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Technical Report Overview

Report: Line Creek Local Aquatic Effects Monitoring Program (LAEMP) Report 2018

Overview: This report presents the 2018 results of the local aquatic effects monitoring program developed for Teck's Line Creek Operations. The report presents data and evaluation of potential effects of the West Line Creek Selenium Active Water Treatment Facility on biological productivity and tissue selenium accumulation downstream of the facility.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information

If you have questions regarding this report, please:

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

Line Creek Local Aquatic Effects Monitoring Program (LAEMP) Report, 2018

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Line Creek Local Aquatic Effects Monitoring Program (LAEMP) Report, 2018

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EXECUTIVE SUMMARY

The Line Creek Local Aquatic Effects Monitoring Program was primarily designed to evaluate changes related to the commissioning of the West Line Creek (WLC) Active Water Treatment Facility (AWTF) at LCO. There are three main foci to the monitoring in relation to the operation of the AWTF. Firstly, the fluidized bed reactor technology used at the WLC AWTF for selenium and nitrate removal requires the addition of phosphorus to the treatment process. Although the WLC AWTF is managed to minimize the amount of residual phosphorus in treated effluent, there is potential for phosphorus concentrations to increase in Line Creek downstream from the WLC AWTF discharge and potentially cause increased algal growth and changes to the trophic status and biotic community structure. Secondly, selenium removal from water involves microbial uptake, which deceases total selenium loads to Line Creek, but has the potential to biotransform selenium into reduced and more readily available forms of selenium to biota (i.e., selenite and organoselenium). The third focus of the LAEMP to monitor other conditions related to active water treatment that could potentially adversely influence the receiving environment, other than nutrients or selenium.

Based on the above, the objectives for the Line Creek LAEMP were expressed as the following study questions: (1) Is active water treatment affecting biological productivity downstream in Line Creek? (2) Are tissue selenium concentrations reduced downstream from the WLC AWTF? and (3) Is WLC AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations, or concentrations of treatment-related constituents other than nutrients or selenium? This report evaluates monitoring data for the 2018 calendar year, except invertebrate tissue selenium data which are presented up to and including January 2019.

The operational status of the AWTF was modified in 2018, with phases of operation that included flow reduction, shutdown, and the recommissioning and restart of AWTF with an advanced oxidation process (AOP[1]). The AWTF was operational at a steady state in 2017, however, sampling from September 2017 showed that selenium concentrations were greater in tissues of aquatic biota than prior to AWTF operation, and aqueous selenium speciation analysis showed the presence of chemically-reduced selenium species in Line Creek downstream of the AWTF. On this basis, effluent flow was decreased from October 2017 to early 2018, and the AWTF was fully shut down in March 2018. The AWTF remained shut down until recommissioning with an AOP which was initiated on August 30, 2018 (no discharge to the environment occurred during this initial recommissioning). Discharge to the receiving environment from the AWTF with AOP

[1] AOP refers to the advanced oxidation process and associated AWTF process modifications.

began on October 29, 2018 with variable flow, and stabilization of the AWTF with AOP operations began in late December 2018.

Biological productivity downstream in Line Creek was generally uninfluenced by AWTF operation in 2018. Periphyton coverage at both mine-exposed and reference areas was moderate in 2018 (based on visual assessment) and showed temporal consistency with results from 2017. Benthic invertebrate biomass and density at mine-exposed areas of Line Creek showed no significant change ($p>0.1$) among years related to changes in AWTF operational status. Benthic invertebrate community endpoints generally indicated no changes in community characteristics related to changes in the AWTF operational status. Overall, the data indicated that biological productivity in Line Creek downstream from the WLC AWTF was not affected in 2018 with 4 months of operation, or by any of the changes in AWTF operational status that have occurred between 2014 and 2018.

Benthic tissue selenium concentrations in Line Creek were lower when the ATWF was either not in operation (March to October 2018), or after the restart of the AWTF with AOP (October 2018 to January 2019), compared to steady state operation of the ATWF during 2016 to 2017. The WLC AWTF successfully decreased concentrations of total selenium in Line Creek; however, the effluent contained higher proportions of reduced selenium species, some of which are known to be more readily accumulated by aquatic biota than selenate. Concentrations of reduced forms of selenium in Line Creek were substantially decreased when the AWTF was not operational in 2018, and following the recommissioning of the AWTF with AOP. Benthic invertebrate tissue monitoring in Line Creek in 2018 indicated that the recommissioned facility (AWTF with AOP) is functioning to decrease concentrations of reduced selenium species in AWTF effluent and limit selenium bioavailability in Line Creek. Selenium concentrations in bull trout and westslope cutthroat trout tissues in 2018 were similar to those reported in 2017, indicating limited change despite changes in AWTF operation in 2018. Benthic invertebrate tissue selenium concentrations in the Fording River upstream and downstream of Line Creek were similar, indicating that changes in tissue selenium accumulation related to AWTF operation were limited to Line Creek.

AWTF operations in 2018 did not appear to have significantly influenced water temperature or dissolved oxygen concentrations downstream in Line Creek. Evaluation of additional water quality parameters (screened relative to guidelines and benchmarks) also demonstrated no obvious increases in concentrations during AWTF operation.

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ACRONYMS AND ABBREVIATIONS

ANOVA – Analysis of Variance

AOP – Advanced Oxidation Process

AWTF – Active Water Treatment Facility

CABIN – Canadian Aquatic Biomonitoring Network

CMO – Coal Mountain Operation

EMC – Environmental Monitoring Committee

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

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

EVO – Elkview Operation

EVWQP – Elk Valley Water Quality Plan

FRO – Fording River Operation

GHO – Greenhills Operation

ICP-MS – Inductively Coupled Plasma Mass Spectrometry

IPA – Implementation Plan Adjustment

K-M – Kaplan-Meier Method

LAEMP – Local Aquatic Effects Monitoring Program

LCO – Line Creek Operation

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

LRL – Laboratory Reporting Limit

MOE– Ministry of Environment

Qx – referring to calendar quarters

QA/QC – Quality Assurance / Quality Control

RAEMP – Regional Aquatic Effects Monitoring Program

SPO – Site Performance Objective

SRC – Saskatchewan Research Council

TKN – Total Kjeldahl Nitrogen

TTF – Trophic Transfer Factors

WLC – West Line Creek

1 INTRODUCTION

1.1 Background

Teck Coal Limited (Teck) operates five steelmaking coal mines in the Elk River watershed, including the Fording River Operation (FRO), Greenhills Operation (GHO), Line Creek Operation (LCO), Elkview Operation (EVO), and Coal Mountain Operation (CMO; Figure 1.1). Discharges from the mines to the Elk River watershed are authorized by the British Columbia Ministry of Environment and Climate Change Strategy (ENV; formerly Ministry of Environment [MOE]) through permits that are periodically issued under provisions of the *Environmental Management Act*. Permit 107517 specifies the terms and conditions associated with discharges from Teck's five Elk Valley mine operations.

Section 9.3.1 of Permit 107517 (version August 25, 2018) outlines the requirements for the Line Creek Local Aquatic Effects Monitoring Program (LAEMP) as follows:

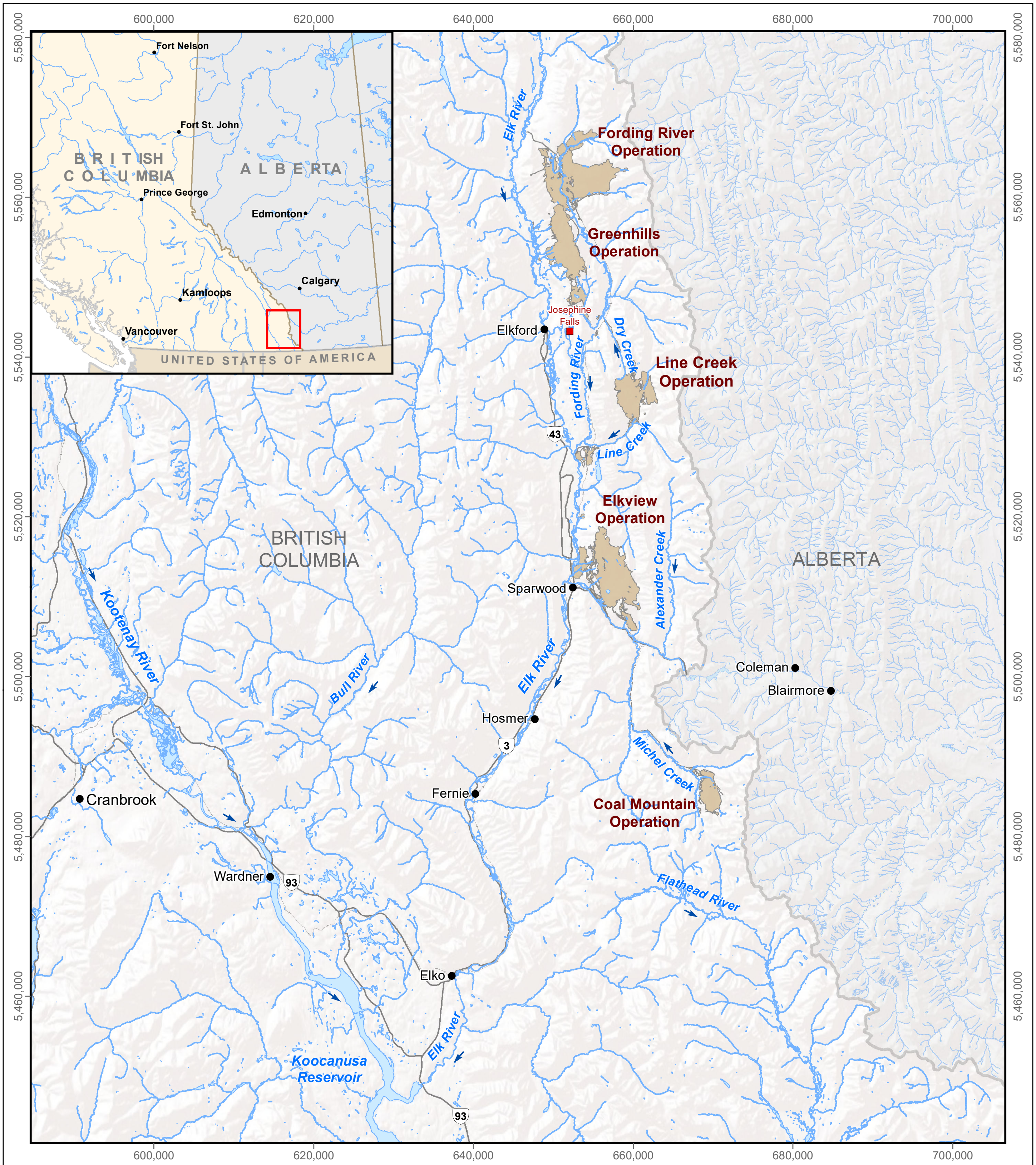
> *"The Permittee must develop and implement a Local Aquatic Effects Monitoring program to determine the effects of the Line Creek discharge on the receiving environment. An annual study design for the program must be prepared in consultation with the EMC[2] and submitted to the Director for approval by May 1 each year."*

Also, Section 10.5 of Permit 107517 states:

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

In addition to monitoring under the LAEMP, Teck's Regional Aquatic Effects Monitoring Program (RAEMP) is a requirement under Permit 107517, and provides comprehensive routine monitoring and assessment of potential mine-related effects on the aquatic environment downstream from Teck's mines in the Elk Valley (i.e., annual sampling and more comprehensive monitoring every three years, with the next cycle of sampling to be completed in September 2019). Teck conducts a variety of additional programs to monitor, evaluate, and/or manage the aquatic effects of mining operations within the Elk Valley at local and regional scales:

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



LEGEND

Teck Coal Mine Operation

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

0 10 20 40 km

Projection: North American Datum 1983 UTM Zone 11

Date: April 2019
Project 187202.0026

minnow environmental inc.

Figure 1.1

Document Path: S:\Projects\187202\187202.0026 - Teck 2018 Line Ck LAEMP - Privileged and Confidential\GIS\Report\18-26 Figure 1.1 Teck Coal Limited Operation.mxd

- water quality monitoring
- calcite monitoring
- Chronic Toxicity Testing Program
- fish and fish habitat management
- Tributary Management Plan

The goal of the Line Creek LAEMP is to assess site-specific conditions (e.g., commissioning of active water treatment) on a more frequent and localized basis, as required until sufficient data have been collected, concerns no longer exist, or relevant monitoring can be incorporated into the RAEMP.

1.2 Study Questions

The Line Creek LAEMP was primarily designed to monitor aquatic health and evaluate potential effects related to the commissioning of the WLC AWTF at LCO. There are three main foci for the monitoring related to the operation of the AWTF, including:

1. The fluidized bed reactor technology used at the WLC AWTF for selenium and nitrate removal requires the addition of phosphorus to the treatment process. Although the WLC AWTF is managed to minimize the amount of residual phosphorus in treated effluent, there is potential for phosphorus concentrations to increase in Line Creek downstream from the WLC AWTF discharge and potentially cause increased algal growth and changes to the trophic status and biotic community structure.

2. The potential for a change in the form of selenium released into Line Creek from the WLC AWTF. Most of the selenium in surface waters of the Elk River watershed (including downstream of Teck's mines) has been in the form of selenate, as would be expected in the well-oxygenated, flowing stream habitats that dominate this watershed. At the WLC AWTF, selenium is removed via uptake into microorganisms within the treatment system where it is transformed to chemically-reduced forms (e.g., selenite and organoselenium species). In aquatic receiving environments, some reduced selenium species are accumulated into the base of the food web more readily than selenate (Ogle et al. 1988; Riedel et al. 1996; Stewart et al. 2010). Although the WLC AWTF was designed to lessen total selenium loads to Line Creek, if some of the selenium discharged by the AWTF is in chemically-reduced forms, tissue selenium concentrations may not decline in the tissues of aquatic biota downstream from the AWTF.

3. Other conditions related to active water treatment that could potentially adversely influence the receiving environment (e.g., an increase in temperature or a decrease in dissolved oxygen concentrations of treated water being released to Line Creek; discharge of treatment-related constituents; or an increase in other aqueous constituents of concern).

Based on the above, the objectives for the Line Creek LAEMP were expressed as the following study questions:

1. Is active water treatment affecting biological productivity downstream in Line Creek?
2. Are tissue selenium concentrations reduced downstream from the WLC AWTF?
3. Is WLC AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations, or concentrations of treatment-related constituents other than nutrients or selenium?

1.3 Line Creek LAEMP Reporting Relative to AWTF Operation

Sampling for the Line Creek LAEMP began in September 2013 prior to initial commissioning of the WLC AWTF in 2014 (Table 1.1). Interpretive reports of the LAEMP results have been submitted annually beginning in May 2014 (Minnow 2015a, 2016a, 2017a, 2018d).

The AWTF operated briefly in 2014 (July 24 to October 26) but was shut down due to challenges with the performance of the facility. It was recommissioned in late 2015, with effluent discharge commencing October 26 and steady state operation commencing at the end of January 2016 (Table 1.1). In late 2016 and early 2017, monitoring data identified elevated aqueous concentrations of chemically-reduced selenium species in Line Creek downstream from the AWTF, along with elevated concentrations of selenium in tissues of aquatic biota (Minnow 2017a). Sampling completed in September 2017 showed that tissue selenium concentrations continued to be elevated (Minnow 2018d), so Teck worked with regulators to obtain necessary authorizations to temporarily shut down the WLC AWTF. In advance of authorization for full shut down, and to minimize chemically-reduced selenium species in Line Creek, effluent flow through the AWTF was reduced on October 16, 2017 by approximately half[3] and remained reduced until the AWTF was fully shut down on March 8, 2018 (Table 1.1). A monitoring plan was approved by ENV (2018) to support the AWTF flow reduction and shutdown process and augment the monitoring that was proposed in the 2017 Line Creek LAEMP study design (Minnow 2017c).

[3] AWTF effluent flow was approximately 5,300 - 5,500 m^3/day during steady-state operations, then was reduced to approximately 2,500 m^3/day during the flow reduction period.

Table 1.1: Dates Associated with Phases of WLC AWTF Operation

<table>
<tr><th colspan="2">Phase</th><th>Start</th><th>End</th><th>Approximate Flow (m^3/day)</th></tr>
<tr><td colspan="2">Initial AWTF Commissioning Phase</td><td>24-Jul-14</td><td>26-Aug-14</td><td>Variable flow</td></tr>
<tr><td colspan="2">Initial AWTF Discharge</td><td>27-Aug-14</td><td>16-Oct-14</td><td>Variable flow</td></tr>
<tr><td colspan="2">AWTF Shutdown (no flow)</td><td>17-Oct-14</td><td>26-Oct-15</td><td>0</td></tr>
<tr><td colspan="2">AWTF Discharge Begins</td><td>26-Oct-15</td><td>30-Jan-16</td><td>Variable flow</td></tr>
<tr><td colspan="2">AWTF Steady State Operation</td><td>31-Jan-16</td><td>15-Oct-17</td><td>~5,300 - 5,500</td></tr>
<tr><td colspan="2">AWTF Flow Reduction</td><td>16-Oct-17</td><td>7-Mar-18</td><td>~2,500</td></tr>
<tr><td colspan="2">AWTF Intakes Closed, System Dewatered</td><td>27-Feb-18</td><td>8-Mar-18</td><td>Variable flow</td></tr>
<tr><td colspan="2">AWTF Shutdown (flow ceases)</td><td>8-Mar-18</td><td>29-Aug-18</td><td>0</td></tr>
<tr><td rowspan="2">AWTF/AOP Recommissioning Phase
(120 days after commissioning date)</td><td>No Discharge</td><td>30-Aug-18</td><td>28-Oct-18</td><td>0</td></tr>
<tr><td>Initial Discharge</td><td>29-Oct-18</td><td>28-Dec-18
(120 days after recommissioning date)</td><td>Variable flow</td></tr>
<tr><td colspan="2">AWTF/AOP Operation Stabilization</td><td>29-Dec-18
(120 days after recommissioning date)</td><td>~Dec 2019</td><td>~5,500 - 7,500</td></tr>
<tr><td colspan="2">AWTF/AOP Steady State Operation</td><td>~Dec 2019</td><td>indefinitely</td><td>~7,500</td></tr>
</table>

The AWTF remained shut down until recommissioning with an advanced oxidation process (AOP[4]) which was initiated on August 30, 2018 (no discharge to the environment occurred during this initial recommissioning). The AOP is designed to reverse the shift in selenium species in ATWF effluent from chemically-reduced species back to a selenate-dominated condition. Discharge to the receiving environment from the AWTF with AOP began on October 29, 2018 with variable flow, and stabilization of AWTF with AOP operations began in late December 2018 (120 days after the start of recommissioning with AOP).[5]

1.4 Linkages to Teck's Adaptive Management Plan

As required in Permit 107517 Section 11, Teck has developed an Adaptive Management Plan (AMP) to support implementation of the Elk Valley Water Quality Plan (EVWQP) to achieve water quality and calcite targets, ensure that human health and the environment are protected, and where necessary, restored, and to facilitate continuous improvement of water quality in the Elk Valley (Teck 2018). 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. The AMP also identifies key uncertainties that need to be reduced to fill gaps in current understanding and support achievement of the EVWQP objectives.

The Line Creek LAEMP was designed to monitor conditions associated with the West Line Creek AWTF operation and answer specific questions on an annual basis (Section 1.2). During or at the conclusion of each annual LAEMP cycle (results are reported on April 30th of each year for the preceding calendar year), management actions may be triggered, depending on the answers to those questions. For example, the Line Creek LAEMP Question #2 is: "Are tissue selenium concentrations reduced downstream from the WLC AWTF?" Monitoring in 2016 and 2017 identified that tissue selenium concentrations were elevated in aquatic biota collected downstream from the AWTF despite reduction in total selenium loads (Minnow 2017a, 2018d). This prompted Teck to initiate further investigations, which confirmed that the elevated tissue selenium concentrations were the result of elevated concentrations of chemically-reduced forms of aqueous selenium in effluent from the AWTF. Therefore, Teck worked with regulators to obtain necessary authorizations to temporarily shut down the WLC AWTF until a technical solution could be implemented. Benthic invertebrate tissue monitoring was conducted throughout the shutdown period according to the approved shutdown monitoring plan (ENV 2018) to evaluate conditions while the AWTF was offline. Additional investigation and pilot-scale trials initiated by Teck indicated that an AOP would reverse the shift in selenium species in ATWF effluent from

[4] AOP refers to the advanced oxidation process and associated AWTF process modifications.

[5] AWTF effluent flow was approximately 5,500 – 7,500 m^3/day during operation stabilization of AWTF with AOP.

chemically-reduced species back to a selenate-dominated condition. The AWTF resumed operation with the newly-commissioned AOP process on October 29, 2018. Benthic invertebrate tissue selenium monitoring was completed as part of the Line Creek LAEMP just prior to the AWTF with AOP operation (in September 2018), and following the initiation of discharge (in December 2018, and January, February, April 2019). Adjustments were made to the timing of sampling events, as required, to accommodate changes in the AWTF with AOP implementation schedule. Monitoring plans and schedules will continue to adapt to findings in the field and operational needs.

The Line Creek LAEMP will continue until sufficient data have been collected to address the LAEMP study questions or relevant monitoring can be incorporated into the RAEMP.

In addition to addressing questions specific to the Line Creek LAEMP on an annual basis, monitoring data from the LAEMP will contribute to the broader data set assessed every three years within the RAEMP. The RAEMP is designed to evaluate AMP Management Question #5 (i.e., “Does monitoring indicate that mine-related changes in aquatic ecosystem conditions are consistent with expectations?”). During the development of the AMP, a number of uncertainties related to Management Question #5 were identified that were summed up as Key Uncertainty 5.1 (i.e., “How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?”). Teck is working with its consultants and the EMC to develop the methodology that will address Key Uncertainty 5.1 and its underlying uncertainties prior to the next RAEMP report in 2020.

LAEMP and RAEMP data will also contribute to answering AMP Management Question #2, (i.e., “Will aquatic ecosystem health be protected by meeting the long-term site performance objectives?). A Key Uncertainty associated with Management Question #2 is “How will the science-based benchmarks be validated and updated?” with underlying uncertainty about how aquatic monitoring data will be used to validate and update the benchmarks. Progress on reducing these uncertainties, and associated learnings, will be described in Annual AMP Reports.

Please refer to the AMP (Teck 2018) 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.

2 METHODS

2.1 Overview

The general approach for the Line Creek LAEMP is summarized in Table 2.1, which explains the data collected and evaluated in relation to each of the study questions. This report includes data up to the end of the 2018 calendar year for all parameters, except benthic invertebrate tissue selenium data which are presented up to and including January 2019. Historical data are also presented where appropriate.

Water quality and biological monitoring locations listed in Tables 2.2 and 2.3 are shown in Figure 2.1. These represent the same locations that were sampled for the LAEMP in 2014 and 2015, with the addition of RG_LCUT (LC_LCUSWLC) in 2016, and RG_LISP24 (WL_DCP_SP24) and RG_LIDCOM (LC_LCC) in 2017.[6] RG_LCUT is situated upstream from the AWTF and mainly reflects water quality influences farther upstream on the main stem of Line Creek (LC_LCUSWLC) when the AWTF is operating. When West Line Creek (LC_WLC) flows are not being diverted to the AWTF for treatment (i.e., during AWTF shutdown) water quality at RG_LCUT also reflects input from West Line Creek. RG_LISP24, and RG_LIDCOM are monitoring areas downstream from the WLC AWTF that were added to the LAEMP to provide additional spatial resolution of the potential influence of the AWTF. Continuous water temperature monitoring locations are shown in Figure 2.2 and listed in Table 2.4.

To address the study questions described in Section 1.2, the 2018 Line Creek LAEMP included evaluation of the following components:

- Periphyton visual coverage scores and tissue selenium concentrations;
- Benthic invertebrate biomass, community, and tissue selenium concentrations (composite-taxa and single-taxon samples);
- Fish tissue selenium concentrations;
- 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;
- *In situ* water quality (including temperature and dissolved oxygen) at routine water quality monitoring locations;

[6] RG_LISP23 (WL_LCUCP_SP23) was also established in 2017 (Minnow 2018d), but monitoring at this location was discontinued in 2018 (Minnow 2018b). Refer to Minnow (2018d) for details of this monitoring area. Supplementary monitoring was completed at two additional sampling areas (LC_LC1 and RG_FO9; Table 2.2, Figure 2.1) in response to observed results. See Section 2.6.3 for details.

Table 2.1: General Approach for Line Creek LAEMP, 2018, as Presented in the LAEMP Study Design (Minnow 2018[b])

Key Questions	Assessment Endpoints	Measurement Endpoints: Water	Measurement Endpoints: Sampling Areas	Measurement Endpoints: Biological	Measurement Endpoints: Sampling Areas	How Data will be Evaluated to Address Key Question[f]
Is active water treatment affecting biological productivity downstream in Line Creek?	Biological productivity downstream from the AWTF discharge post-compared to pre-AWTF commissioning and relative to productivity observed upstream from the discharge	Nutrient concentrations	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.3[a] for timing)	Benthic invertebrate biomass, Benthic invertebrate community structure	Biomass - RG_LI24, RG_SLINE, RG_LILC3, RG_LIDSL (annually) Community - RG_LI24, RG_SLINE, RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23 (annually)	Determine if there is an increase in benthic invertebrate biomass, or shift in community structure that has been demonstrated to correspond with changes in AWTF operational status and changes in parameters associated with productivity (e.g., nutrient concentrations)
Are tissue selenium concentrations reduced downstream from the AWTF?	Tissue selenium concentrations downstream from the AWTF discharge post- compared to pre-AWTF commissioning and relative to concentrations observed upstream from the discharge	Total and dissolved selenium concentrations	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.3[a] for timing)	Periphyton tissue selenium[c] Benthic invertebrate tissue selenium (composite-taxa and single taxon[d] samples) Fish tissue selenium (Westslope cutthroat trout and bull trout)	Periphyton and Benthic invertebrate -RG_LI24, RG_SLINE, RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23 Fish - Area 1 (upstream from canyon: RG_LILC3 to RG_LIDCOM); Area 2 (downstream from canyon: RG_LI8)	Determine if there is a change in benthic invertebrate and fish tissue selenium concentrations over time that corresponds to changes in total selenium concentrations or selenium speciation in water. Benthic invertebrate community data being collected for other purposes can be used as supporting evidence of ecosystem health status downstream from the AWTF.
		Selenium speciation	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.3[a] for timing)			
Is AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations or concentrations of treatment-related constituents other than nutrients or selenium?	Biological community structure downstream from the AWTF discharge post- compared to pre-AWTF commissioning and relative to community structure observed upstream from the discharge	Temperature (data loggers)	5 locations in the effluent mixing zone (see Figure 2.2[b] and Table 2.4)	Benthic invertebrate community structure	RG_LI24, RG_SLINE, RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23 (annually)	Temperatures that are above/below the guideline, and dissolved oxygen concentrations that are above the threshold for effects to fish outside of the initial mixing zone, and confirmation that the mixing zone is small, will be indicative of effective management of treated water discharge. Benthic invertebrate community data being collected for other purposes can be used as supporting evidence of ecosystem health status downstream from the AWTF.
		Dissolved oxygen	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.3[a] for timing)			
		Toxicity	WL_BFWB_OUT_SP21, LC_LCDSSLCC (LIDSL) (see Table 2.3[a] for timing)			Determine if there is a change in benthic invertebrate community endpoints away from the reference condition that does not correspond to observed changes in nutrients or selenium concentrations.

[a] Table 2.3 in this document was Table 3.1 in the study design

[b] Figure 2.2 in this document is similar to Figure 3.1 that was referenced in this table in the study design.

[c] Periphyton tissue selenium monitoring was completed in early 2018 (March to May) in accordance with the approved AWTF Bypass monitoring plan (ENV 2018). Periphyton selenium results were confounded by the presence of abiotic particulate matter containing selenium (Minnow 2017b, 2018b). Monitoring was therefore discontinued following the last AWTF shutdown sampling event in May 2018.

[d] Single taxon benthic invertebrate samples for selenium analysis were collected in March 2018 in accordance with the approved AWTF Bypass monitoring plan (ENV 2018). These samples were the legacy of an earlier investigation and sample collections were discontinued following the March 2018 sampling event.

[f] Data evaluation approach presented differs slightly from the evaluation criteria in Table 2.1 of the study design. The data evaluation approach displayed herein is integrated for water and biological endpoints, and these were presented separately in the study design.

Table 2.2: Monitoring Areas Associated with Line Creek LAEMP, 2018

Area	Water Quality Sampling Station					Biological Sampling			
	Teck Location Code	EMS Number	Location Description	UTM (11U)		Station ID	Location Description	UTM (11U)	
				Easting	Northing			Easting	Northing
Reference	LC_LC1	E216142	Line Creek upstream of LCO and MSA North Pit	661979	5538254	RG_LI24	Tornado Creek	662214	5538393
Reference	LC_SLC	E282149	South Line Creek west side of Main Rock Drain, upstream of Line Creek	660271	5531737	RG_SLINE	South Line Creek upstream of Line Creek and LCO	661122	5531374
Mine-exposed Line Creek	LC_LCUSWLC	E293369	Line Creek downstream of rock drain, upstream of West Line Creek and AWTF outfall	660125	5532281	RG_LCUT	Line Creek downstream of rock drain, downstream of West Line Creek and upstream of AWTF outfall	660114	5532140
Mine-exposed Line Creek	LC_WLC	E261958	West Line Creek	659998	5532227				
Mine-exposed Line Creek	LC_LC3	0200337	Line Creek downstream of West Line Creek and AWTF outfall	660090	5532023	RG_LILC3	Line Creek downstream of West Line Creek and AWTF outfall	659911	5531818
Mine-exposed Line Creek	WL_DCP_SP24	N/A	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	659902	5531445	RG_LISP24	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	659674	5531168
Mine-exposed Line Creek	LC_LCDSSLCC (compliance)	E297110	Line Creek immediately downstream of South Line Creek confluence	659218	5530522	RG_LIDSL	Line Creek downstream of South Line Creek confluence	659294	5530583
Mine-exposed Line Creek	LC_LCC	N/A	Line Creek downstream of the compliance point	658184	5529814	RG_LIDCOM	Line Creek downstream of the compliance point	658184	5529814
Mine-exposed Line Creek	LC_LC4	020044	Line Creek canyon, upstream of Process Plant	655604	5528824	RG_LI8	Line Creek downstream of the canyon	655426	5528959
Mine-exposed Fording River	-					RG_FO9 [a]	Fording River downstream of Josephine falls, upstream of Grace Creek and Line Creek	652235	5540141
Mine-exposed Fording River	LC_LC6	0200338	Fording River downstream of Grace Creek, upstream of Line Creek	654140	5533513	RG_FRUL	Fording River downstream of Grace Creek, upstream of Line Creek	654530	5530162
Mine-exposed Fording River	LC_LC5 (Order - FR5)	0200028	Fording River downstream of Line Creek	652977	5528919	RG_FO23	Fording River downstream of Line Creek	652808	5528334

[a] Sampling area FO9 was not included in the 2018 LCO LAEMP study design (Minnow 2018b). This area was sampled once in December 2018 for the purpose of investigating selenium concentrations upstream of RG_FRUL.

Table 2.3: Summary of Water Quality Monitoring for Permit 107517

Location Description	Teck Water Station Code (associated Biological Station Code in brackets)	EMS Number	UTM (NAD83, 11U)		Water Quality Samples			
			Easting	Northing	Area Type	Field Parameters[a]	All Other Parameters Required Under Mine Permits[b,d,e]	Toxicity[c]
Line Creek upstream of LCO	LC_LC1 (RG_LI24)	E216142	661979	5538254	Reference	M	M	-
South Line Creek	LC_SLC (RG_SLINE)	E282149	660271	5531737	Reference	M	M	-
Line Creek upstream of WLC AWTF	LC_LCUSWLC (RG_LCUT)	E293369	660114	5532140	Mine-exposed	M	M	-
West Line Creek (WLC)	LC_WLC (RG_LCUT)	E261958	5532227	659998	Mine-exposed	M	M	
Line Creek AWTF Influent	WL_LCI_SP02	E293371	660138	5532109	Mine-exposed	D	M	-
West Line Creek AWTF Influent	WL_WLCI_SP01	E293370	660011	5532218	Mine-exposed	D	M	-
AWTF Effluent (buffer pond discharge)	WL_BFWB_OUT_SP21	E291569	660050	5532070	Mine-exposed	D	M[d]	Q
Line Creek ~200 m downstream of the WLC AWTF	LC_LC3 (RG_LILC3)	0200337	660090	5532023	Mine-exposed	W/M	W/M	-
Line Creek	WL_DCP_SP24 (RG_LISP24)	-	659684	5531191	Mine-exposed	S	S	-
Line Creek downstream South Line Creek	LC_LCDSSLCC (RG_LIDSL)	E297110	659218	5530522	Mine-exposed	W/M	W/M[e]	Q/SA[f]
Line Creek downstream of compliance	LC_LCC (RG_LIDCOM)	-	658185	5529820	Mine-exposed	S	S	-
Line Creek upstream of the process plant and ~5,550 m downstream of the WLC AWTF	LC_LC4 (RG_LI8)	0200044	655604	5528824	Mine-exposed	W/M	W/M	-
Fording River upstream Line Creek	LC_LC6 (RG_FRUL)	0200338	654140	5533513	Mine-exposed	S	S	-
Fording River downstream Line Creek	LC_LC5 (RG_FO23)	0200028	652977	5528919	Mine-exposed	W/M	W/M	Q

Notes: "-" = no data/not recorded. D - Daily; T - twice monthly; M - monthly; W - weekly; W/M - weekly during freshet (March 15 to July 15); Q - quarterly; S - September (once). Sampling frequency is currently managed through the permit, and after one year of data collection during sustained operation of the AWTF, sampling frequency may be adjusted.

[a] Dissolved oxygen, water temperature, specific conductance, pH.

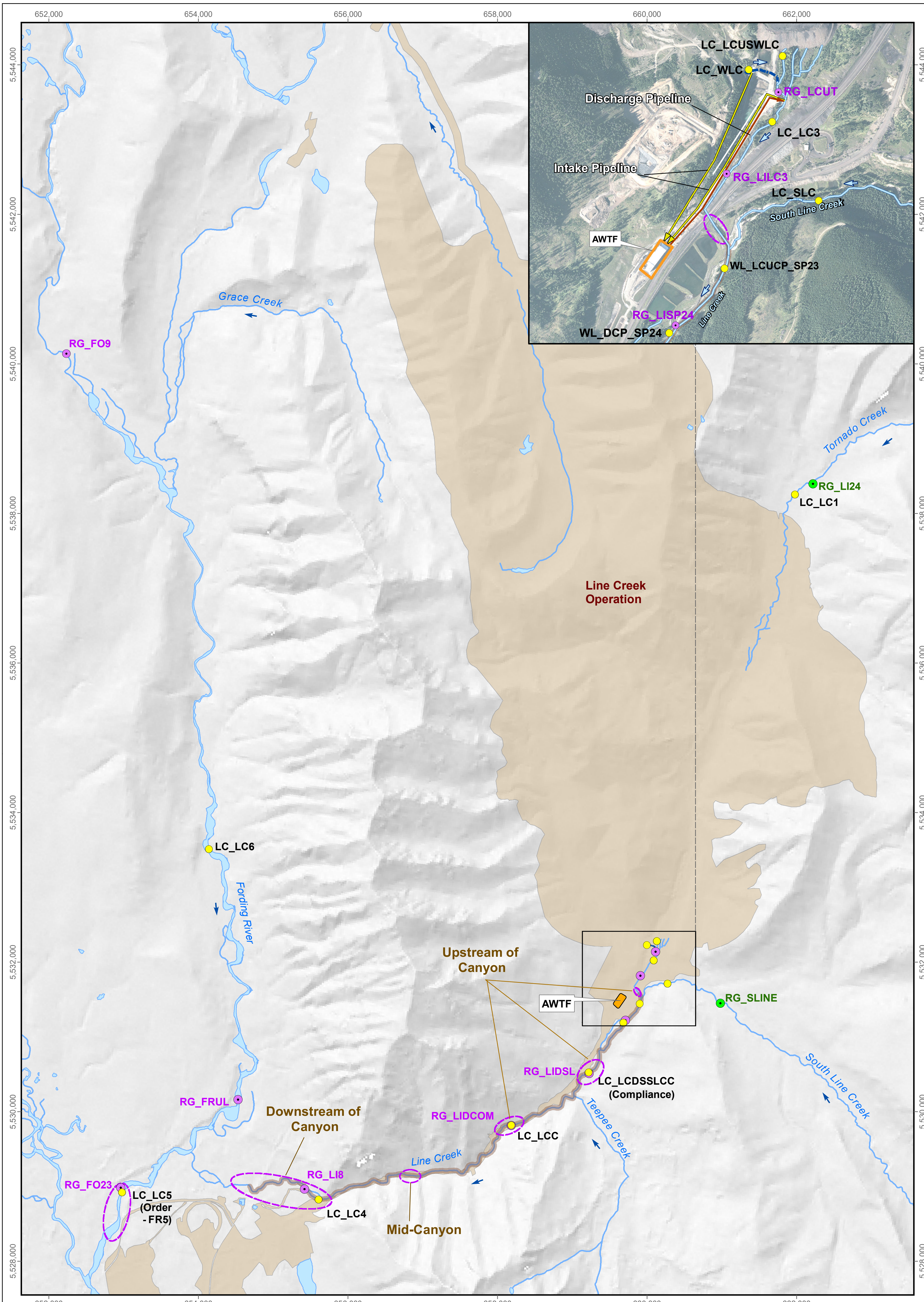
[b] Total and dissolved metals, total and dissolved organic carbon, nutrients, major ions, specific conductance, total dissolved and suspended solids, hardness, alkalnity, and turbidity as per Table 18 of Permit 107517.

