg/L		0.05	14-MAY-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	14-MAY-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	14-MAY-20
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	14-MAY-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	14-MAY-20
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	14-MAY-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	14-MAY-20
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	14-MAY-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	14-MAY-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	14-MAY-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	14-MAY-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	14-MAY-20
MET-T-CCMS-VA	**Water**							
Batch R5086478								
WG3323266-2 LCS								
Aluminum (Al)-Total			98.5		%		80-120	14-MAY-20
Antimony (Sb)-Total			98.4		%		80-120	14-MAY-20
Arsenic (As)-Total			95.4		%		80-120	14-MAY-20
Barium (Ba)-Total			101.6		%		80-120	14-MAY-20
Bismuth (Bi)-Total			104.4		%		80-120	14-MAY-20
Boron (B)-Total			90.4		%		80-120	14-MAY-20
Cadmium (Cd)-Total			95.5		%		80-120	14-MAY-20
Calcium (Ca)-Total			102.0		%		80-120	14-MAY-20
Chromium (Cr)-Total			97.2		%		80-120	14-MAY-20
Cobalt (Co)-Total			96.8		%		80-120	14-MAY-20
Copper (Cu)-Total			96.0		%		80-120	14-MAY-20
Iron (Fe)-Total			96.6		%		80-120	14-MAY-20
Lead (Pb)-Total			103.3		%		80-120	14-MAY-20
Lithium (Li)-Total			105.4		%		80-120	14-MAY-20
Magnesium (Mg)-Total			96.8		%		80-120	14-MAY-20
Manganese (Mn)-Total			97.4		%		80-120	14-MAY-20
Molybdenum (Mo)-Total			95.0		%		80-120	14-MAY-20
Nickel (Ni)-Total			97.4		%		80-120	14-MAY-20
Potassium (K)-Total			98.9		%		80-120	14-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5086478								
WG3323266-2 LCS								
Selenium (Se)-Total			96.4		%		80-120	14-MAY-20
Silicon (Si)-Total			98.5		%		80-120	14-MAY-20
Silver (Ag)-Total			96.6		%		80-120	14-MAY-20
Sodium (Na)-Total			100.2		%		80-120	14-MAY-20
Strontium (Sr)-Total			101.5		%		80-120	14-MAY-20
Thallium (Tl)-Total			98.5		%		80-120	14-MAY-20
Tin (Sn)-Total			97.7		%		80-120	14-MAY-20
Titanium (Ti)-Total			93.8		%		80-120	14-MAY-20
Uranium (U)-Total			103.6		%		80-120	14-MAY-20
Vanadium (V)-Total			96.7		%		80-120	14-MAY-20
Zinc (Zn)-Total			95.7		%		80-120	14-MAY-20
WG3323266-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	14-MAY-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	14-MAY-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	14-MAY-20
Barium (Ba)-Total			<0.00010		mg/L		0.0001	14-MAY-20
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	14-MAY-20
Boron (B)-Total			<0.010		mg/L		0.01	14-MAY-20
Cadmium (Cd)-Total			<0.000005C		mg/L		0.000005	14-MAY-20
Calcium (Ca)-Total			<0.050		mg/L		0.05	14-MAY-20
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	14-MAY-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	14-MAY-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	14-MAY-20
Iron (Fe)-Total			<0.010		mg/L		0.01	14-MAY-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	14-MAY-20
Lithium (Li)-Total			<0.0010		mg/L		0.001	14-MAY-20
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	14-MAY-20
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	14-MAY-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	14-MAY-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	14-MAY-20
Potassium (K)-Total			<0.050		mg/L		0.05	14-MAY-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	14-MAY-20
Silicon (Si)-Total			<0.10		mg/L		0.1	14-MAY-20
Silver (Ag)-Total			<0.000010		mg/L		0.00001	14-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5086478								
WG3323266-1 MB								
Sodium (Na)-Total			<0.050		mg/L		0.05	14-MAY-20
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	14-MAY-20
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	14-MAY-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	14-MAY-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	14-MAY-20
Uranium (U)-Total			<0.000010		mg/L		0.00001	14-MAY-20
Vanadium (V)-Total			<0.00050		mg/L		0.0005	14-MAY-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	14-MAY-20
WG3323266-4 MS		**L2445542-2**						
Aluminum (Al)-Total			90.4		%		70-130	14-MAY-20
Antimony (Sb)-Total			94.7		%		70-130	14-MAY-20
Arsenic (As)-Total			96.3		%		70-130	14-MAY-20
Barium (Ba)-Total			N/A	MS-B	%		-	14-MAY-20
Bismuth (Bi)-Total			91.5		%		70-130	14-MAY-20
Boron (B)-Total			90.9		%		70-130	14-MAY-20
Cadmium (Cd)-Total			95.1		%		70-130	14-MAY-20
Calcium (Ca)-Total			N/A	MS-B	%		-	14-MAY-20
Chromium (Cr)-Total			95.9		%		70-130	14-MAY-20
Cobalt (Co)-Total			92.6		%		70-130	14-MAY-20
Copper (Cu)-Total			89.4		%		70-130	14-MAY-20
Iron (Fe)-Total			91.6		%		70-130	14-MAY-20
Lead (Pb)-Total			93.1		%		70-130	14-MAY-20
Lithium (Li)-Total			97.1		%		70-130	14-MAY-20
Magnesium (Mg)-Total			N/A	MS-B	%		-	14-MAY-20
Manganese (Mn)-Total			94.2		%		70-130	14-MAY-20
Molybdenum (Mo)-Total			96.2		%		70-130	14-MAY-20
Nickel (Ni)-Total			90.4		%		70-130	14-MAY-20
Potassium (K)-Total			93.1		%		70-130	14-MAY-20
Selenium (Se)-Total			N/A	MS-B	%		-	14-MAY-20
Silicon (Si)-Total			94.6		%		70-130	14-MAY-20
Silver (Ag)-Total			92.8		%		70-130	14-MAY-20
Sodium (Na)-Total			91.2		%		70-130	14-MAY-20
Strontium (Sr)-Total			N/A	MS-B	%		-	14-MAY-20
Thallium (Tl)-Total			91.3		%		70-130	14-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5086478								
WG3323266-4 MS		**L2445542-2**						
Tin (Sn)-Total			95.1		%		70-130	14-MAY-20
Titanium (Ti)-Total			94.2		%		70-130	14-MAY-20
Uranium (U)-Total			97.1		%		70-130	14-MAY-20
Vanadium (V)-Total			97.8		%		70-130	14-MAY-20
Zinc (Zn)-Total			89.4		%		70-130	14-MAY-20
Batch R5087656								
WG3323266-3 DUP		**L2445542-1**						
Aluminum (Al)-Total		0.0947	0.0913		mg/L	3.7	20	15-MAY-20
Antimony (Sb)-Total		0.00031	0.00016	J	mg/L	0.00014	0.0002	15-MAY-20
Arsenic (As)-Total		0.00024	0.00012	J	mg/L	0.00012	0.0002	15-MAY-20
Barium (Ba)-Total		0.0756	0.0735		mg/L	2.8	20	15-MAY-20
Boron (B)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	15-MAY-20
Calcium (Ca)-Total		92.3	89.0		mg/L	3.6	20	15-MAY-20
Chromium (Cr)-Total		0.00021	0.00017	J	mg/L	0.00004	0.0002	15-MAY-20
Cobalt (Co)-Total		0.00014	0.00010	J	mg/L	0.00004	0.0002	15-MAY-20
Copper (Cu)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	15-MAY-20
Iron (Fe)-Total		0.068	0.065		mg/L	4.9	20	15-MAY-20
Lithium (Li)-Total		0.0184	0.0179		mg/L	2.9	20	15-MAY-20
Magnesium (Mg)-Total		35.9	35.7		mg/L	0.5	20	15-MAY-20
Manganese (Mn)-Total		0.00485	0.00435		mg/L	11	20	15-MAY-20
Molybdenum (Mo)-Total		0.00133	0.00122		mg/L	9.0	20	15-MAY-20
Nickel (Ni)-Total		0.00269	0.00246		mg/L	8.9	20	15-MAY-20
Potassium (K)-Total		1.25	1.20		mg/L	4.4	20	15-MAY-20
Selenium (Se)-Total		0.0435	0.0417		mg/L	4.2	20	15-MAY-20
Silicon (Si)-Total		1.90	1.83		mg/L	3.7	20	15-MAY-20
Silver (Ag)-Total		0.000013	<0.000010	RPD-NA	mg/L	N/A	20	15-MAY-20
Sodium (Na)-Total		1.70	1.64		mg/L	3.9	20	15-MAY-20
Strontium (Sr)-Total		0.137	0.137		mg/L	0.3	20	15-MAY-20
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	15-MAY-20
Titanium (Ti)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	15-MAY-20
Uranium (U)-Total		0.00192	0.00184		mg/L	4.3	20	15-MAY-20
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	15-MAY-20
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	15-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5088783								
WG3324547-7 DUP		**L2445542-1**						
Aluminum (Al)-Total		0.0947	0.108		mg/L	3.3	20	16-MAY-20
Antimony (Sb)-Total		0.00031	0.00013		mg/L	15	20	16-MAY-20
Arsenic (As)-Total		0.00024	0.00015		mg/L	4.7	20	16-MAY-20
Barium (Ba)-Total		0.0756	0.0701		mg/L	0.0	20	16-MAY-20
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	16-MAY-20
Boron (B)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	16-MAY-20
Cadmium (Cd)-Total		0.0000390	0.0000358		mg/L	8.6	20	16-MAY-20
Calcium (Ca)-Total		92.3	72.5		mg/L	11	20	16-MAY-20
Cobalt (Co)-Total		0.00014	0.00011		mg/L	0.5	20	16-MAY-20
Copper (Cu)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	16-MAY-20
Iron (Fe)-Total		0.068	0.067		mg/L	16	20	16-MAY-20
Lead (Pb)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	16-MAY-20
Lithium (Li)-Total		0.0184	0.0157		mg/L	10	20	16-MAY-20
Magnesium (Mg)-Total		35.9	32.5		mg/L	4.0	20	16-MAY-20
Manganese (Mn)-Total		0.00485	0.00480		mg/L	2.8	20	16-MAY-20
Molybdenum (Mo)-Total		0.00133	0.000987		mg/L	12	20	16-MAY-20
Nickel (Ni)-Total		0.00269	0.00250		mg/L	1.3	20	16-MAY-20
Potassium (K)-Total		1.25	1.21		mg/L	0.7	20	16-MAY-20
Selenium (Se)-Total		0.0435	0.0332		mg/L	19	20	16-MAY-20
Silicon (Si)-Total		1.90	1.57		mg/L	15	20	16-MAY-20
Silver (Ag)-Total		0.000013	<0.000010	RPD-NA	mg/L	N/A	20	16-MAY-20
Sodium (Na)-Total		1.70	1.68		mg/L	2.1	20	16-MAY-20
Strontium (Sr)-Total		0.137	0.102		mg/L	14	20	16-MAY-20
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	16-MAY-20
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	16-MAY-20
Titanium (Ti)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	16-MAY-20
Uranium (U)-Total		0.00192	0.00176		mg/L	11	20	16-MAY-20
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	16-MAY-20
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	16-MAY-20
WG3324547-2 LCS								
Aluminum (Al)-Total			101.2		%		80-120	16-MAY-20
Antimony (Sb)-Total			107.3		%		80-120	16-MAY-20
Arsenic (As)-Total			96.3		%		80-120	16-MAY-20
Barium (Ba)-Total			96.8		%		80-120	16-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5088783								
WG3324547-2 LCS								
Bismuth (Bi)-Total			104.5		%		80-120	16-MAY-20
Boron (B)-Total			87.1		%		80-120	16-MAY-20
Cadmium (Cd)-Total			99.5		%		80-120	16-MAY-20
Calcium (Ca)-Total			99.4		%		80-120	16-MAY-20
Chromium (Cr)-Total			100.4		%		80-120	16-MAY-20
Cobalt (Co)-Total			98.7		%		80-120	16-MAY-20
Copper (Cu)-Total			99.2		%		80-120	16-MAY-20
Iron (Fe)-Total			96.0		%		80-120	16-MAY-20
Lead (Pb)-Total			104.8		%		80-120	16-MAY-20
Lithium (Li)-Total			99.7		%		80-120	16-MAY-20
Magnesium (Mg)-Total			110.1		%		80-120	16-MAY-20
Manganese (Mn)-Total			106.0		%		80-120	16-MAY-20
Molybdenum (Mo)-Total			97.0		%		80-120	16-MAY-20
Nickel (Ni)-Total			99.4		%		80-120	16-MAY-20
Potassium (K)-Total			106.0		%		80-120	16-MAY-20
Selenium (Se)-Total			99.4		%		80-120	16-MAY-20
Silicon (Si)-Total			94.8		%		80-120	16-MAY-20
Silver (Ag)-Total			93.8		%		80-120	16-MAY-20
Sodium (Na)-Total			109.7		%		80-120	16-MAY-20
Strontium (Sr)-Total			95.2		%		80-120	16-MAY-20
Thallium (Tl)-Total			108.2		%		80-120	16-MAY-20
Tin (Sn)-Total			95.7		%		80-120	16-MAY-20
Titanium (Ti)-Total			97.8		%		80-120	16-MAY-20
Uranium (U)-Total			106.9		%		80-120	16-MAY-20
Vanadium (V)-Total			101.1		%		80-120	16-MAY-20
Zinc (Zn)-Total			103.8		%		80-120	16-MAY-20
WG3324547-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	16-MAY-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	16-MAY-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	16-MAY-20
Barium (Ba)-Total			<0.00010		mg/L		0.0001	16-MAY-20
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	16-MAY-20
Boron (B)-Total			<0.010		mg/L		0.01	16-MAY-20
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	16-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5088783								
WG3324547-1 MB								
Calcium (Ca)-Total			<0.050		mg/L		0.05	16-MAY-20
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	16-MAY-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	16-MAY-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	16-MAY-20
Iron (Fe)-Total			<0.010		mg/L		0.01	16-MAY-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	16-MAY-20
Lithium (Li)-Total			<0.0010		mg/L		0.001	16-MAY-20
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	16-MAY-20
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	16-MAY-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	16-MAY-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	16-MAY-20
Potassium (K)-Total			<0.050		mg/L		0.05	16-MAY-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	16-MAY-20
Silicon (Si)-Total			<0.10		mg/L		0.1	16-MAY-20
Silver (Ag)-Total			<0.000010		mg/L		0.00001	16-MAY-20
Sodium (Na)-Total			<0.050		mg/L		0.05	16-MAY-20
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	16-MAY-20
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	16-MAY-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	16-MAY-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	16-MAY-20
Uranium (U)-Total			<0.000010		mg/L		0.00001	16-MAY-20
Vanadium (V)-Total			<0.00050		mg/L		0.0005	16-MAY-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	16-MAY-20
NH3-L-F-CL	**Water**							
Batch R5087338								
WG3324246-11 DUP		**L2445542-2**						
Ammonia as N		0.0153	0.0157		mg/L	2.6	20	15-MAY-20
WG3324246-10 LCS								
Ammonia as N			105.9		%		85-115	15-MAY-20
WG3324246-6 LCS								
Ammonia as N			106.2		%		85-115	15-MAY-20
WG3324246-5 MB								
Ammonia as N			<0.0050		mg/L		0.005	15-MAY-20
WG3324246-9 MB								
Ammonia as N			<0.0050		mg/L		0.005	15-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-L-F-CL	**Water**							
Batch R5087338								
WG3324246-12 MS		**L2445542-2**						
Ammonia as N			111.6		%		75-125	15-MAY-20
NO2-L-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-10 LCS								
Nitrite (as N)			96.7		%		90-110	09-MAY-20
WG3320752-14 LCS								
Nitrite (as N)			96.4		%		90-110	09-MAY-20
WG3320752-13 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	09-MAY-20
WG3320752-9 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	09-MAY-20
NO3-L-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-10 LCS								
Nitrate (as N)			102.7		%		90-110	09-MAY-20
WG3320752-14 LCS								
Nitrate (as N)			102.2		%		90-110	09-MAY-20
WG3320752-13 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	09-MAY-20
WG3320752-9 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	09-MAY-20
ORP-CL	**Water**							
Batch R5089041								
WG3324771-3 CRM		**CL-ORP**						
ORP			225		mV		210-230	16-MAY-20
WG3324771-4 DUP		**L2445542-1**						
ORP		357	356	J	mV	1.6	15	16-MAY-20
P-T-L-COL-CL	**Water**							
Batch R5082438								
WG3322703-14 LCS								
Phosphorus (P)-Total			108.6		%		80-120	13-MAY-20
WG3322703-13 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	13-MAY-20
PH-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-CL	**Water**							
Batch R5080856								
WG3320770-2 LCS								
pH			6.96		pH		6.9-7.1	10-MAY-20
PO4-DO-L-COL-CL	**Water**							
Batch R5080719								
WG3320591-3 DUP		**L2445542-2**						
Orthophosphate-Dissolved (as P)		0.0012	0.0016	J	mg/L	0.0004	0.002	09-MAY-20
WG3320591-2 LCS								
Orthophosphate-Dissolved (as P)			103.7		%		80-120	09-MAY-20
WG3320591-1 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	09-MAY-20
WG3320591-4 MS		**L2445542-1**						
Orthophosphate-Dissolved (as P)			108.1		%		70-130	09-MAY-20
SO4-IC-N-CL	**Water**							
Batch R5080854								
WG3320752-10 LCS								
Sulfate (SO4)			105.1		%		90-110	09-MAY-20
WG3320752-14 LCS								
Sulfate (SO4)			104.9		%		90-110	09-MAY-20
WG3320752-13 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	09-MAY-20
WG3320752-9 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	09-MAY-20
SOLIDS-TDS-CL	**Water**							
Batch R5087837								
WG3323488-5 LCS								
Total Dissolved Solids			104.7		%		85-115	14-MAY-20
WG3323488-4 MB								
Total Dissolved Solids			<10		mg/L		10	14-MAY-20
TKN-L-F-CL	**Water**							
Batch R5087496								
WG3324249-10 LCS								
Total Kjeldahl Nitrogen			88.5		%		75-125	14-MAY-20
WG3324249-2 LCS								
Total Kjeldahl Nitrogen			89.0		%		75-125	14-MAY-20
WG3324249-6 LCS								
Total Kjeldahl Nitrogen			90.0		%		75-125	14-MAY-20
WG3324249-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-L-F-CL	**Water**							
Batch R5087496								
WG3324249-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	14-MAY-20
WG3324249-5 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	14-MAY-20
WG3324249-9 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	14-MAY-20
TSS-L-CL	**Water**							
Batch R5084916								
WG3322385-6 LCS								
Total Suspended Solids			97.4		%		85-115	13-MAY-20
WG3322385-5 MB								
Total Suspended Solids			<1.0		mg/L		1	13-MAY-20
TURBIDITY-CL	**Water**							
Batch R5081315								
WG3320773-2 LCS								
Turbidity			104.5		%		85-115	10-MAY-20
WG3320773-1 MB								
Turbidity			<0.10		NTU		0.1	10-MAY-20

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Oxidation redution potential by elect.							
	1	08-MAY-20 08:30	16-MAY-20 14:00	0.25	198	hours	EHTR-FM
	2	08-MAY-20 12:30	16-MAY-20 14:00	0.25	193	hours	EHTR-FM
pH							
	1	08-MAY-20 08:30	10-MAY-20 10:00	0.25	49	hours	EHTR-FM
	2	08-MAY-20 12:30	10-MAY-20 10:00	0.25	46	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2445542 were received on 09-MAY-20 08:15.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

Page 1 of

COC ID:	Regional Effects Program	TURNAROUND TIME:	Regular

PROJECT/CLIENT INFO

Facility Name / Job#	Dry Creek May 2020 (207202.0024)
Project Manager	Cait Good
Email	cait.good@teck.com
Address	421 Pine Avenue
City	Sparwood — Province: BC
Postal Code	V0B 2G0 — Country: Canada
Phone Number	250-425-8202

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyuda Shvets
Email	Lyudmyla.Shvets@ALSGlobal.com
Address	2559 29 Street NE
City	Calgary — Province: AB
Postal Code	T1Y 7B5 — Country: Canada
Phone Number	403-407-1800

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	cait.good@teck.com	X	X	X
Email 2:	carlie.meyer@teck.com	X	X	X
Email 3:	[redacted]	X	X	X
Email 4:	teckcoal@equisonline.com			X
Email 5:	dhasek@minnow.ca	X	X	X
PO number	692629			

L2445542-COFC

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	HG-T-U-CVAF-VA (N, NONE)	ALS_Package-DOC (F, NONE)	ALS_Package-TKN/TOC (N, H2SO4)	HG-D-CVAF-VA (F, NONE)	TECKCOAL-MET-D-VA (F, NONE)	TECKCOAL-MET-T-VA (N, HNO3)	TECKCOAL-ROUTINE-VA (N, NONE)
LC_FRUS_WS_2020-05-08_0830	LC_FRUS	WS	No	8-May-20	8:30:00	G	7	1	1	1	1	1	1	1
LC_FRB_WS_2020-05-08_1230	LC_FRB	WS	No	8-May-20	12:30:00	G	7	1	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
VPO00692629			AK	5/9 0815

SERVICE REQUEST (rush - subject to availability)				
Regular (default) X	Sampler's Name	Maddy Stokes	Mobile #	647-522-0672
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	MS	Date/Time	May 8, 2020
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

2.2

Teck Coal Ltd.
ATTN: Cait Good
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 12-MAY-20
Report Date: 20-MAY-20 14:56 (MT)
Version: FINAL

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2446425
Project P.O. #: VPO00692629
Job Reference: LINE CREEK OPERATIONS
C of C Numbers: Regional Effects Pro
Legal Site Desc:

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L2446425-1				
	Sample ID	L2446425-1				
	Description	WS				
	Sampled Date	11-MAY-20				
	Sampled Time	09:30				
	Client ID	LC_GRCK_WS_2020-05-11_0930				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (@ 25C) (uS/cm)	347				
	Hardness (as CaCO3) (mg/L)	199				
	pH (pH)	7.61				
	ORP (mV)	367				
	Total Suspended Solids (mg/L)	2.2				
	Total Dissolved Solids (mg/L)	193 DLHC				
	Turbidity (NTU)	0.85				
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	158				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Total (as CaCO3) (mg/L)	158				
	Ammonia as N (mg/L)	0.0309				
	Bromide (Br) (mg/L)	<0.050				
	Chloride (Cl) (mg/L)	<0.50				
	Fluoride (F) (mg/L)	0.125				
	Ion Balance (%)	102				
	Nitrate (as N) (mg/L)	0.0328				
	Nitrite (as N) (mg/L)	<0.0010				
	Total Kjeldahl Nitrogen (mg/L)	<0.050				
	Orthophosphate-Dissolved (as P) (mg/L)	0.0026				
	Phosphorus (P)-Total (mg/L)	0.0040				
	Sulfate (SO4) (mg/L)	40.9				
	Anion Sum (meq/L)	4.02				
	Cation Sum (meq/L)	4.11				
	Cation - Anion Balance (%)	1.1				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	0.88				
	Total Organic Carbon (mg/L)	0.96				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0371				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00013				
	Barium (Ba)-Total (mg/L)	0.0585				
	Beryllium (Be)-Total (ug/L)	<0.020				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	0.014				
	Cadmium (Cd)-Total (ug/L)	0.0071				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2446425-1				
		Description	WS				
		Sampled Date	11-MAY-20				
		Sampled Time	09:30				
		Client ID	LC_GRCK_WS_2020-05-11_0930				
Grouping	**Analyte**						
WATER							
Total Metals	Calcium (Ca)-Total (mg/L)		48.2				
	Chromium (Cr)-Total (mg/L)		0.00017				
	Cobalt (Co)-Total (ug/L)		<0.10				
	Copper (Cu)-Total (mg/L)		<0.00050				
	Iron (Fe)-Total (mg/L)		0.054				
	Lead (Pb)-Total (mg/L)		<0.000050				
	Lithium (Li)-Total (mg/L)		0.0061				
	Magnesium (Mg)-Total (mg/L)		15.5				
	Manganese (Mn)-Total (mg/L)		0.00423				
	Mercury (Hg)-Total (ug/L)		0.00074				
	Molybdenum (Mo)-Total (mg/L)		0.00128				
	Nickel (Ni)-Total (mg/L)		<0.00050				
	Potassium (K)-Total (mg/L)		0.635				
	Selenium (Se)-Total (ug/L)		1.75				
	Silicon (Si)-Total (mg/L)		2.79				
	Silver (Ag)-Total (mg/L)		<0.000010				
	Sodium (Na)-Total (mg/L)		2.71				
	Strontium (Sr)-Total (mg/L)		0.188				
	Thallium (Tl)-Total (mg/L)		<0.000010				
	Tin (Sn)-Total (mg/L)		<0.00010				
	Titanium (Ti)-Total (mg/L)		<0.010				
	Uranium (U)-Total (mg/L)		0.000900				
	Vanadium (V)-Total (mg/L)		<0.00050				
	Zinc (Zn)-Total (mg/L)		<0.0030				
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD				
	Dissolved Metals Filtration Location		FIELD				
	Aluminum (Al)-Dissolved (mg/L)		<0.0030				
	Antimony (Sb)-Dissolved (mg/L)		<0.00010				
	Arsenic (As)-Dissolved (mg/L)		<0.00010				
	Barium (Ba)-Dissolved (mg/L)		0.0576				
	Beryllium (Be)-Dissolved (ug/L)		<0.020				
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050				
	Boron (B)-Dissolved (mg/L)		0.014				
	Cadmium (Cd)-Dissolved (ug/L)		0.0062				
	Calcium (Ca)-Dissolved (mg/L)		50.6				
	Chromium (Cr)-Dissolved (mg/L)		0.00013				
	Cobalt (Co)-Dissolved (ug/L)		<0.10				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2446425-1 WS 11-MAY-20 09:30 LC_GRCK_WS_2020-05-11_0930				
Grouping	**Analyte**						
WATER							
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)		<0.00020				
	Iron (Fe)-Dissolved (mg/L)		<0.010				
	Lead (Pb)-Dissolved (mg/L)		<0.000050				
	Lithium (Li)-Dissolved (mg/L)		0.0062				
	Magnesium (Mg)-Dissolved (mg/L)		17.7				
	Manganese (Mn)-Dissolved (mg/L)		0.00028				
	Mercury (Hg)-Dissolved (mg/L)		<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)		0.00125				
	Nickel (Ni)-Dissolved (mg/L)		<0.00050				
	Potassium (K)-Dissolved (mg/L)		0.637				
	Selenium (Se)-Dissolved (ug/L)		1.77				
	Silicon (Si)-Dissolved (mg/L)		2.60				
	Silver (Ag)-Dissolved (mg/L)		<0.000010				
	Sodium (Na)-Dissolved (mg/L)		2.64				
	Strontium (Sr)-Dissolved (mg/L)		0.184				
	Thallium (Tl)-Dissolved (mg/L)		<0.000010				
	Tin (Sn)-Dissolved (mg/L)		<0.00010				
	Titanium (Ti)-Dissolved (mg/L)		<0.010				
	Uranium (U)-Dissolved (mg/L)		0.000878				
	Vanadium (V)-Dissolved (mg/L)		<0.00050				
	Zinc (Zn)-Dissolved (mg/L)		<0.0010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ACIDITY-PCT-CL	Water	Acidity by Automatic Titration	APHA 2310 Acidity

This analysis is carried out using procedures adapted from APHA Method 2310 "Acidity". Acidity is determined by potentiometric titration to a specified endpoint.

ALK-MAN-CL	Water	Alkalinity (Species) by Manual Titration	APHA 2320 ALKALINITY

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". 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.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

BR-L-IC-N-CL	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

C-DIS-ORG-LOW-CL	Water	Dissolved Organic Carbon	APHA 5310 B-Instrumental

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

C-TOT-ORG-LOW-CL	Water	Total Organic Carbon	APHA 5310 TOTAL ORGANIC CARBON (TOC)

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-L-PCT-CL	Water	Electrical Conductivity (EC)	APHA 2510B

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 25C.

F-IC-N-CL	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction

Reference Information

with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-BC-CL	Water	Ion Balance Calculation	APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-L-F-CL	Water	Ammonia, Total (as N)	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ORP-CL	Water	Oxidation redution potential by elect.	ASTM D1498

This analysis is carried out in accordance with the procedure described in the "ASTM" method D1498 "Oxidation-Reduction Potential of Water" published by the American Society for Testing and Materials (ASTM). Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

P-T-L-COL-CL	Water	Phosphorus (P)-Total	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-CL	Water	pH	APHA 4500 H-Electrode

pH is determined in the laboratory using a pH electrode. All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PO4-DO-L-COL-CL	Water	Orthophosphate-Dissolved (as P)	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-CL	Water	Total Dissolved Solids	APHA 2540 C

A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).

TECKCOAL-IONBAL-CL	Water	Ion Balance Calculation	APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Reference Information

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

TKN-L-F-CL	Water	Total Kjeldahl Nitrogen	APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-L-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

TURBIDITY-CL	Water	Turbidity	APHA 2130 B-Nephelometer

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Regional Effects Pro

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0
Contact: Cait Good

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ACIDITY-PCT-CL	**Water**							
Batch R5083036								
WG3323148-8 LCS								
Acidity (as CaCO3)			93.2		%		85-115	13-MAY-20
WG3323148-7 MB								
Acidity (as CaCO3)			1.5		mg/L		2	13-MAY-20
ALK-MAN-CL	**Water**							
Batch R5083297								
WG3323209-14 LCS								
Alkalinity, Total (as CaCO3)			101.9		%		85-115	13-MAY-20
WG3323209-13 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	14-MAY-20
BE-D-L-CCMS-VA	**Water**							
Batch R5084472								
WG3323479-2 LCS								
Beryllium (Be)-Dissolved			96.4		%		80-120	15-MAY-20
WG3323479-1 MB		**NP**						
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	15-MAY-20
BE-T-L-CCMS-VA	**Water**							
Batch R5084472								
WG3323262-2 LCS								
Beryllium (Be)-Total			97.5		%		80-120	15-MAY-20
WG3323262-1 MB								
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	15-MAY-20
BR-L-IC-N-CL	**Water**							
Batch R5083997								
WG3323374-6 LCS								
Bromide (Br)			100.7		%		85-115	13-MAY-20
WG3323374-5 MB								
Bromide (Br)			<0.050		mg/L		0.05	13-MAY-20
C-DIS-ORG-LOW-CL	**Water**							
Batch R5092369								
WG3325047-10 LCS								
Dissolved Organic Carbon			93.3		%		80-120	19-MAY-20
C-TOT-ORG-LOW-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TOT-ORG-LOW-CL	**Water**							
Batch R5092369								
WG3325047-10 LCS								
Total Organic Carbon			94.2		%		80-120	19-MAY-20
CL-IC-N-CL	**Water**							
Batch R5083997								
WG3323374-6 LCS								
Chloride (Cl)			102.7		%		90-110	13-MAY-20
WG3323374-5 MB								
Chloride (Cl)			<0.50		mg/L		0.5	13-MAY-20
EC-L-PCT-CL	**Water**							
Batch R5083297								
WG3323209-14 LCS								
Conductivity (@ 25C)			101.7		%		90-110	13-MAY-20
WG3323209-13 MB								
Conductivity (@ 25C)			<2.0		uS/cm		2	13-MAY-20
F-IC-N-CL	**Water**							
Batch R5083997								
WG3323374-6 LCS								
Fluoride (F)			105.5		%		90-110	13-MAY-20
WG3323374-5 MB								
Fluoride (F)			<0.020		mg/L		0.02	13-MAY-20
HG-D-CVAA-VA	**Water**							
Batch R5085901								
WG3323804-6 LCS								
Mercury (Hg)-Dissolved			103.5		%		80-120	15-MAY-20
WG3323804-5 MB		**NP**						
Mercury (Hg)-Dissolved			<0.000005C		mg/L		0.000005	15-MAY-20
HG-T-U-CVAF-VA	**Water**							
Batch R5088822								
WG3324697-2 LCS								
Mercury (Hg)-Total			107.4		%		80-120	16-MAY-20
WG3324697-1 MB								
Mercury (Hg)-Total			<0.00050		ug/L		0.0005	16-MAY-20
MET-D-CCMS-VA	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5084472								
WG3323479-2 LCS								
Aluminum (Al)-Dissolved			98.7		%		80-120	15-MAY-20
Antimony (Sb)-Dissolved			106.8		%		80-120	15-MAY-20
Arsenic (As)-Dissolved			97.9		%		80-120	15-MAY-20
Barium (Ba)-Dissolved			94.9		%		80-120	15-MAY-20
Bismuth (Bi)-Dissolved			99.1		%		80-120	15-MAY-20
Boron (B)-Dissolved			89.5		%		80-120	15-MAY-20
Cadmium (Cd)-Dissolved			97.7		%		80-120	15-MAY-20
Calcium (Ca)-Dissolved			101.1		%		80-120	15-MAY-20
Chromium (Cr)-Dissolved			98.4		%		80-120	15-MAY-20
Cobalt (Co)-Dissolved			97.1		%		80-120	15-MAY-20
Copper (Cu)-Dissolved			95.8		%		80-120	15-MAY-20
Iron (Fe)-Dissolved			94.2		%		80-120	15-MAY-20
Lead (Pb)-Dissolved			94.0		%		80-120	15-MAY-20
Lithium (Li)-Dissolved			96.4		%		80-120	15-MAY-20
Magnesium (Mg)-Dissolved			94.4		%		80-120	15-MAY-20
Manganese (Mn)-Dissolved			97.6		%		80-120	15-MAY-20
Molybdenum (Mo)-Dissolved			101.0		%		80-120	15-MAY-20
Nickel (Ni)-Dissolved			98.5		%		80-120	15-MAY-20
Potassium (K)-Dissolved			98.1		%		80-120	15-MAY-20
Selenium (Se)-Dissolved			103.7		%		80-120	15-MAY-20
Silicon (Si)-Dissolved			101.9		%		60-140	15-MAY-20
Silver (Ag)-Dissolved			98.7		%		80-120	15-MAY-20
Sodium (Na)-Dissolved			102.9		%		80-120	15-MAY-20
Strontium (Sr)-Dissolved			110.8		%		80-120	15-MAY-20
Thallium (Tl)-Dissolved			101.4		%		80-120	15-MAY-20
Tin (Sn)-Dissolved			98.7		%		80-120	15-MAY-20
Titanium (Ti)-Dissolved			96.3		%		80-120	15-MAY-20
Uranium (U)-Dissolved			93.3		%		80-120	15-MAY-20
Vanadium (V)-Dissolved			97.4		%		80-120	15-MAY-20
Zinc (Zn)-Dissolved			97.1		%		80-120	15-MAY-20
WG3323479-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	15-MAY-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	15-MAY-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	15-MAY-20

ALS Environmental

Quality Control Report

Workorder: L2446425 Report Date: 20-MAY-20

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5084472								
WG3323479-1 MB		**NP**						
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	15-MAY-20
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	15-MAY-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	15-MAY-20
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	15-MAY-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	15-MAY-20
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	15-MAY-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	15-MAY-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	15-MAY-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	15-MAY-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	15-MAY-20
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	15-MAY-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	15-MAY-20
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	15-MAY-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	15-MAY-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	15-MAY-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	15-MAY-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	15-MAY-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	15-MAY-20
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	15-MAY-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	15-MAY-20
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	15-MAY-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	15-MAY-20
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	15-MAY-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	15-MAY-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	15-MAY-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	15-MAY-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	15-MAY-20
MET-T-CCMS-VA	**Water**							
Batch R5084472								
WG3323262-2 LCS								
Aluminum (Al)-Total			98.0		%		80-120	15-MAY-20
Antimony (Sb)-Total			109.5		%		80-120	15-MAY-20
Arsenic (As)-Total			95.2		%		80-120	15-MAY-20
Barium (Ba)-Total			96.0		%		80-120	15-MAY-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5084472								
WG3323262-2 LCS								
Bismuth (Bi)-Total			104.0		%		80-120	15-MAY-20
Boron (B)-Total			91.5		%		80-120	15-MAY-20
Cadmium (Cd)-Total			96.4		%		80-120	15-MAY-20
Calcium (Ca)-Total			101.9		%		80-120	15-MAY-20
Chromium (Cr)-Total			97.3		%		80-120	15-MAY-20
Cobalt (Co)-Total			95.3		%		80-120	15-MAY-20
Copper (Cu)-Total			94.0		%		80-120	15-MAY-20
Iron (Fe)-Total			92.0		%		80-120	15-MAY-20
Lead (Pb)-Total			98.5		%		80-120	15-MAY-20
Lithium (Li)-Total			97.9		%		80-120	15-MAY-20
Magnesium (Mg)-Total			85.4		%		80-120	15-MAY-20
Manganese (Mn)-Total			97.4		%		80-120	15-MAY-20
Molybdenum (Mo)-Total			102.8		%		80-120	15-MAY-20
Nickel (Ni)-Total			97.5		%		80-120	15-MAY-20
Potassium (K)-Total			97.3		%		80-120	15-MAY-20
Selenium (Se)-Total			99.1		%		80-120	15-MAY-20
Silicon (Si)-Total			104.3		%		80-120	15-MAY-20
Silver (Ag)-Total			100.6		%		80-120	15-MAY-20
Sodium (Na)-Total			103.8		%		80-120	15-MAY-20
Strontium (Sr)-Total			110.5		%		80-120	15-MAY-20
Thallium (Tl)-Total			102.9		%		80-120	15-MAY-20
Tin (Sn)-Total			100.7		%		80-120	15-MAY-20
Titanium (Ti)-Total			93.2		%		80-120	15-MAY-20
Uranium (U)-Total			97.8		%		80-120	15-MAY-20
Vanadium (V)-Total			95.9		%		80-120	15-MAY-20
Zinc (Zn)-Total			94.9		%		80-120	15-MAY-20
WG3323262-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	15-MAY-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	15-MAY-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	15-MAY-20
Barium (Ba)-Total			<0.00010		mg/L		0.0001	15-MAY-20
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	15-MAY-20
Boron (B)-Total			<0.010		mg/L		0.01	15-MAY-20
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	15-MAY-20

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5084472								
WG3323262-1 MB								
Calcium (Ca)-Total			<0.050		mg/L		0.05	15-MAY-20
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	15-MAY-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	15-MAY-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	15-MAY-20
Iron (Fe)-Total			<0.010		mg/L		0.01	15-MAY-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	15-MAY-20
Lithium (Li)-Total			<0.0010		mg/L		0.001	15-MAY-20
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	15-MAY-20
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	15-MAY-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	15-MAY-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	15-MAY-20
Potassium (K)-Total			<0.050		mg/L		0.05	15-MAY-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	15-MAY-20
Silicon (Si)-Total			<0.10		mg/L		0.1	15-MAY-20
Silver (Ag)-Total			<0.000010		mg/L		0.00001	15-MAY-20
Sodium (Na)-Total			<0.050		mg/L		0.05	15-MAY-20
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	15-MAY-20
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	15-MAY-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	15-MAY-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	15-MAY-20
Uranium (U)-Total			<0.000010		mg/L		0.00001	15-MAY-20
Vanadium (V)-Total			<0.00050		mg/L		0.0005	15-MAY-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	15-MAY-20
NH3-L-F-CL	**Water**							
Batch R5091837								
WG3325366-6 LCS								
Ammonia as N			101.3		%		85-115	19-MAY-20
WG3325366-5 MB								
Ammonia as N			<0.0050		mg/L		0.005	19-MAY-20
NO2-L-IC-N-CL	**Water**							
Batch R5083997								
WG3323374-6 LCS								
Nitrite (as N)			104.9		%		90-110	13-MAY-20
WG3323374-5 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	13-MAY-20

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-L-IC-N-CL	**Water**							
Batch R5083997								
WG3323374-6 LCS								
Nitrate (as N)			103.5		%		90-110	13-MAY-20
WG3323374-5 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	13-MAY-20
ORP-CL	**Water**							
Batch R5092422								
WG3325615-5 CRM		**CL-ORP**						
ORP			224		mV		210-230	19-MAY-20
P-T-L-COL-CL	**Water**							
Batch R5082438								
WG3322703-30 LCS								
Phosphorus (P)-Total			109.7		%		80-120	13-MAY-20
WG3322703-29 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	13-MAY-20
PH-CL	**Water**							
Batch R5083297								
WG3323209-14 LCS								
pH			6.99		pH		6.9-7.1	13-MAY-20
PO4-DO-L-COL-CL	**Water**							
Batch R5082066								
WG3322055-10 LCS								
Orthophosphate-Dissolved (as P)			108.7		%		80-120	12-MAY-20
WG3322055-9 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	12-MAY-20
SO4-IC-N-CL	**Water**							
Batch R5083997								
WG3323374-6 LCS								
Sulfate (SO4)			104.9		%		90-110	13-MAY-20
WG3323374-5 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	13-MAY-20
SOLIDS-TDS-CL	**Water**							
Batch R5087837								
WG3323488-14 LCS								
Total Dissolved Solids			100.1		%		85-115	14-MAY-20
WG3323488-13 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TDS-CL	**Water**							
Batch R5087837								
WG3323488-13 MB								
Total Dissolved Solids			<10		mg/L		10	14-MAY-20
TKN-L-F-CL	**Water**							
Batch R5087923								
WG3324412-10 LCS								
Total Kjeldahl Nitrogen			91.0		%		75-125	15-MAY-20
WG3324412-14 LCS								
Total Kjeldahl Nitrogen			93.9		%		75-125	15-MAY-20
WG3324412-18 LCS								
Total Kjeldahl Nitrogen			92.1		%		75-125	15-MAY-20
WG3324412-2 LCS								
Total Kjeldahl Nitrogen			96.9		%		75-125	15-MAY-20
WG3324412-22 LCS								
Total Kjeldahl Nitrogen			95.1		%		75-125	15-MAY-20
WG3324412-6 LCS								
Total Kjeldahl Nitrogen			92.1		%		75-125	15-MAY-20
WG3324412-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	15-MAY-20
WG3324412-13 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	15-MAY-20
WG3324412-17 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	15-MAY-20
WG3324412-21 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	15-MAY-20
WG3324412-5 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	15-MAY-20
WG3324412-9 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	15-MAY-20
TSS-L-CL	**Water**							
Batch R5088638								
WG3323949-29 LCS								
Total Suspended Solids			107.4		%		85-115	15-MAY-20
WG3323949-28 MB								
Total Suspended Solids			<1.0		mg/L		1	15-MAY-20
TURBIDITY-CL	**Water**							

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-CL	**Water**							
Batch R5085357								
WG3323554-8 LCS								
Turbidity			105.0		%		85-115	14-MAY-20
WG3323554-7 MB								
Turbidity			<0.10		NTU		0.1	14-MAY-20

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Oxidation redution potential by elect.							
	1	11-MAY-20 09:30	19-MAY-20 19:00	0.25	202	hours	EHTR-FM
pH							
	1	11-MAY-20 09:30	13-MAY-20 13:00	0.25	52	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2446425 were received on 12-MAY-20 09:20.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

COC ID:	Regional Effects Program	TURNAROUND TIME:	Regular

PROJECT INFORMATION

Facility Name / Job#	Dry Creek May 2020 (207202.0024)
Project Manager	Cait Good
Email	cait.good@teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250-425-8202

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyuda Shvets
Email	Lyudmyla.Shvets@ALSGlobal.com
Address	2559 29 Street NE
City	Calgary
Province	AB
Postal Code	T1Y 7B5
Country	Canada
Phone Number	403-407-1800

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	cait.good@teck.com	X	X	X
Email 2:	carlie.meyer@teck.com	X	X	X
Email 3:	[redacted]	X	X	X
Email 4:	teckcoal@equisonline.com			X
Email 5:	dhasek@minnow.ca	X	X	X
PO number	692629			

SAMPLE DETAILS / **ANALYSIS REQUESTED**

L2446425-COFC

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	HG-T-U-CVAF-VA	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-D-CVAF-VA	TECKCOAL-MET-D-VA	TECKCOAL-MET-T-VA	TECKCOAL-ROUTINE-VA
								N / NONE	F / H2SO4	N / H2SO4	F / NONE	F / HNO3	N / HNO3	N / NONE
LC_GRCK_WS_2020-05-11_0930	LC_GRCK	WS	No	11-May-20	9:30:00	G	7	1	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

VPO00692629

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
		DK	5/12 0920

SERVICE REQUEST

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	Maddy Stokes	Mobile #	647-522-0672
Sampler's Signature	MS	Date/Time	May 11, 2020

Sample Receipt Confirmation

Report Distribution:

Company Name: Teck Coal Ltd.
Contact: Cait Good
Address: 421 Pine Avenue,
Sparwood, BC, V0B 2G0
Phone: 250-425-8202
Fax: --
Email: cait.good@teck.com
carlie.meyer@teck.com
dhasek@minnow.ca
EDD Email: cait.good@teck.com
carlie.meyer@teck.com
dhasek@minnow.ca
teckcoal@equisonline.com
Distribution: Hard Copy: N Email: Y Fax: N EDD: Y

Invoice Distribution:

Acct Name: Teck Coal Ltd.
Contact: Accounts Payable
Address: 421 Pine Avenue,
Sparwood, BC, V0B 2G0
Phone: 250-425-3194
Fax: 250-425-6918
Invoice Email: dlteckcoalaccountspayable@teck.com
cait.good@teck.com
Project #: N/A
Account #: TEC600

Client Information:

Job Reference #: DRY CREEK MAY 2020 (207202.0024)
Project PO #: VPO00692629
Legal Site Description: N/A
Quote #: N/A
Date Sampled: 11-MAY-20
Date Received: 12-MAY-20
Sampled By: MADDY STOKES
Chain Of Custody: Regional Effects Pro

Workorder Summary:

Lab Work Order #: **L2446425**
Estimated completion date: 20-MAY-20
1 Samples received at ALS in **CALGARY**
Client Job #: DRY CREEK MAY 2020 (207202.0024)
Account Manager: Lyudmyla Shvets, B.Sc.
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type
L2446425-1	LC_GRCK_WS_2020-05-11_0930	11-MAY-20 09:30	12-MAY-20 09:20	20-MAY-20		WS

Analysis Requested:	Dissolved Organic Carbon	Total Organic Carbon	Total Mercury in Water by CVAFS [Ultra]	Dissolved Metals in Water	Total Metals in Water	Routine for Teck Coal	Total Kjeldahl Nitrogen	Sample Handling and Disposal Fee
LC_GRCK_WS_2020-05-11_0930	✓	✓	✓	✓	✓	✓	✓	✓

Hold Time Exceedences:
The following samples have exceeded recommended holding times prior to sample receipt.

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
Oxidation redution potential by elect.	L2446425-1	0.25 hours	11-MAY-20	12-MAY-20
pH	L2446425-1	0.25 hours	11-MAY-20	12-MAY-20

Sample Integrity Observations:
No observations were identified for this work order submission.

Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Total Mercury in Water by CVAFS (Ultra) subcontracted to: ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
Hardness subcontracted to: ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
Total Be (Low) in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
Diss. Be (low) in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
Dissolved Metals in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
Diss. Mercury in Water by CVAAS or CVAFS subcontracted to: ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
Total Metals in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.

Teck

COC ID:	Regional Effects Program	TURNAROUND TIME:	Regular

PROJECT INFORMATION		LABORATORY		OTHER INFO			
Facility Name / Job#	Dry Creek May 2020 (207202.0024)	Lab Name	ALS Calgary	Report Format / Distribution	Excel	PDF	EDD
Project Manager	Cait Good	Lab Contact	Lyuda Shvets	Email 1: cait.good@teck.com	x	x	x
Email	cait.good@teck.com	Email	Lyudmyla.Shvets@ALSGlobal.com	Email 2: carlie.meyer@teck.com	x	x	x
Address	421 Pine Avenue	Address	2559 29 Street NE	Email 3: [redacted]	x	x	x
				Email 4: teckcoal@equisonline.com			
City	Sparwood, Province BC	City	Calgary, Province AB	Email 5: dhasek@minnow.ca	x	x	x
Postal Code	V0B 2G0, Country Canada	Postal Code	T1Y 7B5, Country Canada				
Phone Number	250-425-8202	Phone Number	403-407-1800	PO number	692629		

L2446425-COFC

SAMPLE DETAILS / ANALYSIS REQUESTED

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	HG-T-U-CVAF-VA (N, NONE)	ALS_Package-DOC (F, H2SO4)	ALS_Package-TKN/TOC (N, H2SO4)	HG-D-CVAF-VA (F, NONE)	TECKCOAL-MET-D-VA (F, HNO3)	TECKCOAL-MET-T-VA (N, HNO3)	TECKCOAL-ROUTINE-VA (N, NONE)
LC_GRCK_WS_2020-05-11_0930	LC_GRCK	WS	No	11-May-20	9:30:00	G	7	1	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
VPO00692629			DK	5/12 0920

SERVICE REQUEST

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	Maddy Stokes	Mobile #	647-522-0672
Sampler's Signature	MS	Date/Time	May 11, 2020

Teck Coal Ltd.
ATTN: Cait Good
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 26-JUN-20
Report Date: 08-JUL-20 17:55 (MT)
Version: FINAL

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2466732

Project P.O. #: VPO00692629
Job Reference: LINE CREEK OPERATIONS
C of C Numbers: Regional Effects
Legal Site Desc:

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L2466732-1	L2466732-2	L2466732-3	L2466732-4	L2466732-5
	Sample ID	L2466732-1	L2466732-2	L2466732-3	L2466732-4	L2466732-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	24-JUN-20	25-JUN-20	25-JUN-20	24-JUN-20	25-JUN-20
	Sampled Time	13:00	12:00	09:00	08:30	09:00
	Client ID	LC_DC1_WS_2020-06-24_1300	LC_DC4_WS_2020-06-25_1200	LC_DC2_WS_2020-06-25_0900	LC_SPDC_WS_2020-06-24_0830	LC_CC2_WS_2020-06-25_0900
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (@ 25C) (uS/cm)	355	366	381	501	375
	Hardness (as CaCO3) (mg/L)	182	189	187	246	187
	pH (pH)	8.28	8.27	8.23	8.21	8.23
	ORP (mV)	297	390	333	398	398
	Total Suspended Solids (mg/L)	2.1	5.1	3.1	<1.0	1.8
	Total Dissolved Solids (mg/L)	252 DLHC	237 DLHC	244 DLHC	361 DLHC	246 DLHC
	Turbidity (NTU)	1.14	0.95	1.71	4.15	1.85
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	141	138	123	116	122
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	141	138	123	116	122
	Ammonia as N (mg/L)	0.0266	0.0110	0.0183	0.0172	0.0115
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	2.72	3.00	3.66	6.88	3.68
	Fluoride (F) (mg/L)	0.116	0.114	0.114	0.115	0.112
	Ion Balance (%)	89.5	91.6	90.7	90.3	90.3
	Nitrate (as N) (mg/L)	5.93	6.54	8.08	15.3	8.14
	Nitrite (as N) (mg/L)	0.0071	0.0110	0.0175	0.0367	0.0168
	Total Kjeldahl Nitrogen (mg/L)	0.584 TKNI	0.394 TKNI	0.266 TKNI	<0.050 TKNI	<0.050 TKNI
	Orthophosphate-Dissolved (as P) (mg/L)	0.0128	0.0143	0.0152	0.0270	0.0174
	Phosphorus (P)-Total (mg/L)	0.0159	0.0150	0.0215	0.0251	0.0387
	Sulfate (SO4) (mg/L)	40.9	44.6	53.6	95.2	54.0
	Anion Sum (meq/L)	4.17	4.25	4.26	5.59	4.26
	Cation Sum (meq/L)	3.73	3.89	3.86	5.05	3.84
	Cation - Anion Balance (%)	-5.5	-4.4	-4.9	-5.1	-5.1
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.78	1.82	2.41	2.50	2.52
	Total Organic Carbon (mg/L)	1.96	1.84	2.25	2.47	2.37
Total Metals	Aluminum (Al)-Total (mg/L)	0.0198	0.0187	0.0585	0.0415	0.0245
	Antimony (Sb)-Total (mg/L)	0.00023	0.00023	0.00029	0.00040	0.00028
	Arsenic (As)-Total (mg/L)	0.00022	0.00023	0.00029	0.00036	0.00027
	Barium (Ba)-Total (mg/L)	0.181	0.183	0.165	0.116	0.166
	Beryllium (Be)-Total (ug/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (ug/L)	0.0677	0.0652	0.108	0.134	0.0906

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2466732-6	L2466732-7		
	Description	WS	WS		
	Sampled Date	25-JUN-20	25-JUN-20		
	Sampled Time	09:00	09:00		
	Client ID	LC_MT2_WS_2020-06-25_0900	LC_RD2_WS_2020-06-25_0900		
Grouping	**Analyte**				
WATER					
Physical Tests	Conductivity (@ 25C) (uS/cm)	<2.0	<2.0		
	Hardness (as CaCO3) (mg/L)	<0.50			
	pH (pH)	5.68	5.69		
	ORP (mV)	318	373		
	Total Suspended Solids (mg/L)	<1.0	<1.0		
	Total Dissolved Solids (mg/L)	<10	<10		
	Turbidity (NTU)	<0.10	<0.10		
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	1.5	1.4		
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0	<1.0		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)	<1.0	<1.0		
	Ammonia as N (mg/L)	0.0096 RRV	0.0106 RRV		
	Bromide (Br) (mg/L)	<0.050	<0.050		
	Chloride (Cl) (mg/L)	<0.50	<0.50		
	Fluoride (F) (mg/L)	<0.020	<0.020		
	Ion Balance (%)	0.0	0.0		
	Nitrate (as N) (mg/L)	<0.0050	<0.0050		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	<0.050	<0.050		
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010		
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020		
	Sulfate (SO4) (mg/L)	<0.30	<0.30		
	Anion Sum (meq/L)	<0.10	<0.10		
	Cation Sum (meq/L)	<0.10	<0.10		
	Cation - Anion Balance (%)	0.0	0.0		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	<0.50			
	Total Organic Carbon (mg/L)	<0.50	<0.50		
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	<0.0030		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	<0.00010	<0.00010		
	Barium (Ba)-Total (mg/L)	<0.00010	<0.00010		
	Beryllium (Be)-Total (ug/L)	<0.020	<0.020		
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050		
	Boron (B)-Total (mg/L)	<0.010	<0.010		
	Cadmium (Cd)-Total (ug/L)	<0.0050	<0.0050		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2466732-1	L2466732-2	L2466732-3	L2466732-4	L2466732-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	24-JUN-20	25-JUN-20	25-JUN-20	24-JUN-20	25-JUN-20
	Sampled Time	13:00	12:00	09:00	08:30	09:00
	Client ID	LC_DC1_WS_2020-06-24_1300	LC_DC4_WS_2020-06-25_1200	LC_DC2_WS_2020-06-25_0900	LC_SPDC_WS_2020-06-24_0830	LC_CC2_WS_2020-06-25_0900
Grouping	**Analyte**					
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	44.8	45.9	45.9	63.0	42.9
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00011	0.00017	0.00014	0.00012
	Cobalt (Co)-Total (ug/L)	<0.10	<0.10	0.15	0.24	0.11
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.029	0.023	0.051	0.037	0.027
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000071	0.000052	<0.000050
	Lithium (Li)-Total (mg/L)	0.0123	0.0128	0.0137	0.0145	0.0137
	Magnesium (Mg)-Total (mg/L)	17.0	17.9	17.6	23.5	17.4
	Manganese (Mn)-Total (mg/L)	0.00216	0.00171	0.00365	0.00372	0.00214
	Mercury (Hg)-Total (ug/L)	0.00158	0.00134	0.00195	0.00224	0.00177
	Molybdenum (Mo)-Total (mg/L)	0.00163	0.00160	0.00183	0.00274	0.00194
	Nickel (Ni)-Total (mg/L)	0.00290	0.00337	0.00599	0.0119	0.00565
	Potassium (K)-Total (mg/L)	1.26	1.27	1.32	1.73	1.27
	Selenium (Se)-Total (ug/L)	12.8	13.8	16.6	31.5	16.7
	Silicon (Si)-Total (mg/L)	2.63	2.64	2.44	2.62	2.49
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.65	1.74	2.06	2.12	1.98
	Strontium (Sr)-Total (mg/L)	0.0606	0.0600	0.0614	0.0829	0.0640
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	0.000016	0.000016	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000609	0.000656	0.000820	0.00129	0.000795
	Vanadium (V)-Total (mg/L)	0.00095	0.00095	0.00132	0.00170	0.00115
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	0.0043	0.0072	0.0035
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0030	<0.0030	0.0062	0.0061	<0.0030
	Antimony (Sb)-Dissolved (mg/L)	0.00023	0.00023	0.00028	0.00040	0.00027
	Arsenic (As)-Dissolved (mg/L)	0.00021	0.00022	0.00028	0.00034	0.00025
	Barium (Ba)-Dissolved (mg/L)	0.193	0.190	0.182	0.122	0.183
	Beryllium (Be)-Dissolved (ug/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (ug/L)	0.0553	0.0544	0.0704	0.124	0.0719
	Calcium (Ca)-Dissolved (mg/L)	43.4	45.3	45.1	59.8	44.6
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (ug/L)	<0.10	<0.10	<0.10	0.19	<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2466732-6	L2466732-7			
	Description	WS	WS			
	Sampled Date	25-JUN-20	25-JUN-20			
	Sampled Time	09:00	09:00			
	Client ID	LC_MT2_WS_2020-06-25_0900	LC_RD2_WS_2020-06-25_0900			
Grouping	**Analyte**					
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	<0.050	<0.050			
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010			
	Cobalt (Co)-Total (ug/L)	<0.10	<0.10			
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050			
	Iron (Fe)-Total (mg/L)	<0.010	<0.010			
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050			
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010			
	Magnesium (Mg)-Total (mg/L)	<0.10	<0.10			
	Manganese (Mn)-Total (mg/L)	<0.00010	<0.00010			
	Mercury (Hg)-Total (ug/L)	<0.00050	<0.00050			
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050			
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050			
	Potassium (K)-Total (mg/L)	<0.050	<0.050			
	Selenium (Se)-Total (ug/L)	<0.050	<0.050			
	Silicon (Si)-Total (mg/L)	<0.10	<0.10			
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010			
	Sodium (Na)-Total (mg/L)	<0.050	<0.050			
	Strontium (Sr)-Total (mg/L)	<0.00020	<0.00020			
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010			
	Uranium (U)-Total (mg/L)	<0.000010	<0.000010			
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030			
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD	LAB			
	Aluminum (Al)-Dissolved (mg/L)	<0.0030				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	<0.00010				
	Barium (Ba)-Dissolved (mg/L)	<0.00010				
	Beryllium (Be)-Dissolved (ug/L)	<0.020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (ug/L)	<0.0050				
	Calcium (Ca)-Dissolved (mg/L)	<0.050	<0.050			
	Chromium (Cr)-Dissolved (mg/L)	<0.00010				
	Cobalt (Co)-Dissolved (ug/L)	<0.10				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2466732-1	L2466732-2	L2466732-3	L2466732-4	L2466732-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	24-JUN-20	25-JUN-20	25-JUN-20	24-JUN-20	25-JUN-20
	Sampled Time	13:00	12:00	09:00	08:30	09:00
	Client ID	LC_DC1_WS_2020-06-24_1300	LC_DC4_WS_2020-06-25_1200	LC_DC2_WS_2020-06-25_0900	LC_SPDC_WS_2020-06-24_0830	LC_CC2_WS_2020-06-25_0900
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	0.00029	0.00042	0.00060	0.00035	0.00078
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0119	0.0124	0.0139	0.0139	0.0137
	Magnesium (Mg)-Dissolved (mg/L)	17.8	18.5	18.1	23.4	18.3
	Manganese (Mn)-Dissolved (mg/L)	0.00079	0.00064	0.00079	0.00223	0.00082
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00161	0.00164	0.00192	0.00284	0.00193
	Nickel (Ni)-Dissolved (mg/L)	0.00269	0.00310	0.00528	0.0110	0.00539
	Potassium (K)-Dissolved (mg/L)	1.32	1.30	1.33	1.71	1.32
	Selenium (Se)-Dissolved (ug/L)	14.4	16.1	19.5	36.1	19.4
	Silicon (Si)-Dissolved (mg/L)	2.56	2.52	2.46	2.49	2.49
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	1.55	1.63	1.94	2.04	1.94
	Strontium (Sr)-Dissolved (mg/L)	0.0693	0.0694	0.0738	0.0969	0.0741
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	0.000013	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000552	0.000583	0.000711	0.00115	0.000732
	Vanadium (V)-Dissolved (mg/L)	0.00076	0.00081	0.00090	0.00137	0.00087
	Zinc (Zn)-Dissolved (mg/L)	0.0020	0.0019	0.0036	0.0056	0.0027

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2466732-6	L2466732-7			
	Description	WS	WS			
	Sampled Date	25-JUN-20	25-JUN-20			
	Sampled Time	09:00	09:00			
	Client ID	LC_MT2_WS_2020-06-25_0900	LC_RD2_WS_2020-06-25_0900			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Copper (Cu)-Dissolved (mg/L)	<0.00020				
	Iron (Fe)-Dissolved (mg/L)	<0.010				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	<0.0010				
	Magnesium (Mg)-Dissolved (mg/L)	<0.10	<0.0050			
	Manganese (Mn)-Dissolved (mg/L)	<0.00010				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Potassium (K)-Dissolved (mg/L)	<0.050	<0.050			
	Selenium (Se)-Dissolved (ug/L)	<0.050				
	Silicon (Si)-Dissolved (mg/L)	<0.050				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	<0.050	<0.050			
	Strontium (Sr)-Dissolved (mg/L)	<0.00020				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.010				
	Uranium (U)-Dissolved (mg/L)	<0.000010				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	<0.0010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2466732-1, -2, -3, -4, -5, -6
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2466732-1, -2, -3, -4, -5, -6
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2466732-1, -2, -3, -4, -5, -6
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2466732-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2466732-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2466732-1, -2, -3, -4, -5, -6
Matrix Spike	Zinc (Zn)-Dissolved	MS-B	L2466732-1, -2, -3, -4, -5, -6
Matrix Spike	Barium (Ba)-Total	MS-B	L2466732-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Barium (Ba)-Total	MS-B	L2466732-7
Matrix Spike	Boron (B)-Total	MS-B	L2466732-7
Matrix Spike	Calcium (Ca)-Total	MS-B	L2466732-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Calcium (Ca)-Total	MS-B	L2466732-7
Matrix Spike	Copper (Cu)-Total	MS-B	L2466732-7
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2466732-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2466732-7
Matrix Spike	Manganese (Mn)-Total	MS-B	L2466732-7
Matrix Spike	Potassium (K)-Total	MS-B	L2466732-7
Matrix Spike	Sodium (Na)-Total	MS-B	L2466732-7
Matrix Spike	Strontium (Sr)-Total	MS-B	L2466732-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Total	MS-B	L2466732-7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis
TKNI	TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ACIDITY-PCT-CL	Water	Acidity by Automatic Titration	APHA 2310 Acidity

This analysis is carried out using procedures adapted from APHA Method 2310 "Acidity". Acidity is determined by potentiometric titration to a specified endpoint.

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-MAN-CL	Water	Alkalinity (Species) by Manual Titration	APHA 2320 ALKALINITY

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". 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.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-L-IC-N-CL	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
C-DIS-ORG-LOW-CL	Water	Dissolved Organic Carbon	APHA 5310 B-Instrumental

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by

Reference Information

subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

C-TOT-ORG-LOW-CL Water Total Organic Carbon APHA 5310 TOTAL ORGANIC CARBON (TOC)

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-IC-N-CL Water Chloride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-L-PCT-CL Water Electrical Conductivity (EC) APHA 2510B

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 25C.