[c] Acute and chronic as per Permit 107517 requirements.

[d] Three times weekly for selenium and nitrate.

[e] Total phosphorus every two weeks from June 15 - September 30th.

[f] Q = 7 day *C. dubia* and 72 hr *P. subcapitata.* SA = 30-day early life stage rainbow trout.



LEGEND

- Teck Water Quality Station (e.g. LC_LCDSSLCC)
- Mine-exposed Biological Sampling Area (e.g. LIDSL)
- Reference Biological Sampling Area
- Fish Tissue Monitoring Area
- Active Water Treatment Facility (AWTF) Operational-Dependent Flow
- Bull Trout Spawning Area (Smithson and Robinson 2018)
- Teck Coal Mine Operation
- Active Water Treatment Facility (AWTF)

Line Creek LAEMP Biological Monitoring Areas and Teck Water Quality Stations, 2018

0 0.75 1.5 3
km

N
W E
S

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

Date: April 2019
Project 187202.0026

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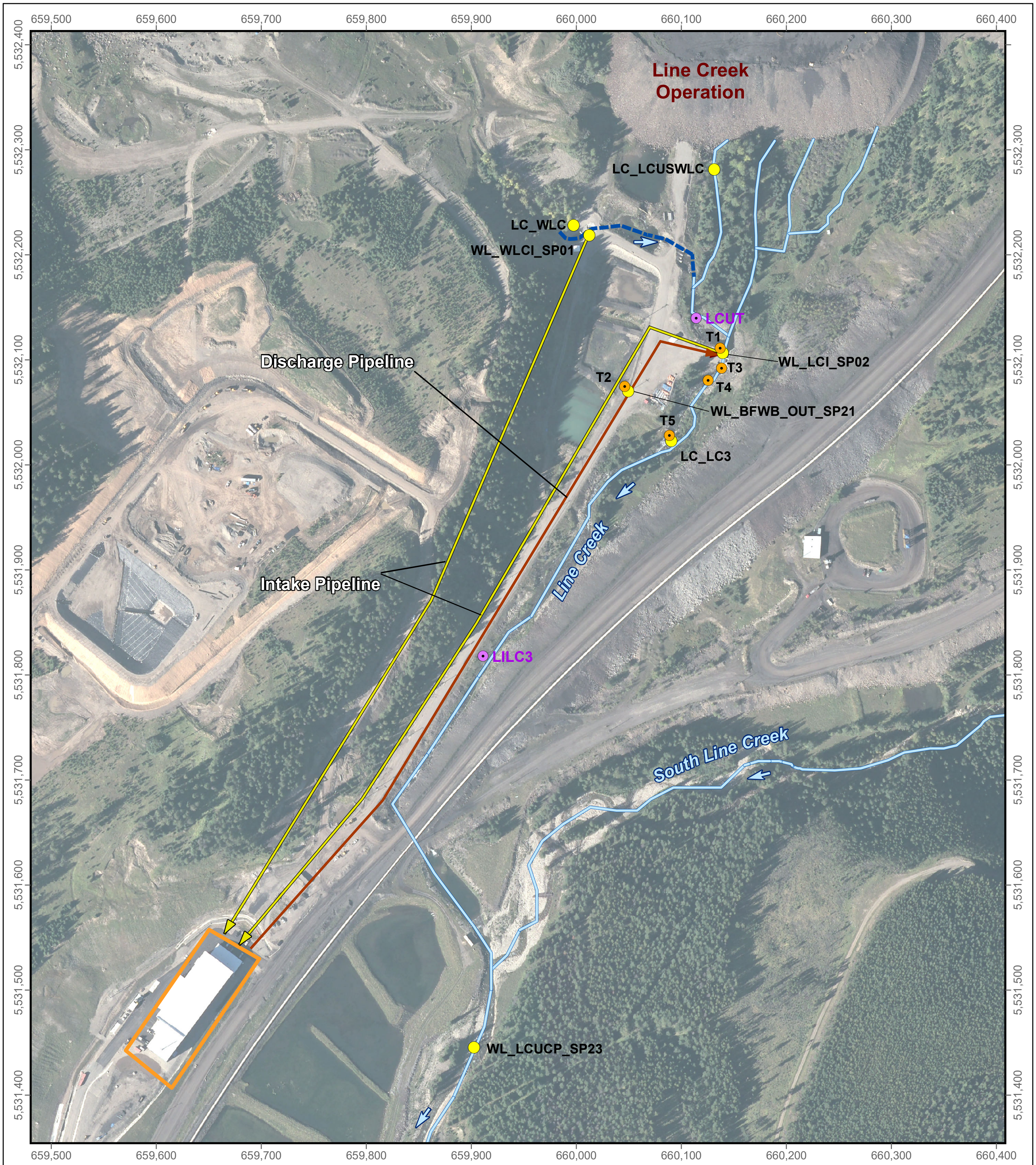
Figure 2.1

Document Path: S:\Projects\187202\187202.0026 - Teck 2018 Line Ck LAEMP - Privileged and Confidential\GIS\Report\18-26 Figure 2.1 LAEMP Monitoring Areas and WQ.mxd



LEGEND

- Temperature Data Logger
- Biological Monitoring Area
- Teck Water Quality Station
- Active Water Treatment Facility (AWTF) Operational-Dependent Flow
- Active Water Treatment Facility (AWTF)

Locations of Temperature Loggers, Biological Monitoring Areas, and Teck Water Quality Stations in Upper Line Creek

0 75 150 300 Meters

Projection: North American Datum 1983 UTM Zone 11

Date: April 2019
Project 187202.0026

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Figure 2.2

Document Path: S:\Projects\187202\187202.0026 - Teck 2018 Line Ck LAEMP - Privileged and Confidential\GIS\Report\18-26 Figure 2.2 LAEMP Monitoring Locations.mxd

Table 2.4: Temperature Data Logger Locations, 2018

Logger ID	Location Description	Coordinates (NAD83, 11U)	
		Easting	Northing
T1	Temperature upstream of LC Intake	660137	5532111
T2	Temperature of Buffer Pond outlet box	660046	5532074
T3	Temperature in V-Notch Discharge	660140	5532096
T4	Temperature 5m Downstream of Discharge	660130	5532076
T5	Temperature at LC3 (100m DS of outfall)	660092	5532030

- Water temperature upstream and downstream of the WLC AWTF recorded continuously with data loggers; and
- Toxicity of WLC AWTF influent and effluent, and surface water samples collected downstream of the AWTF outfall.

Water quality monitoring and toxicity test results presented in this report included requirements specified under Permit 107517 (Table 2.3). Reporting for the LCO LAEMP has also previously included toxicity testing completed in accordance with LCO's Permit 106970 (e.g., Minnow 2018d). On March 4th 2019, Teck received acceptance to integrate Permit 106970 chronic toxicity sampling with the Elk Valley chronic toxicity program under Permit 107517 to align testing and interpretation and to eliminate redundancy (Teck 2019b). Toxicity testing results for 2018 will be presented consistent with previous years under Permit 106970 for LCO, but going forward will align with the Permit 107517 program.

Sampling completed in 2018 and early 2019 is summarized in Table 2.5 relative to the study design approved for the 2018 LAEMP (Minnow 2018b). The 2018 LCO LAEMP study design specified one or two benthic invertebrate tissue selenium sampling events prior to the initial discharge from the AWTF with AOP, and again in February and April 2019. These monitoring events were planned with the acknowledgement that monitoring timing may be adjusted if recommissioning of the AWTF was delayed. Adjustments to these monitoring events were discussed with the EMC in October 2018 due to changes in the AWTF recommissioning schedule, and the monitoring timing was adjusted slightly to December 2018, and January, February, and April 2019. Results of tissue selenium monitoring completed up to and including January 2019 are presented in this report, while all other results are presented for the 2018 calendar year only. Historical data are also presented in tables and figures where appropriate.

Table 2.5: Sampling Completed in Line Creek and Fording River in 2018-2019 Compared to the LAEMP Study Design (Minnow 2018[b])

Area Type	Biological Area Code	EMS Number	Teck Water Station Code	Con-current Water Sampling[a]	2018																					2019					
					After AWTF Shutdown[b]														Before AWTF Discharge Resumed (with AOP)[d]						After AWTF Discharge Resumed (with AOP)[d]	After AWTF/AOP Operations Stabilize[d]					
					0 weeks[c]						4 weeks		8 weeks[b]				12 weeks		Regular LAEMP timing (26 weeks)						5 weeks	11 weeks	17 weeks	25 weeks	September (regular LAEMP timing)		
					Mar 8-11						Apr 3-5		Apr 30-May 4[b]				May 28-29		Sept 6-13						Dec 3-6	Jan 14-17	Feb 25-Mar 7	Apr 22 to 25[d]			
					Tissue Selenium														Tissue Selenium			Productivity/ Community			Tissue Selenium						
					Periphyton	Benthic Invertebrates					Periphyton	Benthic Invertebrates	Periphyton	Benthic Invertebrates	Fish Muscle		Periphyton	Benthic Invertebrates	Benthic Invertebrates	Fish Muscle		Periphyton	Benthic Invertebrates		Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Fish Muscle	
					Scrapings from individual rocks	Composite Taxa	*Parapsyche* sp.	Rhyacophilidae	Ephemeroptera	Chironomidae	Scrapings from individual rocks	Composite Taxa	Scrapings from individual rocks	Composite Taxa	Westslope Cutthroat Trout	Bull Trout	Scrapings from individual rocks	Composite Taxa	Composite Taxa	Westslope Cutthroat Trout	Bull Trout	Visual Coverage Score	Benthic Invertebrates	Hess Sampling (Biomass, Community)	Composite Taxa	Composite Taxa	Composite Taxa	Composite Taxa	Composite Taxa	Westslope Cutthroat Trout	Bull Trout
		Number of samples per area (n)		1	15	10	10	1	1	1	15	10	15	10	8	8	15	10	10	8	8	5	1/3[e]	5/10[f]	10	10	10	10	10	8[g]	8[g]
Refer-ence	RG_SLINE	E282149	LC_SLC	√	√	√	6	√	√	0	-	-	√	√	-	-	-	-	√	-	-	√	√	√	√	√	√	√	T	-	-
Refer-ence	RG_LI24	E216142	LC_LC1	√	0 (frozen)						-	-	√	√	-	-	-	-	√	-	-	√	√	√	√	0 (frozen)	1	√	T	-	-
Mine-exposed	RG_LCUT	E293369/ E261958	LC_LCUSWLC / LC_WLC	√	√	√	√	√	√	√	√	√	√	√	-	-	√	√	√	-	-	√	√	-	√	9	0 (frozen)	5	T		
Mine-exposed	RG_LILC3	0200337	LC_LC3	√	√	√	√	√	√	√	√	√	√	√			√	√	√			√	√	√	√	√	√	√	T		
Mine-exposed	RG_LISP24	-	WL_DCP_SP24	√	√	√	√	√	√	√	√	√	√	√			√	√	√			√	√	-	√	√	√	√	T	T	T
Mine-exposed	RG_LIDSL	E297110	LC_LCDSSLCC (compliance)	√	√	√	√	√	√	√	√	√	√	√	1	4	√	√	√	2	0	√	√	√	√	√	√	√	T		
Mine-exposed	RG_LIDCOM	-	LC_LCC	√	√	√	√	√	√	√	√	√	√	√			√	√	√			√	√	-	√	√	√	√	T		
Mine-exposed	RG_LI8	0200044	LC_LC4	√	√	√	√	√	√	√	√	√	√	√	0	0	√	√	√	5	1	√	√	-	√	√	√	√	T	T	T
Mine-exposed	RG_FRUL	0200338	LC_LC6	√	√	√	3	√	√	√	-	-	-	√	0	0	-	-	√	8[h]	0[h]	√	√	-	√	5	√	-	T	-	-
Mine-exposed	RG_FO23	0200028	LC_LC5	√	√	√	7	√	√	√	√	√	0	√	0	0	√	√	√			√	√	-	√	√	4	√	T	-	-
Mine-exposed	RG_FO9[i]	-	-	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√	-	-	√	-	-	-

Notes: "√" - target sample size was met, otherwise the actual number of samples collected is shown. T - target sample size. "-" = no data/not recorded.

[a] Parameters consistent with Permit 107517, plus selenium speciation.

[b] Sampling conforms with approved AWTF shutdown plan. April 30 to May 4 sampling period represents both the "Eight weeks" and "April/May (Target)" sampling periods identified in the AWTF shutdown plan (ENV 2018).

[c] Exceeds sampling specified for late February/early March 2018 in the Line Creek LAEMP study design submitted May 2017 (Minnow 2017c).

[d] Periphyton selenium monitoring was discontinued because results were confounded by presence of abiotic particulate matter containing selenium (Minnow 2017b, 2018b).

[e] 3 samples at reference areas (RG_SLINE, RG_LI24) and at three mine-exposed areas (RG_LILC3, RG_LIDSL, and RG_LI8); 1 sample at all other areas indicated.

[f] 5 samples at reference areas and 10 samples at mine exposed areas

[g] Target sample sizes will be met, if possible with reasonable sampling effort.

[h] Fish tissue quality sampling was completed in the Lower Fording River as part of the RAEMP.

[i] Sampling area FO9 was not included in the 2018 LCO LAEMP study design (Minnow 2018b). This area was sampled once in December 2018 for the purpose of investigating selenium concentrations upstream of RG_FRUL.

2.2 Water Quality

2.2.1 Routine Water Quality

Water quality data assessed as part of the Line Creek LAEMP included data for routine monitoring managed by Teck (Table 2.3), and water samples collected at the biological monitoring stations concurrently with biological sampling (Table 2.2; Figure 2.1)[7]. Water quality data were downloaded from Teck's EQuIS™ database, including:

- Nutrient concentrations (i.e., nitrate, nitrite, ammonia, total phosphorus, and orthophosphate);
- Selenium concentrations (i.e., total and dissolved selenium concentrations, and selenium speciation data including concentrations of selenate, selenite, dimethylselenoxide, methylseleninic acid, selenocyanate, selenomethionine, and selenosulphate);
- Concentrations of analytes with early warning triggers under the AMP [i.e., total dissolved solids, sulphate, total concentrations of antimony, barium, boron, lithium, manganese, molybdenum, nickel, selenium (previously noted above), uranium and zinc, and dissolved concentrations of cadmium and cobalt]; and
- *In situ* water quality data (i.e., temperature, pH, conductivity, and dissolved oxygen).

Quality assurance and quality control (QA/QC) associated with routine water quality monitoring were discussed in the annual water quality report for Permit 107517 (Teck 2019a).

2.2.2 Toxicity Testing

WLC AWTF effluent samples (WL_BFWB_OUT_SP21) were collected for acute toxicity testing, as stipulated in Permit 107517, along with two samples from upstream of the AWTF (LC_WLC and LC_LCUSWLC), one sample of Line Creek AWTF influent, and eight receiving water samples. The following acute toxicity tests were performed:

- Single concentration acute toxicity test (96-hour LT_{50}) using rainbow trout (*Oncorhynchus mykiss*); Report EPS 1/RM/9 July 1990 (with May 1996 and May 2007 amendments; Environment Canada 2007a); and
- Single concentration acute toxicity test (48-hour LT_{50}) using *Daphnia* spp.; Report EPS 1/RM/11 July 1990 (with May 1996 amendments; Environment Canada 1996).

[7] The routine water quality monitoring locations and the biological monitoring locations for some areas differ slightly (e.g. LC_LCUSWLC; Figure 2.1).

Chronic toxicity tests were also completed on samples collected semi-annually (rainbow trout) or quarterly (all other tests) at the Compliance Point (LC_LCDSSLCC) based on requirements of Permit 107517:

- 72-hour growth/inhibition test using a freshwater alga (*Pseudokirchneriella subcapitata*) (EPS1/RM/25; Environment Canada 2007b);
- 7-day test of reproduction and survival using the cladoceran, *Ceriodaphnia dubia* (EPS1/RM/21; Environment Canada 2007c);
- 28-day water-only test with amphipod, *Hyalella azteca* (adapted from USEPA 2000), using survival and growth endpoints, which is required quarterly as part of the WLC AWTF - Bypass Approval (February 26, 2018) until the WLC AWTF is fully operational or a new regional chronic toxicity program is implemented that supersedes this monitoring; and
- 30-day early life stage toxicity tests using rainbow trout, *O. mykiss* (EPS 1/RM/28-1E; Environment Canada 1998) conducted semi-annually (once in spring, once in fall).

Toxicity tests and associated QA/QC measures were completed and reported by the biological testing laboratory contracted by Teck. The results were summarized in reports completed in accordance with 107517 (Teck 2019a, Golder 2019). Applicable results (i.e., for monitoring stations associated with the Line Creek LAEMP) are summarized in this report.

2.3 Primary Productivity

Periphyton coverage was visually scored during the September 2018 sampling event at each of the ten sampling areas where benthic invertebrates were collected by kick sampling (Table 2.5), consistent with the 2018 monitoring design (Minnow 2018b). Scores were recorded for five stations located a minimum of 5 m apart in each area, and were based on the categories defined in the Canadian Aquatic Biomonitoring Network (CABIN) sampling method (Environment Canada 2012):

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

2.4 Secondary Productivity and Invertebrate Community Structure (Hess Sampling)

Samples for analysis of benthic invertebrate biomass and community were collected in September 2018 from two areas in Line Creek downstream from the WLC AWTF (RG_LILC3 and RG_LIDSL), and at two reference areas (RG_SLINE and RG_LI24). Five samples were collected at each reference area and 10 at each mine-exposed area (Table 2.5; Figure 2.1). The samples were collected using a Hess sampler (0.1 m^2 sampling area) with 500 µm mesh. Stations were located a minimum of 5 m apart to represent the overall area. A single sample was collected at each station by carefully inserting the base of the Hess sampler into the substrate to a depth of approximately 5 to 10 cm. Gravel or cobble enclosed within the Hess sampler was carefully washed while allowing the current to carry dislodged organisms into the mesh collection net. Organisms collected into the net were rinsed into the bottom of the net, and then into a labelled wide-mouth plastic jar. Samples were preserved to a nominal concentration of 10% buffered formalin in ambient water within approximately 6 hours of collection so biomass was not lost through predation or decomposition of tissues before the samples were sorted at the laboratory.

Benthic invertebrate biomass samples were sent to ZEAS Inc. (lead taxonomist Danuta Zaranko) in Nobleton, ON, for sorting and taxonomic identification. Preserved organisms in each sample were sorted from the sample debris into groups separated at the family-level of taxonomy for weighing. Each family group of organisms was placed onto a fine cloth to drain excess surface moisture before being weighed to the nearest 0.0001 g. Total and family-level biomass were reported for each sample (preserved wet weight).

2.5 Benthic Invertebrate Community Structure (Kick Sampling)

Three replicate samples were collected during the September 2018 sampling event from each reference area (RG_SLINE, RG_LI24) and at areas downstream from the AWTF outfall that have been monitored consistently over time (RG_LILC3, RG_LIDSL, and RG_LI8; Table 2.5). Replicates were collected from stations spaced a minimum of 50 m apart, where habitat allowed (i.e., riffle habitat was present) and sampling could be completed safely. Single samples were also collected from riffle habitat at RG_LCUT (located upstream from the AWTF discharge), RG_LISP24, and RG_LIDCOM to provide additional spatial resolution of community characteristics (Table 2.5).

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

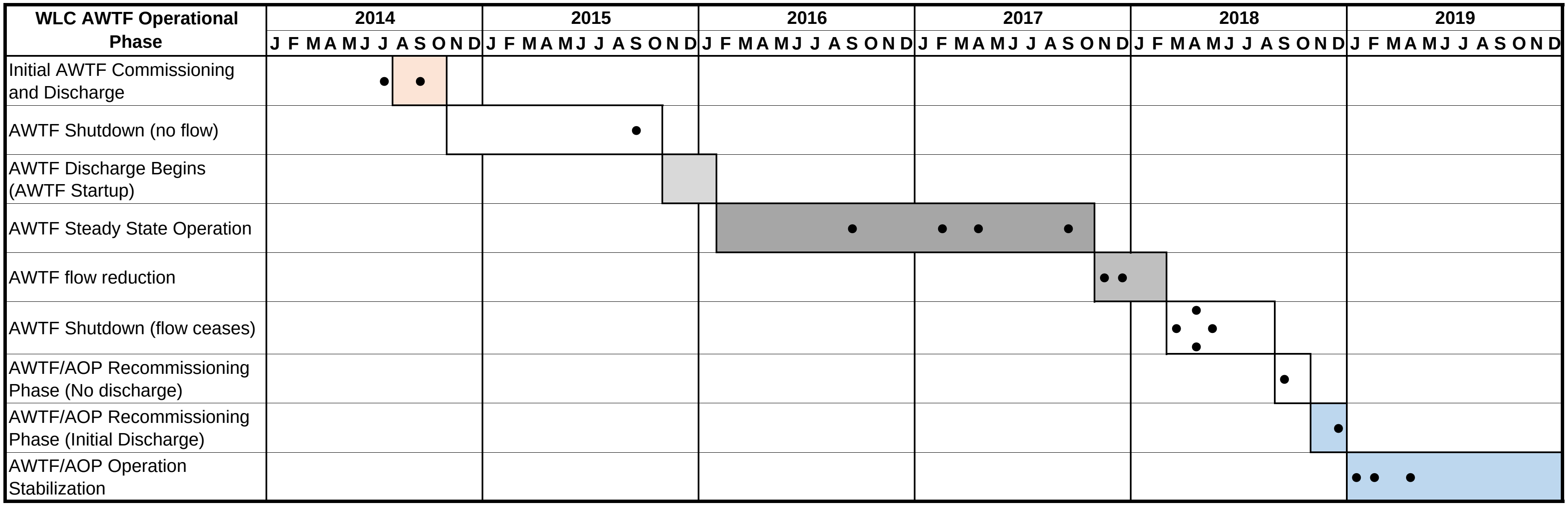
2.6 Tissue Selenium Concentrations

2.6.1 Overview

Monitoring data from 2016 and 2017 indicated that discharge of non-selenate forms of selenium in WLC AWTF effluent were causing selenium concentrations to be higher in the tissues of aquatic biota downstream from the AWTF than prior to AWTF operation (Minnow 2017a, 2018d). Further sampling for tissue selenium analysis was undertaken following the reduction of flow to the AWTF in October 2017 and following the temporary shutdown of the AWTF in March 2018. In 2018 this included approximately monthly sampling between early March and the end of May 2018 (at 0, 4, 8, and 12 weeks following shutdown; Figure 2.3) in accordance with the 2017 Line Creek LAEMP study design (Minnow 2017c) and the approved plan for the AWTF shutdown (ENV 2018).[8] Tissue sampling continued in 2018 in accordance with the 2018 Line Creek LAEMP study design (Minnow 2018b), with sampling prior to discharge from the AWTF with AOP (September 2018) and following the initiation of discharge at intervals of approximately every 6 weeks between early December 2018 and late April 2019 (Figure 2.3; Table 2.5).

Monitoring in addition to that outlined in the 2018 study design (Minnow 2018b) was also completed at two areas in response to increased tissue selenium concentrations reported for previous sampling events. Specifically, additional sampling was completed in September 2018 to investigate elevated benthic invertebrate tissue selenium concentrations at the reference area RG_LI24 observed in May 2018. This involved collection of confirmatory samples at the routine water quality monitoring station LC_LC1 (which is located downstream of RG_LI24), as well as site reconnaissance on foot and by drone to identify potential disturbances or water inputs to the area (Figure 2.1; Table 2.2). Sampling was also implemented at RG_FO9 (Figure 2.1; Table 2.2) to investigate the potential source of increased tissue selenium concentrations upstream of Line Creek on the Fording River (at RG_FRUL) that were observed in September 2018.

[8] Samples collected in December 2017 were not required to be collected under the approved monitoring designs (Minnow 2017c, ENV 2018). These were collected to further monitor tissue selenium concentrations during the reduction of flow through the AWTF.



• = Tissue selenium analysis sampling event

Figure 2.3: Overview of Benthic Invertebrate Tissue Selenium Sampling Events in Relation to Phases of WLC AWTF Operation, 2014 to 2019

Data from sampling events completed up to and including January 2019 are presented in this report, with historical data presented where appropriate.[9] Sampling areas included are those indicated in Table 2.2 and Figure 2.1.

2.6.2 Periphyton

Periphyton monitoring for tissue selenium analysis was completed in early 2018 in accordance with the approved AWTF shutdown monitoring plan (ENV 2018). Monitoring was discontinued following the last shutdown sampling event in May 2018 (Table 2.5) because results are confounded by the presence of abiotic particulate matter containing selenium (Minnow 2017b, 2018b). The removal of periphyton tissue selenium monitoring was discussed with the EMC, and will be excluded from future study designs (e.g., Minnow 2019). Results up to and including March 2018 were presented in the 2017 Line Creek report (as described above; Minnow 2018d), therefore the focus of data presentation for the current report was April to May 2018.

Periphyton tissue samples were collected from one area in Line Creek upstream of the WLC AWTF discharge (RG_LCUT), five areas downstream of the discharge (RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, and RG_LI8), one area downstream of Line Creek in the Fording River (RG_FO23), and from each reference area (RG_SLINE and RG_LI24, at 8 weeks following AWTF shutdown only; Table 2.5). At each area, 15 samples were collected, with each sample being a scraping from an individual rock. After a suitable rock was selected, it was taken to shore and the periphyton was scraped from the surface of the rock using a scalpel until sufficient sample volume (a minimum of 2.0 g wet weight) was attained. Each sample was placed in a vial and the vials were stored in a cooler with freezer packs (in the field) until transferred to a freezer later in the day.

Tissue samples were transported by courier in coolers with ice packs to the Saskatchewan Research Council (SRC) laboratory in Saskatoon, Saskatchewan, where they were freeze-dried and analyzed for selenium using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Results were reported on a dry weight (dw) basis.

2.6.3 Benthic Invertebrates

Benthic invertebrate tissue samples were collected for selenium analysis using the CABIN kick and sweep sampling method described in Section 2.4, except that sampling was not timed. All sampling events (including additional monitoring for investigative purposes) included collection of

[9] The 2017 Line Creek LAEMP report (Minnow 2018d) presented results and data interpretation for sampling events up to and including March 2018. To avoid overlap, the present report does not include presentation of results up to March 2018 unless they are supportive of data interpretation.

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).

Sampling in March 2018 also included collection of samples comprising each of four representative benthic invertebrate taxa, where available (i.e., Chironomidae, Ephemeroptera, *Parapsyche* sp., and Rhyacophilidae; single-taxon samples). These samples were included in the approved AWTF Bypass monitoring plan, and were a remnant of an earlier investigation of whether monitoring of selenium in individual taxa would better facilitate detection of potential trends in tissue selenium concentrations over time (e.g., Minnow 2015b). Recent analyses have indicated that these single-taxon samples do not improve the ability to statistically detect temporal trends (Minnow 2018c) and sampling was discontinued following the March 2018 sampling event (see Table 2.5). Single-taxon tissue selenium results from March 2018 were presented and interpreted in the 2017 Line Creek LAEMP report (as described above; Minnow 2018d). These data are therefore not included in the current report.

For composite-taxa sample collection, as many organisms as possible were carefully removed from sample debris using tweezers until about 2 g of wet tissue was obtained. For single-taxon sample collection, 2 g of wet tissue was targeted, but some samples were smaller if targeted taxa were rare or, in the case of *Parapsyche,* each sample represented a single organism.

Invertebrate tissue samples were placed into labelled vials and stored in a cooler with ice packs until transfer to a freezer later in the day. Tissue samples were kept in a freezer until they were transported by courier in coolers with ice packs to SRC, where they were freeze-dried and subsequently analyzed for selenium using ICP-MS. Results were reported on a dw basis.

2.7 Data Analysis

2.7.1 Water Quality

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. Routine water quality results were paired with the closest biological monitoring station (Table 2.2). The location of routine water quality and biological monitoring stations differ slightly for some areas, therefore samples collected concurrently with biological sampling are named according to the biological monitoring location (Table 2.2). For instance, the biological monitoring area RG_LCUT is situated upstream from the AWTF and mainly reflects water quality influences farther upstream on the main stem of Line Creek (LC_LCUSWLC) when the AWTF is operating, but also reflects input from West Line Creek (LC_WLC) when the AWTF is not operational (and flows are not being diverted to the AWTF for treatment; see Section 2.1). Accordingly, water quality data for RG_LCUT were associated with routine water quality monitoring data from either LC_LCUSWLC (when the AWTF was in steady-state operation) or LC_WLC (when flow through the AWTF was reduced or stopped) for data analysis, based on the AWTF operational time frames outlined in Table 1.1. Water quality data collected concurrently with biological sampling at all other areas were associated with the corresponding routine water quality monitoring station (Table 2.2) for data analysis.

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 mean of the replicates was used. Monthly means were also calculated using the Kaplan-Meier (K-M) 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 2016) 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).

The method described in Minnow (2017b) was used to visually explore temporal changes in total phosphorus and orthophosphate concentrations during AWTF operation. The method involves two steps. First, the monthly upper limits of total phosphorus and orthophosphate concentrations (97.5^{th} percentile) were computed for the baseline (pre-AWTF operation) period at LC_LC3. Secondly, the monthly concentrations were plotted as a ratio of the monthly 97.5^{th} percentile of the concentrations (i.e., monthly mean concentration : monthly 97.5^{th} concentration). These trend plots help visualize deviations from the pre-AWTF range. Total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC [RG_LIDSL]) between June 15^{th} and September 30^{th} were also plotted relative to the phosphorus Site Performance Objective (SPO; ≤ 0.02 mg/L) outlined in Permit 107517.

A temporal analysis for total selenium at LC_LC1 was conducted on monthly mean concentrations among years using an Analysis of Variance (ANOVA) model with factors *Year* and *Month*. The factor *Month* was included in the model to control for seasonal effects within a year. A log-normal distribution was assumed for all data (data were $\log_{10}$-transformed prior to analysis). If the *Year* term of the model was identified as statistically significant ($\alpha < 0.05$), the variability within years (controlling for month) was used to test for significant differences among all pairwise comparisons of year. Significance of the pairwise comparisons was assessed using a Tukey's honestly significant difference test (HSD) with an α of 0.05. Using this method, potential differences in total selenium concentrations between 2018 relative to multiple previous years (2012 to 2017) and relative to 2017 only were assessed. The analysis was completed twice, once including all data, and once excluding one outlying result from 2012.

The magnitude of difference in selenium concentrations for a given year relative to the first year of available data (i.e., 2012) was calculated as:

$(\bar{x}_i - \bar{x}_{2012})/\bar{x}_{2012} \times 100\%$

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).

Routine water quality monitoring results were screened against British Columbia Water Quality Guidelines (BCWQG; BCMOE 2017, 2018) as part of Teck's Annual Water Quality Monitoring Report under Permit 107517 (Teck 2019a). In addition, further screening against BCWQG and Water Quality Benchmarks (Teck 2014) was completed for nutrients (i.e., nitrate, nitrite, total phosphorus, and orthophosphate); total and dissolved selenium, and other selected analytes (i.e., those with early warning triggers under the AMP: total dissolved solids, sulphate, total concentrations of antimony, barium, boron, lithium, manganese, molybdenum, nickel, uranium and zinc, and dissolved concentrations of cadmium and cobalt; Section 2.2.1) for the 2018 calendar year. Plots of these analyte concentrations from 2012 to 2018 were prepared individually for each monitoring station relative to BCWQG and benchmarks (where applicable), and also as combined plots to allow for visual comparison among stations. Selenium species results were plotted as monthly mean concentrations, and as monthly mean proportions of the total sum of detectable selenium species (results below the LRL were excluded from the sum of selenium species because inclusion of these data at the full LRL, or a fraction of the LRL, would influence the proportional results).

Temperature and dissolved oxygen concentrations in Line Creek were also graphically evaluated relative to BCWQG. BC water temperature guidelines for bull trout and westslope cutthroat trout specify a maximum ± 1 °C change from the optimum temperature range for different life stages of these species (spawning, incubation, and rearing; BCMOE 2001b), and dissolved oxygen guidelines are also specific to life stage (buried embryo/alevin and all other life stages; BCMOE 1997). Guidelines for both these parameters were therefore applied to periods of the year relevant to the specific life stage of each of the two species, with the time periods approximated from available literature (McPhail and Baxter 1996; McPhail 2007; COSEWIC 2016). Temperature data from continuous temperature data loggers located immediately upstream of the AWTF, and downstream of the AWTF discharge were plotted relative to discrete temperature measurements recorded at locations further upstream (i.e.,LC_LCUSWLC; Figure 2.2; Table 2.4).

2.7.2 Mass-Balance Analysis

Potential effects of the WLC AWTF on nutrient concentrations (nitrate, total phosphorus, and orthophosphate), were assessed using a mass-balance analysis in response to technical guidance from the EMC that recommended use of this approach. The mass-balance analysis was used to estimate values of these nutrients at monitoring locations downstream of the AWTF (LC_LC3 and LC_LCDSSLCC) using methods similar to those described by Teck (2017). This approach is based on instantaneous mixing of the relative mass loading contributions of the AWTF and tributaries, which were estimated using available flow and water quality data.

Assessment of potential effects to temperature and dissolved oxygen using a mass-balance approach was also recommended in technical guidance from the EMC. However, because these parameters are affected by external influences and are not transported conservatively in a system, the analysis cannot be considered a true mass-balance. Due to these limitations, a mass-balance and was not completed for these parameters. Nutrient concentrations (nitrate, total phosphorus, and orthophosphate) can also be influenced by external factors and are not entirely conserved. Although the potential external influence is lower than for temperature and dissolved oxygen, the limitations of this approach for nutrients must also be considered. Teck has also identified the need to better understand the availability of water at surface in tributaries targeted for treatment in the EVWQP 2019 Implementation Plan Adjustment (IPA; Annex H; Teck 2019c). which will also further improve mass balance analyses in Line Creek.