F-IC-N-CL Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-U-CVAF-VA Water Total Mercury in Water by CVAFS (Ultra) EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-BC-CL Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-CL Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-L-F-CL Water Ammonia, Total (as N) J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ORP-CL Water Oxidation redution potential by elect. ASTM D1498

This analysis is carried out in accordance with the procedure described in the "ASTM" method D1498 "Oxidation-Reduction Potential of Water" published by the American Society for Testing and Materials (ASTM). Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

P-T-L-COL-CL Water Phosphorus (P)-Total APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-CL Water pH APHA 4500 H-Electrode

pH is determined in the laboratory using a pH electrode. All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PO4-DO-L-COL-CL Water Orthophosphate-Dissolved (as P) APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SO4-IC-N-CL Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-CL Water Total Dissolved Solids APHA 2540 C

A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).

TECKCOAL-IONBAL-CL Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

TKN-L-F-CL Water Total Kjeldahl Nitrogen APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-L-CL Water Total Suspended Solids APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

TURBIDITY-CL Water Turbidity APHA 2130 B-Nephelometer

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Regional Effects

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Environmental

Quality Control Report

Workorder: L2466732 Report Date: 08-JUL-20

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0

Contact: Cait Good

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ACIDITY-PCT-CL	**Water**							
Batch R5135983								
WG3352322-9 DUP		**L2466732-1**						
Acidity (as CaCO3)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	28-JUN-20
WG3352322-5 LCS								
Acidity (as CaCO3)			103.6		%		85-115	28-JUN-20
WG3352322-8 LCS								
Acidity (as CaCO3)			102.4		%		85-115	28-JUN-20
WG3352322-4 MB								
Acidity (as CaCO3)			1.4		mg/L		2	28-JUN-20
WG3352322-7 MB								
Acidity (as CaCO3)			1.3		mg/L		2	28-JUN-20
ALK-MAN-CL	**Water**							
Batch R5137376								
WG3352789-11 LCS								
Alkalinity, Total (as CaCO3)			99.6		%		85-115	28-JUN-20
WG3352789-10 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	28-JUN-20
BE-D-L-CCMS-VA	**Water**							
Batch R5139676								
WG3353442-2 LCS								
Beryllium (Be)-Dissolved			95.0		%		80-120	02-JUL-20
WG3353442-1 MB		**NP**						
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	02-JUL-20
BE-T-L-CCMS-VA	**Water**							
Batch R5102794								
WG3352406-3 DUP		**L2466732-1**						
Beryllium (Be)-Total		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	01-JUL-20
WG3352406-2 LCS								
Beryllium (Be)-Total			89.3		%		80-120	01-JUL-20
WG3352406-1 MB								
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	01-JUL-20
WG3352406-4 MS		**L2466732-2**						
Beryllium (Be)-Total			98.4		%		70-130	01-JUL-20
BR-L-IC-N-CL	**Water**							
Batch R5135419								
WG3351773-2 LCS								
Bromide (Br)			97.2		%		85-115	27-JUN-20
WG3351773-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BR-L-IC-N-CL	**Water**							
Batch R5135419								
WG3351773-1 MB								
Bromide (Br)			<0.050		mg/L		0.05	27-JUN-20
C-DIS-ORG-LOW-CL	**Water**							
Batch R5142929								
WG3356320-11 DUP		**L2466732-6**						
Dissolved Organic Carbon		<0.50	<0.50	RPD-NA	mg/L	N/A	20	04-JUL-20
WG3356320-10 LCS								
Dissolved Organic Carbon			102.3		%		80-120	04-JUL-20
WG3356320-6 LCS								
Dissolved Organic Carbon			102.0		%		80-120	04-JUL-20
WG3356320-5 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	04-JUL-20
WG3356320-9 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	04-JUL-20
WG3356320-12 MS		**L2466732-6**						
Dissolved Organic Carbon			117.4		%		70-130	04-JUL-20
Batch R5143013								
WG3356360-14 LCS								
Dissolved Organic Carbon			85.7		%		80-120	05-JUL-20
WG3356360-13 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	05-JUL-20
C-TOT-ORG-LOW-CL	**Water**							
Batch R5142929								
WG3356320-11 DUP		**L2466732-6**						
Total Organic Carbon		<0.50	<0.50	RPD-NA	mg/L	N/A	20	04-JUL-20
WG3356320-10 LCS								
Total Organic Carbon			88.6		%		80-120	04-JUL-20
WG3356320-6 LCS								
Total Organic Carbon			87.9		%		80-120	04-JUL-20
WG3356320-5 MB								
Total Organic Carbon			<0.50		mg/L		0.5	04-JUL-20
WG3356320-9 MB								
Total Organic Carbon			<0.50		mg/L		0.5	04-JUL-20
WG3356320-12 MS		**L2466732-6**						
Total Organic Carbon			113.0		%		70-130	04-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TOT-ORG-LOW-CL	**Water**							
Batch R5143013								
WG3356360-14 LCS								
Total Organic Carbon			98.0		%		80-120	05-JUL-20
WG3356360-13 MB								
Total Organic Carbon			<0.50		mg/L		0.5	05-JUL-20
CL-IC-N-CL	**Water**							
Batch R5135419								
WG3351773-2 LCS								
Chloride (Cl)			101.4		%		90-110	27-JUN-20
WG3351773-1 MB								
Chloride (Cl)			<0.50		mg/L		0.5	27-JUN-20
EC-L-PCT-CL	**Water**							
Batch R5137376								
WG3352789-11 LCS								
Conductivity (@ 25C)			96.7		%		90-110	28-JUN-20
WG3352789-10 MB								
Conductivity (@ 25C)			<2.0		uS/cm		2	28-JUN-20
F-IC-N-CL	**Water**							
Batch R5135419								
WG3351773-2 LCS								
Fluoride (F)			102.2		%		90-110	27-JUN-20
WG3351773-1 MB								
Fluoride (F)			<0.020		mg/L		0.02	27-JUN-20
HG-D-CVAA-VA	**Water**							
Batch R5139077								
WG3353635-10 LCS								
Mercury (Hg)-Dissolved			110.0		%		80-120	01-JUL-20
WG3353635-9 MB		**NP**						
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	01-JUL-20
WG3353635-12 MS		**L2466732-1**						
Mercury (Hg)-Dissolved			104.5		%		70-130	01-JUL-20
HG-T-U-CVAF-VA	**Water**							
Batch R5136477								
WG3352425-2 LCS								
Mercury (Hg)-Total			102.8		%		80-120	29-JUN-20
WG3352425-1 MB								
Mercury (Hg)-Total			<0.00050		ug/L		0.0005	29-JUN-20
MET-D-CCMS-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R5135621								
WG3351939-6 LCS		**TMRM**						
Calcium (Ca)-Dissolved			99.1		%		80-120	28-JUN-20
Magnesium (Mg)-Dissolved			108.6		%		80-120	28-JUN-20
Potassium (K)-Dissolved			107.8		%		80-120	28-JUN-20
Sodium (Na)-Dissolved			96.1		%		80-120	28-JUN-20
WG3351939-5 MB								
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	28-JUN-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	28-JUN-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	28-JUN-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	28-JUN-20
MET-D-CCMS-VA	**Water**							
Batch R5139676								
WG3353442-2 LCS								
Aluminum (Al)-Dissolved			100.2		%		80-120	02-JUL-20
Antimony (Sb)-Dissolved			97.4		%		80-120	02-JUL-20
Arsenic (As)-Dissolved			97.1		%		80-120	02-JUL-20
Barium (Ba)-Dissolved			99.2		%		80-120	02-JUL-20
Bismuth (Bi)-Dissolved			100.8		%		80-120	02-JUL-20
Boron (B)-Dissolved			91.8		%		80-120	02-JUL-20
Cadmium (Cd)-Dissolved			95.8		%		80-120	02-JUL-20
Calcium (Ca)-Dissolved			96.1		%		80-120	02-JUL-20
Chromium (Cr)-Dissolved			99.5		%		80-120	02-JUL-20
Cobalt (Co)-Dissolved			97.6		%		80-120	02-JUL-20
Copper (Cu)-Dissolved			97.7		%		80-120	02-JUL-20
Iron (Fe)-Dissolved			91.3		%		80-120	02-JUL-20
Lead (Pb)-Dissolved			97.7		%		80-120	02-JUL-20
Lithium (Li)-Dissolved			94.0		%		80-120	02-JUL-20
Magnesium (Mg)-Dissolved			99.2		%		80-120	02-JUL-20
Manganese (Mn)-Dissolved			100.4		%		80-120	02-JUL-20
Molybdenum (Mo)-Dissolved			94.2		%		80-120	02-JUL-20
Nickel (Ni)-Dissolved			98.4		%		80-120	02-JUL-20
Potassium (K)-Dissolved			100.3		%		80-120	02-JUL-20
Selenium (Se)-Dissolved			100.9		%		80-120	02-JUL-20
Silicon (Si)-Dissolved			97.2		%		60-140	02-JUL-20
Silver (Ag)-Dissolved			92.2		%		80-120	02-JUL-20

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5139676								
WG3353442-2 LCS								
Sodium (Na)-Dissolved			98.9		%		80-120	02-JUL-20
Strontium (Sr)-Dissolved			107.1		%		80-120	02-JUL-20
Thallium (Tl)-Dissolved			97.6		%		80-120	02-JUL-20
Tin (Sn)-Dissolved			93.6		%		80-120	02-JUL-20
Titanium (Ti)-Dissolved			99.0		%		80-120	02-JUL-20
Uranium (U)-Dissolved			92.0		%		80-120	02-JUL-20
Vanadium (V)-Dissolved			99.97		%		80-120	02-JUL-20
Zinc (Zn)-Dissolved			100.7		%		80-120	02-JUL-20
WG3353442-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	02-JUL-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	02-JUL-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	02-JUL-20
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	02-JUL-20
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	02-JUL-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	02-JUL-20
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	02-JUL-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	02-JUL-20
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	02-JUL-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	02-JUL-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	02-JUL-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	02-JUL-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	02-JUL-20
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	02-JUL-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	02-JUL-20
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	02-JUL-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	02-JUL-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	02-JUL-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	02-JUL-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	02-JUL-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	02-JUL-20
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	02-JUL-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	02-JUL-20
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	02-JUL-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	02-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5139676								
WG3353442-1 MB		**NP**						
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	02-JUL-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	02-JUL-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	02-JUL-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	02-JUL-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	02-JUL-20
MET-T-CCMS-VA	**Water**							
Batch R5102794								
WG3352406-3 DUP		**L2466732-1**						
Aluminum (Al)-Total		0.0198	0.0215		mg/L	8.0	20	01-JUL-20
Antimony (Sb)-Total		0.00023	0.00023		mg/L	3.1	20	01-JUL-20
Arsenic (As)-Total		0.00022	0.00025		mg/L	12	20	01-JUL-20
Barium (Ba)-Total		0.181	0.186		mg/L	2.3	20	01-JUL-20
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	01-JUL-20
Boron (B)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	01-JUL-20
Cadmium (Cd)-Total		0.0000677	0.0000750		mg/L	10	20	01-JUL-20
Calcium (Ca)-Total		44.8	45.5		mg/L	1.6	20	01-JUL-20
Chromium (Cr)-Total		<0.00010	0.00011	RPD-NA	mg/L	N/A	20	01-JUL-20
Cobalt (Co)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-JUL-20
Copper (Cu)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	01-JUL-20
Iron (Fe)-Total		0.029	0.032		mg/L	9.0	20	01-JUL-20
Lead (Pb)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	01-JUL-20
Lithium (Li)-Total		0.0123	0.0126		mg/L	1.9	20	01-JUL-20
Magnesium (Mg)-Total		17.0	17.4		mg/L	2.1	20	01-JUL-20
Manganese (Mn)-Total		0.00216	0.00226		mg/L	4.6	20	01-JUL-20
Molybdenum (Mo)-Total		0.00163	0.00152		mg/L	6.8	20	01-JUL-20
Nickel (Ni)-Total		0.00290	0.00293		mg/L	1.3	20	01-JUL-20
Potassium (K)-Total		1.26	1.27		mg/L	0.8	20	01-JUL-20
Selenium (Se)-Total		0.0128	0.0127		mg/L	1.0	20	01-JUL-20
Silicon (Si)-Total		2.63	2.71		mg/L	3.0	20	01-JUL-20
Silver (Ag)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	01-JUL-20
Sodium (Na)-Total		1.65	1.69		mg/L	2.4	20	01-JUL-20
Strontium (Sr)-Total		0.0606	0.0584		mg/L	3.6	20	01-JUL-20
Thallium (Tl)-Total		<0.000010	0.000015	RPD-NA	mg/L	N/A	20	01-JUL-20
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5102794								
WG3352406-3 DUP		**L2466732-1**						
Titanium (Ti)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	01-JUL-20
Uranium (U)-Total		0.000609	0.000618		mg/L	1.5	20	01-JUL-20
Vanadium (V)-Total		0.00095	0.00096		mg/L	0.7	20	01-JUL-20
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	01-JUL-20
WG3352406-2 LCS								
Aluminum (Al)-Total			99.2		%		80-120	01-JUL-20
Antimony (Sb)-Total			94.9		%		80-120	01-JUL-20
Arsenic (As)-Total			93.3		%		80-120	01-JUL-20
Barium (Ba)-Total			97.4		%		80-120	01-JUL-20
Bismuth (Bi)-Total			89.3		%		80-120	01-JUL-20
Boron (B)-Total			86.8		%		80-120	01-JUL-20
Cadmium (Cd)-Total			96.3		%		80-120	01-JUL-20
Calcium (Ca)-Total			91.7		%		80-120	01-JUL-20
Chromium (Cr)-Total			98.7		%		80-120	01-JUL-20
Cobalt (Co)-Total			96.0		%		80-120	01-JUL-20
Copper (Cu)-Total			97.1		%		80-120	01-JUL-20
Iron (Fe)-Total			99.5		%		80-120	01-JUL-20
Lead (Pb)-Total			92.6		%		80-120	01-JUL-20
Lithium (Li)-Total			91.3		%		80-120	01-JUL-20
Magnesium (Mg)-Total			95.6		%		80-120	01-JUL-20
Manganese (Mn)-Total			98.2		%		80-120	01-JUL-20
Molybdenum (Mo)-Total			93.6		%		80-120	01-JUL-20
Nickel (Ni)-Total			96.1		%		80-120	01-JUL-20
Potassium (K)-Total			95.9		%		80-120	01-JUL-20
Selenium (Se)-Total			90.9		%		80-120	01-JUL-20
Silicon (Si)-Total			100.7		%		80-120	01-JUL-20
Silver (Ag)-Total			92.2		%		80-120	01-JUL-20
Sodium (Na)-Total			100.4		%		80-120	01-JUL-20
Strontium (Sr)-Total			94.4		%		80-120	01-JUL-20
Thallium (Tl)-Total			93.3		%		80-120	01-JUL-20
Tin (Sn)-Total			95.3		%		80-120	01-JUL-20
Titanium (Ti)-Total			90.4		%		80-120	01-JUL-20
Uranium (U)-Total			107.9		%		80-120	01-JUL-20
Vanadium (V)-Total			98.2		%		80-120	01-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5102794								
WG3352406-2 LCS								
Zinc (Zn)-Total			96.7		%		80-120	01-JUL-20
WG3352406-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	01-JUL-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	01-JUL-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	01-JUL-20
Barium (Ba)-Total			<0.00010		mg/L		0.0001	01-JUL-20
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	01-JUL-20
Boron (B)-Total			<0.010		mg/L		0.01	01-JUL-20
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	01-JUL-20
Calcium (Ca)-Total			<0.050		mg/L		0.05	01-JUL-20
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	01-JUL-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	01-JUL-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	01-JUL-20
Iron (Fe)-Total			<0.010		mg/L		0.01	01-JUL-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	01-JUL-20
Lithium (Li)-Total			<0.0010		mg/L		0.001	01-JUL-20
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	01-JUL-20
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	01-JUL-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	01-JUL-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	01-JUL-20
Potassium (K)-Total			<0.050		mg/L		0.05	01-JUL-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	01-JUL-20
Silicon (Si)-Total			<0.10		mg/L		0.1	01-JUL-20
Silver (Ag)-Total			<0.000010		mg/L		0.00001	01-JUL-20
Sodium (Na)-Total			<0.050		mg/L		0.05	01-JUL-20
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	01-JUL-20
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	01-JUL-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	01-JUL-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	01-JUL-20
Uranium (U)-Total			<0.000010		mg/L		0.00001	01-JUL-20
Vanadium (V)-Total			<0.00050		mg/L		0.0005	01-JUL-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	01-JUL-20
WG3352406-4 MS		**L2466732-2**						
Aluminum (Al)-Total			95.0		%		70-130	01-JUL-20
Antimony (Sb)-Total			96.3		%		70-130	01-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5102794								
WG3352406-4 MS		**L2466732-2**						
Arsenic (As)-Total			96.9		%		70-130	01-JUL-20
Barium (Ba)-Total			N/A	MS-B	%		-	01-JUL-20
Bismuth (Bi)-Total			89.8		%		70-130	01-JUL-20
Boron (B)-Total			100.3		%		70-130	01-JUL-20
Cadmium (Cd)-Total			94.4		%		70-130	01-JUL-20
Calcium (Ca)-Total			N/A	MS-B	%		-	01-JUL-20
Chromium (Cr)-Total			99.8		%		70-130	01-JUL-20
Cobalt (Co)-Total			94.4		%		70-130	01-JUL-20
Copper (Cu)-Total			93.7		%		70-130	01-JUL-20
Iron (Fe)-Total			96.3		%		70-130	01-JUL-20
Lead (Pb)-Total			87.8		%		70-130	01-JUL-20
Lithium (Li)-Total			91.2		%		70-130	01-JUL-20
Magnesium (Mg)-Total			N/A	MS-B	%		-	01-JUL-20
Manganese (Mn)-Total			98.9		%		70-130	01-JUL-20
Molybdenum (Mo)-Total			95.6		%		70-130	01-JUL-20
Nickel (Ni)-Total			93.4		%		70-130	01-JUL-20
Potassium (K)-Total			91.3		%		70-130	01-JUL-20
Selenium (Se)-Total			99.1		%		70-130	01-JUL-20
Silicon (Si)-Total			96.6		%		70-130	01-JUL-20
Silver (Ag)-Total			93.1		%		70-130	01-JUL-20
Sodium (Na)-Total			97.0		%		70-130	01-JUL-20
Strontium (Sr)-Total			N/A	MS-B	%		-	01-JUL-20
Thallium (Tl)-Total			90.0		%		70-130	01-JUL-20
Tin (Sn)-Total			95.1		%		70-130	01-JUL-20
Titanium (Ti)-Total			96.0		%		70-130	01-JUL-20
Uranium (U)-Total			103.3		%		70-130	01-JUL-20
Vanadium (V)-Total			100.4		%		70-130	01-JUL-20
Zinc (Zn)-Total			96.5		%		70-130	01-JUL-20
Batch R5141246								
WG3354666-2 LCS								
Aluminum (Al)-Total			102.9		%		80-120	03-JUL-20
Antimony (Sb)-Total			103.6		%		80-120	03-JUL-20
Arsenic (As)-Total			98.2		%		80-120	03-JUL-20
Barium (Ba)-Total			102.0		%		80-120	03-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5141246								
WG3354666-2 LCS								
Bismuth (Bi)-Total			96.6		%		80-120	03-JUL-20
Boron (B)-Total			91.4		%		80-120	03-JUL-20
Cadmium (Cd)-Total			99.1		%		80-120	03-JUL-20
Calcium (Ca)-Total			102.9		%		80-120	03-JUL-20
Chromium (Cr)-Total			101.3		%		80-120	03-JUL-20
Cobalt (Co)-Total			100.8		%		80-120	03-JUL-20
Copper (Cu)-Total			97.5		%		80-120	03-JUL-20
Iron (Fe)-Total			104.0		%		80-120	03-JUL-20
Lead (Pb)-Total			94.8		%		80-120	03-JUL-20
Lithium (Li)-Total			104.1		%		80-120	03-JUL-20
Magnesium (Mg)-Total			103.7		%		80-120	03-JUL-20
Manganese (Mn)-Total			101.1		%		80-120	03-JUL-20
Molybdenum (Mo)-Total			99.1		%		80-120	03-JUL-20
Nickel (Ni)-Total			100.7		%		80-120	03-JUL-20
Potassium (K)-Total			103.8		%		80-120	03-JUL-20
Selenium (Se)-Total			95.4		%		80-120	03-JUL-20
Silicon (Si)-Total			107.2		%		80-120	03-JUL-20
Silver (Ag)-Total			93.4		%		80-120	03-JUL-20
Sodium (Na)-Total			103.8		%		80-120	03-JUL-20
Strontium (Sr)-Total			100.1		%		80-120	03-JUL-20
Thallium (Tl)-Total			98.6		%		80-120	03-JUL-20
Tin (Sn)-Total			98.8		%		80-120	03-JUL-20
Titanium (Ti)-Total			95.6		%		80-120	03-JUL-20
Uranium (U)-Total			95.1		%		80-120	03-JUL-20
Vanadium (V)-Total			100.9		%		80-120	03-JUL-20
Zinc (Zn)-Total			100.5		%		80-120	03-JUL-20
WG3354666-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	03-JUL-20
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	03-JUL-20
Arsenic (As)-Total			<0.00010		mg/L		0.0001	03-JUL-20
Barium (Ba)-Total			<0.00010		mg/L		0.0001	03-JUL-20
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	03-JUL-20
Boron (B)-Total			<0.010		mg/L		0.01	03-JUL-20
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	03-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5141246								
WG3354666-1 MB								
Calcium (Ca)-Total			<0.050		mg/L		0.05	03-JUL-20
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	03-JUL-20
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	03-JUL-20
Copper (Cu)-Total			<0.00050		mg/L		0.0005	03-JUL-20
Iron (Fe)-Total			<0.010		mg/L		0.01	03-JUL-20
Lead (Pb)-Total			<0.000050		mg/L		0.00005	03-JUL-20
Lithium (Li)-Total			<0.0010		mg/L		0.001	03-JUL-20
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	03-JUL-20
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	03-JUL-20
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	03-JUL-20
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	03-JUL-20
Potassium (K)-Total			<0.050		mg/L		0.05	03-JUL-20
Selenium (Se)-Total			<0.000050		mg/L		0.00005	03-JUL-20
Silicon (Si)-Total			<0.10		mg/L		0.1	03-JUL-20
Silver (Ag)-Total			<0.000010		mg/L		0.00001	03-JUL-20
Sodium (Na)-Total			<0.050		mg/L		0.05	03-JUL-20
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	03-JUL-20
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	03-JUL-20
Tin (Sn)-Total			<0.00010		mg/L		0.0001	03-JUL-20
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	03-JUL-20
Uranium (U)-Total			<0.000010		mg/L		0.00001	03-JUL-20
Vanadium (V)-Total			<0.00050		mg/L		0.0005	03-JUL-20
Zinc (Zn)-Total			<0.0030		mg/L		0.003	03-JUL-20
NH3-L-F-CL	**Water**							
Batch R5143028								
WG3356427-19 DUP		**L2466732-6**						
Ammonia as N		0.0096	0.0111		mg/L	14	20	06-JUL-20
WG3356427-18 LCS								
Ammonia as N			97.7		%		85-115	06-JUL-20
WG3356427-22 LCS								
Ammonia as N			104.1		%		85-115	06-JUL-20
WG3356427-17 MB								
Ammonia as N			0.0050		mg/L		0.005	06-JUL-20
WG3356427-21 MB								
Ammonia as N			<0.0050		mg/L		0.005	06-JUL-20

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-L-F-CL	**Water**							
Batch R5143028								
WG3356427-20 MS		**L2466732-6**						
Ammonia as N			105.6		%		75-125	06-JUL-20
NO2-L-IC-N-CL	**Water**							
Batch R5135419								
WG3351773-2 LCS								
Nitrite (as N)			103.0		%		90-110	27-JUN-20
WG3351773-1 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	27-JUN-20
NO3-L-IC-N-CL	**Water**							
Batch R5135419								
WG3351773-2 LCS								
Nitrate (as N)			101.5		%		90-110	27-JUN-20
WG3351773-1 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	27-JUN-20
ORP-CL	**Water**							
Batch R5141502								
WG3355186-3 CRM		**CL-ORP**						
ORP			230		mV		210-230	03-JUL-20
WG3355186-4 DUP		**L2466732-1**						
ORP		297	298	J	mV	0.3	15	03-JUL-20
P-T-L-COL-CL	**Water**							
Batch R5143057								
WG3356440-18 LCS								
Phosphorus (P)-Total			106.7		%		80-120	06-JUL-20
WG3356440-22 LCS								
Phosphorus (P)-Total			106.2		%		80-120	06-JUL-20
WG3356440-17 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	06-JUL-20
WG3356440-21 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	06-JUL-20
PH-CL	**Water**							
Batch R5137376								
WG3352789-11 LCS								
pH			6.98		pH		6.9-7.1	28-JUN-20
PO4-DO-L-COL-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PO4-DO-L-COL-CL	**Water**							
Batch R5134954								
WG3351085-10 LCS								
Orthophosphate-Dissolved (as P)			107.0		%		80-120	26-JUN-20
WG3351085-9 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	26-JUN-20
SO4-IC-N-CL	**Water**							
Batch R5135419								
WG3351773-2 LCS								
Sulfate (SO4)			102.3		%		90-110	27-JUN-20
WG3351773-1 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	27-JUN-20
SOLIDS-TDS-CL	**Water**							
Batch R5139837								
WG3352787-14 LCS								
Total Dissolved Solids			98.9		%		85-115	30-JUN-20
WG3352787-13 MB								
Total Dissolved Solids			<10		mg/L		10	30-JUN-20
Batch R5142172								
WG3353889-12 DUP		**L2466732-5**						
Total Dissolved Solids		246	253		mg/L	2.8	20	02-JUL-20
WG3353889-11 LCS								
Total Dissolved Solids			94.6		%		85-115	02-JUL-20
WG3353889-8 LCS								
Total Dissolved Solids			99.9		%		85-115	02-JUL-20
WG3353889-10 MB								
Total Dissolved Solids			<10		mg/L		10	02-JUL-20
WG3353889-7 MB								
Total Dissolved Solids			<10		mg/L		10	02-JUL-20
TKN-L-F-CL	**Water**							
Batch R5143110								
WG3356496-10 LCS								
Total Kjeldahl Nitrogen			94.7		%		75-125	06-JUL-20
WG3356496-14 LCS								
Total Kjeldahl Nitrogen			95.6		%		75-125	06-JUL-20
WG3356496-2 LCS								
Total Kjeldahl Nitrogen			96.6		%		75-125	06-JUL-20
WG3356496-6 LCS								
Total Kjeldahl Nitrogen			93.5		%		75-125	06-JUL-20
WG3356496-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-L-F-CL	**Water**							
Batch R5143110								
WG3356496-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	06-JUL-20
WG3356496-13 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	06-JUL-20
WG3356496-5 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	06-JUL-20
WG3356496-9 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	06-JUL-20
TSS-L-CL	**Water**							
Batch R5139787								
WG3352864-8 LCS								
Total Suspended Solids			97.3		%		85-115	30-JUN-20
WG3352864-7 MB								
Total Suspended Solids			<1.0		mg/L		1	30-JUN-20
Batch R5141938								
WG3353925-4 LCS								
Total Suspended Solids			97.8		%		85-115	02-JUL-20
WG3353925-3 MB								
Total Suspended Solids			<1.0		mg/L		1	02-JUL-20
TURBIDITY-CL	**Water**							
Batch R5134977								
WG3350811-18 DUP		**L2466732-3**						
Turbidity		1.71	1.73		NTU	1.2	15	26-JUN-20
WG3350811-17 LCS								
Turbidity			98.0		%		85-115	26-JUN-20
WG3350811-16 MB								
Turbidity			<0.10		NTU		0.1	26-JUN-20

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Oxidation redution potential by elect.							
	1	24-JUN-20 13:00	03-JUL-20 07:00	0.25	210	hours	EHTR-FM
	2	25-JUN-20 12:00	03-JUL-20 07:00	0.25	187	hours	EHTR-FM
	3	25-JUN-20 09:00	03-JUL-20 07:00	0.25	190	hours	EHTR-FM
	4	24-JUN-20 08:30	03-JUL-20 07:00	0.25	215	hours	EHTR-FM
	5	25-JUN-20 09:00	03-JUL-20 07:00	0.25	190	hours	EHTR-FM
	6	25-JUN-20 09:00	03-JUL-20 07:00	0.25	190	hours	EHTR-FM
	7	25-JUN-20 09:00	03-JUL-20 07:00	0.25	190	hours	EHTR-FM
pH							
	1	24-JUN-20 13:00	28-JUN-20 13:00	0.25	96	hours	EHTR-FM
	2	25-JUN-20 12:00	28-JUN-20 13:00	0.25	73	hours	EHTR-FM
	3	25-JUN-20 09:00	28-JUN-20 13:00	0.25	76	hours	EHTR-FM
	4	24-JUN-20 08:30	28-JUN-20 13:00	0.25	101	hours	EHTR-FM
	5	25-JUN-20 09:00	28-JUN-20 13:00	0.25	76	hours	EHTR-FM
	6	25-JUN-20 09:00	28-JUN-20 13:00	0.25	76	hours	EHTR-FM
	7	25-JUN-20 09:00	28-JUN-20 13:00	0.25	76	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2466732 were received on 26-JUN-20 09:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

COC ID:	Regional Effects Program	TURNAROUND TIME:	Regular

PROJECT/CLIENT INFO

Facility Name / Job#	Dry Creek May 2020 (207202.0024)
Project Manager	Cait Good
Email	cait.good@teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250-425-8202

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyuda Shvets
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Province	AB
Postal Code	T1Y 7B5
Country	Canada
Phone Number	403-407-1800

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	cait.good@teck.com	X	X	X
Email 2:	carlie.meyer@teck.com	X	X	X
Email 3:		X	X	X
Email 4:	teckcoal@equisonline.com			X
Email 5:	dhasek@minnow.ca	X	X	X

PO number: 692629

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

L2466732-COFC

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	HG-T-U-CVAF-VA (N, NONE)	ALS_Package-DOC (F, NONE)	ALS_Package-TKN/TOC (N, H2SO4)	HG-D-CVAF-VA (F, NONE)	TECKCOAL-MET-D-VA (F, NONE)	TECKCOAL-MET-T-VA (N, HNO3)	TECKCOAL-ROUTINE-VA (N, NONE)
LC_DC1_WS_2020-06-24_1300	LC_DC1	WS	No	24-Jun-20	13:00:00	G	7	1	1	1	1	1	1	1
LC_DC4_WS_2020-06-25_1200	LC_DC4	WS	No	25-Jun-20	12:00:00	G	7	1	1	1	1	1	1	1
LC_DC2_WS_2020-06-25_0900	LC_DC2	WS	No	25-Jun-20	9:00:00	G	7	1	1	1	1	1	1	1
LC_SPDC_WS_2020-06-24_0830	LC_SPDC	WS	No	24-Jun-20	8:30:00	G	7	1	1	1	1	1	1	1
LC_CC2_WS_2020-06-25_0900	LC_CC2	WS	No	25-Jun-20	9:00:00	G	7	1	1	1	1	1	1	1
LC_MT2_WS_2020-06-25_0900	LC_MT2	WS	No	25-Jun-20	9:00:00	G	7	1	1	1	1	1	1	1
LC_RD2_WS_2020-06-25_0900	LC_RD2	WS	No	25-Jun-20	9:00:00	G	4	1		1			1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
VPO00692629				6/26/2020

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X	Sampler's Name	Maddy Stokes	Mobile #	647-522-0672
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	MS	Date/Time	June 25, 2020
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Aqueous Selenium Speciation
Laboratory Reports
(Brooks Applied Labs)

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

April 26, 2021

Teck Resources Limited - Vancouver
Cait Good
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
Cait.Good@teck.com

Re: REP

Dear Cait Good,

On April 15, 2021, Brooks Applied Labs (BAL) received six (6) 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 logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL; sample fractions for total recoverable and dissolved Se had also been preserved by the client prior to receipt. All samples were stored according to BAL SOPs.

<u>Total Recoverable and Dissolved Se</u>
Each aqueous sample fraction for total recoverable or 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.

<u>Se Speciation</u>
Each aqueous sample was analyzed for Se 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, Se 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

Se species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting Se species.

Chromatographic interference, as indicated by an elevated baseline or co-eluting peak, was observed for selenosulfate in samples 2104128-04 and 2104128-07. Due to potential bias in the obtained results, the affected data have been qualified as estimated (**J-1**). Upon client request, Brooks Applied Labs can apply a higher dilution to these samples to potentially mitigate the chromatographic interferences, but a higher dilution would elevate the detection limits for selenomethionine [SeMet] above the client's requested limit of 0.010µg/L.

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 method detection limits (MDLs), MRLs, and other details.

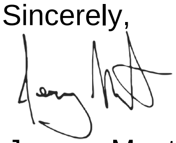
In instances when a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries, and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified 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 RPD of the MS/MSD set was not calculated (**N/C**).

Except for items noted above, and aside from 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 met 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
Brooks Applied Labs
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 27, 2020; Valid to: June 30, 2021

Certificate Number: E87982-35

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	Ag, As, 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-4200	Non-Potable Waters	Se(IV), Se(VI)
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), and DoD/DOE (3)

Issued by: ANAB

Issued on: November 20, 2020; Valid to: March 20, 2022

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)	DoD/DOE Accredited Analytes
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	Ag, Al, As, Ba, Ca, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, Sb, Se, 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)	Not Accredited
EPA 1640 Mod	Non-Potable Waters	Ag, As, Cd, Cu, Pb, Ni, Zn Cr, Co, Se, Tl, V (ISO Only)	Not Accredited
EPA 1631E Mod BAL-3100 (waters)	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury	Methyl Mercury (excluding Solids/Chemicals)
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic, As(III) (ISO Only)	Not Accredited
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)	Not Accredited
AOAC 2015.01 Mod BAL-5000 by BAL-5040	Food	As, Cd, Hg, Pb	Not Accredited
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs	Not Accredited
	Biological by BAL-4115	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4101	Food by BAL-4116	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet	Not Accredited
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)	Not Accredited
SM2340B	Non-Potable Waters	Hardness	Hardness
SM 2540G EPA 160.3 BAL-0501	Solids/Chemicals & Biological	% Dry Weight	% Dry Weight

(1) ISO/IEC 17025:2017 – Certificate Number ADE-1447.2

(2) Non-Governmental NELAC Institute 2016 Standard – Certificate Number ADE-1447.1

(3) Department of Defense/Energy Consolidated Quality Systems Manual v. 5.3 – Certificate Numbers ADE-1447 for DoD, ADE-1447.3 for DOE.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
LC_DCEF_WS_2021-03-08_N	2104128-01	WS	Sample	03/08/2021	04/15/2021
LC_DCEF_WS_2021-03-08_N_NAL	2104128-02	WS	Sample	03/08/2021	04/15/2021
LC_DCEF_WS_2021-03-08_N_NAL	2104128-03	WS	Sample	03/08/2021	04/15/2021
LC_FRB_WS_2021-03-15_N	2104128-04	WS	Sample	03/15/2021	04/15/2021
LC_FRB_WS_2021-03-15_N_NAL	2104128-05	WS	Sample	03/15/2021	04/15/2021
LC_FRB_WS_2021-03-15_N_NAL	2104128-06	WS	Sample	03/15/2021	04/15/2021
LC_FRUS_WS_2021-03-16_N	2104128-07	WS	Sample	03/16/2021	04/15/2021
LC_FRUS_WS_2021-03-16_N_NAL	2104128-08	WS	Sample	03/16/2021	04/15/2021
LC_FRUS_WS_2021-03-16_N_NAL	2104128-09	WS	Sample	03/16/2021	04/15/2021

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
MeSe(IV)	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
MeSe(VI)	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
Se	Water	EPA 1638 Mod	04/15/2021	04/17/2021	B211007	S210429
Se(IV)	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
Se(VI)	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
SeCN	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
SeMet	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
SeSO3	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420
Unk Se Sp	Water	SOP BAL-4201	04/15/2021	04/16/2021	B210996	S210420

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_DCEF_WS_2021-03-08_N										
2104128-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-01	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-01	Se(IV)	WS	D	0.013	J	0.010	0.075	µg/L	B210996	S210420
2104128-01	Se(VI)	WS	D	1.18		0.010	0.055	µg/L	B210996	S210420
2104128-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B210996	S210420
2104128-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B210996	S210420
2104128-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B210996	S210420
LC_DCEF_WS_2021-03-08_N_NAL										
2104128-02	Se	WS	TR	1.45		0.203	0.528	µg/L	B211007	S210429
LC_DCEF_WS_2021-03-08_N_NAL										
2104128-03	Se	WS	D	1.61		0.203	0.528	µg/L	B211007	S210429
LC_FRB_WS_2021-03-15_N										
2104128-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-04	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-04	Se(IV)	WS	D	0.193		0.010	0.075	µg/L	B210996	S210420
2104128-04	Se(VI)	WS	D	63.6		0.010	0.055	µg/L	B210996	S210420
2104128-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B210996	S210420
2104128-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-04	SeSO3	WS	D	≤ 0.010	J-1 U	0.010	0.055	µg/L	B210996	S210420
2104128-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B210996	S210420
LC_FRB_WS_2021-03-15_N_NAL										
2104128-05	Se	WS	TR	72.9		0.203	0.528	µg/L	B211007	S210429
LC_FRB_WS_2021-03-15_N_NAL										
2104128-06	Se	WS	D	67.5		0.203	0.528	µg/L	B211007	S210429

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_FRUS_WS_2021-03-16_N										
2104128-07	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-07	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-07	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-07	Se(IV)	WS	D	0.134		0.010	0.075	µg/L	B210996	S210420
2104128-07	Se(VI)	WS	D	53.8		0.010	0.055	µg/L	B210996	S210420
2104128-07	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B210996	S210420
2104128-07	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210996	S210420
2104128-07	SeSO3	WS	D	≤ 0.010	J-1 U	0.010	0.055	µg/L	B210996	S210420
2104128-07	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B210996	S210420
LC_FRUS_WS_2021-03-16_N_NAL										
2104128-08	Se	WS	TR	62.5		0.203	0.528	µg/L	B211007	S210429
LC_FRUS_WS_2021-03-16_N_NAL										
2104128-09	Se	WS	D	76.1		0.203	0.528	µg/L	B211007	S210429

Accuracy & Precision Summary

Batch: B210996
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B210996-BS1	**Blank Spike, (1923027)**								
	MeSe(IV)		5.095	5.437	µg/L	107%	75-125		
	Se(IV)		5.000	5.110	µg/L	102%	75-125		
	Se(VI)		5.000	4.915	µg/L	98%	75-125		
	SeCN		5.015	4.922	µg/L	98%	75-125		
	SeMet		4.932	4.722	µg/L	96%	75-125		
B210996-DUP8	**Duplicate, (2104128-07)**								
	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)	0.134		0.141	µg/L			5%	25
	Se(VI)	53.79		52.44	µg/L			3%	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
B210996-MS8	**Matrix Spike, (2104128-07)**								
	Se(IV)	0.134	4.900	4.979	µg/L	99%	75-125		
	Se(VI)	53.79	5.100	54.86	µg/L	NR	75-125		
	SeCN	ND	1.962	1.889	µg/L	96%	75-125		
	SeMet	ND	1.977	1.923	µg/L	97%	75-125		
B210996-MSD8	**Matrix Spike Duplicate, (2104128-07)**								
	Se(IV)	0.134	4.900	5.036	µg/L	100%	75-125	1%	25
	Se(VI)	53.79	5.100	56.21	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	2.105	µg/L	107%	75-125	11%	25
	SeMet	ND	1.977	1.963	µg/L	99%	75-125	2%	25

Accuracy & Precision Summary

Batch: B211007
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B211007-BS1	**Blank Spike, (2035012)**								
	Se		200.0	194.9	µg/L	97%	75-125		
B211007-BS2	**Blank Spike, (2035012)**								
	Se		200.0	191.3	µg/L	96%	75-125		
B211007-BS3	**Blank Spike, (2035012)**								
	Se		200.0	194.2	µg/L	97%	75-125		
B211007-BS4	**Blank Spike, (2035012)**								
	Se		200.0	191.1	µg/L	96%	75-125		
B211007-BS5	**Blank Spike, (2035012)**								
	Se		200.0	192.0	µg/L	96%	75-125		
B211007-SRM1	**Reference Material (2041020, TMDA 51.5 Reference Standard - Bottle 7 - SRM)**								
	Se		14.30	13.60	µg/L	95%	75-125		
B211007-SRM2	**Reference Material (2041020, TMDA 51.5 Reference Standard - Bottle 7 - SRM)**								
	Se		14.30	13.55	µg/L	95%	75-125		
B211007-SRM3	**Reference Material (2041020, TMDA 51.5 Reference Standard - Bottle 7 - SRM)**								
	Se		14.30	14.36	µg/L	100%	75-125		
B211007-SRM4	**Reference Material (2041020, TMDA 51.5 Reference Standard - Bottle 7 - SRM)**								
	Se		14.30	13.08	µg/L	91%	75-125		
B211007-SRM5	**Reference Material (2041020, TMDA 51.5 Reference Standard - Bottle 7 - SRM)**								
	Se		14.30	13.83	µg/L	97%	75-125		
B211007-DUP5	**Duplicate, (2104128-02)**								
	Se	1.448		1.377	µg/L			5%	20

Accuracy & Precision Summary

Batch: B211007
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B211007-MS5	**Matrix Spike, (2104128-02)**								
	Se	1.448	220.0	215.8	µg/L	97%	75-125		
B211007-MSD5	**Matrix Spike Duplicate, (2104128-02)**								
	Se	1.448	220.0	215.1	µg/L	97%	75-125	0.3%	20
B211007-DUP6	**Duplicate, (2104128-08)**								
	Se	62.45		64.91	µg/L			4%	20
B211007-MS6	**Matrix Spike, (2104128-08)**								
	Se	62.45	220.0	277.2	µg/L	98%	75-125		
B211007-MSD6	**Matrix Spike Duplicate, (2104128-08)**								
	Se	62.45	220.0	287.8	µg/L	102%	75-125	4%	20

Method Blanks & Reporting Limits

Batch: B210996
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-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
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-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
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B210996-BLK1	0.00	µg/L
B210996-BLK2	0.00	µg/L
B210996-BLK3	0.00	µg/L
B210996-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B211007
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B211007-BLK1	-0.087	µg/L
B211007-BLK2	0.017	µg/L
B211007-BLK3	0.012	µg/L
B211007-BLK4	-0.045	µg/L
B211007-BLK5	0.064	µg/L

Average: -0.008
Limit: 0.480

MDL: 0.185
MRL: 0.480

Sample Containers

Lab ID: 2104128-01
Sample: LC_DCEF_WS_2021-03-08_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/08/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128

Lab ID: 2104128-02
Sample: LC_DCEF_WS_2021-03-08_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/08/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #1 - 2104128

Lab ID: 2104128-03
Sample: LC_DCEF_WS_2021-03-08_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/08/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #1 - 2104128

Lab ID: 2104128-04
Sample: LC_FRB_WS_2021-03-15_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/15/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128

Sample Containers

Lab ID: 2104128-05
Sample: LC_FRB_WS_2021-03-15_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/15/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #1 - 2104128

Lab ID: 2104128-06
Sample: LC_FRB_WS_2021-03-15_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/15/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #1 - 2104128

Lab ID: 2104128-07
Sample: LC_FRUS_WS_2021-03-16_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/16/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #2 - 2104128

Lab ID: 2104128-08
Sample: LC_FRUS_WS_2021-03-16_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/16/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #1 - 2104128

Lab ID: 2104128-09
Sample: LC_FRUS_WS_2021-03-16_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 03/16/2021
Received: 04/15/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #1 - 2104128

Shipping Containers

Styrofoam Cooler #1 - 2104128

Received: April 15, 2021 7:00
Tracking No: 81005 via Courier
Coolant Type: Ice
Temperature: 1.4 °C

Description: Styrofoam Cooler #1
Damaged in transit? No
Returned to client? No
Comments: IR #30

Custody seals present? No
Custody seals intact? No
COC present? Yes

Styrofoam Cooler #2 - 2104128

Received: April 15, 2021 7:00
Tracking No: 81005 via Courier
Coolant Type: Ice
Temperature: 0.6 °C

Description: Styrofoam Cooler #2
Damaged in transit? No
Returned to client? No
Comments: IR #30

Custody seals present? No
Custody seals intact? No
COC present? Yes

COC ID:	Dry Creek March 2021	TURNAROUND TIME:	Regular

PROJECT/CLIENT INFO

Facility Name / Job#	REP
Project Manager	Cait Good
Email	cait.good@teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250.425.8257

LABORATORY

Lab Name	Brooks Applied Labs
Lab Contact	Ben Wozniak
Email	ben@brooksapplied.com
Address	18804 North Creek Parkway
City	Bothell
Province	WA
Postal Code	98011
Country	USA
Phone Number	206-632-6206

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	carlie.meyer@teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	cait.good@teck.com	X	X	X
Email 4:	[illegible]@mnnow.ca	X	X	X
Email 5:	[illegible]@mnnow.ca	X	X	X
Email 5:	[illegible]@mnnow.ca	X	X	X
PO number	625683			

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.	Total Selenium (HNO3, P)	Dissolved Selenium (HNO3, F/P)	Selenium Speciation (F)
LC_DCEF_WS_2021-03-08_N	LC_DCEF	WS	No	08-Mar-21	12:45	G	1			1
LC_DCEF_WS_2021-03-08_N_NAL	LC_DCEF	WS	No	08-Mar-21	12:45	G	2	1	1	
LC_FRB_WS_2021-03-15_N	LC_FRB	WS	No	15-Mar-21	13:45	G	1			1
LC_FRB_WS_2021-03-15_N_NAL	LC_FRB	WS	No	15-Mar-21	13:45	G	2	1	1	
LC_FRUS_WS_2021-03-16_N	RG_RIVER	WS	No	16-Mar-21	11:00	G	1			1
LC_FRUS_WS_2021-03-16_N_NAL	RG_RIVER	WS	No	16-Mar-21	11:00	G	2	1	1	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Samples for total selenium have been preserved in the field. Dissolve selenium have been filtered and preserved. Speciation samples have been filtered and frozen.

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Maddy Stokes	March 23, 2021	[signature] / BAL	4/15/21 6:50

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	Maddy Stokes	Mobile #	647-522-0672
Sampler's Signature	[signature]	Date/Time	March 23 2021

Confidential Teck

BAL Final Report 2104128

COC ID:	Dry Creek March 2021	TURNAROUND TIME:	Regular

PROJECT/CLIENT INFO

Facility Name / Job#	REP
Project Manager	Cait Good
Email	cait.good@teck.com
Address	421 Pine Avenue
City	Sparwood; Province: BC
Postal Code	V0B 2G0; Country: Canada
Phone Number	250.425.8257

LABORATORY

Lab Name	Brooks Applied Labs
Lab Contact	Ben Wozniak
Email	ben@brooksapplied.com
Address	18804 North Creek Parkway
City	Bothell; Province: WA
Postal Code	98011; Country: USA
Phone Number	206-632-6206

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	carlic.meyer@teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	cait.good@teck.com	X	X	X
Email 4:	dhasak@minnow.ca	X	X	X
Email 5:	kbatchelar@minnow.ca	X	X	X
Email 5:	mstokes@minnow.ca	X	X	X
PO number	625683			

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.	Total Selenium (HNO3; P)	Dissolved Selenium (HNO3; F/P)	Selenium Speciation (F)
LC_DCEF_WS_2021-03-08_N	LC_DCEF	WS	No	08-Mar-21	12:45	G	1			1
LC_DCEF_WS_2021-03-08_N_NAL	LC_DCEF	WS	No	08-Mar-21	12:45	G	2	1	1	
LC_FRB_WS_2021-03-15_N	LC_FRB	WS	No	15-Mar-21	13:45	G	1			1
LC_FRB_WS_2021-03-15_N_NAL	LC_FRB	WS	No	15-Mar-21	13:45	G	2	1	1	
LC_FRUS_WS_2021-03-16_N	RG_RIVER	WS	No	16-Mar-21	11:00	G	1			1
LC_FRUS_WS_2021-03-16_N_NAL	RG_RIVER	WS	No	16-Mar-21	11:00	G	2	1	1	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Samples for total selenium have been preserved in the field. Dissolve selenium have been filtered and preserved. Speciation samples have been filtered and frozen.

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Maddy Stokes	March 23, 2021	[illegible] / BAL	4/15/21 6:50

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	Maddy Stokes	Mobile #	647-522-0672
Sampler's Signature	MS	Date/Time	March 23 2021

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 84005

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

DATE April 14/21

INVOICE TO

BILL OF LADING #

PURCHASE ORDER NUMBER

CONSIGNEE (TO) Applied Loss

STREET

POSTAL CODE

CITY/PROVINCE WA

POSTAL CODE

DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
	120 lbs
AHV84005	

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

DECLARED VALUATION: Maximum liability of carrier $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

PICK UP BY · PICK UP TIME · DRIVER'S SIGNATURE - DELIVERY BY · FINISH TIME

CONSIGNEE PRINT
CONSIGNEE SIGN
DATE
TIME
NUMBER OF PIECES RECEIVED

WHITE: Office · YELLOW: Carrier · PINK: Consignee · GOLDENROD: Shipper

GST # 864540398RT0001

COPY

ID: Styrofoam Cooler #1 COC (Y/N) Temperature: 1.4 : 30

Type: Dry Blue Ice Ambient

Locations: CC 20-24 | WL | FK 4-07

	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Types:										
Liner Types:	120		40		40					

By: PJK Date: 4/15/21

2104128

Effective 7/29/20 Revision 004

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 84005

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

DATE

INVOICE TO

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM)

CONSIGNEE (TO)

STREET

STREET

POSTAL CODE

CITY/PROVINCE

POSTAL CODE

INSTRUCTIONS

DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)

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 OR D HERE

DECLARED VALUATION: Maximum liability of carrier $2.00 per lb. ($4.41 per kg) unless declared valuation states otherwise.

$

PICK UP TIME

DELIVERY BY

FINISH TIME

CONSIGNEE PRINT

CONSIGNEE SIGN

DATE

TIME

GST # 864540398RT0001

NUMBER OF PIECES RECEIVED

Cooler ID: Styrofoam Cooler #2 COC (Y/N) Temperature: 0.6 IR: 30

COPY

Coolant Type: Blue Ice Ambient

Sampling Locations:

FR 4-06		CC 4-12		RG		WL		FR 4-07	
T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
	120		120		120		120		120

Container Types:

Received By: OSM Date: 4/15/21

Effective 7/29/20

Revision 004

Benthic Invertebrate Community Taxonomy Laboratory Reports (Cordillera Consulting Inc.)

Project: Teck Dry Creek (19-09) Winter
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2019	2019	2019	2019	2019	2019
Sample:	LC_DC1_BIC-01_2019-12-04	LC_DC1_BIC-02_2019-12-04	LC_DC1_BIC-03_2019-12-04	LC_DCDS_BIC-01_2019-12-04	LC_DCDS_BIC-02_2019-12-04	LC_DCDS_BIC-03_2019-12-04
Sample Collection Date:	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19
CC#:	CC202675	CC202676	CC202677	CC202678	CC202679	CC202680
Phylum: Arthropoda	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	20	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0
Ameletus	0	0	0	100	0	20
| Family: Baetidae	20	320	540	120	140	80
Baetis	80	80	400	20	80	0
Baetis rhodani group	20	20	0	0	40	0
| Family: Ephemerellidae	720	520	340	560	1040	1020
Drunella	0	40	0	40	160	120
Drunella doddsii	100	140	60	60	100	60
| Family: Heptageniidae	3720	3040	3480	140	100	60
Cinygmula	320	140	140	40	80	60
Epeorus	0	40	0	0	0	0
Rhithrogena	0	20	20	0	0	0
| Order: Plecoptera	0	0	20	0	0	0
| Family: Capniidae	0	0	0	0	20	20
| Family: Chloroperlidae	60	40	0	20	0	20
Suwallia	20	0	0	0	0	0
Sweltsa	300	120	40	40	60	60
| Family: Leuctridae	0	0	0	20	0	0
Paraleuctra	20	60	0	0	0	0
| Family: Nemouridae	40	120	120	20	140	20
Visoka cataractae	0	20	0	0	0	0
Zapada	920	1240	1380	740	920	860
Zapada oregonensis group	400	400	260	60	280	240
Zapada cinctipes	60	120	80	20	120	180
Zapada columbiana	60	140	220	120	360	300
| Family: Peltoperlidae	0	0	0	0	0	20
| Family: Perlodidae	0	60	0	60	180	100
Isoperla	0	0	0	0	0	40
Kogotus	80	40	120	20	20	20
Megarcys	20	0	20	40	40	60
| Family: Taeniopterygidae	0	40	80	0	0	0
Taenionema	20	0	100	0	0	0
| Order: Trichoptera	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	20
Anagapetus	0	0	40	0	20	0
| Family: Hydropsychidae	20	0	20	0	0	40

Project: Teck Dry Creek (19-09) Winter
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2019	2019	2019	2019	2019	2019
Sample:	LC_DC1_BIC-01_2019-12-04	LC_DC1_BIC-02_2019-12-04	LC_DC1_BIC-03_2019-12-04	LC_DCDS_BIC-01_2019-12-04	LC_DCDS_BIC-02_2019-12-04	LC_DCDS_BIC-03_2019-12-04
Sample Collection Date:	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19
CC#:	CC202675	CC202676	CC202677	CC202678	CC202679	CC202680
Parapsyche	100	360	140	80	260	260
Parapsyche elsis	40	20	20	80	60	100
| Family: Limnephilidae	20	0	0	60	0	20
Ecclisomyia	20	20	0	260	100	100
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	0	20	20	160	80	240
Rhyacophila betteni group	0	0	40	20	40	20
Rhyacophila brunnea/vemna group	0	40	0	0	40	20
Rhyacophila hyalinata group	0	0	20	0	40	80
Rhyacophila vofixa group	0	0	0	0	100	20
Rhyacophila atrata complex	0	0	20	0	0	0
Rhyacophila narvae	160	40	20	80	20	40
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	600	2360	1840	520	240	360
| Order: Coleoptera	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	20	0
| Family: Elmidae	0	0	0	0	0	0
Heterlimnius	0	0	0	60	0	0
| Order: Diptera	0	0	0	0	0	0
| Family: Chironomidae	0	20	0	0	0	0
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0
Microtendipes	20	0	0	0	0	0
Polypedilum	0	0	0	120	0	40
| Tribe: Tanytarsini	1060	220	180	2780	1220	840
Micropsectra	240	80	60	2940	740	520
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	0	60	0	40	0	60
Pagastia	120	120	140	0	20	40
Pseudodiamesa	20	20	0	320	80	100
| Subfamily: Orthocladiinae	0	0	0	0	0	0
Brillia	0	40	60	40	20	0
Cricotopus (Nostococladius)	120	200	380	40	200	540
Eukiefferiella	180	940	880	380	900	1280
Hydrobaenus	20	0	0	0	0	0
Limnophyes	0	0	0	20	0	0
Orthocladius complex	40	0	0	380	160	140
Parametriocnemus	20	0	20	100	60	0
Parorthocladius	0	0	0	20	0	0
Rheocricotopus	80	80	0	20	0	20

Project: Teck Dry Creek (19-09) Winter
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2019	2019	2019	2019	2019	2019
Sample:	LC_DC1_BIC-01_2019-12-04	LC_DC1_BIC-02_2019-12-04	LC_DC1_BIC-03_2019-12-04	LC_DCDS_BIC-01_2019-12-04	LC_DCDS_BIC-02_2019-12-04	LC_DCDS_BIC-03_2019-12-04
Sample Collection Date:	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19
CC#:	CC202675	CC202676	CC202677	CC202678	CC202679	CC202680
Tvetenia	2140	3440	3360	1120	2700	2580
| Subfamily: Tanypodinae	0	0	0	0	0	0
Zavrelimyia	0	0	0	20	0	0
| Family: Empididae	0	20	0	0	20	0
Chelifera/ Metachela	0	20	20	0	100	40
Neoplasta	0	20	0	0	20	20
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	20	0	0	0
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	200	160	60	40	0	0
| Family: Simuliidae	0	0	0	100	60	0
Simulium	0	40	160	900	1060	80
| Family: Tipulidae	0	0	0	0	0	0
Antocha	0	0	0	20	0	0
Dicranota	20	20	0	0	0	20
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0
Feltria	40	20	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0
Atractides	0	0	0	0	20	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	0	0	0	40	0	0
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	0	80	0	0	40	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0
Rhynchelmis	0	20	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0
Enchytraeus	0	0	0	20	40	20
| Family: Naididae	0	0	0	0	0	0
Nais	0	0	0	20	0	0
Totals:	**12260**	**15240**	**14940**	**13040**	**12380**	**11020**
Taxa present but not included:						

Project: Teck Dry Creek (19-09) Winter
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2019	2019	2019	2019	2019	2019
Sample:	LC_DC1_BIC-01_2019-12-04	LC_DC1_BIC-02_2019-12-04	LC_DC1_BIC-03_2019-12-04	LC_DCDS_BIC-01_2019-12-04	LC_DCDS_BIC-02_2019-12-04	LC_DCDS_BIC-03_2019-12-04
Sample Collection Date:	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19	04-Dec-19
CC#:	CC202675	CC202676	CC202677	CC202678	CC202679	CC202680
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0
| Class: Ostracoda	20	0	20	20	20	20
Phylum: Nemata	0	20	0	0	20	0
Phylum: Platyhelminthes	0	0	0	0	0	0
| Class: Turbellaria	20	20	20	20	20	20
Totals:	**40**	**40**	**40**	**40**	**60**	**40**

Note: 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.