The mass-balance analysis included data from the initiation of AWTF steady-state operation in February 2016[10] (Table 1.1) to December 2018. Specifically, monthly means of the listed nutrients (calculated using the method described above) and monthly mean flows (calculated from flow data provided by Teck in Microsoft Excel spreadsheets) were used to complete the analysis. Flow from West Line Creek that entered Line Creek directly (i.e., was not diverted to the AWTF; *WLC Flow*) was calculated as LC_WLC – WL_WLCI_SP01 to account for the water diverted to the AWTF (Figure 2.4). If flow at WL_WLCI_SP01 exceeded the flow at LC_WLC, *WLC Flow* was assumed to be zero. Routine flow measurements are not collected upstream of LC_LC3. Therefore, the flow upstream of LC_LC3 was assumed to be the sum of the AWTF effluent discharge and upstream flow that was not diverted to the AWTF ("*US Flow";* Figure 2.4), and was calculated by subtracting total AWTF influent flow (WL_WLCI_SP01 + WL_LCI_SP02 + WLC Flow) from measured flow at LC_LC3 (Figure 2.4).

[10] AWTF Effluent chemistry data were not available for February or March 2016, despite discharge from the AWTF occurring in these months. The mass-balance analysis therefore included data from April 2016 to December 2018 only.

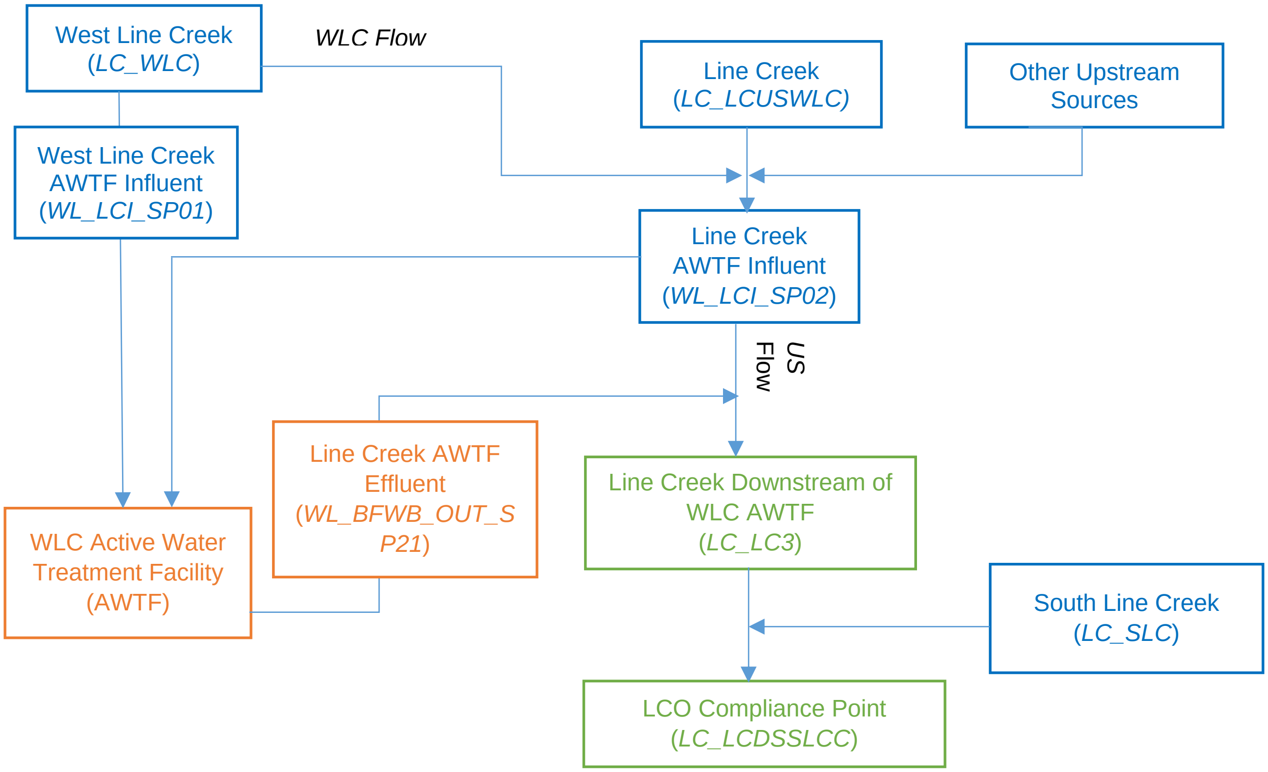


Figure 2.4. Flow Diagram of Monitoring Locations Used in Mass-Balance Analysis Showing Potential Upstream (Blue) and AWTF (Orange) Sources of Parameters and Estimated Locations (Green)

The estimated mass loading [11] at LC_LC3 for each parameter was calculated as the sum of four different sources using calculated flows and parameter data (i.e., mass loading = flow x concentration, with concentration denoted by square brackets). Refer to Figure 2.4 and Table 2.3 for details of the flow and water chemistry monitoring locations listed below:

1. the "West Line Creek contribution" which was calculated as: *WLC Flow* × [LC_WLC];
2. the "Line Creek contribution" which was calculated as: *US flow* × [WL_LCI_SP02];
3. the "Influent Input" which was calculated as the sum of WL_WLCI_SP01 flow × [WL_WLCI_SP01] and WL_LCI_SP02 flow × [WL_LCI_SP02]); and
4. the "AWTF contribution" to the effluent load, which was calculated as the total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) – total influent load (see contribution 3).

The estimated mass loadings at LC_LCDSSLCC were calculated as the sum from two different sources:

1. LC_LC3 (LC_LC3 flow × [LC_ LC3]); and
2. LC_SLC (*SLC Flow* × [LC_SLC]), where *SLC Flow* was calculated as the flow at LC_LC3 minus the flow at LC_LCDSSLCC.

The estimated values for each parameter at these areas (the sum of contributions from each source) were graphically compared to observed results, with the difference between the graphed series used as an indicator of the balance of these parameters in the system. All plots and calculations for the mass-balance analysis were completed using Microsoft Excel.

2.7.3 Secondary Productivity Endpoints

Potential effects of AWTF operation on benthic invertebrate biomass and density were analyzed among areas and years using an ANOVA model. The model was used to assess changes in the difference in benthic invertebrate biomass or density between control (i.e., reference) and impact (i.e., mine-exposed) areas among years. Data were included for the two reference areas (RG_SLINE and RG_LI24) and two mine-exposed areas (RG_LIDSL and RG_LILC3) sampled in 2018, and included all available results from 2014 to 2018. As recommended by the EMC, the analyses were completed by separately evaluating changes at each mine-exposed area relative to the two reference areas. Outliers with studentized residuals with magnitude greater than four

[11] The units for estimated mass loading were kg/day for concentration data (total phosphorus, orthophosphate, and nitrate).

were removed from the analysis, and one sample from RG_SLINE in 2018 was excluded due to issues with sample preservation identified by the laboratory.

The ANOVA model that was fit to the data for each mine-exposed area (and both reference areas) was:

$$Y = CI + Year + Area(CI) + Year \times CI + Year \times Area(CI) + \epsilon$$

where:

- Y = response variable;
- CI = a fixed factor for area type with two levels (control and impact);
- $Year$ = a fixed factor for year (2014-2018);
- $Area(CI)$ = a fixed factor for area because there are two reference areas (nested in CI because each area can only be assigned to one level of CI);
- $Year \times CI$ = the interaction between $Year$ and CI with a significant effect suggesting the difference between reference and mine-exposed areas varies among years;
- $Year \times Area(CI)$ = the interaction between $Year$ and $Area$ with a significant effect suggesting the difference between control and reference depends on which reference area the mine-exposed area is being compared to; and
- ϵ = the error term.

The ANOVA model was used to test for CI effects (i.e., changes in the difference between mine-exposed and reference areas among years). These changes were assessed by testing the significance of the interaction terms containing the $Year$ and CI terms. An α of 0.1 was used to test the significance of the interaction terms.

Interpretation of the ANOVA table began by assessing the significance of the interaction between $Area(CI)$ and $Year$. If the interaction was significant, then the differences among areas changed over time, but it depended on which years and areas were compared. In that case, separate ANOVA models were run for each reference area with factors for $Area$ (1 mine-exposed and 1 reference), $Year$ and $Year$ × $Area$. If there was a significant interaction, contrasts were conducted (with Bonferroni correction for the number of tests) to test for significant changes between the mine-exposed area and reference area among years.

If the interaction term between $Area(CI)$ and $Year$ was not significant, then the interpretation of the ANOVA table continued by assessing the significance of the interaction between CI and $Year$. This term in the model assessed whether the relative differences among area types depended on year. If this interaction terms was significant, then contrasts were conducted to determine the changes between the mine-exposed area and the reference areas among years.

Testing the significance of the interaction terms is the key hypothesis of interest in the ANOVA model as it tests for changes in the relative differences among areas over time. If all interaction terms are not significant, then it can be concluded that there are no Year effects that can be compared to AWTF operation schedules. Data were log_{10}-transformed prior to analysis. The ANOVA models and contrasts were conducted in R (R Core Team 2016) using customized scripts. Plots for visualizing the ANOVA analysis results were prepared in Microsoft Excel, and data were presented on log_{10}-transformed y-axes for consistency with the statistical approach.

Temporal differences in benthic invertebrate biomass and density at mine-exposed areas (RG_LILC3 and RG_LIDSL) were also assessed over the same time period (2014 to 2018) using an ANOVA for each area and endpoint. Prior to analysis, data were transformed if required (log_{10}, square root, fourth root) to meet the assumptions of the analysis. The transformation with the highest p-value from a Shapiro-Wilk test for normality that also passed a Levene's test for homogeneity of variances was selected. If assumptions could not be met, data were rank-transformed. When the overall ANOVA was significant ($\alpha < 0.1$), a Tukey's *post hoc* test was conducted for all pairwise comparisons. Graphical plots of the data were prepared using Microsoft Excel, and letters were used to indicate which years differed significantly from one another.

The relationship between mean benthic invertebrate biomass and density (as measured by Hess sampling) and mean total abundance (as measured by kick sampling) was tested using simple linear regression and data from mine-exposed and reference Line Creek monitoring stations from 2014 to 2018 ($\alpha = 0.05$). If replicate data were not available for a given area and year, single results were used in the regression. Linear regressions and the estimation of their prediction intervals were conducted in R (R Core Team 2016).

2.7.4 Selenium Tissue Chemistry

Selenium concentrations measured in tissues of benthic invertebrates and fish were plotted over time relative to corresponding site-specific effect benchmarks (Table 2.6).

Potential effects of AWTF operation on tissue selenium concentrations were evaluated for composite-taxa benthic invertebrate samples from each of the eight mine-exposed sampling areas using an ANOVA model. As recommended by the EMC, the analyses were completed by separately evaluating changes at each mine-exposed area relative to the two reference areas.

The ANOVA model that was fit to the data for each mine-exposed area (and both reference areas) was:

Table 2.6: Selenium Benchmarks for Benthic Invertebrates and Fish Tissues in the Elk Valley

Endpoint	Tissue Type	Benchmark			Source
		Value (µg/g dw)	Type	Description	
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	Site-specific benchmark	Level 1 (~10% effect) benchmark for dietary effects to juvenile fish (growth)	Teck (2014)
	Whole body	18 [b]	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)
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)
Other Fish	Egg/ovary	18	Site-specific benchmark	Level 1 (~10% effect) benchmark for reproduction effects to other species than westslope cutthroat trout	Teck (2014)
	Egg/ovary	22	Site-specific benchmark	Level 2 (~10% effect) benchmark for reproduction effects to other species than westslope cutthroat trout	Teck (2014)
	Egg/ovary	31	Site-specific benchmark	Level 3 (~50% effect) benchmark for reproduction effects to other species than westslope cutthroat trout	Golder (2014)
	Muscle	18	Site-specific benchmark	Muscle equivalent to the 18 mg/kg dw ovary benchmark, based on the relationship observed between selenium in muscle and ovary in longnose sucker	Minnow (2018a)
	Egg/ovary	11	BC guideline	Combination of weight of evidence and mean of published effects data with an uncertainty factor of 2 applied	BCMOE (2014)
	Whole body	4	BC guideline	Combination of weight of evidence and mean of published effects data with an uncertainty factor of 2 applied	BCMOE (2014)
	Muscle/ muscle plug	4	BC guideline	Whole-body translation to derive muscle benchmark with no additional uncertainty factor	BCMOE (2014)

[a] Site-specific benchmark not applicable to westslope cutthroat trout for reasons outlined in Teck (2014).

[b] BC guidelines were not used in assessment of benthic invertebrate and fish tissue selenium concentrations in the current report. Assessment was completed relative to site-specific benchmarks only.

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

where:

- Y = response variable;
- CI = a fixed factor for area type with two levels (control and impact);
- $Period$ = a fixed factor for time with up to 5 levels (Before [September 2012], Initial Operations [August to October 2014], Steady-state [February 2016 to October 2017], Shutdown [March to August 2018], and Restart [October to January 2019]) depending on data availability[12], where each period included between 1 and 3 individual sampling events and reflected the operational status of the WLC AWTF;
- $Period \times \mathrm{CI}$ = the interaction between $Period$ and CI with a significant effect suggesting the difference between reference and mine-exposed varies among periods;
- $Time(Period) \times \mathrm{CI}$ = the interaction between $Time(Period)$ and CI with a significant effect suggesting the difference between reference and mine-exposed varies among periods, but it depends on which sampling months are being compared; and
- ϵ = the error term.

Only one data point was collected for a given area in some years (i.e., no replicate sampling). Individual replicate data were used in the analyses rather than means (where n > 1 at an area), thus variation was assumed to be consistent across years. Because replicates within areas were not available for all years, an Area(CI) x Year interaction could not be tested, and this term was excluded from the model.

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 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, with a Bonferroni correction for the number of tests. 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:

[12] Commissioning-phase discharge from the AWTF began August 27, 2014, and the facility was shut down on October 17, 2014, and recommissioned in October 2015. Composite-taxa benthic invertebrate tissue selenium monitoring was completed in September 2015. Due to the brief period of exposure to less-than-capacity AWTF effluent, benthic invertebrate tissue selenium data from September 2015 are not considered representative of steady-state AWTF operation but also do not represent a no-discharge condition. They were therefore excluded from ANOVA analyses, but are displayed in plots for context.

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

The ANOVA model outlined above was also used to evaluate changes in the difference of tissue selenium concentrations between sampling areas located upstream (RG_FRUL) and downstream (RG_FO23) of Line Creek on the Fording River. In addition, the ANOVA model was used to assess changes in the difference of tissue selenium concentrations between RG_LILC3 (located immediately downstream of the AWTF) and reference within the steady-state and shutdown time periods. The objective of this analysis was to evaluate recovery of tissue selenium concentrations following shutdown of the AWTF at RG_LILC3.

Similar to the ANOVA model used to assess secondary productivity, 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 among control and mine-exposed 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 AWTF operation schedules. Data were $\log_{10}$-transformed prior to analysis using ANOVA. The ANOVA model analysis and contrasts were conducted in R (R Core Team 2016) using customized scripts. Plots for visualizing the ANOVA results were prepared in Microsoft Excel, and data were presented on $\log_{10}$-transformed y-axes for consistency with the statistical approach.

Spatial differences in tissue selenium concentrations among areas during each sampling event from March 2017 to January 2019 were tested using an ANOVA. Prior to analysis, data were transformed if required ($\log_{10}$, square root, fourth root) to meet the assumptions of the analysis. The transformation with highest p-value from a Shapiro-Wilk test for normality that also passed a Levene's test for homogeneity of variances was selected. If assumptions could not be met, data were rank-transformed. When the overall ANOVA was significant ($\alpha < 0.1$), a Tukey's *post hoc* test was conducted for all pairwise comparisons. The ANOVA models and contrasts were conducted in R (R Core Team 2016) using customized scripts. Graphical plots of the data were prepared using Microsoft Excel, and letters were used to indicate which years differed significantly from one another.

Composite-taxa benthic invertebrate tissue selenium results from 2012 to December 2018 were plotted relative to total selenium concentrations measured in water samples collected at or near the same time (within approximately 3 days) as the tissue samples. A line representing the regional one-step water-to-invertebrate selenium accumulation model was also presented on the plot (Teck 2014). 95% percentile confidence limits for the model were calculated using the formula below (as described in Whitmore 1986):

$$\hat{Y} \pm t_{\frac{\alpha}{2},n-2} S_r \sqrt{(1 + \frac{1}{n} + \frac{(x-\bar{x})^2}{(n-1)S_x^2})}$$

where:

- $\hat{Y}$= the fitted regression value at X
- S_r= the root mean square deviation of the fitted regression model (= 0.220; $\log_{10}$-transformed)
- n = sample size (= 291)
- $\bar{X}$ = mean of the sample X_i values (= 0.488)
- S_x^2 = variance of the sample X_i values (= 0.885).

2.7.5 Benthic Invertebrate Community Data

Community endpoints that were evaluated included density (Hess samples) or sample abundance (kick samples), family richness (Hess and kick samples), richness at lowest practical level of taxonomy (LPL richness; kick samples), and (for both Hess and kick samples) the absolute and relative abundances of major taxonomic groups (e.g., the combined orders of Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies], collectively known as EPT, Ephemeroptera alone, and Chironomidae [midges]). Community data for kick samples were plotted to show changes over time relative to normal ranges computed from reference area data in the RAEMP (Minnow 2018a).[13]

[13] Data collected for RAEMP monitoring (where available) were plotted in addition to those collected specifically for the LCO LAEMP as outlined in the monitoring design (Minnow 2018b).

3 PRODUCTIVITY

3.1 Overview

Monitoring data are evaluated in this section to address Study Question #1: Is active water treatment affecting biological productivity downstream in Line Creek? To address this study question, primary and secondary productivity monitoring endpoints and aqueous nutrient concentrations were evaluated in relation to the AWTF operational status; the AWTF was not operational for the majority (approximately 8 months) of 2018.

3.2 Site Performance Objectives and Aqueous Nutrient Concentrations

As outlined in Section 1.2, the AWTF treatment process requires the addition of phosphorus, and there is the potential for increased phosphorus concentrations downstream in Line Creek during AWTF operation. In 2018, aqueous total phosphorus concentrations at the Compliance Point were consistently below the SPO of 0.02 mg/L during the growing season (June 15 to September 30), as they were during the rest of 2018 (Figure 3.1).

A previous evaluation using data to the end of 2017 showed that total phosphorus and orthophosphate concentrations at LC_LC3 (the monitoring station located closest downstream of the AWTF discharge) were significantly higher than reference during AWTF operation, compared to prior to AWTF operation (Minnow 2018d). However, no changes in concentrations of both analytes during AWTF operation were detected at the Compliance Point (LC_LCDSSLCC) or at stations farther downstream relative to reference, compared to before AWTF operation (Minnow 2018d). Furthermore, total phosphorus concentrations at the Compliance Point were below the SPO throughout the AWTF operation time periods (Figure 3.1). These results are consistent with a previous mass balance analysis, which indicated that phosphorus loads from the AWTF could be expected to slightly increase aqueous concentrations at LC_LC3, but would be unlikely to result in a detectable change in concentration at the Compliance Point (Minnow 2017b).

In this report, a mass-balance analysis was completed to assess the relative influence of the AWTF on nutrient concentrations (total phosphorus, orthophosphate, and nitrate) at mine-exposed areas downstream of the AWTF discharge. Data from April 2016 (the earliest date of available effluent chemistry data following the start of AWTF steady-state operation) until December 2018 were used in the analysis (see Section 2.7.2). Evaluation of the mass-balance results involved the comparison of monthly mean estimated loads to observed monthly mean loads at LC_LC3 and LC_LCDSSLCC.

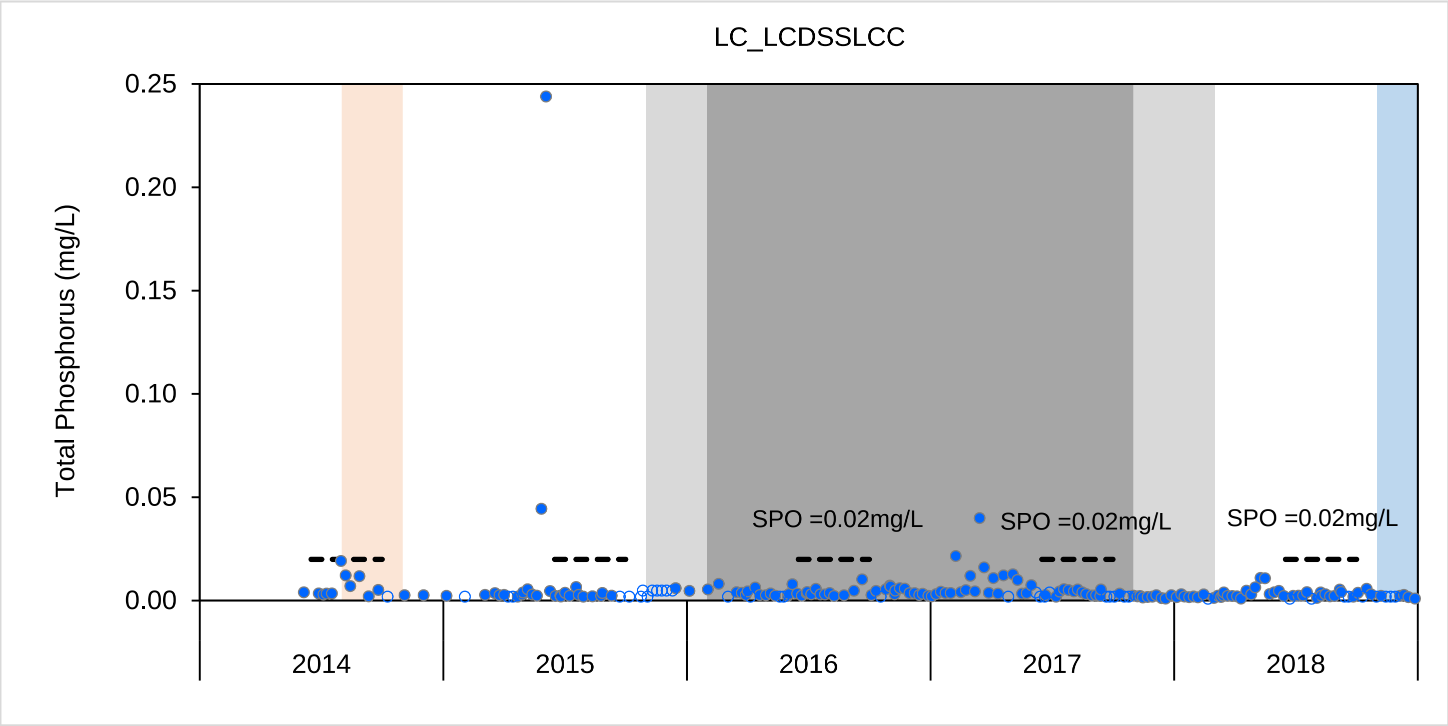


Figure 3.1: Total Phosphorus Concentrations in Water Collected from the Line Creek Compliance Point (LC_LCDSSLCC), 2013 to 2018

AWTF Initial Operations	AWTF Flow Reduction
AWTF Start up	AWTF/AOP Restart
AWTF Steady-State	AWTF Non-Operational

Notes: SPO = Site Performance Objective. This pertains to the compliance point (LC_LCDSSLCC) only, as a growing season average calculated from measurements collected every two weeks between June 15th and September 30th, annually. If multiple results existed for a given location and day, the Kaplan-Meier mean of the duplicates was presented. Hollow symbols represent results below the laboratory reporting limit (LRL).

For total phosphorus, concentrations at monitoring locations in 2018 were generally within the range of concentrations reported prior to AWTF steady-state operation (2013 to 2015; Figure 3.2; Appendix Figure A.1), which is consistent with the fact that the AWTF was not operational for the majority of 2018. Results of the mass-balance analysis for total phosphorus showed greater variability between the estimated (presented as stacked bars in Figure 3.3 to show the contribution of each source) and observed loads (presented as horizontal bars in Figure 3.3) at LC_LC3 during AWTF steady-state operation than during AWTF flow reduction, shutdown, and restart with AOP. This variability was consistent with results of the previous mass-balance for both chloride and phosphorus, and may indicate that the AWTF was not operating at steady-state throughout the time period indicated, or that flow and/or concentrations fluctuate and the sampling frequency does not adequately capture these fluctuations (Teck 2017).

As outlined above, the purpose of the mass-balance analysis was to assess the relative influence of the AWTF on nutrient loads downstream. Analysis results indicated the AWTF was a primary source of total phosphorus load to LC_LC3 during only a few months of steady-state operation (July, September, and December 2016, and February 2017; range = 51.1 to 60.9%; Appendix Table A.1), and had an average contribution of 31.7% of the total load during steady-state operation (range = 5.7 to 61.5%), and 14.7% and 15.5% during flow reduction and AWTF with AOP restart, respectively (Figure 3.3; Appendix Table A.1). The similarity between estimated and observed loads during AWTF flow reduction, shutdown, and restart at LC_LC3 and LC_LCDSSLCC (with the exception of May 2018) suggested that phosphorus was conserved (e.g., was not consumed or lost; Figure 3.3). For the Compliance Point (LC_LCDSSLCC), the mass-balance results also showed similarity between the estimated and observed loads during flow reduction and shutdown AWTF phases (with the exception of May 2018; Figure 3.3).

Orthophosphate concentrations at all monitoring locations during the AWTF shutdown in 2018 were also within the range of results reported prior to AWTF operation (2012 to 2015) but increased during the AWTF with AOP restart (Figure 3.4; Appendix Figure A.2). Similar to total phosphorus, mass-balance results for orthophosphate showed greater variability between estimated and observed loads at LC_LC3 during AWTF steady-state operation compared to the flow reduction, shutdown, and restart with AOP AWTF phases (Figure 3.5). Loads at LC_LC3 during May and June (during AWTF shutdown) and December 2018 (during AWTF with AOP restart) were under-estimated, indicating that the assumed inputs did not best represent the conditions during those time periods. Orthophosphate loads from the AWTF were generally not the primary source to LC_LC3, with the exception of November 2016 when the AWTF contributed 50.8% of the orthophosphate load (Figure 3.5; Appendix Table A.2). The average contribution of the AWTF to the total load at LC_LC3 was 17.4% during steady-state operation, and was negative (-1.7% and -2.5%) during the flow reduction and AWTF with AOP restart phases, respectively

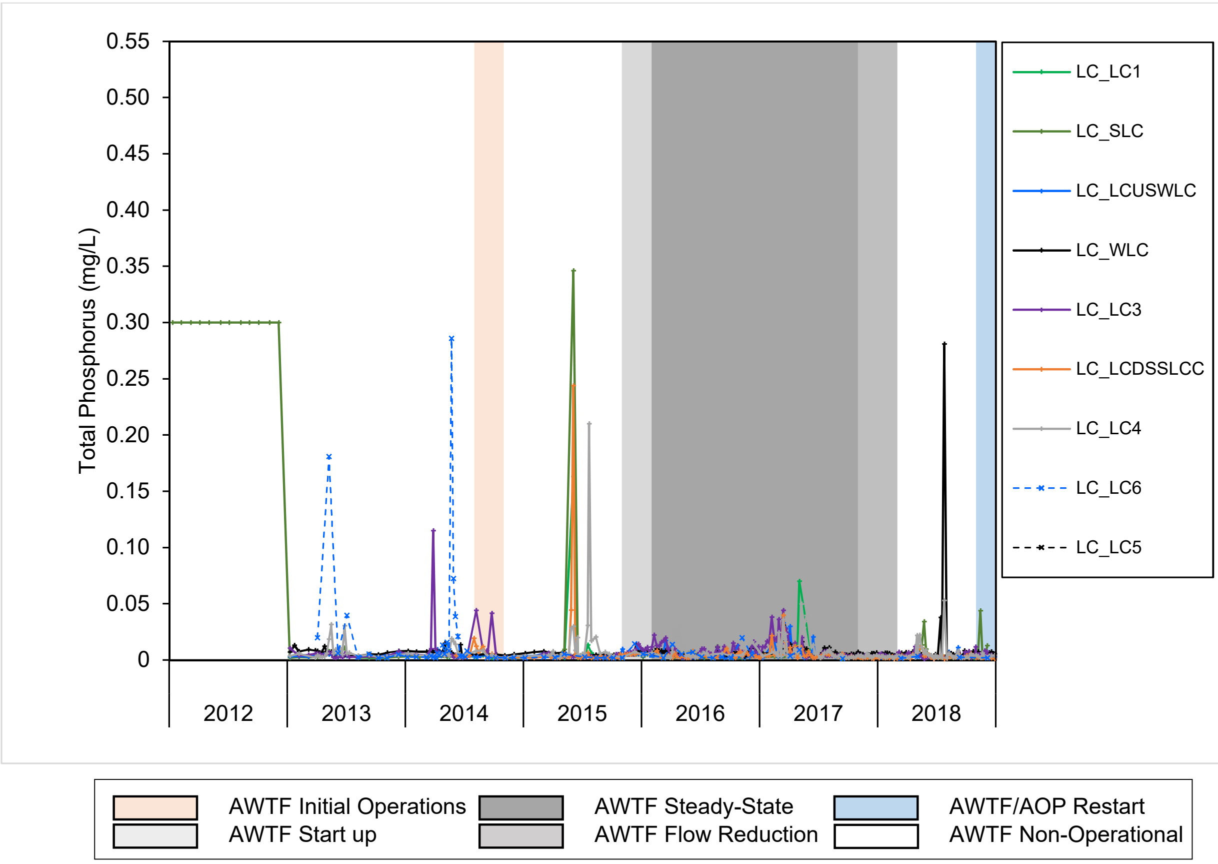


Figure 3.2: Time Series Plots for Aqueous Total Phosphorus from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.001 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

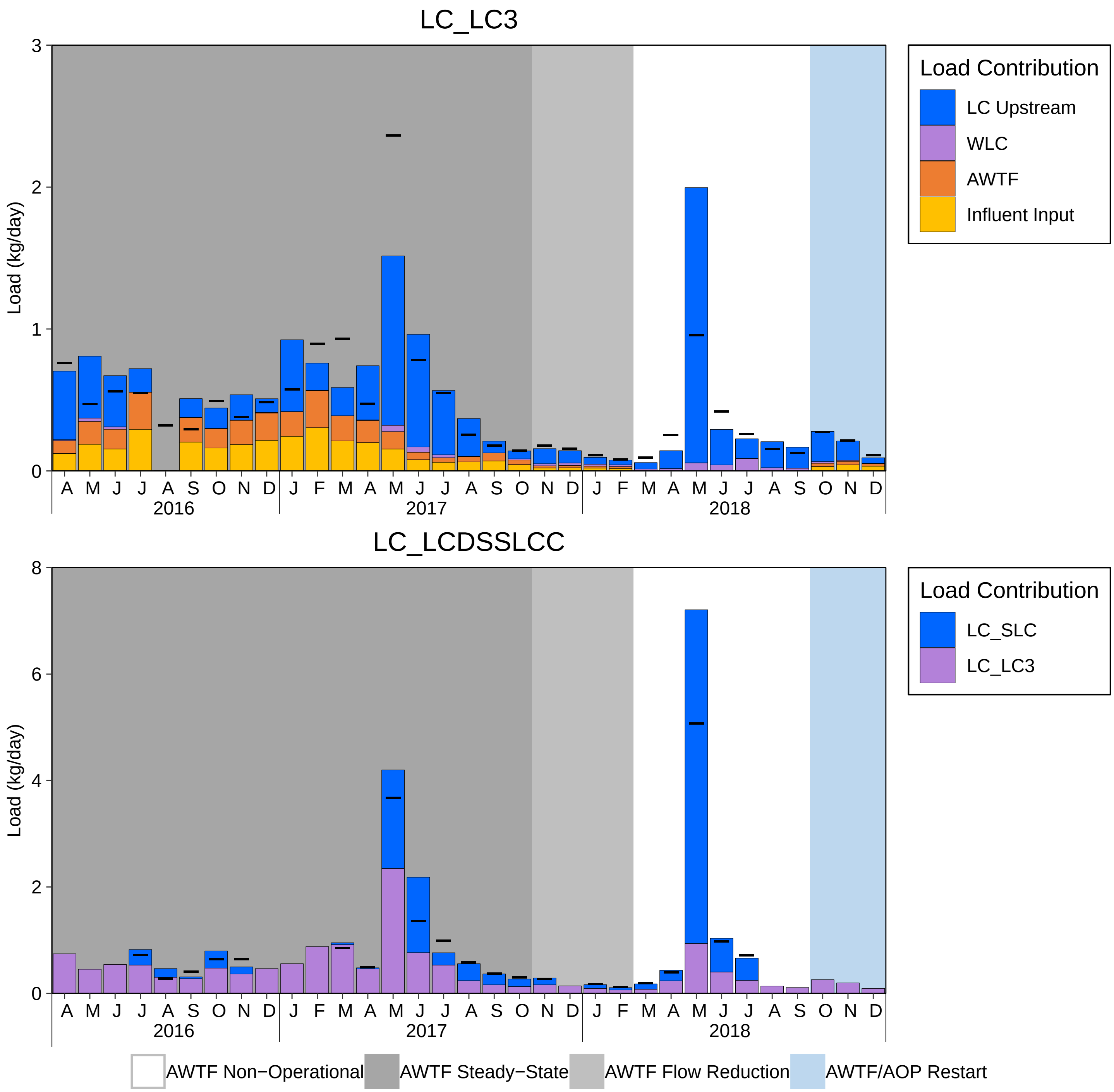


Figure 3.3: Monthly Mean Total hosphorus Estimated and Observed Loads at LC_LC3 and LC_LCDSSLCC in Line Creek, 2016 to 2018

Notes: Stacked bars indicate load contributions from the identified sources. Dashes indicate observed loads at LC_LC3 and LC_LCDSSLCC. LC = Load contributed by Line Creek upstream of the AWTF influent intake (i.e. load not diverted to the AWTF for treatment); WLC = Load contributed by West Line Creek directly to Line Creek (i.e., load not diverted to the AWTF for treatment); Residual Influent Input = Load that originated from WLC or LC, but was not removed as part of the AWTF treatment; AWTF = Load contributed by the WLC AWTF; LC_SLC = Load contributed by South Line Creek; LC_LC3 = Total load contributed from LC_LC3 to LC_LCLSSLCC. Total phosphorus data were not available for August 2016. Analysis excluded one anomalous result (0.281 mg/L) reported for LC_WLC on July 24, 2018.