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC3_BIC-01_2020-05-07	LC_DC3_BIC-02_2020-05-07	LC_DC3_BIC-03_2020-05-07	LC_DCEF_BIC-01_2020-05-06	LC_DCEF_BIC-02_2020-05-06	LC_DCEF_BIC-03_2020-05-06	LC_SPDC_BIC-01_2020-05-05	LC_SPDC_BIC-02_2020-05-05	LC_SPDC_BIC-03_2020-05-05
Sample Collection Date:	07-May-20	07-May-20	07-May-20	06-May-20	06-May-20	06-May-20	05-May-20	05-May-20	05-May-20
CC#:	CC210041	CC210042	CC210043	CC210044	CC210045	CC210046	CC210047	CC210048	CC210049
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	9	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0
Ameletus	0	0	0	0	18	27	0	3	0
| Family: Baetidae	0	0	0	0	0	0	0	0	0
Baetis	0	0	0	0	53	36	0	0	0
Baetis rhodani group	0	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	0	0	0	0	0	0	0	0	0
Drunella	0	0	0	112	129	64	25	0	0
Drunella coloradensis	0	0	0	0	12	0	0	0	0
Drunella doddsii	20	14	10	25	6	27	0	6	0
Drunella spinifera	0	0	0	0	0	0	0	0	0
| Family: Heptageniidae	10	0	0	762	265	173	0	0	0
Cinygmula	0	0	0	162	100	36	0	0	0
Epeorus	0	0	0	0	0	0	0	0	0
Rhithrogena	0	0	0	0	6	18	0	0	0
| Order: Plecoptera	10	0	0	0	0	0	0	0	0
| Family: Capniidae	0	7	0	0	0	0	0	0	0
Capnura	0	0	0	0	0	0	0	0	0
| Family: Chloroperlidae	40	29	40	250	35	91	0	0	0
Haploperla	0	0	0	0	0	9	0	0	0
Suwallia	0	0	0	0	0	0	0	0	0
Sweltsa	30	0	20	62	41	45	0	0	0
| Family: Leuctridae	30	0	0	0	0	0	0	0	0
Paraleuctra	0	0	10	0	6	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	27	0	11	16
Ostrocerca	0	0	0	0	0	0	12	0	0
Visoka cataractae	0	0	20	0	0	18	0	0	0
Zapada	350	193	380	362	100	182	0	8	0
Zapada oregonensis group	50	0	0	0	0	0	56	17	0
Zapada cinctipes	0	0	0	0	0	0	0	0	0
Zapada columbiana	0	0	0	0	0	0	0	0	0
| Family: Peltoperlidae	10	7	10	75	12	9	0	0	0
Yoraperla	30	14	40	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	0	0
Hesperoperla	0	0	0	0	0	0	0	0	0
| Family: Perlodidae	0	14	30	38	12	36	6	3	8
Isoperla	0	0	0	0	0	0	6	0	0
Kogotus	0	0	0	0	0	0	0	0	0
Megarcys	60	0	0	0	0	0	0	0	0
| Family: Taeniopterygidae	0	0	10	0	0	0	0	0	0
| Order: Trichoptera	0	0	0	0	6	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0	0	0
| Family: Glossosomatidae	10	0	10	0	0	0	0	0	0
Anagapetus	0	0	0	0	0	0	0	0	0
| Family: Hydropsychidae	0	0	0	0	0	0	0	0	0
Parapsyche	0	0	0	0	0	0	6	0	0
Parapsyche elsis	0	0	0	0	0	0	12	6	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	10	0	0	9	0	0	0
Chyranda centralis	10	0	0	0	0	0	0	0	0

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Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC3_BIC-01_2020-05-07	LC_DC3_BIC-02_2020-05-07	LC_DC3_BIC-03_2020-05-07	LC_DCEF_BIC-01_2020-05-06	LC_DCEF_BIC-02_2020-05-06	LC_DCEF_BIC-03_2020-05-06	LC_SPDC_BIC-01_2020-05-05	LC_SPDC_BIC-02_2020-05-05	LC_SPDC_BIC-03_2020-05-05
Sample Collection Date:	07-May-20	07-May-20	07-May-20	06-May-20	06-May-20	06-May-20	05-May-20	05-May-20	05-May-20
CC#:	CC210041	CC210042	CC210043	CC210044	CC210045	CC210046	CC210047	CC210048	CC210049
Dicosmoecus	0	0	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0	0	3	0
| **Family: Rhyacophilidae**	0	0	0	0	0	0	0	0	0
Rhyacophila	60	79	160	38	12	55	44	19	8
Rhyacophila betteni group	0	0	0	0	0	9	0	0	0
Rhyacophila brunnea/vemna group	40	21	0	0	12	18	0	0	4
Rhyacophila hyalinata group	0	7	0	0	6	0	6	3	0
Rhyacophila vofixa group	100	14	50	12	0	0	0	0	0
Rhyacophila atrata complex	10	0	0	0	0	0	0	0	0
Rhyacophila narvae	0	0	0	0	0	0	0	0	0
Rhyacophila verrula group	0	0	0	0	0	9	0	0	0
| **Family: Thremmatidae**	0	0	0	0	0	0	0	0	0
Oligophlebodes	20	7	10	25	0	0	6	11	0
| **Family: Uenoidae**	0	0	0	0	0	0	0	0	0
Neothremma	0	0	0	0	0	0	0	0	0
| **Order: Coleoptera**	0	0	0	0	0	0	0	0	0
| **Family: Elmidae**	0	0	0	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	0	0	0	0
| **Family: Staphylinidae**	0	0	0	0	0	0	0	0	0
| **Order: Diptera**	0	0	0	0	0	0	0	0	0
| **Order: Tipuloidea**	0	0	10	0	0	0	0	0	0
| **Family: Ceratopogonidae**	0	0	0	0	0	0	0	0	0
Mallochohelea	0	14	0	0	0	0	0	0	0
| **Family: Chironomidae**	30	0	10	0	12	36	50	25	16
| **Subfamily: Chironominae**	0	0	0	0	0	0	0	0	0
| **Tribe: Chironomini**	0	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	27	0	0	0
Stictochironomus	0	0	0	0	0	0	0	0	0
| **Tribe: Tanytarsini**	0	36	0	38	12	27	0	6	0
Constempellina sp. C	0	0	0	0	0	0	0	0	0
Micropsectra	880	714	500	1888	635	1327	44	42	40
Sublettea	0	0	0	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0	6	11	0
| **Subfamily: Diamesinae**	0	0	0	0	0	0	0	0	0
| **Tribe: Diamesini**	0	0	0	0	0	0	0	0	0
Diamesa	0	0	0	0	0	0	44	25	44
Pagastia	60	36	150	25	112	127	0	6	0
Pseudodiamesa	0	0	0	0	12	0	0	0	0
| **Subfamily: Orthocladiinae**	10	7	10	12	0	0	0	3	8
Brillia	30	14	10	75	18	36	0	0	0
Corynoneura	0	7	0	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	6	0	0
Eukiefferiella	800	614	1010	62	112	309	850	644	1064
Heleniella	0	0	0	0	0	0	0	0	0
Heterotrissocladius	0	0	0	0	0	0	0	0	0
Hydrobaenus	0	0	0	0	0	0	0	0	0
Limnophyes	230	321	240	38	6	0	0	8	0
Metriocnemus	0	0	0	0	6	36	0	0	0
Orthocladius complex	160	150	520	25	71	127	38	78	116
Orthocladius lignicola	0	0	0	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0	0	0	0
Parametriocnemus	10	0	0	0	0	0	12	0	8
Paraphaenocladius	0	0	0	0	0	9	0	0	0
Parasmittia carinata	0	0	0	0	0	0	0	0	0
Parorthocladius	0	0	30	0	6	0	0	0	4

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Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC3_BIC-01_2020-05-07	LC_DC3_BIC-02_2020-05-07	LC_DC3_BIC-03_2020-05-07	LC_DCEF_BIC-01_2020-05-06	LC_DCEF_BIC-02_2020-05-06	LC_DCEF_BIC-03_2020-05-06	LC_SPDC_BIC-01_2020-05-05	LC_SPDC_BIC-02_2020-05-05	LC_SPDC_BIC-03_2020-05-05
Sample Collection Date:	07-May-20	07-May-20	07-May-20	06-May-20	06-May-20	06-May-20	05-May-20	05-May-20	05-May-20
CC#:	CC210041	CC210042	CC210043	CC210044	CC210045	CC210046	CC210047	CC210048	CC210049
Rheocricotopus	0	0	0	62	18	9	0	0	0
Stilocladius	0	0	0	0	6	9	0	0	0
Thienemanniella	0	0	0	0	6	9	0	0	0
Tvetenia	20	36	30	38	6	9	0	0	4
Zalutschia	0	0	0	0	0	0	0	0	0
| Subfamily: Prodiamesinae	0	0	0	0	0	0	0	0	0
Monodiamesa	0	0	0	0	0	0	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0	0	0	0	0
| Family: Empididae	0	0	0	0	12	9	0	0	0
Clinocera	0	0	0	12	0	0	0	0	0
Neoplasta	0	0	30	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	29	20	0	18	18	0	0	0
| Family: Simuliidae	10	0	20	25	0	9	169	22	20
Helodon	0	0	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0	0	0
Simulium	140	36	100	0	0	0	562	97	148
| Family: Tipulidae	0	0	0	0	0	0	0	0	0
| Family: Limoniidae	0	0	0	0	0	0	0	0	0
| Family: Pediciidae	0	0	0	0	0	0	0	0	0
Antocha	0	0	0	0	0	0	0	0	0
Dicranota	0	21	30	0	0	0	0	0	0
Eloeophila	0	0	0	0	0	0	0	0	0
Ulomorpha	0	0	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	20	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0	0
Aturus	0	7	0	12	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0	0
Feltria	0	0	10	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0	0
Lebertia	10	0	10	0	6	0	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0	0
Sperchon	0	0	0	0	0	0	0	0	0
Sperchonopsis	10	0	0	0	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0	0
Torrenticola	0	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	18	0	0	4
| Family: Hydrozetidae	0	0	0	0	18	27	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	0	0

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Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC3_BIC-01_2020-05-07	LC_DC3_BIC-02_2020-05-07	LC_DC3_BIC-03_2020-05-07	LC_DCEF_BIC-01_2020-05-06	LC_DCEF_BIC-02_2020-05-06	LC_DCEF_BIC-03_2020-05-06	LC_SPDC_BIC-01_2020-05-05	LC_SPDC_BIC-02_2020-05-05	LC_SPDC_BIC-03_2020-05-05
Sample Collection Date:	07-May-20	07-May-20	07-May-20	06-May-20	06-May-20	06-May-20	05-May-20	05-May-20	05-May-20
CC#:	CC210041	CC210042	CC210043	CC210044	CC210045	CC210046	CC210047	CC210048	CC210049
Phylum: Annelida	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	36	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	14	0	50	29	136	0	0	0
Enchytraeus	0	0	40	0	6	9	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0	0	0
Totals:	**3290**	**2462**	**3610**	**4285**	**1958**	**3266**	**1960**	**1057**	**1512**
Taxa present but not included:									
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	0	0	0	6	18	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	10	7	10	12	6	9	6	3	4
| Class: Branchiopoda	0	0	0	0	0	0	0	0	0
| Order: Cladocera	10	0	0	0	0	0	0	3	0
| Class: Maxillipoda	0	0	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	0	0	9	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	0	0	0	0	0	0	0
Phylum: Nemata	0	0	0	0	0	9	0	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	10	7	10	0	0	0	0	3	4
Totals:	**30**	**14**	**20**	**12**	**12**	**45**	**6**	**9**	**8**

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.

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-05-05	LC_DCDS_BIC-02_2020-05-05	LC_DCDS_BIC-03_2020-05-05	LC_DC2_BIC-01_2020-05-06	LC_DC2_BIC-02_2020-05-06	LC_DC2_BIC-03_2020-05-06	LC_DC4_BIC-01_2020-05-04	LC_DC4_BIC-02_2020-05-04	LC_DC4_BIC-03_2020-05-04
Sample Collection Date:	05-May-20	05-May-20	05-May-20	06-May-20	06-May-20	06-May-20	04-May-20	04-May-20	04-May-20
CC#:	CC210050	CC210051	CC210052	CC210053	CC210054	CC210055	CC210056	CC210057	CC210058
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	2	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0
Ameletus	0	27	0	0	0	2	0	0	0
| Family: Baetidae	25	27	0	0	0	0	88	20	240
Baetis	38	27	38	15	0	4	612	440	700
Baetis rhodani group	0	0	0	0	0	0	12	20	80
| Family: Ephemerellidae	362	218	550	15	0	4	100	80	220
Drunella	12	36	12	0	0	0	338	500	360
Drunella coloradensis	0	0	0	0	0	0	0	0	0
Drunella doddsii	12	0	25	23	7	0	0	20	40
Drunella spinifera	0	0	0	0	0	0	0	0	0
| Family: Heptageniidae	650	582	412	31	20	13	600	820	1280
Cinygmula	0	18	0	0	0	4	150	300	380
Epeorus	0	0	0	0	0	0	0	0	0
Rhithrogena	0	0	0	0	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	0	0	0
| Family: Capniidae	0	0	0	0	0	0	0	0	0
Capnura	0	0	0	0	0	0	0	0	0
| Family: Chloroperlidae	25	27	25	8	0	9	75	260	260
Haploperla	0	0	0	0	0	0	0	0	0
Suwallia	12	0	0	0	0	0	0	0	0
Sweltsa	50	27	50	8	27	2	50	0	80
| Family: Leuctridae	0	0	12	0	0	0	12	0	0
Paraleuctra	0	0	0	0	0	2	0	0	0
| Family: Nemouridae	0	0	12	8	0	2	0	0	0
Ostrocerca	0	9	12	0	0	0	12	0	20
Visoka cataractae	0	0	0	0	0	0	0	0	0
Zapada	825	855	400	200	207	122	250	240	640
Zapada oregonensis group	112	0	12	0	7	2	0	20	0
Zapada cinctipes	0	0	0	8	0	0	0	40	0
Zapada columbiana	50	9	0	8	7	2	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	0	0
Hesperoperla	0	0	0	0	0	0	0	0	0
| Family: Perlodidae	12	18	12	54	7	4	12	40	0
Isoperla	0	18	0	0	0	0	0	0	0
Kogotus	12	0	0	0	0	9	0	0	20
Megarcys	38	0	0	0	20	4	12	120	20
| Family: Taeniopterygidae	0	0	0	0	0	0	0	0	0
| Order: Trichoptera	38	18	12	0	7	2	0	0	0
| Family: Brachycentridae	0	0	0	0	0	2	0	0	0
Micrasema	0	0	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	9	0	0	0	0	0	0	0
Anagapetus	0	18	0	0	0	0	0	0	0
| Family: Hydropsychidae	25	0	0	0	33	20	0	0	0
Parapsyche	88	73	50	8	0	9	12	0	100
Parapsyche elsis	88	9	25	38	33	4	12	80	80
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	12	0	0	0	0	0	0
Chyranda centralis	12	0	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-05-05	LC_DCDS_BIC-02_2020-05-05	LC_DCDS_BIC-03_2020-05-05	LC_DC2_BIC-01_2020-05-06	LC_DC2_BIC-02_2020-05-06	LC_DC2_BIC-03_2020-05-06	LC_DC4_BIC-01_2020-05-04	LC_DC4_BIC-02_2020-05-04	LC_DC4_BIC-03_2020-05-04
Sample Collection Date:	05-May-20	05-May-20	05-May-20	06-May-20	06-May-20	06-May-20	04-May-20	04-May-20	04-May-20
CC#:	CC210050	CC210051	CC210052	CC210053	CC210054	CC210055	CC210056	CC210057	CC210058
Dicosmoecus	0	0	0	0	0	0	0	0	0
Ecclisomyia	0	9	12	0	0	11	12	140	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0	0
Rhyacophila	412	291	312	492	420	100	250	60	260
Rhyacophila betteni group	12	0	0	8	7	29	0	0	0
Rhyacophila brunnea/vemna group	0	0	0	0	7	0	0	0	0
Rhyacophila hyalinata group	38	9	0	0	7	4	0	0	20
Rhyacophila vofixa group	25	0	50	0	0	2	0	0	0
Rhyacophila atrata complex	0	0	0	0	0	0	0	0	0
Rhyacophila narvae	25	0	0	0	0	0	12	40	20
Rhyacophila verrula group	0	0	0	0	0	0	100	20	60
| Family: Thremmatidae	0	0	0	0	0	0	0	0	0
Oligophlebodes	125	36	175	223	173	69	225	260	80
| Family: Uenoidae	0	0	0	0	0	0	0	0	0
Neothremma	0	0	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0	0
| Family: Elmidae	12	0	12	0	7	0	0	0	0
Heterlimnius	0	0	0	0	0	2	0	0	0
| Family: Staphylinidae	0	0	0	0	93	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Order: Tipuloidea	0	0	0	0	0	2	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	12	60	0
| Family: Chironomidae	150	100	150	46	13	9	112	140	160
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	0	0	0
Polypedilum	12	9	62	0	13	0	0	20	0
Stictochironomus	0	0	0	0	0	0	0	0	0
| Tribe: Tanytarsini	200	73	338	492	293	24	12	1460	200
Constempellina sp. C	0	0	0	0	0	0	0	0	0
Micropsectra	325	209	475	200	127	49	162	1560	500
Sublettea	0	0	0	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0
Diamesa	12	18	12	0	0	0	0	0	0
Pagastia	25	18	0	46	40	11	88	160	40
Pseudodiamesa	0	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	25	31	7	2	0	0	0
Brillia	0	36	12	15	20	11	75	20	20
Corynoneura	0	0	0	15	0	2	0	0	0
Cricotopus (Nostococladius)	38	36	200	185	100	44	12	0	0
Diplocladius cultriger	0	0	0	0	0	0	0	0	0
Eukiefferiella	400	309	525	338	167	16	375	160	320
Heleniella	0	0	0	0	0	0	0	0	0
Heterotrissocladius	0	0	0	0	0	0	0	0	0
Hydrobaenus	0	0	0	0	0	0	0	0	0
Limnophyes	0	0	0	0	7	2	0	0	0
Metriocnemus	0	0	0	0	0	0	0	0	0
Orthocladius complex	50	36	75	38	47	2	412	40	380
Orthocladius lignicola	0	0	0	0	0	2	0	0	0
Parakiefferiella	0	0	0	0	0	0	0	0	0
Parametriocnemus	25	36	50	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0	0	0	0
Parasmittia carinata	0	0	0	0	0	0	0	0	0
Parorthocladius	0	0	38	0	7	0	0	0	20

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Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-05-05	LC_DCDS_BIC-02_2020-05-05	LC_DCDS_BIC-03_2020-05-05	LC_DC2_BIC-01_2020-05-06	LC_DC2_BIC-02_2020-05-06	LC_DC2_BIC-03_2020-05-06	LC_DC4_BIC-01_2020-05-04	LC_DC4_BIC-02_2020-05-04	LC_DC4_BIC-03_2020-05-04
Sample Collection Date:	05-May-20	05-May-20	05-May-20	06-May-20	06-May-20	06-May-20	04-May-20	04-May-20	04-May-20
CC#:	CC210050	CC210051	CC210052	CC210053	CC210054	CC210055	CC210056	CC210057	CC210058
Rheocricotopus	0	0	0	15	0	0	0	20	0
Stilocladius	0	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0	0
Tvetenia	125	100	38	123	173	42	50	140	60
Zalutschia	0	0	0	0	0	0	0	0	0
| Subfamily: Prodiamesinae	0	0	0	0	0	0	0	0	0
Monodiamesa	0	0	0	0	0	0	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	2	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0	0	0	0	0
| Family: Empididae	0	9	12	0	0	0	0	20	0
Clinocera	0	0	0	0	0	0	0	0	0
Neoplasta	12	9	0	0	0	4	0	0	20
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	9	0	54	0	36	50	80	80
| Family: Simuliidae	0	27	0	0	7	4	12	0	40
Helodon	0	0	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0	0	0
Simulium	38	9	50	0	0	0	12	0	0
| Family: Tipulidae	0	0	0	0	0	0	0	0	0
| Family: Limoniidae	0	0	0	0	0	2	0	0	0
| Family: Pediciidae	12	18	0	0	0	0	0	0	0
Antocha	0	0	0	0	0	0	0	0	0
Dicranota	0	0	12	8	13	27	12	40	20
Eloeophila	0	0	0	0	0	0	0	0	0
Ulomorpha	0	0	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	7	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0	0
Aturus	12	0	0	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0	0
Lebertia	0	0	0	0	0	0	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0	0
Sperchon	0	9	0	0	0	0	0	0	0
Sperchonopsis	0	0	0	0	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0	0
Torrenticola	0	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	20	2	0	0	0
| Family: Hydrozetidae	0	0	0	15	0	0	0	20	0
Phylum: Mollusca	0	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	0	0

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Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-05-05	LC_DCDS_BIC-02_2020-05-05	LC_DCDS_BIC-03_2020-05-05	LC_DC2_BIC-01_2020-05-06	LC_DC2_BIC-02_2020-05-06	LC_DC2_BIC-03_2020-05-06	LC_DC4_BIC-01_2020-05-04	LC_DC4_BIC-02_2020-05-04	LC_DC4_BIC-03_2020-05-04
Sample Collection Date:	05-May-20	05-May-20	05-May-20	06-May-20	06-May-20	06-May-20	04-May-20	04-May-20	04-May-20
CC#:	CC210050	CC210051	CC210052	CC210053	CC210054	CC210055	CC210056	CC210057	CC210058
Phylum: Annelida	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	12	27	0	85	7	13	0	0	20
Enchytraeus	0	0	0	54	27	7	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0	0	0
Totals:	**4583**	**3467**	**4306**	**2907**	**2184**	**756**	**4342**	**7460**	**6840**
Taxa present but not included:									
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	12	9	12	8	7	2	12	20	20
| Class: Branchiopoda	0	0	0	0	0	0	0	0	0
| Order: Cladocera	0	0	0	0	0	0	0	0	0
| Class: Maxillipoda	0	0	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	0	0	0	4	0	0	0
Phylum: Nemata	0	0	0	8	7	0	0	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	12	9	12	8	7	2	12	20	0
Totals:	**24**	**18**	**24**	**24**	**21**	**8**	**24**	**40**	**20**

ND designation of a taxa represents a non-d

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Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC1_BIC-01_2020-05-04	_DC1_BIC-02_2020-05	LC_DC1_BIC-03_2020-05-04	LC_FRUS_BIC-01_2020-05-08	LC_FRUS_BIC-02_2020-05-08	LC_FRUS_BIC-03_2020-05-08	LC_FRB_BIC-01_2020-05-08	LC_FRB_BIC-02_2020-05-08	LC_FRB_BIC-03_2020-05-08
Sample Collection Date:	04-May-20	04-May-20	04-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20
CC#:	CC210059	CC210060	CC210061	CC210062	CC210063	CC210064	CC210065	CC210066	CC210067
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	7	0	20	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0
Ameletus	0	0	0	18	56	13	75	40	140
| Family: Baetidae	100	100	133	0	0	7	0	0	60
Baetis	320	350	33	0	3	0	80	140	60
Baetis rhodani group	260	67	50	0	3	7	0	0	0
| Family: Ephemerellidae	60	133	100	0	0	0	0	40	20
Drunella	80	183	83	0	6	60	15	140	40
Drunella coloradensis	0	0	0	0	0	0	0	0	0
Drunella doddsii	20	67	67	0	0	0	0	0	0
Drunella spinifera	0	0	0	4	0	0	15	0	0
| Family: Heptageniidae	1360	967	983	43	112	120	235	580	60
Cinygmula	80	83	50	18	19	7	90	160	0
Epeorus	0	0	0	0	0	7	20	100	0
Rhithrogena	0	0	0	0	3	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	0	0	20
| Family: Capniidae	0	0	0	21	6	40	10	0	20
Capnura	0	0	0	32	0	40	0	0	0
| Family: Chloroperlidae	60	17	0	4	9	0	10	40	20
Haploperla	0	0	0	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0	0	0	0
Sweltsa	60	17	50	0	16	0	30	0	0
| Family: Leuctridae	0	0	0	0	0	0	0	40	0
Paraleuctra	0	0	0	0	0	0	5	0	0
| Family: Nemouridae	20	0	0	54	56	193	55	100	100
Ostrocerca	0	0	17	96	88	260	105	360	180
Visoka cataractae	0	0	0	0	0	0	0	0	0
Zapada	1400	1383	1317	57	91	200	105	660	540
Zapada oregonensis group	20	0	33	4	3	0	5	20	0
Zapada cinctipes	40	0	33	11	3	7	5	20	40
Zapada columbiana	0	0	33	18	3	7	5	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	0	0
Hesperoperla	0	0	0	7	3	0	0	0	0
| Family: Perlodidae	60	0	100	46	31	67	0	100	100
Isoperla	0	0	0	50	38	120	20	20	0
Kogotus	0	133	0	0	0	13	10	60	0
Megarcys	20	33	0	14	3	80	20	80	20
| Family: Taeniopterygidae	0	0	0	0	0	0	0	0	0
| Order: Trichoptera	0	0	0	0	0	7	5	0	0
| Family: Brachycentridae	0	0	0	0	0	7	0	0	0
Micrasema	0	0	0	4	0	0	0	40	0
| Family: Glossosomatidae	0	0	0	0	0	0	0	0	0
Anagapetus	0	0	0	0	0	0	0	0	0
| Family: Hydropsychidae	20	17	0	0	0	0	0	0	0
Parapsyche	0	83	83	0	0	0	0	0	0
Parapsyche elsis	240	33	50	0	0	7	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	3	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	0	0	0	0
Chyranda centralis	0	0	0	0	0	0	0	0	0

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Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC1_BIC-01_2020-05-04	_DC1_BIC-02_2020-05	LC_DC1_BIC-03_2020-05-04	LC_FRUS_BIC-01_2020-05-08	LC_FRUS_BIC-02_2020-05-08	LC_FRUS_BIC-03_2020-05-08	LC_FRB_BIC-01_2020-05-08	LC_FRB_BIC-02_2020-05-08	LC_FRB_BIC-03_2020-05-08
Sample Collection Date:	04-May-20	04-May-20	04-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20
CC#:	CC210059	CC210060	CC210061	CC210062	CC210063	CC210064	CC210065	CC210066	CC210067
Dicosmoecus	0	0	0	0	0	7	5	20	0
Ecclisomyia	0	17	0	21	12	7	10	40	120
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0	0
Rhyacophila	260	217	133	39	25	147	55	120	120
Rhyacophila betteni group	20	0	0	0	6	0	0	0	20
Rhyacophila brunnea/vemna group	0	0	17	4	3	7	15	160	0
Rhyacophila hyalinata group	0	0	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	0	0
Rhyacophila atrata complex	0	0	0	0	0	0	5	0	0
Rhyacophila narvae	20	0	0	0	0	0	0	40	0
Rhyacophila verrula group	0	0	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0	0
Oligophlebodes	1020	783	867	0	0	0	0	40	0
| Family: Uenoidae	0	0	0	0	0	0	0	0	0
Neothremma	0	0	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0	120	0
Heterlimnius	0	0	0	11	0	13	0	0	20
| Family: Staphylinidae	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Order: Tipuloidea	0	0	0	0	0	0	15	20	0
| Family: Ceratopogonidae	0	0	17	0	0	0	5	0	0
Mallochohelea	0	0	0	0	0	0	0	0	0
| Family: Chironomidae	80	17	17	18	19	7	25	180	160
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	6	0	0	0	0
Polypedilum	0	0	0	25	3	7	15	20	20
Stictochironomus	0	0	0	0	0	0	0	0	20
| Tribe: Tanytarsini	460	50	183	71	6	73	55	100	60
Constempellina sp. C	0	0	0	4	3	7	0	0	0
Micropsectra	460	200	217	232	259	247	655	1280	1840
Sublettea	0	0	0	0	0	0	5	0	0
Tanytarsus	0	0	0	0	3	7	0	20	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0
Diamesa	0	0	0	0	0	0	0	0	0
Pagastia	60	67	50	0	16	7	15	80	140
Pseudodiamesa	0	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	20	0	0	21	28	27	10	0	20
Brillia	40	17	0	21	3	27	0	20	0
Corynoneura	0	0	17	21	25	7	30	0	20
Cricotopus (Nostococladius)	540	417	50	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0	0	0
Eukiefferiella	260	150	67	57	6	60	25	60	220
Heleniella	0	0	0	4	0	0	0	0	0
Heterotrissocladius	0	0	0	7	9	0	5	20	20
Hydrobaenus	0	0	0	0	9	13	20	100	0
Limnophyes	0	0	0	7	3	0	0	0	0
Metriocnemus	0	0	0	0	0	0	0	0	0
Orthocladius complex	20	67	33	39	88	160	465	960	1140
Orthocladius lignicola	0	0	0	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0	5	20	0
Parametriocnemus	0	0	33	11	0	13	0	0	0
Paraphaenocladius	0	0	0	0	0	0	5	0	0
Parasmittia carinata	0	0	0	0	0	0	5	0	0
Parorthocladius	0	0	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC1_BIC-01_2020-05-04	_DC1_BIC-02_2020-05	LC_DC1_BIC-03_2020-05-04	LC_FRUS_BIC-01_2020-05-08	LC_FRUS_BIC-02_2020-05-08	LC_FRUS_BIC-03_2020-05-08	LC_FRB_BIC-01_2020-05-08	LC_FRB_BIC-02_2020-05-08	LC_FRB_BIC-03_2020-05-08
Sample Collection Date:	04-May-20	04-May-20	04-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20
CC#:	CC210059	CC210060	CC210061	CC210062	CC210063	CC210064	CC210065	CC210066	CC210067
Rheocricotopus	20	0	0	43	34	7	25	0	0
Stilocladius	0	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	10	40	100
Tvetenia	160	83	350	39	12	33	50	60	100
Zalutschia	0	0	0	0	0	13	0	0	0
| Subfamily: Prodiamesinae	0	0	0	0	0	0	0	0	0
Monodiamesa	0	0	0	0	0	0	0	20	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	40	20
Zavrelimyia	0	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	21	66	7	10	0	40
| Family: Empididae	20	0	0	0	0	0	0	0	0
Clinocera	0	0	0	0	0	0	0	0	0
Neoplasta	20	0	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	80	133	150	4	22	0	35	220	480
| Family: Simuliidae	80	0	33	32	0	27	10	40	0
Helodon	0	0	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0	0	0
Simulium	0	0	0	7	0	0	10	0	0
| Family: Tipulidae	0	0	0	0	0	0	0	0	0
| Family: Limoniidae	0	0	0	0	0	0	0	0	0
| Family: Pediciidae	0	0	0	0	6	0	0	0	0
Antocha	0	0	0	0	0	0	0	60	0
Dicranota	100	17	50	0	0	0	5	40	20
Eloeophila	0	0	0	0	0	7	0	0	0
Ulomorpha	0	0	0	0	0	0	0	60	0
| Order: Megaloptera	0	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0	0	20
| Order: Thysanoptera	0	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0	0	0	0
| Family: Aturidae	20	0	0	0	0	0	0	0	0
Aturus	0	0	0	11	16	7	10	20	40
| Family: Feltriidae	0	0	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0	0
Lebertia	0	0	17	7	38	20	50	160	240
| Family: Sperchontidae	0	0	0	0	0	0	0	0	0
Sperchon	0	17	0	4	0	0	5	0	0
Sperchonopsis	0	0	0	0	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0	0
Torrenticola	0	0	0	0	0	0	0	20	20
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0	0
| Order: Oribatida	0	17	0	11	0	13	0	0	0
| Family: Hydrozetidae	0	0	0	4	0	20	0	0	20
Phylum: Mollusca	0	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	0	20

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DC1_BIC-01_2020-05-04	_DC1_BIC-02_2020-05	LC_DC1_BIC-03_2020-05-04	LC_FRUS_BIC-01_2020-05-08	LC_FRUS_BIC-02_2020-05-08	LC_FRUS_BIC-03_2020-05-08	LC_FRB_BIC-01_2020-05-08	LC_FRB_BIC-02_2020-05-08	LC_FRB_BIC-03_2020-05-08
Sample Collection Date:	04-May-20	04-May-20	04-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20	08-May-20
CC#:	CC210059	CC210060	CC210061	CC210062	CC210063	CC210064	CC210065	CC210066	CC210067
Phylum: Annelida	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	67	0	4	3	7	25	0	0
Enchytraeus	0	117	17	0	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	10	20	120
Totals:	**7980**	**6119**	**5533**	**1301**	**1284**	**2280**	**2625**	**6980**	**6600**
Taxa present but not included:									
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	17	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	20	17	17	4	3	7	5	20	20
| Class: Branchiopoda	0	0	0	0	0	0	0	0	0
| Order: Cladocera	0	0	0	0	0	0	0	0	0
| Class: Maxillipoda	0	0	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	4	0	0	0	0	20
Phylum: Annelida	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	0	0	0	0	0	0	0
Phylum: Nemata	0	0	0	4	0	7	5	20	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	20	17	17	4	3	7	0	20	20
Totals:	**40**	**51**	**34**	**16**	**6**	**21**	**10**	**60**	**60**

ND designation of a taxa represents a non-d

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020
Sample:	LC_GRCK_BIC-01_2020-05-11	LC_GRCK_BIC-02_2020-05-11	LC_GRCK_BIC-03_2020-05-11
Sample Collection Date:	11-May-20	11-May-20	11-May-20
CC#:	CC210068	CC210069	CC210070
Phylum: Arthropoda	0	0	0
| Order: Collembola	22	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Ephemeroptera	0	0	0
| Family: Ameletidae	0	0	0
Ameletus	33	60	40
| Family: Baetidae	33	80	340
Baetis	911	1620	2220
Baetis rhodani group	200	280	180
| Family: Ephemerellidae	0	0	0
Drunella	22	20	0
Drunella coloradensis	0	0	0
Drunella doddsii	0	20	0
Drunella spinifera	0	0	0
| Family: Heptageniidae	333	440	400
Cinygmula	0	40	100
Epeorus	44	120	120
Rhithrogena	22	80	0
| Order: Plecoptera	0	0	0
| Family: Capniidae	0	0	0
Capnura	0	0	0
| Family: Chloroperlidae	89	40	100
Haploperla	0	0	0
Suwallia	0	0	0
Sweltsa	0	0	0
| Family: Leuctridae	11	100	0
Paraleuctra	0	20	0
| Family: Nemouridae	56	60	0
Ostrocerca	0	0	0
Visoka cataractae	100	100	500
Zapada	844	960	1280
Zapada oregonensis group	0	20	0
Zapada cinctipes	0	0	0
Zapada columbiana	0	0	0
| Family: Peltoperlidae	11	0	0
Yoraperla	22	0	0
| Family: Perlidae	0	0	0
Hesperoperla	0	0	0
| Family: Perlodidae	22	40	20
Isoperla	11	0	0
Kogotus	0	0	0
Megarcys	11	20	0
| Family: Taeniopterygidae	0	0	0
| Order: Trichoptera	0	40	0
| Family: Brachycentridae	0	0	0
Micrasema	0	0	20
| Family: Glossosomatidae	0	0	40
Anagapetus	0	40	0
| Family: Hydropsychidae	0	0	0
Parapsyche	0	0	0
Parapsyche elsis	0	20	0
| Family: Lepidostomatidae	0	0	0
Lepidostoma	0	0	0
| Family: Limnephilidae	0	0	20
Chyranda centralis	0	0	20

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
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250-494-7553

Site:	2020	2020	2020
Sample:	LC_GRCK_BIC-01_2020-05-11	LC_GRCK_BIC-02_2020-05-11	LC_GRCK_BIC-03_2020-05-11
Sample Collection Date:	11-May-20	11-May-20	11-May-20
CC#:	CC210068	CC210069	CC210070
Dicosmoecus	0	0	0
Ecclisomyia	11	0	0
| Family: Rhyacophilidae	0	0	0
Rhyacophila	89	360	160
Rhyacophila betteni group	0	0	0
Rhyacophila brunnea/vemna group	22	20	0
Rhyacophila hyalinata group	0	0	0
Rhyacophila vofixa group	0	0	0
Rhyacophila atrata complex	0	0	0
Rhyacophila narvae	11	0	0
Rhyacophila verrula group	0	0	0
| Family: Thremmatidae	0	0	0
Oligophlebodes	0	0	40
| Family: Uenoidae	0	0	0
Neothremma	378	220	280
| Order: Coleoptera	0	0	0
| Family: Elmidae	0	20	0
Heterlimnius	0	0	0
| Family: Staphylinidae	0	0	0
| Order: Diptera	0	0	0
| Order: Tipuloidea	0	0	0
| Family: Ceratopogonidae	0	0	0
Mallochohelea	0	0	0
| Family: Chironomidae	0	0	0
| Subfamily: Chironominae	0	0	0
| Tribe: Chironomini	0	0	0
Paracladopelma	0	0	0
Polypedilum	0	0	0
Stictochironomus	0	0	0
| Tribe: Tanytarsini	111	160	280
Constempellina sp. C	0	0	0
Micropsectra	400	580	600
Sublettea	0	0	0
Tanytarsus	0	0	0
| Subfamily: Diamesinae	0	0	0
| Tribe: Diamesini	0	0	0
Diamesa	0	0	0
Pagastia	11	20	60
Pseudodiamesa	0	0	0
| Subfamily: Orthocladiinae	11	40	40
Brillia	56	60	40
Corynoneura	0	0	0
Cricotopus (Nostococladius)	0	0	0
Diplocladius cultriger	0	0	0
Eukiefferiella	56	120	120
Heleniella	0	0	40
Heterotrissocladius	0	0	40
Hydrobaenus	0	0	0
Limnophyes	33	100	100
Metriocnemus	0	0	0
Orthocladius complex	0	0	20
Orthocladius lignicola	0	0	0
Parakiefferiella	0	0	0
Parametriocnemus	156	200	240
Paraphaenocladius	0	0	0
Parasmittia carinata	0	0	0
Parorthocladius	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
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250-494-7553

Site:	2020	2020	2020
Sample:	LC_GRCK_BIC-01_2020-05-11	LC_GRCK_BIC-02_2020-05-11	LC_GRCK_BIC-03_2020-05-11
Sample Collection Date:	11-May-20	11-May-20	11-May-20
CC#:	CC210068	CC210069	CC210070
Rheocricotopus	89	140	240
Stilocladius	0	0	0
Thienemanniella	0	0	0
Tvetenia	0	40	0
Zalutschia	0	0	0
| Subfamily: Prodiamesinae	0	0	0
Monodiamesa	0	0	0
| Subfamily: Tanypodinae	0	0	0
Zavrelimyia	0	0	0
| Tribe: Pentaneurini	0	0	0
Thienemannimyia group	0	0	0
| Family: Empididae	0	0	0
Clinocera	0	0	0
Neoplasta	0	0	20
| Family: Pelecorhynchidae	0	0	0
Glutops	11	0	20
| Family: Psychodidae	0	0	0
Pericoma/Telmatoscopus	0	20	20
| Family: Simuliidae	11	0	60
Helodon	22	0	0
Prosimulium/Helodon	100	100	80
Simulium	0	0	0
| Family: Tipulidae	0	0	0
| Family: Limoniidae	0	0	0
| Family: Pediciidae	0	0	0
Antocha	0	0	0
Dicranota	11	20	60
Eloeophila	0	0	0
Ulomorpha	0	0	0
| Order: Megaloptera	0	0	0
| Family: Sialidae	0	0	0
Sialis	0	0	0
| Order: Thysanoptera	0	0	0
Subphylum: Chelicerata	0	0	0
| Class: Arachnida	0	0	0
| Order: Trombidiformes	0	20	0
| Family: Aturidae	0	0	0
Aturus	0	0	0
| Family: Feltriidae	0	0	0
Feltria	0	0	0
| Family: Lebertiidae	0	0	0
Lebertia	0	0	0
| Family: Sperchontidae	0	0	0
Sperchon	0	0	0
Sperchonopsis	0	0	0
| Family: Torrenticolidae	0	0	0
Torrenticola	0	0	0
| Order: Sarcoptiformes	0	0	0
| Order: Oribatida	0	0	0
| Family: Hydrozetidae	0	0	0
Phylum: Mollusca	0	0	0
| Class: Bivalvia	0	0	0
| Order: Veneroida	0	0	0
| Family: Pisidiidae	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#1
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020
Sample:	LC_GRCK_BIC-01_2020-05-11	LC_GRCK_BIC-02_2020-05-11	LC_GRCK_BIC-03_2020-05-11
Sample Collection Date:	11-May-20	11-May-20	11-May-20
CC#:	CC210068	CC210069	CC210070
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Lumbriculida	0	0	0
| Family: Lumbriculidae	0	0	20
| Order: Tubificida	0	0	0
| Family: Enchytraeidae	0	0	0
Enchytraeus	0	0	20
| Family: Naididae	0	0	0
Nais	0	0	0
Totals:	**4386**	**6460**	**8000**
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
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	11	20	20
| Class: Branchiopoda	0	0	0
| Order: Cladocera	0	0	0
| Class: Maxillipoda	0	0	0
| Class: Copepoda	0	0	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	0	0	0
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	11	20	20
Totals:	**22**	**40**	**40**

ND designation of a taxa represents a non-d

Project: Teck Dry Creek LAEMP (20-24)#2
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-06-24	LC_DCDS_BIC-02_2020-06-24	LC_DCDS_BIC-03_2020-06-24	LC_DC1_BIC-01_2020-06-24	LC_DC1_BIC-02_2020-06-24	LC_DC1_BIC-03_2020-06-24
Sample Collection Date:	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20
CC#:	CC210071	CC210072	CC210073	CC210074	CC210075	CC210076
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0
Ameletus	110	183	40	0	20	0
| Family: Baetidae	10	17	0	0	60	0
Baetis	290	267	540	220	1000	980
Baetis rhodani group	90	183	200	240	320	140
| Family: Ephemerellidae	10	0	0	0	60	20
Drunella	70	183	310	220	180	0
Drunella coloradensis	290	183	310	340	380	140
Drunella doddsii	0	0	30	120	80	60
Drunella spinifera	0	0	0	0	20	0
| Family: Heptageniidae	290	350	260	280	360	400
Cinygmula	450	383	200	100	280	20
| Order: Plecoptera	0	0	0	0	0	0
| Family: Chloroperlidae	0	17	10	20	140	120
Sweltsa	90	100	10	40	40	20
| Family: Leuctridae	0	0	0	20	20	20
| Family: Nemouridae	0	0	0	0	0	0
Visoka cataractae	10	0	0	0	0	0
Zapada	110	117	160	420	500	200
Zapada oregonensis group	80	150	180	580	1120	700
Zapada columbiana	100	250	280	80	120	340
| Family: Perlodidae	40	0	10	60	60	0
Isoperla	0	33	0	20	0	0
Kogotus	10	17	0	80	180	20
Megarcys	10	0	10	20	40	0
| Order: Trichoptera	0	0	10	0	20	0
| Family: Hydropsychidae	0	0	0	20	20	20
Arctopsyche	0	0	10	0	0	0
Parapsyche	30	50	0	20	20	20
Parapsyche elsis	80	0	110	60	40	20
| Family: Limnephilidae	0	0	0	0	0	0
Chyranda centralis	0	0	20	0	0	0
Ecclisomyia	40	67	20	20	20	0
| Family: Rhyacophilidae	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#2
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-06-24	LC_DCDS_BIC-02_2020-06-24	LC_DCDS_BIC-03_2020-06-24	LC_DC1_BIC-01_2020-06-24	LC_DC1_BIC-02_2020-06-24	LC_DC1_BIC-03_2020-06-24
Sample Collection Date:	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20
CC#:	CC210071	CC210072	CC210073	CC210074	CC210075	CC210076
Rhyacophila	60	50	110	60	120	40
Rhyacophila betteni group	0	50	20	0	0	20
Rhyacophila brunnea/vemna group	0	17	0	0	0	0
Rhyacophila hyalinata group	10	0	0	0	0	20
Rhyacophila vofixa group	30	67	90	0	0	0
Rhyacophila alberta group	0	0	0	80	100	100
Rhyacophila narvae	0	0	0	40	0	0
Rhyacophila verrula group	10	17	20	0	40	20
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	50	67	50	520	800	1680
| Order: Coleoptera	0	0	0	0	0	0
| Family: Curculionidae	0	0	0	20	0	0
| Family: Elmidae	10	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0
| Family: Chironomidae	80	83	80	100	40	20
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0
Polypedilum	10	33	0	40	0	0
| Tribe: Tanytarsini	0	17	0	0	20	20
Micropsectra	1020	1250	730	3800	3420	3760
Rheotanytarsus	0	0	0	0	0	20
Stempellinella	0	0	0	0	20	20
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	220	283	180	80	20	120
Pagastia	30	67	10	60	40	40
Pseudodiamesa	0	17	20	20	20	0
| Subfamily: Orthocladiinae	0	0	0	0	20	0
Brillia	10	0	50	0	40	20
Cricotopus (Nostococladius)	30	183	60	140	220	40
Eukiefferiella	90	100	70	180	140	160
Orthocladius complex	110	150	30	200	120	240
Parametriocnemus	10	17	10	0	20	0
Parorthocladius	0	17	0	20	0	0
Rheocricotopus	140	217	80	100	40	20
Tvetenia	100	350	180	100	80	180
| Subfamily: Tanypodinae	0	0	0	0	0	0
Zavrelimyia	0	17	0	0	0	20

Project: Teck Dry Creek LAEMP (20-24)#2
Minnow Environmental (BC)
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-06-24	LC_DCDS_BIC-02_2020-06-24	LC_DCDS_BIC-03_2020-06-24	LC_DC1_BIC-01_2020-06-24	LC_DC1_BIC-02_2020-06-24	LC_DC1_BIC-03_2020-06-24
Sample Collection Date:	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20
CC#:	CC210071	CC210072	CC210073	CC210074	CC210075	CC210076
| Family: Empididae	10	0	30	20	20	20
Neoplasta	20	0	60	40	40	60
Wiedemannia	10	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	0	40	20	0
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	0	0	0	20	0
| Family: Simuliidae	10	0	20	0	0	20
Prosimulium	10	0	0	0	0	0
Prosimulium/Helodon	20	67	100	0	0	0
Simulium	0	0	0	20	0	40
| Family: Tipulidae	0	0	0	0	0	0
Dicranota	0	17	0	0	40	0
Rhabdomastix	0	0	20	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	0	0	10	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	10	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	20	0
| Family: Hydrozetidae	30	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	20	0	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	33	0	60	180	120
Enchytraeus	10	17	0	60	80	0
Totals:	**4360**	**5753**	**4750**	**8800**	**10840**	**10060**
Taxa present but not included:						

Project: Teck Dry Creek LAEMP (20-24)#2
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01_2020-06-24	LC_DCDS_BIC-02_2020-06-24	LC_DCDS_BIC-03_2020-06-24	LC_DC1_BIC-01_2020-06-24	LC_DC1_BIC-02_2020-06-24	LC_DC1_BIC-03_2020-06-24
Sample Collection Date:	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20	24-Jun-20
CC#:	CC210071	CC210072	CC210073	CC210074	CC210075	CC210076
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0
| Family: Cecidomyiidae	0	17	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0
| Class: Ostracoda	10	17	10	20	20	20
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Lumbricidae	0	0	10	0	0	0
Phylum: Nemata	0	0	0	20	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0
| Class: Turbellaria	10	17	10	20	20	20
Totals:	**20**	**51**	**30**	**60**	**40**	**40**

Notes: 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.

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_FRB_BIC-01_2020-08-28	LC_FRB_BIC-02_2020-08-28	LC_FRB_BIC-03_2020-08-28	LC_FRUS_BIC-01_2020-08-28	LC_FRUS_BIC-02_2020-08-29	LC_FRUS_BIC-03_2020-08-29	LC_GRCK_BIC-01_2020-08-29
Sample Collection Date:	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
CC#:	CC210548	CC210549	CC210550	CC210551	CC210552	CC210553	CC210554
Phylum: Arthropoda	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	60	0	20	0	40	120	0
| Family: Baetidae	20	160	200	300	360	140	100
Acentrella	20	0	20	60	0	20	0
Baetis	920	1040	580	1360	740	740	320
Baetis rhodani group	960	350	1000	1200	1520	1320	40
Baetis bicaudatus	20	0	0	0	0	0	0
| Family: Ephemerellidae	220	120	440	140	420	220	0
Drunella	0	10	0	0	0	0	0
Drunella coloradensis	0	0	0	40	0	80	0
Drunella doddsii	20	0	0	20	20	20	0
Drunella spinifera	100	20	0	0	40	40	0
Ephemerella	0	10	40	0	20	0	20
Ephemerella tibialis	0	0	0	0	40	40	0
| Family: Heptageniidae	1520	290	560	460	600	840	440
Cinygma	0	0	0	0	0	0	0
Cinygmula	0	0	20	0	20	20	0
Epeorus	60	10	40	80	60	20	900
Rhithrogena	0	0	0	0	0	0	40
| Order: Plecoptera	0	20	20	0	0	0	80
| Family: Capniidae	120	50	0	0	60	0	360
| Family: Chloroperlidae	20	0	20	0	40	20	60
Plumiperla	0	0	0	0	0	0	0
Sweltsa	40	10	60	40	120	20	40
| Family: Leuctridae	0	10	20	0	20	0	0
Paraleuctra	0	0	0	0	0	0	20
| Family: Nemouridae	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	220
Zapada	240	110	540	300	260	280	500
Zapada oregonensis group	80	50	260	180	260	180	20
Zapada cinctipes	40	0	160	40	100	0	60
Zapada columbiana	0	20	0	40	140	40	1320
| Family: Peltoperlidae	0	0	0	0	0	0	40
Yoraperla	0	0	0	0	0	0	80
| Family: Perlidae	0	0	0	0	0	0	0
Hesperoperla	0	0	0	20	0	20	0
| Family: Perlodidae	420	170	320	1680	800	600	160
Kogotus	0	50	40	80	120	60	20
Megarcys	60	20	0	100	20	40	40
| Family: Taeniopterygidae	160	40	20	0	60	120	0
| Order: Trichoptera	0	50	20	20	20	20	0
| Family: Apataniidae	0	0	0	0	0	0	0
Pedomoecus sierra	0	0	0	0	20	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0
| Family: Glossosomatidae	40	0	20	20	0	0	0
| Family: Hydropsychidae	100	50	20	120	60	40	120
Parapsyche elsis	0	10	20	60	0	0	0
| Family: Limnephilidae	0	0	0	0	0	0	0
Clostoeca disjuncta	0	0	0	0	0	0	0
Cryptochia	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_FRB_BIC-01_2020-08-28	LC_FRB_BIC-02_2020-08-28	LC_FRB_BIC-03_2020-08-28	LC_FRUS_BIC-01_2020-08-28	LC_FRUS_BIC-02_2020-08-29	LC_FRUS_BIC-03_2020-08-29	LC_GRCK_BIC-01_2020-08-29
Sample Collection Date:	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
CC#:	CC210548	CC210549	CC210550	CC210551	CC210552	CC210553	CC210554
Dicosmoecus	0	0	0	0	20	0	0
Ecclisomyia	0	0	0	0	0	0	0
| **Family: Rhyacophilidae**	0	0	0	0	0	0	0
Rhyacophila	0	50	80	40	180	20	380
Rhyacophila betteni group	20	0	0	0	0	0	0
Rhyacophila brunnea/vemna group	140	100	260	280	260	120	20
Rhyacophila hyalinata group	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	100
Rhyacophila atrata complex	100	30	60	0	60	20	0
Rhyacophila narvae	0	10	20	20	100	0	120
| **Family: Thremmatidae**	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	0	0	0
| **Family: Uenoidae**	0	0	0	0	0	0	0
Neothremma	0	0	0	0	0	0	240
| **Order: Coleoptera**	0	0	0	0	0	0	0
| **Family: Amphizoidae**	0	0	0	0	0	0	0
Amphizoa	0	0	0	0	0	0	0
| **Family: Curculionidae**	0	0	0	0	0	0	0
| **Family: Dytiscidae**	0	0	0	0	0	0	0
| **Family: Elmidae**	120	90	380	180	280	160	0
Heterlimnius	60	20	220	160	320	140	0
| **Family: Staphylinidae**	0	0	0	0	0	0	0
| **Order: Diptera**	0	0	0	0	0	0	0
| **Family: Ceratopogonidae**	0	0	0	0	0	0	0
Mallochohelea	20	0	20	0	0	0	0
| **Family: Chironomidae**	420	390	140	280	200	40	80
| **Subfamily: Chironominae**	0	0	0	0	0	0	0
| **Tribe: Chironomini**	0	0	0	0	0	0	0
Chironomus	0	10	0	0	0	0	0
| **Tribe: Tanytarsini**	0	0	20	20	0	0	0
Micropsectra	40	10	0	0	20	0	20
Stempellinella	0	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0	0
| **Subfamily: Diamesinae**	0	0	0	0	0	0	0
| **Tribe: Boreoheptagyiini**	0	0	0	0	0	0	0
Boreoheptagyia	0	0	0	0	0	0	0
| **Tribe: Diamesini**	0	0	0	0	0	0	0
Diamesa	40	10	20	0	0	0	0
Pagastia	140	80	180	60	140	40	0
Pseudodiamesa	0	0	0	0	0	0	0
| **Subfamily: Orthocladiinae**	0	0	0	0	0	0	0
Brillia	0	10	0	20	0	0	160
Corynoneura	0	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0
Eukiefferiella	1480	990	700	780	400	80	100
Hydrobaenus	20	10	20	40	20	40	0
Limnophyes	0	0	20	20	20	0	60
Metriocnemus	0	0	0	0	0	0	0
Orthocladius complex	1540	900	1020	640	340	80	80
Orthocladius lignicola	0	0	0	0	0	0	0
Parametriocnemus	0	0	0	20	0	0	0
Parorthocladius	20	0	0	0	0	0	0
Rheocricotopus	140	40	100	40	60	20	40
Thienemanniella	0	0	0	0	0	0	0
Tvetenia	180	100	400	320	220	100	140
| **Subfamily: Podonominae**	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_FRB_BIC-01_2020-08-28	LC_FRB_BIC-02_2020-08-28	LC_FRB_BIC-03_2020-08-28	LC_FRUS_BIC-01_2020-08-28	LC_FRUS_BIC-02_2020-08-29	LC_FRUS_BIC-03_2020-08-29	LC_GRCK_BIC-01_2020-08-29
Sample Collection Date:	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
CC#:	CC210548	CC210549	CC210550	CC210551	CC210552	CC210553	CC210554
| Tribe: Boreochlini	0	0	0	0	0	0	0
Boreochlus	0	0	0	0	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0
| Tribe: Procladiini	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0
| Family: Dixidae	0	0	0	0	0	0	20
| Family: Empididae	0	0	0	0	0	0	0
Clinocera	0	0	0	40	0	0	20
Neoplasta	20	40	20	80	80	80	0
Oreogeton	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0
Glutops	0	0	0	20	20	0	0
| Family: Psychodidae	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	360	110	300	140	120	40	80
| Family: Simuliidae	20	0	0	0	0	0	20
Simulium	40	0	0	80	40	0	0
| Family: Tipulidae	0	20	20	0	0	0	20
Antocha	0	10	80	0	0	0	0
Dicranota	0	0	0	0	0	0	20
| Family: Limoniidae	0	0	0	0	0	0	0
Eloeophila	0	0	0	20	0	0	0
Rhabdomastix	0	0	0	0	0	0	0
Tipula	0	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0	0
| Family: Corixidae	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0
| Order: Trombidiformes	20	0	20	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	0	0	0	20	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0
Albertathyas	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_FRB_BIC-01_2020-08-28	LC_FRB_BIC-02_2020-08-28	LC_FRB_BIC-03_2020-08-28	LC_FRUS_BIC-01_2020-08-28	LC_FRUS_BIC-02_2020-08-29	LC_FRUS_BIC-03_2020-08-29	LC_GRCK_BIC-01_2020-08-29
Sample Collection Date:	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
CC#:	CC210548	CC210549	CC210550	CC210551	CC210552	CC210553	CC210554
| Family: Hygrobatidae	20	0	0	0	0	0	0
Atractides	0	0	0	0	0	0	40
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	280	100	240	120	240	240	0
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	20	0	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	20	0	20	20	0	20	0
Suborder: Prostigmata	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	0	0	20	0	0	0	20
| Family: Hydrozetidae	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0
Pisidium	20	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	40	0	0	0	0
Enchytraeus	0	0	0	0	0	0	40
| Family: Naididae	0	0	0	0	0	0	0
Nais	40	0	40	0	0	0	0
Totals:	**10580**	**5800**	**8920**	**9820**	**9120**	**6300**	**6820**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	20	10	0	20	20	0	20
| Class: Branchiopoda	0	0	0	0	0	0	0
| Order: Cladocera	0	0	0	20	0	0	0
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	0	0	0	0
Phylum: Nemata	20	10	0	20	20	20	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0
| Class: Turbellaria	20	10	20	0	20	20	20
Totals:	**60**	**30**	**20**	**60**	**60**	**40**	**40**

Notes: 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.

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_GRCK_BIC-02_2020-08-29	LC_GRCK_BIC-03_2020-08-29	LC_DCDS_BIC-01_2020-09-01	LC_DCDS_BIC-02_2020-09-01	LC_DCDS_BIC-03_2020-09-01	LC_SPDC_BIC-01_2020-09-01	LC_SPDC_BIC-02_2020-09-01
Sample Collection Date:	29-Aug-20	29-Aug-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20
CC#:	CC210555	CC210556	CC210557	CC210558	CC210559	CC210560	CC210561
Phylum: Arthropoda	0	0	0	0	0	0	0
| Order: Collembola	60	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	20	0	0	0	0	0	0
| Family: Baetidae	0	12	40	60	40	0	20
Acentrella	0	0	0	0	0	0	0
Baetis	420	212	520	440	140	0	60
Baetis rhodani group	120	38	140	160	20	20	0
Baetis bicaudatus	0	0	0	0	0	0	0
| Family: Ephemerellidae	0	0	1580	1320	1100	220	240
Drunella	0	0	0	0	20	0	0
Drunella coloradensis	0	0	0	0	0	0	0
Drunella doddsii	40	0	140	20	160	0	20
Drunella spinifera	0	0	0	0	0	0	0
Ephemerella	0	0	0	0	0	0	0
Ephemerella tibialis	0	0	0	0	0	0	0
| Family: Heptageniidae	380	188	180	220	120	0	0
Cinygma	0	0	0	0	0	0	0
Cinygmula	60	38	0	0	0	0	0
Epeorus	1060	738	20	0	0	0	0
Rhithrogena	60	12	0	0	0	0	0
| Order: Plecoptera	0	0	0	60	0	0	0
| Family: Capniidae	680	88	0	20	0	0	0
| Family: Chloroperlidae	60	25	80	0	20	0	0
Plumiperla	0	0	0	0	0	0	0
Sweltsa	60	38	0	0	0	0	0
| Family: Leuctridae	40	12	20	20	20	0	0
Paraleuctra	0	0	0	0	0	0	0
| Family: Nemouridae	0	38	60	120	20	0	0
Visoka cataractae	520	138	0	0	0	0	0
Zapada	820	200	660	820	440	140	80
Zapada oregonensis group	100	12	220	300	280	60	20
Zapada cinctipes	0	0	20	0	0	0	0
Zapada columbiana	1900	750	880	1140	460	0	20
| Family: Peltoperlidae	0	25	0	0	0	0	0
Yoraperla	0	12	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0
Hesperoperla	0	0	0	0	0	0	0
| Family: Perlodidae	240	25	80	200	100	0	20
Kogotus	0	0	40	40	0	20	0
Megarcys	20	100	20	0	0	0	0
| Family: Taeniopterygidae	0	0	0	0	0	0	0
| Order: Trichoptera	0	12	280	160	120	0	140
| Family: Apataniidae	0	0	0	0	0	0	0
Pedomoecus sierra	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0	0
| Family: Hydropsychidae	40	0	4140	4560	2800	420	260
Parapsyche elsis	20	25	100	120	120	80	20
| Family: Limnephilidae	0	50	20	80	0	0	20
Clostoeca disjuncta	0	0	0	0	0	0	0
Cryptochia	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_GRCK_BIC-02_2020-08-29	LC_GRCK_BIC-03_2020-08-29	LC_DCDS_BIC-01_2020-09-01	LC_DCDS_BIC-02_2020-09-01	LC_DCDS_BIC-03_2020-09-01	LC_SPDC_BIC-01_2020-09-01	LC_SPDC_BIC-02_2020-09-01
Sample Collection Date:	29-Aug-20	29-Aug-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20
CC#:	CC210555	CC210556	CC210557	CC210558	CC210559	CC210560	CC210561
Dicosmoecus	0	0	0	0	0	0	0
Ecclisomyia	20	12	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila	420	200	80	20	20	0	0
Rhyacophila betteni group	0	0	0	40	0	0	0
Rhyacophila brunnea/vemna group	140	12	60	0	40	0	0
Rhyacophila hyalinata group	0	0	80	80	20	20	0
Rhyacophila vofixa group	0	0	20	20	20	0	0
Rhyacophila atrata complex	0	0	0	0	0	0	0
Rhyacophila narvae	100	38	20	20	100	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	60	20	0	40
| Family: Uenoidae	0	0	0	0	0	0	0
Neothremma	980	388	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Amphizoidae	0	0	0	0	0	0	0
Amphizoa	20	0	0	0	0	0	0
| Family: Curculionidae	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	20
| Family: Elmidae	0	0	0	0	0	0	0
Heterlimnius	20	12	0	20	0	0	0
| Family: Staphylinidae	0	0	20	0	0	0	0
| Order: Diptera	40	0	0	0	0	0	0
| Family: Ceratopogonidae	60	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0
| Family: Chironomidae	180	38	380	560	240	2000	720
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Chironomus	0	0	0	0	0	0	0
| Tribe: Tanytarsini	60	0	0	0	20	0	0
Micropsectra	140	25	0	0	0	180	40
Stempellinella	0	0	0	0	0	0	0
Tanytarsus	0	0	20	0	0	40	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0
| Tribe: Boreoheptagyiini	0	0	0	0	0	0	0
Boreoheptagyia	60	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0
Diamesa	0	0	80	80	60	100	100
Pagastia	0	0	20	0	40	0	20
Pseudodiamesa	0	0	0	0	0	300	260
| Subfamily: Orthocladiinae	20	0	100	20	0	20	0
Brillia	680	88	40	0	0	0	0
Corynoneura	20	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	80	60	0	0	0
Diplocladius cultriger	0	0	0	0	0	60	20
Eukiefferiella	180	88	1100	600	300	2620	840
Hydrobaenus	40	0	40	20	20	100	80
Limnophyes	60	0	0	0	20	0	0
Metriocnemus	0	0	0	0	0	0	0
Orthocladius complex	20	12	960	740	240	520	440
Orthocladius lignicola	0	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	20	20
Parorthocladius	20	0	100	60	20	140	60
Rheocricotopus	80	25	20	20	0	0	0
Thienemanniella	0	0	0	0	0	0	0
Tvetenia	500	112	460	800	360	40	40
| Subfamily: Podonominae	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_GRCK_BIC-02_2020-08-29	LC_GRCK_BIC-03_2020-08-29	LC_DCDS_BIC-01_2020-09-01	LC_DCDS_BIC-02_2020-09-01	LC_DCDS_BIC-03_2020-09-01	LC_SPDC_BIC-01_2020-09-01	LC_SPDC_BIC-02_2020-09-01
Sample Collection Date:	29-Aug-20	29-Aug-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20
CC#:	CC210555	CC210556	CC210557	CC210558	CC210559	CC210560	CC210561
| **Tribe: Boreochlini**	0	0	0	0	0	0	0
Boreochlus	20	0	0	0	0	0	0
| **Subfamily: Tanypodinae**	0	0	0	0	0	0	0
| **Tribe: Procladiini**	0	0	0	0	0	0	0
Procladius	0	0	20	0	0	0	0
| **Family: Dixidae**	0	0	0	0	0	0	0
| **Family: Empididae**	0	0	0	0	0	0	0
Clinocera	20	0	0	0	0	0	0
Neoplasta	0	0	40	80	0	0	0
Oreogeton	0	0	0	0	0	0	0
| **Family: Muscidae**	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0
| **Family: Pelecorhynchidae**	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0
| **Family: Psychodidae**	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	420	62	40	20	40	0	0
| **Family: Simuliidae**	0	0	120	0	20	1280	540
Simulium	20	0	580	780	1200	33700	6340
| **Family: Tipulidae**	40	0	0	20	0	0	0
Antocha	0	0	0	0	0	0	0
Dicranota	20	0	20	0	0	0	0
| **Family: Limoniidae**	0	0	0	0	0	0	0
Eloeophila	0	0	0	0	0	0	0
Rhabdomastix	0	12	0	0	0	0	0
Tipula	0	0	0	0	0	0	0
| **Order: Hemiptera**	0	0	0	0	0	0	0
| **Family: Corixidae**	0	0	0	0	0	0	0
| **Order: Thysanoptera**	20	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| **Class: Arachnida**	0	0	0	0	0	0	0
| **Order: Trombidiformes**	0	0	0	40	0	0	0
| **Family: Aturidae**	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0
| **Family: Feltriidae**	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	0
| **Family: Hydryphantidae**	0	0	0	0	0	0	0
Albertathyas	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	0

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Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_GRCK_BIC-02_2020-08-29	LC_GRCK_BIC-03_2020-08-29	LC_DCDS_BIC-01_2020-09-01	LC_DCDS_BIC-02_2020-09-01	LC_DCDS_BIC-03_2020-09-01	LC_SPDC_BIC-01_2020-09-01	LC_SPDC_BIC-02_2020-09-01
Sample Collection Date:	29-Aug-20	29-Aug-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20	01-Sep-20
CC#:	CC210555	CC210556	CC210557	CC210558	CC210559	CC210560	CC210561
| Family: Hygrobatidae	0	0	0	0	0	0	0
Atractides	20	25	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	0	0	40	20	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	0	12	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0
Suborder: Prostigmata	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0	0
| Family: Hydrozetidae	20	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0
Enchytraeus	20	25	20	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0
Totals:	**11200**	**3974**	**13800**	**14040**	**8780**	**42100**	**10500**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	0	20	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	20	12	0	20	20	20	20
| Class: Branchiopoda	0	0	0	0	0	0	0
| Order: Cladocera	0	12	0	0	0	20	20
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	0	0	0	20
Phylum: Nemata	20	0	20	20	0	20	20
Phylum: Platyhelminthes	0	0	0	0	0	0	0
| Class: Turbellaria	20	12	20	20	20	20	20
Totals:	**60**	**36**	**60**	**60**	**40**	**80**	**100**