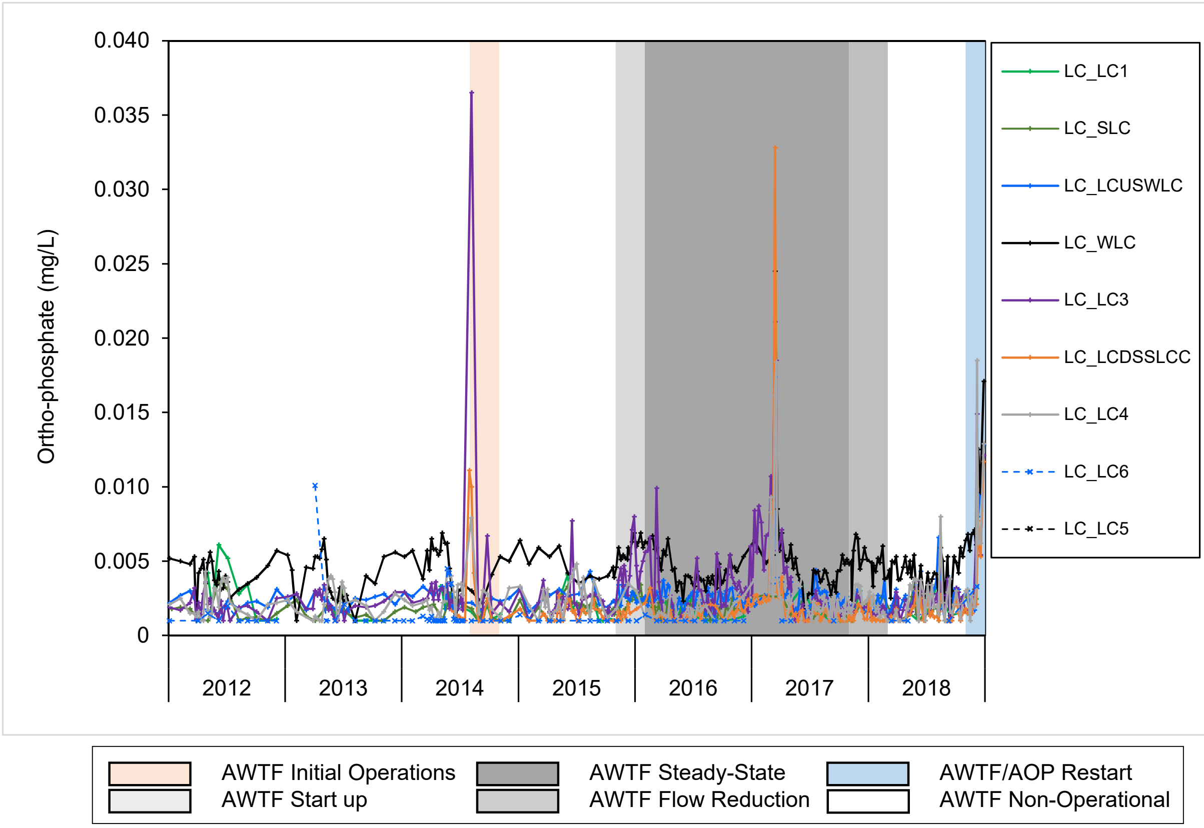


Figure 3.4: Time Series Plots for Aqueous Total Orthophosphate from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.001 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

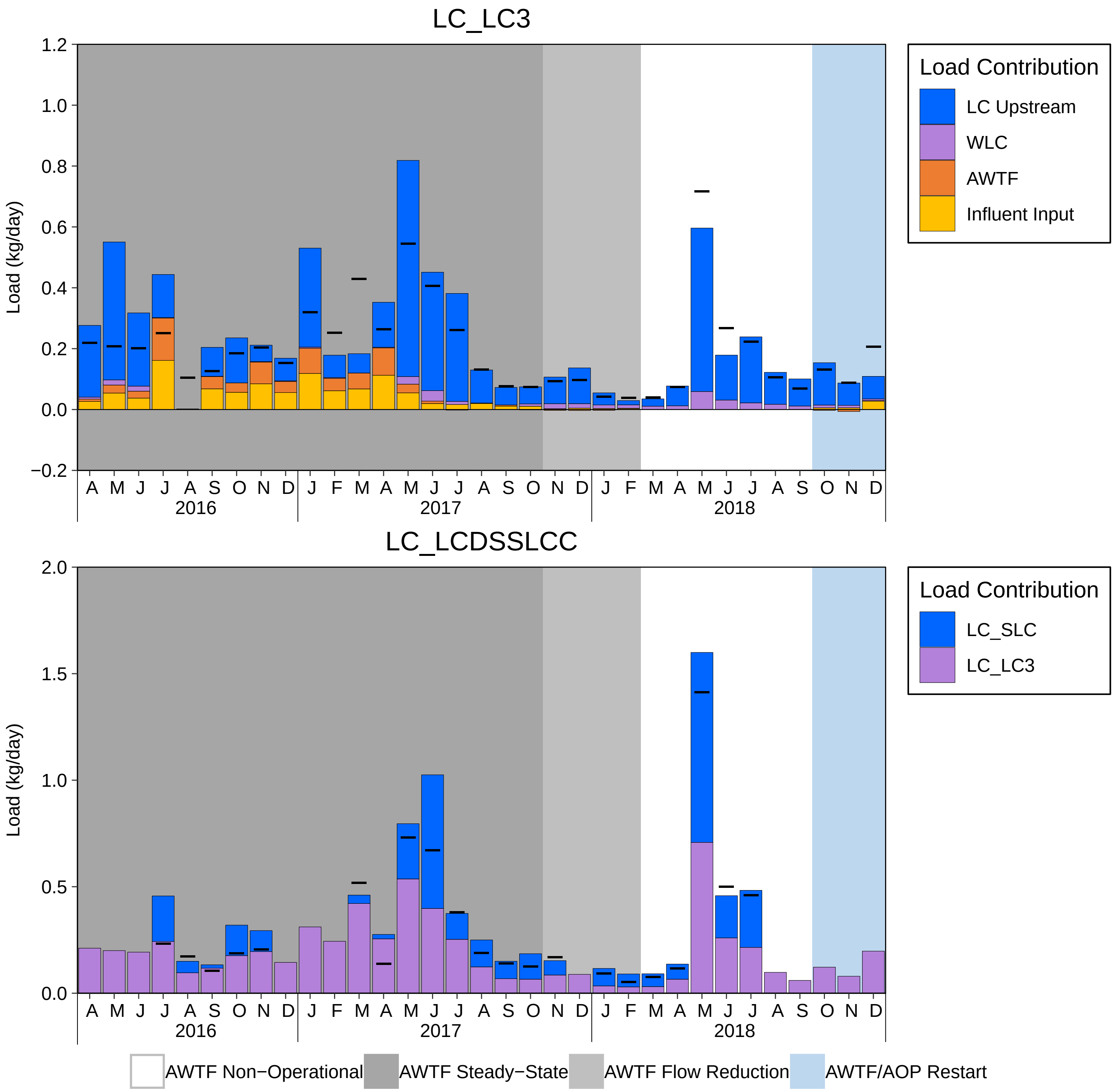


Figure 3.55: Monthly Mean Orthophosphate Estimated and Observed Loads at LC_LC3 and LC_LCDSSLCC in Line Creek, 2016 to 2018

Notes: Stacked bars indicate load contributions from the identified sources. Dashes indicate observed loads at LC_LC3 and LC_LCDSSLCC. LC = Load contributed by Line Creek upstream of the AWTF influent intake (i.e. load not diverted to the AWTF for treatment); WLC = Load contributed by West Line Creek directly to Line Creek (i.e., load not diverted to the AWTF for treatment); Residual Influent Input = Load that originated from WLC or LC, but was not removed as part of the AWTF treatment; AWTF = Load contributed by the WLC AWTF; LC_SLC = Load contributed by South Line Creek; LC_LC3 = Total load contributed from LC_LC3 to LC_LCLSSLCC.

(Figure 3.5; Appendix Table A.2). The negative AWTF contributions may be a result of conversion between forms of phosphorus in the system. As observed for total phosphorus, mass-balance results for the Compliance Point also showed similarity between the estimated and observed loads during flow reduction and shutdown AWTF phases (with the exception of May 2018; Figure 3.5)

Total phosphorus and orthophosphate concentrations were further evaluated using an approach recommended in the Proposal to Update the Site Performance Objective for Phosphorus in Line Creek (Minnow 2017b[14]) that might allow for early detection of potential changes in concentrations of these aqueous nutrients downstream of the AWTF. The evaluation involved the comparison of monthly mean total phosphorus and orthophosphate concentrations to the upper range (97.5th percentile) of concentrations observed in each month during the baseline (pre-AWTF) period at LC_LC3 (upper panels in Figures 3.6 and 3.7). Monthly mean concentrations were then expressed as a ratio of the baseline 97.5th percentile for each month (bottom panels in Figures 3.6 and 3.7).

Total phosphorus concentrations at LC_LC3 were generally below the baseline 97.5th percentiles during flow reduction, shutdown, and AWTF with AOP restart operational phases of the AWTF in 2018 (Figure 3.6). Orthophosphate concentrations at LC_LC3 in 2018 were similarly below the baseline 97.5th percentiles throughout the year, with the exception of one sampling event during the AWTF with AOP restart phase (Figure 3.7). These results are in contrast to the total phosphorus and orthophosphate concentrations during steady-state operation of the AWTF (in 2016 and 2017) that were greater than the baseline 97.5th percentiles at LC_LC3, although total phosphorus at the Compliance Point remained below the SPO throughout (Figure 3.1, see above). As outlined above, it was anticipated that aqueous phosphorus concentrations at LC_LC3 during shutdown of the AWTF in 2018 would be lower than during steady-state operation because phosphorus is only added when the AWTF is in operation.

Aqueous nitrate concentrations at all monitoring locations in 2018 were within the range of results reported prior to AWTF steady-state operation (2012 to 2015), including during AWTF with AOP restart at the end of 2018 (Figure 3.8; Appendix Figure A.3). Nitrate concentrations at Line Creek mine-exposed monitoring stations both upstream and downstream of the AWTF discharge were above the long-term BCWQG and the Level 1 benchmark in 2018, and also above the Level 2 benchmark at stations closest to the mine operations (i.e., those upstream of LC_LCDSSLCC; Appendix Table C.1; Appendix Figure A.3).

[14] Included as Appendix C in Minnow (2017b).

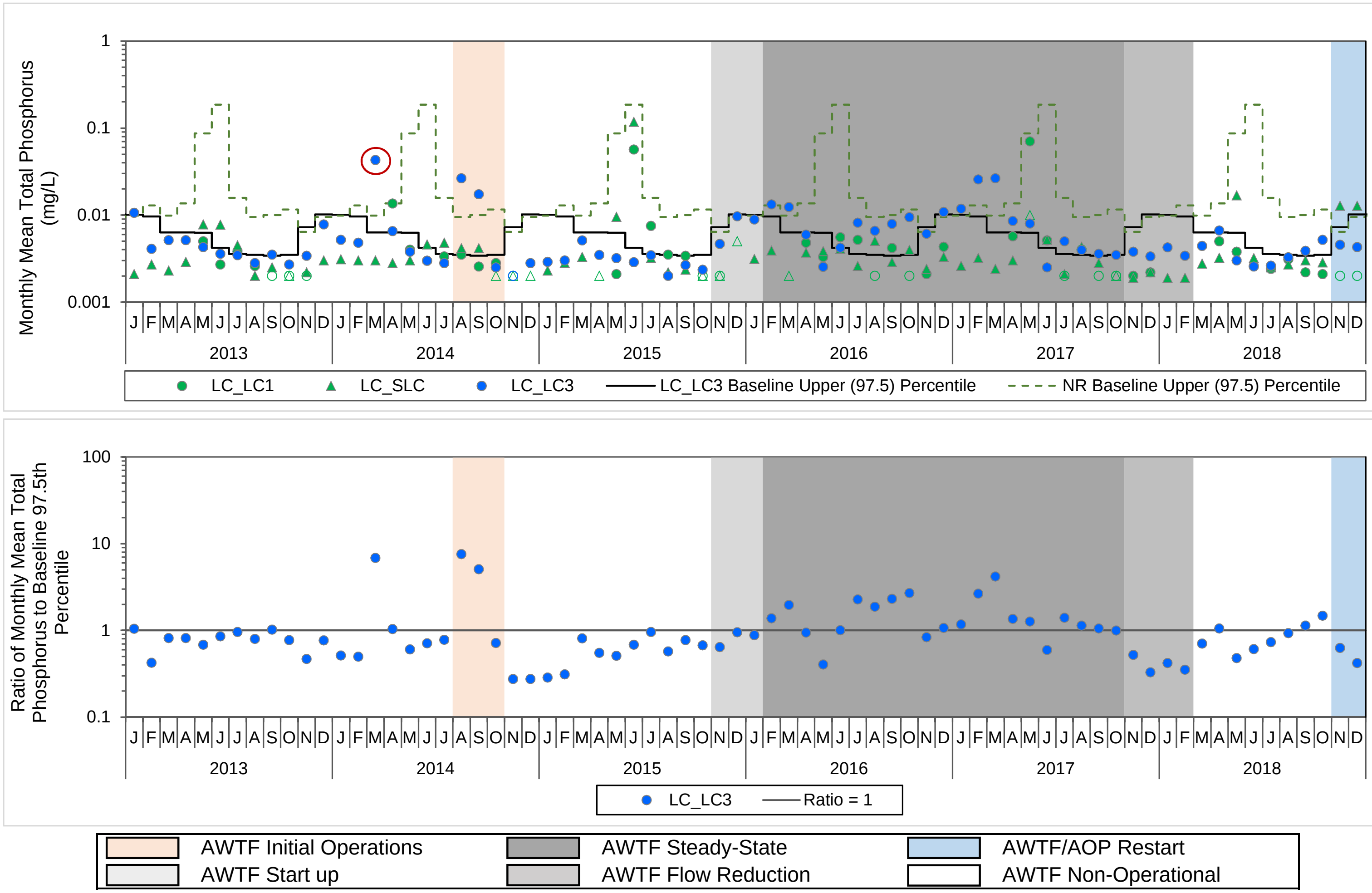


Figure 3.6: Total Phosphorus at LC_LC3 During AWTF Operation Relative to Pre-Operational Baseline Concentrations

Notes: Top panel shows monthly mean concentrations at LC_LC3 and reference stations relative to the monthly percentiles for the baseline period prior to AWTF operation. The data used to define the baseline 97.5th percentile for each month were concentrations for the specified month, the preceding month and the following month for unshaded months prior to 2018 shown in panels. The normal range (NR) was calculated from the 97.5 percentile in the RAEMP (Minnow, 2018a). Concentrations less than the laboratory reporting limit (LRL) are shown as hollow symbols at the LRL. Red circle indicates outlier excluded from the calculation of baseline percentile. Bottom panel presents the ratio of monthly mean concentrations at LC_LC3 relative to the baseline 97.5th percentile for the corresponding month.

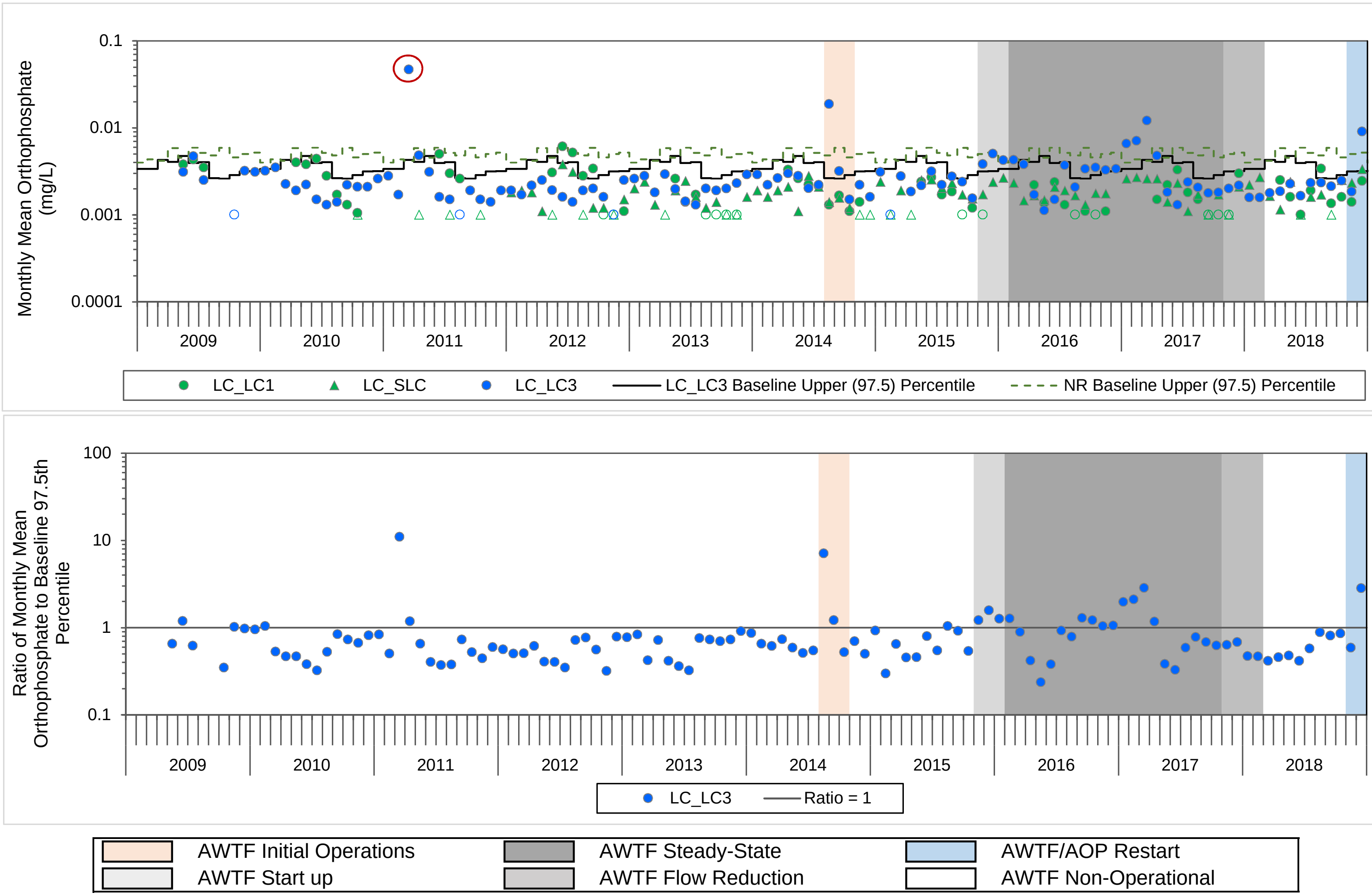


Figure 3.7: Orthophosphate at LC_LC3 During AWTF Operation Relative to Pre-Operational Baseline Concentrations

Notes: Top panel shows monthly mean concentrations at LC_LC3 and reference stations relative to the monthly percentiles for the baseline period prior to AWTF operation. The data used to define the baseline 97.5th percentile for each month were concentrations for the specified month, the preceding month and the following month for unshaded months prior to 2018 shown in panels. The normal range (NR) was calculated from the 97.5 percentile in the RAEMP (Minnow, 2018a). Concentrations less than the laboratory reporting limit (LRL) are shown as hollow symbols at the LRL. Red circle indicates outlier excluded from the calculation of baseline percentile. Bottom panel presents the ratio of monthly mean concentrations at LC_LC3 relative to the baseline 97.5th percentile for the corresponding month.

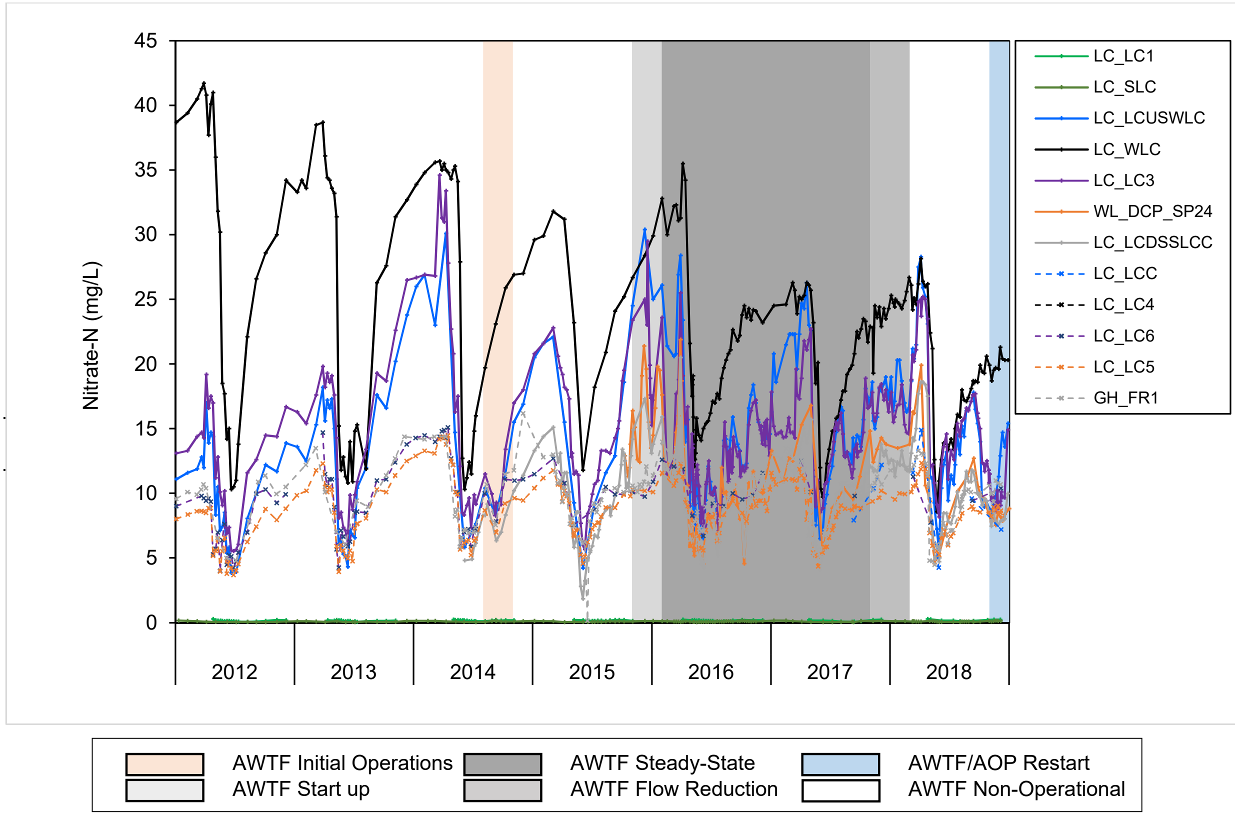


Figure 3.8: Time Series Plots for Aqueous Nitrate-N from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.005 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Nitrate loads at LC_LC3 estimated by the mass-balance were generally similar to observed loads (with the exception of May and June in 2017 and 2018; Figure 3.9), indicating that system inputs were accurately represented by the model. As outlined in Section 1.2, the AWTF removes nitrate when in operation. On average, the AWTF removed 11.9% of the total nitrate load at LC_LC3 during steady-state operation (2016 and 2017; range = 1.5 to 25.1%), and an average of 9.4% and 15.4% of the total load during flow-reduction (November 2017 to March 2018) and AWTF with AOP restart, respectively (October to December 2018; Figure 3.9; Appendix Table A.3). The observed nitrate loads at the Compliance Point (LC_LCDSSLCC) were consistently above the estimated loads throughout the time period evaluated (2016 to 2018), indicating a potential source of nitrate to the system that was not accounted for by the model inputs (Figure 3.9). As outlined in Section 2.7.2, limitations of the mass balance analysis include the availability of flow and water chemistry data, and assumptions about the conservation of parameters in the system. Teck is planning further investigations into water availability in Line Creek and West line creek to support siting and design of planned AWTF intakes to ensure water quality targets are met at the Line creek Compliance Point, as per Teck (2019).

3.3 Primary Productivity Indicators

Periphyton coverage was moderate at both mine-exposed and reference areas in 2018 (Appendix Figure A.4, Appendix Table A.4), with the majority of visual scores between 2 and 3 (of a possible range from 1 [rocks not slippery and no obvious colour] to 5 [rocks mostly obscured by algae]). These results are consistent with periphyton coverage observations in 2017, indicating temporal consistency.

3.4 Secondary Productivity Indicators

ANOVA analyses of benthic invertebrate biomass and density (based on Hess sampling, 2014 to 2018) were performed excluding two outlying values for the reference area RG_SLINE; one in 2017 and one in 2018 (Figure 3.10; see Section 2.7.3 for data analysis methods, including outlier removal). Results of these analyses showed no significant changes in the difference in biomass between the mine-exposed areas (RG_LILC3 and RG_LIDSL) and reference areas among years (Figure 3.10; Appendix Table A.5). Benthic invertebrate density at the mine-exposed areas was similar among years when compared to the change at RG_LI24, but differed significantly among years when compared to RG_SLINE (Figure 3.11; Appendix Table A.6; Appendix Figure A.5). Specifically, the differences relative to RG_SLINE were smaller in 2018 (6.7 and 2.3 fold higher at RG_LILC3 and RG_LIDSL, respectively) compared to 2014 (19.8 and 5.5 fold higher at RG_LILC3 and RG_LIDSL, respectively; Figure 3.11; Table 3.1; Appendix Table A.6; Appendix Figure A.5). This appeared to be related to an increase in mean densities at RG_SLINE rather than a decrease at the mine-exposed areas (Figure 3.11; Table 3.1).

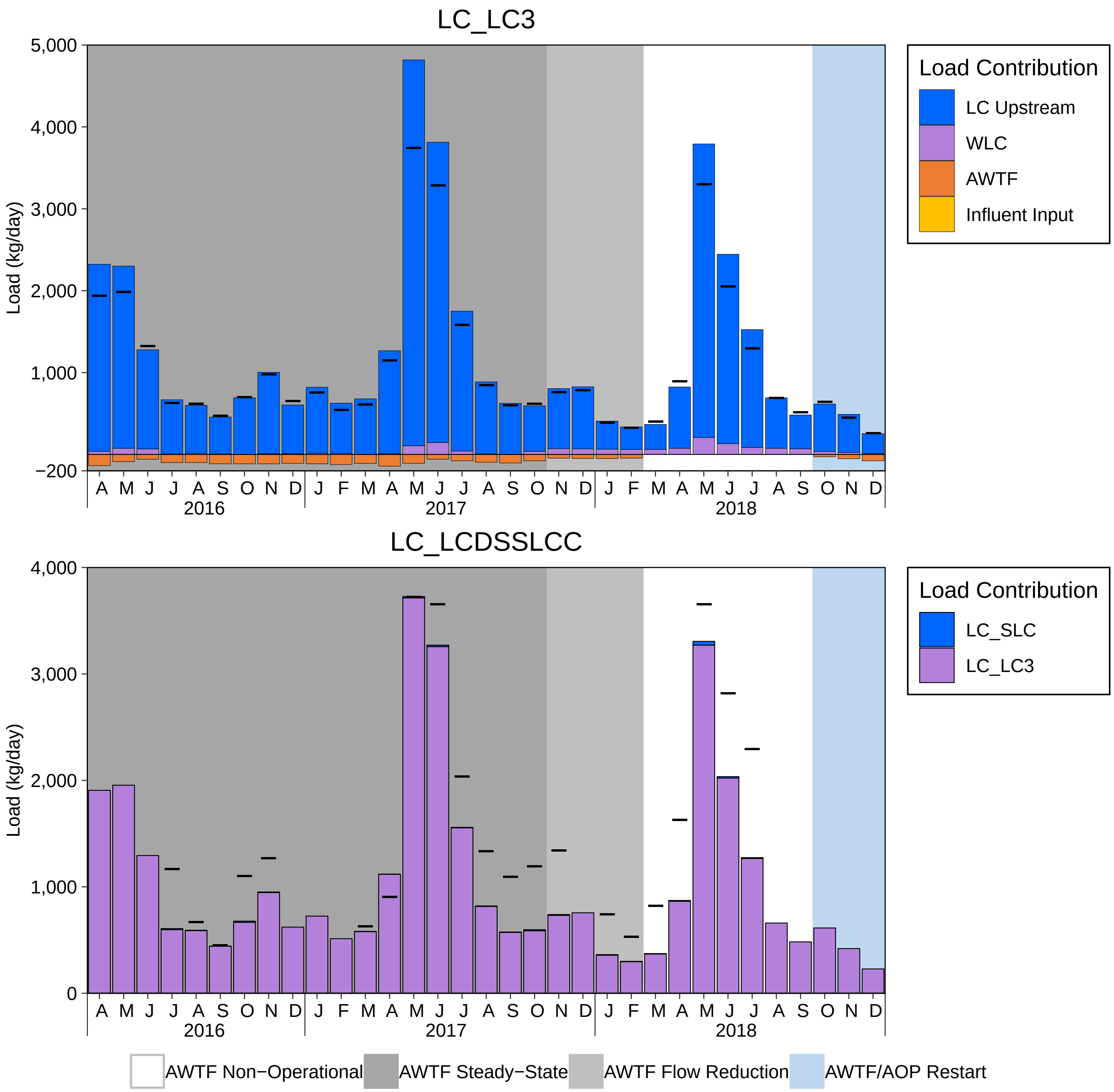


Figure 3.9: Monthly Mean Nitrate (as N) Estimated and Observed Loads at LC_LC3 and LC_LCDSSLCC in Line Creek, 2016 to 2018

Notes: Stacked bars indicate load contributions from the identified sources. Dashes indicate observed loads at LC_LC3 and LC_LCDSSLCC. LC = Load contributed by Line Creek upstream of the AWTF influent intake (i.e. load not diverted to the AWTF for treatment); WLC = Load contributed by West Line Creek directly to Line Creek (i.e., load not diverted to the AWTF for treatment); Residual Influent Input = Load that originated from WLC or LC, but was not removed as part of the AWTF treatment; AWTF = Load contributed by the WLC AWTF; LC_SLC = Load contributed by South Line Creek; LC_LC3 = Total load contributed from LC_LC3 to LC_LCLSSLCC.

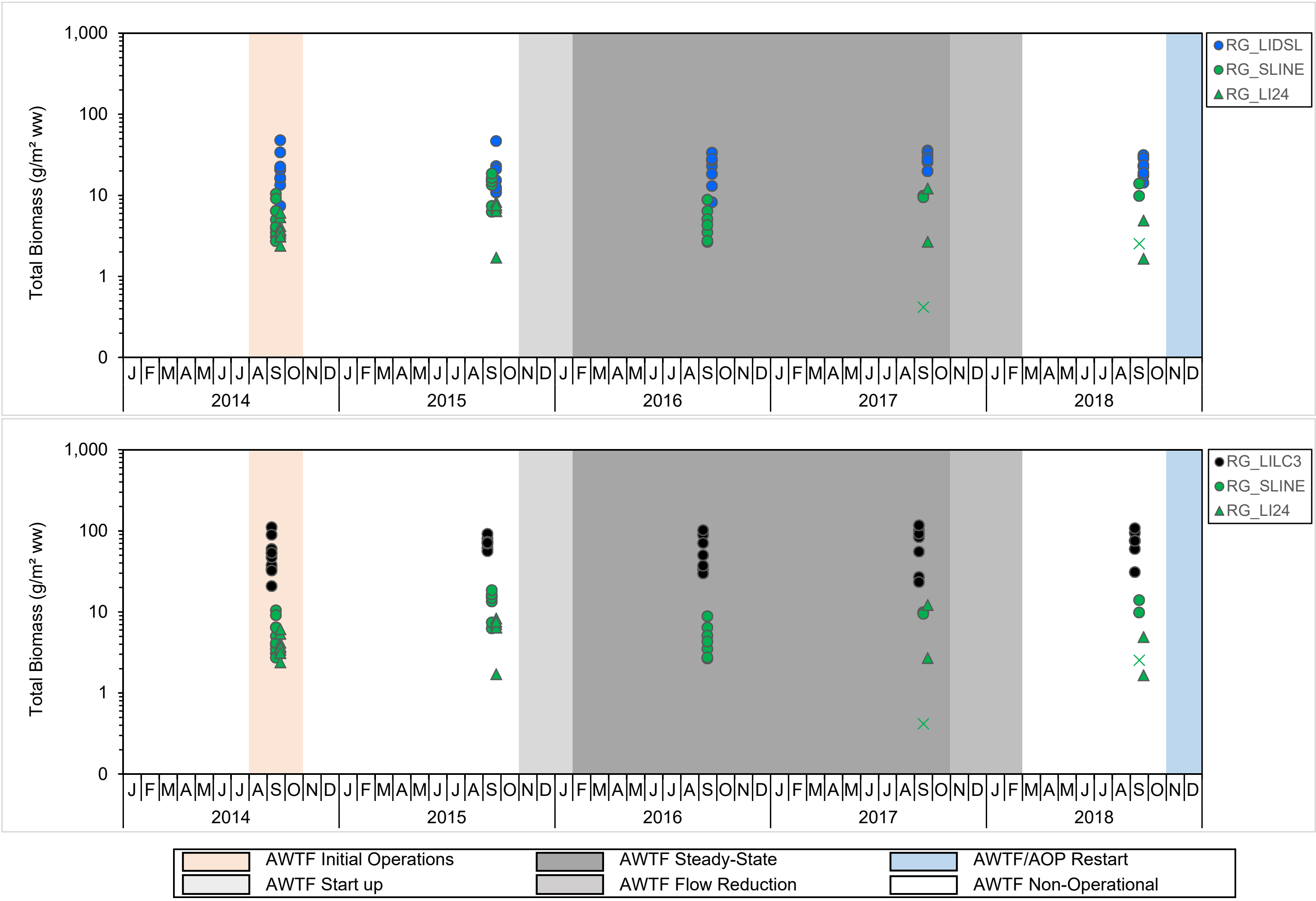


Figure 3.10: Total Benthic Invertebrate Biomass (Hess Sampling), for RG_LIDSL and RG_LILC3 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2018

Notes: Two outliers from RG_SLINE were removed from the statistical analyses and are plotted with the × symbol. The sampling dates for RG_SLINE and RG_LI24 are shifted slightly to show overlapping points.

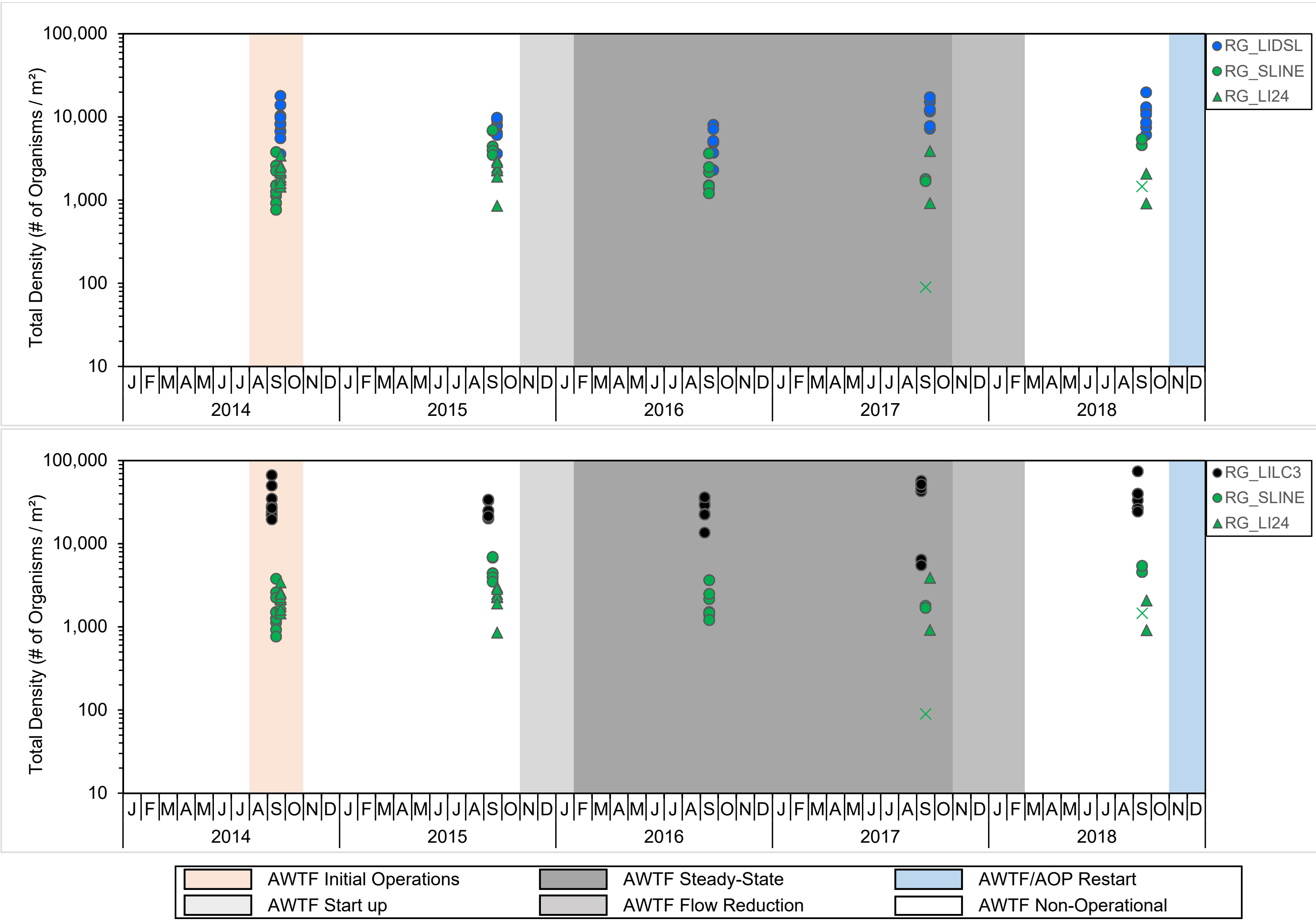


Figure 3.11: Total Benthic Invertebrate Density (Hess Sampling), for RG_LIDSL and RG_LILC3 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2018

Notes: Two outliers from SLINE were removed from the statistical analyses and are plotted with the × symbol. The sampling dates for RG_SLINE and RG_LI24 are shifted slightly to show overlapping points.

Table 3.1: Geometric Means of Benthic Invertebrate Density for Hess Sampling in Areas of Line Creek, 2014 to 2018

Area	Benthic Density (# organisms/m²)				
	Brief AWTF Operation	No AWTF Operation	AWTF Steady-State Operation		AWTF Shtudown
	2014	2015	2016	2017	2018
RG_LI24	2,120	2,028	-	1,723	1,933
RG_SLINE	1,508	4,300	2,072	1,072	5,062
RG_SLINE [a]	1,508	4,300	2,072	1,993	5,062
RG_LILC3	29,805	24,136	24,564	27,162	34,153
RG_LIDSL	8,276	7,690	5,024	9,910	11,452

Note: "-" = no data/not recorded.
[a] One outlier removed in 2017 and 2018.

Benthic invertebrate abundance in kick and sweep samples was above the regional normal range (>97.5th percentile) for one of three kick samples from RG_LILC3 in 2018, but within the range of observations for that area in previous years (Appendix Figure A.6). Kick sample abundance was also above the normal range for the single sample collected further downstream at RG_LIDCOM, and for all three kick samples collected at RG_LI8 (the furthest downstream sampling area in Line Creek; Appendix Figure A.6). Total abundance at RG_LI8 was higher than in the majority of previous sampling years, but the absence of similarly elevated abundance results closer to the AWTF discharge, and the fact that the AWTF was not operational for 6 months prior to (or during) sampling, indicates this is unlikely related to an AWTF influence.

In summary, monitoring data indicate that secondary productivity in Line Creek was not affected by changes in the AWTF operational status in 2018. This is not unexpected given that the AWTF was not operational for the majority (8 months) of the year.

3.5 Benthic Invertebrate Community Structure

Endpoints related to benthic invertebrate community structure were evaluated relative to normal (regional reference area) ranges defined in the RAEMP (Minnow 2018a) for samples collected by the CABIN kick and sweep method. LPL-level community richness (i.e., number of different taxa identified to lowest practical level of identification) was within the normal range at all sampling areas in 2018, with the exception of one replicate at RG_LILC3 (the sampling area closest downstream of the AWTF discharge; Appendix Figure A.7). Although within the normal range, richness at both RG_LILC3 and RG_LIDSL in 2018 was more similar to richness documented in 2012 and 2013 (prior to AWTF operation) than in more recent sampling years (2016 to 2017, when the AWTF was in steady-state operation). Percent Ephemeroptera (mayflies) values were lower than the reference area normal range at the majority of mine-exposed areas in 2018, but values for both % Ephemeroptera and % EPT (mayflies, stoneflies, and caddisflies) in 2018 were within ranges observed in previous years (Appendix Figures A.8 and A.9). Chironomids typically represent 27% or less of benthic invertebrate communities sampled in riffle habitats of the Elk Valley but are sometimes found in greater relative abundance in areas that are heavily disturbed by mining or have naturally soft substrates (Minnow 2018a). Chironomid proportions were elevated at areas immediately upstream (RG_LCUT) and downstream from the AWTF (particularly RG_LILC3, RG_LISP24, and RG_LIDSL: Appendix Figure A.10). At RG_LILC3 and RG_LIDSL, chironomid proportions were slightly higher in 2018 than in previous years (Appendix Figure A.10).

3.6 Potential Relationships Between Benthic Invertebrate Productivity and Abundance

Relationships between benthic invertebrate productivity (measured as biomass and density by Hess sampling) and total abundance (measured by kick sampling) were explored to evaluate whether kick sampling could be considered for use in secondary productivity monitoring. Mean biomass and density from 2014 to 2018 at Line Creek were both significantly positively related to total abundance ($p < 0.05$; Figures 3.12 and 3.13). Although biomass and density are area-based measures (per m^2) and total abundance is based on sampling time (3-minute kick), the significant positive relationships between these parameters indicates that further investigation into the use of total abundance (kick-sampling) for secondary productivity monitoring is warranted. Continued replicate Hess and kick-sampling has been recommended in the 2019 Line Creek study design (Minnow 2019) to allow for further evaluation of this relationship.

3.7 Summary

Total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC) were below the SPO of 0.02 mg/L during the 2018 growing season (June 15 to September 30), consistent with previous years. Aqueous nutrient concentrations (total phosphorus, orthophosphate, and nitrate) in 2018 were generally within the range observed prior to AWTF operation, although orthophosphate increased at the end of 2018 during AWTF with AOP restart. Mass-balance analysis indicated that the AWTF was generally not the primary contributor of total phosphorus or orthophosphate loads to the downstream environment during operations (steady-state, flow reduction, or ATF with AOP restart). During steady-state operation, the AWTF removed approximately 11.9% of the total nitrate load from effluent on average.

Periphyton coverage at both mine-exposed and reference areas was moderate in 2018 (based on visual assessment) and showed temporal consistency with results from 2017. Benthic

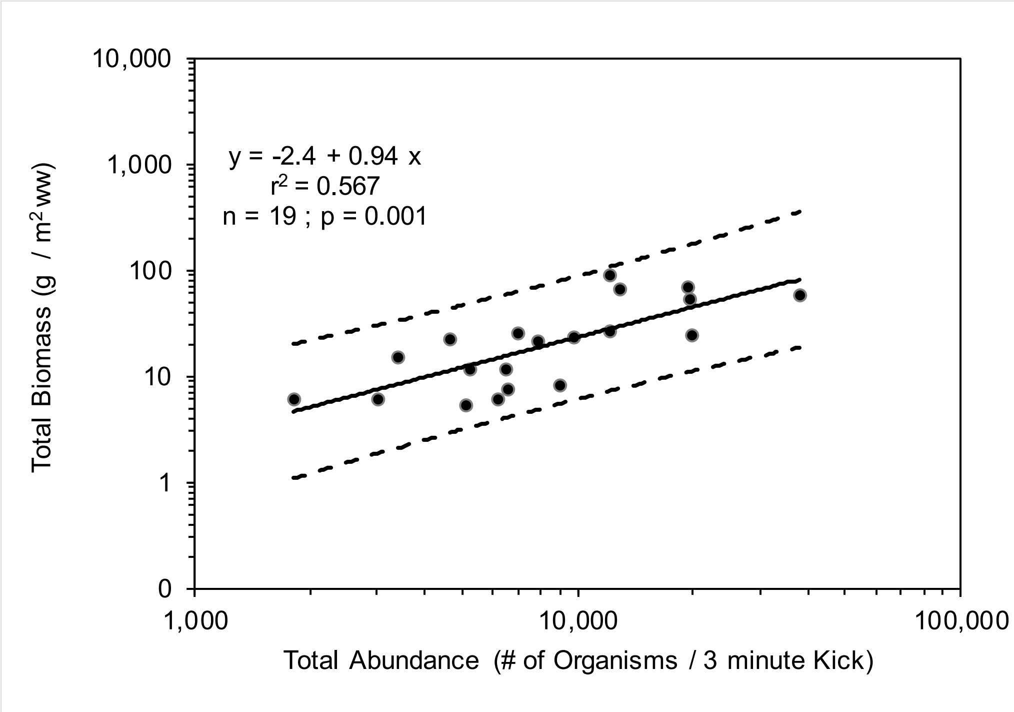


Figure 3.12: Simple Linear Regression Model for Mean Benthic Invertebrate Total Biomass (g/m2 wet weight; Hess Samples) Values Relative to Single Total Abundance (per 3-minute Kick Sample) Values for Line Creek LAEMP Areas, 2014 to 2018

Notes: If replicate total abundance results were available, these were used in the regression model as mean values. Solid and dashed black lines denote the regression line and 95 % prediction limits from the linear regression, respectively.

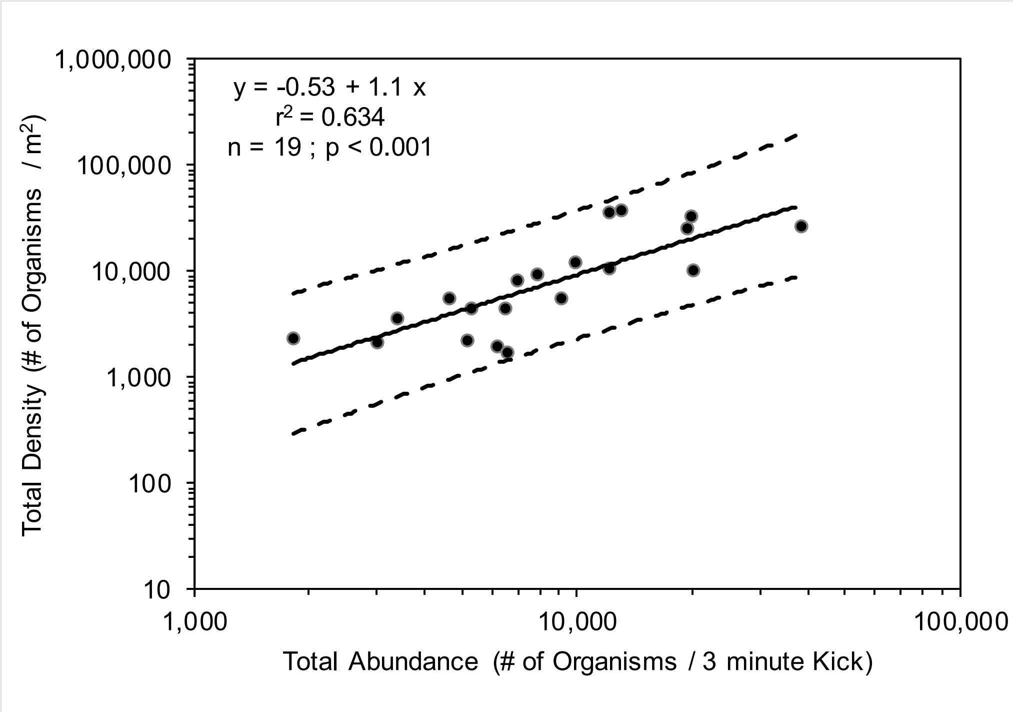


Figure 3.13: Simple Linear Regression Model for Mean Benthic Invertebrate Total Density (per m2; Hess Samples) Values Relative to Single Total Abundance (per 3-minute Kick Sample) Values for Line Creek LAEMP Areas, 2014 to 2018

Notes: If replicate total abundance results were available, these were used in the regression model as mean values. Solid and dashed black lines denote the regression line and 95 % prediction limits from the linear regression, respectively.

invertebrate biomass and density at mine-exposed areas of Line Creek also showed no significant change ($p>0.1$) among years related to changes in the AWTF operational status. Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, generally indicated no change in community characteristics related to changes in the AWTF operational status, other than possibly a small increase in larval chironomid (midge) proportions and a decrease in taxonomic richness in 2018 at sampling areas immediately downstream from the AWTF outfall. Significant positive relationships between both biomass and density (measured by Hess sampling) and total abundance (measured by kick-sampling) indicated that further investigation into the potential use of kick sampling for secondary productivity monitoring is warranted.

Overall, biological productivity downstream from the WLC AWTF did not change in 2018 (when the AWTF was not operational for 8 months of the year), and productivity was not affected by AWTF operational status changes that have occurred between 2014 and 2018.

4 SELENIUM CONCENTRATIONS

4.1 Overview

Monitoring data are evaluated in this section to address Study Question #2: Are tissue selenium concentrations reduced downstream from the WLC AWTF?

4.2 Historical Composite-Taxa Benthic Invertebrate Selenium Concentrations

Composite-taxa benthic invertebrate tissue selenium concentrations were slightly greater downstream of the AWTF (e.g., RG_LILC3 and RG_LIDSL) in September 2014, following approximately 6 weeks of initial AWTF operations (Table 4.1; Figure 4.1). Operation of the AWTF ceased in October 2014, and a slight decrease in tissue selenium concentrations was noted in September 2015, after about 11 months without AWTF operation (Table 1.1; Table 4.1; Figure 4.1). AWTF discharge resumed October 26, 2015 and treatment operations were stabilized by the end of January 2016 (Table 1.1). In September 2016, after about 9 months of steady-state operation, tissue selenium concentrations appeared to be higher downstream from the AWTF than had been previously observed (particularly at RG_LILC3; Table 4.1; Figure 4.1).

Following receipt of tissue selenium data in 2016, Teck identified challenges in the performance of the WLC AWTF with respect to selenium. Although treatment was successfully reducing total selenium concentrations in Line Creek, it had become apparent that some of the remaining selenium in the effluent was in chemical forms having potentially greater bioavailability to aquatic biota than selenate, which is the dominant form in the influent and other areas of the watershed (Minnow 2017a).

Greater within-area sample replication was initiated in early 2017 (Figure 4.1; Table 4.1; Minnow 2017a), and evaluation of data until late 2017 (September) confirmed that selenium concentrations in benthic invertebrates were significantly elevated at mine-exposed areas in Line Creek when the AWTF was in steady-state operation (2016 to 2017) relative to historical levels, when compared to the change at reference areas over the same time (Minnow 2018d). In response to these increased benthic invertebrate selenium concentrations, Teck reduced effluent flow through the WLC AWTF (“AWTF flow reduction”) in advance of receiving authorization to temporarily suspend AWTF operations (“AWTF shutdown”; see Section 1.3; Table 1.1). During the shutdown period, the AWTF was recommissioned with an AOP (“AWTF/AOP restart”), a process designed to reverse the shift in selenium species in AWTF effluent from chemically-reduced species back to a selenate-dominated condition, and thereby decreasing bioavailability (see Section 1.3). Discharge to the receiving environment from the AWTF with AOP began on October 29, 2018 (“AWTF/AOP Restart”; Table 1.1).

Table 4.1: Mean[a] Selenium Concentrations (mg/kg dw) in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, 2006 to 2019

Area		Biological Area Code	Biological Area Description	Teck Water Station Code	Prior to AWTF Operation									Initial AWTF Operation (July 24 to Oct 16, 2014	No AWTF Operation (Oct 17, 2014 to Oct 26, 2015)	AWTF Steady State Operation (Jan 31, 2016 to Oct 15, 2017)				AWTF Flow Reduction (Oct 16, 2017 to Mar 7, 2018)		After AWTF Shutdown (Mar 8, 2018 to Aug 29, 2018)				Before AWTF Discharge Resumed with AOP (Aug 30 to Oct 28, 2018)	After AWTF/AOP Discharge Resumed (Oct 29 to Dec 28, 2018)	After AWTF/AOP Operations Stabilize (Dec 29, 2018 to present)
					2006 (August)	2009 (May/ June)	2009 (August/ September)	2010 (May)	2010 (August)	2011 (August)	2012 (September)	2013 (July)	2014 (July)	2014 (September)	2015 (September)	2016 (September)	2017 (February/ March)	2017 (April)	2017 (September)	2017 (November) 3 weeks	2017 (December) 7 weeks	2018 (Mar 8 - 11) 0 weeks	2018 (Apr 3 - 5) 4 weeks	2018 (Apr 30 - May 4) 8 weeks	2018 (May 28 - 29) 12 weeks	2018 (September 6 -13) 26 weeks	2018 (December 3-6) 5 weeks	2019 (January 14-17) 11 weeks
Sample Size (n)					1	1	1	3	1	1	1	1	1	1	1	1	5	10	10	10	10	10	10	10	10	10	10	10
Line Creek	Reference	RG_LI24	South fork of upper Line Creek (Tornado Creek) upstream of LCO and Teck water station LC_LC1	LC_LC1	1.4	4.4	-	-	-	-	5.1	-	-	4.0	5.3	3.8	-	-	5.2	-	-	(frozen)	-	13	-	7.0	5.6	(frozen)
Line Creek	Reference	RG_SLINE	South Line Creek upstream of Line Creek and LCO	LC_SLC	-	-	-	-	-	-	4.8	-	-	6.0	3.9	4.1	-	4.1	4.8	-	-	5.2	-	5.7	-	6.6	4.3	4.0
Line Creek	Mine-exposed	RG_LCUT	Line Creek downstream of rock drain, downstream of West Line Creek and upstream of AWTF outfall	LC_LCUSWLC/ LC_WLC	-	-	-	-	-	-	-	-	-	-	-	6.2	5.0	6.4	5.9	6.7	6.9	6.3	7.0	7.6	7.5	7.9	6.5	6.1[b]
Line Creek	Mine-exposed	RG_LILC3	Line Creek downstream of West Line Creek and AWTF outfall	LC_LC3	-	-	-	-	-	-	7.0	-	-	17	13	35	27	37	24	26	27	14	19	18	15	10	8.2	8.5
Line Creek	Mine-exposed	RG_LISP23	Line Creek downstream of LC_WTF_OUT, downstream of confluence with South Line Creek, upstream of contingency pond discharge	WL_LCUCP_SP23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-	-
Line Creek	Mine-exposed	RG_LISP24	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	WL_DCP_SP24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	14	13	7.4	11	10	8.9	8.2	6.7	6.2
Line Creek	Mine-exposed	RG_LIDSL	Line Creek downstream of South Line Creek confluence	LC_LCDSSLCC (Compliance Point)	-	-	-	-	-	-	8.1	-	5.6	14	8.9	16	12	10	14	12	11	6.6	9.3	10	9.3	7.2	6.7	5.7
Line Creek	Mine-exposed	RG_LIDCOM	Line Creek downstream of the compliance point	LC_LCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.6	7.4	9.4	7.7	9.3	9.1	9.4	7.7	7.4	7.0
Line Creek	Mine-exposed	RG_LI8	Line Creek downstream of the canyon	LC_LC4	7.8	11	8.0	-	6.3	8.4	7.8	4.3	-	8.4	9.3	12	8.9	8.6	11	8.3	8.9	6.9	10	12	8.6	9.0	7.2	5.8
Fording River	Mine-exposed	RG_FO9	Fording River downstream of Josephine falls, upstream of Grace Creek and Line Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.4	-
Fording River	Mine-exposed	RG_FRUL	Fording River downstream of Grace Creek, upstream of Line Creek	LC_LC6	-	-	-	-	-	-	7.9	-	-	-	7.5	-	-	7.0	8.1	-	-	6.9	-	8.1	-	11	10	7.5[c]
Fording River	Mine-exposed	RG_FO23	Fording River downstream of Line Creek	LC_LC5	10	5.8	9.7	5.0	5.9[b]	8.8	7.5	11	8.8	-	6.4	6.7	-	6.6	8.9	-	-	6.4	7.9	8.7	7.6	9.4	9.8	7.3

Notes: "-" = no data/not recorded. FRUL=FOUL prior to 2016. Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

[a] Means are only presented where the number of samples > 1, all other data are individual values.

[b] Sample size n = 9. [d] Sample size n = 1.

[c] Sample size n = 5. [e] Sample size n = 4.

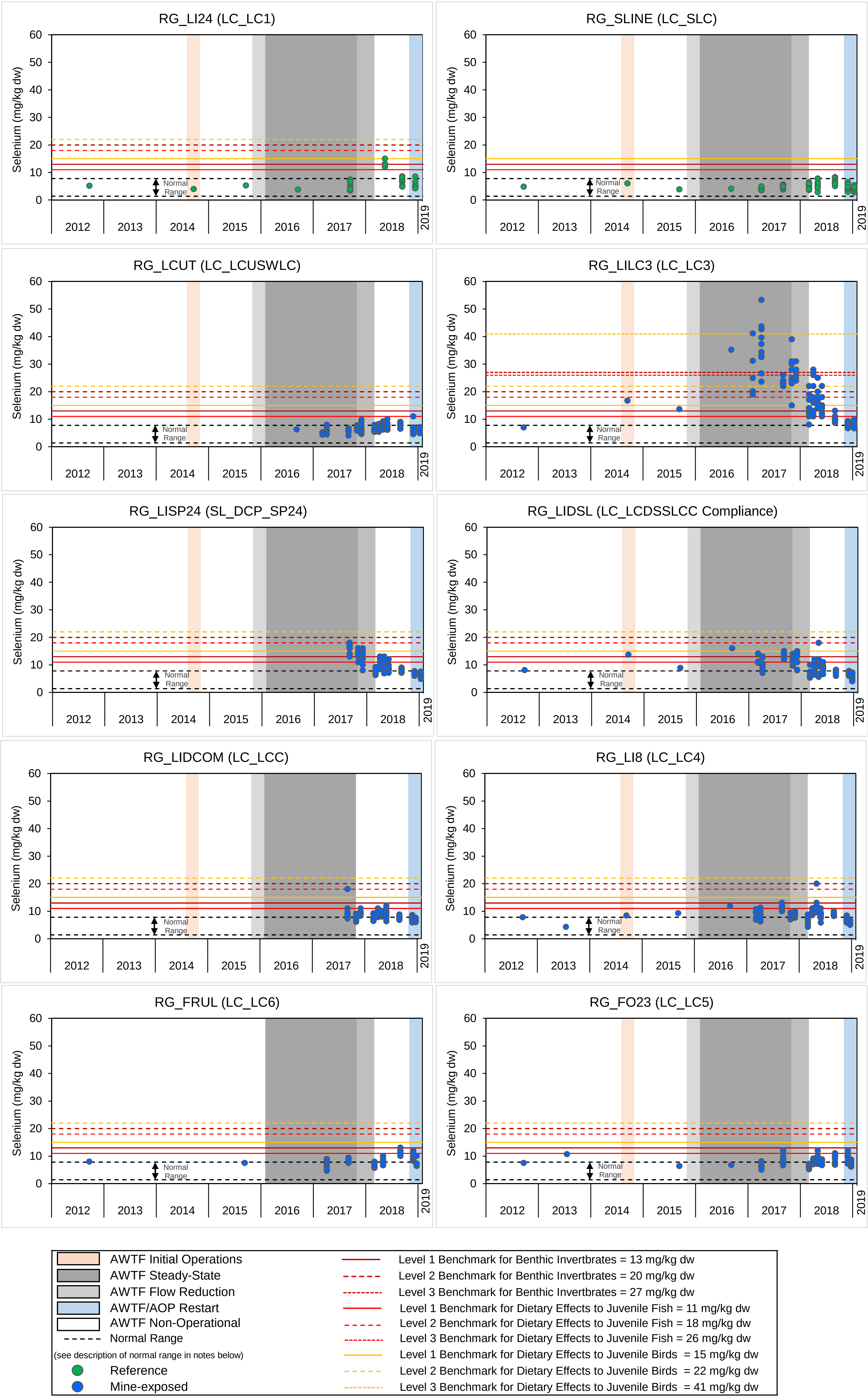


Figure 4.1: Tissue Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples from Line Creek and Fording River, 2012 to January 2019

Notes: Dashed black lines represent the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

4.3 2018 Composite-Taxa Benthic Invertebrate Selenium Concentrations

ANOVA analyses completed for this report compared the difference in selenium concentrations of composite-taxa benthic invertebrate samples between mine-exposed and reference areas among AWTF operational phases (see Section 2.7.4 for details). These analyses, which included data for samples collected until January 2019, indicated that benthic invertebrate selenium concentrations at mine-exposed areas downstream of the AWTF on Line Creek were significantly lower during AWTF shutdown and AWTF with AOP restart relative to during AWTF steady-state operation, when compared to changes at the reference areas over the same time frame (with the exception of the restart phase at RG_LIDCOM; Figures 4.2 to 4.4; Appendix Tables B.6 to B.10). For the areas located closest to the AWTF discharge (RG_LILC3 and RG_LISP24), a significant decrease was observed for all sampling events that occurred in the AWTF shutdown and AWTF with AOP restart phases evaluated (i.e., for each of the three AWTF shutdown and each of the two AWTF with AOP restart sampling events), whereas for areas located further downstream, the difference was dependent on which sampling events within the AWTF shutdown or AWTF with AOP restart phases were contrasted (i.e., results from some shutdown and AWTF with AOP restart sampling events did not differ from steady-state results; Appendix Tables B.6 to B.10). This spatial difference in the significant differences is likely related to the greater magnitude of change that occurred at the areas located closest to the AWTF discharge among these time periods (relative to reference) than occurred at sampling areas further downstream (Figure 4.1).

Benthic invertebrate selenium concentrations also decreased significantly between AWTF shutdown and AWTF with AOP restart at two areas (RG_LILC3, located closest downstream of the AWTF discharge; and RG_LI8, located furthest downstream in Line Creek), although these differences depended on the sampling events within the AWTF shutdown and AWTF with AOP phases that were contrasted (i.e., results from some AWTF shutdown sampling events did not differ from some AWTF with AOP sampling events; Figure 4.2 to 4.4; Appendix Tables B.6 to B.10). At RG_LIDCOM, benthic invertebrate selenium concentrations increased significantly between the AWTF shutdown and AWTF with AOP restart phases when compared to reference, but this was related to a decrease in selenium concentrations at the reference areas rather than an increase at RG_LIDCOM (Figure 4.4; Appendix Table B.9).

Selenium concentrations of composite-taxa benthic invertebrate tissue samples collected from multiple mine-exposed areas downstream of the AWTF between November 2017 and May 2018 (during AWTF flow reduction and shutdown) were significantly elevated relative to reference areas (RG_LI24 and RG_SLINE) or to the area upstream of the AWTF outfall (RG_LCUT; Figure 4.5). In June 2018 (after 12 weeks of AWTF shutdown), selenium concentrations were only significantly elevated at RG_LILC3 (the sampling area located closest downstream of the AWTF discharge)

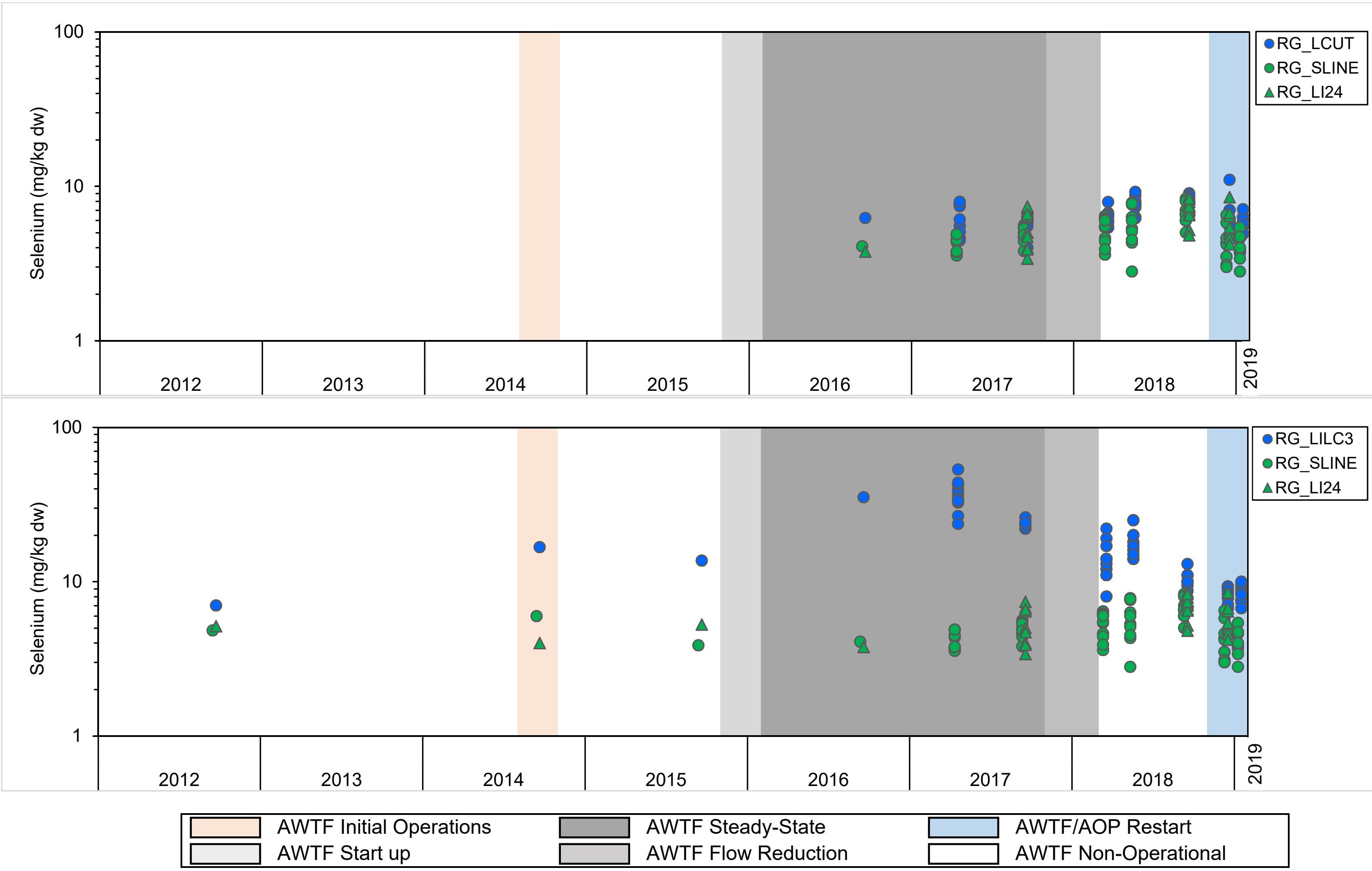


Figure 4.2: Benthic Invertebrate Selenium Concentrations, for RG_LCUT and RG_LILC3 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

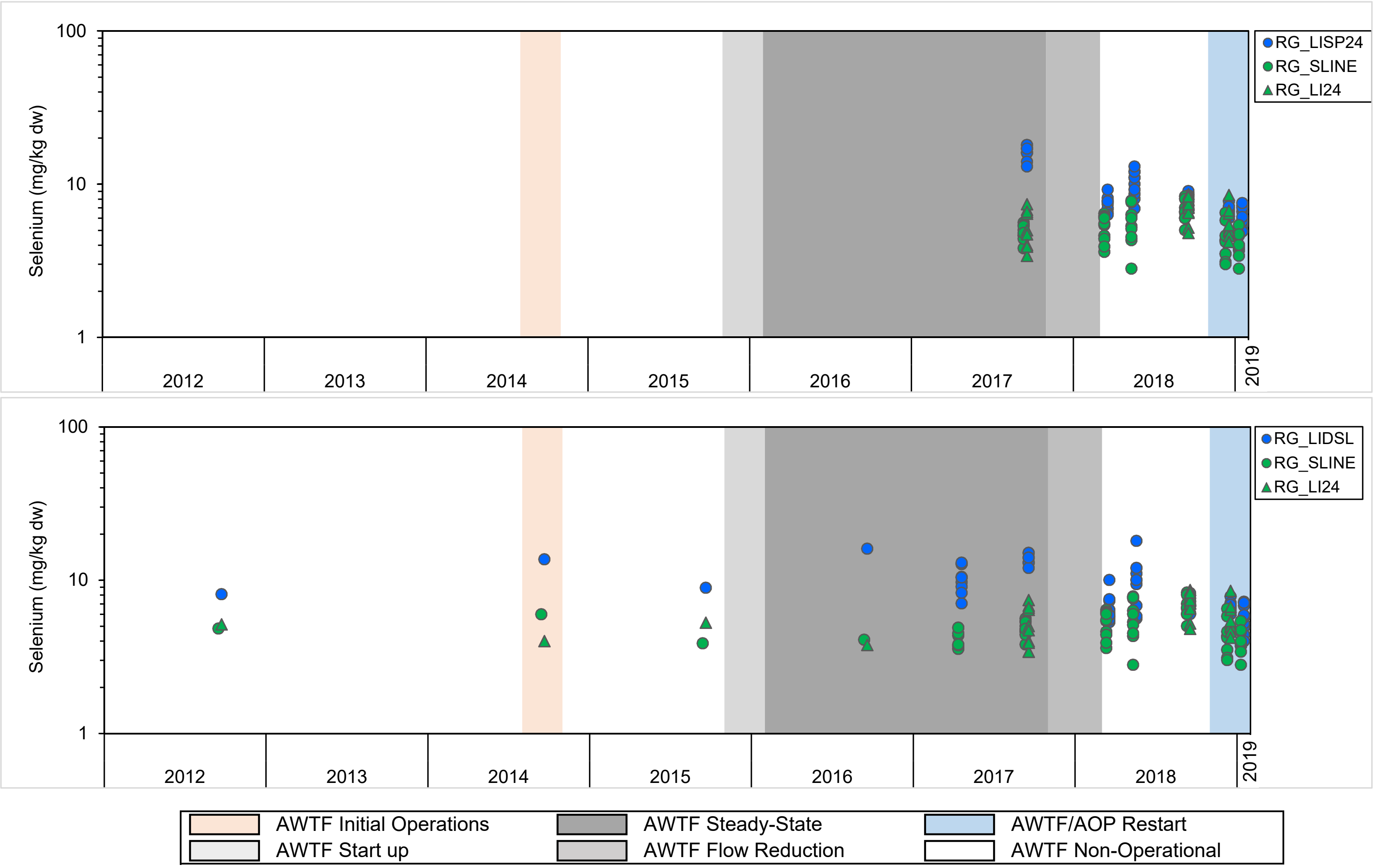


Figure 4.3: Benthic Invertebrate Selenium Concentrations, for RG_LISP24 and RG_LIDSL (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

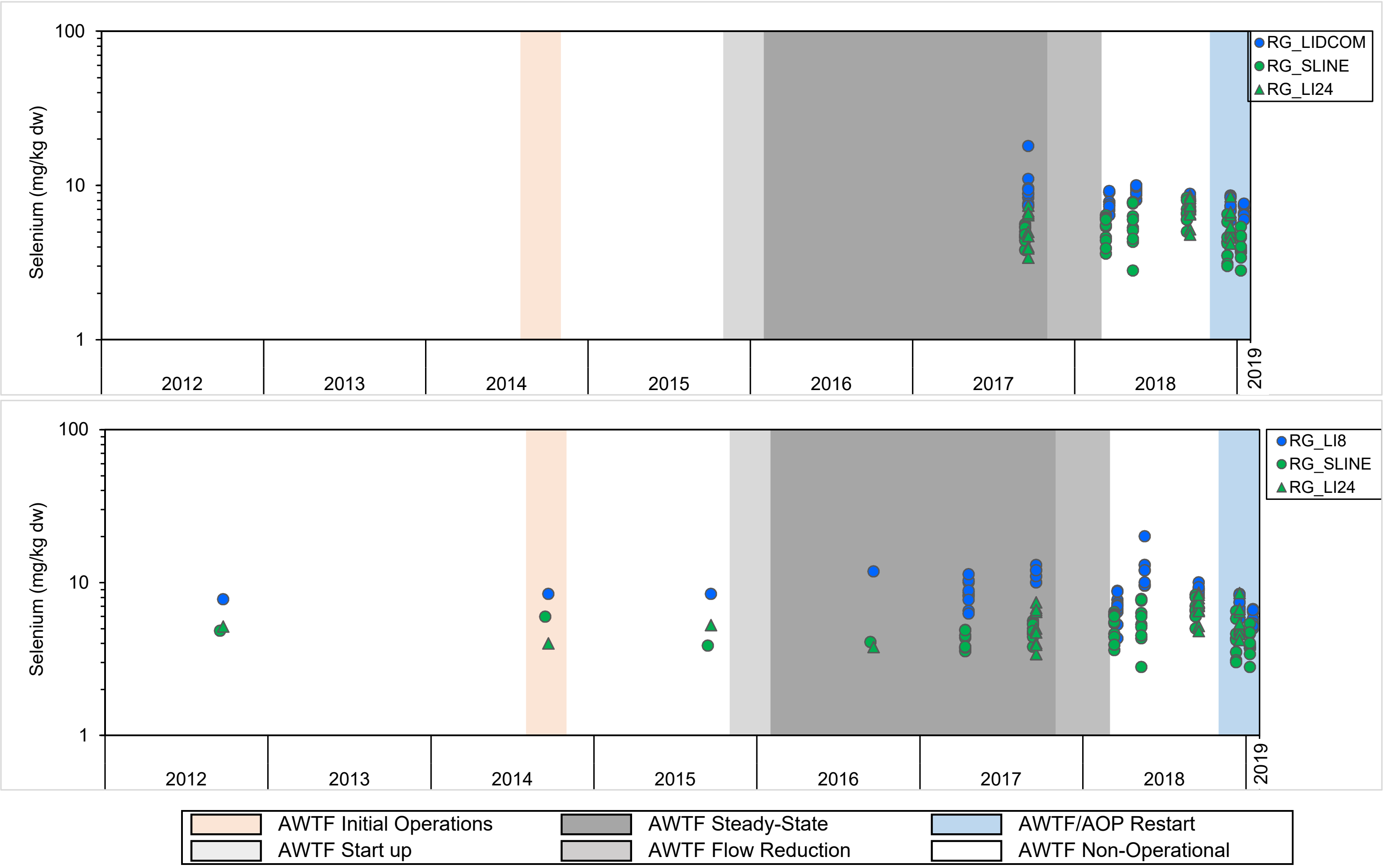


Figure 4.4: Benthic Invertebrate Selenium Concentrations, for RG_LIDCOM and RG_LI8 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

relative to reference or RG_LCUT, indicating the spatial extent of elevated benthic invertebrate selenium concentrations had decreased. This continued to be the only sampling area with significantly elevated benthic invertebrate selenium concentrations (relative to reference or upstream) through the AWTF shutdown and AWTF with AOP restart periods until January 2019 (11 weeks following initiation of discharge from AWTF with AOP; Figure 4.5).