Notes: ND designation of a taxa represents a non-distinct taxa

Project: Teck Dry Creek LAEMP (20-24)#3
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_SPDC_BIC-03_2020-09-01	LC_DC3_BIC-01_2020-09-02	LC_DC3_BIC-02_2020-09-02	LC_DC3_BIC-03_2020-09-02	LC_DC1_BIC-01_2020-09-02	LC_DC1_BIC-02_2020-09-02	LC_DC1_BIC-03_2020-09-02
Sample Collection Date:	01-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20
CC#:	CC210562	CC210563	CC210564	CC210565	CC210566	CC210567	CC210568
Phylum: Arthropoda	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	0	0
| Family: Baetidae	4	0	0	0	300	300	260
Acentrella	0	0	0	0	0	0	0
Baetis	0	20	0	0	860	1160	1040
Baetis rhodani group	0	0	0	0	1040	1520	360
Baetis bicaudatus	0	0	0	0	0	0	0
| Family: Ephemerellidae	57	60	80	80	1020	1480	960
Drunella	0	0	0	0	20	20	0
Drunella coloradensis	0	0	0	0	20	20	20
Drunella doddsii	0	20	20	0	200	440	100
Drunella spinifera	0	0	0	0	0	0	0
Ephemerella	0	0	0	0	0	0	0
Ephemerella tibialis	0	0	0	0	0	0	0
| Family: Heptageniidae	0	0	0	20	1660	2940	420
Cinygma	0	0	0	0	0	0	0
Cinygmula	0	0	0	0	0	60	0
Epeorus	0	0	0	0	40	40	0
Rhithrogena	0	0	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	20
| Family: Capniidae	0	140	20	20	20	0	0
| Family: Chloroperlidae	4	40	80	20	180	20	60
Plumiperla	0	40	0	0	0	0	0
Sweltsa	0	20	40	20	80	120	40
| Family: Leuctridae	0	40	20	0	0	40	0
Paraleuctra	0	0	0	0	0	20	0
| Family: Nemouridae	0	40	20	20	40	20	0
Visoka cataractae	0	40	20	40	0	0	0
Zapada	13	100	80	0	1100	2520	800
Zapada oregonensis group	0	40	140	20	740	1080	720
Zapada cinctipes	0	0	0	0	0	0	0
Zapada columbiana	0	980	1540	260	260	460	320
| Family: Peltoperlidae	0	0	0	0	0	0	0
Yoraperla	0	20	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0
Hesperoperla	0	0	0	0	0	0	0
| Family: Perlodidae	0	60	160	0	160	120	60
Kogotus	0	0	20	0	20	240	80
Megarcys	0	240	40	40	60	40	80
| Family: Taeniopterygidae	0	0	0	0	0	120	20
| Order: Trichoptera	22	0	0	0	260	220	160
| Family: Apataniidae	0	0	0	0	0	0	0
Pedomoecus sierra	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0	0
| Family: Hydropsychidae	39	0	0	40	740	740	340
Parapsyche elsis	0	0	0	0	120	120	180
| Family: Limnephilidae	35	20	0	0	60	0	0
Clostoeca disjuncta	0	0	0	0	0	0	0
Cryptochia	0	0	20	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_SPDC_BIC-03_2020-09-01	LC_DC3_BIC-01_2020-09-02	LC_DC3_BIC-02_2020-09-02	LC_DC3_BIC-03_2020-09-02	LC_DC1_BIC-01_2020-09-02	LC_DC1_BIC-02_2020-09-02	LC_DC1_BIC-03_2020-09-02
Sample Collection Date:	01-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20
CC#:	CC210562	CC210563	CC210564	CC210565	CC210566	CC210567	CC210568
Dicosmoecus	0	0	0	0	0	0	0
Ecclisomyia	0	0	40	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila	0	180	60	20	80	80	0
Rhyacophila betteni group	0	0	0	0	0	0	0
Rhyacophila brunnea/vemna group	0	60	40	40	80	20	0
Rhyacophila hyalinata group	0	60	0	20	0	20	40
Rhyacophila vofixa group	0	60	20	20	0	0	0
Rhyacophila atrata complex	0	0	0	0	0	20	0
Rhyacophila narvae	0	0	0	0	40	80	0
| Family: Thremmatidae	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	0	0	40
| Family: Uenoidae	0	0	0	0	0	0	0
Neothremma	0	40	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Amphizoidae	0	0	0	0	0	0	0
Amphizoa	0	0	0	0	0	0	0
| Family: Curculionidae	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	0	0
| Family: Staphylinidae	0	0	0	0	20	0	20
| Order: Diptera	0	60	20	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Mallochohelea	0	0	20	0	0	20	0
| Family: Chironomidae	161	360	880	860	760	1040	860
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Chironomus	0	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	20
Micropsectra	70	0	0	0	40	40	20
Stempellinella	0	0	0	0	20	20	0
Tanytarsus	9	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0
| Tribe: Boreoheptagyiini	0	0	0	0	0	0	0
Boreoheptagyia	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0
Diamesa	35	60	60	60	140	160	340
Pagastia	0	160	360	140	220	200	160
Pseudodiamesa	157	620	720	580	0	20	20
| Subfamily: Orthocladiinae	0	20	20	0	0	0	0
Brillia	0	0	20	0	0	20	0
Corynoneura	0	20	0	0	0	20	0
Cricotopus (Nostococladius)	0	0	0	0	60	80	80
Diplocladius cultriger	4	0	0	0	0	0	0
Eukiefferiella	96	1160	3500	2100	640	1000	1040
Hydrobaenus	296	480	680	820	120	460	280
Limnophyes	0	0	20	0	0	0	80
Metriocnemus	0	0	0	0	0	0	0
Orthocladius complex	461	800	1940	1800	480	600	1020
Orthocladius lignicola	0	20	0	0	0	20	0
Parametriocnemus	13	0	0	0	0	0	0
Parorthocladius	17	80	80	60	20	80	80
Rheocricotopus	0	0	0	0	1000	1260	620
Thienemanniella	0	0	0	0	0	20	0
Tvetenia	9	380	380	160	1220	2360	1040
| Subfamily: Podonominae	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_SPDC_BIC-03_2020-09-01	LC_DC3_BIC-01_2020-09-02	LC_DC3_BIC-02_2020-09-02	LC_DC3_BIC-03_2020-09-02	LC_DC1_BIC-01_2020-09-02	LC_DC1_BIC-02_2020-09-02	LC_DC1_BIC-03_2020-09-02
Sample Collection Date:	01-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20
CC#:	CC210562	CC210563	CC210564	CC210565	CC210566	CC210567	CC210568
| Tribe: Boreochlini	0	0	0	0	0	0	0
Boreochlus	0	0	0	0	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0
| Tribe: Procladiini	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0
| Family: Dixidae	0	0	0	0	0	0	0
| Family: Empididae	0	0	40	20	20	0	0
Clinocera	0	80	40	0	0	0	0
Neoplasta	0	20	0	0	60	20	0
Oreogeton	0	40	40	60	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0
Limnophora	4	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	20	0
| Family: Psychodidae	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	720	840	300	480	620	680
| Family: Simuliidae	39	0	20	20	20	0	20
Simulium	200	0	0	0	300	180	460
| Family: Tipulidae	0	0	80	0	0	40	0
Antocha	0	0	0	0	0	0	0
Dicranota	0	20	0	40	0	0	0
| Family: Limoniidae	0	0	0	0	0	0	0
Eloeophila	0	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0	0
Tipula	0	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0	0
| Family: Corixidae	4	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	20	0	0
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0
Feltria	0	60	100	40	0	0	0
| Family: Hydryphantidae	0	20	0	0	0	0	0
Albertathyas	0	40	40	20	0	0	0
Wandesia	96	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_SPDC_BIC-03_2020-09-01	LC_DC3_BIC-01_2020-09-02	LC_DC3_BIC-02_2020-09-02	LC_DC3_BIC-03_2020-09-02	LC_DC1_BIC-01_2020-09-02	LC_DC1_BIC-02_2020-09-02	LC_DC1_BIC-03_2020-09-02
Sample Collection Date:	01-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20	02-Sep-20
CC#:	CC210562	CC210563	CC210564	CC210565	CC210566	CC210567	CC210568
| Family: Hygrobatidae	0	0	20	0	0	0	0
Atractides	0	80	100	40	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	0	120	280	40	0	20	20
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	4	0	20	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0
Suborder: Prostigmata	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	0	0	20	20	0	0	0
| Family: Hydrozetidae	0	20	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0
Enchytraeus	0	20	0	0	0	0	20
| Family: Naididae	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0
Totals:	**1849**	**7780**	**12800**	**7860**	**14840**	**22400**	**13000**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	4	20	20	20	20	20	0
| Class: Branchiopoda	0	0	0	0	0	0	0
| Order: Cladocera	4	20	0	0	0	0	0
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	4	0	0	0	0	0	0
Phylum: Nemata	0	20	0	20	20	20	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0
| Class: Turbellaria	4	20	20	20	20	20	0
Totals:	**16**	**80**	**40**	**60**	**60**	**60**	**0**

Notes: ND designation of a taxa represents a non-distinct taxa

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCEF_BIC-01_2020-09-03	LC_DCEF_BIC-02_2020-09-02	LC_DCEF_BIC-03_2020-09-02	LC_DC2_BIC-01_2020-09-03	LC_DC2_BIC-02_2020-09-03	LC_DC2_BIC-03_2020-09-03	LC_DC4_BIC-01_2020-09-03
Sample Collection Date:	03-Sep-20	02-Sep-20	02-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20
CC#:	CC210569	CC210570	CC210571	CC210572	CC210573	CC210574	CC210575
Phylum: Arthropoda	0	0	0	0	0	0	0
| Order: Collembola	0	0	18	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	200	240	82	0	0	0	40
| Family: Baetidae	0	0	0	120	140	80	900
Acentrella	0	0	0	0	0	0	0
Baetis	0	0	9	620	780	580	4160
Baetis rhodani group	0	0	0	740	760	1280	3820
Baetis bicaudatus	0	0	0	0	0	0	0
| Family: Ephemerellidae	800	220	118	1160	1500	1740	1560
Drunella	183	80	182	0	20	20	0
Drunella coloradensis	17	80	0	0	0	0	0
Drunella doddsii	433	760	191	460	280	240	220
Drunella spinifera	0	0	0	0	0	0	0
Ephemerella	0	0	0	0	0	0	0
Ephemerella tibialis	0	0	0	0	0	0	0
| Family: Heptageniidae	1267	1240	482	700	720	600	2240
Cinygma	0	0	0	0	0	0	200
Cinygmula	0	0	9	0	20	0	0
Epeorus	0	0	0	0	0	0	0
Rhithrogena	17	40	0	0	0	0	0
| Order: Plecoptera	17	0	0	0	60	0	0
| Family: Capniidae	17	0	9	20	0	20	0
| Family: Chloroperlidae	183	300	91	60	60	40	260
Plumiperla	33	0	0	0	0	0	0
Sweltsa	383	420	173	60	0	0	380
| Family: Leuctridae	0	0	0	0	0	0	0
Paraleuctra	17	0	9	0	0	0	0
| Family: Nemouridae	0	0	18	20	0	0	0
Visoka cataractae	0	20	0	0	0	0	0
Zapada	0	20	0	1800	1340	1980	180
Zapada oregonensis group	33	60	9	320	280	180	160
Zapada cinctipes	0	0	0	0	880	340	20
Zapada columbiana	517	900	273	420	200	460	660
| Family: Peltoperlidae	17	60	18	0	0	0	0
Yoraperla	50	20	18	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0
Hesperoperla	0	0	0	0	0	0	0
| Family: Perlodidae	200	340	136	40	40	100	600
Kogotus	0	0	0	0	0	0	80
Megarcys	550	160	64	20	20	20	440
| Family: Taeniopterygidae	0	0	0	80	100	0	0
| Order: Trichoptera	0	0	9	260	80	340	580
| Family: Apataniidae	0	0	0	0	0	0	0
Pedomoecus sierra	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	20	0
| Family: Glossosomatidae	0	0	0	0	0	20	0
| Family: Hydropsychidae	0	0	0	2060	1640	1920	580
Parapsyche elsis	0	0	0	140	20	100	120
| Family: Limnephilidae	50	20	9	80	20	0	240
Clostoeca disjuncta	0	20	0	0	0	0	0
Cryptochia	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCEF_BIC-01_2020-09-03	LC_DCEF_BIC-02_2020-09-02	LC_DCEF_BIC-03_2020-09-02	LC_DC2_BIC-01_2020-09-03	LC_DC2_BIC-02_2020-09-03	LC_DC2_BIC-03_2020-09-03	LC_DC4_BIC-01_2020-09-03
Sample Collection Date:	03-Sep-20	02-Sep-20	02-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20
CC#:	CC210569	CC210570	CC210571	CC210572	CC210573	CC210574	CC210575
Dicosmoecus	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila	467	160	136	220	60	60	100
Rhyacophila betteni group	0	20	0	40	40	60	0
Rhyacophila brunnea/vemna group	133	0	9	40	0	80	0
Rhyacophila hyalinata group	0	0	0	100	0	20	80
Rhyacophila vofixa group	17	0	0	0	20	0	0
Rhyacophila atrata complex	0	0	0	0	0	0	0
Rhyacophila narvae	0	0	0	200	20	40	760
| Family: Thremmatidae	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	240	140	140	0
| Family: Uenoidae	0	0	0	0	0	0	0
Neothremma	0	0	9	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Amphizoidae	0	0	0	0	0	0	0
Amphizoa	0	0	0	0	0	0	0
| Family: Curculionidae	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	20	0
Heterlimnius	0	0	0	0	0	0	0
| Family: Staphylinidae	0	20	0	0	0	0	0
| Order: Diptera	0	0	9	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0
| Family: Chironomidae	150	180	36	240	200	360	600
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Chironomus	0	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0
Micropsectra	0	0	9	20	0	0	20
Stempellinella	0	0	0	0	0	0	20
Tanytarsus	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0
| Tribe: Boreoheptagyiini	0	0	0	0	0	0	0
Boreoheptagyia	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0
Diamesa	17	0	0	0	0	0	0
Pagastia	33	20	9	0	60	20	360
Pseudodiamesa	17	0	18	0	0	20	0
| Subfamily: Orthocladiinae	0	0	0	0	0	20	0
Brillia	17	0	0	100	100	40	0
Corynoneura	17	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	20	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0
Eukiefferiella	383	220	82	140	80	200	200
Hydrobaenus	0	20	0	60	160	60	440
Limnophyes	0	20	0	0	0	0	0
Metriocnemus	0	0	9	0	0	0	0
Orthocladius complex	83	140	45	60	0	80	300
Orthocladius lignicola	0	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	0	0
Parorthocladius	0	40	0	0	0	0	80
Rheocricotopus	17	60	27	0	0	0	80
Thienemanniella	0	0	0	0	0	0	0
Tvetenia	150	260	191	340	620	660	640
| Subfamily: Podonominae	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCEF_BIC-01_2020-09-03	LC_DCEF_BIC-02_2020-09-02	LC_DCEF_BIC-03_2020-09-02	LC_DC2_BIC-01_2020-09-03	LC_DC2_BIC-02_2020-09-03	LC_DC2_BIC-03_2020-09-03	LC_DC4_BIC-01_2020-09-03
Sample Collection Date:	03-Sep-20	02-Sep-20	02-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20
CC#:	CC210569	CC210570	CC210571	CC210572	CC210573	CC210574	CC210575
| Tribe: Boreochlini	0	0	0	0	0	0	0
Boreochlus	0	0	0	0	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0
| Tribe: Procladiini	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0
| Family: Dixidae	0	0	0	0	0	0	0
| Family: Empididae	0	0	0	0	0	0	0
Clinocera	0	0	18	0	0	0	0
Neoplasta	17	0	0	180	100	240	40
Oreogeton	33	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	217	40	164	120	100	180	80
| Family: Simuliidae	0	0	0	0	0	20	0
Simulium	0	0	0	140	0	40	40
| Family: Tipulidae	0	20	0	0	0	20	0
Antocha	0	0	0	0	0	0	0
Dicranota	50	40	18	0	0	0	0
| Family: Limoniidae	0	0	0	0	0	0	0
Eloeophila	0	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0	0
Tipula	17	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0	0
| Family: Corixidae	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	9	0	0	0	20
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	0	0	0	0	20	0	0
| Family: Feltriidae	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	20
| Family: Hydryphantidae	0	0	0	0	0	0	0
Albertathyas	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
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scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020
Sample:	LC_DCEF_BIC-01_2020-09-03	LC_DCEF_BIC-02_2020-09-02	LC_DCEF_BIC-03_2020-09-02	LC_DC2_BIC-01_2020-09-03	LC_DC2_BIC-02_2020-09-03	LC_DC2_BIC-03_2020-09-03	LC_DC4_BIC-01_2020-09-03
Sample Collection Date:	03-Sep-20	02-Sep-20	02-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20	03-Sep-20
CC#:	CC210569	CC210570	CC210571	CC210572	CC210573	CC210574	CC210575
| Family: Hygrobatidae	0	0	0	0	0	0	0
Atractides	33	0	18	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	133	20	45	0	0	0	20
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	0	0	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0
Suborder: Prostigmata	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0
Stygothrombium	33	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	0	20	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Enchytraeidae	17	0	0	0	0	20	0
Enchytraeus	0	0	9	0	0	120	0
| Family: Naididae	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0
Totals:	**7035**	**6300**	**2797**	**11440**	**10680**	**12600**	**21340**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Cecidomyiidae	17	0	9	0	0	20	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	17	20	9	20	20	20	20
| Class: Branchiopoda	0	0	0	0	0	0	0
| Order: Cladocera	0	0	0	0	0	0	0
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	0	0	0	0
Phylum: Nemata	17	20	9	20	20	20	20
Phylum: Platyhelminthes	0	0	0	0	0	0	0
| Class: Turbellaria	17	20	9	20	20	20	20
Totals:	**68**	**60**	**36**	**60**	**60**	**80**	**60**

Notes: ND designation of a taxa represents a non-distinct taxa

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020
Sample:	LC_DC4_BIC-02_2020-09-03	LC_DC4_BIC-03_2020-09-03
Sample Collection Date:	03-Sep-20	03-Sep-20
CC#:	CC210576	CC210577
Phylum: Arthropoda	0	0
| Order: Collembola	0	0
Subphylum: Hexapoda	0	0
| Class: Insecta	0	0
| Order: Ephemeroptera	0	0
| Family: Ameletidae	0	0
Ameletus	20	20
| Family: Baetidae	100	120
Acentrella	0	0
Baetis	640	1660
Baetis rhodani group	1940	4680
Baetis bicaudatus	0	0
| Family: Ephemerellidae	2660	1680
Drunella	0	0
Drunella coloradensis	40	60
Drunella doddsii	280	240
Drunella spinifera	0	0
Ephemerella	0	0
Ephemerella tibialis	0	0
| Family: Heptageniidae	980	520
Cinygma	0	0
Cinygmula	100	140
Epeorus	40	60
Rhithrogena	0	0
| Order: Plecoptera	0	20
| Family: Capniidae	0	0
| Family: Chloroperlidae	240	320
Plumiperla	20	0
Sweltsa	760	760
| Family: Leuctridae	0	20
Paraleuctra	20	40
| Family: Nemouridae	100	60
Visoka cataractae	0	0
Zapada	120	140
Zapada oregonensis group	500	840
Zapada cinctipes	0	20
Zapada columbiana	320	400
| Family: Peltoperlidae	0	0
Yoraperla	0	20
| Family: Perlidae	0	0
Hesperoperla	0	0
| Family: Perlodidae	220	460
Kogotus	60	40
Megarcys	200	280
| Family: Taeniopterygidae	0	0
| Order: Trichoptera	140	40
| Family: Apataniidae	0	0
Pedomoecus sierra	0	0
| Family: Brachycentridae	0	0
Brachycentrus americanus	0	20
| Family: Glossosomatidae	0	0
| Family: Hydropsychidae	320	440
Parapsyche elsis	100	160
| Family: Limnephilidae	180	140
Clostoeca disjuncta	0	0
Cryptochia	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020
Sample:	LC_DC4_BIC-02_2020-09-03	LC_DC4_BIC-03_2020-09-03
Sample Collection Date:	03-Sep-20	03-Sep-20
CC#:	CC210576	CC210577
Dicosmoecus	0	0
Ecclisomyia	0	0
| Family: Rhyacophilidae	0	0
Rhyacophila	80	80
Rhyacophila betteni group	0	40
Rhyacophila brunnea/vemna group	40	20
Rhyacophila hyalinata group	20	20
Rhyacophila vofixa group	20	20
Rhyacophila atrata complex	0	0
Rhyacophila narvae	260	260
| Family: Thremmatidae	0	0
Oligophlebodes	0	0
| Family: Uenoidae	0	0
Neothremma	0	0
| Order: Coleoptera	0	0
| Family: Amphizoidae	0	0
Amphizoa	0	0
| Family: Curculionidae	20	0
| Family: Dytiscidae	0	0
| Family: Elmidae	0	0
Heterlimnius	0	0
| Family: Staphylinidae	0	0
| Order: Diptera	0	20
| Family: Ceratopogonidae	0	0
Mallochohelea	0	0
| Family: Chironomidae	240	360
| Subfamily: Chironominae	0	0
| Tribe: Chironomini	0	0
Chironomus	0	0
| Tribe: Tanytarsini	0	0
Micropsectra	20	20
Stempellinella	0	0
Tanytarsus	0	0
| Subfamily: Diamesinae	0	0
| Tribe: Boreoheptagyiini	0	0
Boreoheptagyia	0	0
| Tribe: Diamesini	0	0
Diamesa	0	0
Pagastia	60	260
Pseudodiamesa	0	0
| Subfamily: Orthocladiinae	0	0
Brillia	0	20
Corynoneura	0	20
Cricotopus (Nostococladius)	0	0
Diplocladius cultriger	0	0
Eukiefferiella	80	300
Hydrobaenus	360	240
Limnophyes	20	0
Metriocnemus	0	0
Orthocladius complex	80	200
Orthocladius lignicola	0	0
Parametriocnemus	0	0
Parorthocladius	20	40
Rheocricotopus	240	200
Thienemanniella	0	0
Tvetenia	220	560
| Subfamily: Podonominae	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020
Sample:	LC_DC4_BIC-02_2020-09-03	LC_DC4_BIC-03_2020-09-03
Sample Collection Date:	03-Sep-20	03-Sep-20
CC#:	CC210576	CC210577
| Tribe: Boreochlini	0	0
Boreochlus	0	0
| Subfamily: Tanypodinae	0	0
| Tribe: Procladiini	0	0
Procladius	0	0
| Family: Dixidae	0	0
| Family: Empididae	0	0
Clinocera	0	0
Neoplasta	0	0
Oreogeton	0	0
| Family: Muscidae	0	0
Limnophora	0	0
| Family: Pelecorhynchidae	0	0
Glutops	0	0
| Family: Psychodidae	0	0
Pericoma/Telmatoscopus	160	40
| Family: Simuliidae	0	0
Simulium	60	20
| Family: Tipulidae	0	0
Antocha	0	0
Dicranota	80	0
| Family: Limoniidae	0	0
Eloeophila	0	0
Rhabdomastix	0	0
Tipula	0	0
| Order: Hemiptera	0	0
| Family: Corixidae	0	0
| Order: Thysanoptera	0	0
Subphylum: Chelicerata	0	0
| Class: Arachnida	0	0
| Order: Trombidiformes	0	20
| Family: Aturidae	0	0
Aturus	0	0
| Family: Feltriidae	0	0
Feltria	0	0
| Family: Hydryphantidae	0	0
Albertathyas	0	0
Wandesia	0	0

Project: Teck Dry Creek LAEMP (20-24)#3
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020
Sample:	LC_DC4_BIC-02_2020-09-03	LC_DC4_BIC-03_2020-09-03
Sample Collection Date:	03-Sep-20	03-Sep-20
CC#:	CC210576	CC210577
| Family: Hygrobatidae	0	0
Atractides	0	0
| Family: Lebertiidae	0	0
Lebertia	0	20
| Family: Sperchontidae	0	0
Sperchon	0	0
| Family: Torrenticolidae	0	0
Testudacarus	0	0
Suborder: Prostigmata	0	0
| Family: Stygothrombidiidae	0	0
Stygothrombium	0	0
| Order: Sarcoptiformes	0	0
| Order: Oribatida	0	0
| Family: Hydrozetidae	0	0
Phylum: Mollusca	0	0
| Class: Bivalvia	0	0
| Order: Veneroida	0	0
| Family: Pisidiidae	0	0
Pisidium	0	0
Phylum: Annelida	0	0
Subphylum: Clitellata	0	0
| Class: Oligochaeta	0	0
| Order: Tubificida	0	0
| Family: Enchytraeidae	0	0
Enchytraeus	0	0
| Family: Naididae	0	0
Nais	0	0
Totals:	**12180**	**16180**
Taxa present but not included:		
Phylum: Arthropoda	0	0
Subphylum: Hexapoda	0	0
| Class: Insecta	0	0
| Order: Diptera	0	0
| Family: Cecidomyiidae	20	0
Subphylum: Crustacea	0	0
| Class: Ostracoda	20	20
| Class: Branchiopoda	0	0
| Order: Cladocera	0	0
| Class: Maxillipoda	0	0
| Class: Copepoda	0	0
Phylum: Nemata	20	20
Phylum: Platyhelminthes	0	0
| Class: Turbellaria	0	20
Totals:	**60**	**60**

Notes: ND designation of a taxa represents a non-distinct taxa

Project: Teck Dry Creek LAEMP (20-24)#4
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01	LC_DCDS_BIC-02	LC_DCDS_BIC-03	LC_DC1_BIC-01	LC_DC1_BIC-02	LC_DC1_BIC-03
Sample Collection Date:	01-Dec-20	01-Dec-20	01-Dec-20	30-Nov-20	30-Nov-20	30-Nov-20
CC#:	CC211637	CC211638	CC211639	CC211640	CC211641	CC211642
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Baetidae	10	0	4	120	45	33
Baetis	110	57	52	900	180	333
| Family: Ephemerellidae	40	29	36	480	90	467
Drunella	0	0	0	0	0	17
Drunella doddsii	0	14	0	140	15	33
| Family: Heptageniidae	0	0	32	560	125	600
Epeorus	0	14	0	0	0	0
| Order: Plecoptera	0	0	4	20	30	33
| Family: Capniidae	0	29	0	0	0	0
| Family: Chloroperlidae	120	14	24	80	50	33
Sweltsa	20	29	4	0	5	17
| Family: Leuctridae	0	14	0	0	0	0
Paraleuctra	10	0	0	20	0	0
| Family: Nemouridae	270	371	96	220	50	267
Zapada	710	1286	276	1240	260	817
Zapada oregonensis group	30	86	20	180	0	50
Zapada cinctipes	0	29	8	100	0	0
Zapada columbiana	300	243	72	20	5	67
| Family: Perlodidae	60	86	12	60	5	17
Kogotus	20	0	0	0	0	0
Megarcys	10	14	4	60	10	17
| Family: Taeniopterygidae	10	29	8	100	65	100
| Order: Trichoptera	0	0	0	40	10	117
| Family: Apataniidae	0	0	0	0	0	0
Apatania	10	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0
Anagapetus	0	0	0	0	0	17

Project: Teck Dry Creek LAEMP (20-24)#4

Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01	LC_DCDS_BIC-02	LC_DCDS_BIC-03	LC_DC1_BIC-01	LC_DC1_BIC-02	LC_DC1_BIC-03
Sample Collection Date:	01-Dec-20	01-Dec-20	01-Dec-20	30-Nov-20	30-Nov-20	30-Nov-20
CC#:	CC211637	CC211638	CC211639	CC211640	CC211641	CC211642
| Family: Hydropsychidae	50	186	24	40	25	167
Parapsyche	130	29	0	140	10	0
Parapsyche elsis	30	57	4	120	10	33
| Family: Limnephilidae	10	14	20	0	0	0
Ecclisomyia	20	86	4	0	0	17
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	150	29	28	0	0	0
Rhyacophila angelita group	0	0	0	20	0	0
Rhyacophila betteni group	0	0	4	0	0	0
Rhyacophila brunnea/vemna group	10	57	4	0	5	17
Rhyacophila hyalinata group	0	0	0	0	5	0
Rhyacophila narvae	20	14	0	20	5	0
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	170	243	100	920	225	1400
| Order: Coleoptera	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0
Heterlimnius	0	14	0	0	0	0
| Order: Diptera	0	0	0	0	0	0
| Family: Chironomidae	0	0	0	0	0	0
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Tanytarsini	0	43	8	20	0	0
Micropsectra	120	86	20	0	20	17
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	30	14	0	0	0	0
Pagastia	90	57	0	20	5	83
Pseudodiamesa	40	57	36	0	15	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0
Brillia	10	0	4	0	0	17
Cricotopus (Nostococladius)	20	14	12	20	0	17
Eukiefferiella	290	629	88	360	35	250

Project: Teck Dry Creek LAEMP (20-24)#4
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01	LC_DCDS_BIC-02	LC_DCDS_BIC-03	LC_DC1_BIC-01	LC_DC1_BIC-02	LC_DC1_BIC-03
Sample Collection Date:	01-Dec-20	01-Dec-20	01-Dec-20	30-Nov-20	30-Nov-20	30-Nov-20
CC#:	CC211637	CC211638	CC211639	CC211640	CC211641	CC211642
Limnophyes	10	0	0	0	0	0
Orthocladius complex	30	100	36	60	0	33
Rheocricotopus	0	29	12	0	0	0
Tvetenia	330	586	240	840	195	717
| Subfamily: Tanypodinae	0	0	4	0	0	0
| Family: Empididae	0	0	0	0	0	0
Neoplasta	60	0	0	0	0	17
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	0	20	0	0
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	40	43	4	600	115	300
| Family: Simuliidae	0	14	0	20	5	0
Prosimulium/Helodon	0	0	0	0	0	17
Simulium	0	0	0	20	0	17
| Family: Tipulidae	0	0	0	0	5	0
Dicranota	0	29	4	60	10	0
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	10	14	0	0	5	0
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	0	0	0	20	5	0
| Order: Sarcoptiformes	0	0	0	0	0	0
| Order: Oribatida	0	0	0	20	0	0
| Family: Hydrozetidae	0	14	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0

Project: Teck Dry Creek LAEMP (20-24)#4
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2020	2020	2020	2020	2020	2020
Sample:	LC_DCDS_BIC-01	LC_DCDS_BIC-02	LC_DCDS_BIC-03	LC_DC1_BIC-01	LC_DC1_BIC-02	LC_DC1_BIC-03
Sample Collection Date:	01-Dec-20	01-Dec-20	01-Dec-20	30-Nov-20	30-Nov-20	30-Nov-20
CC#:	CC211637	CC211638	CC211639	CC211640	CC211641	CC211642
| Family: Enchytraeidae	0	0	0	0	0	0
Enchytraeus	10	0	4	0	0	0
Totals:	**3410**	**4802**	**1312**	**7680**	**1645**	**6154**
Taxa present but not included:						
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0
| Family: Cecidomyiidae	0	14	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0
| Class: Ostracoda	10	14	4	0	5	17
Phylum: Nemata	0	0	0	20	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0
| Class: Turbellaria	10	14	4	0	0	0
Totals:	**20**	**42**	**8**	**20**	**5**	**17**

Notes: 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.

BIC
METHODS
AND
QC

Methods and QC Report 2019

Project ID: Teck Dry Creek (19-09) Winter

Client: Minnow Environmental

Prepared by:
Cordillera Consulting Inc.
Summerland, BC

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*** Note ***

A note on the data. There are some new, exciting additions to the Cordillera data spreadsheet. You will immediately notice that we are now providing whole sample data and metrics at the Family level. You will also notice two tabs with ND. This in an important improvement to our data. This allows the metrics to be more accurately calculated. The ND or Non-Distinct is used in the lab to identify things at a higher taxonomic resolution than other things from the same Family/Order that are already counted at the Genu/Species level. This removes some duplication in the taxa richness counts. Cordillera's taxonomists use the ND when there are juvenile or damaged specimens that we can't quite ID but that we're sure are represented by existing ID's. We have been working on these changes for a while to provide better data for you, our client.

Sample Reception

On December 16, 2019, Cordillera Consulting received 6 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-01_2019-12-04	CC202675	12/4/2019	400µM	1
LC_DC1_BIC-02_2019-12-04	CC202676	12/4/2019	400µM	1
LC_DC1_BIC-03_2019-12-04	CC202677	12/4/2019	400µM	1
LC_DCDS_BIC-01_2019-12-04	CC202678	12/4/2019	400µM	1
LC_DCDS_BIC-02_2019-12-04	CC202679	12/4/2019	400µM	1
LC_DCDS_BIC-03_2019-12-04	CC202680	12/4/2019	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-01_2019-12-04	04-Dec-19	CC202675	5%	613
LC_DC1_BIC-02_2019-12-04	04-Dec-19	CC202676	5%	762
LC_DC1_BIC-03_2019-12-04	04-Dec-19	CC202677	5%	747
LC_DCDS_BIC-01_2019-12-04	04-Dec-19	CC202678	5%	652
LC_DCDS_BIC-02_2019-12-04	04-Dec-19	CC202679	5%	619
LC_DCDS_BIC-03_2019-12-04	04-Dec-19	CC202680	5%	551

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 - QC1, CC# - CC202677, Percent sampled = 5%, Sieve size = 400					
Plecoptera		1			
Total:		**1**		**747**	**100%**

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

Table to come shortly

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 - 2019, Sample - LC_DC1_BIC-01_2019-12-04, CC# - CC202675, Percent sampled = 5%, Sieve size = 400	609	0.00	0.32733224	1.14192496	0.00818331

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 - 2019, Sample - LC_DC1_BIC-01_2019-12-04, CC# - CC202675, Percent sampled = 5%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Baetidae	1	2	No			X		
Baetis	4	3	No			X		
Baetis rhodani group	1	1						
Chloroperlidae	3	3						
Cinygmula	16	15	No			X		
Cricotopus (Nostococladius)	6	6						
Dicranota	1	1						
Drunella doddsii	5	5						

Ecclisomyia	1	1						
Ephemerellidae	36	36						
Eukiefferiella	9	9						
Feltria	2	2						
Heptageniidae	186	188	No			X		
Hydrobaenus	1	1						
Hydropsychidae	1	1						
Kogotus	4	4						
Limnephilidae	1	1						
Megarcys	1	1						
Micropsectra	12	12						
Microtendipes	1	1						
Nemouridae	2	2						
Oligophlebodes	30	29	No			X		
Orthocladius complex	2	2						
Pagastia	6	6						
Paraleuctra	1	1						
Parametriocnemus	1	1						
Parapsyche	5	5						
Parapsyche elsis	2	2						
Pericoma/Telmatoscopus	10	10						
Pseudodiamesa	1	1						
Rheocricotopus	4	3	No			X		
Rhyacophila narvae	8	8						
Suwallia	1	1						
Sweltsa	15	15						
Taenionema	1	1						
Tanytarsini	53	52	No			X		
Tvetenia	107	105	No			X		
Zapada	46	46						
Zapada cinctipes	3	3						
Zapada columbiana	3	3						
Zapada oregonensis group	20	20						
Total:	**613**	**609**						
					0	**8**	**0**	
% Total Misidentification Rate =	misidentifications	x100 =	0.00	**Pass**				
	total number							

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[2] Southwest Association of Freshwater Invertebrate Taxonomists. (2015). www.safit.org

[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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Methods and QC Report 2020

Project ID: Teck Dry Creek LAEMP (20-24) #1

Client: Minnow Environmental

Prepared by:
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Summerland, BC

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Sample Reception

On May 21, 2020, Cordillera Consulting received 30 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_DC3_BIC-01_2020-05-07	CC210041	5/7/2020	400µM	1
LC_DC3_BIC-02_2020-05-07	CC210042	5/7/2020	400µM	1
LC_DC3_BIC-03_2020-05-07	CC210043	5/7/2020	400µM	1
LC_DCEF_BIC-01_2020-05-06	CC210044	5/6/2020	400µM	1
LC_DCEF_BIC-02_2020-05-06	CC210045	5/6/2020	400µM	1
LC_DCEF_BIC-03_2020-05-06	CC210046	5/6/2020	400µM	1
LC_SPDC_BIC-01_2020-05-05	CC210047	5/5/2020	400µM	1
LC_SPDC_BIC-02_2020-05-05	CC210048	5/5/2020	400µM	1
LC_SPDC_BIC-03_2020-05-05	CC210049	5/5/2020	400µM	1
LC_DCDS_BIC-01_2020-05-05	CC210050	5/5/2020	400µM	1
LC_DCDS_BIC-02_2020-05-05	CC210051	5/5/2020	400µM	1
LC_DCDS_BIC-03_2020-05-05	CC210052	5/5/2020	400µM	1
LC_DC2_BIC-01_2020-05-06	CC210053	5/6/2020	400µM	1
LC_DC2_BIC-02_2020-05-06	CC210054	5/6/2020	400µM	1
LC_DC2_BIC-03_2020-05-06	CC210055	5/6/2020	400µM	1
LC_DC4_BIC-01_2020-05-04	CC210056	5/4/2020	400µM	1
LC_DC4_BIC-02_2020-05-04	CC210057	5/4/2020	400µM	1
LC_DC4_BIC-03_2020-05-04	CC210058	5/4/2020	400µM	1
LC_DC1_BIC-01_2020-05-04	CC210059	5/4/2020	400µM	1
LC_DC1_BIC-02_2020-05-04	CC210060	5/4/2020	400µM	1
LC_DC1_BIC-03_2020-05-04	CC210061	5/4/2020	400µM	1
LC_FRUS_BIC-01_2020-05-08	CC210062	5/8/2020	400µM	1
LC_FRUS_BIC-02_2020-05-08	CC210063	5/8/2020	400µM	1
LC_FRUS_BIC-03_2020-05-08	CC210064	5/8/2020	400µM	1
LC_FRB_BIC-01_2020-05-08	CC210065	5/8/2020	400µM	1
LC_FRB_BIC-02_2020-05-08	CC210066	5/8/2020	400µM	1
LC_FRB_BIC-03_2020-05-08	CC210067	5/8/2020	400µM	1

LC_GRCK_BIC-01_2020-05-11	CC210068	5/11/2020	400µM	1
LC_GRCK_BIC-02_2020-05-11	CC210069	5/11/2020	400µM	1
LC_GRCK_BIC-03_2020-05-11	CC210070	5/11/2020	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_DC3_BIC-01_2020-05-07	07-May-20	CC210041	10%	329
LC_DC3_BIC-02_2020-05-07	07-May-20	CC210042	14%	345
LC_DC3_BIC-03_2020-05-07	07-May-20	CC210043	10%	361
LC_DCEF_BIC-01_2020-05-06	06-May-20	CC210044	8%	343

LC_DCEF_BIC-02_2020-05-06	06-May-20	CC210045	17%	332
LC_DCEF_BIC-03_2020-05-06	06-May-20	CC210046	11%	360
LC_SPDC_BIC-01_2020-05-05	05-May-20	CC210047	16%	314
LC_SPDC_BIC-02_2020-05-05	05-May-20	CC210048	36%	380
LC_SPDC_BIC-03_2020-05-05	05-May-20	CC210049	25%	378
LC_DCDS_BIC-01_2020-05-05	05-May-20	CC210050	8%	367
LC_DCDS_BIC-02_2020-05-05	05-May-20	CC210051	11%	382
LC_DCDS_BIC-03_2020-05-05	05-May-20	CC210052	8%	345
LC_DC2_BIC-01_2020-05-06	06-May-20	CC210053	13%	378
LC_DC2_BIC-02_2020-05-06	06-May-20	CC210054	15%	327
LC_DC2_BIC-03_2020-05-06	06-May-20	CC210055	45%	344
LC_DC4_BIC-01_2020-05-04	04-May-20	CC210056	8%	348
LC_DC4_BIC-02_2020-05-04	04-May-20	CC210057	5%	373
LC_DC4_BIC-03_2020-05-04	04-May-20	CC210058	5%	342
LC_DC1_BIC-01_2020-05-04	04-May-20	CC210059	5%	399
LC_DC1_BIC-02_2020-05-04	04-May-20	CC210060	6%	367
LC_DC1_BIC-03_2020-05-04	04-May-20	CC210061	6%	332
LC_FRUS_BIC-01_2020-05-08	08-May-20	CC210062	28%	364
LC_FRUS_BIC-02_2020-05-08	08-May-20	CC210063	32%	412
LC_FRUS_BIC-03_2020-05-08	08-May-20	CC210064	15%	341
LC_FRB_BIC-01_2020-05-08	08-May-20	CC210065	20%	525
LC_FRB_BIC-02_2020-05-08	08-May-20	CC210066	5%	349
LC_FRB_BIC-03_2020-05-08	08-May-20	CC210067	5%	330
LC_GRCK_BIC-01_2020-05-11	11-May-20	CC210068	9%	395
LC_GRCK_BIC-02_2020-05-11	11-May-20	CC210069	5%	323
LC_GRCK_BIC-03_2020-05-11	11-May-20	CC210070	5%	400

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 - QC1, CC# - CC210048, Percent sampled = 36%, Sieve size = 400					
Chironomidae		1			
Total:		**1**		**380**	**100%**
Site - QC, Sample - QC2, CC# - CC210057, Percent sampled = 5%, Sieve size = 400					
Chironomidae		2			
Ephemeroptera		2			
Oligochaeta		1			
Total:		**5**		**373**	**99%**
Site - QC, Sample - QC3, CC# - CC210070, Percent sampled = 5%, Sieve size = 400					
Chironomidae		2			
Ephemeroptera		2			
Plecoptera		3			
Oligochaeta		4			
Total:		**11**		**400**	**97%**

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											By	Time		Percent Range		Min	Max
210049	LC_SPDC_BIC-03	363	378	372	366																	CM	90	1479	0.82	3.97	0.61	2.23
210043	LC_DC3_BIC-03	357	354	330	392	327	341	351	347	341	355											CM	1015	3495	0.00	16.58	0.43	12.16
210065	LC_FRB_BIC-01_2020_05-08	494	435	472	451	475																CM	585	2327	0.63	11.94	1.42	6.53

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.
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$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

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 - 2020, Sample - LC_DC3_BIC-01_2020-05-07, CC# - CC210041, Percent sampled = 10%, Sieve size = 400	328	0.00	0.152207	0.60790274	0.00456621
Site - 2020, Sample - LC_DC2_BIC-02_2020-05-06, CC# - CC210054, Percent sampled = 15%, Sieve size = 400	326	0.00	0.15313936	0.6116208	0.00459418
Site - 2020, Sample - LC_GRCK_BIC-01_2020-05-11, CC# - CC210068, Percent sampled = 9%, Sieve size = 400	393	0.00	0.25380711	2.02531646	0.0177665

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 - 2020, Sample - LC_DC3_BIC-01_2020-05-07, CC# - CC210041, Percent sampled = 10%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Brillia	3	3						
Chironomidae	3	3						
Chloroperlidae	4	3	No			X		
Chyranda centralis	1	1						
Drunella doddsii	2	2						
Eukiefferiella	80	81	No			X		
Glossosomatidae	1	1						

Heptageniidae	1	1						
Lebertia	1	1						
Leuctridae	3	3						
Limnophyes	23	23						
Megarcys	6	6						
Micropsectra	88	88						
Oligophlebodes	2	2						
Orthocladiinae	1	1						
Orthocladius complex	16	16						
Pagastia	6	6						
Parametriocnemus	1	1						
Peltoperlidae	1	1						
Plecoptera	1	1						
Rhyacophila	6	6						
Rhyacophila atrata complex	1	1						
Rhyacophila brunnea/vemna group	4	4						
Rhyacophila vofixa group	10	10						
Simuliidae	1	1						
Simulium	14	13	No			X		
Sperchonopsis	1	1						
Sweltsa	3	3						
Tvetenia	2	2						
Yoraperla	3	3						
Zapada	35	35						
Zapada oregonensis group	5	5						
Total:	**329**	**328**						
					0	**3**	**0**	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				
Site - 2020, Sample - LC_DC2_BIC-02_2020-05-06, CC# - CC210054, Percent sampled = 15%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficient Taxonomic Resolution**	**Comments**
Brillia	3	3						
Chironomidae	2	2						
Cricotopus (Nostococladius)	15	14	No			X		

Dicranota	2	2						
Drunella doddsii	1	1						
Elmidae	1	1						
Enchytraeidae	1	1						
Enchytraeus	4	4						
Eukiefferiella	25	26	No			X		
Heptageniidae	3	3						
Hydropsychidae	5	5						
Limnophyes	1	1						
Megarcys	3	3						
Micropsectra	19	19						
Oligophlebodes	26	26						
Oribatida	3	3						
Orthocladiinae	1	1						
Orthocladius complex	7	7						
Pagastia	6	6						
Parapsyche elsis	5	5						
Parorthocladius	1	1						
Perlodidae	1	1						
Polypedilum	2	2						
Rhyacophila	63	62	No			X		
Rhyacophila betteni group	1	1						
Rhyacophila brunnea/vemna group	1	1						
Rhyacophila hyalinata group	1	1						
Simuliidae	1	1						
Staphylinidae	14	14						
Sweltsa	4	4						
Tanytarsini	44	44						
Thysanoptera	1	1						
Trichoptera	1	1						
Tvetenia	26	26						
Zapada	31	31						
Zapada columbiana	1	1						
Zapada oregonensis group	1	1						
Total:	**327**	**326**						
					0	**3**	**0**	
% Total Misidentification Rate =	misidentifications	x100 =	0.00	**Pass**				
	total number							

Site - 2020, Sample - LC_GRCK_BIC-01_2020-05-11, CC# - CC210068, Percent sampled = 9%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Ameletus	3	3						
Baetidae	3	8	No			X		
Baetis	82	75	No			X		
Baetis rhodani group	18	18						
Brillia	5	5						
Chloroperlidae	8	8						
Collembola	2	2						
Dicranota	1	1						
Drunella	2	2						
Ecclisomyia	1	1						
Epeorus	4	4						
Eukiefferiella	5	5						
Glutops	1	1						
Helodon	2	2						
Heptageniidae	30	30						
Isoperla	1	1						
Leuctridae	1	1						
Limnophyes	3	2	No			X		
Megarcys	1	1						
Micropsectra	36	36						
Nemouridae	5	5						
Neothremma	34	34						
Orthocladiinae	1	1						
Pagastia	1	1						
Parametriocnemus	14	14						
Peltoperlidae	1	1						
Perlodidae	2	2						
Prosimulium/Helodon	9	9						
Rheocricotopus	8	8						
Rhithrogena	2	2						
Rhyacophila	8	8						
Rhyacophila brunnea/vemna group	2	2						
Rhyacophila narvae	1	1						
Simuliidae	1	1						

Tanytarsini	10	10						
Visoka cataractae	9	9						
Yoraperla	2	2						
Zapada	76	77	No			X		
Total:	**395**	**393**						
					0	**4**	**0**	
% Total Misidentification Rate =	misidentifications	x100	0.00	**Pass**				
	total number	=						

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[2] Southwest Association of Freshwater Invertebrate Taxonomists. (2015). www.safit.org

[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

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Methods and QC Report 2020

Project ID: Teck Dry Creek (20-24) #2

Client: Minnow

Prepared by:

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Sample Reception

On July 7, 2020, Cordillera Consulting received 6 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_2020-06-24	CC210071	6/24/2020	400µM	1
LC_DCDS_BIC-02_2020-06-24	CC210072	6/24/2020	400µM	1
LC_DCDS_BIC-03_2020-06-24	CC210073	6/24/2020	400µM	1
LC_DC1_BIC-01_2020-06-24	CC210074	6/24/2020	400µM	1
LC_DC1_BIC-02_2020-06-24	CC210075	6/24/2020	400µM	1
LC_DC1_BIC-03_2020-06-24	CC210076	6/24/2020	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_2020-06-24	24-Jun-20	CC210071	10%	436
LC_DCDS_BIC-02_2020-06-24	24-Jun-20	CC210072	6%	345
LC_DCDS_BIC-03_2020-06-24	24-Jun-20	CC210073	10%	475
LC_DC1_BIC-01_2020-06-24	24-Jun-20	CC210074	5%	440
LC_DC1_BIC-02_2020-06-24	24-Jun-20	CC210075	5%	542
LC_DC1_BIC-03_2020-06-24	24-Jun-20	CC210076	5%	503

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 - QC1, CC# - CC210075, Percent sampled = 5%, Sieve size = 400					
Diptera		1			
Plecoptera		3			
Total:		**4**		**542**	**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											By	Time		Percent Range		Min	Max
210073	LC_DCDS_BIC-03_2020-06-24	450	438	433	458	495	454	448	462	459	473											CM	1175	4570	0.22	12.53	0.22	8.32

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 - 2020, Sample - LC_DCDS_BIC-02_2020-06-24, CC# - CC210072, Percent sampled = 6%, Sieve size = 400	344	0.00	0.14513788	1.15942029	0.01015965

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 - 2020, Sample - LC_DCDS_BIC-02_2020-06-24, CC# - CC210072, Percent sampled = 6%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Ameletus	11	11						
Baetidae	1	3	No			X		
Baetis	16	14	No			X		
Baetis rhodani group	11	11						
Chironomidae	5	5						
Chloroperlidae	1	1						
Cinygmula	23	22	No			X		
Cricotopus (Nostococladius)	11	11						
Diamesa	17	17						
Dicranota	1	1						

Drunella	11	11						
Drunella coloradensis	11	11						
Ecclisomyia	4	4						
Enchytraeidae	2	2						
Enchytraeus	1	1						
Eukiefferiella	6	6						
Heptageniidae	21	22	No			X		
Isoperla	2	2						
Kogotus	1	1						
Micropsectra	75	74	No			X		
Oligophlebodes	4	4						
Orthocladius complex	9	9						
Pagastia	4	4						
Parametriocnemus	1	1						
Parapsyche	3	3						
Parorthocladius	1	1						
Polypedilum	2	2						
Prosimulium/Helodon	4	4						
Pseudodiamesa	1	1						
Rheocricotopus	13	13						
Rhyacophila	3	3						
Rhyacophila betteni group	3	3						
Rhyacophila brunnea/vemna group	1	1						
Rhyacophila verrula group	1	1						
Rhyacophila vofixa group	4	4						
Sweltsa	6	6						
Tanytarsini	1	1						
Tvetenia	21	21						
Zapada	7	7						
Zapada columbiana	15	15						
Zapada oregonensis group	9	9						
Zavrelimyia	1	1						
Total:	**345**	**344**						
					0	**5**	**0**	
% Total Misidentification Rate =	misidentifications	x100 =	0.00	**Pass**				
	total number							

References

[1] McDermott, H., Paull, T., Strachan, S. (May 2014). Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples, Environment Canada. ISBN: 978-1-100-25417-3

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Methods and QC Report 2020

Project ID: Teck Dry Creek (20-24) #3

Client: Minnow Environmental

Prepared by:
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Sample Reception

On September 10, 2020, Cordillera Consulting received 30 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_FRB_BIC-01_2020-08-28	CC210548	8/28/2020	400µM	1
LC_FRB_BIC-02_2020-08-28	CC210549	8/28/2020	400µM	1
LC_FRB_BIC-03_2020-08-28	CC210550	8/28/2020	400µM	1
LC_FRUS_BIC-01_2020-08-28	CC210551	8/28/2020	400µM	1
LC_FRUS_BIC-02_2020-08-29	CC210552	8/29/2020	400µM	1
LC_FRUS_BIC-03_2020-08-29	CC210553	8/29/2020	400µM	1
LC_GRCK_BIC-01_2020-08-29	CC210554	8/29/2020	400µM	2
LC_GRCK_BIC-02_2020-08-29	CC210555	8/29/2020	400µM	2
LC_GRCK_BIC-03_2020-08-29	CC210556	8/29/2020	400µM	1
LC_DCDS_BIC-01_2020-09-01	CC210557	9/1/2020	400µM	1
LC_DCDS_BIC-02_2020-09-01	CC210558	9/1/2020	400µM	1
LC_DCDS_BIC-03_2020-09-01	CC210559	9/1/2020	400µM	1
LC_SPDC_BIC-01_2020-09-01	CC210560	9/1/2020	400µM	1
LC_SPDC_BIC-02_2020-09-01	CC210561	9/1/2020	400µM	1
LC_SPDC_BIC-03_2020-09-01	CC210562	9/1/2020	400µM	1
LC_DC3_BIC-01_2020-09-02	CC210563	9/2/2020	400µM	1
LC_DC3_BIC-02_2020-09-02	CC210564	9/2/2020	400µM	1
LC_DC3_BIC-03_2020-09-02	CC210565	9/2/2020	400µM	1
LC_DC1_BIC-01_2020-09-02	CC210566	9/2/2020	400µM	1
LC_DC1_BIC-02_2020-09-02	CC210567	9/2/2020	400µM	1
LC_DC1_BIC-03_2020-09-02	CC210568	9/2/2020	400µM	1
LC_DCEF_BIC-01_2020-09-03	CC210569	9/3/2020	400µM	1
LC_DCEF_BIC-02_2020-09-02	CC210570	9/2/2020	400µM	1
LC_DCEF_BIC-03_2020-09-02	CC210571	9/2/2020	400µM	1
LC_DC2_BIC-01_2020-09-03	CC210572	9/3/2020	400µM	1
LC_DC2_BIC-02_2020-09-03	CC210573	9/3/2020	400µM	1
LC_DC2_BIC-03_2020-09-03	CC210574	9/3/2020	400µM	1

LC_DC4_BIC-01_2020-09-03	CC210575	9/3/2020	400µM	1
LC_DC4_BIC-02_2020-09-03	CC210576	9/3/2020	400µM	1
LC_DC4_BIC-03_2020-09-03	CC210577	9/3/2020	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_FRB_BIC-01_2020-08-28	28-Aug-20	CC210548	5%	529
LC_FRB_BIC-02_2020-08-28	28-Aug-20	CC210549	10%	580
LC_FRB_BIC-03_2020-08-28	28-Aug-20	CC210550	5%	446
LC_FRUS_BIC-01_2020-08-28	28-Aug-20	CC210551	5%	491
LC_FRUS_BIC-02_2020-08-29	29-Aug-20	CC210552	5%	456

LC_FRUS_BIC-03_2020-08-29	29-Aug-20	CC210553	5%	315
LC_GRCK_BIC-01_2020-08-29	29-Aug-20	CC210554	5%	341
LC_GRCK_BIC-02_2020-08-29	29-Aug-20	CC210555	5%	560
LC_GRCK_BIC-03_2020-08-29	29-Aug-20	CC210556	8%	318
LC_DCDS_BIC-01_2020-09-01	01-Sep-20	CC210557	5%	690
LC_DCDS_BIC-02_2020-09-01	01-Sep-20	CC210558	5%	702
LC_DCDS_BIC-03_2020-09-01	01-Sep-20	CC210559	5%	439
LC_SPDC_BIC-01_2020-09-01	01-Sep-20	CC210560	5%	2105
LC_SPDC_BIC-02_2020-09-01	01-Sep-20	CC210561	5%	525
LC_SPDC_BIC-03_2020-09-01	01-Sep-20	CC210562	23%	425
LC_DC3_BIC-01_2020-09-02	02-Sep-20	CC210563	5%	389
LC_DC3_BIC-02_2020-09-02	02-Sep-20	CC210564	5%	640
LC_DC3_BIC-03_2020-09-02	02-Sep-20	CC210565	5%	393
LC_DC1_BIC-01_2020-09-02	02-Sep-20	CC210566	5%	742
LC_DC1_BIC-02_2020-09-02	02-Sep-20	CC210567	5%	1120
LC_DC1_BIC-03_2020-09-02	02-Sep-20	CC210568	5%	650
LC_DCEF_BIC-01_2020-09-03	03-Sep-20	CC210569	6%	422
LC_DCEF_BIC-02_2020-09-02	02-Sep-20	CC210570	5%	315
LC_DCEF_BIC-03_2020-09-02	02-Sep-20	CC210571	11%	308
LC_DC2_BIC-01_2020-09-03	03-Sep-20	CC210572	5%	572
LC_DC2_BIC-02_2020-09-03	03-Sep-20	CC210573	5%	534
LC_DC2_BIC-03_2020-09-03	03-Sep-20	CC210574	5%	630
LC_DC4_BIC-01_2020-09-03	03-Sep-20	CC210575	5%	1067
LC_DC4_BIC-02_2020-09-03	03-Sep-20	CC210576	5%	609
LC_DC4_BIC-03_2020-09-03	03-Sep-20	CC210577	5%	809

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 - QC1, CC# - CC210551, Percent sampled = 5%, Sieve size = 400			
Chironomidae	3		
Ephemeroptera	2		
Plecoptera	1		
Trombidiformes	1		
Total:	**7**	**491**	**99%**
Site - QC, Sample - QC2, CC# - CC210560, Percent sampled = 5%, Sieve size = 400			
Chironomidae	2		
Total:	**2**	**2105**	**100%**
Site - QC, Sample - QC3, CC# - CC210576, Percent sampled = 5%, Sieve size = 400			
Trichoptera	1		
Total:	**1**	**609**	**100%**

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
210549	LC_FRB_BIC-02	565	500	586	562	584	564	591	592	587	555											TV	500	5686	0.17	15.54	0.63	12.06
210552	LC_FRUS_BIC-2	457	449	440	454	455	444	457	454	437	440	405	405	463	471	441	465	424	475	424	426	AR	845	8886	0.00	14.74	0.07	8.85
210561	LC_SPDC_BIC-2	511	490	426	506	487	493	491	479	493	503	461	500	487	492	509	502	483	511	513	523	JH	720	9860	0.00	18.55	0.00	13.59

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 - 2020, Sample - LC_FRB_BIC-01_2020-08-28, CC# - CC210548, Percent sampled = 5%, Sieve size = 400	527	0.00	0.18939394	0.56710775	0.00378788
Site - 2020, Sample - LC_GRCK_BIC-02_2020-08-29, CC# - CC210555, Percent sampled = 5%, Sieve size = 400	559	0.00	0.0893655	0.89285714	0.0080429
Site - 2020, Sample - LC_DCEF_BIC-02_2020-09-02, CC# - CC210570, Percent sampled = 5%, Sieve size = 400	313	0.00	0.31847134	0.95238095	0.00636943

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 - 2020, Sample - LC_FRB_BIC-01_2020-08-28, CC# - CC210548, Percent sampled = 5%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Acentrella	1	1						
Ameletus	3	3						

Baetidae	1	1						
Baetis	46	45	No			X		
Baetis bicaudatus	1	1						
Baetis rhodani group	48	49	No			X		
Capniidae	6	6						
Chironomidae	21	21						
Chloroperlidae	1	1						
Diamesa	2	2						
Drunella doddsii	1	1						
Drunella spinifera	5	5						
Elmidae	6	6						
Epeorus	3	3						
Ephemerellidae	11	11						
Eukiefferiella	74	73	No			X		
Glossosomatidae	2	2						
Heptageniidae	76	75	No			X		
Heterlimnius	3	3						
Hydrobaenus	1	1						
Hydropsychidae	5	5						
Hygrobatidae	1	1						
Lebertia	14	14						
Mallochohelea	1	1						
Megarcys	3	3						
Micropsectra	2	2						
Nais	2	2						
Neoplasta	1	1						
Orthocladius complex	77	77						
Pagastia	7	7						
Parorthocladius	1	1						
Pericoma/Telmatoscopus	18	18						
Perlodidae	21	21						
Pisidium	1	1						
Rheocricotopus	7	7						
Rhyacophila atrata complex	5	5						
Rhyacophila betteni group	1	1						
Rhyacophila brunnea/vemna group	7	7						
Simuliidae	1	1						
Simulium	2	2						
Sperchon	1	1						
Sweltsa	2	2						
Taeniopterygidae	8	8						

Testudacarus	1	1						
Trombidiformes	1	1						
Tvetenia	9	9						
Zapada	12	12						
Zapada cinctipes	2	2						
Zapada oregonensis group	4	4						
Total:	**529**	**527**						
					0	**4**	**0**	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				

Site - 2020, Sample - LC_GRCK_BIC-02_2020-08-29, CC# - CC210555, Percent sampled = 5%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficient Taxonomic Resolution**	**Comments**
Ameletus	1	1						
Amphizoa	1	1						
Atractides	1	1						
Baetis	21	20	No			X		
Baetis rhodani group	6	7	No			X		
Boreochlus	1	1						
Boreoheptagyia	3	3						
Brillia	34	34						
Capniidae	34	34						
Ceratopogonidae	3	3						
Chironomidae	9	9						
Chloroperlidae	3	3						
Cinygmula	3	3						
Clinocera	1	1						
Collembola	3	3						
Corynoneura	1	1						
Dicranota	1	1						
Diptera	2	2						
Drunella doddsii	2	2						
Ecclisomyia	1	1						
Enchytraeus	1	1						
Epeorus	53	54	No			X		
Eukiefferiella	9	9						

Heptageniidae	19	17	No			X		
Heterlimnius	1	1						
Hydrobaenus	2	2						
Hydropsychidae	2	2						
Hydrozetidae	1	1						
Leuctridae	2	2						
Limnophyes	3	3						
Megarcys	1	1						
Micropsectra	7	7						
Neothremma	49	49						
Orthocladiinae	1	1						
Orthocladius complex	1	1						
Parapsyche elsis	1	1						
Parorthocladius	1	1						
Pericoma/Telmatoscopus	21	21						
Perlodidae	12	12						
Rheocricotopus	4	4						
Rhithrogena	3	3						
Rhyacophila	21	20	No			X		
Rhyacophila brunnea/vemna group	7	7						
Rhyacophila narvae	5	6	No			X		
Simulium	1	1						
Sweltsa	3	3						
Tanytarsini	3	3						
Thysanoptera	1	1						
Tipulidae	2	2						
Tvetenia	25	24	No			X		
Visoka cataractae	26	26						
Zapada	41	41						
Zapada columbiana	95	96	No			X		
Zapada oregonensis group	5	5						
Total:	**560**	**559**						
					0	8	0	
% Total Misidentification Rate =	misidentifications	x100 =	0.00	**Pass**				
	total number							

Site - 2020, Sample - LC_DCEF_BIC-02_2020-09-02, CC# - CC210570, Percent sampled = 5%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Ameletus	12	12						
Chironomidae	9	9						
Chloroperlidae	15	15						
Clostoeca disjuncta	1	1						
Dicranota	2	2						
Drunella	4	4						
Drunella coloradensis	4	4						
Drunella doddsii	38	38						
Ephemerellidae	11	11						
Eukiefferiella	11	11						
Heptageniidae	62	60	No			X		
Hydrobaenus	1	1						
Lebertia	1	1						
Limnephilidae	1	1						
Limnophyes	1	1						
Megarcys	8	8						
Oribatida	1	1						
Orthocladius complex	7	7						
Pagastia	1	1						
Parorthocladius	2	2						
Peltoperlidae	3	3						
Pericoma/Telmatoscopus	2	2						
Perlodidae	17	17						
Rheocricotopus	3	3						
Rhithrogena	2	2						
Rhyacophila	8	8						
Rhyacophila betteni group	1	1						
Staphylinidae	1	1						
Sweltsa	21	21						
Tipulidae	1	1						
Tvetenia	13	13						
Visoka cataractae	1	1						
Yoraperla	1	1						
Zapada	1	1						
Zapada columbiana	45	44	No			X		

Zapada oregonensis group	3	4	No			X		
Total:	**315**	**313**						
					0	**3**	**0**	
% Total Misidentification Rate	misidentifications	x100	0.00	**Pass**				
=	total number	=						

References

[1] McDermott, H., Paull, T., Strachan, S. (May 2014). Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples, Environment Canada. ISBN: 978-1-100-25417-3

[2] Southwest Association of Freshwater Invertebrate Taxonomists. (2015). www.safit.org

[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

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Westfall, Minter J. Jr. and May, Michael L. 1996. Damselflies of North America. Scientific Publishers, Gainesville, FL.

Wiggins, Glenn B. 1998. Larvae of the North American Caddisfly Genera (Tricoptera) 2nd ed. University of Toronto Press. Toronto Ontario.

Methods and QC Report 2021

Project ID: Teck Dry Creek (20-24) #4

Client: Minnow Environmental

Prepared by:

Cordillera Consulting Inc.
Summerland, BC

Unit 1, 13216 Henry Ave B1202
Summerland, BC, V0H 1Z0
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Table of Contents

Sample Reception

On December 16, 2020, Cordillera Consulting received 6 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	CC211637	12/1/2020	400µM	1
LC_DCDS_BIC-02	CC211638	12/1/2020	400µM	2
LC_DCDS_BIC-03	CC211639	12/1/2020	400µM	1
LC_DC1_BIC-01	CC211640	11/30/2020	400µM	1
LC_DC1_BIC-02	CC211641	11/30/2020	400µM	1
LC_DC1_BIC-03	CC211642	11/30/2020	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	01-Dec-20	CC211637	10%	341
LC_DCDS_BIC-02	01-Dec-20	CC211638	7%	336
LC_DCDS_BIC-03	01-Dec-20	CC211639	25%	328
LC_DC1_BIC-01	30-Nov-20	CC211640	5%	384
LC_DC1_BIC-02	30-Nov-20	CC211641	20%	329
LC_DC1_BIC-03	30-Nov-20	CC211642	6%	369

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 - QC1, CC# - CC211640, Percent sampled = 5%, Sieve size = 400			
No Invertebrates Found	0		
Total:	**0**	**384**	**100%**

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
211642	LC_DC1_BIC-02	326	312	337	320	328																AR	195	1623	0.61	7.42	0.43	3.88

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 - 2020, Sample - LC_DCDS_BIC-02, CC# - CC211638, Percent sampled = 7%, Sieve size = 400	334	0.30	0.29850746	1.48809524	0.0119403

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 - 2020, Sample - LC_DCDS_BIC-02, CC# - CC211638, Percent sampled = 7%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Baetis	4	4						
Capniidae	2	2						
Chloroperlidae	1	1						
Cricotopus (Nostococladius)	1	1						
Diamesa	1	1						
Dicranota	2	2						
Drunella doddsii	1	1						
Ecclisomyia	6	6						

Epeorus	1	1						
Ephemerellidae	2	2						
Eukiefferiella	44	44						
Heterlimnius	1	1						
Hydropsychidae	13	13						
Hydrozetidae	1	1						
Lebertia	1	1						
Leuctridae	1	1						
Limnephilidae	1	1						
Megarcys	1	1						
Micropsectra	6	6						
Nemouridae	26	25	No			X		
Oligophlebodes	17	17						
Orthocladius complex	7	7						
Pagastia	4	4						
Parapsyche	2	3	No			X		
Parapsyche elsis	4	3	No			X		
Pericoma/Telmatoscopus	3	3						
Perlodidae	6	6						
Pseudodiamesa	4	4						
Rheocricotopus	2	2						
Rhyacophila	2	2						
Rhyacophila brunnea/vemna group	4	4						
Rhyacophila narvae	1	1						
Simuliidae	1	1						
Sweltsa	2	2						
Taeniopterygidae	2	2						
Tanytarsini	3	3						
Tvetenia	41	40	No			X		
Zapada	90	89	No			X		
Zapada cinctipes	2	3	No			X		
Zapada columbiana	17	16	No	1		X		
Zapada oregonensis group	6	7	No			X		
Total:	**336**	**334**						
					0	**8**	**0**	
% Total Misidentification Rate =	misidentifications	x100 =	0.30	**Pass**				
	total number							

References

[1] McDermott, H., Paull, T., Strachan, S. (May 2014). Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples, Environment Canada. ISBN: 978-1-100-25417-3

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Benthic Invertebrate
Tissue Chemistry
Laboratory Reports
(Trichanalytics Inc.)

June 22, 2020

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client: Katharina Batchelar
Aquatic Scientist
Minnow Environmental
Phone: 250-595-1627
Email: kbatchelar@minnow.ca

Date Received:	22 Jun 2020
Date of Analysis:	25 Jun 2020
Final Report Date:	29 Jun 2020
Project No.:	2020-117
Method No.:	MET-002.04

Client Project: Regional Effects Monitoring/Dry Creek 20-24

Analytical Request: Benthic Tissue Microchemistry (total metals and moisture) – 50 samples.
See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in part per million (ppm) dry weight.
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Samples were not frozen upon receipt due to delay in shipping.
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 102%; range 97 - 110%).

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy — 29 Jun 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio — 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_DC2_INV-01_2020-05-06	LC_DC2_INV-02_2020-05-06	LC_DC2_INV-03_2020-05-06	LC_DC2_INV-04_2020-05-06	LC_DC2_INV-05_2020-05-06
		Lab ID	001	002	003	004	005
		Wet Weight (g)	2.0696	2.1612	1.8226	1.8798	1.9888
		Dry Weight (g)	0.4760	0.4894	0.4499	0.5199	0.4585
		Moisture (%)	77.0	77.4	75.3	72.3	76.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	15	13	19	12	12
88Sr	0.001	0.003	8.4	8.1	4.1	4.3	5.9
95Mo	0.007	0.023	0.595	0.725	0.702	0.563	0.667
107Ag	0.001	0.003	0.164	0.169	0.151	0.108	0.155
111Cd	0.045	0.150	2.0	1.8	8.0	1.7	1.8
118Sn	0.017	0.057	0.357	0.394	0.273	0.245	0.481
121Sb	0.003	0.010	0.141	0.131	0.100	0.054	0.087
137Ba	0.001	0.003	171	222	273	156	216
202Hg	0.027	0.090	0.095	0.107	0.107	0.083	0.095
205Tl	0.001	0.003	0.107	0.109	0.104	0.053	0.074
208Pb	0.002	0.007	0.931	0.985	0.643	0.324	0.399
238U	0.001	0.003	0.164	0.196	0.177	0.112	0.202

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DCEF_INV-01_2020-05-06	LC_DCEF_INV-02_2020-05-06	LC_DCEF_INV-03_2020-05-06	LC_DCEF_INV-04_2020-05-06	LC_DCEF_INV-05_2020-05-06
		Lab ID	006	007	008	009	010
		Wet Weight (g)	0.8632	1.2970	1.1260	1.4132	1.4361
		Dry Weight (g)	0.2453	0.3511	0.2925	0.3192	0.3527
		Moisture (%)	71.6	72.9	74.0	77.4	75.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	6.9	5.2	5.7	5.4	5.5
88Sr	0.001	0.003	5.3	4.4	8.0	5.5	5.6
95Mo	0.007	0.023	0.290	0.267	0.383	0.267	0.342
107Ag	0.001	0.003	0.100	0.096	0.085	0.075	0.100
111Cd	0.045	0.150	4.6	3.8	4.3	3.0	4.3
118Sn	0.017	0.057	0.457	0.240	0.319	0.229	0.206
121Sb	0.003	0.010	0.062	0.040	0.071	0.035	0.042
137Ba	0.001	0.003	170	82	201	127	152
202Hg	0.027	0.090	0.138	0.067	0.138	0.063	0.079
205Tl	0.001	0.003	0.021	0.011	0.022	0.014	0.015
208Pb	0.002	0.007	0.223	0.082	0.222	0.122	0.139
238U	0.001	0.003	0.071	0.029	0.095	0.033	0.074

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DC3_INV-01_2020-05-07	LC_DC3_INV-02_2020-05-07	LC_DC3_INV-03_2020-05-07	LC_DC3_INV-04_2020-05-07	LC_DC3_INV-05_2020-05-07
		Lab ID	011	012	013	014	015
		Wet Weight (g)	1.2994	1.5641	1.7209	1.0339	1.3557
		Dry Weight (g)	0.4001	0.4239	0.4102	0.2675	0.3123
		Moisture (%)	69.2	72.9	76.2	74.1	77.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	5.0	7.1	4.9	9.6	5.4
88Sr	0.001	0.003	10	4.5	7.2	3.3	6.6
95Mo	0.007	0.023	0.429	0.226	0.383	0.539	0.342
107Ag	0.001	0.003	0.160	0.057	0.129	0.128	0.097
111Cd	0.045	0.150	1.7	0.592	1.1	1.9	1.1
118Sn	0.017	0.057	0.233	0.141	0.201	0.558	0.164
121Sb	0.003	0.010	0.139	0.054	0.071	0.090	0.100
137Ba	0.001	0.003	147	48	105	78	102
202Hg	0.027	0.090	0.159	0.078	0.086	0.110	0.083
205Tl	0.001	0.003	0.103	0.041	0.046	0.059	0.081
208Pb	0.002	0.007	0.877	0.236	0.417	0.491	0.605
238U	0.001	0.003	0.157	0.033	0.064	0.085	0.107

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_FRUS_INV-01_2020-05-08	LC_FRUS_INV-02_2020-05-08	LC_FRUS_INV-03_2020-05-08	LC_FRUS_INV-04_2020-05-08	LC_FRUS_INV-05_2020-05-08
		Lab ID	016	017	018	019	020
		Wet Weight (g)	1.6620	1.5419	1.6826	1.7282	1.5045
		Dry Weight (g)	0.4070	0.3954	0.4863	0.4825	0.4088
		Moisture (%)	75.5	74.4	71.1	72.1	72.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	7.6	6.2	6.6	5.5	6.5
88Sr	0.001	0.003	8.1	6.9	4.8	7.1	6.7
95Mo	0.007	0.023	0.394	0.334	0.444	0.296	0.284
107Ag	0.001	0.003	0.213	0.094	0.107	0.157	0.201
111Cd	0.045	0.150	1.6	2.0	2.3	0.915	1.1
118Sn	0.017	0.057	0.374	0.242	0.166	0.389	0.321
121Sb	0.003	0.010	0.068	0.084	0.047	0.041	0.047
137Ba	0.001	0.003	83	69	40	48	38
202Hg	0.027	0.090	0.072	0.062	0.068	0.072	0.062
205Tl	0.001	0.003	0.057	0.037	0.022	0.016	0.016
208Pb	0.002	0.007	0.803	0.615	0.411	0.254	0.336
238U	0.001	0.003	0.114	0.133	0.061	0.051	0.084

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_DC4_INV-01_2020-05-04	LC_DC4_INV-02_2020-05-04	LC_DC4_INV-03_2020-05-04	LC_DC4_INV-04_2020-05-04	LC_DC4_INV-05_2020-05-04
		Lab ID	021	022	023	024	025
		Wet Weight (g)	1.9354	1.8530	2.5289	1.7046	1.9088
		Dry Weight (g)	0.4062	0.3867	0.5569	0.3853	0.3898
		Moisture (%)	79.0	79.1	78.0	77.4	79.6
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	12	13	6.1	6.3	9.4
88Sr	0.001	0.003	3.2	5.6	2.4	3.4	7.2
95Mo	0.007	0.023	0.542	0.713	0.296	0.246	0.662
107Ag	0.001	0.003	0.108	0.087	0.047	0.071	0.115
111Cd	0.045	0.150	2.9	5.4	1.4	1.8	5.2
118Sn	0.017	0.057	0.255	0.299	0.067	0.093	0.461
121Sb	0.003	0.010	0.083	0.140	0.050	0.037	0.124
137Ba	0.001	0.003	254	327	122	70	261
202Hg	0.027	0.090	0.115	0.122	0.106	0.144	0.072
205Tl	0.001	0.003	0.031	0.061	0.014	0.020	0.033
208Pb	0.002	0.007	0.473	0.818	0.174	0.245	0.584
238U	0.001	0.003	0.160	0.233	0.036	0.079	0.216

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DC1_INV-01_2020-05-04	LC_DC1_INV-02_2020-05-04	LC_DC1_INV-03_2020-05-04	LC_DC1_INV-04_2020-05-04	LC_DC1_INV-05_2020-05-04
		Lab ID	026	027	028	029	030
		Wet Weight (g)	2.1822	2.1025	2.2585	2.2993	2.0306
		Dry Weight (g)	0.4889	0.4216	0.4613	0.4225	0.4099
		Moisture (%)	77.6	79.9	79.6	81.6	79.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	12	10	8.8	8.0	7.5
88Sr	0.001	0.003	4.5	2.6	1.8	2.3	3.1
95Mo	0.007	0.023	0.526	0.340	0.309	0.410	0.290
107Ag	0.001	0.003	0.118	0.049	0.051	0.051	0.083
111Cd	0.045	0.150	3.4	1.8	2.0	2.5	1.5
118Sn	0.017	0.057	0.173	0.159	0.241	0.190	0.111
121Sb	0.003	0.010	0.139	0.077	0.063	0.069	0.039
137Ba	0.001	0.003	301	170	132	160	103
202Hg	0.027	0.090	0.163	0.051	0.068	0.058	0.068
205Tl	0.001	0.003	0.027	0.022	0.015	0.018	0.012
208Pb	0.002	0.007	0.329	0.211	0.187	0.262	0.158
238U	0.001	0.003	0.157	0.067	0.056	0.080	0.049

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

		Client ID	LC_SPDC_INV-01_2020-05-05	LC_SPDC_INV-02_2020-05-05	LC_SPDC_INV-03_2020-05-05	LC_SPDC_INV-04_2020-05-05	LC_SPDC_INV-05_2020-05-05
		Lab ID	031	032	033	034	035
		Wet Weight (g)	1.3568	0.6611	1.3843	2.1092	1.7939
		Dry Weight (g)	0.2419	0.1332	0.2472	0.4877	0.3890
		Moisture (%)	82.2	79.9	82.1	76.9	78.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	25	26	22	13	25
88Sr	0.001	0.003	4.3	15	5.7	1.4	6.3
95Mo	0.007	0.023	0.549	0.955	0.615	0.347	0.771
107Ag	0.001	0.003	0.152	0.308	0.138	0.078	0.176
111Cd	0.045	0.150	1.3	2.1	1.4	1.1	1.5
118Sn	0.017	0.057	0.544	0.960	0.273	0.135	0.291
121Sb	0.003	0.010	0.113	0.248	0.135	0.044	0.145
137Ba	0.001	0.003	187	460	134	90	201
202Hg	0.027	0.090	0.092	0.152	0.097	0.045	0.103
205Tl	0.001	0.003	0.047	0.224	0.114	0.049	0.098
208Pb	0.002	0.007	0.499	1.3	0.651	0.182	0.502
238U	0.001	0.003	0.129	0.312	0.133	0.067	0.175

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DCDS_INV-01_2020-05-05	LC_DCDS_INV-02_2020-05-05	LC_DCDS_INV-03_2020-05-05	LC_DCDS_INV-04_2020-05-05	LC_DCDS_INV-05_2020-05-05
		Lab ID	036	037	038	039	040
		Wet Weight (g)	2.3675	1.8475	2.6604	2.0389	2.2288
		Dry Weight (g)	0.4959	0.4259	0.5747	0.4135	0.4620
		Moisture (%)	79.1	76.9	78.4	79.7	79.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	13	36	33	25	25
88Sr	0.001	0.003	1.5	2.5	1.5	1.6	1.8
95Mo	0.007	0.023	0.248	0.736	0.195	0.428	0.492
107Ag	0.001	0.003	0.054	0.121	0.053	0.066	0.066
111Cd	0.045	0.150	1.6	1.6	0.617	0.737	0.822
118Sn	0.017	0.057	0.104	0.158	0.060	0.115	0.074
121Sb	0.003	0.010	0.060	0.066	0.047	0.057	0.050
137Ba	0.001	0.003	65	131	72	92	77
202Hg	0.027	0.090	0.064	0.082	0.064	0.064	0.094
205Tl	0.001	0.003	0.046	0.048	0.034	0.046	0.039
208Pb	0.002	0.007	0.227	0.259	0.123	0.198	0.235
238U	0.001	0.003	0.059	0.083	0.049	0.069	0.050

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_FRB_INV-01_2020-05-08	LC_FRB_INV-02_2020-05-08	LC_FRB_INV-03_2020-05-08	LC_FRB_INV-04_2020-05-08	LC_FRB_INV-05_2020-05-08
		Lab ID	041	042	043	044	045
		Wet Weight (g)	1.9600	1.6807	1.8437	2.0033	1.8448
		Dry Weight (g)	0.5585	0.4459	0.5142	0.6608	0.5834
		Moisture (%)	71.5	73.5	72.1	67.0	68.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	5.9	6.3	5.6	4.8	6.6
88Sr	0.001	0.003	6.0	13	13	6.8	2.1
95Mo	0.007	0.023	0.319	0.351	0.370	0.249	0.305
107Ag	0.001	0.003	0.172	0.170	0.196	0.130	0.062
111Cd	0.045	0.150	1.5	2.7	2.3	1.1	0.357
118Sn	0.017	0.057	0.234	0.519	0.330	0.110	0.063
121Sb	0.003	0.010	0.033	0.099	0.08	0.047	0.038
137Ba	0.001	0.003	36	98	89	50	15
202Hg	0.027	0.090	0.050	0.097	0.062	0.065	0.056
205Tl	0.001	0.003	0.015	0.053	0.032	0.018	0.007
208Pb	0.002	0.007	0.207	0.783	0.637	0.369	0.123
238U	0.001	0.003	0.026	0.121	0.082	0.046	0.031

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent
Date of Analysis: 25 Jun 2020

Teck Coal Limited

Tissue Analysis Results

Parameter	DL (ppm)	LOQ (ppm)	LC_GRCK_INV-01_2020-05-11	LC_GRCK_INV-02_2020-05-11	LC_GRCK_INV-03_2020-05-11	LC_GRCK_INV-04_2020-05-11	LC_GRCK_INV-05_2020-05-11
Lab ID			046	047	048	049	050
Wet Weight (g)			1.3150	1.5709	1.4669	1.7252	0.9489
Dry Weight (g)			0.3530	0.3628	0.4488	0.5504	0.2685
Moisture (%)			73.2	76.9	69.4	68.1	71.7
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.434	1.4	5.0	5.8	8.8	4.6	7.2
88Sr	0.001	0.003	12	25	22	9.4	9.6
95Mo	0.007	0.023	0.408	0.411	0.816	0.351	0.649
107Ag	0.001	0.003	0.052	0.133	0.094	0.061	0.106
111Cd	0.045	0.150	2.1	2.2	4.8	0.889	1.4
118Sn	0.017	0.057	0.267	0.290	0.238	0.134	0.080
121Sb	0.003	0.010	0.053	0.031	0.078	0.028	0.034
137Ba	0.001	0.003	73	73	126	29	51
202Hg	0.027	0.090	0.085	0.112	0.127	0.180	0.091
205Tl	0.001	0.003	0.038	0.027	0.069	0.031	0.028
208Pb	0.002	0.007	0.687	0.373	1.6	0.239	0.442
238U	0.001	0.003	0.153	0.088	0.182	0.077	0.116

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Date of Analysis: 25 Jun 2020

Teck Coal Limited

Tissue QA/QC Relative Percent Difference Results

Client ID	LC_FRUS_INV-01_2020-05-08			LC_FRUS_INV-03_2020-05-08			LC_SPDC_INV-04_2020-05-05		
Lab ID	016			018			034		
Parameter	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	1.3	0.908	-	0.670	0.818	-	0.414	0.438	-
11B	4.7	3.2	38.0	2.2	2.3	4.4	1.1	1.1	0.0
23Na	3,727	2,894	25.2	2,072	2,951	35.0	2,245	2,645	16.4
24Mg	1,033	716	36.2	1,155	1,226	6.0	595	559	6.2
27Al	2,464	2,439	1.0	1,506	1,269	17.1	550	649	16.5
31P	9,519	8,815	7.7	7,125	8,658	19.4	7,691	6,676	14.1
39K	10,702	8,637	21.4	7,142	9,108	24.2	7,251	7,544	4.0
44Ca	8,394	4,981	**51.0**	4,369	5,343	20.1	814	1,302	**46.1**
49Ti	224	168	28.6	110	103	6.6	37	42	12.7
51V	6.0	6.2	3.3	2.7	2.4	11.8	1.3	1.7	26.7
52Cr	19	14	30.3	5.3	5.7	7.3	3.3	3.4	3.0
55Mn	75	62	19.0	35	47	29.3	68	86	23.4
57Fe	1,366	989	32.0	985	984	0.1	320	435	30.5
59Co	1.7	1.5	12.5	1.2	1.4	15.4	0.944	1.3	-
60Ni	34	26	26.7	11	11	0.0	15	12	22.2
63Cu	27	21	25.0	19	22	14.6	9.0	9.6	6.5
66Zn	296	222	28.6	242	315	26.2	143	156	8.7
75As	0.608	0.584	-	0.490	0.731	-	0.426	0.440	-
77Se	7.6	6.8	11.1	6.6	7.3	10.1	13	16	20.7
88Sr	8.1	5.8	33.1	4.8	6.8	34.5	1.4	1.7	19.4
95Mo	0.394	0.325	-	0.444	0.340	-	0.347	0.516	-
107Ag	0.213	0.126	-	0.107	0.148	-	0.078	0.077	-
111Cd	1.6	1.4	13.3	2.3	2.8	19.6	1.1	1.5	30.8
118Sn	0.374	0.259	-	0.166	0.204	-	0.135	0.147	-
121Sb	0.068	0.070	-	0.047	0.058	-	0.044	0.044	-
137Ba	85	76	11.7	40	52	26.1	90	84	6.9
202Hg	0.072	0.083	-	0.068	0.072	-	0.045	0.075	-
205Tl	0.057	0.037	-	0.022	0.026	-	0.049	0.043	-
208Pb	0.803	0.586	-	0.411	0.484	-	0.182	0.226	-
238U	0.114	0.089	-	0.061	0.060	-	0.067	0.085	-

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.

Only applies to QC samples at concentrations above 1 ppm.

Bold values indicate RPD results greater than DQO objectives

Teck Coal Limited

Tissue QA/QC Relative Percent Difference Results

Client ID	LC_GRCK_INV-03_2020-05-11			LC_GRCK_INV-05_2020-05-11		
Lab ID	048			050		
Parameter	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	1.8	1.3	32.3	0.485	0.392	-
11B	6.7	5.0	29.1	1.9	1.6	17.1
23Na	3,262	3,172	2.8	2,938	2,749	6.6
24Mg	1,552	1,144	30.3	798	891	11.0
27Al	3,771	2,705	32.9	858	724	16.9
31P	10,259	9,997	2.6	9,035	10,709	17.0
39K	8,644	9,514	9.6	7,356	6,658	10.0
44Ca	7,844	8,299	5.6	4,287	6,346	38.7
49Ti	318	239	28.4	82.9	52.4	**45.1**
51V	7.8	5.6	32.8	1.5	0.964	-
52Cr	12	7.0	**50.3**	4.6	4.0	14.0
55Mn	93	129	32.4	66	74	11.4
57Fe	2,266	1,910	17.0	911	681	28.9
59Co	1.4	1.6	13.3	0.632	0.732	-
60Ni	14	7.1	**65.4**	6.1	6.0	1.7
63Cu	19	23	19.0	17	22	25.6
66Zn	265	314	16.9	204	295	36.5
75As	1.2	1.1	8.7	0.497	0.526	-
77Se	8.8	8.4	4.7	7.2	6.2	14.9
88Sr	22	22	0.0	9.6	13	30.1
95Mo	0.816	1.0	-	0.649	0.573	-
107Ag	0.094	0.118	-	0.106	0.093	-
111Cd	4.8	5.7	17.1	1.4	1.2	15.4
118Sn	0.238	0.214	-	0.080	0.107	-
121Sb	0.078	0.073	-	0.034	0.042	-
137Ba	126	129	2.4	51	46	10.3
202Hg	0.127	0.115	-	0.091	0.100	-
205Tl	0.069	0.059	-	0.028	0.025	-
208Pb	1.6	1.6	0.0	0.442	0.317	-
238U	0.182	0.176	-	0.116	0.08	-

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.

Only applies to QC samples at concentrations above 1 ppm.

Bold values indicate RPD results greater than DQO objectives

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	0.005	1.21	1.2	99	9.4	1.3	106	5.6
11B	0.289	4.5	5.2	115	1.7	5.4	120	1.7
23Na	5.1	14,000	13,779	98	3.3	14,858	106	3.4
24Mg	0.029	910	908	100	2.7	975	107	3.7
27Al	0.116	197	198	100	1.3	229	116	3.0
31P	31	8,000	7,820	98	4.4	8,128	102	4.1
39K	1.3	15,500	16,409	106	4.6	16,774	108	2.9
44Ca	11	2,360	2,498	106	5.4	2,519	107	7.0
49Ti	0.157	12.24	12	94	5.8	14	117	12
51V	0.010	1.57	1.6	100	8.5	1.8	114	7.0
52Cr	0.52	1.87	1.9	104	2.5	2.1	112	2.5
55Mn	0.004	3.17	3.3	104	3.9	3.6	112	7.0
57Fe	1.3	343	373	109	6.9	394	115	6.4
59Co	0.002	0.25	0.272	109	6.5	0.290	116	5.0
60Ni	0.013	1.34	1.5	108	5.4	1.6	118	5.5
63Cu	0.005	15.7	17	109	5.0	18	113	5.9
66Zn	0.738	51.6	55	106	4.4	57	111	5.7
75As	0.407	6.87	6.8	98	5.1	7.1	103	3.7
77Se	0.434	3.45	3.4	98	4.0	3.3	97	5.8
88Sr	0.001	10.1	11	109	6.1	11	111	6.1
95Mo	0.007	0.29	0.292	101	6.9	0.330	114	5.7
107Ag	0.001	0.0252	0.027	106	8.5	0.029	113	6.5
111Cd	0.045	0.299	0.332	111	11.0	0.380	127	9.7
118Sn	0.017	0.061	0.068	111	11.0	0.072	118	6.3
121Sb	0.003	0.011	0.010	92	10.0	0.014	125	14.0
137Ba	0.001	8.6	9.0	104	2.1	9.9	115	7.3
202Hg	0.027	0.412	0.428	104	8.4	0.474	115	5.3
205Tl	0.001	-	-	-	-	-	-	-
208Pb	0.002	0.404	0.461	114	12.0	0.476	118	9.9
238U	0.001	0.050	0.056	112	9.1	0.062	123	11.0

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% was established for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Teck Coal Limited

Tissue QA/QC Accuracy and Precision Results

Sample Group ID			03			04		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.005	1.21	1.3	107	4.2	1.3	109	7.6
11B	0.289	4.5	4.8	106	1.6	4.8	107	3.1
23Na	5.1	14,000	15,551	111	5.8	15,462	110	4.7
24Mg	0.029	910	978	108	6.1	1,030	113	9.4
27Al	0.116	197	183	93	3.2	196	99	7.8
31P	31	8,000	8,522	106	3.9	8,738	109	6.7
39K	1.3	15,500	17,114	110	6.1	16,828	109	6.8
44Ca	11	2,360	2,542	108	4.8	2,661	113	4.9
49Ti	0.157	12.24	12	96	12.0	14	112	6.5
51V	0.010	1.57	1.6	100	7.7	1.8	113	6.9
52Cr	0.52	1.87	1.9	99	2.3	2.1	113	4.1
55Mn	0.004	3.17	3.3	103	2.9	3.7	116	5.3
57Fe	1.3	343	373	109	2.9	408	119	5.6
59Co	0.002	0.25	0.265	106	1.3	0.294	118	2.7
60Ni	0.013	1.34	1.4	108	2.5	1.5	116	4.5
63Cu	0.005	15.7	17	107	2.2	18	117	2.6
66Zn	0.738	51.6	55	107	1.6	59	114	5.5
75As	0.407	6.87	7.2	105	2.0	7.3	106	5.4
77Se	0.434	3.45	3.8	110	1.6	3.6	104	4.1
88Sr	0.001	10.1	11	109	4.8	12	118	5.0
95Mo	0.007	0.29	0.310	107	5.2	0.324	112	3.1
107Ag	0.001	0.0252	0.028	111	7.4	0.032	129	5.8
111Cd	0.045	0.299	0.325	109	3.5	0.377	126	3.1
118Sn	0.017	0.061	0.065	106	13.0	0.078	128	25
121Sb	0.003	0.011	0.013	114	18.0	0.013	120	7.5
137Ba	0.001	8.6	8.9	103	2.2	8.9	104	3.2
202Hg	0.027	0.412	0.401	97	4.5	0.444	108	2.2
205Tl	0.001	-	-	-	-	-	-	-
208Pb	0.002	0.404	0.417	103	9.8	0.485	120	8.7
238U	0.001	0.05	0.049	98	6.3	0.060	120	4.8

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% was established for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID
01	LC_DC2_INV-01_2020-05-06	001
	LC_DC2_INV-02_2020-05-06	002
	LC_DC2_INV-03_2020-05-06	003
	LC_DC2_INV-04_2020-05-06	004
	LC_DC2_INV-05_2020-05-06	005
	LC_DCEF_INV-01_2020-05-06	006
	LC_DCEF_INV-02_2020-05-06	007
	LC_DCEF_INV-03_2020-05-06	008
	LC_DCEF_INV-04_2020-05-06	009
	LC_DCEF_INV-05_2020-05-06	010
	LC_DC3_INV-01_2020-05-07	011
	LC_DC3_INV-02_2020-05-07	012
	LC_DC3_INV-03_2020-05-07	013
	LC_DC3_INV-04_2020-05-07	014
	LC_DC3_INV-05_2020-05-07	015
	LC_FRUS_INV-01_2020-05-08	016
02	LC_FRUS_INV-02_2020-05-08	017
	LC_FRUS_INV-03_2020-05-08	018
	LC_FRUS_INV-04_2020-05-08	019
	LC_FRUS_INV-05_2020-05-08	020
	LC_DC4_INV-01_2020-05-04	021
	LC_DC4_INV-02_2020-05-04	022
	LC_DC4_INV-03_2020-05-04	023
	LC_DC4_INV-04_2020-05-04	024
	LC_DC4_INV-05_2020-05-04	025
	LC_DC1_INV-01_2020-05-04	026
	LC_DC1_INV-02_2020-05-04	027
	LC_DC1_INV-03_2020-05-04	028
	LC_DC1_INV-04_2020-05-04	029
	LC_DC1_INV-05_2020-05-04	030
	LC_SPDC_INV-01_2020-05-05	031
03	LC_SPDC_INV-02_2020-05-05	032
	LC_SPDC_INV-03_2020-05-05	033
	LC_SPDC_INV-04_2020-05-05	034
	LC_SPDC_INV-05_2020-05-05	035
	LC_DCDS_INV-01_2020-05-05	036
	LC_DCDS_INV-02_2020-05-05	037
	LC_DCDS_INV-03_2020-05-05	038
	LC_DCDS_INV-04_2020-05-05	039

Sample Group ID	Client ID	Lab ID
04	LC_DCDS_INV-05_2020-05-05	040
	LC_FRB_INV-01_2020-05-08	041
	LC_FRB_INV-02_2020-05-08	042
	LC_FRB_INV-03_2020-05-08	043
	LC_FRB_INV-04_2020-05-08	044
	LC_FRB_INV-05_2020-05-08	045
	LC_GRCK_INV-01_2020-05-11	046
	LC_GRCK_INV-02_2020-05-11	047
	LC_GRCK_INV-03_2020-05-11	048
	LC_GRCK_INV-04_2020-05-11	049
	LC_GRCK_INV-05_2020-05-11	050

TrichAnalytics Inc.
207-1753 Sean Heights, Saanichton, BC, V8M 0B3
Ph: (250) 532-1084

Chain of Custody (COC) for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number: Regional Effects Monitoring/Dry Creek 20-24			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	2 Lamb St	Address:	
City, Province:	Georgetown, ON	City, Province:	
Postal Code:	L7G 3M9	Postal Code:	
Phone:	778-677-3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich ID #:		Sample Identification:	Sample Type: Species	Sample type
001	1	LC_DC2_INV-01_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
002	2	LC_DC2_INV-02_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
003	3	LC_DC2_INV-03_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
004	4	LC_DC2_INV-04_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
005	5	LC_DC2_INV-05_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
006	6	LC_DCEF_INV-01_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
007	7	LC_DCEF_INV-02_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
008	8	LC_DCEF_INV-03_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
009	9	LC_DCEF_INV-04_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
010	10	LC_DCEF_INV-05_2020-05-06 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
011	11	LC_DC3_INV-01_2020-05-07 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
012	12	LC_DC3_INV-02_2020-05-07 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
013	13	LC_DC3_INV-03_2020-05-07 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
014	14	LC_DC3_INV-04_2020-05-07 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
015	15	LC_DC3_INV-05_2020-05-07 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
016	16	LC_FRUS_INV-01_2020-05-08 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
017	17	LC_FRUS_INV-02_2020-05-08 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
018	18	LC_FRUS_INV-03_2020-05-08 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
019	19	LC_FRUS_INV-04_2020-05-08 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
020	20	LC_FRUS_INV-05_2020-05-08 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture

Sample(s) Release Maddy Stokes	Sample(s) Received By: GERIENE LABINE
Signature: Maddy Stokes	Signature: [signature]
Date Sent: 17-Jun-20	Date Received: 22 JUN 2020 (PROJECT #: 2020-117)
Sample(s) Returned to Client By: NOTE: page 2 of 3	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

COM-011.01

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis
Invoicing	Reporting (if different from Invoicing)

Project Number: Regional Effects Monitoring/Dry Creek 20-24

Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	2 Lamb St	Address:	
City, Province:	Georgetown, ON	City, Province:	
Postal Code:	L7G 3M9	Postal Code:	
Phone:	778-677-3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich ID#:		Sample Identification:	Sample Type: Species	Sample type
021	1	LC_DC4_INV-01_2020-05-04 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
022	2	LC_DC4_INV-02_2020-05-04 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
023	3	LC_DC4_INV-03_2020-05-04 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
024	4	LC_DC4_INV-04_2020-05-04 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
025	5	LC_DC4_INV-05_2020-05-04 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
026	6	LC_DC1_INV-01_2020-05-04 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
027	7	LC_DC1_INV-02_2020-05-04 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
028	8	LC_DC1_INV-03_2020-05-04 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
029	9	LC_DC1_INV-04_2020-05-04 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
030	10	LC_DC1_INV-05_2020-05-04 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
031	11	LC_SPDC_INV-01_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
032	12	LC_SPDC_INV-02_2020-05-05 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
033	13	LC_SPDC_INV-03_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
034	14	LC_SPDC_INV-04_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
035	15	LC_SPDC_INV-05_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
036	16	LC_DCDS_INV-01_2020-05-05 ✓	Composite	Benthic Invertebrate; Total Metals and % Moisture
037	17	LC_DCDS_INV-02_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
038	18	LC_DCDS_INV-03_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
039	19	LC_DCDS_INV-04_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
040	20	LC_DCDS_INV-05_2020-05-05 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture

Sample(s) Released By:	Maddy Stokes	Sample(s) Received By:	Gerienie LaBine
Signature:	*Maddy Stokes*	Signature:	[signature]
Date Sent:	17-Jun-20	Date Received:	22 Jun 2020 (Project #2020-117)
Sample(s) Returned to Client By: NOTE: page 1 of 3		Shipping Conditions:	
		Shipping Container:	
Signature:		Date Sent:	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis
Invoicing	Reporting (if different from Invoicing)

Project Number: Regional Effects Monitoring/Dry Creek 20-24

Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	2 Lamb St	Address:	
City, Province:	Georgetown, ON	City, Province:	
Postal Code:	L7G 3M9	Postal Code:	
Phone:	778-677-3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich ID #:		Sample Identification:	Sample Type: Species	Sample type
041	1	LC_FRB_INV-01_2020-05-08 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
042	2	LC_FRB_INV-02_2020-05-08 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
043	3	LC_FRB_INV-03_2020-05-08 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
044	4	LC_FRB_INV-04_2020-05-08 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
045	5	LC_FRB_INV-05_2020-05-08 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
046	6	LC_GRCK_INV-01_2020-05-11 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
047	7	LC_GRCK_INV-02_2020-05-11 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
048	8	LC_GRCK_INV-03_2020-05-11 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
049	9	LC_GRCK_INV-04_2020-05-11 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
050	10	LC_GRCK_INV-05_2020-05-11 ✓	Composite	Benthic Invertebrate, Total Metals and % Moisture
~~051~~ GGOL	11	23Jun2020.		
~~0~~	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			

Sample(s) Release Maddy Stokes	Sample(s) Received By: Gerlene LaBine
Signature: *Maddy Stokes*	Signature: [signature]
Date Sent: 17-Jun-20	Date Received: 22 JUN 2020 (Project #: 2020-117)
Sample(s) Returned to Client By: NOTE: page 3 of 3	Shipping Conditions: Shipping Container:
Signature:	Date Sent:

COM-011.01

July 8, 2020

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client: Dave Hasek
Aquatic Scientist
Minnow Environmental
Phone: (778) 677-3500
Email: dhasek@minnow.ca

Date Received: 08 Jul 2020
Date of Analysis: 16 Jul 2020
Final Report Date: 20 Jul 2020
Project No.: 2020-122
Method No.: MET-002.04

Client Project: Regional Effects Monitoring/Dry Creek 20-24

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 35 samples.
See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in part per million (ppm) dry weight.
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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 99%; range 93 - 108%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy 20 Jul 2020
Reviewed and Approved by Jennie Christensen, PhD, RPBio Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA Testing Accreditation No. A4196

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24

Tissue Analysis Results

		Client ID	LC_DC4_INV-01_2020-06-25	LC_DC4_INV-02_2020-06-25	LC_DC4_INV-03_2020-06-25	LC_DC4_INV-04_2020-06-25	LC_DC4_INV-05_2020-06-25
		Lab ID	001	002	003	004	005
		Wet Weight (g)	1.1814	0.8747	1.3021	1.0309	1.5890
		Dry Weight (g)	0.2970	0.1943	0.3028	0.2572	0.3770
		Moisture (%)	74.9	77.8	76.7	75.1	76.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.285	0.950	8.9	8.5	7.1	6.0	7.3
88Sr	0.001	0.003	8.1	5.5	4.3	2.3	5.8
95Mo	0.006	0.020	0.595	0.590	0.377	0.482	0.729
107Ag	0.001	0.003	0.121	0.132	0.188	0.098	0.122
111Cd	0.069	0.230	4.0	9.2	3.7	1.7	1.9
118Sn	0.017	0.057	0.151	0.290	0.177	0.156	0.246
121Sb	0.006	0.020	0.067	0.077	0.039	0.037	0.057
137Ba	0.001	0.003	290	114	115	130	202
202Hg	0.026	0.087	0.047	0.074	0.047	0.043	0.078
205Tl	0.001	0.003	0.064	0.075	0.036	0.029	0.038
208Pb	0.002	0.007	0.389	0.410	0.190	0.137	0.244
238U	0.001	0.003	0.063	0.098	0.036	0.030	0.049

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24

Tissue Analysis Results

		Client ID	LC_DC1_INV-01_2020-06-24	LC_DC1_INV-02_2020-06-24	LC_DC1_INV-03_2020-06-24	LC_DC1_INV-04_2020-06-24	LC_DC1_INV-05_2020-06-24
		Lab ID	006	007	008	009	010
		Wet Weight (g)	1.1979	1.2897	1.3433	1.1829	1.1712
		Dry Weight (g)	0.2537	0.2584	0.2769	0.2147	0.2520
		Moisture (%)	78.8	80.0	79.4	81.8	78.5
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.285	0.950	9.6	7.4	3.1	3.2	19
88Sr	0.001	0.003	3.5	2.7	9.5	9.8	11
95Mo	0.006	0.020	0.577	0.377	0.309	0.275	0.761
107Ag	0.001	0.003	0.119	0.080	0.024	0.024	0.216
111Cd	0.069	0.230	8.1	9.5	0.284	0.267	27
118Sn	0.017	0.057	0.508	0.355	0.081	0.077	0.777
121Sb	0.006	0.020	0.074	0.042	0.011	0.011	0.187
137Ba	0.001	0.003	154	112	9.6	9.6	277
202Hg	0.026	0.087	0.070	0.059	0.408	0.404	0.120
205Tl	0.001	0.003	0.077	0.079	0.007	0.007	0.182
208Pb	0.002	0.007	0.376	0.179	0.359	0.287	1.0
238U	0.001	0.003	0.078	0.060	0.049	0.043	0.088

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24

Tissue Analysis Results

		Client ID	LC_SPDC_INV-01_2020-06-24	LC_SPDC_INV-02_2020-06-24	LC_SPDC_INV-03_2020-06-24	LC_SPDC_INV-04_2020-06-24	LC_SPDC_INV-05_2020-06-24
		Lab ID	011	012	013	014	015
		Wet Weight (g)	0.9367	0.5625	0.8906	0.8734	0.5465
		Dry Weight (g)	0.2174	0.1305	0.2132	0.1686	0.1212
		Moisture (%)	76.8	76.8	76.1	80.7	77.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.285	0.950	25	27	24	20	20
88Sr	0.001	0.003	9.3	5.5	3.0	6.5	7.9
95Mo	0.006	0.020	0.716	0.555	0.441	0.504	0.527
107Ag	0.001	0.003	0.229	0.143	0.096	0.147	0.164
111Cd	0.069	0.230	3.1	1.7	1.1	1.8	1.6
118Sn	0.017	0.057	0.618	0.345	0.253	0.440	1.0
121Sb	0.006	0.020	0.152	0.074	0.051	0.132	0.107
137Ba	0.001	0.003	229	156	100	154	211
202Hg	0.026	0.087	0.089	0.075	0.050	0.066	0.077
205Tl	0.001	0.003	0.126	0.100	0.069	0.120	0.096
208Pb	0.002	0.007	0.975	0.571	0.267	0.587	0.727
238U	0.001	0.003	0.145	0.078	0.035	0.117	0.109

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-01_2020-06-24	LC_DCDS_INV-02_2020-06-24	LC_DCDS_INV-03_2020-06-24	LC_DCDS_INV-04_2020-06-24	LC_DCDS_INV-05_2020-06-24
		Lab ID	016	017	018	019	020
		Wet Weight (g)	1.0487	0.7371	1.2658	0.4493	1.2624
		Dry Weight (g)	0.2557	0.1749	0.2806	0.1333	0.2437
		Moisture (%)	75.6	76.3	77.8	70.3	80.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.285	0.950	8.0	9.4	5.7	9.0	16
88Sr	0.001	0.003	8.5	7.5	4.2	8.0	4.0
95Mo	0.006	0.020	0.481	0.564	0.303	0.707	0.444
107Ag	0.001	0.003	0.090	0.112	0.084	0.166	0.110
111Cd	0.069	0.230	3.6	10	1.2	15	1.7
118Sn	0.017	0.057	0.470	0.829	0.290	1.1	0.433
121Sb	0.006	0.020	0.112	0.123	0.030	0.147	0.086
137Ba	0.001	0.003	171	189	134	205	186
202Hg	0.026	0.087	0.058	0.066	0.054	0.104	0.066
205Tl	0.001	0.003	0.086	0.094	0.029	0.168	0.080
208Pb	0.002	0.007	0.634	0.670	0.146	0.827	0.484
238U	0.001	0.003	0.113	0.118	0.027	0.185	0.090

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24

Tissue Analysis Results

		Client ID	LC_DC2_INV-01_2020-06-25	LC_DC2_INV-02_2020-06-25	LC_DC2_INV-03_2020-06-25	LC_DC2_INV-04_2020-06-25	LC_DC2_INV-05_2020-06-25
		Lab ID	021	022	023	024	025
		Wet Weight (g)	0.8178	0.5971	0.6355	0.8485	0.6642
		Dry Weight (g)	0.1875	0.1235	0.1581	0.2224	0.1743
		Moisture (%)	77.1	79.3	75.1	73.8	73.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.285	0.950	8.8	6.5	7.9	13	7.8
88Sr	0.001	0.003	4.2	6.2	6.4	4.7	6.0
95Mo	0.006	0.020	0.461	0.765	0.546	0.713	0.616
107Ag	0.001	0.003	0.145	0.132	0.149	0.095	0.126
111Cd	0.069	0.230	6.9	4.5	6.3	3.6	2.5
118Sn	0.017	0.057	0.477	0.824	0.401	0.464	0.425
121Sb	0.006	0.020	0.074	0.165	0.091	0.081	0.074
137Ba	0.001	0.003	163	281	175	169	198
202Hg	0.026	0.087	0.119	0.087	0.076	0.064	0.055
205Tl	0.001	0.003	0.107	0.117	0.099	0.075	0.064
208Pb	0.002	0.007	0.495	0.916	0.504	0.392	0.400
238U	0.001	0.003	0.091	0.170	0.105	0.107	0.081

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24

Tissue Analysis Results

		Client ID	LC_DCEF_INV-01_2020-06-22	LC_DCEF_INV-02_2020-06-22	LC_DCEF_INV-03_2020-06-22	LC_DCEF_INV-04_2020-06-22	LC_DCEF_INV-05_2020-06-22
		Lab ID	026	027	028	029	030
		Wet Weight (g)	1.5650	1.4170	1.1098	1.0222	1.4687
		Dry Weight (g)	0.4272	0.4262	0.2880	0.2443	0.3620
		Moisture (%)	72.7	69.9	74.0	76.1	75.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.285	0.950	3.5	4.1	5.1	5.4	5.9
88Sr	0.001	0.003	1.6	2.5	2.9	3.9	2.1
95Mo	0.006	0.020	0.222	0.216	0.421	0.548	0.330
107Ag	0.001	0.003	0.097	0.118	0.108	0.096	0.081
111Cd	0.069	0.230	0.893	4.0	4.5	4.6	2.4
118Sn	0.017	0.057	0.084	0.079	0.078	0.587	0.122
121Sb	0.006	0.020	0.010	0.013	0.021	0.033	0.015
137Ba	0.001	0.003	48	66	67	122	52
202Hg	0.026	0.087	0.030	0.042	0.037	0.047	0.058
205Tl	0.001	0.003	0.005	0.008	0.014	0.016	0.009
208Pb	0.002	0.007	0.021	0.016	0.043	0.092	0.032
238U	0.001	0.003	0.005	0.005	0.016	0.023	0.012

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24

Tissue Analysis Results

		Client ID	LC_DC3_INV-01_2020-06-22	LC_DC3_INV-02_2020-06-22	LC_DC3_INV-03_2020-06-22	LC_DC3_INV-04_2020-06-22	LC_DC3_INV-05_2020-06-22
		Lab ID	031	032	033	034	035
		Wet Weight (g)	1.4095	1.4608	1.4981	1.2972	1.4070
		Dry Weight (g)	0.3118	0.3356	0.3618	0.3190	0.3565
		Moisture (%)	77.9	77.0	75.8	75.4	74.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.285	0.950	5.8	6.7	10	4.0	6.4
88Sr	0.001	0.003	1.8	3.5	4.6	2.4	1.8
95Mo	0.006	0.020	0.318	0.469	0.509	0.222	0.238
107Ag	0.001	0.003	0.069	0.131	0.170	0.072	0.104
111Cd	0.069	0.230	0.801	0.975	1.4	0.627	0.694
118Sn	0.017	0.057	0.130	0.174	0.280	0.100	0.052
121Sb	0.006	0.020	0.030	0.054	0.059	0.033	0.030
137Ba	0.001	0.003	48	65	110	43	38
202Hg	0.026	0.087	0.053	0.047	0.055	0.040	0.040
205Tl	0.001	0.003	0.022	0.029	0.026	0.018	0.016
208Pb	0.002	0.007	0.101	0.156	0.246	0.117	0.099
238U	0.001	0.003	0.019	0.032	0.046	0.018	0.016

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24
Tissue QA/QC Relative Percent Difference Results

	Client ID	LC_DC4_INV-02_2020-06-25			LC_SPDC_INV-03_2020-06-24			LC_DC2_INV-01_2020-06-25		
	Lab ID	002			013			021		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.005	0.799	0.589	30.3	0.551	0.518	6.2	0.732	0.924	23.2
11B	0.112	2.1	1.4	40.0	1.0	1.1	-	1.8	2.7	40.0
23Na	5.0	4,750	4,025	16.5	3,160	3,344	5.7	3,712	3,766	1.4
24Mg	0.046	1,928	1,558	21.2	1,413	1,347	4.8	1,755	1,961	11.1
27Al	0.065	992	993	0.1	889	860	3.3	1,919	2,696	33.7
31P	58	12,548	10,638	16.5	12,235	12,003	1.9	13,171	12,577	4.6
39K	6.5	12,999	10,421	22.0	9,670	9,931	2.7	13,110	44,032	10.3
44Ca	15	3,744	2,479	40.7	1,543	1,496	3.1	2,033	2,577	23.6
49Ti	0.124	61	57	6.8	53	52	1.9	120	176	37.8
51V	0.018	2.6	2.3	12.2	1.9	1.9	0.0	3.8	5.7	40.0
52Cr	0.478	7.7	6.2	21.6	4.1	5.0	-	5.9	8.5	36.1
55Mn	0.016	65	51	24.1	65	59	9.7	83	101	19.6
57Fe	3.6	446	426	4.6	399	388	2.8	691	934	29.9
59Co	0.002	6.2	4.7	27.5	2.0	2.6	26.1	9.4	9.2	2.2
60Ni	0.013	36	27	28.6	15	21	33.3	33	41	21.6
63Cu	0.006	16	15	6.5	12	12	0.0	14	14	0.0
66Zn	0.306	328	263	22.0	208	192	8.0	352	414	16.2
75As	0.423	2.2	1.5	-	0.456	0.565	-	2.1	2.3	-
77Se	0.285	8.5	6.4	28.2	24	24	0.0	8.8	9.6	8.7
88Sr	0.001	5.5	3.7	39.1	3.0	2.6	14.3	4.2	5.6	28.6
95Mo	0.006	0.590	0.490	18.5	0.441	0.361	20.0	0.461	0.531	14.1
107Ag	0.001	0.132	0.099	28.6	0.096	0.091	5.3	0.145	0.151	4.1
111Cd	0.069	9.2	5.6	**48.6**	1.1	1.4	24.0	6.9	9.8	34.7
118Sn	0.017	0.290	0.218	28.3	0.253	0.268	5.8	0.477	0.587	20.7
121Sb	0.006	0.077	0.054	35.1	0.051	0.051	-	0.074	0.107	36.5
137Ba	0.001	114	105	8.2	100	93	7.3	163	192	16.3
202Hg	0.026	0.074	0.127	-	0.050	0.039	-	0.119	0.095	-
205Tl	0.001	0.075	0.050	40.0	0.069	0.068	1.5	0.107	0.122	13.1
208Pb	0.002	0.410	0.294	33.0	0.267	0.275	3.0	0.495	0.710	35.7
238U	0.001	0.098	0.063	**43.5**	0.035	0.043	20.5	0.091	0.131	36.0

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
Bold indicates DQO exceedance, but result is accepted as it does not impact the reportable results.

Client ID: LC_DC3_INV-02_2020-06-22
Lab ID: 032

Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.005	0.289	0.215	29.4
11B	0.112	0.659	0.509	-
23Na	5.0	2,759	2,240	20.8
24Mg	0.046	1,425	1,376	3.5
27Al	0.065	425	305	32.9
31P	58	10,206	10,011	1.9
39K	6.5	8,734	6,378	31.2
44Ca	15	1,987	1,867	6.2
49Ti	0.124	27	18	40.0
51V	0.018	1.3	1.0	26.1
52Cr	0.478	3.7	3.0	-
55Mn	0.016	66	53	21.8
57Fe	3.6	264	202	26.6
59Co	0.002	1.4	1.3	7.4
60Ni	0.013	15	12	22.2
63Cu	0.006	17	14	19.4
66Zn	0.306	225	208	7.9
75As	0.423	0.481	<0.423	-
77Se	0.285	6.7	5.9	12.7
88Sr	0.001	3.5	2.8	22.2
95Mo	0.006	0.469	0.381	20.7
107Ag	0.001	0.131	0.119	9.6
111Cd	0.069	0.975	0.948	2.8
118Sn	0.017	0.174	0.122	35.1
121Sb	0.006	0.054	0.039	-
137Ba	0.001	65	60	8.0
202Hg	0.026	0.047	0.042	-
205Tl	0.001	0.029	0.023	23.1
208Pb	0.002	0.156	0.154	1.3
238U	0.001	0.032	0.028	13.3

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: Regional Effects Monitoring/Dry Creek 20-24

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	0.005	1.21	1.3	106	10.1	1.3	110	6.9
11B	0.112	4.5	5.2	115	1.1	4.8	106	1.9
23Na	5.0	14000	15,864	113	8.0	15,163	108	5.2
24Mg	0.046	910	1,022	112	5.1	1,000	110	5.3
27Al	0.065	197.2	228	115	8.1	209	106	4.2
31P	58	8000	8,301	104	9.2	8,927	112	5.9
39K	6.5	15500	17,489	113	9.0	16,782	108	6.3
44Ca	15	2360	2,560	109	9.8	2,479	105	4.4
49Ti	0.124	12.24	14	118	10.6	12	100	7.5
51V	0.018	1.57	1.6	104	12.4	1.7	106	5.6
52Cr	0.478	1.87	2.0	107	10.9	2.0	109	3.0
55Mn	0.016	3.17	3.4	107	7.1	3.4	107	3.3
57Fe	3.6	343	369	108	6.4	387	113	7.5
59Co	0.002	0.25	0.279	112	6.4	0.277	111	5.2
60Ni	0.013	1.34	1.5	109	8.5	1.5	111	3.5
63Cu	0.006	15.7	18	113	11.6	18	114	4.2
66Zn	0.306	51.6	55	107	6.9	56	109	4.9
75As	0.423	6.87	6.5	95	10.5	7.5	109	4.4
77Se	0.285	3.45	3.2	93	11.4	3.7	108	2.7
88Sr	0.001	10.1	11	107	7.3	11	109	7.1
95Mo	0.006	0.29	0.313	108	10.9	0.306	106	1.6
107Ag	0.001	0.0252	0.029	117	5.9	0.026	105	5.0
111Cd	0.069	0.299	0.338	113	7.9	0.359	120	7.4
118Sn	0.017	0.061	0.069	114	15.8	0.065	107	8.1
121Sb	0.006	0.011	0.010	92	11.9	0.010	95	**21.8**
137Ba	0.001	8.6	10.0	116	1.9	8.9	104	4.0
202Hg	0.026	0.412	0.434	105	16.4	0.394	96	5.6
205Tl	0.001	-	-	-	-	-	-	-
208Pb	0.002	0.404	0.480	119	15.9	0.426	106	6.3
238U	0.001	0.05	0.061	122	11.1	0.052	104	9.5

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% was established for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results.

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24

Tissue QA/QC Accuracy and Precision Results

Sample Group ID			03			04		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.005	1.21	1.4	116	4.7	1.2	100	5.9
11B	0.112	4.5	5.5	123	2.4	4.6	103	4.6
23Na	5.0	14000	16,777	120	5.3	13,513	97	4.8
24Mg	0.046	910	1,064	117	3.3	844	93	5.1
27Al	0.065	197.2	210	107	4.1	196	100	7.6
31P	58	8000	8,745	109	3.4	7,514	94	5.3
39K	6.5	15500	18,715	121	5.3	15,192	98	4.5
44Ca	15	2360	2,948	125	5.7	2,250	95	3.4
49Ti	0.124	12.24	13	103	7.6	13	104	8.9
51V	0.018	1.57	1.8	114	9.4	1.5	98	8.4
52Cr	0.478	1.87	2.2	120	4.2	1.8	95	4.9
55Mn	0.016	3.17	3.7	118	3.7	3.1	96	5.6
57Fe	3.6	343	423	123	4.3	337	98	2.6
59Co	0.002	0.25	0.292	117	4.6	0.241	96	5.2
60Ni	0.013	1.34	1.6	122	2.3	1.3	98	5.9
63Cu	0.006	15.7	19	120	2.7	15	98	7.1
66Zn	0.306	51.6	60	116	2.5	52	100	1.2
75As	0.423	6.87	7.4	108	2.6	6.8	98	3.9
77Se	0.285	3.45	3.4	99	5.1	3.4	97	4.0
88Sr	0.001	10.1	12	120	3.5	9.8	97	4.7
95Mo	0.006	0.29	0.335	115	1.7	0.305	105	5.4
107Ag	0.001	0.0252	0.032	127	5.9	0.028	111	6.9
111Cd	0.069	0.299	0.378	126	9.1	0.289	97	8.6
118Sn	0.017	0.061	0.073	120	9.6	0.057	93	6.4
121Sb	0.006	0.011	0.011	97	19.9	0.012	106	5.7
137Ba	0.001	8.6	9.9	116	2.7	8.9	103	2.9
202Hg	0.026	0.412	0.509	124	4.2	0.400	97	5.0
205Tl	0.001	-	-	-	-	-	-	-
208Pb	0.002	0.404	0.574	**142**	15.8	0.362	90	13.7
238U	0.001	0.05	0.064	128	10.8	0.047	94	8.1

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% was established for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results.

Teck Coal Limited: Regional Effects Monitoring/Dry Creek 20-24
Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC4_INV-01_2020-06-25	001	16 Jul 2020
	LC_DC4_INV-02_2020-06-25	002	
	LC_DC4_INV-03_2020-06-25	003	
	LC_DC4_INV-04_2020-06-25	004	
	LC_DC4_INV-05_2020-06-25	005	
	LC_DC1_INV-01_2020-06-24	006	
	LC_DC1_INV-02_2020-06-24	007	
	LC_DC1_INV-03_2020-06-24	008	
	LC_DC1_INV-04_2020-06-24	009	
02	LC_DC1_INV-05_2020-06-24	010	16 Jul 2020
	LC_SPDC_INV-01_2020-06-24	011	
	LC_SPDC_INV-02_2020-06-24	012	
	LC_SPDC_INV-03_2020-06-24	013	
	LC_SPDC_INV-04_2020-06-24	014	
	LC_SPDC_INV-05_2020-06-24	015	
	LC_DCDS_INV-01_2020-06-24	016	
	LC_DCDS_INV-02_2020-06-24	017	
	LC_DCDS_INV-03_2020-06-24	018	
03	LC_DCDS_INV-04_2020-06-24	019	16 Jul 2020
	LC_DCDS_INV-05_2020-06-24	020	
	LC_DC2_INV-01_2020-06-25	021	
	LC_DC2_INV-02_2020-06-25	022	
	LC_DC2_INV-03_2020-06-25	023	
	LC_DC2_INV-04_2020-06-25	024	
	LC_DC2_INV-05_2020-06-25	025	
	LC_DCEF_INV-01_2020-06-22	026	
	LC_DCEF_INV-02_2020-06-22	027	
04	LC_DCEF_INV-03_2020-06-22	028	16 Jul 2020
	LC_DCEF_INV-04_2020-06-22	029	
	LC_DCEF_INV-05_2020-06-22	030	
	LC_DC3_INV-01_2020-06-22	031	
	LC_DC3_INV-02_2020-06-22	032	
	LC_DC3_INV-03_2020-06-22	033	
	LC_DC3_INV-04_2020-06-22	034	
	LC_DC3_INV-05_2020-06-22	035	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number: Regional Effects Monitoring/Dry Creek 20-24			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	2 Lamb St	Address:	
City, Province:	Georgetown, ON	City, Province:	
Postal Code:	L7G 3M9	Postal Code:	
Phone:	778-677-3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich ID#:	#	Sample Identification:	Sample Type: Species	Sample type
001	1	LC_DC4_INV-01_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
002	2	LC_DC4_INV-02_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
003	3	LC_DC4_INV-03_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
004	4	LC_DC4_INV-04_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
005	5	LC_DC4_INV-05_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
006	6	LC_DC1_INV-01_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
007	7	LC_DC1_INV-02_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
008	8	LC_DC1_INV-03_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
009	9	LC_DC1_INV-04_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
010	10	LC_DC1_INV-05_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
011	11	LC_SPDC_INV-01_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
012	12	LC_SPDC_INV-02_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
BEG OL 08 JUL 2020 ~~OK~~ 013	13	LC_SPDC_INV-03_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
014	14	LC_SPDC_INV-04_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
015	15	LC_SPDC_INV-05_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
016	16	LC_DCDS_INV-01_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
017	17	LC_DCDS_INV-02_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
018	18	LC_DCDS_INV-03_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
019	19	LC_DCDS_INV-04_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture
020	20	LC_DCDS_INV-05_2020-06-24	Composite	Benthic Invertebrate; Total Metals and % Moisture

Sample(s) Released By:	Maddy Stokes	Sample(s) Received By: GERIENE LABINE
Signature:	Maddy Stokes	Signature: Gerrine L B
Date Sent:	6-Jul-20	Date Received: 08 JUL 2020 (Project#: 2020-122)
Sample(s) Returned to Client By: NOTE: page 1 of 2 GOL		Shipping Conditions:
		Shipping Container:
Signature:		Date Sent:

COM-011.01

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis
Invoicing	Reporting (if different from Invoicing)

Project Number: Regional Effects Monitoring/Dry Creek 20-24

Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	2 Lamb St	Address:	
City, Province:	Georgetown, ON	City, Province:	
Postal Code:	L7G 3M9	Postal Code:	
Phone:	778-677-3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich ID#:		Sample Identification:	Sample Type: Species	Sample type
021	1	LC_DC2_INV-01_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
022	2	LC_DC2_INV-02_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
023	3	LC_DC2_INV-03_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
024	4	LC_DC2_INV-04_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
025	5	LC_DC2_INV-05_2020-06-25	Composite	Benthic Invertebrate; Total Metals and % Moisture
026	6	LC_DCEF_INV-01_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
027	7	LC_DCEF_INV-02_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
028	8	LC_DCEF_INV-03_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
029	9	LC_DCEF_INV-04_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
030	10	LC_DCEF_INV-05_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
031	11	LC_DC3_INV-01_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
032	12	LC_DC3_INV-02_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
033	13	LC_DC3_INV-03_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
034	14	LC_DC3_INV-04_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
035	15	LC_DC3_INV-05_2020-06-22	Composite	Benthic Invertebrate; Total Metals and % Moisture
	16			
	17			
	18			
	19			
	20			

Sample(s) Release Maddy Stokes	Sample(s) Received By: GERIENE LABINE
Signature: *Maddy Stokes*	Signature:
Date Sent: 17-Jun-20	Date Received: 08 JUL 2020 (Project#: 2020-122)
Sample(s) Returned to Client By: NOTE: page 2 of 2 GL	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

COM-011.01

September 5, 2020

T r i c h A n a l y t i c s   I n c .