Tissue selenium concentrations in benthic invertebrates collected in the Fording River were similar downstream compared to upstream of Line Creek in sampling events from March 2017 to January 2019, with the exception of September 2018 (Figure 4.5). In September 2018, selenium concentrations upstream of Line Creek on the Fording River (RG_FRUL) were higher than those downstream of Line Creek (RG_FO23), suggesting an influence unrelated to Line Creek (Figure 4.5; Table 4.1). Benthic invertebrate selenium concentrations downstream of Line Creek in the Fording River were significantly lower during AWTF shutdown compared to steady-state AWTF operation, relative to changes at the reference areas over the same time period (Figure 4.6; Appendix Table B.12). However, the changes in selenium concentrations observed at RG_FO23 (downstream of Line Creek) among AWTF operational phases did not differ from those at RG_FRUL (upstream of Line Creek), with the exception of September 2018 described above (Figure 4.7; Appendix Table B.13). These results indicate that the increase in selenium accumulation by aquatic biota (related to AWTF operation) was limited to Line Creek, which is consistent with previous findings (Minnow 2018d).

4.4 Aqueous Selenium Speciation and Bioaccumulation

Selenium concentrations in benthic invertebrate tissues were significantly elevated during steady-state AWTF operation even though the AWTF was effective in reducing total selenium concentrations in Line Creek (particularly at LC_LC3; Figure 4.8). Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate (Figure 4.9; Appendix Figure B.1; Appendix Table B.1), with lesser amounts (typically ~1-2%) of chemically-reduced forms such as selenite (e.g., LC_LCUSWLC in Figure 4.10[15]; Appendix Figure B.3; Appendix B.1). However, a greater proportion of the total selenium discharged by the AWTF in 2016 to 2017 was in these chemically-reduced forms, some of which are known to be more readily accumulated by aquatic biota (Ogle et al. 1988; Riedel et al. 1996; Stewart et al. 2010).

As described in Section 1.3, the WLC AWTF was temporarily shut down in response to increases in chemically-reduced forms of aqueous selenium in effluent and downstream of the AWTF, and associated increases in benthic invertebrate tissue selenium concentrations in Line Creek. As expected, concentrations of non-selenate selenium forms downstream of the AWTF discharge

[15] Note the differences in the y-axis scales of Figures 4.9 versus 4.10.

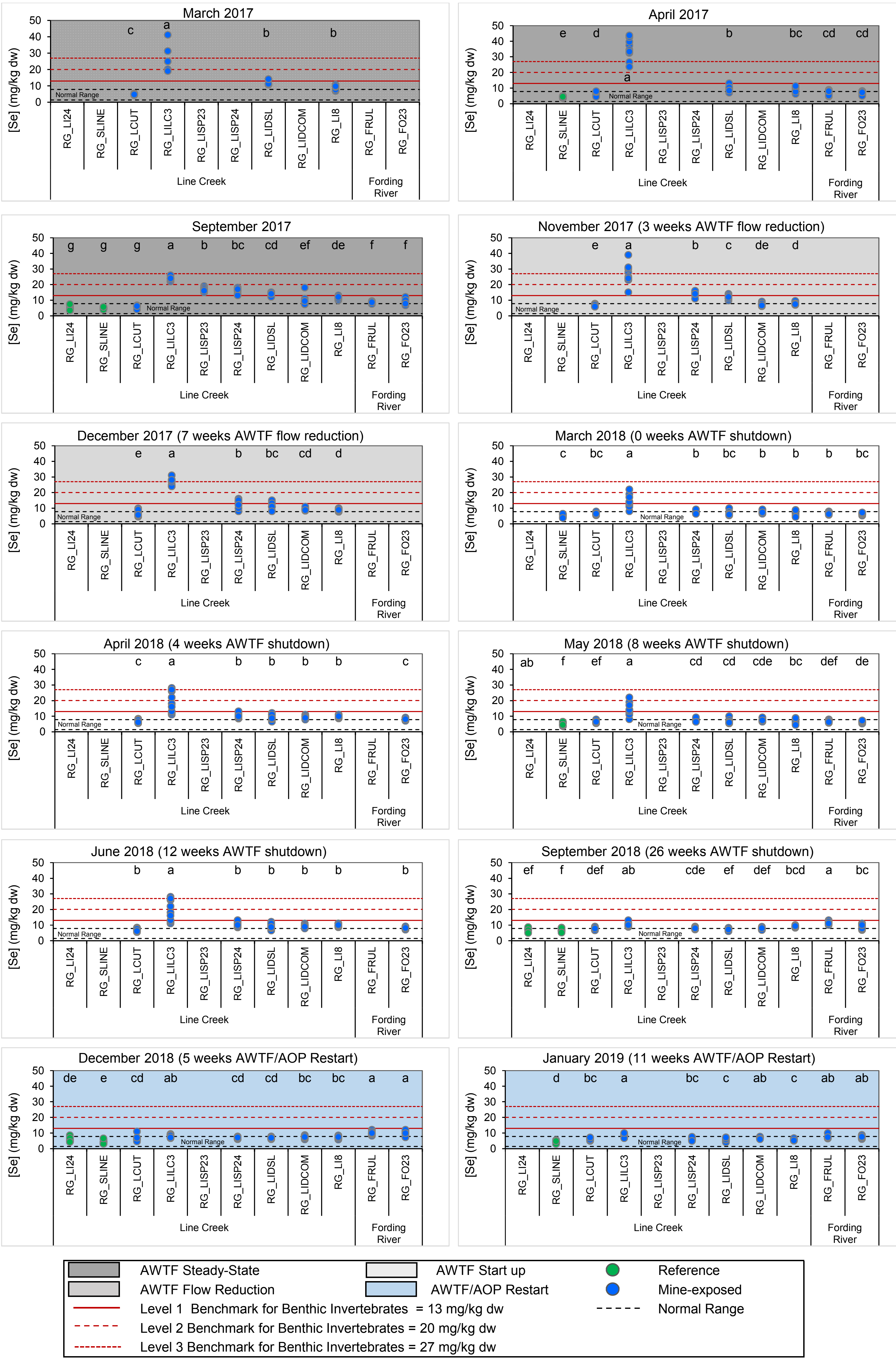


Figure 4.5: Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples Collected at Reference (Green) and Mine-exposed (Blue) Areas of Line Creek and Fording River, 2017 to 2019

Notes: Dashed black lines represent the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 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 (α = 0.05) in a Tukey's HSD test following a one-way ANOVA by area. The best transformation (log10, square root, fourth root, or none) was chosen as the highest p-value from a Shapiro-Wilk test for normality that also passed a Levene's test for homogeneity of variances. If assumptions could not be met, data were rank-transformed. Transformations were variable, therefore data are shown on untransformed axes.

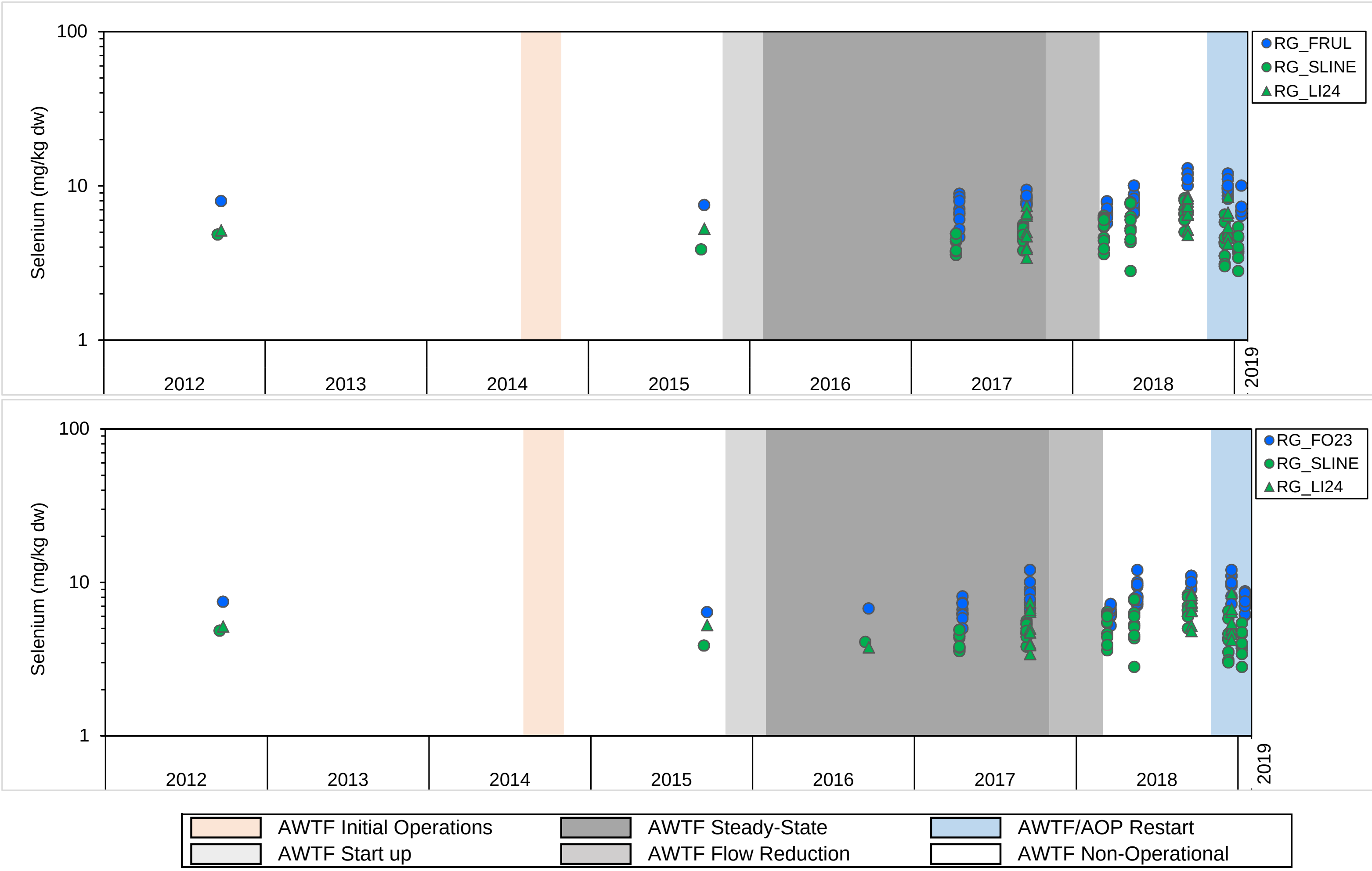


Figure 4.6: Benthic Invertebrate Selenium Concentrations, for RG_FRUL and RG_FO23 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

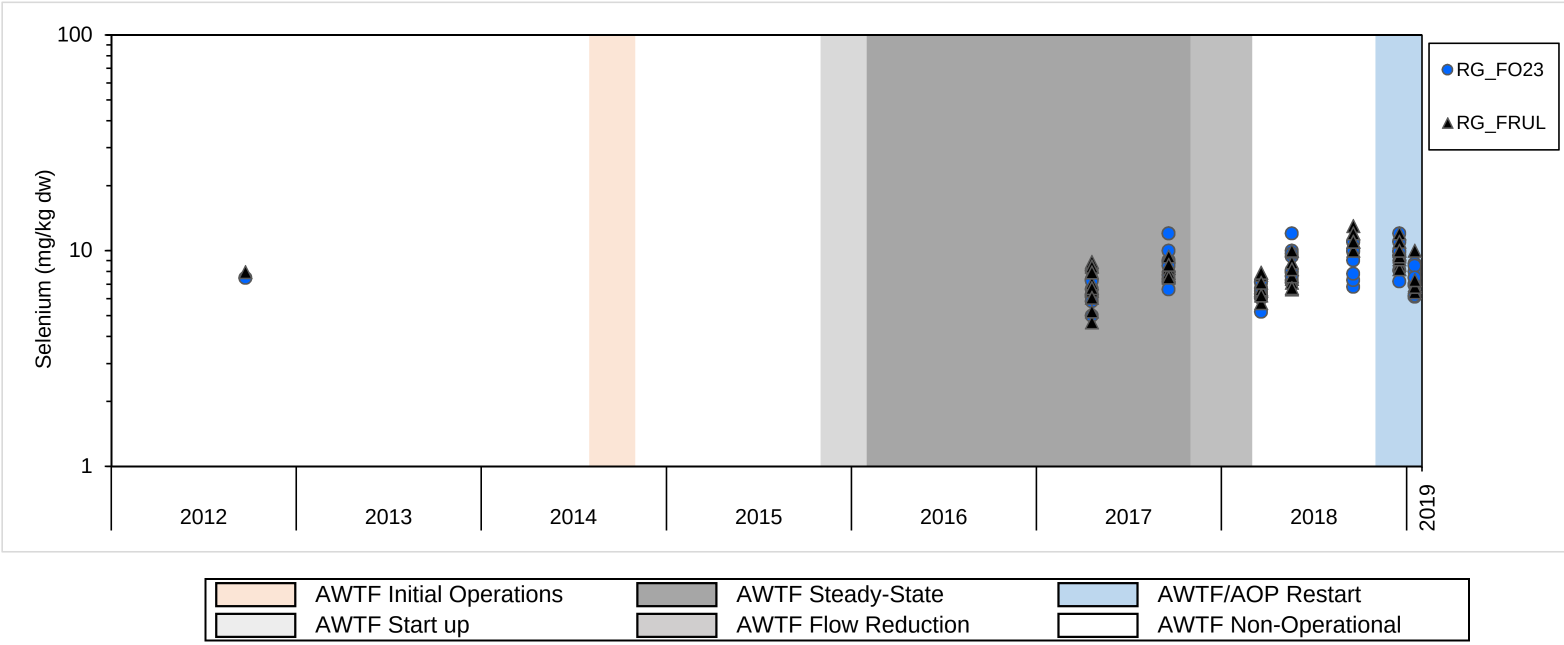


Figure 4.7: Benthic Invertebrate Selenium Concentrations, for RG_FO23 (Mine-exposed Area) Relative to RG_FRUL (Upstream Control), 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

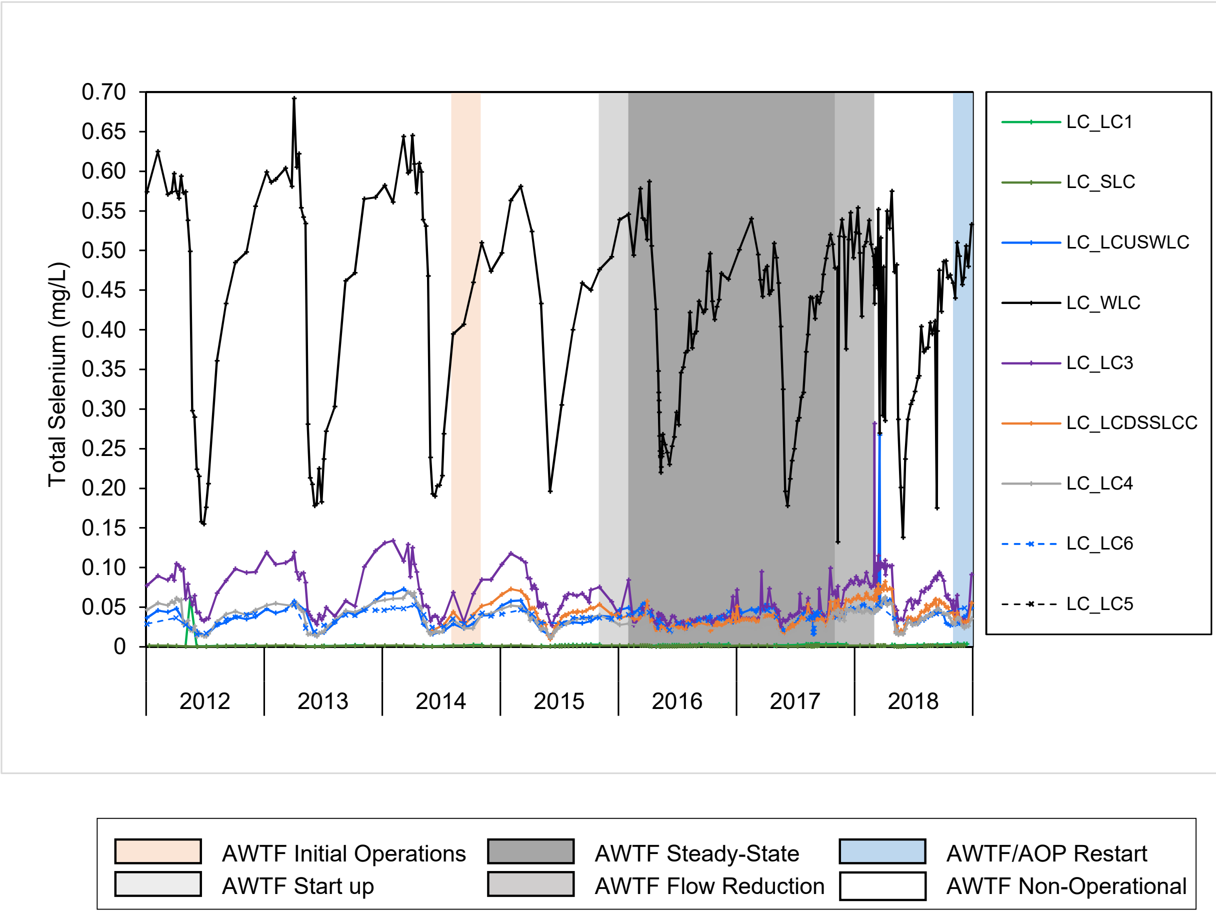


Figure 4.8: Time Series Plots for Aqueous Total Selenium from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.00034 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

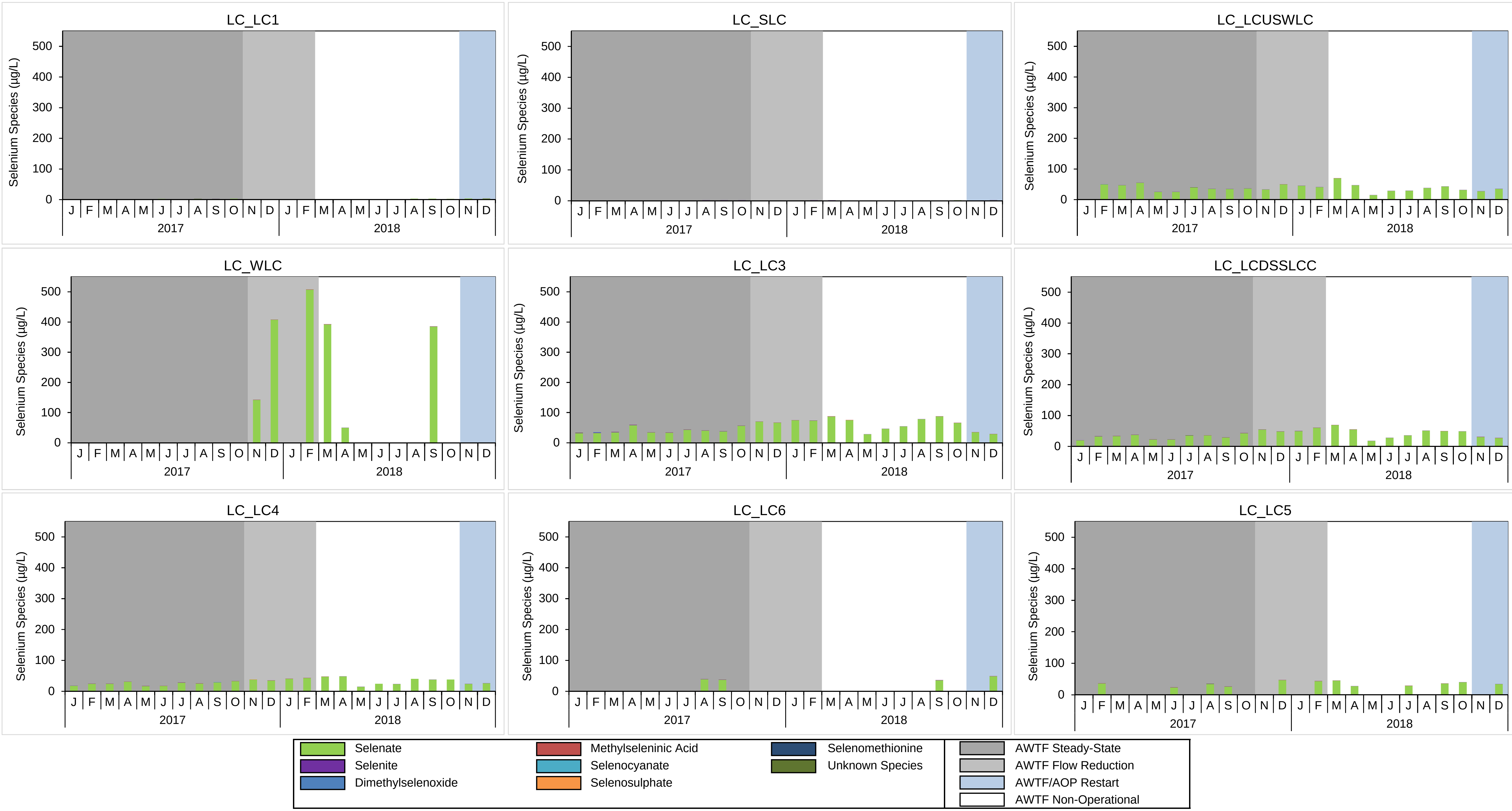


Figure 4.9: Aqueous Concentrations of Selenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) and Reference (LC_LC1, LC_SLC) Stations in Line Creek and Fording River, January 2017 to December 2018

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

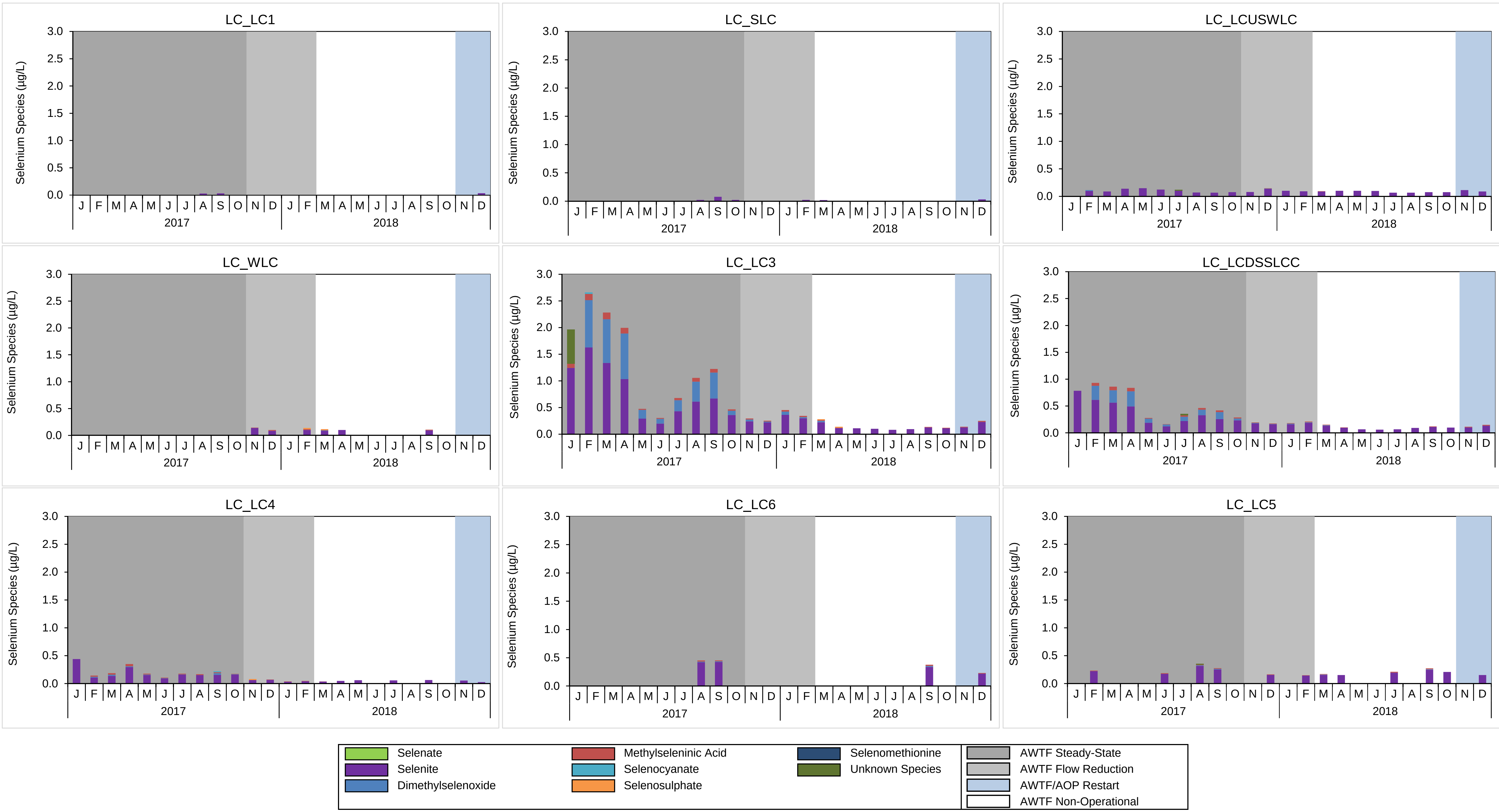


Figure 4.10: Aqueous Concentrations of Non-Selenate Selenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) and Reference (LC_LC1, LC_SLC) Stations in Line Creek and Fording River, January 2017 to December 2018

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

decreased during this shutdown period (Figure 4.10), while total selenium and selenate concentrations increased (Figures 4.8 and 4.9). Discharge from the recommissioned AWTF with AOP was initiated in October 2018. Following initiation of discharge (November and December 2018), concentrations of non-selenate selenium forms in Line Creek remained within the range of those observed during the flow reduction and shutdown phases (e.g., RG_LILC3; Figure 4.10), indicating the recommissioned AWTF with AOP was functioning as intended. These results were corroborated by selenium concentrations in benthic invertebrates from downstream of the AWTF discharge in Line Creek that were lower during restart with AOP than during AWTF steady-state operation or shutdown (relative to reference; see Section 4.3).

In the Fording River, concentrations of non-selenate forms of selenium were lower downstream of Line Creek (LC_LC5) compared to upstream (LC_LC6) during the AWTF with AOP restart, or were otherwise similar (when concentrations were above the LRL; Figures 4.9 and 4.10; Appendix Table B.1). These results are consistent with the finding that composite-taxa benthic invertebrate tissue selenium concentrations were not elevated in the Fording River downstream of Line Creek relative to upstream as discussed in Section 4.3.

Benthic invertebrate tissue selenium results from 2012 to 2018 were also plotted (Figure 4.11) relative to the regional one-step water-to-invertebrate selenium accumulation model (Teck 2014). The model is based on observed relationships between aqueous and benthic invertebrate tissue selenium values from samples collected previously in Line Creek and in other areas of the Elk River watershed (Teck 2014). Most plotted values were within 95% prediction limits of the model, except for samples collected nearest the AWTF in 2016 and 2017 (i.e.,, RG_LILC3 in Figure 4.11[16]). Specifically, samples at RG_LILC3 that plotted outside of the model 95% prediction limits included those collected during AWTF steady-state and flow reduction phases (in 2016 and 2017), while those collected during AWTF with AOP restart (in late 2018 and early 2019) plotted just below the model line (Figure 4.12). This supports the conclusion that selenium accumulation in Line Creek during AWTF steady-state operation was related to higher-than-normal concentrations of non-selenate forms of selenium, and that the recommissioning of the AWTF with AOP has been functioning to decrease non-selenate forms and associated accumulation in aquatic biota.

4.5 Effects of AWTF Shutdown and Supporting Investigations

As outlined above, shutdown of the AWTF was associated with a significant decrease in benthic invertebrate selenium concentrations at areas downstream of the AWTF on Line Creek. At

[16] Tissue selenium concentrations for RG_LILC3 that were close to model predictions at very high aqueous Se concentrations (>100 µg/L) were collected in March 2018 after the AWTF was shut down (i.e., reflecting combined inputs from West Line Creek [untreated] and Line Creek) and aqueous selenium was predominantly in selenate form.

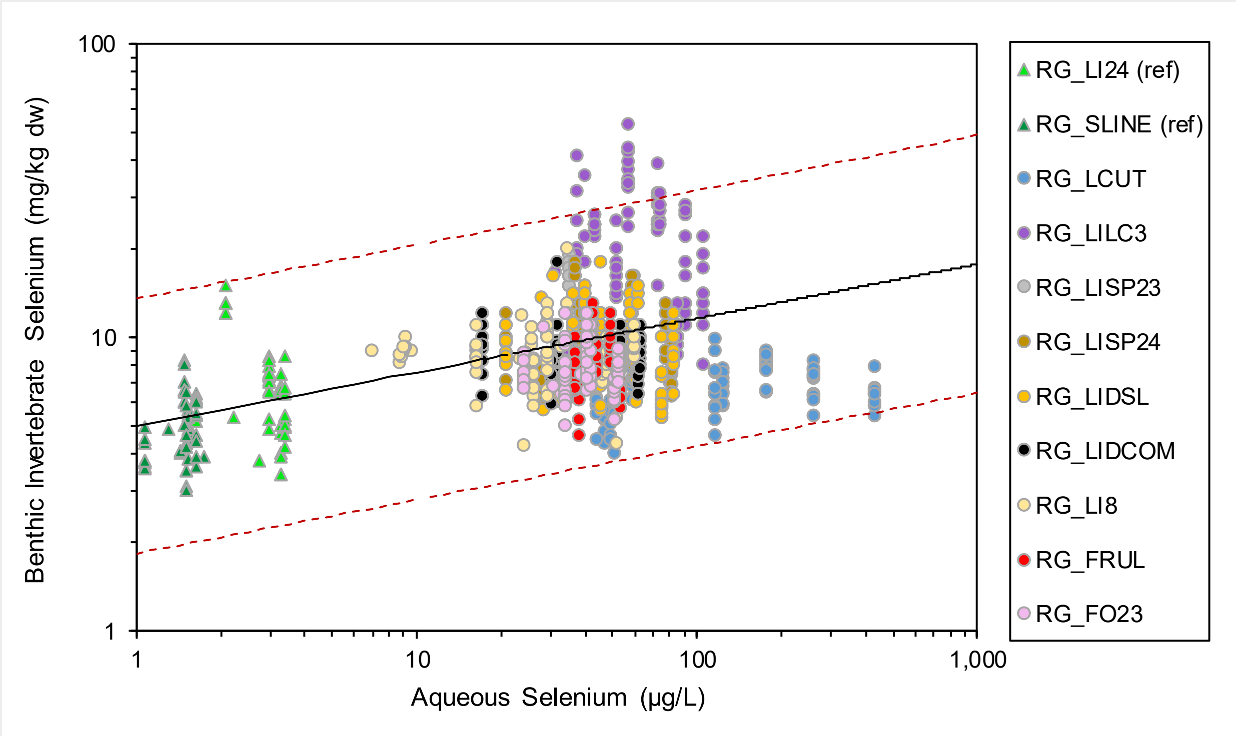


Figure 4.11: Observed and Modelled Selenium Concentrations in Benthic Invertebrate Composite Samples Relative to Aqueous Selenium Concentrations At Stations Upstream and Downstream of Line Creek Operations, 2012 to 2018

Notes: One data point for station FO23 on September 16th, 2015 is the average of two duplicate measurements. triangles indicate reference stations and circles indicate mine-exposed stations.

[a] Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one-step water to benthic invertebrate selenium accumulation model: log10[Se]benthic invertebrate = 0.696+0.184×log10[Se]aq (Golder 2018a). The 95% prediction limits for a single value from the one-step water to benthic invertebrate selenium accumulation model are plotted as dashed red lines.

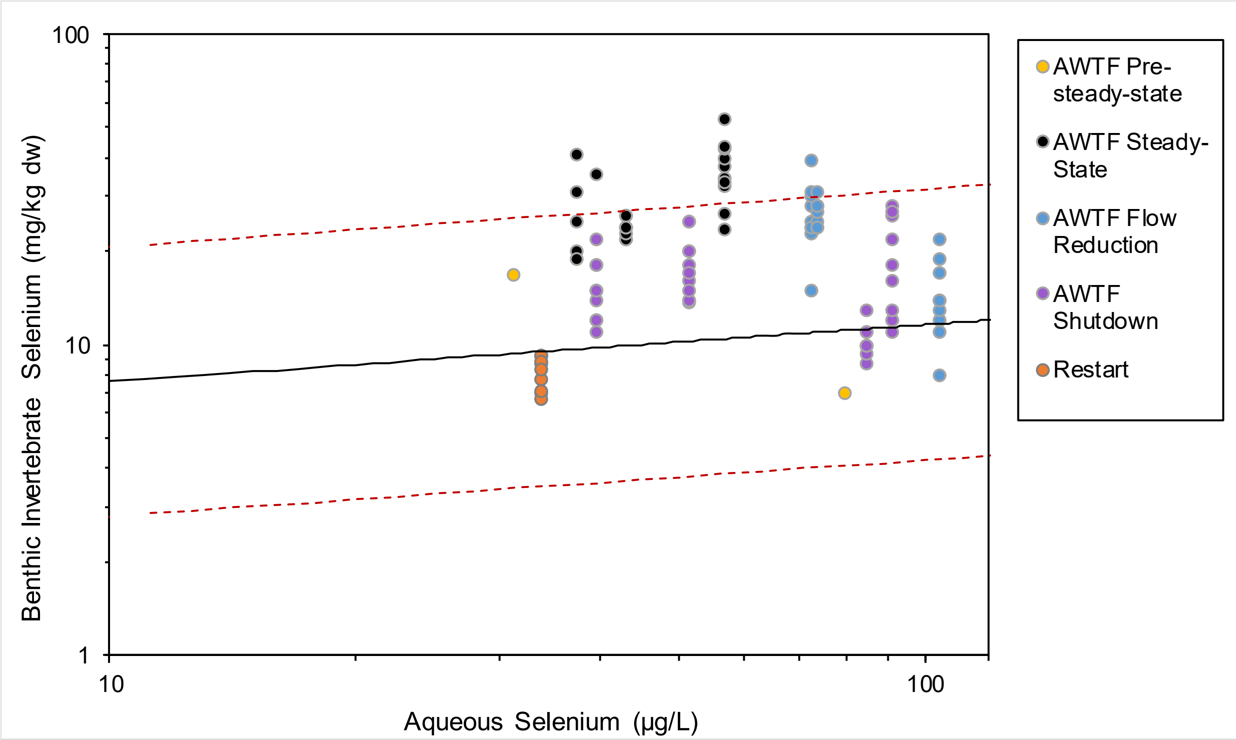


Figure 4.12: Observed and Modelled Selenium Concentrations in Benthic Invertebrate Composite Samples Relative to Aqueous Selenium Concentrations At RG_LILC3, Line Creek, 2012 to 2018

[a] Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one-step water to benthic invertebrate selenium accumulation model: log10[Se]benthic invertebrate=0.696+0.184×log10[Se]aq (Teck 2014). The 95% prediction limits for a single value from the one-step water to benthic invertebrate selenium accumulation model are plotted as dashed red lines.