Tissue Microchemistry Analysis Report

Client: Dave Hasek
Aquatic Scientist
Minnow Environmental
Phone: (778) 677-3500
Email: dhasek@minnow.ca

Date Received: 05 Sep 2020
Date of Analysis: 15 Sep 2020
16 Sep 2020
Final Report Date: 17 Sep 2020
Project No.: 2020-140
Method No.: MET-002.04

Client Project: Teck Coal Limited/Minnow Environmental Benthic Invertebrate Analysis

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 50 samples.
See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in part per million (ppm) dry weight.
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.
CoC transcription error noted for sample ID LC_FRUS_INV_1_2020_09-28 and corrected for reporting as per Client request.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 101%; range 96 - 108%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy — 17 Sep 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio — 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_SPDC_INV_1_ 2020_09-01	LC_SPDC_INV_2_ 2020_09-01	LC_SPDC_INV_3_ 2020_09-01	LC_SPDC_INV_4_ 2020_09-01	LC_SPDC_INV_5_ 2020_09-01
		Lab ID	001	002	003	004	005
		Wet Weight (g)	1.0082	1.2064	2.4896	2.3289	4.7072
		Dry Weight (g)	0.1839	0.2476	0.4225	0.3885	0.7125
		Moisture (%)	81.8	79.5	83.0	83.3	84.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	1.7	2.5	1.5	2.4	1.8
11B	0.129	0.430	4.3	6.5	3.8	6.3	4.4
23Na	3.6	12	5,186	5,151	5,907	5,838	7,938
24Mg	0.033	0.110	1,705	1,349	1,935	1,629	2,187
27Al	0.040	0.133	3,415	4,780	3,138	3,847	3,691
31P	83	277	12,665	10,817	11,004	11,547	14,306
39K	37	123	15,251	15,612	16,896	16,952	23,514
44Ca	92	307	8,345	7,543	7,161	10,345	10,678
49Ti	0.264	0.880	310	415	285	314	318
51V	0.014	0.047	8.2	12	7.5	10	7.4
52Cr	0.474	1.6	5.1	4.4	3.6	3.8	3.3
55Mn	0.013	0.043	116	141	144	129	118
57Fe	13	43	1,587	1,919	1,392	1,653	1,314
59Co	0.004	0.013	6.9	10	8.2	8.1	8.3
60Ni	0.012	0.040	46	64	57	51	58
63Cu	0.008	0.027	19	19	17	20	15
66Zn	0.757	2.5	263	185	215	220	143
75As	0.203	0.677	1.0	1.4	0.871	1.3	1.2
77Se	0.556	1.9	26	20	21	21	22
88Sr	0.001	0.003	20	20	18	29	23
95Mo	0.007	0.023	1.4	1.0	1.1	1.1	0.955
107Ag	0.001	0.003	0.343	0.381	0.278	0.419	0.326
111Cd	0.084	0.280	4.9	3.3	3.1	3.9	2.2
118Sn	0.023	0.077	0.600	0.312	0.268	0.390	0.200
121Sb	0.009	0.030	0.260	0.387	0.185	0.445	0.220
137Ba	0.001	0.003	240	302	263	270	268
202Hg	0.027	0.090	0.201	0.150	0.146	0.160	0.102
205Tl	0.001	0.003	0.159	0.125	0.088	0.123	0.093
208Pb	0.001	0.003	1.9	1.7	1.2	1.7	1.4
238U	0.001	0.003	0.261	0.309	0.323	0.446	0.073

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_DCDS_INV_1_ 2020_09-01	LC_DCDS_INV_2_ 2020_09-01	LC_DCDS_INV_3_ 2020_09-01	LC_DCDS_INV_4_ 2020_09-01	LC_DCDS_INV_5_ 2020_09-01
		Lab ID	006	007	008	009	010
		Wet Weight (g)	3.2949	5.5067	5.3574	6.3766	7.4146
		Dry Weight (g)	0.7488	1.1433	1.0581	1.5042	1.7167
		Moisture (%)	77.3	79.2	80.2	76.4	76.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	1.3	1.1	1.1	0.483	1.1
11B	0.129	0.430	3.4	2.6	2.9	0.738	2.5
23Na	3.6	12	4,265	3,880	3,808	4,523	3,713
24Mg	0.033	0.110	1,289	1,009	1,293	923	1,106
27Al	0.040	0.133	2,733	2,012	2,747	252	1,992
31P	83	277	11,909	12,504	11,567	12,215	10,414
39K	37	123	12,606	11,145	11,534	14,849	10,821
44Ca	92	307	2,876	2,881	2,910	1,665	3,253
49Ti	0.264	0.880	253	160	176	25	150
51V	0.014	0.047	6.8	5.2	7.9	1.4	5.3
52Cr	0.474	1.6	5.3	4.5	5.9	2.1	4.2
55Mn	0.013	0.043	113	139	131	46	184
57Fe	13	43	940	1,040	1,023	258	966
59Co	0.004	0.013	7.0	8.7	8.1	2.7	9.8
60Ni	0.012	0.040	53	75	57	17	70
63Cu	0.008	0.027	14	15	18	9.8	14
66Zn	0.757	2.5	237	259	262	174	261
75As	0.203	0.677	1.0	0.844	0.802	0.530	0.834
77Se	0.556	1.9	28	23	33	23	24
88Sr	0.001	0.003	7.1	6.0	6.8	1.9	7.1
95Mo	0.007	0.023	0.544	0.647	0.725	0.326	0.634
107Ag	0.001	0.003	0.169	0.172	0.209	0.102	0.177
111Cd	0.084	0.280	2.3	3.0	2.7	0.960	3.3
118Sn	0.023	0.077	0.161	0.185	0.190	0.155	0.122
121Sb	0.009	0.030	0.150	0.141	0.141	0.073	0.176
137Ba	0.001	0.003	143	126	135	46	146
202Hg	0.027	0.090	0.099	0.102	0.088	0.065	0.075
205Tl	0.001	0.003	0.062	0.058	0.057	0.020	0.055
208Pb	0.001	0.003	0.801	0.700	0.716	0.160	0.731
238U	0.001	0.003	0.182	0.242	0.202	0.060	0.217

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_2020_09-02	LC_DC1_INV_2_2020_09-02	LC_DC1_INV_3_2020_09-02	LC_DC1_INV_4_2020_09-02	LC_DC1_INV_5_2020_09-02
		Lab ID	011	012	013	014	015
		Wet Weight (g)	4.3576	4.9680	3.3072	9.0750	8.7324
		Dry Weight (g)	0.9940	0.9803	0.6603	1.5919	1.6422
		Moisture (%)	77.2	80.3	80.0	82.5	81.2
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.511	0.423	0.443	0.599	0.474
11B	0.129	0.430	0.680	0.461	0.588	0.715	0.767
23Na	3.6	12	3,634	3,547	3,547	4,488	3,978
24Mg	0.033	0.110	1,050	1,127	942	966	784
27Al	0.040	0.133	266	156	222	268	157
31P	83	277	12,153	12,418	10,154	12,368	10,019
39K	37	123	10,416	9,552	9,720	10,965	10,145
44Ca	92	307	1,449	1,320	1,489	1,397	2,219
49Ti	0.264	0.880	17	11	12	23	11
51V	0.014	0.047	0.816	0.608	0.642	1.0	0.682
52Cr	0.474	1.6	2.4	2.0	2.2	2.2	2.1
55Mn	0.013	0.043	37	44	35	31	35
57Fe	13	43	269	214	215	333	324
59Co	0.004	0.013	0.387	0.255	0.338	0.476	0.867
60Ni	0.012	0.040	11	7.0	9.6	7.8	12
63Cu	0.008	0.027	12	13	8.0	9.4	14
66Zn	0.757	2.5	169	222	150	173	215
75As	0.203	0.677	0.390	0.322	0.390	0.390	0.470
77Se	0.556	1.9	10	11	9.9	12	13
88Sr	0.001	0.003	1.6	1.3	1.5	1.5	1.8
95Mo	0.007	0.023	0.399	0.483	0.290	0.369	0.363
107Ag	0.001	0.003	0.079	0.090	0.041	0.064	0.108
111Cd	0.084	0.280	1.0	1.0	0.994	1.5	2.5
118Sn	0.023	0.077	0.054	0.041	0.078	0.068	0.078
121Sb	0.009	0.030	0.044	0.022	0.040	0.046	0.040
137Ba	0.001	0.003	110	147	93	98	94
202Hg	0.027	0.090	0.041	0.054	<0.027	0.027	0.082
205Tl	0.001	0.003	0.011	0.012	0.013	0.014	0.014
208Pb	0.001	0.003	0.104	0.080	0.097	0.136	0.119
238U	0.001	0.003	0.034	0.040	0.033	0.040	0.048

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_2020_09-03	LC_DC2_INV_2_2020_09-03	LC_DC2_INV_3_2020_09-03	LC_DC2_INV_4_2020_09-03	LC_DC2_INV_5_2020_09-03
		Lab ID	016	017	018	019	020
		Wet Weight (g)	3.6045	4.6192	3.9976	3.6085	4.6831
		Dry Weight (g)	0.7878	0.9278	0.9439	0.8401	0.9060
		Moisture (%)	78.1	79.9	76.4	76.7	80.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.571	0.781	0.798	0.479	0.449
11B	0.129	0.430	1.0	1.6	1.7	0.867	0.874
23Na	3.6	12	4,014	3,437	4,510	3,168	2,839
24Mg	0.033	0.110	955	776	1,176	701	593
27Al	0.040	0.133	699	1,387	1,211	542	646
31P	83	277	11,882	9,132	14,125	9,373	9,319
39K	37	123	13,116	10,049	14,300	8,971	8,506
44Ca	92	307	1,213	1,511	1,278	1,209	981
49Ti	0.264	0.880	42	104	87	37	23
51V	0.014	0.047	1.9	3.9	3.3	1.7	1.4
52Cr	0.474	1.6	2.7	9.0	2.1	4.8	4.5
55Mn	0.013	0.043	47	48	154	56	42
57Fe	13	43	284	788	688	354	342
59Co	0.004	0.013	5.2	7.4	18	6.3	4.8
60Ni	0.012	0.040	23	49	34	43	27
63Cu	0.008	0.027	16	13	25	9.2	9.7
66Zn	0.757	2.5	227	215	496	196	174
75As	0.203	0.677	0.501	0.781	0.813	0.577	<0.203
77Se	0.556	1.9	13	17	15	11	9.5
88Sr	0.001	0.003	2.0	3.7	2.4	2.3	1.4
95Mo	0.007	0.023	0.526	0.508	0.761	0.458	0.336
107Ag	0.001	0.003	0.131	0.145	0.340	0.084	0.084
111Cd	0.084	0.280	2.7	5.5	11	2.4	2.0
118Sn	0.023	0.077	0.085	0.244	0.051	0.108	0.054
121Sb	0.009	0.030	0.059	0.106	0.119	0.043	0.040
137Ba	0.001	0.003	77	129	286	90	67
202Hg	0.027	0.090	0.061	0.068	0.136	0.063	0.052
205Tl	0.001	0.003	0.024	0.033	0.035	0.074	0.064
208Pb	0.001	0.003	0.247	0.426	0.423	0.310	0.229
238U	0.001	0.003	0.104	0.122	0.262	0.094	0.060

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_2020_09-02	LC_DC3_INV_2_2020_09-02	LC_DC3_INV_3_2020_09-02	LC_DC3_INV_4_2020_09-02	LC_DC3_INV_5_2020_09-02
		Lab ID	021	022	023	024	025
		Wet Weight (g)	0.9263	2.6094	1.2995	1.6587	1.8180
		Dry Weight (g)	0.2256	0.5820	0.2595	0.3958	0.3930
		Moisture (%)	75.6	77.7	80.0	76.1	78.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	1.3	1.6	1.6	1.2	0.903
11B	0.129	0.430	4.4	4.7	3.4	3.3	3.1
23Na	3.6	12	2,829	3,591	2,948	3,434	3,176
24Mg	0.033	0.110	1,382	1,347	1,033	1,736	1,251
27Al	0.040	0.133	3,158	4,353	3,624	2,795	2,232
31P	83	277	10,321	8,872	9,174	12,120	12,360
39K	37	123	9,751	8,813	9,236	13,172	10,462
44Ca	92	307	2,987	3,025	2,724	3,064	3,208
49Ti	0.264	0.880	244	422	279	220	170
51V	0.014	0.047	8.2	13	8.7	8.5	7.5
52Cr	0.474	1.6	34	9.4	20	11	16
55Mn	0.013	0.043	76	55	42	61	63
57Fe	13	43	1,868	2,087	1,446	1,339	1,824
59Co	0.004	0.013	11	6.5	6.7	11	12
60Ni	0.012	0.040	121	60	79	66	85
63Cu	0.008	0.027	18	15	15	24	21
66Zn	0.757	2.5	255	185	183	287	351
75As	0.203	0.677	0.580	0.969	0.566	0.750	0.905
77Se	0.556	1.9	7.2	7.1	6.5	7.5	8.6
88Sr	0.001	0.003	8.2	10	18	8.1	8.3
95Mo	0.007	0.023	0.611	0.550	0.427	0.595	0.557
107Ag	0.001	0.003	0.157	0.171	0.119	0.211	0.155
111Cd	0.084	0.280	1.8	1.7	1.3	1.7	3.3
118Sn	0.023	0.077	0.344	0.251	0.332	0.329	0.416
121Sb	0.009	0.030	0.112	0.205	0.122	0.132	0.142
137Ba	0.001	0.003	177	156	200	98	125
202Hg	0.027	0.090	0.052	0.067	0.045	0.089	0.089
205Tl	0.001	0.003	0.179	0.289	0.172	0.238	0.230
208Pb	0.001	0.003	0.685	1.4	0.751	0.864	0.658
238U	0.001	0.003	0.287	0.274	0.188	0.164	0.196

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	LC_DC4_INV_1_2 020_09-03	LC_DC4_INV_2_2 020_09-03	LC_DC4_INV_3_2 020_09-03	LC_DC4_INV_4_2 020_09-03	LC_DC4_INV_5_2 020_09-03
		Lab ID	026	027	028	029	030
		Wet Weight (g)	5.6844	3.3260	2.9449	5.8267	5.0064
		Dry Weight (g)	1.2610	0.6862	0.6070	1.3562	1.1006
		Moisture (%)	77.8	79.4	79.4	76.7	78.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.602	0.417	0.407	0.377	0.484
11B	0.129	0.430	0.788	2.2	1.6	0.595	1.1
23Na	3.6	12	4,198	3,617	3,852	2,492	3,280
24Mg	0.033	0.110	1,036	870	962	918	939
27Al	0.040	0.133	466	309	335	345	640
31P	83	277	11,178	9,612	10,464	7,392	9,827
39K	37	123	11,735	10,542	10,975	7,250	9,417
44Ca	92	307	1,311	1,348	1,540	1,032	1,963
49Ti	0.264	0.880	28	20	23	16	37
51V	0.014	0.047	1.4	0.879	1.0	0.709	1.6
52Cr	0.474	1.6	2.5	2.4	2.7	2.2	2.7
55Mn	0.013	0.043	36	29	35	33	53
57Fe	13	43	403	219	292	232	316
59Co	0.004	0.013	1.2	0.706	1.3	0.993	2.0
60Ni	0.012	0.040	17	10	14	8.5	13
63Cu	0.008	0.027	14	12	13	9.4	11
66Zn	0.757	2.5	210	189	268	172	252
75As	0.203	0.677	0.526	0.425	0.501	0.363	0.538
77Se	0.556	1.9	11	9.0	11	7.8	10
88Sr	0.001	0.003	1.9	1.6	1.8	1.3	2.4
95Mo	0.007	0.023	0.489	0.442	0.495	0.442	0.388
107Ag	0.001	0.003	0.101	0.090	0.081	0.053	0.070
111Cd	0.084	0.280	2.8	2.0	3.6	1.9	3.1
118Sn	0.023	0.077	0.092	0.115	0.128	0.041	0.103
121Sb	0.009	0.030	0.050	0.033	0.041	0.033	0.050
137Ba	0.001	0.003	127	105	129	100	146
202Hg	0.027	0.090	0.045	0.045	0.051	0.038	0.064
205Tl	0.001	0.003	0.024	0.018	0.021	0.020	0.022
208Pb	0.001	0.003	0.264	0.136	0.162	0.139	0.264
238U	0.001	0.003	0.079	0.048	0.066	0.043	0.088

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_ 2020_09-02	LC_DCEF_INV_2_ 2020_09-02	LC_DCEF_INV_3_ 2020_09-02	LC_DCEF_INV_4_ 2020_09-03	LC_DCEF_INV_5_ 2020_09-03
		Lab ID	031	032	033	034	035
		Wet Weight (g)	1.8956	2.0168	1.3341	2.3683	1.9926
		Dry Weight (g)	0.4193	0.4594	0.2876	0.4996	0.5187
		Moisture (%)	77.9	77.2	78.4	78.9	74.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.330	0.324	0.305	0.384	0.305
11B	0.129	0.430	1.1	0.661	0.672	0.892	0.688
23Na	3.6	12	3,119	2,945	2,917	3,341	2,745
24Mg	0.033	0.110	1,005	1,106	1,082	1,453	534
27Al	0.040	0.133	243	177	120	183	252
31P	83	277	9,802	10,790	9,783	12,329	9,338
39K	37	123	10,296	9,599	8,091	9,857	10,296
44Ca	92	307	2,298	3,244	2,301	2,590	2,182
49Ti	0.264	0.880	13	11	7.1	13	15
51V	0.014	0.047	1.5	1.0	0.746	1.5	1.0
52Cr	0.474	1.6	2.4	2.6	2.2	2.4	3.1
55Mn	0.013	0.043	26	19	16	23	13
57Fe	13	43	241	219	210	283	230
59Co	0.004	0.013	0.336	0.351	0.332	0.401	0.374
60Ni	0.012	0.040	4.3	4.4	3.0	4.4	5.7
63Cu	0.008	0.027	18	19	19	20	23
66Zn	0.757	2.5	283	209	191	212	192
75As	0.203	0.677	0.776	0.914	0.770	0.974	0.676
77Se	0.556	1.9	6.3	4.8	4.6	7.4	5.1
88Sr	0.001	0.003	2.2	3.9	2.4	2.4	2.4
95Mo	0.007	0.023	0.341	0.388	0.335	0.415	0.274
107Ag	0.001	0.003	0.059	0.095	0.073	0.084	0.092
111Cd	0.084	0.280	4.9	6.2	4.1	5.7	3.3
118Sn	0.023	0.077	0.195	0.144	0.221	0.236	0.128
121Sb	0.009	0.030	0.052	0.039	0.037	0.045	0.041
137Ba	0.001	0.003	128	75	60	81	48
202Hg	0.027	0.090	0.070	0.045	0.058	0.058	0.070
205Tl	0.001	0.003	0.013	0.012	0.012	0.014	0.012
208Pb	0.001	0.003	0.107	0.098	0.087	0.122	0.082
238U	0.001	0.003	0.097	0.052	0.043	0.066	0.031

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_ 2020_08-28	LC_FRUS_INV_2_ 2020_08-28	LC_FRUS_INV_3_ 2020_08-28	LC_FRUS_INV_4_ 2020_08-28	LC_FRUS_INV_5_ 2020_08-28
		Lab ID	036	037	038	039	040
		Wet Weight (g)	2.4618	2.7377	2.8492	3.3215	4.0893
		Dry Weight (g)	0.6411	0.7184	0.7142	0.7351	1.0853
		Moisture (%)	74.0	73.8	74.9	77.9	73.5
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.678	0.503	0.494	0.791	0.675
11B	0.129	0.430	1.8	0.920	1.2	2.0	1.1
23Na	3.6	12	3,365	3,277	2,739	3,232	2,994
24Mg	0.033	0.110	1,969	1,424	1,565	1,810	1,367
27Al	0.040	0.133	684	219	375	604	420
31P	83	277	11,741	7,718	10,010	10,708	8,579
39K	37	123	11,675	8,158	9,003	10,143	8,801
44Ca	92	307	3,071	2,895	2,555	2,863	2,247
49Ti	0.264	0.880	44	14	24	47	26
51V	0.014	0.047	1.3	0.504	0.670	1.1	0.807
52Cr	0.474	1.6	3.0	2.8	2.5	2.8	2.2
55Mn	0.013	0.043	65	35	52	86	76
57Fe	13	43	547	326	322	581	333
59Co	0.004	0.013	1.9	1.1	1.7	3.2	1.3
60Ni	0.012	0.040	9.0	7.0	5.7	10	7.0
63Cu	0.008	0.027	20	19	15	21	19
66Zn	0.757	2.5	347	303	273	374	271
75As	0.203	0.677	0.627	0.432	0.522	0.794	0.446
77Se	0.556	1.9	9.9	9.4	7.9	9.8	11
88Sr	0.001	0.003	5.0	4.2	3.6	4.4	3.3
95Mo	0.007	0.023	0.318	0.221	0.304	0.470	0.304
107Ag	0.001	0.003	0.139	0.083	0.093	0.126	0.126
111Cd	0.084	0.280	3.1	1.1	2.3	3.7	2.4
118Sn	0.023	0.077	0.127	0.069	0.087	0.278	0.064
121Sb	0.009	0.030	0.042	0.024	0.024	0.033	0.028
137Ba	0.001	0.003	44	23	35	44	33
202Hg	0.027	0.090	0.061	0.041	<0.027	0.027	0.047
205Tl	0.001	0.003	0.020	0.012	0.013	0.020	0.013
208Pb	0.001	0.003	0.254	0.117	0.140	0.277	0.181
238U	0.001	0.003	0.142	0.057	0.048	0.105	0.136

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Parameter	DL (ppm)	LOQ (ppm)	LC_FRB_INV_1_2020_08-28	LC_FRB_INV_2_2020_08-28	LC_FRB_INV_3_2020_08-28	LC_FRB_INV_4_2020_08-28	LC_FRB_INV_5_2020_08-28
Lab ID			041	042	043	044	045
Wet Weight (g)			3.2515	2.9668	3.4299	3.2471	2.5282
Dry Weight (g)			0.7174	0.6199	0.6976	0.6954	0.4953
Moisture (%)			77.9	79.1	79.7	78.6	80.4
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.813	0.810	0.857	0.509	0.500
11B	0.129	0.430	1.7	2.1	1.7	1.2	0.906
23Na	3.6	12	3,741	3,920	3,427	2,910	2,843
24Mg	0.033	0.110	2,031	2,442	1,961	1,346	966
27Al	0.040	0.133	839	767	875	450	339
31P	83	277	11,411	12,176	12,871	9,668	9,907
39K	37	123	11,339	11,716	10,139	9,144	8,165
44Ca	92	307	3,288	3,738	3,313	2,297	2,116
49Ti	0.264	0.880	58	63	62	33	23
51V	0.014	0.047	1.5	1.9	1.5	0.845	0.643
52Cr	0.474	1.6	3.4	3.1	3.1	2.7	2.3
55Mn	0.013	0.043	81	93	74	59	47
57Fe	13	43	645	924	689	440	325
59Co	0.004	0.013	1.7	3.3	2.5	1.6	1.0
60Ni	0.012	0.040	9.7	12	10	7.1	6.3
63Cu	0.008	0.027	19	18	17	16	13
66Zn	0.757	2.5	297	375	307	269	207
75As	0.203	0.677	0.787	1.1	0.738	0.641	0.592
77Se	0.556	1.9	12	15	9.7	9.2	9.1
88Sr	0.001	0.003	5.2	6.6	5.3	3.4	3.4
95Mo	0.007	0.023	0.331	0.483	0.456	0.249	0.235
107Ag	0.001	0.003	0.126	0.126	0.085	0.076	0.069
111Cd	0.084	0.280	3.2	5.6	3.2	2.6	2.0
118Sn	0.023	0.077	0.168	0.324	0.278	0.110	0.179
121Sb	0.009	0.030	0.042	0.066	0.047	0.028	0.024
137Ba	0.001	0.003	51	67	49	30	35
202Hg	0.027	0.090	0.044	0.068	0.047	<0.027	0.054
205Tl	0.001	0.003	0.026	0.030	0.023	0.017	0.010
208Pb	0.001	0.003	0.305	0.433	0.285	0.178	0.168
238U	0.001	0.003	0.091	0.150	0.096	0.057	0.067

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_ 2020_08-29	LC_GRCK_INV_2_ 2020_08-29	LC_GRCK_INV_3_ 2020_08-29	LC_GRCK_INV_4_ 2020_08-29	LC_GRCK_INV_5_ 2020_08-29
		Lab ID	046	047	048	049	050
		Wet Weight (g)	1.8784	2.1161	1.6623	1.3672	2.0338
		Dry Weight (g)	0.4329	0.4670	0.3940	0.2826	0.4234
		Moisture (%)	77.0	77.9	76.3	79.3	79.2
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	1.6	0.306	0.500	0.653	0.584
11B	0.129	0.430	5.3	1.3	2.4	3.0	2.3
23Na	3.6	12	3,408	2,410	3,695	3,365	3,606
24Mg	0.033	0.110	1,448	584	1,560	1,432	872
27Al	0.040	0.133	3,384	1,102	999	1,432	1,020
31P	83	277	12,167	8,183	11,756	11,663	10,371
39K	37	123	10,961	9,476	11,791	10,514	11,550
44Ca	92	307	3,177	2,253	3,150	2,665	2,885
49Ti	0.264	0.880	110	34	76	112	81
51V	0.014	0.047	2.6	0.972	1.5	2.1	1.6
52Cr	0.474	1.6	11	2.1	3.6	3.6	3.5
55Mn	0.013	0.043	83	47	48	51	51
57Fe	13	43	1,661	407	565	820	652
59Co	0.004	0.013	1.8	0.806	0.686	1.0	0.814
60Ni	0.012	0.040	33	3.8	7.3	7.5	8.3
63Cu	0.008	0.027	17	14	18	21	20
66Zn	0.757	2.5	336	312	319	265	336
75As	0.203	0.677	1.2	0.690	0.488	0.961	0.502
77Se	0.556	1.9	7.6	7.9	7.1	8.5	6.5
88Sr	0.001	0.003	14	6.7	10	8.9	9.1
95Mo	0.007	0.023	0.470	0.338	0.366	0.525	0.345
107Ag	0.001	0.003	0.113	0.132	0.098	0.104	0.107
111Cd	0.084	0.280	1.5	1.6	1.5	2.3	1.2
118Sn	0.023	0.077	0.405	0.139	0.231	0.356	0.278
121Sb	0.009	0.030	0.080	0.038	0.028	0.042	0.038
137Ba	0.001	0.003	87	31	50	40	51
202Hg	0.027	0.090	0.109	0.149	0.085	0.064	0.081
205Tl	0.001	0.003	0.044	0.025	0.022	0.030	0.023
208Pb	0.001	0.003	0.899	0.237	0.307	0.421	0.347
238U	0.001	0.003	0.168	0.080	0.083	0.107	0.141

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_SPDC_INV_4_2020_09-01			LC_DC3_INV_1_2020_09-02			LC_DCEF_INV_2_2020_09-02		
Lab ID		004			021			032		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.004	2.4	3.3	31.6	1.3	1.7	26.7	0.324	0.348	7.1
11B	0.129	6.3	7.8	21.3	4.4	5.5	22.2	0.661	0.788	-
23Na	3.6	5,838	5,536	5.3	2,829	3,677	26.1	2,945	3,009	2.1
24Mg	0.033	1,629	1,650	1.3	1,382	1,343	2.9	1,106	1,160	4.8
27Al	0.040	3,847	3,436	11.3	3,158	4,702	39.3	177	197	10.7
31P	83	11,547	10,359	10.8	10,321	11,023	6.6	10,790	11,645	7.6
39K	37	16,952	17,625	3.9	9,751	12,344	23.5	9,599	9,415	1.9
44Ca	92	10,345	8,312	21.8	2,987	3,173	6.0	3,244	3,696	13.0
49Ti	0.264	314	390	21.6	244	312	24.5	11	12	8.7
51V	0.014	10	9.7	3.0	8.2	11	29.2	1.0	1.3	26.1
52Cr	0.474	3.8	4.0	-	34	32	6.1	2.6	2.6	-
55Mn	0.013	129	129	0.0	76	65	15.6	19	19	0.0
57Fe	13	1,653	1,680	1.6	1,868	1,791	4.2	219	238	8.3
59Co	0.004	8.1	7.5	7.7	11	9.1	18.9	0.351	0.397	12.3
60Ni	0.012	51	48	6.1	121	125	3.3	4.4	4.8	8.7
63Cu	0.008	20	20	0.0	18	15	18.2	19	20	5.1
66Zn	0.757	220	194	12.6	255	205	21.7	209	246	16.3
75As	0.203	1.3	1.3	-	0.580	0.630	-	0.914	1.0	-
77Se	0.556	21	20	4.9	7.2	7.1	1.4	4.8	4.8	-
88Sr	0.001	29	29	0.0	8.2	9.5	14.7	3.9	4.7	18.6
95Mo	0.007	1.1	1.2	8.7	0.611	0.595	2.7	0.388	0.395	1.8
107Ag	0.001	0.419	0.407	2.9	0.157	0.151	3.9	0.095	0.092	3.2
111Cd	0.084	3.9	3.4	13.7	1.8	1.4	25.0	6.2	5.8	6.7
118Sn	0.023	0.390	0.571	37.7	0.344	0.344	0.0	0.144	0.185	-
121Sb	0.009	0.445	0.418	6.3	0.112	0.139	21.5	0.039	0.047	-
137Ba	0.001	270	298	9.9	177	187	5.5	75	88	16.0
202Hg	0.027	0.160	0.163	-	0.052	0.059	-	0.045	0.051	-
205Tl	0.001	0.123	0.133	7.8	0.179	0.254	34.6	0.012	0.016	28.6
208Pb	0.001	1.7	1.7	0.0	0.685	1.0	37.4	0.098	0.105	6.9
238U	0.001	0.446	0.458	2.7	0.287	0.349	19.5	0.052	0.072	32.3

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_FRUS_INV_2_2020_08-28			LC_FRB_INV_4_2020_08-28		
Lab ID		037			044		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.004	0.503	0.488	3.0	0.509	0.631	21.4
11B	0.129	0.920	1.1	-	1.2	1.2	-
23Na	3.6	3,277	2,696	19.5	2,910	2,816	3.3
24Mg	0.033	1,424	1,326	7.1	1,346	1,477	9.3
27Al	0.040	219	282	25.1	450	619	31.6
31P	83	7,718	8,144	5.4	9,668	9,298	3.9
39K	37	8,158	6,979	15.6	9,144	9,769	6.6
44Ca	92	2,895	2,870	0.9	2,297	2,621	13.2
49Ti	0.264	14	20	35.3	33	41	21.6
51V	0.014	0.504	0.631	22.4	0.845	1.3	**42.4**
52Cr	0.474	2.8	2.4	-	2.7	2.5	-
55Mn	0.013	35	41	15.8	59	80	30.2
57Fe	13	326	328	0.6	440	531	18.7
59Co	0.004	1.1	0.954	14.2	1.6	2.0	22.2
60Ni	0.012	7.0	6.7	4.4	7.1	7.7	8.1
63Cu	0.008	19	17	11.1	16	16	0.0
66Zn	0.757	303	345	13.0	269	284	5.4
75As	0.203	0.432	0.334	-	0.641	0.794	-
77Se	0.556	9.4	7.7	19.9	9.2	11	17.8
88Sr	0.001	4.2	3.8	10.0	3.4	4.3	23.4
95Mo	0.007	0.221	0.207	6.5	0.249	0.345	32.3
107Ag	0.001	0.083	0.124	39.6	0.076	0.082	7.6
111Cd	0.084	1.1	1.4	24.0	2.6	3.4	26.7
118Sn	0.023	0.069	0.084	-	0.110	0.127	-
121Sb	0.009	0.024	0.033	-	0.028	0.033	-
137Ba	0.001	23	30	26.4	30	39	26.1
202Hg	0.027	0.041	0.075	-	<0.027	0.054	-
205Tl	0.001	0.012	0.012	0.0	0.017	0.018	5.7
208Pb	0.001	0.117	0.167	35.2	0.178	0.226	23.8
238U	0.001	0.057	0.068	17.6	0.057	0.065	13.1

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
Bold indicates DQO exceedance, but result is accepted as it does not impact the reportable results.

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	0.004	1.21	1.1	94	4.8	1.2	102	8.8
11B	0.129	4.5	5.1	113	4.1	4.4	98	3.3
23Na	3.6	14,000	13,408	96	3.7	15,294	109	3.0
24Mg	0.033	910	874	96	5.4	951	105	2.9
27Al	0.040	197.2	193	98	7.8	191	97	6.0
31P	83	8,000	7,343	92	4.4	8,517	107	1.6
39K	37	15,500	15,331	99	8.9	16,611	107	6.5
44Ca	92	2,360	2,336	99	6.9	2,446	104	2.7
49Ti	0.264	12.24	14	111	9.3	12	98	5.6
51V	0.014	1.57	1.4	87	15.0	1.6	104	10.6
52Cr	0.474	1.87	1.9	100	4.8	2.0	109	4.7
55Mn	0.013	3.17	3.1	97	8.3	3.5	109	3.8
57Fe	13	343	326	95	7.3	377	110	3.0
59Co	0.004	0.25	0.265	106	6.7	0.283	113	7.2
60Ni	0.012	1.34	1.4	101	6.4	1.5	115	4.8
63Cu	0.008	15.7	17	106	7.0	18	116	1.6
66Zn	0.757	51.6	52	101	4.1	56	108	4.3
75As	0.203	6.87	6.2	91	3.7	7.5	109	1.8
77Se	0.556	3.45	3.3	96	6.3	3.7	108	4.1
88Sr	0.001	10.1	9.3	92	4.6	11	107	3.5
95Mo	0.007	0.29	0.279	96	6.6	0.313	108	6.0
107Ag	0.001	0.0252	0.028	111	9.3	0.029	117	7.4
111Cd	0.084	0.299	0.363	121	10.0	0.363	122	5.2
118Sn	0.023	0.061	0.056	92	12.2	0.061	100	14.4
121Sb	0.009	0.011	0.015	136	16.1	0.008	72	**37.3**
137Ba	0.001	8.6	9.6	111	2.0	8.4	98	1.4
202Hg	0.027	0.412	0.402	98	3.5	0.458	111	5.6
205Tl	0.001	-	-	-	-	-	-	-
208Pb	0.001	0.404	0.331	82	**24.4**	0.394	98	14.1
238U	0.001	0.050	0.041	82	12.9	0.054	109	9.2

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% was established for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Bold indicates DQO exceedance, but result is accepted as it does not impact the reportable results.

Teck Coal Limited

Tissue QA/QC Accuracy and Precision Results

		Sample Group ID	03			04		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.004	1.2	1.3	106	11.5	1.4	117	4.8
11B	0.129	4.5	4.6	103	1.3	5.2	115	2.3
23Na	3.6	14,000	13,929	100	4.5	15,357	110	4.1
24Mg	0.033	910	908	100	6.8	973	107	3.0
27Al	0.040	197	205	104	8.2	204	104	3.5
31P	83	8,000	7,452	93	6.7	7,909	99	3.0
39K	37	15,500	15,805	102	5.8	15,774	102	4.1
44Ca	92	2,360	2,480	105	5.6	2,464	104	4.5
49Ti	0.264	12	13	106	12.1	14	117	12.5
51V	0.014	1.6	1.7	106	16.5	1.7	111	4.5
52Cr	0.474	1.9	2.0	108	9.7	2.2	116	2.0
55Mn	0.013	3.2	3.2	100	7.0	3.4	107	3.6
57Fe	13	343	355	104	8.7	365	107	4.1
59Co	0.004	0.250	0.282	113	8.2	0.293	117	4.1
60Ni	0.012	1.3	1.5	110	8.4	1.5	114	3.7
63Cu	0.008	16	16	103	7.5	17	109	2.6
66Zn	0.757	52	54	105	6.7	57	111	1.1
75As	0.203	6.9	6.6	96	7.0	7.0	103	2.6
77Se	0.556	3.5	3.4	100	8.6	3.5	101	4.4
88Sr	0.001	10	10	104	8.3	11	111	2.3
95Mo	0.007	0.290	0.273	94	6.6	0.287	99	7.9
107Ag	0.001	0.025	0.027	106	12.9	0.027	108	6.4
111Cd	0.084	0.299	0.317	106	6.3	0.329	110	4.7
118Sn	0.023	0.061	0.062	102	**23.6**	0.067	110	12.2
121Sb	0.009	0.011	0.012	105	**29.9**	0.013	120	16.0
137Ba	0.001	8.6	9.2	107	3.2	9.3	108	2.6
202Hg	0.027	0.412	0.421	102	4.7	0.441	107	2.4
205Tl	0.001	-	-	-	-	-	-	-
208Pb	0.001	0.404	0.470	116	17.5	0.413	102	11.7
238U	0.001	0.050	0.049	98	8.3	0.048	97	9.7

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% was established for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Bold indicates DQO exceedance, but result is accepted as it does not impact the reportable results.

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_SPDC_INV_1_2020_09-01	001	15 Sep 2020
	LC_SPDC_INV_2_2020_09-01	002	
	LC_SPDC_INV_3_2020_09-01	003	
	LC_SPDC_INV_4_2020_09-01	004	
	LC_SPDC_INV_5_2020_09-01	005	
	LC_DCDS_INV_1_2020_09-01	006	
	LC_DCDS_INV_2_2020_09-01	007	
	LC_DCDS_INV_3_2020_09-01	008	
	LC_DCDS_INV_4_2020_09-01	009	
	LC_DCDS_INV_5_2020_09-01	010	
	LC_DC1_INV_1_2020_09-02	011	
	LC_DC1_INV_2_2020_09-02	012	
	LC_DC1_INV_3_2020_09-02	013	
	LC_DC1_INV_4_2020_09-02	014	
	LC_DC1_INV_5_2020_09-02	015	
	LC_DC2_INV_1_2020_09-03	016	
	LC_DC2_INV_2_2020_09-03	017	
	LC_DC2_INV_3_2020_09-03	018	
02	LC_DC2_INV_4_2020_09-03	019	15 Sep 2020
	LC_DC2_INV_5_2020_09-03	020	
	LC_DC3_INV_1_2020_09-02	021	
	LC_DC3_INV_2_2020_09-02	022	
	LC_DC3_INV_3_2020_09-02	023	
	LC_DC3_INV_4_2020_09-02	024	
	LC_DC3_INV_5_2020_09-02	025	
03	LC_DC4_INV_1_2020_09-03	026	16 Sep 2020
	LC_DC4_INV_2_2020_09-03	027	
	LC_DC4_INV_3_2020_09-03	028	
	LC_DC4_INV_4_2020_09-03	029	
	LC_DC4_INV_5_2020_09-03	030	
	LC_DCEF_INV_1_2020_09-02	031	
	LC_DCEF_INV_2_2020_09-02	032	
	LC_DCEF_INV_3_2020_09-02	033	
	LC_DCEF_INV_4_2020_09-03	034	
	LC_DCEF_INV_5_2020_09-03	035	
04	LC_FRUS_INV_1_2020_08-28	036	16 Sep 2020
	LC_FRUS_INV_2_2020_08-28	037	
	LC_FRUS_INV_3_2020_08-28	038	
	LC_FRUS_INV_4_2020_08-28	039	
	LC_FRUS_INV_5_2020_08-28	040	

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
04	LC_FRB_INV_1_2020_08-28	041	16 Sep 2020
	LC_FRB_INV_2_2020_08-28	042	
	LC_FRB_INV_3_2020_08-28	043	
	LC_FRB_INV_4_2020_08-28	044	
	LC_FRB_INV_5_2020_08-28	045	
	LC_GRCK_INV_1_2020_08-29	046	
	LC_GRCK_INV_2_2020_08-29	047	
	LC_GRCK_INV_3_2020_08-29	048	
	LC_GRCK_INV_4_2020_08-29	049	
	LC_GRCK_INV_5_2020_08-29	050	

TrichAnalytics Inc.
207-1753 Sean Heights, Saanichton, BC, V8M 0B3
Ph: (250) 532-1084

Chain of Custody (COC)
for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number:			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	204-1006 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778 677 3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID:		Sample Identification:		Species	Sample type
001	1	LC_SPDC_INV-1_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
002	2	LC_SPDC_INV-2_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
003	3	LC_SPDC_INV-3_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
004	4	LC_SPDC_INV-4_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
005	5	LC_SPDC_INV-5_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
006	6	LC_DCDS_INV-1_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
007	7	LC_DCDS_INV-2_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
008	8	LC_DCDS_INV-3_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
009	9	LC_DCDS_INV-4_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
010	10	LC_DCDS_INV-5_2020_09-01	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
011	11	LC_DC1_INV-1_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
012	12	LC_DC1_INV-2_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
013	13	LC_DC1_INV-3_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
014	14	LC_DC1_INV-4_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
015	15	LC_DC1_INV-5_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
016	16	LC_DC2_INV-1_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
017	17	LC_DC2_INV-2_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
018	18	LC_DC2_INV-3_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
019	19	LC_DC2_INV-4_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
020	20	LC_DC2_INV-5_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue

Sample(s) Release	Dave Hasek	Sample(s) Received By:	GERIANE LABINE
Signature:		Signature:	
Date Sent:	5-Sep-20	Date Received:	09 SEP 2020 (Project #2020-140)
Sample(s) Returned to Client By:		Shipping Conditions:	
		Shipping Container:	
Signature:		Date Sent:	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number:			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	204-1006 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778 677 3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID		Sample Identification:		Sample Type: Species	Sample type
021	21	LC_DC3_INV-1_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
022	22	LC_DC3_INV-2_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
023	23	LC_DC3_INV-3_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
024	24	LC_DC3_INV-4_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
025	25	LC_DC3_INV-5_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
026	26	LC_DC4_INV-1_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
027	27	LC_DC4_INV-2_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
028	28	LC_DC4_INV-3_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
029	29	LC_DC4_INV-4_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
030	30	LC_DC4_INV-5_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
031	31	LC_DCEF_INV-1_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
032	32	LC_DCEF_INV-2_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
033	33	LC_DCEF_INV-3_2020_09-02	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
034	34	LC_DCEF_INV-4_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
035	35	LC_DCEF_INV-5_2020_09-03	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
* 036	36	LC_FRUS_INV-1_2020_09-28	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
037	37	LC_FRUS_INV-2_2020_08-28	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
038	38	LC_FRUS_INV-3_2020_08-28	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
039	39	LC_FRUS_INV-4_2020_08-28	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
040	40	LC_FRUS_INV-5_2020_08-28	✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue

* Note: Client confirmed via email 16 Sep 2020 that sample ID contains a transcription error. Sample ID should contain "08" instead of "09". DJS 16 Sep 2020

Sample(s) Release	Dave Hasek	Sample(s) Received By:	Genene LaBine.
Signature:	Dave H	Signature:	Genene LB
Date Sent:	5-Sep-20	Date Received:	09 SEP 2020 (Project #: 2020-140)
Sample(s) Returned to Client By:		Shipping Conditions:	
		Shipping Container:	
Signature:		Date Sent:	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number:			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	204-1006 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778 677 3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID:	Sample Identification:	Species	Sample type
041	41 LC_FRB_INV-1_2020_08-28 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
042	41 LC_FRB_INV-2_2020_08-28 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
043	41 LC_FRB_INV-3_2020_08-28 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
044	41 LC_FRB_INV-4_2020_08-28 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
045	41 LC_FRB_INV-5_2020_08-28 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
046	41 LC_GRCK_INV-1_2020_08-29 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
047	41 LC_GRCK_INV-2_2020_08-29 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
048	41 LC_GRCK_INV-3_2020_08-29 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
049	41 LC_GRCK_INV-4_2020_08-29 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
050	41 LC_GRCK_INV-5_2020_08-29 ✓	Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue
		Trichoptera/Plecoptera	Benthic Invertebrate Tissue

Sample(s) Release Dave Hasek	Sample(s) Received By: Genene LaBine
Signature: Dave H	Signature: Genene LaB
Date Sent: 5-Sep-20	Date Received: 09 SEP 2020 (Project # 2020-140)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

September 29, 2020

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client: Dave Hasek
Aquatic Scientist
Minnow Environmental
Phone: (778) 677-3500
Email: dhasek@minnow.ca

Date Received: 29 Sep 2020
Date of Analysis: 02 Oct 2020
Final Report Date: 02 Oct 2020
Project No.: 2020-154
Method No.: MET-002.04

Client Project: Teck Coal/Minnow Environmental Dry Creek Supplemental Sampling (20-24)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 12 samples.
See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in part per million (ppm) dry weight.
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.
CoC transcription errors noted for sample IDs and corrected for reporting as per Client request.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (result achieved 102%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy 02 Oct 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA Testing Accreditation No. A4196

		Client ID	LC_DC1_INV-1_2020-09-23	LC_DC1_INV-2_2020-09-23	LC_DC1_INV-3_2020-09-23	LC_DC2_INV-1_2020-09-23	LC_DC2_INV-2_2020-09-23
		Lab ID	156	157	158	159	160
		Wet Weight (g)	0.8679	1.1868	0.6614	1.6839	1.6303
		Dry Weight (g)	0.2080	0.2600	0.1355	0.3860	0.3462
		Moisture (%)	76.0	78.1	79.5	77.1	78.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.002	0.007	0.513	0.502	0.475	0.569	0.548
11B	0.078	0.260	0.909	0.814	0.881	0.795	0.751
23Na	1.5	5.0	3,415	4,416	3,799	3,851	3,966
24Mg	0.022	0.073	1,065	1,159	1,360	1,105	1,134
27Al	0.035	0.117	395	250	253	431	381
31P	94	313	10,512	13,415	13,588	10,751	13,234
39K	9.3	31	10,533	12,130	12,689	10,264	10,539
44Ca	17	57	1,622	1,441	1,999	1,081	1,370
49Ti	0.185	0.617	23	14	13	26	22
51V	0.018	0.060	1.2	0.766	0.894	1.1	1.1
52Cr	0.484	1.6	4.6	2.7	3.6	2.3	2.5
55Mn	0.008	0.027	46	41	30	50	56
57Fe	2.8	9.3	476	330	352	202	231
59Co	0.002	0.007	0.638	0.507	0.596	5.3	5.9
60Ni	0.013	0.043	17	12	14	18	19
63Cu	0.004	0.013	11	12	14	14	16
66Zn	1.1	3.7	210	190	217	238	246
75As	0.454	1.5	<0.454	<0.454	0.505	<0.454	<0.454
77Se	0.489	1.6	10	10	9.4	11	13
88Sr	0.001	0.003	2.2	2.0	2.2	1.7	2.2
95Mo	0.006	0.020	0.383	0.328	0.372	0.405	0.514
107Ag	0.001	0.003	0.068	0.068	0.078	0.076	0.118
111Cd	0.057	0.190	1.8	2.4	2.1	3.6	4.6
118Sn	0.029	0.097	0.090	0.179	0.304	0.057	0.120
121Sb	0.005	0.017	0.032	0.030	0.030	0.024	0.032
137Ba	0.001	0.003	140	107	72	60	92
202Hg	0.023	0.077	0.069	0.048	0.069	0.062	0.083
205Tl	0.001	0.003	0.016	0.014	0.017	0.026	0.026
208Pb	0.001	0.003	0.150	0.119	0.093	0.172	0.191
238U	0.001	0.003	0.055	0.043	0.046	0.085	0.094

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	LC_DC2_INV-3_2020-09-23	LC_DC4_INV-1_2020-09-23	LC_DC4_INV-2_2020-09-23	LC_DC4_INV-3_2020-09-23	LC_DCDS_INV-1_2020-09-23
		Lab ID	161	162	163	164	165
		Wet Weight (g)	1.5596	1.6198	1.1365	1.3758	2.0111
		Dry Weight (g)	0.3632	0.4362	0.2365	0.2702	0.5125
		Moisture (%)	76.7	73.1	79.2	80.4	74.5
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.002	0.007	0.502	0.449	0.320	0.500	0.581
11B	0.078	0.260	0.718	0.593	0.637	0.857	1.1
23Na	1.5	5.0	3,145	3,595	3,652	4,021	2,943
24Mg	0.022	0.073	1,218	1,028	884	1,307	930
27Al	0.035	0.117	420	244	195	449	772
31P	94	313	10,000	11,711	9,110	10,160	9,468
39K	9.3	31	9,242	9,051	8,588	10,555	7,875
44Ca	17	57	988	993	738	1,458	1,236
49Ti	0.185	0.617	28	15	13	25	58
51V	0.018	0.060	1.4	0.752	0.564	1.2	2.0
52Cr	0.484	1.6	3.1	2.8	2.4	2.7	3.4
55Mn	0.008	0.027	42	25	21	30	82
57Fe	2.8	9.3	258	237	132	286	364
59Co	0.002	0.007	3.8	0.781	0.591	0.993	6.1
60Ni	0.013	0.043	18	8.6	7.3	8.2	26
63Cu	0.004	0.013	14	13	8.4	13	11
66Zn	1.1	3.7	249	190	147	153	140
75As	0.454	1.5	<0.454	<0.454	<0.454	0.483	0.516
77Se	0.489	1.6	13	11	4.1	7.9	20
88Sr	0.001	0.003	1.7	1.4	1.0	2.2	2.3
95Mo	0.006	0.020	0.427	0.471	0.241	0.323	0.361
107Ag	0.001	0.003	0.081	0.074	0.048	0.072	0.071
111Cd	0.057	0.190	2.0	1.6	1.1	2.2	1.2
118Sn	0.029	0.097	0.060	0.102	0.115	0.299	0.100
121Sb	0.005	0.017	0.027	0.027	0.018	0.027	0.053
137Ba	0.001	0.003	84	71	67	73	51
202Hg	0.023	0.077	0.076	0.048	0.055	0.034	0.048
205Tl	0.001	0.003	0.022	0.016	0.012	0.016	0.035
208Pb	0.001	0.003	0.153	0.103	0.074	0.103	0.290
238U	0.001	0.003	0.067	0.040	0.038	0.051	0.075

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	LC_DCDS_INV-2_2020-09-23	LC_DCDS_INV-3_2020-09-23
		Lab ID	166	167
		Wet Weight (g)	2.2782	1.7201
		Dry Weight (g)	0.5491	0.3760
		Moisture (%)	75.9	78.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)
7Li	0.002	0.007	0.585	0.727
11B	0.078	0.260	0.938	1.6
23Na	1.5	5.0	3,899	3,245
24Mg	0.022	0.073	1,013	1,363
27Al	0.035	0.117	669	1,227
31P	94	313	11,446	12,140
39K	9.3	31	11,792	10,966
44Ca	17	57	1,230	1,608
49Ti	0.185	0.617	47	86
51V	0.018	0.060	1.7	3.3
52Cr	0.484	1.6	2.5	4.6
55Mn	0.008	0.027	99	79
57Fe	2.8	9.3	329	453
59Co	0.002	0.007	7.8	3.3
60Ni	0.013	0.043	35	33
63Cu	0.004	0.013	13	14
66Zn	1.1	3.7	204	218
75As	0.454	1.5	0.516	<0.454
77Se	0.489	1.6	20	21
88Sr	0.001	0.003	2.2	3.8
95Mo	0.006	0.020	0.482	0.438
107Ag	0.001	0.003	0.112	0.132
111Cd	0.057	0.190	2.0	1.5
118Sn	0.029	0.097	0.125	0.164
121Sb	0.005	0.017	0.048	0.063
137Ba	0.001	0.003	78	128
202Hg	0.023	0.077	0.069	0.083
205Tl	0.001	0.003	0.031	0.040
208Pb	0.001	0.003	0.227	0.303
238U	0.001	0.003	0.084	0.101

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

	Client ID	LC_DC1_INV-3_2020-09-23			LC_DCDS_INV-3_2020-09-23		
	Lab ID	158			167		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.002	0.475	0.425	11.1	0.727	0.786	7.8
11B	0.078	0.881	0.661	-	1.6	1.8	11.8
23Na	1.5	3,799	3,113	19.8	3,245	2,943	9.8
24Mg	0.022	1,360	1,388	2.0	1,363	1,288	5.7
27Al	0.035	253	206	20.5	1,227	1,538	22.5
31P	94	13,588	12,521	8.2	12,140	11,244	7.7
39K	9.3	12,689	10,834	15.8	10,966	9,269	16.8
44Ca	17	1,999	1,692	16.6	1,608	1,918	17.6
49Ti	0.185	13	14	7.4	86	119	32.2
51V	0.018	0.894	0.720	21.6	3.3	4.5	30.8
52Cr	0.484	3.6	2.8	-	4.6	5.6	-
55Mn	0.008	30	31	3.3	79	84	6.1
57Fe	2.8	352	277	23.8	453	666	38.1
59Co	0.002	0.596	0.447	28.6	3.3	4.3	26.3
60Ni	0.013	14	9.4	39.3	33	33	0.0
63Cu	0.004	14	12	15.4	14	16	13.3
66Zn	1.1	217	190	13.3	218	271	21.7
75As	0.454	0.505	<0.454	-	<0.454	0.593	-
77Se	0.489	9.4	9.2	2.2	21	22	4.7
88Sr	0.001	2.2	2.3	4.4	3.8	5.4	34.8
95Mo	0.006	0.372	0.328	12.6	0.438	0.547	22.1
107Ag	0.001	0.078	0.071	9.4	0.132	0.159	18.6
111Cd	0.057	2.1	2.2	4.7	1.5	1.8	18.2
118Sn	0.029	0.304	0.145	-	0.164	0.189	-
121Sb	0.005	0.030	0.024	-	0.063	0.084	28.6
137Ba	0.001	72	70	2.8	128	124	3.2
202Hg	0.023	0.069	0.048	-	0.083	0.096	-
205Tl	0.001	0.017	0.014	19.4	0.040	0.053	28.0
208Pb	0.001	0.093	0.074	22.8	0.303	0.402	28.1
238U	0.001	0.046	0.033	32.9	0.101	0.130	25.1

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

			Sample Group ID	01	
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.002	1.21	1.3	109	9.1
11B	0.078	4.5	5.6	125	1.8
23Na	1.5	14,000	14,731	105	5.7
24Mg	0.022	910	973	107	7.3
27Al	0.035	197.2	252	128	4.4
31P	94	8,000	8,391	105	6.5
39K	9.3	15,500	16,601	107	7.0
44Ca	17	2,360	2,285	97	3.8
49Ti	0.185	12.24	15	125	9.2
51V	0.018	1.57	1.6	101	14.4
52Cr	0.484	1.87	2.0	105	10.8
55Mn	0.008	3.17	3.4	106	7.4
57Fe	2.8	343	378	110	8.2
59Co	0.002	0.25	0.283	113	7.3
60Ni	0.013	1.34	1.5	111	9.5
63Cu	0.004	15.7	18	112	8.4
66Zn	1.1	51.6	59	115	5.5
75As	0.454	6.87	6.9	101	7.5
77Se	0.489	3.45	3.5	102	8.4
88Sr	0.001	10.1	11	109	8.2
95Mo	0.006	0.29	0.309	106	9.5
107Ag	0.001	0.0252	0.027	106	5.2
111Cd	0.057	0.299	0.365	122	8.6
118Sn	0.029	0.061	0.071	116	8.4
121Sb	0.005	0.011	0.011	98	18.1
137Ba	0.001	8.6	10	119	0.7
202Hg	0.023	0.412	0.423	103	13.8
205Tl	0.001	-	-	-	-
208Pb	0.001	0.404	0.404	100	7.5
238U	0.001	0.05	0.054	109	13.4

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.

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC1_INV-1_2020-09-23	156	02 Oct 2020
	LC_DC1_INV-2_2020-09-23	157	
	LC_DC1_INV-3_2020-09-23	158	
	LC_DC2_INV-1_2020-09-23	159	
	LC_DC2_INV-2_2020-09-23	160	
	LC_DC2_INV-3_2020-09-23	161	
	LC_DC4_INV-1_2020-09-23	162	
	LC_DC4_INV-2_2020-09-23	163	
	LC_DC4_INV-3_2020-09-23	164	
	LC_DCDS_INV-1_2020-09-23	165	
	LC_DCDS_INV-2_2020-09-23	166	
	LC_DCDS_INV-3_2020-09-23	167	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number: Dry Creek Supplemental Sampling (20-24)			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	1006-204 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778-677-3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID:	Sample Identification:	Sample Type: Species	Sample type
156	1 LC ~~RG~~_DC1_INV-1_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
157	2 LC ~~RG~~_DC1_INV-2_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
158	3 LC ~~RG~~_DC1_INV-3_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
159	4 LC ~~RG~~_DC2_INV-1_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
160	5 LC ~~RG~~_DC2_INV-2_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
161	6 LC ~~RG~~_DC2_INV-3_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
162	7 LC ~~RG~~_DC4_INV-1_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
163	8 LC ~~RG~~_DC4_INV-2_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
164	9 LC ~~RG~~_DC4_INV-3_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
165	10 LC ~~RG~~_DCDS_INV-1_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
166	11 LC ~~RG~~_DCDS_INV-2_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples
167	12 LC ~~RG~~_DCDS_INV-3_2020-09-23 *	-	Composite-taxa benthic invertebrate tissue samples

Sample(s) Released By: Dave Hasek	Sample(s) Received By: Gerene LaBine
Signature:	Signature: Gerene LB
Date Sent: 29-Sep-20	Date Received: 30 Sep 2020 (Project #: 2020-154)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

*Sample container reads "LC". GL 30Sep2020 Confirmation by client that sample IDs should contain LC 30 Sep 2020 DSS

October 8, 2020

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Dave Hasek Aquatic Scientist Minnow Environmental	Date Received: Date of Analysis: Final Report Date:	08 Oct 2020 09 Oct 2020 09 Oct 2020
Phone:	(778) 677-3500	Project No.:	2020-156
Email:	dhasek@minnow.ca	Method No.:	MET-002.04

Client Project: Teck Coal/Minnow Environmental Dry Creek Supplemental Sampling (20-24)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 12 samples. See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in part per million (ppm) dry weight.
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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (result achieved 110%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy — 09 Oct 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio — 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-01_2020-09-30	LC_DC1_INV-02_2020-09-30	LC_DC1_INV-03_2020-09-30	LC_DC2_INV-01_2020-09-30	LC_DC2_INV-02_2020-09-30
		Lab ID	269	270	271	272	273
		Wet Weight (g)	1.4285	1.1025	0.9017	1.1241	1.2324
		Dry Weight (g)	0.3270	0.2145	0.1902	0.2254	0.2725
		Moisture (%)	77.1	80.5	78.9	79.9	77.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.230	0.767	11	9.1	11	11	18
88Sr	0.001	0.003	2.9	3.4	4.1	2.4	8.1
95Mo	0.001	0.003	0.337	0.297	0.459	0.398	0.917
107Ag	0.001	0.003	0.076	0.064	0.087	0.093	0.144
111Cd	0.076	0.253	1.5	1.5	2.1	2.0	13
118Sn	0.021	0.070	0.175	0.224	0.245	0.182	0.650
121Sb	0.007	0.023	0.039	0.066	0.099	0.055	0.215
137Ba	0.001	0.003	96	122	157	90	221
202Hg	0.021	0.070	0.033	0.041	0.049	0.049	0.073
205Tl	0.001	0.003	0.020	0.034	0.038	0.040	0.137
208Pb	0.001	0.003	0.136	0.202	0.307	0.218	0.977
238U	0.001	0.003	0.037	0.063	0.091	0.093	0.260

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_DC2_INV-03_2020-09-30	LC_DC4_INV-01_2020-09-30	LC_DC4_INV-02_2020-09-30	LC_DC4_INV-03_2020-09-30	LC_DCDS_INV-01_2020-09-30
		Lab ID	274	275	276	277	278
		Wet Weight (g)	1.4499	1.6925	1.3115	1.3433	1.3871
		Dry Weight (g)	0.2760	0.4236	0.2716	0.3205	0.3666
		Moisture (%)	81.0	75.0	79.3	76.1	73.6
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
77Se	0.230	0.767	14	10	9.7	8.3	18
88Sr	0.001	0.003	3.5	1.7	1.2	1.5	2.9
95Mo	0.001	0.003	0.445	0.357	0.303	0.432	0.418
107Ag	0.001	0.003	0.147	0.106	0.077	0.060	0.102
111Cd	0.076	0.253	2.7	1.7	2.7	1.4	1.2
118Sn	0.021	0.070	0.279	0.175	0.126	0.070	0.112
121Sb	0.007	0.023	0.077	0.039	0.033	0.039	0.077
137Ba	0.001	0.003	109	121	108	100	92
202Hg	0.021	0.070	0.065	0.033	0.024	0.033	0.049
205Tl	0.001	0.003	0.058	0.025	0.021	0.025	0.048
208Pb	0.001	0.003	0.318	0.136	0.090	0.148	0.303
238U	0.001	0.003	0.127	0.043	0.038	0.047	0.086

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Parameter	DL (ppm)	LOQ (ppm)		
		Client ID	LC_DCDS_INV-02_2020-09-30	LC_DCDS_INV-03_2020-09-30
		Lab ID	279	280
		Wet Weight (g)	2.2138	1.8824
		Dry Weight (g)	0.5154	0.4212
		Moisture (%)	76.7	77.6
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)
77Se	0.230	0.767	21	13
88Sr	0.001	0.003	4.1	3.3
95Mo	0.001	0.003	0.526	0.418
107Ag	0.001	0.003	0.117	0.106
111Cd	0.076	0.253	1.6	2.5
118Sn	0.021	0.070	0.147	0.084
121Sb	0.007	0.023	0.113	0.055
137Ba	0.001	0.003	98	131
202Hg	0.021	0.070	0.073	0.045
205Tl	0.001	0.003	0.072	0.060
208Pb	0.001	0.003	0.405	0.229
238U	0.001	0.003	0.124	0.111

Notes:

ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Client ID	Lab ID	t Weight (g)	/ Weight (g)	/loisture (%)	Parameter	77Se
					DL (ppm)	0.230
					LOQ (ppm)	0.767
LC_DC1_INV-01_2020-09-30	269	1.4285	0.3270	77.1	(ppm)	11
LC_DC1_INV-02_2020-09-30	270	1.1025	0.2145	80.5	(ppm)	9.1
LC_DC1_INV-03_2020-09-30	271	0.9017	0.1902	78.9	(ppm)	11
LC_DC2_INV-01_2020-09-30	272	1.1241	0.2254	79.9	(ppm)	11
LC_DC2_INV-02_2020-09-30	273	1.2324	0.2725	77.9	(ppm)	18
LC_DC2_INV-03_2020-09-30	274	1.4499	0.2760	81.0	(ppm)	14
LC_DC4_INV-01_2020-09-30	275	1.6925	0.4236	75.0	(ppm)	10
LC_DC4_INV-02_2020-09-30	276	1.3115	0.2716	79.3	(ppm)	9.7
LC_DC4_INV-03_2020-09-30	277	1.3433	0.3205	76.1	(ppm)	8.3
LC_DCDS_INV-01_2020-09-30	278	1.3871	0.3666	73.6	(ppm)	18
LC_DCDS_INV-02_2020-09-30	279	2.2138	0.5154	76.7	(ppm)	21
LC_DCDS_INV-03_2020-09-30	280	1.8824	0.4212	77.6	(ppm)	13

Teck Coal Limited

Tissue QA/QC Relative Percent Difference Results

Client ID		LC_DC2_INV-03_2020-09-30			LC_DC4_INV-03_2020-09-30		
Lab ID		274			277		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.004	0.777	0.658	16.6	0.456	0.518	12.7
11B	0.066	1.4	1.4	0.0	0.911	0.864	5.3
23Na	1.9	6,999	5,962	16.0	4,174	5,216	22.2
24Mg	0.030	1,602	1,396	13.7	1,156	1,147	0.8
27Al	0.051	877	796	9.7	497	488	1.8
31P	83	13,560	12,254	10.1	11,978	11,558	3.6
39K	1.6	12,503	10,654	16.0	9,843	10,675	8.1
44Ca	8.2	1,359	1,633	18.3	977	1,011	3.4
49Ti	0.277	73	76	4.0	35	41	15.8
51V	0.017	2.6	2.4	8.0	1.2	1.4	15.4
52Cr	0.206	4.7	5.2	10.1	2.9	3.2	9.8
55Mn	0.004	67	64	4.6	26	32	20.7
57Fe	0.818	481	429	11.4	344	398	14.6
59Co	0.004	6.4	7.5	15.8	0.815	1.1	29.8
60Ni	0.013	35	37	5.6	10	12	18.2
63Cu	0.007	15	14	6.9	10	12	18.2
66Zn	0.638	233	248	6.2	167	180	7.5
75As	0.427	0.670	0.634	-	0.490	0.591	-
77Se	0.230	14	11	24.0	8.3	8.7	4.7
88Sr	0.001	3.5	2.9	18.8	1.5	1.6	6.5
95Mo	0.001	0.445	0.391	12.9	0.432	0.486	11.8
107Ag	0.001	0.147	0.121	19.4	0.060	0.079	27.3
111Cd	0.076	2.7	3.1	13.8	1.4	1.9	30.3
118Sn	0.021	0.279	0.210	28.2	0.070	0.098	-
121Sb	0.007	0.077	0.066	-	0.039	0.050	-
137Ba	0.001	109	106	2.8	100	120	18.2
202Hg	0.021	0.065	0.057	-	0.033	0.041	-
205Tl	0.001	0.058	0.055	5.3	0.025	0.028	11.3
208Pb	0.001	0.318	0.286	10.6	0.148	0.160	7.8
238U	0.001	0.127	0.113	11.7	0.047	0.059	22.6

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 Accuracy and Precision Results

Sample Group ID: 01

Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.004	1.21	1.4	117	10.7
11B	0.066	4.5	5.0	112	1.8
23Na	1.9	14,000	15,939	114	2.9
24Mg	0.030	910	1,027	113	5.0
27Al	0.051	197.2	202	103	6.0
31P	83	8,000	8,366	105	4.1
39K	1.6	15,500	17,205	111	1.7
44Ca	8.2	2,360	2,482	105	4.3
49Ti	0.277	12.24	14	114	15.4
51V	0.017	1.57	1.8	113	7.9
52Cr	0.206	1.87	2.0	108	4.3
55Mn	0.004	3.17	3.6	113	5.9
57Fe	0.818	343	400	117	4.9
59Co	0.004	0.25	0.287	115	2.5
60Ni	0.013	1.34	1.5	113	4.2
63Cu	0.007	15.7	19	118	5.8
66Zn	0.638	51.6	57	111	1.6
75As	0.427	6.87	7.6	110	2.5
77Se	0.230	3.45	3.8	110	4.2
88Sr	0.001	10.1	11	113	3.3
95Mo	0.001	0.29	0.316	109	7.2
107Ag	0.001	0.0252	0.031	122	2.8
111Cd	0.076	0.299	0.374	125	6.1
118Sn	0.021	0.061	0.073	119	5.7
121Sb	0.007	0.011	0.011	100	**35.4**
137Ba	0.001	8.6	9.2	107	3.2
202Hg	0.021	0.412	0.435	106	3.4
205Tl	0.001	0.0013	-	-	-
208Pb	0.001	0.404	0.434	107	4.6
238U	0.001	0.05	0.055	109	5.8

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

Bold indicates DQO exceedance, but result is accepted as it does not impact the reportable results.

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC1_INV-01_2020-09-30	269	09 Oct 2020
	LC_DC1_INV-02_2020-09-30	270	
	LC_DC1_INV-03_2020-09-30	271	
	LC_DC2_INV-01_2020-09-30	272	
	LC_DC2_INV-02_2020-09-30	273	
	LC_DC2_INV-03_2020-09-30	274	
	LC_DC4_INV-01_2020-09-30	275	
	LC_DC4_INV-02_2020-09-30	276	
	LC_DC4_INV-03_2020-09-30	277	
	LC_DCDS_INV-01_2020-09-30	278	
	LC_DCDS_INV-02_2020-09-30	279	
	LC_DCDS_INV-03_2020-09-30	280	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number: 20-24			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	204 - 1006 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778.677.3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID:		Sample Identification:	Sample Type: Species	Sample type
269	1	LC_DC1_INV-01_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
270	2	LC_DC1_INV-02_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
271	3	LC_DC1_INV-03_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
EE GL 08 Oct 2020 ~~278~~ 272	4	LC_DC2_INV-01_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
273	5	LC_DC2_INV-02_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
274	6	LC_DC2_INV-03_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
275	7	LC_DC4_INV-01_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
276	8	LC_DC4_INV-02_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
277	9	LC_DC4_INV-03_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
278	10	LC_DCDS_INV-01_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
279	11	LC_DCDS_INV-02_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
280	12	LC_DCDS_INV-03_2020-09-30	Composite	Composite-taxa benthic invertebrate tissue samples
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			

Sample(s) Released By: Maddy Stokes	Sample(s) Received By: Geriene LaBine
Signature:	Signature:
Date Sent: 5-Oct-20	Date Received: 08 Oct 2020 (Project #: 2020-156)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

COM-011.01

October 23, 2020

T r i c h A n a l y t i c s   I n c .

Tissue Microchemistry Analysis Report

Client: Dave Hasek
Aquatic Scientist
Minnow Environmental
Phone: (778) 677-3500
Email: dhasek@minnow.ca

Date Received:	23 Oct 2020
Date of Analysis:	27 Oct 2020
Final Report Date:	28 Oct 2020
Project No.:	2020-159
Method No.:	MET-002.04

Client Project: Teck Coal/Minnow Environmental Dry Creek Sampling (20-24)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 12 samples. See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in part per million (ppm) dry weight.
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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 102%).
Sample container ID labeling error for LC_DC2 and LC_DC4 samples has been identifed and addressed for final report.
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy — 28 Oct 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio — 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-01_2020-10-06	LC_DC1_INV-02_2020-10-06	LC_DC1_INV-03_2020-10-06	LC_DC2_INV-01_2020-10-06	LC_DC2_INV-02_2020-10-06
		Lab ID	411	412	413	417	418
		Wet Weight (g)	0.9072	0.7016	0.9985	1.1113	1.0504
		Dry Weight (g)	0.2233	0.1578	0.2201	0.2553	0.1895
		Moisture (%)	75.4	77.5	78.0	77.0	82.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.510	0.686	0.600	0.524	0.505
11B	0.068	0.227	1.3	1.6	1.3	1.9	2.0
23Na	3.1	10	4,488	5,241	4,421	3,317	4,277
24Mg	0.061	0.203	1,430	1,674	1,205	1,389	1,290
27Al	0.045	0.150	479	662	430	757	652
31P	83	277	13,288	15,726	12,805	10,154	11,703
39K	2.5	8.3	12,737	15,615	11,722	8,868	9,818
44Ca	2.6	8.7	2,277	2,643	1,830	1,602	2,038
49Ti	0.194	0.647	35	45	28	53	41
51V	0.028	0.093	1.5	1.9	1.5	2.1	1.8
52Cr	0.113	0.377	8.4	7.0	5.6	4.1	4.7
55Mn	0.006	0.020	46	53	52	60	50
57Fe	1.3	4.3	570	642	531	342	376
59Co	0.005	0.017	0.670	0.919	0.691	5.9	5.3
60Ni	0.012	0.040	26	27	19	30	34
63Cu	0.009	0.030	16	15	13	12	14
66Zn	0.653	2.2	236	251	187	285	328
75As	0.328	1.1	0.573	0.651	0.521	1.0	1.1
77Se	0.341	1.1	11	12	11	13	13
88Sr	0.001	0.003	3.3	3.6	2.4	3.1	3.7
95Mo	0.001	0.003	0.518	0.407	0.426	0.444	0.391
107Ag	0.001	0.003	0.091	0.086	0.086	0.126	0.111
111Cd	0.060	0.200	2.3	2.6	1.6	3.3	3.3
118Sn	0.021	0.070	0.213	0.593	0.198	0.170	0.200
121Sb	0.001	0.003	0.058	0.074	0.066	0.053	0.059
137Ba	0.001	0.003	122	173	147	126	108
202Hg	0.033	0.110	0.043	0.053	<0.033	0.044	0.066
205Tl	0.001	0.003	0.032	0.038	0.027	0.052	0.045
208Pb	0.008	0.027	0.193	0.248	0.197	0.281	0.320
238U	0.001	0.003	0.061	0.072	0.064	0.155	0.158

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-03_2020-10-06	LC_DC4_INV-01_2020-10-06	LC_DC4_INV-02_2020-10-06	LC_DC4_INV-03_2020-10-06	LC_DCDS_INV-01_2020-10-06
		Lab ID	419	414	415	416	420
		Wet Weight (g)	1.2453	0.9636	1.1224	1.0721	1.1909
		Dry Weight (g)	0.2618	0.2244	0.2548	0.2383	0.2626
		Moisture (%)	79.0	76.7	77.3	77.8	77.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.637	0.471	0.373	0.385	0.860
11B	0.068	0.227	1.9	0.976	0.837	0.558	3.7
23Na	3.1	10	3,907	3,526	2,623	4,287	3,120
24Mg	0.061	0.203	1,165	1,256	1,042	1,139	1,557
27Al	0.045	0.150	951	368	315	186	2,037
31P	83	277	9,577	11,411	9,240	10,523	9,804
39K	2.5	8.3	9,877	8,627	7,879	8,228	8,877
44Ca	2.6	8.7	1,678	1,357	1,057	1,569	3,019
49Ti	0.194	0.647	67	21	20	10	196
51V	0.028	0.093	2.3	1.3	0.975	0.630	4.8
52Cr	0.113	0.377	4.2	4.9	3.5	2.7	5.8
55Mn	0.006	0.020	53	28	27	22	101
57Fe	1.3	4.3	377	441	294	191	849
59Co	0.005	0.017	5.2	1.0	0.604	0.608	7.3
60Ni	0.012	0.040	29	18	14	7.7	41
63Cu	0.009	0.030	13	12	9.9	9.5	12
66Zn	0.653	2.2	232	192	223	149	230
75As	0.328	1.1	1.1	0.608	0.556	0.590	1.0
77Se	0.341	1.1	9.0	8.4	7.7	8.5	11
88Sr	0.001	0.003	3.2	1.7	1.4	1.6	6.8
95Mo	0.001	0.003	0.444	0.417	0.287	0.315	0.408
107Ag	0.001	0.003	0.106	0.066	0.050	0.066	0.126
111Cd	0.060	0.200	2.3	1.9	1.2	1.2	2.0
118Sn	0.021	0.070	0.200	0.270	0.083	0.260	0.300
121Sb	0.001	0.003	0.066	0.041	0.041	0.033	0.106
137Ba	0.001	0.003	101	130	85	68	150
202Hg	0.033	0.110	<0.033	<0.033	<0.033	0.043	0.066
205Tl	0.001	0.003	0.055	0.025	0.018	0.018	0.084
208Pb	0.008	0.027	0.357	0.167	0.154	0.090	0.651
238U	0.001	0.003	0.155	0.056	0.041	0.029	0.173

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_DCDS_INV-02_2020-10-06	LC_DCDS_INV-03_2020-10-06
		Lab ID	421	422
		Wet Weight (g)	1.4587	1.2473
		Dry Weight (g)	0.3431	0.2540
		Moisture (%)	76.5	79.6
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.611	0.788
11B	0.068	0.227	10	2.4
23Na	3.1	10	4,455	4,692
24Mg	0.061	0.203	1,411	1,675
27Al	0.045	0.150	852	1,147
31P	83	277	13,384	13,155
39K	2.5	8.3	11,570	13,632
44Ca	2.6	8.7	1,860	2,376
49Ti	0.194	0.647	70	96
51V	0.028	0.093	2.2	3.1
52Cr	0.113	0.377	4.9	4.8
55Mn	0.006	0.020	108	111
57Fe	1.3	4.3	426	523
59Co	0.005	0.017	7.4	7.9
60Ni	0.012	0.040	43	60
63Cu	0.009	0.030	13	13
66Zn	0.653	2.2	262	314
75As	0.328	1.1	0.841	0.731
77Se	0.341	1.1	23	20
88Sr	0.001	0.003	4.7	4.3
95Mo	0.001	0.003	0.479	0.391
107Ag	0.001	0.003	0.136	0.141
111Cd	0.060	0.200	2.0	2.5
118Sn	0.021	0.070	0.350	0.240
121Sb	0.001	0.003	0.086	0.092
137Ba	0.001	0.003	121	146
202Hg	0.033	0.110	0.077	0.077
205Tl	0.001	0.003	0.062	0.081
208Pb	0.008	0.027	0.376	0.450
238U	0.001	0.003	0.121	0.153

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

Parameter	DL (ppm)	LC_DC1_INV-02_2020-10-06 (Lab ID 412) Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	LC_DCDS_INV-02_2020-10-06 (Lab ID 421) Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.006	0.686	0.650	5.4	0.611	0.618	1.1
11B	0.068	1.6	1.5	6.5	10	9.1	9.4
23Na	3.1	5,241	5,231	0.2	4,455	4,032	10
24Mg	0.061	1,674	1,543	8.1	1,411	1,405	0.4
27Al	0.045	662	577	14	852	887	4.0
31P	83	15,726	16,108	2.4	13,384	11,309	17
39K	2.5	15,615	15,303	2.0	11,570	11,178	3.4
44Ca	2.6	2,643	2,356	12	1,860	1,540	19
49Ti	0.194	45	41	9.3	70	64	9.0
51V	0.028	1.9	1.9	0.0	2.2	2.2	0.0
52Cr	0.113	7.0	5.9	17	4.9	4.6	6.3
55Mn	0.006	53	54	1.9	108	101	6.7
57Fe	1.3	642	644	0.3	426	383	11
59Co	0.005	0.919	0.928	1.0	7.4	6.7	9.9
60Ni	0.012	27	25	7.7	43	38	12
63Cu	0.009	15	13	14	13	12	8.0
66Zn	0.653	251	220	13	262	247	5.9
75As	0.328	0.651	0.712	-	0.841	0.695	-
77Se	0.341	12	12	0.0	23	24	4.3
88Sr	0.001	3.6	3.1	15	4.7	3.5	29
95Mo	0.001	0.407	0.426	4.6	0.479	0.399	18
107Ag	0.001	0.086	0.091	5.6	0.136	0.106	25
111Cd	0.060	2.6	2.7	3.8	2.0	1.6	22
118Sn	0.021	0.593	0.509	15	0.350	0.260	30
121Sb	0.001	0.074	0.074	0.0	0.086	0.079	8.5
137Ba	0.001	173	151	14	121	118	2.5
202Hg	0.033	0.053	0.043	-	0.077	0.066	-
205Tl	0.001	0.038	0.035	8.2	0.062	0.063	1.6
208Pb	0.008	0.248	0.261	5.1	0.376	0.350	7.2
238U	0.001	0.072	0.078	8.0	0.121	0.108	11

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	0.006	1.21	1.4	112	6.2	1.1	94	4.1
11B	0.068	4.5	5.1	113	3.2	5.0	110	1.1
23Na	3.1	14,000	15,166	108	5.1	13,624	97	8.3
24Mg	0.061	910	1,038	114	5.2	871	96	4.9
27Al	0.045	197.2	204	103	4.8	191	97	8.5
31P	83	8,000	8,043	100	3.2	7,690	96	7.0
39K	2.5	15,500	16,839	109	2.9	15,091	97	4.2
44Ca	2.6	2,360	2,560	108	4.5	2,361	100	3.1
49Ti	0.194	12.24	12	99	7.0	12	97	17
51V	0.028	1.57	1.6	101	5.9	1.6	100	12
52Cr	0.113	1.87	2.0	107	2.2	1.9	100	5.8
55Mn	0.006	3.17	3.6	114	3.2	3.0	95	4.2
57Fe	1.3	343	396	115	2.6	339	99	5.5
59Co	0.005	0.25	0.277	111	4.8	0.250	100	6.1
60Ni	0.012	1.34	1.5	115	4.9	1.3	98	4.8
63Cu	0.009	15.7	18	117	4.1	15	98	5.6
66Zn	0.653	51.6	56	108	2.8	51	98	6.4
75As	0.328	6.87	7.1	103	2.5	6.8	100	5.3
77Se	0.341	3.45	3.5	102	6.5	3.5	102	4.7
88Sr	0.001	10.1	11	111	5.2	9.7	96	5.2
95Mo	0.001	0.29	0.311	107	7.8	0.273	94	3.6
107Ag	0.001	0.0252	0.031	124	7.2	0.022	88	12
111Cd	0.060	0.299	0.332	111	11	0.272	91	5.1
118Sn	0.021	0.061	0.070	114	8.8	0.069	113	14
121Sb	0.001	0.011	0.015	135	**25**	0.008	72	**37**
137Ba	0.001	8.6	9.1	106	5.9	9.1	106	6.1
202Hg	0.033	0.412	0.473	115	2.9	0.444	108	5.9
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.008	0.404	0.460	114	11	0.415	103	12
238U	0.001	0.05	0.051	102	7.6	0.048	96	6.1

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.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC1_INV-01_2020-10-06	411	27 Oct 2020
	LC_DC1_INV-02_2020-10-06	412	
	LC_DC1_INV-03_2020-10-06	413	
	LC_DC2_INV-01_2020-10-06	417	
	LC_DC2_INV-02_2020-10-06	418	
	LC_DC2_INV-03_2020-10-06	419	
02	LC_DC4_INV-01_2020-10-06	414	27 Oct 2020
	LC_DC4_INV-02_2020-10-06	415	
	LC_DC4_INV-03_2020-10-06	416	
	LC_DCDS_INV-01_2020-10-06	420	
	LC_DCDS_INV-02_2020-10-06	421	
	LC_DCDS_INV-03_2020-10-06	422	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number: 20-24			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	204 - 1006 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778.677.3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID:		Sample Identification:	Sample Type: Species	Sample type
411	1	LC_DC1_INV-01_2020-10-06	Composite	Composite-taxa benthic invertebrate tissue samples
412	2	LC_DC1_INV-02_2020-10-06	Composite	Composite-taxa benthic invertebrate tissue samples
413	3	LC_DC1_INV-03_2020-10-06	Composite	Composite-taxa benthic invertebrate tissue samples
414	4	LC_DC~~2~~4_INV-01_2020-10-06 *	Composite	Composite-taxa benthic invertebrate tissue samples
415	5	LC_DC~~2~~4_INV-02_2020-10-06 *	Composite	Composite-taxa benthic invertebrate tissue samples
416	6	LC_DC~~2~~4_INV-03_2020-10-06 *	Composite	Composite-taxa benthic invertebrate tissue samples
417	7	LC_DC~~4~~2_INV-01_2020-10-06 *	Composite	Composite-taxa benthic invertebrate tissue samples
418	8	LC_DC~~4~~2_INV-02_2020-10-06 *	Composite	Composite-taxa benthic invertebrate tissue samples
419	9	LC_DC~~4~~2_INV-03_2020-10-06 *	Composite	Composite-taxa benthic invertebrate tissue samples
420	10	LC_DCDS_INV-01_2020-10-06	Composite	Composite-taxa benthic invertebrate tissue samples
421	11	LC_DCDS_INV-02_2020-10-06	Composite	Composite-taxa benthic invertebrate tissue samples
422	12	LC_DCDS_INV-03_2020-10-06	Composite	Composite-taxa benthic invertebrate tissue samples
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			

Sample(s) Released By: Maddy Stokes / Marc Giorgini	Sample(s) Received By: Geniene LaBrie
Signature:	Signature:
Date Sent: 19-Oct-20	Date Received: 23 Oct 2020 (Project #: 2020-159)
Sample(s) Returned to Client By:	Shipping Conditions: Frozen
	Shipping Container: Styro - Cooler
Signature:	Date Sent: 19-OCT-20

* Client confirmed sample container labeling error; LC_DC2 sample IDs should be labeled LC_DC4, and LC_DC4 sample IDs should be labeled LC_DC2 27OCT2020 OJS

October 30, 2020

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Dave Hasek	Date Received:	30 Oct 2020
	Aquatic Scientist	Date of Analysis:	03 Nov 2020
	Minnow Environmental	Final Report Date:	03 Nov 2020
Phone:	(778) 677-3500	Project No.:	2020-167
Email:	dhasek@minnow.ca	Method No.:	MET-002.04

Client Project: Teck Coal/Minnow Environmental Dry Creek Sampling (20-24)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 12 samples.
See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in part per million (ppm) dry weight.
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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 99%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy | 03 Nov 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio | 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-01_2020-10-21	LC_DC1_INV-02_2020-10-21	LC_DC1_INV-03_2020-10-21	LC_DC2_INV-01_2020-10-21	LC_DC2_INV-02_2020-10-21
		Lab ID	001	002	003	004	005
		Wet Weight (g)	0.9838	0.7841	0.9765	1.3141	0.9192
		Dry Weight (g)	0.2267	0.1471	0.1922	0.2651	0.1946
		Moisture (%)	77.0	81.2	80.3	79.8	78.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.397	0.636	0.437	0.876	0.856
11B	0.078	0.260	0.932	1.3	1.7	2.3	2.2
23Na	1.3	4.3	2,725	3,831	2,687	3,391	3,517
24Mg	0.017	0.057	1,127	1,270	1,171	1,404	1,498
27Al	0.037	0.123	321	313	334	1,227	1,280
31P	66	220	9,369	12,102	9,479	10,323	11,380
39K	12	40	7,550	10,811	8,423	9,837	9,640
44Ca	59	197	1,575	1,878	2,399	2,120	2,254
49Ti	0.237	0.790	26	21	21	97	113
51V	0.033	0.110	1.1	1.1	1.0	3.7	3.7
52Cr	0.471	1.6	3.3	3.6	3.6	5.4	5.2
55Mn	0.010	0.033	34	39	34	48	55
57Fe	2.9	9.7	370	397	363	520	550
59Co	0.001	0.003	0.360	0.438	0.382	4.5	4.9
60Ni	0.012	0.040	9.1	12	11	30	33
63Cu	0.012	0.040	9.9	11	12	14	16
66Zn	0.795	2.7	178	165	163	228	213
75As	0.349	1.2	0.411	0.490	0.529	0.764	0.862
77Se	0.435	1.4	8.4	9.2	6.7	9.5	11
88Sr	0.001	0.003	2.2	2.7	3.0	4.6	4.7
95Mo	0.001	0.003	0.395	0.376	0.346	0.573	0.613
107Ag	0.001	0.003	0.076	0.055	0.055	0.096	0.121
111Cd	0.068	0.227	1.1	1.0	1.3	2.4	2.8
118Sn	0.020	0.067	0.120	0.335	0.378	0.499	0.529
121Sb	0.006	0.020	0.029	0.042	0.041	0.073	0.094
137Ba	0.001	0.003	92	103	87	126	144
202Hg	0.028	0.093	<0.028	0.036	<0.028	0.042	0.048
205Tl	0.001	0.003	0.013	0.016	0.014	0.047	0.051
208Pb	0.001	0.003	0.097	0.111	0.113	0.348	0.387
238U	0.001	0.003	0.043	0.053	0.048	0.171	0.199

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_DC2_INV-03_2020-10-21	LC_DC4_INV-01_2020-10-21	LC_DC4_INV-02_2020-10-21	LC_DC4_INV-03_2020-10-21	LC_DCDS_INV-01_2020-10-21
		Lab ID	006	007	008	009	010
		Wet Weight (g)	1.7960	1.6514	1.5128	1.5687	1.0932
		Dry Weight (g)	0.3855	0.3299	0.2818	0.3029	0.2291
		Moisture (%)	78.5	80.0	81.4	80.7	79.0
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.448	0.314	0.584	0.391	0.649
11B	0.078	0.260	0.535	0.631	1.6	0.754	2.7
23Na	1.3	4.3	2,796	2,626	3,466	3,359	3,214
24Mg	0.017	0.057	899	965	1,423	1,103	1,398
27Al	0.037	0.123	209	166	632	189	1,176
31P	66	220	8,351	8,294	10,624	10,021	10,052
39K	12	40	7,942	7,772	11,083	10,867	9,726
44Ca	59	197	699	1,118	2,253	2,035	2,102
49Ti	0.237	0.790	12	11	61	16	97
51V	0.033	0.110	0.657	0.609	2.2	0.973	3.5
52Cr	0.471	1.6	2.3	2.5	4.5	2.5	4.8
55Mn	0.010	0.033	35	21	23	23	61
57Fe	2.9	9.7	113	278	649	303	510
59Co	0.001	0.003	2.4	0.293	0.829	0.584	3.6
60Ni	0.012	0.040	7.7	6.1	16	9.6	29
63Cu	0.012	0.040	9.4	10	10	10	14
66Zn	0.795	2.7	153	130	141	167	155
75As	0.349	1.2	0.353	0.630	1.6	1.1	0.848
77Se	0.435	1.4	8.8	6.5	6.7	6.4	11
88Sr	0.001	0.003	1.1	1.4	3.7	2.1	4.6
95Mo	0.001	0.003	0.316	0.290	0.377	0.435	0.348
107Ag	0.001	0.003	0.071	0.059	0.072	0.072	0.099
111Cd	0.068	0.227	0.680	1.1	1.2	1.6	1.2
118Sn	0.020	0.067	0.082	0.354	0.300	0.246	0.294
121Sb	0.006	0.020	0.031	0.025	0.058	0.041	0.074
137Ba	0.001	0.003	61	70	109	74	92
202Hg	0.028	0.093	0.048	<0.028	<0.028	<0.028	<0.028
205Tl	0.001	0.003	0.019	0.011	0.029	0.018	0.050
208Pb	0.001	0.003	0.087	0.064	0.226	0.138	0.369
238U	0.001	0.003	0.026	0.027	0.069	0.061	0.136

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	LC_DCDS_INV-02_2020-10-21	LC_DCDS_INV-03_2020-10-21
		Lab ID	011	012
		Wet Weight (g)	1.4024	1.3827
		Dry Weight (g)	0.3048	0.2950
		Moisture (%)	78.3	78.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.975	0.846
11B	0.078	0.260	2.7	2.0
23Na	1.3	4.3	3,082	2,798
24Mg	0.017	0.057	1,212	1,246
27Al	0.037	0.123	1,685	1,564
31P	66	220	9,880	9,410
39K	12	40	9,606	7,247
44Ca	59	197	2,074	1,408
49Ti	0.237	0.790	140	111
51V	0.033	0.110	5.0	4.4
52Cr	0.471	1.6	6.3	3.6
55Mn	0.010	0.033	80	89
57Fe	2.9	9.7	755	682
59Co	0.001	0.003	5.8	6.3
60Ni	0.012	0.040	41	17
63Cu	0.012	0.040	16	10
66Zn	0.795	2.7	197	132
75As	0.349	1.2	0.775	0.582
77Se	0.435	1.4	20	20
88Sr	0.001	0.003	4.9	3.7
95Mo	0.001	0.003	0.667	0.696
107Ag	0.001	0.003	0.125	0.092
111Cd	0.068	0.227	1.8	1.2
118Sn	0.020	0.067	0.324	0.144
121Sb	0.006	0.020	0.099	0.107
137Ba	0.001	0.003	126	80
202Hg	0.028	0.093	0.039	0.039
205Tl	0.001	0.003	0.072	0.056
208Pb	0.001	0.003	0.488	0.468
238U	0.001	0.003	0.171	0.086

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_DC1_INV-03_2020-10-21			LC_DC4_INV-02_2020-10-21		
Lab ID		003			008		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.006	0.437	0.462	5.6	0.584	0.540	7.8
11B	0.078	1.7	2.0	16	1.6	1.5	6.5
23Na	1.3	2,687	2,647	1.5	3,466	3,597	3.7
24Mg	0.017	1,171	1,370	16	1,423	1,505	5.6
27Al	0.037	334	397	17	632	574	9.6
31P	66	9,479	9,984	5.2	10,624	11,910	11
39K	12	8,423	7,095	17	11,083	11,128	0.4
44Ca	59	2,399	2,585	7.5	2,253	2,693	18
49Ti	0.237	21	28	29	61	57	6.8
51V	0.033	1.0	1.3	26	2.2	2.2	0.0
52Cr	0.471	3.6	3.9	-	4.5	4.9	-
55Mn	0.010	34	35	2.9	23	26	12
57Fe	2.9	363	426	16	649	595	8.7
59Co	0.001	0.382	0.483	23	0.829	0.824	0.6
60Ni	0.012	11	14	24	16	17	6.1
63Cu	0.012	12	12	0.0	10	11	9.5
66Zn	0.795	163	192	16	141	167	17
75As	0.349	0.529	0.509	-	1.6	1.7	-
77Se	0.435	6.7	7.2	7.2	6.7	6.2	7.8
88Sr	0.001	3.0	3.6	18	3.7	4.3	15
95Mo	0.001	0.346	0.455	27	0.377	0.377	0.0
107Ag	0.001	0.055	0.060	8.7	0.072	0.079	9.3
111Cd	0.068	1.3	1.9	38	1.2	1.5	22
118Sn	0.020	0.378	0.421	11	0.300	0.312	3.9
121Sb	0.006	0.040	0.046	-	0.058	0.074	-
137Ba	0.001	87	95	8.8	109	118	7.9
202Hg	0.028	<0.028	<0.028	-	<0.028	<0.028	-
205Tl	0.001	0.014	0.019	30	0.029	0.027	7.1
208Pb	0.001	0.113	0.142	23	0.226	0.187	19
238U	0.001	0.048	0.069	36	0.069	0.072	4.3

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	0.006	1.21	1.3	110	7.3	1.2	99	6.0
11B	0.078	4.5	4.8	108	1.2	4.6	102	3.5
23Na	1.3	14,000	14,767	106	14	13,990	100	7.0
24Mg	0.017	910	996	110	12	885	97	3.0
27Al	0.037	197.2	187	95	6.8	201	102	4.6
31P	66	8,000	7,916	99	12	7,642	96	6.1
39K	12	15,500	15,731	102	11	15,867	102	4.8
44Ca	59	2,360	2,457	104	9.8	2,283	97	1.4
49Ti	0.237	12.24	13	108	12	14	114	9.9
51V	0.033	1.57	1.6	104	16	1.7	109	7.6
52Cr	0.471	1.87	2.1	110	13	1.8	97	6.1
55Mn	0.010	3.17	3.5	111	8.7	3.2	100	1.6
57Fe	2.9	343	368	107	11	343	100	4.0
59Co	0.001	0.25	0.270	108	8.3	0.258	103	5.2
60Ni	0.012	1.34	1.5	112	12	1.3	99	5.4
63Cu	0.012	15.7	17	108	11	16	99	4.2
66Zn	0.795	51.6	56	108	5.7	52	102	3.4
75As	0.349	6.87	6.8	99	11	6.7	97	3.2
77Se	0.435	3.45	3.4	99	8.9	3.4	99	6.0
88Sr	0.001	10.1	10	103	12	10	104	4.5
95Mo	0.001	0.29	0.301	104	12	0.284	98	8.5
107Ag	0.001	0.0252	0.030	120	12	0.026	104	0.0
111Cd	0.068	0.299	0.344	115	5.7	0.320	107	8.3
118Sn	0.020	0.061	0.060	99	7.2	0.066	109	13
121Sb	0.006	0.011	0.016	136	17	0.012	105	**39**
137Ba	0.001	8.6	9.4	109	4.7	8.6	100	3.3
202Hg	0.028	0.412	0.412	100	5.6	0.395	96	7.2
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.001	0.404	0.421	104	**23**	0.465	115	17
238U	0.001	0.05	0.050	100	12	0.048	97	8.3

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.

Bold indicates DQO exceedance, but result is accepted as it does not impact the reportable results.

Teck Coal Limited
Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC1_INV-01_2020-10-21	001	03 Nov 2020
	LC_DC1_INV-02_2020-10-21	002	
	LC_DC1_INV-03_2020-10-21	003	
	LC_DC2_INV-01_2020-10-21	004	
	LC_DC2_INV-02_2020-10-21	005	
	LC_DC2_INV-03_2020-10-21	006	
02	LC_DC4_INV-01_2020-10-21	007	03 Nov 2020
	LC_DC4_INV-02_2020-10-21	008	
	LC_DC4_INV-03_2020-10-21	009	
	LC_DCDS_INV-01_2020-10-21	010	
	LC_DCDS_INV-02_2020-10-21	011	
	LC_DCDS_INV-03_2020-10-21	012	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number: 20-24			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	204 - 1006 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778.677.3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID:		Sample Identification:	Sample Type: Species	Sample type
001	1	LC_DC1_INV-01_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
002	2	LC_DC1_INV-02_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
003	3	LC_DC1_INV-03_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
004	4	LC_DC2_INV-01_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
005	5	LC_DC2_INV-02_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
006	6	LC_DC2_INV-03_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
007	7	LC_DC4_INV-01_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
008	8	LC_DC4_INV-02_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
009	9	LC_DC4_INV-03_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
010	10	LC_DCDS_INV-01_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
011	11	LC_DCDS_INV-02_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
012.	12	LC_DCDS_INV-03_2020-10-21	Composite	Composite-taxa benthic invertebrate tissue samples
	13			
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Sample(s) Released By: Maddy Stokes	Sample(s) Received By: Generene LaBine
Signature:	Signature:
Date Sent: 29-Oct-20	Date Received: 30 Oct 2020 (Project #: 2020-167)
Sample(s) Returned to Client By:	Shipping Conditions: FROZEN
	Shipping Container: COOLER
Signature:	Date Sent: 29-OCT-2020

COM-011.01

November 19, 2020

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Dave Hasek	Date Received:	19 Nov 2020
	Aquatic Scientist	Date of Analysis:	20 Nov 2020
	Minnow Environmental	Final Report Date:	23 Nov 2020
Phone:	(778) 677-3500	Project No.:	2020-172
Email:	dhasek@minnow.ca	Method No.:	MET-002.04

Client Project: Teck Coal/Minnow Environmental Dry Creek Sampling (20-24)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 12 samples. See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in part per million (ppm) dry weight.
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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 107%; range 104 - 110%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Analytical Report Signed in PDF Copy — 23 Nov 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio — 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-01_2020-11-05	LC_DC1_INV-02_2020-11-05	LC_DC1_INV-03_2020-11-05	LC_DC2_INV-01_2020-11-05	LC_DC2_INV-02_2020-11-05
		Lab ID	053	054	055	056	057
		Wet Weight (g)	0.6597	1.0149	0.6750	1.4329	1.0219
		Dry Weight (g)	0.1373	0.2617	0.1485	0.3641	0.2301
		Moisture (%)	79.2	74.2	78.0	74.6	77.5
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.470	0.713	0.738	0.479	0.748
11B	0.084	0.280	1.0	1.2	2.0	1.0	1.8
23Na	0.864	2.9	3,456	4,083	4,052	3,358	3,843
24Mg	0.013	0.043	1,067	1,246	1,436	1,001	1,345
27Al	0.028	0.093	485	551	1,323	627	1,100
31P	77	257	10,337	11,876	12,242	9,094	11,663
39K	3.7	12	8,964	11,434	11,572	8,430	10,703
44Ca	23	77	1,186	1,039	1,973	901	1,308
49Ti	0.297	0.990	33	39	112	49	100
51V	0.022	0.073	1.2	1.3	3.1	1.7	2.8
52Cr	0.452	1.5	2.7	2.6	7.4	2.8	3.9
55Mn	0.005	0.017	33	42	45	44	55
57Fe	1.3	4.3	321	442	854	267	455
59Co	0.002	0.007	0.364	0.397	0.923	3.5	4.8
60Ni	0.014	0.047	8.9	9.4	23	17	25
63Cu	0.008	0.027	11	14	12	9.4	13
66Zn	0.634	2.1	184	207	207	177	242
75As	0.416	1.4	<0.416	0.475	0.575	<0.416	0.726
77Se	0.229	0.763	8.7	11	9.1	11	14
88Sr	0.001	0.003	1.9	1.5	3.6	2.1	3.0
95Mo	0.001	0.003	0.303	0.429	0.366	0.391	0.479
107Ag	0.001	0.003	0.050	0.087	0.088	0.076	0.110
111Cd	0.047	0.157	1.4	1.4	2.1	1.7	2.4
118Sn	0.016	0.053	0.259	0.176	0.284	0.105	0.306
121Sb	0.007	0.023	0.044	0.050	0.083	0.050	0.088
137Ba	0.001	0.003	103	143	135	109	144
202Hg	0.026	0.087	0.071	0.064	0.071	0.064	0.113
205Tl	0.001	0.003	0.010	0.013	0.021	0.018	0.026
208Pb	0.005	0.017	0.119	0.137	0.248	0.196	0.334
238U	0.001	0.003	0.038	0.047	0.083	0.093	0.137

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-03_2020-11-05	LC_DC4_INV-01_2020-11-05	LC_DC4_INV-02_2020-11-05	LC_DC4_INV-03_2020-11-05	LC_DCDS_INV-01_2020-11-05
		Lab ID	058	059	060	061	062
		Wet Weight (g)	0.8474	0.9761	0.7067	1.0003	0.6245
		Dry Weight (g)	0.2065	0.2687	0.1581	0.2200	0.1427
		Moisture (%)	75.6	72.5	77.6	78.0	77.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.871	0.464	0.840	0.484	1.2
11B	0.084	0.280	2.1	1.1	2.7	1.1	3.9
23Na	0.864	2.9	2,804	3,737	4,306	3,234	3,627
24Mg	0.013	0.043	1,072	1,224	1,850	1,270	1,309
27Al	0.028	0.093	1,904	579	1,744	520	2,341
31P	77	257	9,056	11,649	13,642	10,383	10,858
39K	3.7	12	7,625	9,412	14,038	11,016	9,119
44Ca	23	77	1,371	1,818	3,619	1,620	2,012
49Ti	0.297	0.990	189	50	148	36	208
51V	0.022	0.073	4.9	1.9	4.8	1.5	6.7
52Cr	0.452	1.5	7.8	4.6	10	3.6	8.4
55Mn	0.005	0.017	43	17	23	20	96
57Fe	1.3	4.3	735	615	1,140	435	869
59Co	0.002	0.007	4.6	0.570	1.3	0.589	8.2
60Ni	0.014	0.047	31	15	30	11	47
63Cu	0.008	0.027	9.4	11	14	9.7	13
66Zn	0.634	2.1	160	179	230	155	206
75As	0.416	1.4	0.701	1.3	2.2	1.3	0.817
77Se	0.229	0.763	9.6	7.6	6.2	5.8	19
88Sr	0.001	0.003	5.1	2.5	6.6	2.4	5.8
95Mo	0.001	0.003	0.391	0.364	0.468	0.279	0.640
107Ag	0.001	0.003	0.074	0.067	0.116	0.067	0.138
111Cd	0.047	0.157	1.2	1.7	1.6	0.926	1.4
118Sn	0.016	0.053	0.130	0.072	0.228	0.080	0.210
121Sb	0.007	0.023	0.099	0.044	0.094	0.039	0.127
137Ba	0.001	0.003	136	99	125	78	151
202Hg	0.026	0.087	0.064	0.051	0.074	0.037	0.083
205Tl	0.001	0.003	0.031	0.017	0.039	0.018	0.062
208Pb	0.005	0.017	0.427	0.178	0.406	0.138	0.563
238U	0.001	0.003	0.124	0.056	0.114	0.039	0.191

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_DCDS_INV-02_2020-11-05	LC_DCDS_INV-03_2020-11-05
		Lab ID	063	064
		Wet Weight (g)	0.7905	0.6412
		Dry Weight (g)	0.1994	0.1709
		Moisture (%)	74.8	73.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)
7Li	0.004	0.013	0.765	1.1
11B	0.084	0.280	2.2	3.6
23Na	0.864	2.9	4,108	3,830
24Mg	0.013	0.043	1,266	1,434
27Al	0.028	0.093	1,918	3,931
31P	77	257	10,069	11,327
39K	3.7	12	9,302	10,817
44Ca	23	77	1,131	1,891
49Ti	0.297	0.990	169	306
51V	0.022	0.073	5.2	8.2
52Cr	0.452	1.5	7.9	15
55Mn	0.005	0.017	91	105
57Fe	1.3	4.3	794	1,278
59Co	0.002	0.007	6.6	9.0
60Ni	0.014	0.047	45	70
63Cu	0.008	0.027	13	14
66Zn	0.634	2.1	225	244
75As	0.416	1.4	0.903	1.1
77Se	0.229	0.763	25	19
88Sr	0.001	0.003	3.9	11
95Mo	0.001	0.003	0.657	0.804
107Ag	0.001	0.003	0.116	0.120
111Cd	0.047	0.157	1.7	2.8
118Sn	0.016	0.053	0.123	0.351
121Sb	0.007	0.023	0.102	0.143
137Ba	0.001	0.003	133	207
202Hg	0.026	0.087	0.093	0.079
205Tl	0.001	0.003	0.063	0.092
208Pb	0.005	0.017	0.506	0.680
238U	0.001	0.003	0.171	0.203

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_DC1_INV-03_2020-11-05			LC_DCDS_INV-03_2020-11-05		
Lab ID		055			064		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.004	0.738	0.699	5.4	1.1	1.3	17
11B	0.084	2.0	2.0	0.0	3.6	4.3	18
23Na	0.864	4,052	3,829	5.7	3,830	3,641	5.1
24Mg	0.013	1,436	1,395	2.9	1,434	1,435	0.1
27Al	0.028	1,323	1,349	1.9	3,931	3,846	2.2
31P	77	12,242	12,280	0.3	11,327	11,977	5.6
39K	3.7	11,572	11,793	1.9	10,817	11,076	2.4
44Ca	23	1,973	2,030	2.8	1,891	2,071	9.1
49Ti	0.297	112	99	12	306	356	15
51V	0.022	3.1	3.1	0.0	8.2	10	20
52Cr	0.452	7.4	6.8	8.5	15	17	13
55Mn	0.005	45	42	6.9	105	111	5.6
57Fe	1.3	854	747	13	1,278	1,484	15
59Co	0.002	0.923	0.934	1.2	9.0	9.5	5.4
60Ni	0.014	23	23	0.0	70	81	15
63Cu	0.008	12	12	0.0	14	17	19
66Zn	0.634	207	188	9.6	244	262	7.1
75As	0.416	0.575	0.557	-	1.1	1.1	-
77Se	0.229	9.1	8.8	3.4	19	20	5.1
88Sr	0.001	3.6	3.5	2.8	11	15	31
95Mo	0.001	0.366	0.366	0.0	0.804	0.862	7.0
107Ag	0.001	0.088	0.079	11	0.120	0.140	15
111Cd	0.047	2.1	2.3	9.1	2.8	2.7	3.6
118Sn	0.016	0.284	0.296	4.1	0.351	0.395	12
121Sb	0.007	0.083	0.072	14	0.143	0.182	24
137Ba	0.001	135	128	5.3	207	260	23
202Hg	0.026	0.071	0.053	-	0.079	0.093	-
205Tl	0.001	0.021	0.021	0.0	0.092	0.107	15
208Pb	0.005	0.248	0.243	2.0	0.680	0.787	15
238U	0.001	0.083	0.080	3.7	0.203	0.218	7.1

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	0.004	1.21	1.3	107	12	1.3	112	8.2
11B	0.084	4.5	5.7	126	2.6	5.4	121	1.4
23Na	0.864	14,000	14,417	103	7.1	14,914	106	5.5
24Mg	0.013	910	934	103	8.4	997	110	6.5
27Al	0.028	197.2	217	110	2.1	217	110	4.1
31P	77	8,000	7,804	98	6.0	8,731	109	2.4
39K	3.7	15,500	15,669	101	8.6	16,600	107	4.8
44Ca	23	2,360	2,359	100	6.2	2,570	109	7.9
49Ti	0.297	12.24	17	135	4.9	17	135	8.9
51V	0.022	1.57	1.5	96	12	1.7	106	10
52Cr	0.452	1.87	1.9	101	6.5	2.1	110	4.7
55Mn	0.005	3.17	3.3	103	5.8	3.5	111	5.5
57Fe	1.3	343	359	105	8.0	389	113	5.6
59Co	0.002	0.25	0.268	107	4.6	0.274	110	7.1
60Ni	0.014	1.34	1.5	110	8.0	1.6	116	4.7
63Cu	0.008	15.7	17	111	7.0	18	113	7.8
66Zn	0.634	51.6	58	112	5.6	58	113	2.8
75As	0.416	6.87	6.8	99	6.2	7.6	111	4.2
77Se	0.229	3.45	3.6	104	5.8	3.8	110	4.1
88Sr	0.001	10.1	10	100	7.1	11	110	3.9
95Mo	0.001	0.29	0.280	96	2.0	0.346	119	8.9
107Ag	0.001	0.0252	0.026	105	11	0.034	134	12
111Cd	0.047	0.299	0.334	112	4.9	0.347	116	8.3
118Sn	0.016	0.061	0.056	92	19	0.066	108	20
121Sb	0.007	0.011	0.017	**150**	0.0	0.014	125	20
137Ba	0.001	8.6	11	124	1.5	10	121	4.0
202Hg	0.026	0.412	0.404	98	4.5	0.478	116	4.3
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.005	0.404	0.392	97	9.1	0.488	121	17
238U	0.001	0.05	0.050	100	12	0.052	104	8.3

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.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC1_INV-01_2020-11-05	053	20 Nov 2020
	LC_DC1_INV-02_2020-11-05	054	
	LC_DC1_INV-03_2020-11-05	055	
	LC_DC2_INV-01_2020-11-05	056	
	LC_DC2_INV-02_2020-11-05	057	
	LC_DC2_INV-03_2020-11-05	058	
02	LC_DC4_INV-01_2020-11-05	059	20 Nov 2020
	LC_DC4_INV-02_2020-11-05	060	
	LC_DC4_INV-03_2020-11-05	061	
	LC_DCDS_INV-01_2020-11-05	062	
	LC_DCDS_INV-02_2020-11-05	063	
	LC_DCDS_INV-03_2020-11-05	064	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number: 20-24			
Company Name:	Minnow Environmental	Company Name:	
Contact Name:	Dave Hasek	Contact Name:	
Address:	204 - 1006 Fort Street	Address:	
City, Province:	Victoria, BC	City, Province:	
Postal Code:	V8V 3K4	Postal Code:	
Phone:	778.677.3500	Phone:	
Email:	dhasek@minnow.ca	Email:	

Sample Analysis Requested

Trich Sample ID:		Sample Identification:	Sample Type: Species	Sample type
053	1	LC_DC1_INV-01_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
054	2	LC_DC1_INV-02_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
055	3	LC_DC1_INV-03_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
056	4	LC_DC2_INV-01_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
057	5	LC_DC2_INV-02_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
058	6	LC_DC2_INV-03_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
059	7	LC_DC4_INV-01_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
060	8	LC_DC4_INV-02_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
061	9	LC_DC4_INV-03_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
062	10	LC_DCDS_INV-01_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
063	11	LC_DCDS_INV-02_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
064	12	LC_DCDS_INV-03_2020-11-05	Composite	Composite-taxa benthic invertebrate tissue samples
	13			
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	20			

Sample(s) Released By: Maddy Stokes	Sample(s) Received By: Genene LaBine
Signature:	Signature: Genene LB
Date Sent: 18-Nov-20	Date Received: 19 Nov 2020 (Project # 2020-172)
Sample(s) Returned to Client By:	Shipping Conditions: [illegible] 19Nov2020
	Shipping Container:
Signature:	Date Sent:

COM-011.01

December 10, 2020

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Dave Hasek	Date Received:	10 Dec 2020
	Aquatic Scientist	Date of Analysis:	14 Dec 2020
	Minnow Environmental	Final Report Date:	16 Dec 2020
Phone:	(778) 677-3500	Project No.:	2020-176
Email:	dhasek@minnow.ca	Method No.:	MET-002.04

Client Project: Teck Coal/Minnow Environmental Dry Creek Sampling (20-24)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 30 samples.
See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in part per million (ppm) dry weight.
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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 103%, range 98 - 109%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

16 Dec 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio — Date

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CALA Testing Accreditation No. A4196

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DC3_INV-01_2020-12-01	LC_DC3_INV-02_2020-12-01	LC_DC3_INV-03_2020-12-01	LC_DC3_INV-04_2020-12-01	LC_DC3_INV-05_2020-12-01
		Lab ID	023	024	025	026	027
		Wet Weight (g)	0.7055	0.6956	0.9471	0.7537	0.7836
		Dry Weight (g)	0.1806	0.1895	0.2665	0.1918	0.1702
		Moisture (%)	74.4	72.8	71.9	74.6	78.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.809	0.407	0.328	0.439	1.3
11B	0.095	0.317	2.6	1.2	1.0	0.663	3.3
23Na	0.643	2.1	3,197	3,072	2,808	3,830	4,648
24Mg	0.022	0.073	1,759	1,457	1,340	1,071	1,505
27Al	0.039	0.130	1,734	858	564	441	2,722
31P	75	250	12,242	11,466	10,108	8,270	9,824
39K	2.7	9.0	11,318	9,602	9,028	6,542	9,304
44Ca	9.3	31	3,407	2,473	2,207	2,026	2,832
49Ti	0.188	0.627	133	66	55	32	232
51V	0.054	0.180	5.6	2.4	1.8	1.5	8.9
52Cr	0.401	1.3	7.1	4.6	3.8	4.0	12
55Mn	0.005	0.017	40	37	23	30	40
57Fe	0.758	2.5	849	442	314	273	1,289
59Co	0.004	0.013	3.0	1.6	1.7	2.3	4.1
60Ni	0.013	0.043	34	16	18	16	61
63Cu	0.012	0.040	15	12	11	8.7	12
66Zn	0.339	1.1	226	225	151	178	168
75As	0.508	1.7	0.809	<0.508	0.693	<0.508	0.743
77Se	0.274	0.913	6.8	6.8	4.8	6.5	5.9
88Sr	0.001	0.003	9.4	4.4	3.5	2.7	11
95Mo	0.001	0.003	0.447	0.365	0.215	0.207	0.414
107Ag	0.001	0.003	0.108	0.070	0.076	0.059	0.097
111Cd	0.053	0.177	0.968	0.951	0.525	0.689	1.2
118Sn	0.107	0.357	0.182	0.285	<0.107	0.149	0.173
121Sb	0.001	0.003	0.094	0.044	0.044	0.030	0.132
137Ba	0.001	0.003	126	73	48	32	127
202Hg	0.032	0.107	0.059	<0.032	<0.032	0.036	0.036
205Tl	0.001	0.003	0.093	0.042	0.046	0.037	0.110
208Pb	0.005	0.017	0.513	0.238	0.180	0.138	0.933
238U	0.001	0.003	0.168	0.098	0.058	0.054	0.195

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-01_2020-12-01	LC_DCEF_INV-02_2020-12-01	LC_DCEF_INV-03_2020-12-01	LC_DCEF_INV-04_2020-12-01	LC_DCEF_INV-05_2020-12-01
		Lab ID	028	029	030	031	032
		Wet Weight (g)	1.3017	0.5755	0.8481	0.9118	0.9800
		Dry Weight (g)	0.2873	0.1271	0.2043	0.2269	0.2091
		Moisture (%)	77.9	77.9	75.9	75.1	78.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.473	0.394	0.387	0.204	0.296
11B	0.095	0.317	1.5	1.7	0.818	0.265	0.673
23Na	0.643	2.1	4,222	2,871	3,704	2,721	3,592
24Mg	0.022	0.073	1,529	1,569	1,576	1,161	1,557
27Al	0.039	0.130	328	502	138	46	173
31P	75	250	10,921	11,468	11,963	9,518	12,533
39K	2.7	9.0	9,560	9,946	11,208	8,455	10,828
44Ca	9.3	31	2,405	3,246	2,533	1,418	2,511
49Ti	0.188	0.627	21	23	8.3	2.6	10
51V	0.054	0.180	2.3	3.4	1.2	0.360	1.2
52Cr	0.401	1.3	4.2	4.8	2.8	2.1	3.1
55Mn	0.005	0.017	20	18	17	13	14
57Fe	0.758	2.5	340	413	195	65	193
59Co	0.004	0.013	0.369	0.358	0.162	0.104	0.219
60Ni	0.013	0.043	8.2	9.9	4.5	2.3	5.9
63Cu	0.012	0.040	20	18	26	17	19
66Zn	0.339	1.1	219	207	279	230	211
75As	0.508	1.7	0.842	1.2	0.850	0.609	1.4
77Se	0.274	0.913	5.8	4.4	5.7	4.5	4.5
88Sr	0.001	0.003	3.5	4.4	3.1	1.5	3.1
95Mo	0.001	0.003	0.331	0.446	0.414	0.244	0.383
107Ag	0.001	0.003	0.092	0.086	0.097	0.054	0.065
111Cd	0.053	0.177	3.1	3.5	3.0	2.5	3.0
118Sn	0.107	0.357	0.206	0.281	<0.107	<0.107	0.265
121Sb	0.001	0.003	0.072	0.110	0.055	0.022	0.066
137Ba	0.001	0.003	87	136	85	29	69
202Hg	0.032	0.107	0.036	0.059	0.047	0.039	0.039
205Tl	0.001	0.003	0.016	0.022	0.009	0.003	0.012
208Pb	0.005	0.017	0.142	0.155	0.088	0.021	0.072
238U	0.001	0.003	0.145	0.212	0.103	0.021	0.075

Notes:

ppm = parts per million

DL = detection limit

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g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DCDS_INV-01_2020-12-01	LC_DCDS_INV-02_2020-12-01	LC_DCDS_INV-03_2020-12-01	LC_DCDS_INV-04_2020-12-01	LC_DCDS_INV-05_2020-12-01
		Lab ID	033	034	035	036	037
		Wet Weight (g)	1.1852	1.6068	1.3670	1.0110	1.2816
		Dry Weight (g)	0.2512	0.3473	0.3025	0.1870	0.2725
		Moisture (%)	78.8	78.4	77.9	81.5	78.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.764	0.728	0.587	1.0	0.873
11B	0.095	0.317	2.5	2.4	1.6	3.9	3.8
23Na	0.643	2.1	2,594	2,842	2,992	2,113	2,919
24Mg	0.022	0.073	1,141	1,122	1,043	1,364	1,382
27Al	0.039	0.130	1,871	1,605	989	2,966	2,079
31P	75	250	8,724	7,751	9,292	8,443	9,281
39K	2.7	9.0	7,598	7,469	7,782	6,937	8,235
44Ca	9.3	31	2,035	1,662	1,465	3,340	3,475
49Ti	0.188	0.627	170	125	88	248	178
51V	0.054	0.180	5.4	5.1	3.3	9.6	7.6
52Cr	0.401	1.3	5.8	5.5	4.8	8.7	11
55Mn	0.005	0.017	81	106	104	106	110
57Fe	0.758	2.5	704	721	506	1,236	1,016
59Co	0.004	0.013	5.4	7.0	6.2	7.0	11
60Ni	0.013	0.043	32	31	28	55	71
63Cu	0.012	0.040	11	11	9.7	12	14
66Zn	0.339	1.1	179	149	175	208	215
75As	0.508	1.7	0.738	0.898	0.633	0.946	1.0
77Se	0.274	0.913	19	17	17	9.7	18
88Sr	0.001	0.003	5.8	4.9	3.2	9.2	6.6
95Mo	0.001	0.003	0.557	0.444	0.557	0.661	0.722
107Ag	0.001	0.003	0.097	0.097	0.097	0.122	0.119
111Cd	0.053	0.177	1.5	1.1	1.4	1.8	2.4
118Sn	0.107	0.357	0.226	0.137	0.145	0.444	0.201
121Sb	0.001	0.003	0.110	0.110	0.081	0.213	0.147
137Ba	0.001	0.003	104	132	105	168	131
202Hg	0.032	0.107	0.052	0.039	0.065	0.052	0.077
205Tl	0.001	0.003	0.080	0.067	0.048	0.117	0.096
208Pb	0.005	0.017	0.450	0.540	0.310	0.778	0.582
238U	0.001	0.003	0.180	0.165	0.116	0.333	0.366

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-01_2020-12-02	LC_DC2_INV-02_2020-12-02	LC_DC2_INV-03_2020-12-02	LC_DC2_INV-04_2020-12-02	LC_DC2_INV-05_2020-12-02
		Lab ID	038	039	040	041	042
		Wet Weight (g)	0.6906	0.8374	0.6733	1.2499	0.9683
		Dry Weight (g)	0.1273	0.1989	0.1506	0.2833	0.2435
		Moisture (%)	81.6	76.2	77.6	77.3	74.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.395	0.392	0.588	0.396	0.499
11B	0.095	0.317	1.1	0.532	1.3	0.681	1.1
23Na	0.643	2.1	2,756	3,866	4,140	3,009	3,531
24Mg	0.022	0.073	1,103	776	1,171	1,065	1,141
27Al	0.039	0.130	499	200	628	378	583
31P	75	250	10,158	10,147	10,860	7,825	10,297
39K	2.7	9.0	8,060	8,862	10,494	7,086	9,407
44Ca	9.3	31	2,019	642	1,501	658	1,188
49Ti	0.188	0.627	34	15	44	26	38
51V	0.054	0.180	1.5	0.976	2.0	1.2	1.9
52Cr	0.401	1.3	4.1	2.5	4.2	3.6	5.4
55Mn	0.005	0.017	42	31	46	37	57
57Fe	0.758	2.5	245	170	297	248	316
59Co	0.004	0.013	3.6	2.3	3.8	2.5	4.3
60Ni	0.013	0.043	14	8.5	21	12	20
63Cu	0.012	0.040	12	5.8	12	11	14
66Zn	0.339	1.1	253	113	207	136	217
75As	0.508	1.7	<0.508	<0.508	0.602	<0.508	0.516
77Se	0.274	0.913	9.4	8.9	13	12	10
88Sr	0.001	0.003	2.9	1.0	3.1	1.7	2.2
95Mo	0.001	0.003	0.557	0.215	0.448	0.332	0.448
107Ag	0.001	0.003	0.076	0.038	0.095	0.063	0.095
111Cd	0.053	0.177	2.4	0.708	5.3	1.0	1.5
118Sn	0.107	0.357	0.393	<0.107	0.200	<0.107	0.109
121Sb	0.001	0.003	0.051	0.026	0.053	0.033	0.046
137Ba	0.001	0.003	98	55	121	71	103
202Hg	0.032	0.107	0.065	0.042	0.056	<0.032	<0.032
205Tl	0.001	0.003	0.030	0.017	0.036	0.027	0.031
208Pb	0.005	0.017	0.178	0.089	0.206	0.147	0.181
238U	0.001	0.003	0.069	0.043	0.119	0.052	0.069

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-01_2020-12-02	LC_DC4_INV-02_2020-12-02	LC_DC4_INV-03_2020-12-02	LC_DC4_INV-04_2020-12-02	LC_DC4_INV-05_2020-12-02
		Lab ID	043	044	045	046	047
		Wet Weight (g)	1.1392	1.2852	1.4097	1.3531	1.4635
		Dry Weight (g)	0.2204	0.2856	0.2997	0.2866	0.3111
		Moisture (%)	80.7	77.8	78.7	78.8	78.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.471	0.431	0.336	0.350	0.504
11B	0.095	0.317	1.2	0.723	0.777	0.894	1.1
23Na	0.643	2.1	3,310	3,421	2,704	2,504	4,212
24Mg	0.022	0.073	1,436	1,067	1,080	1,250	1,568
27Al	0.039	0.130	424	241	270	338	428
31P	75	250	10,569	9,967	9,308	7,801	13,134
39K	2.7	9.0	9,822	9,393	8,231	7,725	11,726
44Ca	9.3	31	3,497	1,833	2,293	2,886	2,904
49Ti	0.188	0.627	30	14	15	16	27
51V	0.054	0.180	1.5	0.979	1.1	1.2	1.8
52Cr	0.401	1.3	4.3	3.3	3.5	3.5	3.4
55Mn	0.005	0.017	15	18	16	14	18
57Fe	0.758	2.5	630	495	467	419	517
59Co	0.004	0.013	0.625	0.521	0.465	0.283	0.459
60Ni	0.013	0.043	14	9.1	8.5	8.1	9.3
63Cu	0.012	0.040	12	9.0	11	9.6	11
66Zn	0.339	1.1	187	147	183	127	177
75As	0.508	1.7	1.8	0.947	1.0	1.2	1.3
77Se	0.274	0.913	5.4	6.4	6.9	4.8	5.1
88Sr	0.001	0.003	4.4	2.0	2.7	3.5	3.4
95Mo	0.001	0.003	0.341	0.413	0.377	0.251	0.333
107Ag	0.001	0.003	0.076	0.069	0.076	0.057	0.061
111Cd	0.053	0.177	1.4	0.895	1.2	0.932	1.2
118Sn	0.107	0.357	0.173	<0.107	0.145	0.195	0.199
121Sb	0.001	0.003	0.040	0.026	0.033	0.033	0.036
137Ba	0.001	0.003	106	93	70	74	92
202Hg	0.032	0.107	<0.032	0.042	<0.032	<0.032	0.043
205Tl	0.001	0.003	0.018	0.011	0.011	0.014	0.014
208Pb	0.005	0.017	0.156	0.121	0.116	0.114	0.143
238U	0.001	0.003	0.055	0.038	0.039	0.043	0.054

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
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g = grams
% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DC1_INV-01_2020-11-30	LC_DC1_INV-02_2020-11-30	LC_DC1_INV-03_2020-11-30	LC_DC1_INV-04_2020-11-30	LC_DC1_INV-05_2020-11-30
		Lab ID	048	049	050	051	052
		Wet Weight (g)	1.2122	1.5708	0.6592	0.8532	1.0416
		Dry Weight (g)	0.2933	0.3779	0.1398	0.1823	0.2173
		Moisture (%)	75.8	75.9	78.8	78.6	79.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.578	0.545	0.500	0.540	0.331
11B	0.095	0.317	1.1	1.4	1.6	1.8	0.949
23Na	0.643	2.1	4,459	3,916	3,152	3,249	3,534
24Mg	0.022	0.073	1,259	1,068	1,251	1,164	907
27Al	0.039	0.130	509	737	652	869	132
31P	75	250	12,265	10,085	10,230	9,086	10,219
39K	2.7	9.0	10,771	9,745	9,918	8,348	8,346
44Ca	9.3	31	1,912	1,399	2,870	2,386	1,219
49Ti	0.188	0.627	32	48	38	59	14
51V	0.054	0.180	1.5	2.3	2.0	2.7	0.484
52Cr	0.401	1.3	4.8	5.0	3.5	4.7	2.4
55Mn	0.005	0.017	64	62	43	50	33
57Fe	0.758	2.5	474	694	468	658	259
59Co	0.004	0.013	0.724	0.721	0.451	0.714	0.335
60Ni	0.013	0.043	15	17	11	14	7.3
63Cu	0.012	0.040	13	11	12	11	9.1
66Zn	0.339	1.1	204	164	182	158	133
75As	0.508	1.7	0.574	<0.508	<0.508	0.518	<0.508
77Se	0.274	0.913	11	8.9	7.7	7.3	8.3
88Sr	0.001	0.003	2.3	2.1	4.0	4.4	1.3
95Mo	0.001	0.003	0.387	0.376	0.344	0.311	0.311
107Ag	0.001	0.003	0.067	0.058	0.052	0.055	0.045
111Cd	0.053	0.177	2.4	1.6	1.9	2.2	1.3
118Sn	0.107	0.357	0.157	0.110	0.382	0.217	0.157
121Sb	0.001	0.003	0.036	0.046	0.046	0.050	0.043
137Ba	0.001	0.003	126	140	119	113	118
202Hg	0.032	0.107	0.043	0.050	0.046	0.036	0.043
205Tl	0.001	0.003	0.019	0.021	0.018	0.021	0.009
208Pb	0.005	0.017	0.166	0.209	0.198	0.242	0.091
238U	0.001	0.003	0.042	0.055	0.066	0.058	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_DC3_INV-04_2020-12-01			LC_DCEF_INV-03_2020-12-01			LC_DC2_INV-05_2020-12-02		
Lab ID		026			030			042		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.007	0.439	0.488	11	0.387	0.421	8.4	0.499	0.469	6.2
11B	0.095	0.663	0.928	-	0.818	0.818	-	1.1	0.936	-
23Na	0.643	3,830	3,479	9.6	3,704	4,003	7.8	3,531	3,156	11
24Mg	0.022	1,071	1,195	11	1,576	1,610	2.1	1,141	1,037	9.6
27Al	0.039	441	581	27	138	150	8.3	583	606	3.9
31P	75	8,270	8,132	1.7	11,963	13,588	13	10,297	9,868	4.3
39K	2.7	6,542	7,284	11	11,208	12,397	10	9,407	8,274	13
44Ca	9.3	2,026	1,878	7.6	2,533	2,580	1.8	1,188	1,184	0.3
49Ti	0.188	32	48	40	8.3	10	19	38	43	12
51V	0.054	1.5	1.9	24	1.2	1.3	8.0	1.9	1.9	0.0
52Cr	0.401	4.0	4.4	-	2.8	3.3	-	5.4	4.4	20
55Mn	0.005	30	34	13	17	18	5.7	57	46	21
57Fe	0.758	273	311	13	195	194	0.5	316	340	7.3
59Co	0.004	2.3	1.8	24	0.162	0.162	0.0	4.3	3.5	21
60Ni	0.013	16	17	6.1	4.5	5.3	16	20	16	22
63Cu	0.012	8.7	8.7	0.0	26	24	8.0	14	11	24
66Zn	0.339	178	171	4.0	279	275	1.4	217	177	20
75As	0.508	<0.508	<0.508	-	0.850	0.891	-	0.516	<0.508	-
77Se	0.274	6.5	6.2	4.7	5.7	5.2	9.2	10	9.7	3.0
88Sr	0.001	2.7	2.9	7.1	3.1	3.4	9.2	2.2	2.3	4.4
95Mo	0.001	0.207	0.232	11	0.414	0.398	3.9	0.448	0.431	3.9
107Ag	0.001	0.059	0.059	0.0	0.097	0.086	12	0.095	0.088	7.7
111Cd	0.053	0.689	0.590	16	3.0	2.9	3.4	1.5	1.8	18
118Sn	0.107	0.149	0.149	-	<0.107	0.107	-	0.109	<0.107	-
121Sb	0.001	0.030	0.039	26	0.055	0.044	22	0.046	0.046	0.0
137Ba	0.001	32	36	12	85	86	1.2	103	88	16
202Hg	0.032	0.036	<0.032	-	0.047	0.047	-	<0.032	0.056	-
205Tl	0.001	0.037	0.046	22	0.009	0.010	11	0.031	0.029	6.7
208Pb	0.005	0.138	0.146	5.6	0.088	0.088	0.0	0.181	0.188	3.8
238U	0.001	0.054	0.063	15	0.103	0.088	16	0.069	0.068	1.5