RG_LILC3, benthic invertebrate tissue selenium concentrations from the last (September 2018) shutdown sampling event showed the greatest decrease, compared to changes at the reference areas over the same time (Figure 4.13; Appendix Table B.14). Similarly, the greatest decrease in benthic invertebrate tissue selenium concentrations within the shutdown period at RG_LILC3 occurred between the first (March 2018) and last (September 2018) sampling events (Appendix Table B.14). Thus, over the 7 months of the AWTF shutdown period, benthic invertebrate tissue selenium concentrations continued to decrease.

In May 2018, selenium concentrations reported in benthic invertebrates were anomalously high at the RG_LI24 reference area (mean = 13 mg/kg dw), and 2.5 times higher than the previous sampling event on average (Table 4.1; Figure 4.13). As described above, this reference area is upstream from drainages associated with mining disturbances. Potential causes of this increase were investigated by confirming results with the analytical laboratory, cross-checking field notes, chain-of-custody forms, and field photographs, completing reconnaissance of the sampling area on foot and with use of a drone, and conducting additional sampling at a downstream monitoring location (LC_LC1; Figure 2.1) in September 2018. Results of the investigation identified no apparent cause of the increase, and selenium concentrations at the downstream location were similar to those reported in previous sampling events (see RG_DSLI24 in Appendix Table B.4). Therefore, it was concluded that the anomalous results were likely due to field error. Results from RG_LI24 in December 2018 (that were similar to results prior to May 2018) corroborate the May 2018 results as being anomalous.

In addition, previous evaluation of aqueous total selenium concentrations at the LC_LC1 reference area identified significant increases in aqueous total selenium since 2014 (Minnow 2018d). Further analysis of temporal changes indicated that concentrations in 2018 had not changed significantly compared to 2017, but remained higher than concentrations measured in 2012 to 2015[17] (Appendix Table B.15). Continued monitoring at this reference location will include ongoing analysis of temporal changes in total selenium (Minnow 2019), and additional field verification is recommended if concentrations continue to increase.

In the Fording River upstream of Line Creek (RG_FRUL) an increase in composite-taxa benthic invertebrate selenium concentrations was observed in September 2018 (Figure 4.13; Table 4.1; Appendix Table B.4). Additional sampling completed further upstream in the Fording River in

[17] Results discussed herein are excluding of one outlier in from the analysis. No significant differences among years were found with inclusion of the outlier (Appendix Table B.15). Results for the contrast of 2017 vs. 2016 differed slightly in the present report compared to the previous evaluation (Minnow 2018d) due the use of different statistical analyses. The ANOVA model described in Section 2.7.1 is the preferred method for this temporal analysis because it can detect temporal increases or decreases in concentrations. The repeated measures ANOVA used in Minnow (2018d) only has the ability to detect step-wise increases.

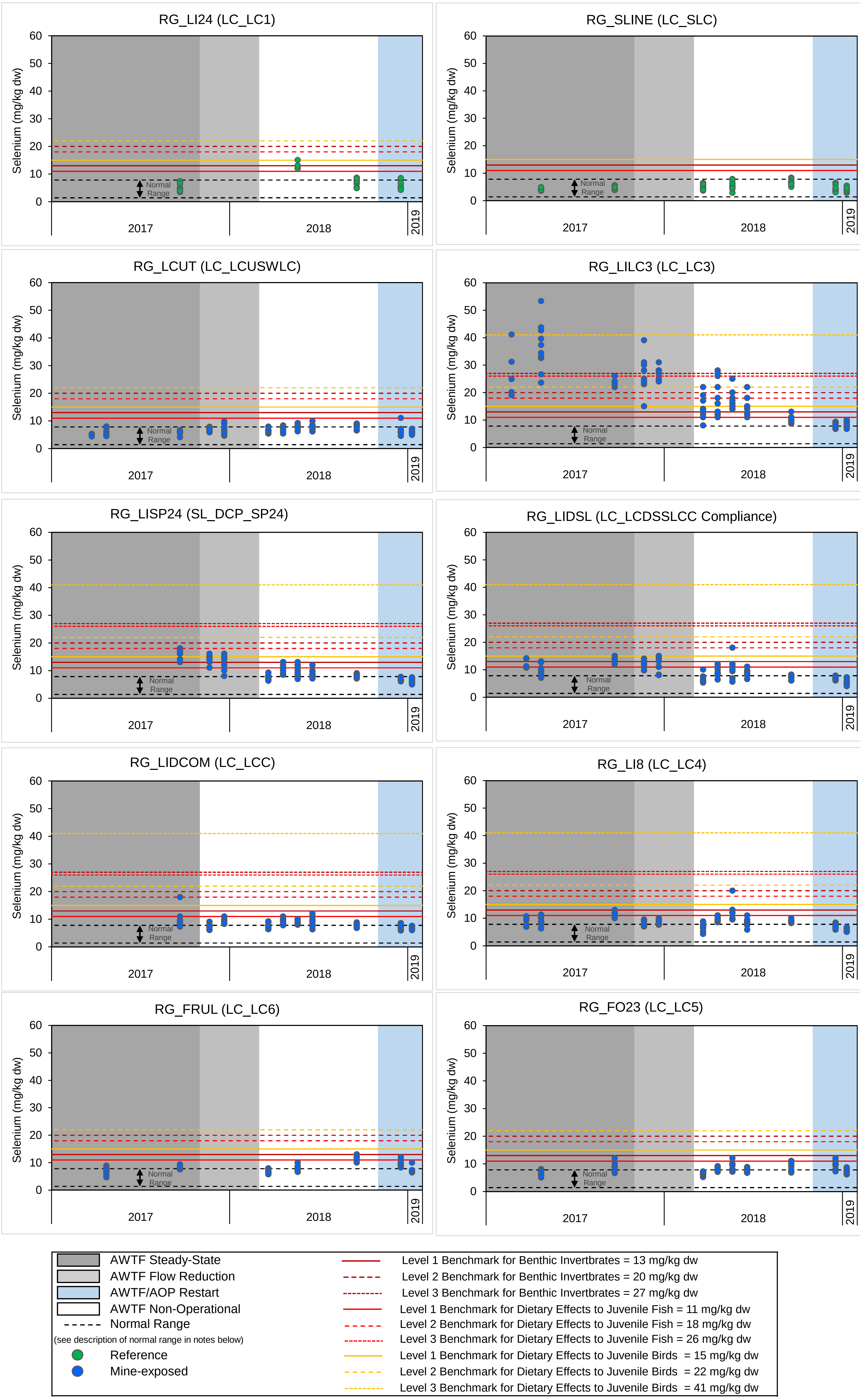


Figure 4.13: Tissue Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples from Line Creek and Fording River, 2017 to 2019

Notes: Dashed black lines represent the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

response to this result in December 2018 (RG_FO9; Figure 2.1; Table 2.2) indicated that tissue selenium concentrations at this upstream location were not similarly elevated to those documented at RG_FRUL during the same sampling event (Table 4.1).

4.6 Single-Taxon Benthic Invertebrate and Periphyton Selenium Concentrations

Selenium concentrations measured in single-taxon benthic invertebrate samples in March 2018 (i.e., Ephemeroptera, Rhyacophilidae, *Parapsyche* sp., and Chironomidae) were a remnant of an earlier investigation [(see Section 2.6.3 and the 2017 Line Creek LAEMP interpretive report (Minnow 2018d) for detailed results and data interpretation].

Periphyton selenium concentrations documented in 2018 were confounded by the presence of abiotic particles containing inorganic selenium, as evidenced by selenium concentrations in periphyton samples that exceeded those in benthic invertebrate samples (especially at RG_LCUT, upstream of the AWTF; Appendix Figure B.4). This is consistent with results from previous monitoring years (e.g., 2017; Appendix Figure B.4; Minnow 2018d), and with results of previous metals and total organic carbon content analyses that suggested the presence of abiotic matter in periphyton that likely contained selenium (Minnow 2017a). Periphyton tissue data were therefore considered less reliable than benthic invertebrate tissue data for interpreting selenium bioaccumulation in the aquatic food web of Line Creek.

As indicated in Section 2.6.2, periphyton tissue selenium analysis was completed in early 2018 to comply with the approved AWTF shutdown monitoring plan (ENV 2018), but was discontinued following the last sampling event in May 2018 and following discussions with the EMC regarding this change. Individual and summarized monitoring results are presented in Appendix Tables B.2 and B.3, but were not analyzed in detail.

4.7 Fish Tissue Selenium Concentrations

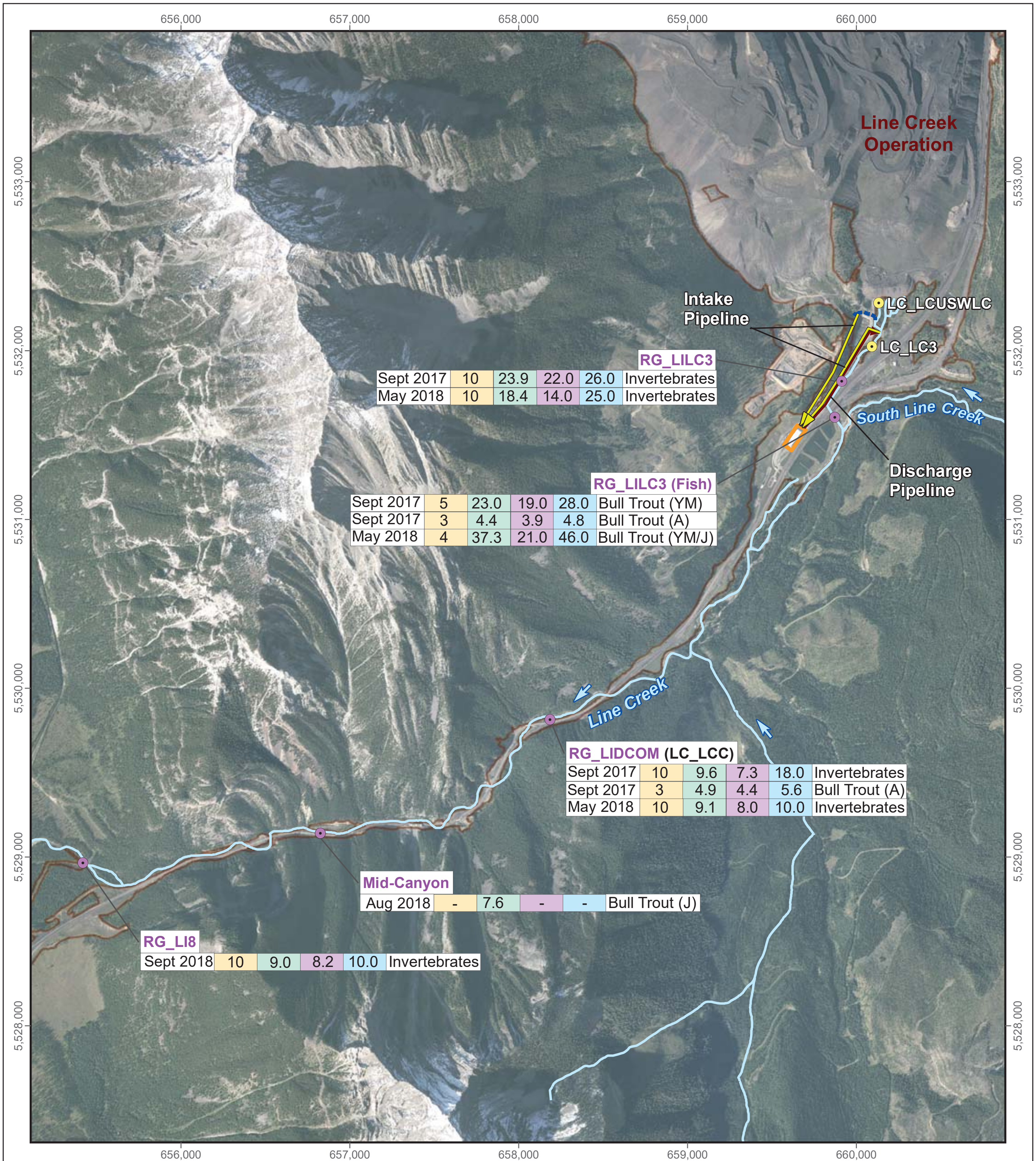
4.7.1 Muscle

Trophic transfer factors (TTF) represent ratios of consumer to dietary tissue selenium concentrations and are often used to describe selenium transfer in aquatic food webs. Selenium concentrations in fish muscle are usually similar to dietary exposure concentrations, as reflected in TTFs of approximately one for a wide range of small-bodied versus large-bodied and marine versus freshwater fish species (Table 4.2).

Young bull trout (i.e., < 46 cm fork length) captured in Line Creek in spring (April/May) and summer had muscle selenium concentrations similar to or higher than those in benthic invertebrates collected in the same vicinity (Figures 4.14 and 4.15; Appendix Table B.16). This suggested that these bull trout were resident individuals feeding near the capture area. Larger adult bull trout

Table 4.2: Trophic Transfer Factors (TTF) for Fish Muscle or Whole Body Relative to Diet (Presser and Luoma 2010)

Common Name	Scientific Name	TTF
Chinese mudskipper	*Periophthalmus cantonensis*	0.84
Striped bass (juvenile)	*Morone saxatilis*	0.89
Sucker	*Catostomus sp.*	0.97
Rainbow trout	*Oncorhynchus mykiss*	0.98
Fathead minnow (larval and adult)	*Pimephales promelas*	1.0
Largemouth bass	*Micropterus salmoides*	1.0
Cutthroat trout	*Oncorhynchus clarkii*	1.0
Bluegill	*Lepomis macrochirus*	1.1
Mangrove snapper	*Lutjanus argentimaculatus*	1.1
European sea bass	*Dicentrarchus labrax*	1.1
Chub	*Gila sp.*	1.2
Yellowfin goby	*Acanthogobius flavimanus*	1.2
Western mosquitofish	*Gambusia affinis*	1.3
White sturgeon	*Acipenser transmontanus*	1.3
Brown trout	*Salmo trutta*	1.3
Mountain whitefish	*Prosopium williamsoni*	1.3
Sailfin molly	*Poecilia latipinna*	1.4
Mottled sculpin	*Cottus bairdi*	1.4
Longnose dace	*Rhinichthys cataractae*	1.5
Redside shiner	*Richardsonius balteatus*	1.5
Starry flounder	*Platichthys stellatus*	1.6



LEGEND

- Biological Sampling Station (Teck Water Quality Station)
- Teck Water Quality Station Only
- Active Water Treatment Facility (AWTF) Operational-Dependent Flow
- Active Water Treatment Facility (AWTF)

Bull Trout Muscle and Benthic Invertebrate Selenium Concentrations

n	mean	min	max

(A) - Adult
(YM) - Young Male
(J) - Juvenile, Sex Unknown

Bull Trout Muscle versus Benthic Invertebrate Selenium Concentrations, Line Creek, 2017 - 2018

0 500 1,000 2,000 Meters

N E S W

Projection: North American Datum 1983 UTM Zone 11

Date: April 2019
Project 187202.0026

minnow environmental inc.

Figure 4.14

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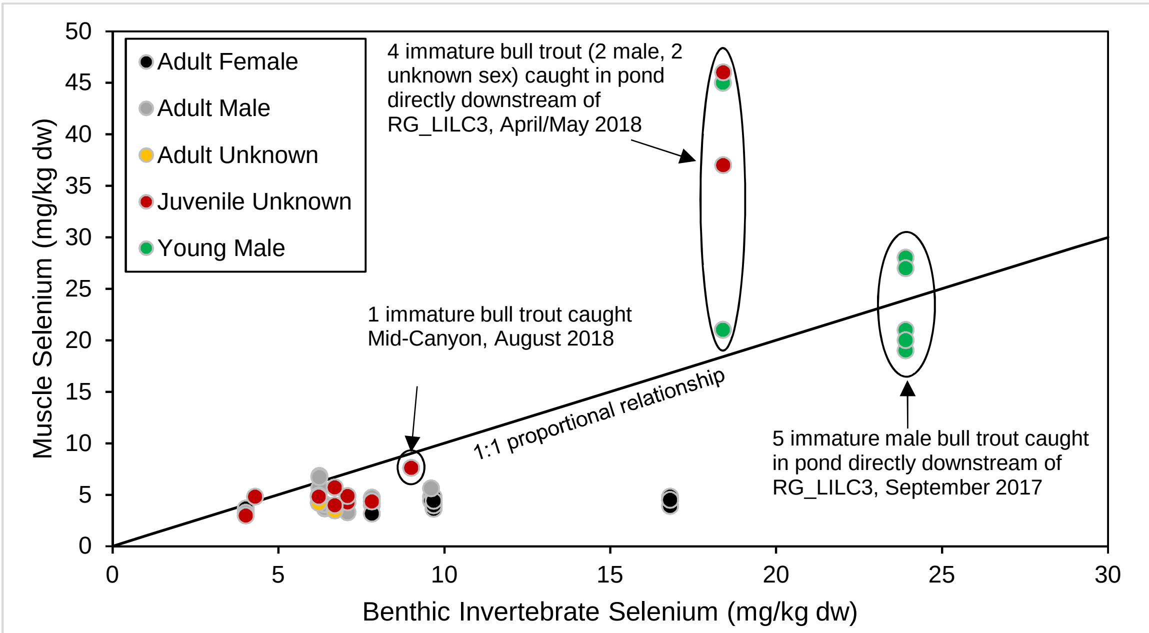

Figure 4.15: Bull Trout Muscle Selenium Concentrations Compared to Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples Collected in Same Area

Notes: Data reflect bull trout captured in Line Creek in 2018 LAEMP, 2017 LAEMP (Minnow 2018d), and in 2006 regional selenium monitoring (Minnow et al. 2007). Muscle selenium concentrations for fish caught downstream of RG_LILC3 were compared to composite benthic invertebrate selenium concentrations measured at RG_LILC3 in September 2017 and April/May 2018 (Table 4.1). Muscle selenium concentrations of fish caught Mid-Canyon were compared to composite benthic invertebrate selenium concentrations measured at RG_LI8 in September 2018 (Table 4.1).

(i.e., > 60 cm fork length) were not captured in 2018, but those captured in upper Line Creek in 2017 had muscle selenium concentrations lower than those in benthic invertebrates (Figure 4.15), suggesting non-residency. Line Creek is a regionally important stream for bull trout spawning (Minnow 2016b), therefore these larger adult bull trout were likely individuals that had recently migrated into Line Creek to spawn.

The ratio of muscle selenium concentrations of young bull trout to benthic invertebrate selenium concentrations was higher for fish captured in April/May 2018 than in September 2017 (Figure 4.15). This discrepancy is likely related to the change in AWTF operational status (shutdown) that occurred 8 weeks prior to bull trout sampling. It is anticipated that changes to fish tissue selenium concentrations would occur later than those observed in benthic invertebrates due to the fact that the primary exposure route for these fish is dietary, and also potentially because of a slower growth rate and lower specific feeding (e.g., feeding per unit mass of consumer) of fish compared to benthic invertebrates. This is supported by the closer resemblance between the bull trout muscle selenium concentrations in spring 2018 and benthic invertebrate selenium concentrations during AWTF flow reduction in November and December 2017 (mean = 26 to 27 mg/kg dw; Table 4.1), and a TTF closer to one for the single bull trout captured in August 2018 (Figure 4.15).

Selenium concentrations in tissues of westslope cutthroat trout have been monitored in Line Creek since 2001 (Golder 2005). In 2018, selenium concentrations in muscle from westslope cutthroat trout captured closest to the AWTF outfall (RG_LIDSL and RG_LIDCOM) were within the range of results from these areas reported in 2017, although the low sample sizes (n = 1 for RG_LIDSL, n = 2 for RG_LIDCOM) limit the confidence with which conclusions relating to potential effects of the AWTF can be drawn (Figure 4.16, top panel; Appendix Table B.17). Consistent with results from 2017 (Minnow 2018d), selenium concentrations in muscle from fish captured further from the WLC AWTF (i.e., Mid-Canyon and RG_LI8; approximately 4.4 and 6.1 km from the AWTF discharge, respectively; Figure 2.1) were similar to those observed previously (Figure 4.16, top panel; Appendix Table B.17). Muscle selenium concentrations of westslope cutthroat trout captured downstream of Line Creek in the Fording River in 2018 (near RG_FO23) were similar to those from RG_LI8 in 2018 and previous years.

4.7.2 Ovaries

Measurement of selenium in eggs or ripening ovaries is the most direct way to evaluate potential effects of selenium on fish reproduction compared to measurement of selenium in water or other tissue types (Janz et al. 2010; Golder 2014; USEPA 2016). For this reason, site-specific benchmarks were derived in the EVWQP based on fish egg/ovary selenium concentrations (Golder 2014). However, it is challenging to align sampling events when fish are ripe so that eggs

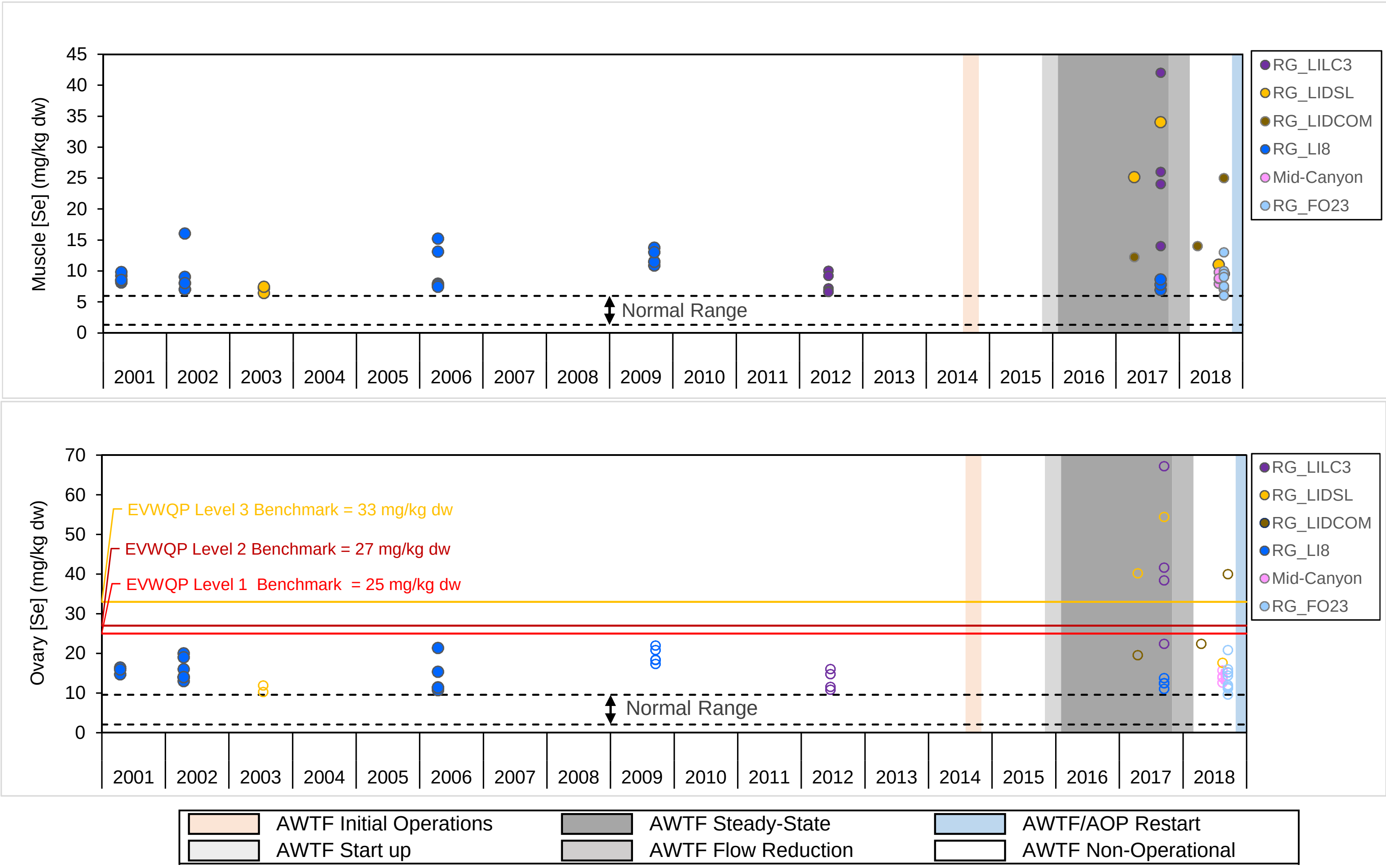

Figure 4.16: Selenium Concentrations in Muscle and Ovaries of Westslope Cutthroat Trout Sampled From Line Creek, 2001 to 2018

Notes: Ovary concentrations that were estimated from muscle selenium concentrations (based on the ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation 2011) are plotted with open circles. Ovary selenium was estimated only for individuals lacking measured ovary concentrations if female or if sex was unknown because sampling was non-lethal. Dashed black lines represent the muscle normal range defined as the 2.5th and 97.5th percentiles of the 1998 to 2015 reference area muscle data from the Regional Aquatic Environmental Monitoring Program (RAEMP). Ovary normal range was estimated from the muscle values multiplied by the 1.6:1 conversion presented by Nautilus and Interior Reforestation 2011.

can be harvested non-lethally from females (by applying gentle abdominal pressure). If non-lethal expression of eggs is not possible, collection of ovaries requires that fish be sacrificed. Therefore, monitoring of selenium in fish has often involved non-lethal collection of muscle plugs for selenium analysis. Selenium concentrations in fish eggs/ovaries can be estimated from muscle for fish species that exhibit a strong muscle-to-ovary selenium relationship, as an indirect means of evaluating potential effects of selenium on fish reproduction. Such relationships have been described for a variety of fish species from data in the scientific literature (USEPA 2016) and based on studies in the Elk Valley (Table 4.3). Ovary-to-muscle selenium ratios are typically <3:1 but can range up to 7:1 for some species.

A strong ovary-to-muscle relationship has been characterized for westslope cutthroat trout (Figure 4.17), which indicates that egg/ovary selenium concentrations are typically about 1.6 times the concentrations in muscle of the same fish (Nautilus and Interior Reforestation 2011). Measured and estimated ovary selenium concentrations for westslope cutthroat in Line Creek have been below the EVWQP Level 1 benchmark of 25 mg/kg dw (Golder 2014) since 2001, with the exception of five samples from 2017 and one from 2018 (Figure 4.16). In 2018, the estimated ovary selenium concentration of the single fish that was above the Level 1 benchmark of 25 mg/kg dw was captured closest to the AWTF discharge (RG_LIDCOM; Figure 4.16, bottom panel; Appendix Table B.17).

Selenium monitoring data in the Elk Valley are more limited for bull trout than for westslope cutthroat trout. Available tissue selenium concentration data indicate an ovary-to-muscle ratio of approximately 3.3 (Minnow 2018d). However, because bull trout sampled non-lethally in 2018 were juveniles (Appendix Table B.16), ovary selenium concentrations were not estimated for these fish or compared to associated effects benchmarks (Level 1 Benchmark of 18 mg/kg dw[18] [Golder 2014] and the EC10 for Dolly Varden of 56.2 mg/kg dw[19] [USEPA 2016]).

4.8 Summary

Concentrations of non-selenate forms of selenium in Line Creek were substantially decreased when the AWTF was not operational in 2018, and following the recommissioning of the AWTF

[18] Benchmark applies to fish species other than westslope cutthroat trout.

[19] The Effect Concentration (EC10) screening value of 56.2 mg/kg dw identified for Dolly Varden was applied to bull trout ovary selenium concentrations. Bull trout (*Salvelinus confluentus*) belong to a relatively tolerant genus. McDonald et al. (2010) reported an EC10 of 54 mg/kg dw in eggs for Dolly Varden (*S. malma*), later recalculated as 56.2 mg/kg dw in eggs by USEPA (2016). Holm et al. (2005) reported no effects to brook trout (*S. fontinalis*) across a wide range of egg selenium concentrations. USEPA (2016) concluded that "the effect threshold [for brook trout] appears to be substantially higher [than the reported no-effect concentration] based on the absence of any consistent concentration-response relationship up to the maximum observed egg concentration of 18.9 mg Se/kg ww or 48.7 mg Se/kg dw". As such, the selected screening value of 56.2 mg/kg dw in ovary tissue would be a conservative basis for evaluating potential risk to members of the genus *Salvelinus*, including bull trout.

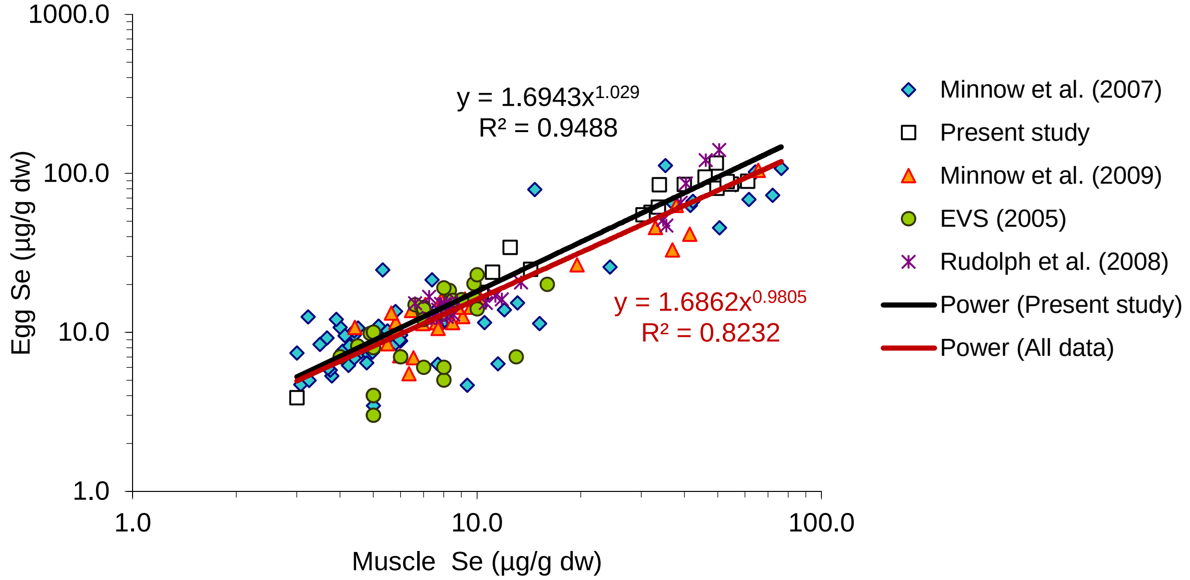

Figure 4.17: Relationship between Westslope Cutthroat Trout Muscle and Ovary Selenium Concentrations [from Nautilus and Interior Reforestation (2011)]

Notes: Range of ovary: muscle ratios from regression is 1.6 to 1.7.

Table 4.3: Ovary to Muscle Selenium Relationships for Different Fish Species in the Elk Valley and Various Locations in the Literature

Location	Source	Common Name	Scientific Name	Ovary to Muscle Concentration Ratios[a]				Regression[b]	
				n	Min	Max	Median	p	r^2
Elk Valley	Koocanusa Reservoir	Kokanee	*Oncorhynchus nerka*	16	1.6	3.1	2.1	0.61	-
		Largescale Sucker	*Catostomus macrocheilus*	17	0.78	2.5	1.4	<0.001	0.89
		Northern Pikeminnow	*Ptychocheilus oregonensis*	64	2.0	10	3.6	<0.001	0.55
		Peamouth Chub	*Mylocheilus caurinus*	90	1.1	7.8	3.3	<0.001	0.43
		Rainbow Trout	*Oncorhynchus mykiss*	9	3.2	12	4.3	0.81	-
		Redside Shiner	*Richardsonius balteatus*	51	2.8	15	7.3	<0.001	0.42
		Yellow Perch	*Perca flavescens*	54	1.1	1.5	1.2	<0.001	0.78
	RAEMP (Minnow 2018a)	Longnose Sucker	*Catostomus catostomus*	19	0.64	2.1	1.1	<0.001	0.96
		Mountain Whitefish	*Prosopium williamsoni*	106	1.8	16	6.5	<0.001	0.52
	Nautilus and IR (2011)	Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	>100	0.5[c]	6[c]	1.6[c]	<0.001	0.82
Various	USEPA (2016)	Black Bullhead	*Ameiurus melas*	10	3.4	19	6.8	0.25	-
		Bluegill	*Lepomis macrochirus*	29	0.14	2.4	1.4	<0.001	0.65
		Bluehead Sucker	*Catostomus discobolus*	7	0.94	1.8	1.5	<0.001	0.91
		Brook Trout	*Salvelinus fontinalis*	17	0.54	2.3	1.1	<0.001	0.91
		Brown Trout	*Salmo trutta*	4	0.38	11	7.0	0.71	-
		Channel Catfish	*Ictaluris punctatus*	4	3.7	8.7	5.8	0.67	-
		Common Carp	*Cyprinus carpio*	6	0.39	1.5	1.1	0.007	0.84
		Cutthroat Trout	*Oncorhynchus clarkii*	69	1.0	11	1.8	<0.001	0.82
		Dolly Varden	*Salvelinus malma*	17	0.71	3.6	1.3	<0.001	0.90
		Flannelmouth Sucker	*Catostomus latipinnis*	7	0.85	1.4	1.1	0.036	0.58
		Green Sunfish	*Lepomis cyanellus*	38	0.79	1.8	1.2	<0.001	0.89
		Largemouth Bass	*Micropterus salmoides*	13	0.77	1.8	1.1	0.22	-
		Mountain Whitefish	*Prosopium williamsoni*	27	3.5	8.2	5.8	<0.001	0.33
		Northern Pike	*Esox lucius*	14	1.0	3.9	1.9	<0.001	0.83
		Rainbow Trout	*Oncorhynchus mykiss*	47	0.04	4.4	1.9	<0.001	0.96
		Razorback Sucker	*Xyrauchen texanus*	34	1.1	5.2	2.3	<0.001	0.80
		Roundtail Chub	*Gila robusta*	7	1.5	2.5	2.0	0.026	0.62
		Smallmouth Bass	*Micropterus dolomieu*	6	0.94	1.6	1.2	0.006	0.85
		White Sturgeon	*Acipenser transmontanus*	6	1.6	21	1.3	0.006	0.86
		White Sucker	*Catostomus commersonii*	40	0.47	2.1	1.0	<0.001	0.59

Note: "-" = no data/not recorded.
[a] Ratio of ovary to muscle for individual fish as listed by USEPA (2016), augmented by data from Elk Valley studies.
[b] r^2 presented for significant relationships ($p<0.05$)
[c] Estimated from a figure in Nautilus and IR (2011)

with AOP in late 2018 and early 2019. Benthic invertebrate tissue monitoring in Line Creek in 2018 identified decreased selenium concentrations during the shutdown of the AWTF and following the AWTF restart with AOP, compared to concentrations that were observed during steady-state operation of the AWTF. Tissue selenium concentrations of benthic invertebrates in the Fording River were similar downstream from Line Creek compared to upstream, indicating that changes in tissue selenium accumulation related to AWTF operation were limited to Line Creek. Benthic invertebrate tissue selenium monitoring results collected following the restart of the AWTF with AOP (until January 2019) indicate that the recommissioned facility is functioning to decrease the non-selenate species in AWTF effluent, and limit selenium bioavailability in Line Creek. Further monitoring during the growing season while the plant is fully operational will be useful in confirming this. Selenium concentrations in bull trout and westslope cutthroat trout tissues were similar to those reported in 2017, however sample sizes for evaluating a temporal change in 2018 were limited.