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	0.007	1.21	1.3	107	12	1.1	91	5.2
11B	0.095	4.5	4.9	110	2.8	4.5	101	2.9
23Na	0.643	14,000	14,971	107	4.9	13,900	99	4.2
24Mg	0.022	910	925	102	4.9	894	98	3.6
27Al	0.039	197.2	180	91	3.8	195	99	3.2
31P	75	8,000	8,421	105	4.6	7,872	98	3.9
39K	2.7	15,500	16,062	104	4.4	15,450	100	5.6
44Ca	9.3	2,360	2,405	102	5.8	2,303	98	4.8
49Ti	0.188	12.24	11	93	6.8	12	102	5.9
51V	0.054	1.57	1.8	112	5.4	1.6	102	7.9
52Cr	0.401	1.87	2.0	107	2.6	1.8	96	3.1
55Mn	0.005	3.17	3.4	108	5.0	3.1	99	3.6
57Fe	0.758	343	369	108	4.3	334	97	2.1
59Co	0.004	0.25	0.264	106	5.1	0.251	100	4.7
60Ni	0.013	1.34	1.5	111	4.8	1.3	99	5.3
63Cu	0.012	15.7	17	111	4.7	16	103	6.8
66Zn	0.339	51.6	55	107	3.1	51	98	3.6
75As	0.508	6.87	7.4	108	2.6	6.8	99	5.2
77Se	0.274	3.45	3.6	103	3.7	3.4	98	3.2
88Sr	0.001	10.1	11	104	2.7	10	99	4.7
95Mo	0.001	0.29	0.293	101	6.2	0.298	103	4.3
107Ag	0.001	0.0252	0.029	116	10	0.024	94	12
111Cd	0.053	0.299	0.286	96	5.4	0.292	98	13
118Sn	0.107	0.061	0.064	104	**23**	0.059	96	18
121Sb	0.001	0.011	0.011	100	0.0	0.012	107	**34**
137Ba	0.001	8.6	9.2	107	4.9	8.6	100	2.0
202Hg	0.032	0.412	0.438	106	3.0	0.427	104	7.5
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.005	0.404	0.451	112	18	0.380	94	5.8
238U	0.001	0.05	0.060	120	15	0.049	98	4.3

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.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results

Teck Coal Limited
Tissue QA/QC Accuracy and Precision Results

Parameter	DL (ppm)	Certified Conc. (ppm)	03 Mean Estimated Conc. (ppm)	03 Accuracy (%)	03 Precision RSD (%)	04 Mean Estimated Conc. (ppm)	04 Accuracy (%)	04 Precision RSD (%)
7Li	0.007	1.21	1.4	113	7.6	1.2	99	8.8
11B	0.095	4.5	4.5	100	4.3	5.1	114	4.4
23Na	0.643	14,000	15,653	112	4.6	14,263	102	8.0
24Mg	0.022	910	946	104	3.2	928	102	10
27Al	0.039	197.2	181	92	3.2	187	95	3.8
31P	75	8,000	8,701	109	2.5	8,384	105	7.4
39K	2.7	15,500	16,510	106	3.5	15,463	100	9.5
44Ca	9.3	2,360	2,566	109	1.5	2,358	100	9.5
49Ti	0.188	12.24	11	90	14	12	96	8.0
51V	0.054	1.57	1.5	96	8.2	1.7	107	15
52Cr	0.401	1.87	2.0	109	3.5	2.0	106	11
55Mn	0.005	3.17	3.3	104	4.4	3.2	100	9.6
57Fe	0.758	343	360	105	3.2	341	99	8.9
59Co	0.004	0.25	0.274	110	5.4	0.257	103	8.9
60Ni	0.013	1.34	1.4	103	4.3	1.5	109	7.9
63Cu	0.012	15.7	17	109	1.9	17	110	8.5
66Zn	0.339	51.6	57	111	5.7	55	107	4.8
75As	0.508	6.87	7.4	108	3.5	7.2	105	7.8
77Se	0.274	3.45	3.8	109	2.9	3.5	102	7.3
88Sr	0.001	10.1	11	112	2.6	10	99	11
95Mo	0.001	0.29	0.291	100	6.8	0.291	100	7.2
107Ag	0.001	0.0252	0.028	110	12	0.025	99	13
111Cd	0.053	0.299	0.359	120	7.4	0.342	114	8.8
118Sn	0.107	0.061	0.051	84	**26**	0.068	111	**28**
121Sb	0.001	0.011	0.009	84	**39**	0.012	105	20
137Ba	0.001	8.6	8.3	97	3.7	8.8	102	4.5
202Hg	0.032	0.412	0.416	101	2.8	0.419	102	14
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.005	0.404	0.358	89	16	0.396	98	12
238U	0.001	0.05	0.054	109	14	0.050	100	14

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.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results

Teck Coal Limited
Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC3_INV-01_2020-12-01	023	14 Dec 2020
	LC_DC3_INV-02_2020-12-01	024	
	LC_DC3_INV-03_2020-12-01	025	
	LC_DC3_INV-04_2020-12-01	026	
	LC_DC3_INV-05_2020-12-01	027	
	LC_DCEF_INV-01_2020-12-01	028	
	LC_DCEF_INV-02_2020-12-01	029	
	LC_DCEF_INV-03_2020-12-01	030	
02	LC_DCEF_INV-04_2020-12-01	031	14 Dec 2020
	LC_DCEF_INV-05_2020-12-01	032	
	LC_DCDS_INV-01_2020-12-01	033	
	LC_DCDS_INV-02_2020-12-01	034	
	LC_DCDS_INV-03_2020-12-01	035	
	LC_DCDS_INV-04_2020-12-01	036	
	LC_DCDS_INV-05_2020-12-01	037	
	LC_DC2_INV-01_2020-12-02	038	
03	LC_DC2_INV-02_2020-12-02	039	14 Dec 2020
	LC_DC2_INV-03_2020-12-02	040	
	LC_DC2_INV-04_2020-12-02	041	
	LC_DC2_INV-05_2020-12-02	042	
	LC_DC4_INV-01_2020-12-02	043	
	LC_DC4_INV-02_2020-12-02	044	
	LC_DC4_INV-03_2020-12-02	045	
	LC_DC4_INV-04_2020-12-02	046	
04	LC_DC4_INV-05_2020-12-02	047	14 Dec 2020
	LC_DC1_INV-01_2020-11-30	048	
	LC_DC1_INV-02_2020-11-30	049	
	LC_DC1_INV-03_2020-11-30	050	
	LC_DC1_INV-04_2020-11-30	051	
	LC_DC1_INV-05_2020-11-30	052	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number: 20-24 (Teck Dry Creek LAEMP)			
Company Name:	Teck	Company Name:	Minnow Environmental
Contact Name:	Cait Good	Contact Name:	Dave Hasek
Address:	PO Box 1777	Address:	204-1006 Fort Street
City, Province:	Sparwood, BC	City, Province:	Victoria, BC
Postal Code:	V0B 2G0	Postal Code:	V8V 3K4
Phone:	250.425.8202	Phone:	778.677.3500
Email:	Cait.Good@teck.com	Email:	dhasek@minnow.ca

Sample Analysis Requested

Trich Sample ID:		Sample Identification:		Sample Type: Species	Sample type
023	1	LC_DC3_INV-01_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
024	2	LC_DC3_INV-02_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
025	3	LC_DC3_INV-03_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
026	4	LC_DC3_INV-04_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
027	5	LC_DC3_INV-05_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
028	6	LC_DCEF_INV-01_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
029	7	LC_DCEF_INV-02_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
030	8	LC_DCEF_INV-03_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
031	9	LC_DCEF_INV-04_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
032	10	LC_DCEF_INV-05_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
033	11	LC_DCDS_INV-01_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
034	12	LC_DCDS_INV-02_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
035	13	LC_DCDS_INV-03_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
036	14	LC_DCDS_INV-04_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
037	15	LC_DCDS_INV-05_2020-12-01	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
038	16	LC_DC2_INV-01_2020-12-02	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
039	17	LC_DC2_INV-02_2020-12-02	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
040	18	LC_DC2_INV-03_2020-12-02	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
041	19	LC_DC2_INV-04_2020-12-02	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
042	20	LC_DC2_INV-05_2020-12-02	✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis

Sample(s) Released By:	Sample(s) Received By: Geriene LaBine
Signature:	Signature: [signature]
Date Sent:	Date Received: 10 Dec 2020 (Project #: 2020-176)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

TrichAnalytics Inc.
207-1753 Sean Heights, Saanichton, BC, V8M 0B3
Ph: (250) 532-1084

Chain of Custody (COC) for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number: 20-24 (Teck Dry Creek LAEMP)			
Company Name:	Teck	Company Name:	Minnow Environmental
Contact Name:	Cait Good	Contact Name:	Dave Hasek
Address:	PO Box 1777	Address:	204-1006 Fort Street
City, Province:	Sparwood, BC	City, Province:	Victoria, BC
Postal Code:	V0B 2G0	Postal Code:	V8V 3K4
Phone:	250.425.8202	Phone:	778.677.3500
Email:	Cait.Good@teck.com	Email:	dhasek@minnow.ca

Sample Analysis Requested

Trich Sample ID:	Sample Identification:		Sample Type: Species	Sample type
043	1	LC_DC4_INV-01_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
044	2	LC_DC4_INV-02_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
045	3	LC_DC4_INV-03_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
046	4	LC_DC4_INV-04_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
047	5	LC_DC4_INV-05_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
048	6	LC_DC1_INV-01_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
049	7	LC_DC1_INV-02_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
050	8	LC_DC1_INV-03_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
051	9	LC_DC1_INV-04_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
052	10	LC_DC1_INV-05_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis

Sample(s) Released By:	Sample(s) Received By: Genevieve LaBine
Signature:	Signature: Genevieve LB
Date Sent:	Date Received: 10 DEC 2020 (PROJECT #: 2020-176)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

Fish Aging and Tissue Chemistry Analysis Laboratory Reports (AAE Tech Services and Trichanalytics Inc.)

Fish #	Sample ID	Species	Plus Growth	Date	Structure	Ageing Method	Primary Ager	Age Estimate	CI	QA/QC Ager	Age Estimate	CI	Final Age Estimate	Notes
2	LC_DC2-WCT-2-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	FG	NC	2	FG	**2**	Broken otoliths
3	LC_DC2-WCT-3-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	FP	NC	2	FP	**2**	Otoliths are deformed
10	LC_DC2-WCT-10-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	G	NC	2	G	**2**	
11	LC_DC2-WCT-11-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	FG	NC	2	G	**2**	
12	LC_DC2-WCT-12-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	P	NC	2	FP	**2**	Otoliths are deformed
13	LC_DC2-WCT-13-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	G	NC	2	G	**2**	
15	LC_DC2-WCT-15-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	FG	NC	2	FG	**2**	
16	LC_DC2-WCT-16-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	P	NC	2	P	**2**	Otoliths are deformed
17	LC_DC2-WCT-17-OT-2020-10-08	Westslope Cutthroat Trout	+	08-Oct-20	Otolith	Whole	CC	2	FP	NC	2	P	**2**	Otoliths are deformed
18	LC_DC2-WCT-18-OT-2020-10-09	Westslope Cutthroat Trout	+	09-Oct-20	Otolith	Whole	CC	5	F	NC	5	F	**5**	
20	LC_DC2-WCT-20-OT-2020-10-09	Westslope Cutthroat Trout	+	09-Oct-20	Otolith	Whole	CC	2	G	NC	2	G	**2**	
21	LC_DC2-WCT-21-OT-2020-10-09	Westslope Cutthroat Trout	+	09-Oct-20	Otolith	Whole	CC	2	P	NC	2	FP	2	Otoliths are deformed
23	LC_DC2-WCT-23-OT-2020-10-09	Westslope Cutthroat Trout	+	09-Oct-20	Otolith	Whole	CC	2	G	NC	2	FG	**2**	
24	LC_DC2-WCT-24-OT-2020-10-09	Westslope Cutthroat Trout	+	09-Oct-20	Otolith	Whole	CC	2	FP	NC	2	FP	**2**	Otoliths are deformed
25	LC_DC2-WCT-25-OT-2020-10-09	Westslope Cutthroat Trout	+	09-Oct-20	Otolith	Whole	CC	2	FG	NC	2	FG	**2**	

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client: Carlie Meyer
Environmental Technician
Teck Coal Limited
Phone: 250.433.6210
Email: Carlie.Meyer@teck.com

Date Received:	30 Oct 2020
Date of Analysis:	04 Nov 2020
Final Report Date:	05 Nov 2020
Project No.:	2020-168
Method No.:	MET-002.04

Client Project: Teck Coal Limited: Fish Tissue Analysis

Analytical Request: Fish Tissue Microchemistry (total metals and moisture) – 21 samples.
See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in part per million (ppm) dry weight.
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 102%; range 100 - 104%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

05 Nov 2020

Reviewed and Approved by Jennie Christensen, PhD, RPBio — 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_DC2-WCT-1-M-2020-10-08	LC_DC2-WCT-2-M-2020-10-08	LC_DC2-WCT-3-M-2020-10-08	LC_DC2-WCT-4-M-2020-10-08	LC_DC2-WCT-6-M-2020-10-08
		Lab ID	025	026	027	028	029
		Wet Weight (g)	4.2876	4.3288	1.7473	7.4577	2.0331
		Dry Weight (g)	1.1534	1.2346	0.4924	1.9651	0.5379
		Moisture (%)	73.1	71.5	71.8	73.7	73.5
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.118	0.086	0.095	0.155	0.145
11B	0.076	0.253	0.076	<0.076	<0.076	<0.076	<0.076
23Na	1.4	4.7	1,706	1,490	1,391	1,795	1,351
24Mg	0.022	0.073	927	1,319	1,196	1,292	1,410
27Al	0.037	0.123	0.775	0.661	1.6	2.5	1.2
31P	66	220	11,653	12,580	11,435	14,013	12,842
39K	5.6	19	21,184	24,772	24,209	28,374	22,976
44Ca	56	187	737	836	1,068	557	1,176
49Ti	0.341	1.1	1.2	1.2	1.2	1.2	1.2
51V	0.034	0.113	<0.034	<0.034	<0.034	<0.034	<0.034
52Cr	0.417	1.4	1.6	1.6	1.8	1.2	1.6
55Mn	0.005	0.017	0.345	0.375	0.511	0.296	0.443
57Fe	1.7	5.7	27	20	27	19	31
59Co	0.001	0.003	0.383	0.339	0.538	0.315	0.455
60Ni	0.001	0.003	0.188	0.108	0.632	0.215	0.376
63Cu	0.012	0.040	2.1	2.0	1.6	2.4	2.0
66Zn	0.524	1.7	21	22	26	16	32
75As	0.468	1.6	<0.468	<0.468	<0.468	<0.468	<0.468
77Se	0.274	0.913	9.9	11	9.3	10	10
88Sr	0.001	0.003	0.108	0.090	0.158	0.045	0.178
95Mo	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
107Ag	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
111Cd	0.046	0.153	<0.046	<0.046	<0.046	<0.046	<0.046
118Sn	0.021	0.070	0.035	0.047	0.118	0.272	0.213
121Sb	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
137Ba	0.001	0.003	0.174	0.087	0.174	0.087	0.349
202Hg	0.030	0.100	0.034	<0.030	<0.030	<0.030	<0.030
205Tl	0.001	0.003	0.112	0.133	0.118	0.153	0.088
208Pb	0.007	0.023	<0.007	<0.007	<0.007	<0.007	<0.007
238U	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001

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-WCT-7-M-2020-10-08	LC_DC2-WCT-10-M-2020-10-08	LC_DC2-WCT-11-M-2020-10-08	LC_DC2-WCT-12-M-2020-10-08	LC_DC2-WCT-13-M-2020-10-08
		Lab ID	030	031	032	033	034
		Wet Weight (g)	4.2776	4.8089	4.2675	3.9949	4.6693
		Dry Weight (g)	1.1546	1.2618	1.1150	1.0348	1.2159
		Moisture (%)	73.0	73.8	73.9	74.1	74.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.105	0.143	0.127	0.114	0.130
11B	0.076	0.253	<0.076	0.076	0.076	<0.076	<0.076
23Na	1.4	4.7	1,344	1,706	1,813	1,731	1,350
24Mg	0.022	0.073	1,309	1,403	1,602	1,253	1,373
27Al	0.037	0.123	0.878	0.889	3.7	1.4	1.2
31P	66	220	10,698	13,923	13,014	11,168	11,046
39K	5.6	19	18,865	27,871	24,033	17,782	16,136
44Ca	56	187	1,025	735	1,017	937	814
49Ti	0.341	1.1	1.2	1.2	1.2	1.2	1.2
51V	0.034	0.113	<0.034	<0.034	<0.034	<0.034	<0.034
52Cr	0.417	1.4	1.7	1.5	1.7	1.5	1.4
55Mn	0.005	0.017	0.410	0.394	0.514	0.494	0.470
57Fe	1.7	5.7	26	24	29	28	27
59Co	0.001	0.003	0.534	0.346	0.479	0.464	0.407
60Ni	0.001	0.003	0.188	0.108	0.323	0.188	0.242
63Cu	0.012	0.040	1.7	2.0	2.3	2.1	2.1
66Zn	0.524	1.7	24	20	25	22	20
75As	0.468	1.6	<0.468	<0.468	<0.468	<0.468	<0.468
77Se	0.274	0.913	11	9.5	11	9.8	10
88Sr	0.001	0.003	0.131	0.099	0.140	0.131	0.104
95Mo	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
107Ag	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
111Cd	0.046	0.153	<0.046	<0.046	<0.046	<0.046	<0.046
118Sn	0.021	0.070	0.041	0.118	0.059	0.047	0.024
121Sb	0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.011
137Ba	0.001	0.003	0.087	0.087	0.261	0.261	0.261
202Hg	0.030	0.100	<0.030	<0.030	<0.030	<0.030	0.085
205Tl	0.001	0.003	0.069	0.085	0.085	0.117	0.079
208Pb	0.007	0.023	<0.007	<0.007	<0.007	<0.007	<0.007
238U	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001

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_DC2-WCT-15-M-2020-10-08	LC_DC2-WCT-16-M-2020-10-08	LC_DC2-WCT-17-M-2020-10-08	LC_DC2-WCT-18-M-2020-10-09	LC_DC2-WCT-20-M-2020-10-09
		Lab ID	035	036	037	038	039
		Wet Weight (g)	3.8637	3.5823	3.3945	10.4430	6.4646
		Dry Weight (g)	1.0161	0.8953	0.8578	2.5476	1.6613
		Moisture (%)	73.7	75.0	74.7	75.6	74.3
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.193	0.192	0.113	0.177	0.104
11B	0.076	0.253	<0.076	<0.076	<0.076	<0.076	<0.076
23Na	1.4	4.7	1,785	2,366	1,645	2,165	1,668
24Mg	0.022	0.073	1,434	1,157	1,465	1,398	1,043
27Al	0.037	0.123	0.682	0.618	3.3	0.627	0.383
31P	66	220	13,629	14,854	12,805	14,219	10,626
39K	5.6	19	23,038	32,471	23,842	27,157	18,953
44Ca	56	187	890	749	908	579	733
49Ti	0.341	1.1	1.2	1.3	1.3	1.3	1.0
51V	0.034	0.113	<0.034	<0.034	<0.034	<0.034	<0.034
52Cr	0.417	1.4	1.6	1.3	1.6	1.5	1.3
55Mn	0.005	0.017	0.408	0.335	0.520	0.351	0.291
57Fe	1.7	5.7	18	24	27	28	23
59Co	0.001	0.003	0.339	0.424	0.424	0.341	0.378
60Ni	0.001	0.003	0.161	0.292	0.449	0.135	0.112
63Cu	0.012	0.040	2.2	2.0	2.3	1.7	2.2
66Zn	0.524	1.7	18	24	24	16	21
75As	0.468	1.6	<0.468	<0.468	<0.468	<0.468	<0.468
77Se	0.274	0.913	11	9.8	9.8	14	8.9
88Sr	0.001	0.003	0.079	0.094	0.144	0.091	0.098
95Mo	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
107Ag	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
111Cd	0.046	0.153	<0.046	0.077	<0.046	<0.046	<0.046
118Sn	0.021	0.070	0.024	0.114	0.149	0.137	0.057
121Sb	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
137Ba	0.001	0.003	0.174	0.157	0.315	0.315	0.079
202Hg	0.030	0.100	<0.030	<0.030	<0.030	<0.030	<0.030
205Tl	0.001	0.003	0.074	0.088	0.119	0.125	0.069
208Pb	0.007	0.023	<0.007	<0.007	<0.007	<0.007	<0.007
238U	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001

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-WCT-21-M-2020-10-09	LC_DC2-WCT-22-M-2020-10-09	LC_DC2-WCT-23-M-2020-10-09	LC_DC2-WCT-24-M-2020-10-09	LC_DC2-WCT-25-M-2020-10-09
		Lab ID	040	041	042	043	044
		Wet Weight (g)	4.2835	2.8221	3.9218	3.2843	3.0775
		Dry Weight (g)	1.0124	0.6370	0.9634	0.7531	0.7367
		Moisture (%)	76.4	77.4	75.4	77.1	76.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.006	0.020	0.179	0.264	0.151	0.164	0.185
11B	0.076	0.253	<0.076	<0.076	<0.076	<0.076	<0.076
23Na	1.4	4.7	2,022	1,614	1,925	1,310	1,811
24Mg	0.022	0.073	1,362	1,104	1,284	1,161	1,420
27Al	0.037	0.123	0.279	2.0	0.279	0.897	1.0
31P	66	220	12,380	9,832	11,747	10,715	11,424
39K	5.6	19	21,198	16,824	20,650	18,003	16,834
44Ca	56	187	1,133	888	810	927	1,086
49Ti	0.341	1.1	1.3	1.6	1.3	1.0	1.6
51V	0.034	0.113	<0.034	<0.034	<0.034	<0.034	<0.034
52Cr	0.417	1.4	1.4	1.4	1.4	1.4	1.7
55Mn	0.005	0.017	0.340	0.253	0.320	0.405	0.432
57Fe	1.7	5.7	36	18	22	18	27
59Co	0.001	0.003	0.433	0.598	0.373	0.503	0.672
60Ni	0.001	0.003	0.224	0.180	0.180	0.471	0.180
63Cu	0.012	0.040	2.6	1.2	2.2	1.2	1.7
66Zn	0.524	1.7	24	23	20	23	24
75As	0.468	1.6	<0.468	<0.468	<0.468	<0.468	<0.468
77Se	0.274	0.913	11	9.7	11	9.2	14
88Sr	0.001	0.003	0.228	0.126	0.130	0.187	0.157
95Mo	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
107Ag	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
111Cd	0.046	0.153	<0.046	<0.046	<0.046	<0.046	<0.046
118Sn	0.021	0.070	0.218	0.103	0.092	0.097	0.114
121Sb	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
137Ba	0.001	0.003	0.472	0.236	0.236	0.315	0.236
202Hg	0.030	0.100	<0.030	<0.030	<0.030	<0.030	<0.030
205Tl	0.001	0.003	0.138	0.073	0.121	0.074	0.126
208Pb	0.007	0.023	0.011	<0.007	<0.007	<0.007	<0.007
238U	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001

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-WCT-5-M-2020-10-08
		Lab ID	045
		Wet Weight (g)	3.5789
		Dry Weight (g)	0.8836
		Moisture (%)	75.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)
7Li	0.006	0.020	0.083
11B	0.076	0.253	<0.076
23Na	1.4	4.7	1,400
24Mg	0.022	0.073	1,396
27Al	0.037	0.123	0.453
31P	66	220	11,441
39K	5.6	19	21,365
44Ca	56	187	927
49Ti	0.341	1.1	1.0
51V	0.034	0.113	<0.034
52Cr	0.417	1.4	1.4
55Mn	0.005	0.017	0.351
57Fe	1.7	5.7	21
59Co	0.001	0.003	0.333
60Ni	0.001	0.003	0.258
63Cu	0.012	0.040	1.6
66Zn	0.524	1.7	26
75As	0.468	1.6	<0.468
77Se	0.274	0.913	10
88Sr	0.001	0.003	0.177
95Mo	0.001	0.003	<0.001
107Ag	0.001	0.003	<0.001
111Cd	0.046	0.153	<0.046
118Sn	0.021	0.070	0.080
121Sb	0.001	0.003	<0.001
137Ba	0.001	0.003	0.157
202Hg	0.030	0.100	<0.030
205Tl	0.001	0.003	0.140
208Pb	0.007	0.023	<0.007
238U	0.001	0.003	<0.001

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_DC2-WCT-2-M-2020-10-08			LC_DC2-WCT-6-M-2020-10-08			LC_DC2-WCT-21-M-2020-10-09		
		Lab ID: 026			029			040		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.006	0.086	0.077	11	0.145	0.164	12	0.179	0.200	11
11B	0.076	<0.076	<0.076	-	<0.076	0.076	-	<0.076	<0.076	-
23Na	1.4	1,490	1,331	11	1,351	1,895	34	2,022	1,806	11
24Mg	0.022	1,319	1,200	9.4	1,410	1,501	6.3	1,362	1,370	0.6
27Al	0.037	0.661	0.744	12	1.2	1.8	40	0.279	0.418	-
31P	66	12,580	11,552	8.5	12,842	16,692	26	12,380	10,737	14
39K	5.6	24,772	19,013	26	22,976	34,096	39	21,198	18,359	14
44Ca	56	836	673	22	1,176	1,175	0.1	1,133	1,117	1.4
49Ti	0.341	1.2	1.2	-	1.2	1.2	-	1.3	1.3	-
51V	0.034	<0.034	<0.034	-	<0.034	<0.034	-	<0.034	<0.034	-
52Cr	0.417	1.6	1.6	-	1.6	1.7	-	1.4	1.6	-
55Mn	0.005	0.375	0.296	24	0.443	0.505	13	0.340	0.351	3.2
57Fe	1.7	20	17	16	31	32	3.2	36	36	0.0
59Co	0.001	0.339	0.267	24	0.455	0.483	6.0	0.433	0.492	13
60Ni	0.001	0.108	0.081	29	0.376	0.376	0.0	0.224	0.224	0.0
63Cu	0.012	2.0	1.8	11	2.0	2.0	0.0	2.6	2.5	3.9
66Zn	0.524	22	21	4.7	32	28	13	24	25	4.1
75As	0.468	<0.468	<0.468	-	<0.468	<0.468	-	<0.468	<0.468	-
77Se	0.274	11	9.8	12	10	11	9.5	11	11	0.0
88Sr	0.001	0.090	0.068	28	0.178	0.178	0.0	0.228	0.236	3.4
95Mo	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
107Ag	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
111Cd	0.046	<0.046	<0.046	-	<0.046	0.080	-	<0.046	<0.046	-
118Sn	0.021	0.047	0.047	-	0.213	0.260	20	0.218	0.126	-
121Sb	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
137Ba	0.001	0.087	<0.001	-	0.349	0.349	0.0	0.472	0.472	0.0
202Hg	0.030	<0.030	<0.030	-	<0.030	<0.030	-	<0.030	<0.030	-
205Tl	0.001	0.133	0.126	5.4	0.088	0.086	2.3	0.126	0.105	18
208Pb	0.007	<0.007	<0.007	-	<0.007	<0.007	-	0.011	<0.007	-
238U	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-

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	0.006	1.21	1.4	114	6.9	1.3	107	6.6
11B	0.076	4.5	4.6	103	2.7	5.1	114	4.0
23Na	1.4	14,000	15,114	108	2.3	14,831	106	4.8
24Mg	0.022	910	974	107	4.6	958	105	1.9
27Al	0.037	197.2	194	98	4.9	193	98	4.3
31P	66	8,000	8,676	108	1.9	8,282	104	3.8
39K	5.6	15,500	17,070	110	4.3	16,484	106	4.2
44Ca	56	2,360	2,648	112	2.7	2,444	104	2.7
49Ti	0.341	12.24	13	107	2.5	14	115	17
51V	0.034	1.57	1.7	110	8.7	1.5	96	6.5
52Cr	0.417	1.87	2.1	111	3.4	2.0	104	4.1
55Mn	0.005	3.17	3.3	105	3.1	3.5	111	4.1
57Fe	1.7	343	375	109	3.8	376	110	4.3
59Co	0.001	0.25	0.279	112	3.5	0.287	115	5.5
60Ni	0.001	1.34	1.4	107	2.0	1.5	109	3.7
63Cu	0.012	15.7	18	112	2.7	18	113	3.8
66Zn	0.524	51.6	58	112	2.6	57	110	3.4
75As	0.468	6.87	7.2	104	2.3	7.1	104	3.5
77Se	0.274	3.45	3.6	104	1.8	3.5	100	6.8
88Sr	0.001	10.1	11	111	1.2	11	106	3.6
95Mo	0.001	0.29	0.327	113	5.0	0.272	94	9.0
107Ag	0.001	0.0252	0.030	120	15	0.027	106	12
111Cd	0.046	0.299	0.359	120	12	0.340	114	12
118Sn	0.021	0.061	0.061	101	18	0.054	88	7.1
121Sb	0.001	0.011	0.011	100	0.0	0.011	100	0.0
137Ba	0.001	8.6	8.9	104	3.2	9.2	107	5.5
202Hg	0.030	0.412	0.450	109	4.0	0.434	105	3.5
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.007	0.404	0.437	108	12	0.357	88	12
238U	0.001	0.05	0.053	106	5.7	0.053	105	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.

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC2-WCT-1-M-2020-10-08	025	04 Nov 2020
	LC_DC2-WCT-2-M-2020-10-08	026	
	LC_DC2-WCT-3-M-2020-10-08	027	
	LC_DC2-WCT-4-M-2020-10-08	028	
	LC_DC2-WCT-6-M-2020-10-08	029	
	LC_DC2-WCT-7-M-2020-10-08	030	
	LC_DC2-WCT-10-M-2020-10-08	031	
	LC_DC2-WCT-11-M-2020-10-08	032	
	LC_DC2-WCT-12-M-2020-10-08	033	
	LC_DC2-WCT-13-M-2020-10-08	034	
	LC_DC2-WCT-15-M-2020-10-08	035	
02	LC_DC2-WCT-16-M-2020-10-08	036	04 Nov 2020
	LC_DC2-WCT-17-M-2020-10-08	037	
	LC_DC2-WCT-18-M-2020-10-09	038	
	LC_DC2-WCT-20-M-2020-10-09	039	
	LC_DC2-WCT-21-M-2020-10-09	040	
	LC_DC2-WCT-22-M-2020-10-09	041	
	LC_DC2-WCT-23-M-2020-10-09	042	
	LC_DC2-WCT-24-M-2020-10-09	043	
	LC_DC2-WCT-25-M-2020-10-09	044	
	LC_DC2-WCT-5-M-2020-10-08	045	

TrichAnalytics Inc.
207-1753 Sean Heights, Saanichton, BC, V8M 0B3
Ph: (250) 532-1084

Chain of Custody (COC)
for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number:	PO 707822		
Company Name:	Teck Coal	Company Name:	
Contact Name:	Carlie Meyer	Contact Name:	
Address:	421 Pine Ave	Address:	
City, Province:	Sparwood BC	City, Province:	
Postal Code:	V0B 2G0	Postal Code:	
Phone:	250-433-6210	Phone:	
Email:	carlie.meyer@teck.com	Email:	cait.good@teck.com Mariah.Arnold@teck.com

Sample Analysis Requested

Trich Sample ID	#	Sample Identification	Species	Sample type
025	1	LC_DC2-WCT-1-M-2020-10-08	WCT	Dorsal muscle - note skin on not removed by field crew please remove prior to analysis. GOL.
026	2	LC_DC2-WCT-2-M-2020-10-08		
027	3	LC_DC2-WCT-3-M-2020-10-08		
028	4	LC_DC2-WCT-4-M-2020-10-08		
029	5	LC_DC2-WCT-6-M-2020-10-08		
030	6	LC_DC2-WCT-7-M-2020-10-08		
031	7	LC_DC2-WCT-10-M-2020-10-08		
032	8	LC_DC2-WCT-11-M-2020-10-08		
033	9	LC_DC2-WCT-12-M-2020-10-08		
034	10	LC_DC2-WCT-13-M-2020-10-08		
035	11	LC_DC2-WCT-15-M-2020-10-08		
036	12	LC_DC2-WCT-16-M-2020-10-08		
037	13	LC_DC2-WCT-17-M-2020-10-08		
038	14	LC_DC2-WCT-18-M-2020-10-09		
039	15	LC_DC2-WCT-20-M-2020-10-09		
040	16	LC_DC2-WCT-21-M-2020-10-09		
041	17	LC_DC2-WCT-22-M-2020-10-09		
042	18	LC_DC2-WCT-23-M-2020-10-09		
043	19	LC_DC2-WCT-24-M-2020-10-09		
044	20	LC_DC2-WCT-25-M-2020-10-09		

Sample(s) Released By: Carlie Meyer	Sample(s) Received By: Genevie LaBine
Signature: C. Meyer	Signature: Genevie LB
Date Sent: Oct 29, 2020	Date Received: 30 Oct 2020 (Project # 2020-168)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number:	PO 707822		
Company Name:	Teck Coal	Company Name:	
Contact Name:	Carlie Meyer	Contact Name:	
Address:	421 Pine Ave	Address:	
City, Province:	Sparwood BC	City, Province:	
Postal Code:	V0B 2G0	Postal Code:	
Phone:	250-433-6210	Phone:	
Email:	carlie.meyer@teck.com	Email:	cait.good@teck.com Mariah.Arnold@teck.com

Sample Analysis Requested

Trich Sample ID:		Sample Identification:	Sample Type: Species	Sample type
045	1	LC_DC2-WCT-5-M-2020-10-08	WCT	Dorsal muscle - note skin on not removed by field crew please remove prior to analysis.
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Sample(s) Released By: Carlie Meyer	Sample(s) Received By: Genene LaBine
Signature: C. Meyer	Signature: Genene LaBine
Date Sent: Oct 29, 2020	Date Received: 30Oct2020 (Project # 2020-168)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

COM-011.01

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Dave Hasek	Date Received:	10 Dec 2020
	Aquatic Scientist	Date of Analysis:	14 Dec 2020
	Minnow Environmental	Final Report Date:	16 Dec 2020
Phone:	(778) 677-3500	Project No.:	2020-176
Email:	dhasek@minnow.ca	Method No.:	MET-002.04

Client Project: Teck Coal/Minnow Environmental Dry Creek Sampling (20-24)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 30 samples. See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in part per million (ppm) dry weight.
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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (average achieved 103%, range 98 - 109%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

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

16 Dec 2020
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_DC3_INV-01_2020-12-01	LC_DC3_INV-02_2020-12-01	LC_DC3_INV-03_2020-12-01	LC_DC3_INV-04_2020-12-01	LC_DC3_INV-05_2020-12-01
		Lab ID	023	024	025	026	027
		Wet Weight (g)	0.7055	0.6956	0.9471	0.7537	0.7836
		Dry Weight (g)	0.1806	0.1895	0.2665	0.1918	0.1702
		Moisture (%)	74.4	72.8	71.9	74.6	78.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.809	0.407	0.328	0.439	1.3
11B	0.095	0.317	2.6	1.2	1.0	0.663	3.3
23Na	0.643	2.1	3,197	3,072	2,808	3,830	4,648
24Mg	0.022	0.073	1,759	1,457	1,340	1,071	1,505
27Al	0.039	0.130	1,734	858	564	441	2,722
31P	75	250	12,242	11,466	10,108	8,270	9,824
39K	2.7	9.0	11,318	9,602	9,028	6,542	9,304
44Ca	9.3	31	3,407	2,473	2,207	2,026	2,832
49Ti	0.188	0.627	133	66	55	32	232
51V	0.054	0.180	5.6	2.4	1.8	1.5	8.9
52Cr	0.401	1.3	7.1	4.6	3.8	4.0	12
55Mn	0.005	0.017	40	37	23	30	40
57Fe	0.758	2.5	849	442	314	273	1,289
59Co	0.004	0.013	3.0	1.6	1.7	2.3	4.1
60Ni	0.013	0.043	34	16	18	16	61
63Cu	0.012	0.040	15	12	11	8.7	12
66Zn	0.339	1.1	226	225	151	178	168
75As	0.508	1.7	0.809	<0.508	0.693	<0.508	0.743
77Se	0.274	0.913	6.8	6.8	4.8	6.5	5.9
88Sr	0.001	0.003	9.4	4.4	3.5	2.7	11
95Mo	0.001	0.003	0.447	0.365	0.215	0.207	0.414
107Ag	0.001	0.003	0.108	0.070	0.076	0.059	0.097
111Cd	0.053	0.177	0.968	0.951	0.525	0.689	1.2
118Sn	0.107	0.357	0.182	0.285	<0.107	0.149	0.173
121Sb	0.001	0.003	0.094	0.044	0.044	0.030	0.132
137Ba	0.001	0.003	126	73	48	32	127
202Hg	0.032	0.107	0.059	<0.032	<0.032	0.036	0.036
205Tl	0.001	0.003	0.093	0.042	0.046	0.037	0.110
208Pb	0.005	0.017	0.513	0.238	0.180	0.138	0.933
238U	0.001	0.003	0.168	0.098	0.058	0.054	0.195

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-01_2020-12-01	LC_DCEF_INV-02_2020-12-01	LC_DCEF_INV-03_2020-12-01	LC_DCEF_INV-04_2020-12-01	LC_DCEF_INV-05_2020-12-01
		Lab ID	028	029	030	031	032
		Wet Weight (g)	1.3017	0.5755	0.8481	0.9118	0.9800
		Dry Weight (g)	0.2873	0.1271	0.2043	0.2269	0.2091
		Moisture (%)	77.9	77.9	75.9	75.1	78.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.473	0.394	0.387	0.204	0.296
11B	0.095	0.317	1.5	1.7	0.818	0.265	0.673
23Na	0.643	2.1	4,222	2,871	3,704	2,721	3,592
24Mg	0.022	0.073	1,529	1,569	1,576	1,161	1,557
27Al	0.039	0.130	328	502	138	46	173
31P	75	250	10,921	11,468	11,963	9,518	12,533
39K	2.7	9.0	9,560	9,946	11,208	8,455	10,828
44Ca	9.3	31	2,405	3,246	2,533	1,418	2,511
49Ti	0.188	0.627	21	23	8.3	2.6	10
51V	0.054	0.180	2.3	3.4	1.2	0.360	1.2
52Cr	0.401	1.3	4.2	4.8	2.8	2.1	3.1
55Mn	0.005	0.017	20	18	17	13	14
57Fe	0.758	2.5	340	413	195	65	193
59Co	0.004	0.013	0.369	0.358	0.162	0.104	0.219
60Ni	0.013	0.043	8.2	9.9	4.5	2.3	5.9
63Cu	0.012	0.040	20	18	26	17	19
66Zn	0.339	1.1	219	207	279	230	211
75As	0.508	1.7	0.842	1.2	0.850	0.609	1.4
77Se	0.274	0.913	5.8	4.4	5.7	4.5	4.5
88Sr	0.001	0.003	3.5	4.4	3.1	1.5	3.1
95Mo	0.001	0.003	0.331	0.446	0.414	0.244	0.383
107Ag	0.001	0.003	0.092	0.086	0.097	0.054	0.065
111Cd	0.053	0.177	3.1	3.5	3.0	2.5	3.0
118Sn	0.107	0.357	0.206	0.281	<0.107	<0.107	0.265
121Sb	0.001	0.003	0.072	0.110	0.055	0.022	0.066
137Ba	0.001	0.003	87	136	85	29	69
202Hg	0.032	0.107	0.036	0.059	0.047	0.039	0.039
205Tl	0.001	0.003	0.016	0.022	0.009	0.003	0.012
208Pb	0.005	0.017	0.142	0.155	0.088	0.021	0.072
238U	0.001	0.003	0.145	0.212	0.103	0.021	0.075

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	LC_DCDS_INV-01_2020-12-01	LC_DCDS_INV-02_2020-12-01	LC_DCDS_INV-03_2020-12-01	LC_DCDS_INV-04_2020-12-01	LC_DCDS_INV-05_2020-12-01
		Lab ID	033	034	035	036	037
		Wet Weight (g)	1.1852	1.6068	1.3670	1.0110	1.2816
		Dry Weight (g)	0.2512	0.3473	0.3025	0.1870	0.2725
		Moisture (%)	78.8	78.4	77.9	81.5	78.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.764	0.728	0.587	1.0	0.873
11B	0.095	0.317	2.5	2.4	1.6	3.9	3.8
23Na	0.643	2.1	2,594	2,842	2,992	2,113	2,919
24Mg	0.022	0.073	1,141	1,122	1,043	1,364	1,382
27Al	0.039	0.130	1,871	1,605	989	2,966	2,079
31P	75	250	8,724	7,751	9,292	8,443	9,281
39K	2.7	9.0	7,598	7,469	7,782	6,937	8,235
44Ca	9.3	31	2,035	1,662	1,465	3,340	3,475
49Ti	0.188	0.627	170	125	88	248	178
51V	0.054	0.180	5.4	5.1	3.3	9.6	7.6
52Cr	0.401	1.3	5.8	5.5	4.8	8.7	11
55Mn	0.005	0.017	81	106	104	106	110
57Fe	0.758	2.5	704	721	506	1,236	1,016
59Co	0.004	0.013	5.4	7.0	6.2	7.0	11
60Ni	0.013	0.043	32	31	28	55	71
63Cu	0.012	0.040	11	11	9.7	12	14
66Zn	0.339	1.1	179	149	175	208	215
75As	0.508	1.7	0.738	0.898	0.633	0.946	1.0
77Se	0.274	0.913	19	17	17	9.7	18
88Sr	0.001	0.003	5.8	4.9	3.2	9.2	6.6
95Mo	0.001	0.003	0.557	0.444	0.557	0.661	0.722
107Ag	0.001	0.003	0.097	0.097	0.097	0.122	0.119
111Cd	0.053	0.177	1.5	1.1	1.4	1.8	2.4
118Sn	0.107	0.357	0.226	0.137	0.145	0.444	0.201
121Sb	0.001	0.003	0.110	0.110	0.081	0.213	0.147
137Ba	0.001	0.003	104	132	105	168	131
202Hg	0.032	0.107	0.052	0.039	0.065	0.052	0.077
205Tl	0.001	0.003	0.080	0.067	0.048	0.117	0.096
208Pb	0.005	0.017	0.450	0.540	0.310	0.778	0.582
238U	0.001	0.003	0.180	0.165	0.116	0.333	0.366

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

		Client ID	LC_DC2_INV-01_2020-12-02	LC_DC2_INV-02_2020-12-02	LC_DC2_INV-03_2020-12-02	LC_DC2_INV-04_2020-12-02	LC_DC2_INV-05_2020-12-02
		Lab ID	038	039	040	041	042
		Wet Weight (g)	0.6906	0.8374	0.6733	1.2499	0.9683
		Dry Weight (g)	0.1273	0.1989	0.1506	0.2833	0.2435
		Moisture (%)	81.6	76.2	77.6	77.3	74.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.395	0.392	0.588	0.396	0.499
11B	0.095	0.317	1.1	0.532	1.3	0.681	1.1
23Na	0.643	2.1	2,756	3,866	4,140	3,009	3,531
24Mg	0.022	0.073	1,103	776	1,171	1,065	1,141
27Al	0.039	0.130	499	200	628	378	583
31P	75	250	10,158	10,147	10,860	7,825	10,297
39K	2.7	9.0	8,060	8,862	10,494	7,086	9,407
44Ca	9.3	31	2,019	642	1,501	658	1,188
49Ti	0.188	0.627	34	15	44	26	38
51V	0.054	0.180	1.5	0.976	2.0	1.2	1.9
52Cr	0.401	1.3	4.1	2.5	4.2	3.6	5.4
55Mn	0.005	0.017	42	31	46	37	57
57Fe	0.758	2.5	245	170	297	248	316
59Co	0.004	0.013	3.6	2.3	3.8	2.5	4.3
60Ni	0.013	0.043	14	8.5	21	12	20
63Cu	0.012	0.040	12	5.8	12	11	14
66Zn	0.339	1.1	253	113	207	136	217
75As	0.508	1.7	<0.508	<0.508	0.602	<0.508	0.516
77Se	0.274	0.913	9.4	8.9	13	12	10
88Sr	0.001	0.003	2.9	1.0	3.1	1.7	2.2
95Mo	0.001	0.003	0.557	0.215	0.448	0.332	0.448
107Ag	0.001	0.003	0.076	0.038	0.095	0.063	0.095
111Cd	0.053	0.177	2.4	0.708	5.3	1.0	1.5
118Sn	0.107	0.357	0.393	<0.107	0.200	<0.107	0.109
121Sb	0.001	0.003	0.051	0.026	0.053	0.033	0.046
137Ba	0.001	0.003	98	55	121	71	103
202Hg	0.032	0.107	0.065	0.042	0.056	<0.032	<0.032
205Tl	0.001	0.003	0.030	0.017	0.036	0.027	0.031
208Pb	0.005	0.017	0.178	0.089	0.206	0.147	0.181
238U	0.001	0.003	0.069	0.043	0.119	0.052	0.069

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-01_2020-12-02	LC_DC4_INV-02_2020-12-02	LC_DC4_INV-03_2020-12-02	LC_DC4_INV-04_2020-12-02	LC_DC4_INV-05_2020-12-02
		Lab ID	043	044	045	046	047
		Wet Weight (g)	1.1392	1.2852	1.4097	1.3531	1.4635
		Dry Weight (g)	0.2204	0.2856	0.2997	0.2866	0.3111
		Moisture (%)	80.7	77.8	78.7	78.8	78.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.471	0.431	0.336	0.350	0.504
11B	0.095	0.317	1.2	0.723	0.777	0.894	1.1
23Na	0.643	2.1	3,310	3,421	2,704	2,504	4,212
24Mg	0.022	0.073	1,436	1,067	1,080	1,250	1,568
27Al	0.039	0.130	424	241	270	338	428
31P	75	250	10,569	9,967	9,308	7,801	13,134
39K	2.7	9.0	9,822	9,393	8,231	7,725	11,726
44Ca	9.3	31	3,497	1,833	2,293	2,886	2,904
49Ti	0.188	0.627	30	14	15	16	27
51V	0.054	0.180	1.5	0.979	1.1	1.2	1.8
52Cr	0.401	1.3	4.3	3.3	3.5	3.5	3.4
55Mn	0.005	0.017	15	18	16	14	18
57Fe	0.758	2.5	630	495	467	419	517
59Co	0.004	0.013	0.625	0.521	0.465	0.283	0.459
60Ni	0.013	0.043	14	9.1	8.5	8.1	9.3
63Cu	0.012	0.040	12	9.0	11	9.6	11
66Zn	0.339	1.1	187	147	183	127	177
75As	0.508	1.7	1.8	0.947	1.0	1.2	1.3
77Se	0.274	0.913	5.4	6.4	6.9	4.8	5.1
88Sr	0.001	0.003	4.4	2.0	2.7	3.5	3.4
95Mo	0.001	0.003	0.341	0.413	0.377	0.251	0.333
107Ag	0.001	0.003	0.076	0.069	0.076	0.057	0.061
111Cd	0.053	0.177	1.4	0.895	1.2	0.932	1.2
118Sn	0.107	0.357	0.173	<0.107	0.145	0.195	0.199
121Sb	0.001	0.003	0.040	0.026	0.033	0.033	0.036
137Ba	0.001	0.003	106	93	70	74	92
202Hg	0.032	0.107	<0.032	0.042	<0.032	<0.032	0.043
205Tl	0.001	0.003	0.018	0.011	0.011	0.014	0.014
208Pb	0.005	0.017	0.156	0.121	0.116	0.114	0.143
238U	0.001	0.003	0.055	0.038	0.039	0.043	0.054

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-01_2020-11-30	LC_DC1_INV-02_2020-11-30	LC_DC1_INV-03_2020-11-30	LC_DC1_INV-04_2020-11-30	LC_DC1_INV-05_2020-11-30
		Lab ID	048	049	050	051	052
		Wet Weight (g)	1.2122	1.5708	0.6592	0.8532	1.0416
		Dry Weight (g)	0.2933	0.3779	0.1398	0.1823	0.2173
		Moisture (%)	75.8	75.9	78.8	78.6	79.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.007	0.023	0.578	0.545	0.500	0.540	0.331
11B	0.095	0.317	1.1	1.4	1.6	1.8	0.949
23Na	0.643	2.1	4,459	3,916	3,152	3,249	3,534
24Mg	0.022	0.073	1,259	1,068	1,251	1,164	907
27Al	0.039	0.130	509	737	652	869	132
31P	75	250	12,265	10,085	10,230	9,086	10,219
39K	2.7	9.0	10,771	9,745	9,918	8,348	8,346
44Ca	9.3	31	1,912	1,399	2,870	2,386	1,219
49Ti	0.188	0.627	32	48	38	59	14
51V	0.054	0.180	1.5	2.3	2.0	2.7	0.484
52Cr	0.401	1.3	4.8	5.0	3.5	4.7	2.4
55Mn	0.005	0.017	64	62	43	50	33
57Fe	0.758	2.5	474	694	468	658	259
59Co	0.004	0.013	0.724	0.721	0.451	0.714	0.335
60Ni	0.013	0.043	15	17	11	14	7.3
63Cu	0.012	0.040	13	11	12	11	9.1
66Zn	0.339	1.1	204	164	182	158	133
75As	0.508	1.7	0.574	<0.508	<0.508	0.518	<0.508
77Se	0.274	0.913	11	8.9	7.7	7.3	8.3
88Sr	0.001	0.003	2.3	2.1	4.0	4.4	1.3
95Mo	0.001	0.003	0.387	0.376	0.344	0.311	0.311
107Ag	0.001	0.003	0.067	0.058	0.052	0.055	0.045
111Cd	0.053	0.177	2.4	1.6	1.9	2.2	1.3
118Sn	0.107	0.357	0.157	0.110	0.382	0.217	0.157
121Sb	0.001	0.003	0.036	0.046	0.046	0.050	0.043
137Ba	0.001	0.003	126	140	119	113	118
202Hg	0.032	0.107	0.043	0.050	0.046	0.036	0.043
205Tl	0.001	0.003	0.019	0.021	0.018	0.021	0.009
208Pb	0.005	0.017	0.166	0.209	0.198	0.242	0.091
238U	0.001	0.003	0.042	0.055	0.066	0.058	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_DC3_INV-04_2020-12-01			LC_DCEF_INV-03_2020-12-01			LC_DC2_INV-05_2020-12-02		
Lab ID		026			030			042		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.007	0.439	0.488	11	0.387	0.421	8.4	0.499	0.469	6.2
11B	0.095	0.663	0.928	-	0.818	0.818	-	1.1	0.936	-
23Na	0.643	3,830	3,479	9.6	3,704	4,003	7.8	3,531	3,156	11
24Mg	0.022	1,071	1,195	11	1,576	1,610	2.1	1,141	1,037	9.6
27Al	0.039	441	581	27	138	150	8.3	583	606	3.9
31P	75	8,270	8,132	1.7	11,963	13,588	13	10,297	9,868	4.3
39K	2.7	6,542	7,284	11	11,208	12,397	10	9,407	8,274	13
44Ca	9.3	2,026	1,878	7.6	2,533	2,580	1.8	1,188	1,184	0.3
49Ti	0.188	32	48	40	8.3	10	19	38	43	12
51V	0.054	1.5	1.9	24	1.2	1.3	8.0	1.9	1.9	0.0
52Cr	0.401	4.0	4.4	-	2.8	3.3	-	5.4	4.4	20
55Mn	0.005	30	34	13	17	18	5.7	57	46	21
57Fe	0.758	273	311	13	195	194	0.5	316	340	7.3
59Co	0.004	2.3	1.8	24	0.162	0.162	0.0	4.3	3.5	21
60Ni	0.013	16	17	6.1	4.5	5.3	16	20	16	22
63Cu	0.012	8.7	8.7	0.0	26	24	8.0	14	11	24
66Zn	0.339	178	171	4.0	279	275	1.4	217	177	20
75As	0.508	<0.508	<0.508	-	0.850	0.891	-	0.516	<0.508	-
77Se	0.274	6.5	6.2	4.7	5.7	5.2	9.2	10	9.7	3.0
88Sr	0.001	2.7	2.9	7.1	3.1	3.4	9.2	2.2	2.3	4.4
95Mo	0.001	0.207	0.232	11	0.414	0.398	3.9	0.448	0.431	3.9
107Ag	0.001	0.059	0.059	0.0	0.097	0.086	12	0.095	0.088	7.7
111Cd	0.053	0.689	0.590	16	3.0	2.9	3.4	1.5	1.8	18
118Sn	0.107	0.149	0.149	-	<0.107	0.107	-	0.109	<0.107	-
121Sb	0.001	0.030	0.039	26	0.055	0.044	22	0.046	0.046	0.0
137Ba	0.001	32	36	12	85	86	1.2	103	88	16
202Hg	0.032	0.036	<0.032	-	0.047	0.047	-	<0.032	0.056	-
205Tl	0.001	0.037	0.046	22	0.009	0.010	11	0.031	0.029	6.7
208Pb	0.005	0.138	0.146	5.6	0.088	0.088	0.0	0.181	0.188	3.8
238U	0.001	0.054	0.063	15	0.103	0.088	16	0.069	0.068	1.5

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	0.007	1.21	1.3	107	12	1.1	91	5.2
11B	0.095	4.5	4.9	110	2.8	4.5	101	2.9
23Na	0.643	14,000	14,971	107	4.9	13,900	99	4.2
24Mg	0.022	910	925	102	4.9	894	98	3.6
27Al	0.039	197.2	180	91	3.8	195	99	3.2
31P	75	8,000	8,421	105	4.6	7,872	98	3.9
39K	2.7	15,500	16,062	104	4.4	15,450	100	5.6
44Ca	9.3	2,360	2,405	102	5.8	2,303	98	4.8
49Ti	0.188	12.24	11	93	6.8	12	102	5.9
51V	0.054	1.57	1.8	112	5.4	1.6	102	7.9
52Cr	0.401	1.87	2.0	107	2.6	1.8	96	3.1
55Mn	0.005	3.17	3.4	108	5.0	3.1	99	3.6
57Fe	0.758	343	369	108	4.3	334	97	2.1
59Co	0.004	0.25	0.264	106	5.1	0.251	100	4.7
60Ni	0.013	1.34	1.5	111	4.8	1.3	99	5.3
63Cu	0.012	15.7	17	111	4.7	16	103	6.8
66Zn	0.339	51.6	55	107	3.1	51	98	3.6
75As	0.508	6.87	7.4	108	2.6	6.8	99	5.2
77Se	0.274	3.45	3.6	103	3.7	3.4	98	3.2
88Sr	0.001	10.1	11	104	2.7	10	99	4.7
95Mo	0.001	0.29	0.293	101	6.2	0.298	103	4.3
107Ag	0.001	0.0252	0.029	116	10	0.024	94	12
111Cd	0.053	0.299	0.286	96	5.4	0.292	98	13
118Sn	0.107	0.061	0.064	104	**23**	0.059	96	18
121Sb	0.001	0.011	0.011	100	0.0	0.012	107	**34**
137Ba	0.001	8.6	9.2	107	4.9	8.6	100	2.0
202Hg	0.032	0.412	0.438	106	3.0	0.427	104	7.5
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.005	0.404	0.451	112	18	0.380	94	5.8
238U	0.001	0.05	0.060	120	15	0.049	98	4.3

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.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results

Teck Coal Limited

Tissue QA/QC Accuracy and Precision Results

		Sample Group ID	03			04		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.007	1.21	1.4	113	7.6	1.2	99	8.8
11B	0.095	4.5	4.5	100	4.3	5.1	114	4.4
23Na	0.643	14,000	15,653	112	4.6	14,263	102	8.0
24Mg	0.022	910	946	104	3.2	928	102	10
27Al	0.039	197.2	181	92	3.2	187	95	3.8
31P	75	8,000	8,701	109	2.5	8,384	105	7.4
39K	2.7	15,500	16,510	106	3.5	15,463	100	9.5
44Ca	9.3	2,360	2,566	109	1.5	2,358	100	9.5
49Ti	0.188	12.24	11	90	14	12	96	8.0
51V	0.054	1.57	1.5	96	8.2	1.7	107	15
52Cr	0.401	1.87	2.0	109	3.5	2.0	106	11
55Mn	0.005	3.17	3.3	104	4.4	3.2	100	9.6
57Fe	0.758	343	360	105	3.2	341	99	8.9
59Co	0.004	0.25	0.274	110	5.4	0.257	103	8.9
60Ni	0.013	1.34	1.4	103	4.3	1.5	109	7.9
63Cu	0.012	15.7	17	109	1.9	17	110	8.5
66Zn	0.339	51.6	57	111	5.7	55	107	4.8
75As	0.508	6.87	7.4	108	3.5	7.2	105	7.8
77Se	0.274	3.45	3.8	109	2.9	3.5	102	7.3
88Sr	0.001	10.1	11	112	2.6	10	99	11
95Mo	0.001	0.29	0.291	100	6.8	0.291	100	7.2
107Ag	0.001	0.0252	0.028	110	12	0.025	99	13
111Cd	0.053	0.299	0.359	120	7.4	0.342	114	8.8
118Sn	0.107	0.061	0.051	84	**26**	0.068	111	**28**
121Sb	0.001	0.011	0.009	84	**39**	0.012	105	20
137Ba	0.001	8.6	8.3	97	3.7	8.8	102	4.5
202Hg	0.032	0.412	0.416	101	2.8	0.419	102	14
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.005	0.404	0.358	89	16	0.396	98	12
238U	0.001	0.05	0.054	109	14	0.050	100	14

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.

Bold indicates DQO exceedance but result is accepted as it does not impact the reportable results

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC3_INV-01_2020-12-01	023	14 Dec 2020
	LC_DC3_INV-02_2020-12-01	024	
	LC_DC3_INV-03_2020-12-01	025	
	LC_DC3_INV-04_2020-12-01	026	
	LC_DC3_INV-05_2020-12-01	027	
	LC_DCEF_INV-01_2020-12-01	028	
	LC_DCEF_INV-02_2020-12-01	029	
	LC_DCEF_INV-03_2020-12-01	030	
02	LC_DCEF_INV-04_2020-12-01	031	14 Dec 2020
	LC_DCEF_INV-05_2020-12-01	032	
	LC_DCDS_INV-01_2020-12-01	033	
	LC_DCDS_INV-02_2020-12-01	034	
	LC_DCDS_INV-03_2020-12-01	035	
	LC_DCDS_INV-04_2020-12-01	036	
	LC_DCDS_INV-05_2020-12-01	037	
	LC_DC2_INV-01_2020-12-02	038	
03	LC_DC2_INV-02_2020-12-02	039	14 Dec 2020
	LC_DC2_INV-03_2020-12-02	040	
	LC_DC2_INV-04_2020-12-02	041	
	LC_DC2_INV-05_2020-12-02	042	
	LC_DC4_INV-01_2020-12-02	043	
	LC_DC4_INV-02_2020-12-02	044	
	LC_DC4_INV-03_2020-12-02	045	
	LC_DC4_INV-04_2020-12-02	046	
04	LC_DC4_INV-05_2020-12-02	047	14 Dec 2020
	LC_DC1_INV-01_2020-11-30	048	
	LC_DC1_INV-02_2020-11-30	049	
	LC_DC1_INV-03_2020-11-30	050	
	LC_DC1_INV-04_2020-11-30	051	
	LC_DC1_INV-05_2020-11-30	052	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084		Chain of Custody (COC) for LA-ICP-MS Analysis	
Invoicing		Reporting (if different from Invoicing)	
Project Number: 20-24 (Teck Dry Creek LAEMP)			
Company Name:	Teck	Company Name:	Minnow Environmental
Contact Name:	Cait Good	Contact Name:	Dave Hasek
Address:	PO Box 1777	Address:	204-1006 Fort Street
City, Province:	Sparwood, BC	City, Province:	Victoria, BC
Postal Code:	V0B 2G0	Postal Code:	V8V 3K4
Phone:	250.425.8202	Phone:	778.677.3500
Email:	Cait.Good@teck.com	Email:	dhasek@minnow.ca

Sample Analysis Requested

Trich Sample ID:	Sample Identification:		Sample Type: Species	Sample type
023	1	LC_DC3_INV-01_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
024	2	LC_DC3_INV-02_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
025	3	LC_DC3_INV-03_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
026	4	LC_DC3_INV-04_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
027	5	LC_DC3_INV-05_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
028	6	LC_DCEF_INV-01_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
029	7	LC_DCEF_INV-02_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
030	8	LC_DCEF_INV-03_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
031	9	LC_DCEF_INV-04_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
032	10	LC_DCEF_INV-05_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
033	11	LC_DCDS_INV-01_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
034	12	LC_DCDS_INV-02_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
035	13	LC_DCDS_INV-03_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
036	14	LC_DCDS_INV-04_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
037	15	LC_DCDS_INV-05_2020-12-01 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
038	16	LC_DC2_INV-01_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
039	17	LC_DC2_INV-02_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
040	18	LC_DC2_INV-03_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
041	19	LC_DC2_INV-04_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
042	20	LC_DC2_INV-05_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis

Sample(s) Released By:	Sample(s) Received By: Geriene LaBine
Signature:	Signature: [signature]
Date Sent:	Date Received: 10 Dec 2020 (Project #: 2020-176)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis
Invoicing	Reporting (if different from Invoicing)

Project Number: 20-24 (Teck Dry Creek LAEMP)

Company Name:	Teck	Company Name:	Minnow Environmental
Contact Name:	Cait Good	Contact Name:	Dave Hasek
Address:	PO Box 1777	Address:	204-1006 Fort Street
City, Province:	Sparwood, BC	City, Province:	Victoria, BC
Postal Code:	V0B 2G0	Postal Code:	V8V 3K4
Phone:	250.425.8202	Phone:	778.677.3500
Email:	Cait.Good@teck.com	Email:	dhasek@minnow.ca

Sample Analysis Requested

Trich Sample ID:	Sample Identification:		Sample Type:	
			Species	Sample type
043	1	LC_DC4_INV-01_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
044	2	LC_DC4_INV-02_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
045	3	LC_DC4_INV-03_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
046	4	LC_DC4_INV-04_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
047	5	LC_DC4_INV-05_2020-12-02 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
048	6	LC_DC1_INV-01_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
049	7	LC_DC1_INV-02_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
050	8	LC_DC1_INV-03_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
051	9	LC_DC1_INV-04_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
052	10	LC_DC1_INV-05_2020-11-30 ✓	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis

Sample(s) Released By:	Sample(s) Received By: Genevieve LaBine
Signature:	Signature: Genevieve LB
Date Sent:	Date Received: 10 DEC 2020 (PROJECT #: 2020-176)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

COM-011.01