5 OTHER POTENTIAL INFLUENCES OF THE WLC AWTF

5.1 Overview

Monitoring data are evaluated in this section to address Study Question #3: Is WLC AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations, or concentrations of treatment-related constituents other than nutrients or selenium?

5.2 Temperature

Water temperatures measured by continuous loggers in Line Creek upstream (LC Intake Pond [T1]) and downstream (LC Mixing Zone Discharge [T4] and LC3 Downstream [T5]) of the AWTF were generally similar to each other (Figure 5.1)[20]. These temperatures were also similar during most months to discrete temperature measurements collected further upstream during routine monitoring (LC_LCUSWLC), although temperatures in mid-summer (late July to late September) exceeded those measured further upstream (at LC_LCUSWLC; Figure 5.1).

BC water temperature guidelines specified for different life stages of bull trout and westslope cutthroat trout, are defined as a maximum ± 1º C change from the optimum temperature range for different life stages (BCMOE 2001b). Line Creek water temperatures throughout 2018 were within, or lower than, the optimum temperature ranges for both species (Figure 5.2).

5.3 Dissolved Oxygen

Most dissolved oxygen concentrations measured in 2018 both upstream and downstream from the AWTF were above or only slightly below the instantaneous minimum criterion for the protection of the most sensitive fish (embryo/alevin) life stages (9 mg/L; BCMOE 1997), and above the 30-day mean for all other life stages (8 mg/L; Figure 5.3). Monthly mean concentrations were less than the 30-day mean criteria of 11 mg/L for the most sensitive life stages (buried embryo/alevin) at almost all stations in some months; in particular at LC_LCUSWLC upstream from the AWTF (5 of 12 months) and also at reference stations (2 of 12 months; Table 5.1). This pattern suggests that the observed dissolved oxygen concentrations below the 30-day criterion were not related to AWTF operation.

[20] Temperature data loggers at locations representing AWTF effluent (Buffer Pond Outlet Box [T2] and V Notch Discharge [T3] were above water during the AWTF shutdown (March to October 2018) and did not function properly following the restart of AWTF with AOP in October 2018. Data from these data loggers are therefore excluded from interpretation.

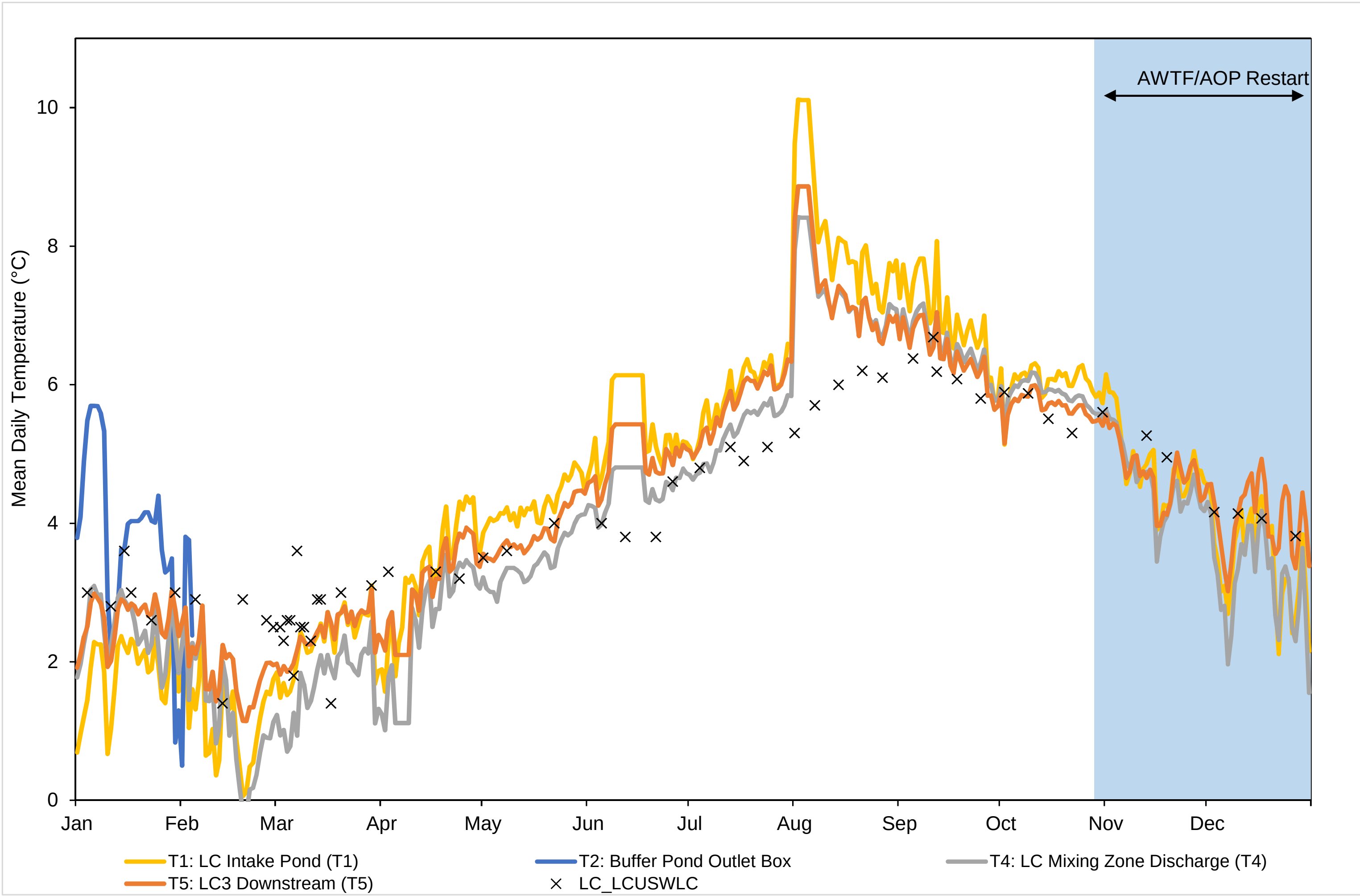

Figure 5.1: Mean Daily Water Temperature (°C) Recorded by Temperature Data Loggers, Line Creek LAEMP, 2018

Notes: Data loggers T2 (Buffer Pond Outlet Box) and T3 (V-notch discharge) were above water during AWTF shutdown, and did not function properly following the AWTF restart. Therefore, data for T3 were excluded from plot entirely, and data for T2 were excluded after Feb 5th, 2018. Temperatures measured at T1, T4 and T5 on August 6th and 7th were suspected errors (<2.3°C) and were also excluded. Temperatures at station LC_LCUSWLC represent discrete measures and are therefore not presented as a continuous line.

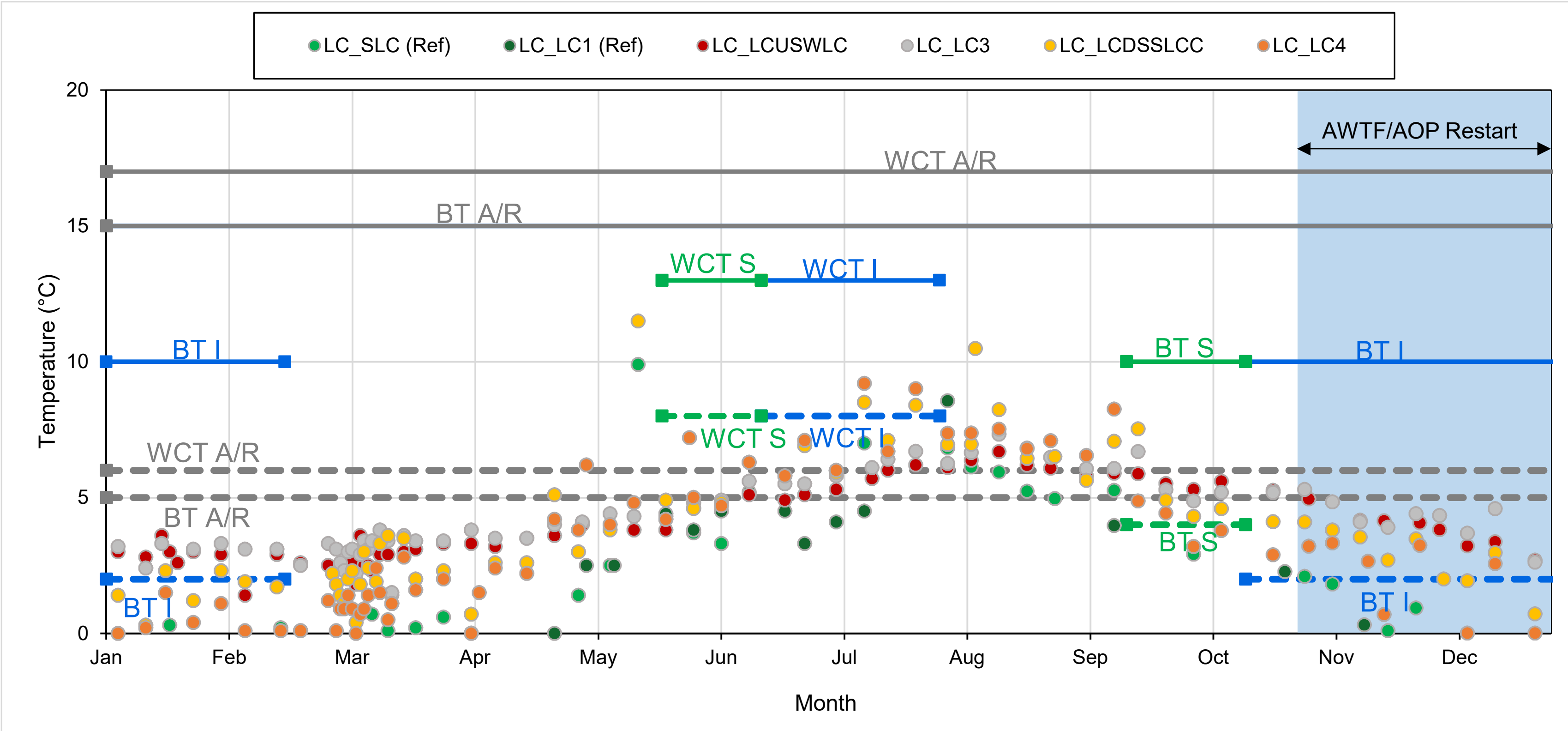

Figure 5.2: Water Temperatures at Monitoring Stations in Line Creek in 2018 Relative to BCMOE (2001b) Guidelines for Maximum (Solid Lines) and Minimum (Dotted Lines) Temperatures for Protection of Fish Species Found in Line Creek

Notes: BT-bull trout. WCT-westslope cutthroat trout. S-spawning. I-incubation. A/R- alevin/rearing. The timing of fish life history stages was taken from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007).

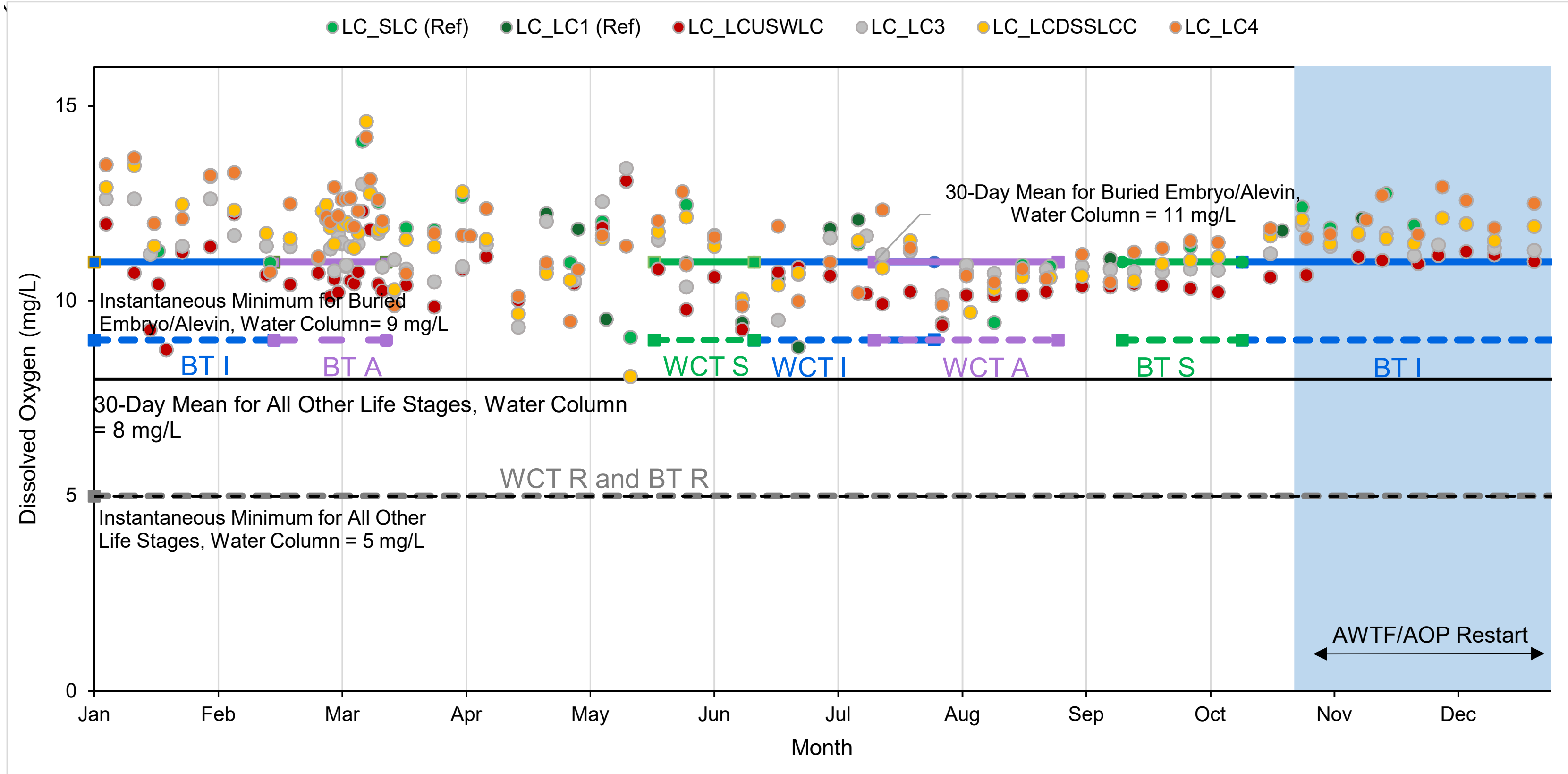

Figure 5.3: Dissolved Oxygen Concentrations at Sampling Stations in Line Creek in 2018, Relative to the BCMOE (1997) Criteria for the Protection of Fish Life Stages

Notes: BT-bull trout. WCT-westslope cutthroat trout. S-spawning. I-incubation. A/R- alevin/rearing. The timing of fish life history stages was taken from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007). Spawning, incubation, and alevin stages were included in application of buried embryo/alevin guideline values.

Table 5.1: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Line Creek, 2018

Month	LC_LC1	LC_SLC	LC_LCUSWLC	LC_WLC	LC_LC3	LC_LCDSSLCC	LC_LCC	LC_LC4
January	-	11	11	11	12	13	-	13
February	-	11	11	11	12	12	-	12
March	-	13	11	11	11	12	14	12
April	12	12	11	11	11	11	13	11
May	11	11	11	12	12	11	-	12
June	10	12	10	11	10	11	-	11
July	12	11	10	11	11	11	-	11
August	9	10	10	11	11	10	-	10
September	11	11	10	11	11	11	12	11
October	12	12	10	11	11	11	-	12
November	12	12	11	12	11	12	-	12
December	-	-	11	11	12	12	-	12

(shaded) Less than 30-day water column mean criterion of 11 mg/L for buried embryo/alevin life stages

5.4 Analytes with Early Warning Triggers

Evaluation of analytes with early warning triggers under the AMP relative to BCWQG (see Sections 2.2.1 and 2.7.1) indicated that concentrations of nitrate, sulphate, and total chromium, total selenium (discussed above), total mercury, and dissolved cadmium exceeded the long-term BCWQG in samples from stations upstream (or at reference) and downstream of the AWTF discharge in 2018 (Appendix Table C.1; Appendix Figures C.1 to C.28). The short-term BCWQG for dissolved cadmium (at LC_WLC only, 5% of samples) and ammonia (at LC_LC3 and LC_LCDSSLCC only, 22% and 4% of samples) was also exceeded in samples from 2018 (Appendix Table C.1).

Dissolved cadmium and sulphate concentrations exceeded the Level 1 benchmark, and nitrate, total selenium, and total nickel concentrations exceeded both the Level 1 and 2 benchmarks in samples from upstream and downstream of the AWTF discharge (with the exception of total nickel which exceeded the interim Level 2 benchmark upstream of the AWTF only; Appendix Table C.1; Appendix Figures C.1 to C.28).

Visual inspection of results from 2012 to 2018 indicated no obvious increases in concentrations of these analytes at monitoring stations downstream of the AWTF discharge during AWTF operation (steady-state or AWTF with AOP restart; Appendix Figures C.1 to C.28), indicating no influence of AWTF operation on downstream concentrations of these analytes.

5.5 Toxicity Results

Sample for acute toxicity testing were collected from upstream of the AWTF, effluent, and the receiving environment. Of the 37 samples collected for acute toxicity testing of the water flea *Daphnia magna*, or the 36 samples collected for acute toxicity testing of rainbow trout (*Oncorhynchus mykiss)* in 2018, none caused >50% mortality to either organism (Table 5.2; Appendix Table C.2).

Chronic toxicity testing is performed quarterly on samples collected at the Compliance Point (LC_LCDSSLCC). The second and fourth quarter (Q2 and Q4) tests in 2018 resulted in decreased *Ceriodaphnia dubia* reproduction relative to all four reference station samples (Table 5.3; Golder 2019). Mean *C. dubia* reproduction for the Q2 and Q4 tests were below the local normal range of responses, indicating a likely adverse response to the test water (Golder 2019). Brood output of *C. dubia* (i.e., the number of broods per toxicity test) has the potential to bias test results low if a test is terminated prior to the production of a brood. Although evaluation of 2018 results indicated that brood output had minimal effect on the classification of test results, *C. dubia* test duration is being extended for 2019 testing (to eight days) to help to identify cases where differences in brood output among tests might bias the measured

Table 5.2: Summary of Acute Toxicity Test Results for Line Creek Monitoring Stations, 2018

Water Station		Water Flea *(Daphnia magna)*		Rainbow Trout *(Oncorhynchus mykiss)*	
Teck Code	**Description**	**# Tests > 50% Mortality**	**Total # tests**	**# Tests > 50% Mortality**	**Total # tests**
WL_WLCI_SP01	West Line Creek AWTF influent	0	1	0	0
WL_BFWB_OUT_SP21	West Line Creek AWTF effluent outfall	0	26	0	27
LC_LC3	Line Creek downstream of West Line Creek and AWTF outfall	0	2	0	2
LC_LCDSSLCC (Compliance)	Line Creek immediately downstream of South Line Creek confluence	0	3	0	3
LC_LC5	Fording River downstream of Line Creek	0	3	0	2
LC_LCUSWLC	Line Creek upstream of West Line Creek, below rock drain	0	1	0	1
LC_WLC	West Line Creek	0	1	0	1

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

Table 5.3: Results of Quarterly and Semi-Annual Chronic Toxicity Tests at LC_LCDSSLCC in 2015 to 2018[a] (Golder 2016, 2017, 2018, and 2019)

Quarter		Water Flea (*Ceriodaphnia dubia*)		Amphipod (*Hyalella azteca*)		Green Alga (*Pseudokirchneriella subcapitata*)	Rainbow Trout (*Oncorhynchus mykiss*)			
		Survival (% control-normalized)	Reproduction (% control-normalized)	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)
2015	Q1	100 ± 0	98 ± 14	-	-	117 ± 2.2	-	-	-	-
	Q2	100 ± 0	**82 ± 12**	-	-	**69.2 ± 5.7**	102 ± 3	101 ± 6	101 ± 4	101 ± 5
	Q3	100 ± 0	107 ± 20	-	-	83 ± 21	-	-	-	-
	Q4	100 ± 0	80 ± 24	-	-	94 ± 18	88 ± 9	87 ± 9	98 ± 4	103 ± 4
2016	Q1	100 ± 0	109 ± 16	-	-	129.5 ± 5.3	-	-	-	-
	Q2	100 ± 0	**67 ± 39**	-	-	**91.0 ± 4.8**	78 ± 6	88 ± 16	104 ± 2	97 ± 12
	Q3	100 ± 0	83 ± 21	-	-	119.5 ± 5.5	-	-	-	-
	Q4	100 ± 0	94 ± 18	-	-	156.0 ± 4.5	**70 ± 10**	**69 ± 8**	104 ± 1	116 ± 11
2017	Q1	100 ± 0	**92 ± 38**	-	-	211.8 ± 15.4	-	-	-	-
	Q2	100 ± 0	124 ± 11	-	-	134.0 ± 4.2	99 ± 8	93 ± 18	107 ± 6	125 ± 10
	Q3	100 ± 0	104 ± 25	-	-	146.8 ± 10.1	-	-	-	-
	Q4	100 ± 0	127 ± 15	-	-	103.5 ± 4.4	**41 ± 44**	**41 ± 44**	109 ± 3	119 ± 5
2018	Q1	100 ± 0	75 ± 19	-	-	164.3 ± 10.3	-	-	-	-
	Q2	100 ± 0	***40 ± 12***	96 ± 15	108 ± 35	147.5 ± 4.8	102 ± 3	103 ± 2	104 ± 5	109 ± 16
	Q3	100 ± 0	106 ± 18	109 ± 10	150 ± 30	97.0 ± 12.2	-	-	-	-
	Q4	100 ± 35	***63 ± 23***	74 ± 30	***35 ± 20***	***87.7 ± 8.2***	100 ± 9	103 ± 11	106 ± 1	110 ± 4

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).
[shaded box] result significantly lower than South Line Creek reference (LC_SLC).
[a] Results presented as percent survival or endpoint ± standard deviation.

reproductive output (Golder 2019). No effects to *C. dubia* were observed in samples collected in the remaining quarters (Q1 and Q3; Table 5.3). Testing completed in 2015 and 2016 also resulted in reduced reproduction relative to one or more Elk Valley reference samples in one of the four samples collected annually (Table 5.3).

Hyalella azteca chronic toxicity testing was initiated in 2018 at LC_LCDSSLCC. The dry weight of *H. azteca* was significantly reduced in Q4 of 2018 compared to all reference station samples with the exception of South Line Creek (LC_SLC; Table 5.3). The mean dry weight for the Q4 test was below the local normal range of responses, indicating a likely adverse response to the test water (Golder 2019).

P. subcapitata cell-yield was significantly reduced in Q2 of 2018 compared to all four reference station samples. However, due to the low effect-size relative to reference (19%) and results falling within the local and regional reference normal ranges, the difference was categorized as no adverse response according to decision criteria (Golder 2019). Testing completed in 2015, 2016, and 2017 also resulted in reduced algal growth relative to one or more Elk Valley reference samples in one of the four samples collected annually (Table 5.3).

No effects to the early-life-stage survival and viability of rainbow trout were observed in either of the two semi-annual tests conducted in Q2 (when the AWTF was not in operation) or in Q4 (October 30th to November 27th, immediately following initiation of discharge from the AWTF with AOP; Table 5.3; Golder 2019). Tests conducted in 2015 (when the AWTF was not operational) also resulted in no significant effects on rainbow trout test endpoints relative to Elk Valley reference samples, but effects were observed for two of four endpoints in semi-annual tests completed in 2016 (during steady-state AWTF operation) and in 2017 (Q4 only, during AWTF steady-state operation/flow reduction; Tables 1.1 and 5.3).

Overall, toxicity testing at the Compliance Point (LC_LCDSSLCC) indicated that results in 2018 were similar to or showed less toxicity than in prior years (2015, 2016, and 2017; Table 5.3). This is consistent with the fact that the AWTF was not operational for the majority of 2018. These results are also consistent with findings of benthic invertebrate community monitoring over the same time period that generally indicated no change in community characteristics associated with AWTF operational status in 2018.

5.6 Summary

AWTF operations in 2018 did not significantly change water temperature or dissolved oxygen concentrations downstream in Line Creek. Evaluation of water quality analytes with early warning triggers also demonstrated no increases in analyte concentrations during AWTF operation (in 2016 and 2017) or in 2018 (when the AWTF was not operational for the majority of the year).

Also, toxicity test data did not indicate greater toxicity in 2018 compared to previous years. In other words, there do not appear to be influences on aquatic biota associated with the WLC AWTF operations in 2018 that are not already being addressed through monitoring related to Study Questions #1 (productivity) and #2 (tissue selenium accumulation).

6 SUMMARY

Potential effects to the aquatic environment related to the commissioning of the WLC AWTF were evaluated by addressing three study questions which focus on: 1) potential effects to biological productivity; 2) selenium concentrations in biota; and 3) other potential effects not addressed by the first two study questions.

Evaluation of Study Question #1 (potential influences to biological productivity) indicated that aqueous total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC) were consistently below the SPO of 0.02 mg/L during the 2018 growing season. In 2018, concentrations of the nutrients total phosphorus, orthophosphate, and nitrate were generally in the ranges of concentrations observed in previous years. Mass-balance analysis indicated that the AWTF was generally not the primary contributor of total phosphorus or orthophosphate loadings to the downstream environment during the operational phase of the AWTF. During steady-state operation, the AWTF removed approximately 11.9% of the total nitrate load from effluent on average.

Periphyton coverage at both mine-exposed and reference areas was moderate in 2018 (based on visual assessment) and showed temporal consistency with results from 2017. Benthic invertebrate biomass and density in mine-exposed areas of Line Creek also showed no significant change ($p>0.1$) among years related to changes in the AWTF operational status. Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, generally indicated no change in community characteristics related to changes in the AWTF operational status. Significant positive relationships between both biomass and density (measured by Hess sampling) and total abundance (measured by kick-sampling) indicated that further investigation into the potential use of kick-sampling for secondary productivity monitoring is warranted.

Overall, assessment of Study Question #1 indicated that biological productivity downstream from the WLC AWTF was not affected in 2018 (when the AWTF was not operational for 8 months of the year), or by AWTF operational status changes that occurred between 2014 and 2018 (summarized in Table 6.1).

Evaluation of Study Question #2 (assessment of selenium concentrations) focused on aqueous selenium concentrations and selenium concentrations in biota. Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate, with lesser amounts (typically ~1-2%) of chemically-reduced forms such as selenite. Although the WLC AWTF successfully decreased concentrations of total selenium in Line Creek, the effluent contained higher proportions of reduced selenium species, some of which are known to be more readily accumulated by aquatic

Table 6.1: Summary of Measurement Endpoints, Analyses, and Results of Line Creek LAEMP, 2018

Key Questions	Water				Biological			
	Measurement Endpoint	**Indicator**	**Analysis/Evaluation**	**Result**	**Measurement Endpoint**	**Indicator**	**Analysis/Evaluation**	**Result**
Is active water treatment affecting biological productivity downstream in Line Creek?	Nutrient concentrations	Nitrate	**1)** Mass-balance analysis: 2016 to 2018. Stations: LC_LC3, LC_LCDSSLCC **2)** Comparison to BCWQG and Water Quality Benchmarks	**1)** Mean AWTF removal of 12% of total nitrate load at LC_LC3 when AWTF in operation. **2)** Concentrations > BCWQG and Level 1 benchmark both upstream and downstream of AWTF discharge, and > Level 2 benchmark at stations closest to mine operations	Periphyton productivity	Visual Coverage Scores	Coverage scored according to CABIN guidance (Environment Canada 2012)	Coverage scored as moderate at mine-exposed and reference stations, and consistent with 2017 results.
					Benthic invertebrate productivity	Biomass	ANOVA analysis among years = 2014, 2015, 2016, 2017, 2018 Areas: Ref = RG_SLINE, RG_LI24; Exp = RG_LILC3, RG_LIDSL	No effect associated with changes in the AWTF operational status (no difference among years at Exp relative to Ref).
						Density	ANOVA analysis among years = 2014, 2015, 2016, 2017, 2018 Areas: Ref = RG_SLINE, RG_LI24; Exp = RG_LILC3, RG_LIDSL	No effect at Exp areas associated with changes in the AWTF operational status, when compared to RG_LI24. Significant decrease in 2018 at Exp areas when compared to RG_SLINE. Significant difference to RG_SLINE likely related to increase in density at this Ref area compared to previous years, rather than decrease in density at mine-exposed areas.
		Phosphorus	**1)** Mass-balance analysis: 2016 to 2018. Stations: LC_LC3, LC_LCDSSLCC **2)** Comparison to SPO **3)** Comparison to baseline 97.5th percentile; LC_LC3	**1)** Mean AWTF contribution of 32% of total phosphorus load at LC_LC3 when AWTF in operation. **2)** Phosphorus did not exceed SPO in 2018 (AWTF not operational for 8 months of year). **3)** Concentrations generally below baseline during all 2018 routine sampling events.	Benthic invertebrate community structure	Abundance	Comparison to past observations and reference normal range (NR)	No evidence of effect associated with changes in AWTF operational status on secondary productivity.
						Richness	Comparison to past observations and reference normal range (NR)	All results within NR. No evidence of adverse effect associated with changes in AWTF operational status. Slight decrease (within NR) at RG_LILC3 and RG_LIDSL to values more similar to before AWTF operation
		Orthophosphate	**1)** Mass-balance analysis: 2016 to 2018. Stations: LC_LC3, LC_LCDSSLCC **2)** Comparison to baseline 97.5th percentile; LC_LC3	**1)** Mean AWTF contribution of 17% of total phosphorus load at LC_LC3 when AWTF in operation. **2)** Concentrations generally below baseline throughout 2018, except for one event during AWTF restart with AOP.		%EPT, %Ephemeroptera (%E), %Chironomidae (%C)	Comparison to past observations and reference normal range (NR)	%E and %EPT within range of past observations; no evidence of effect associated with changes in AWTF operational status. Slight increase in %C at exposed stations in 2018 compared to previous years.

Notes: Ref = Reference sampling station/area; Exp = Mine-exposed sampling station/area; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; Ephem = Ephemeroptera; BT = Bull trout; WCT = Westslope cutthroat trout. Water quality benchmarks are those outlined in Teck (2014).

Table 6.1: Summary of Measurement Endpoints, Analyses, and Results of Line Creek LAEMP, 2018

Key Questions	Water				Biological			
	Measurement Endpoint	Indicator	Analysis/Evaluation	Result	Measurement Endpoint	Indicator	Analysis/Evaluation	Result
Are tissue selenium concentrations reduced downstream from the AWTF?	Total and dissolved selenium concentrations		**1)** ANOVA analysis: 2012-2018 for total Se at LC_LC1 **2)** Visual inspection of data	**1)** Significant increases in total Se in 2014, 2015, and 2017. No change between 2017 and 2018. **2)** Increase in total Se downstream of AWTF during flow reduction and shutdown.	Tissue Selenium	Periphyton	Tissue selenium monitored until May 2018. Results confounded by the presence of abiotic particles containing inorganic selenium, therefore no analyses completed. Sampling discontinued after May 2018 due to this confounding.	No analyses completed.
	Selenium speciation		Comparison downstream relative to upstream from the AWTF, and of Line Creek input to Fording River	Lower concentrations of non-selenate selenium species in Line Creek downstream relative to upstream of AWTF during shutdown and restart with AOP, compared to during steady-state operation Concentrations of non-selenite species in Fording River usually similar to or lower downstream of input from Line Creek compared to upstream.		Composite-taxa samples	**1)** ANOVA analysis: Before = 2012; Initial Operations = 2014; Steady-state = 2016 to 2017; Shutdown = Mar to Aug 2018; Restart = Oct 2018 to Jan 2019 Areas: Ref = RG_SLINE, RG_LI24; Exp = RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23 **2)** Spatial analysis using ANOVA during each sampling event (Mar 2017 to Jan 2019) **3)** Comparison to reference normal range (NR) **4)** Comparison to site-specific benchmarks	**1)** Significant decrease in tissue [Se] during AWTF shutdown and restart with AOP compared to steady-state at all mine-exposed areas downstream of the AWTF, relative to reference (except RG_LIDCOM during restart). Further significant decrease at RG_LILC3 and RG_LISP24 between AWTF shutdown and AWTF/AOP restart phases. **2)** Significantly higher tissue [Se] at more than one mine-exposed area (including RG_LILC3) relative to upstream of AWTF and reference during flow reduction and shutdown of AWTF (until May 2018), and only at RG_LILC3 after June 2018, and during restart with AOP. Concentrations in Fording River similar downstream and upstream of Line Creek input. **3)** Tissue [Se] of one or more samples higher than NR at all mine-exposed areas and upstream of AWTF during AWTF shutdown and restart with AOP. **4)** Tissue [Se] of one or more samples during AWTF shutdown higher or equal to Level 1 benchmark at all Line Creek mine-exposed stations downstream of AWTF outfall, and higher than Level 3 benchmark during shutdown at RG_LILC3, RG_LIDSL, and RG_LI8. Tissue [Se] below Level 1 benchmark at all areas during AWTF restart with AOP.
						Single taxon samples	Results part of an earlier investigation and were discontinued following March 2018 sampling event.	No analyses completed because all prior results presented in Minnow (2018d).
						Fish (WCT and BT)	Comparison to past observations and site-specific benchmarks	**WCT:** Fish muscle [Se] and estimated ovary [Se] within the range of previous years including before and during AWTF operation (2006 to 2017). Estimated ovary [Se] higher than level 1 benchmark for one individual from near RG_LIDCOM. **BT**: Muscle [Se] higher in fish presumed to be resident (juveniles) than in larger adults presumed to be migratory spawners, consistent with previous results of otolith selenium analysis in juvenile and adult bull trout (Minnow 2018d). Ovary Se not estimated for juveniles (all fish captured in 2018).
	Selenium bioaccumulation model		Comparison of composite-taxa benthic tissue selenium results to one-step water-to-invertebrate model	Most tissue selenium concentrations similar or less than model predictions. Samples collected nearest the AWTF higher than model during AWTF operation (steady-sate and flow reduction) , and slightly less than model predictions during AWTF restart with AOP.	Benthic invertebrate community structure	Abundance	Comparison to past observations and reference normal range (NR)	No evidence of effect associated with changes in AWTF operational status on secondary productivity.
						Richness	Comparison to past observations and reference normal range (NR)	All results within NR. No evidence of adverse effect associated with changes in AWTF operational status. Slight decrease (within NR) at RG_LILC3 and RG_LIDSL to values more similar to before AWTF operation.
						%EPT, %E, %C	Comparison to past observations and reference normal range (NR)	%E and %EPT within range of previous years; no evidence of effect associated with changes in AWTF operational status. Slight increase in %C at exposed stations in 2018 compared to previous years.

Notes: Ref = Reference sampling station/area; Exp = Mine-exposed sampling station/area; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; Ephem = Ephemeroptera; BT = Bull trout; WCT = Westslope cutthroat trout. Water quality benchmarks are those outlined in Teck (2014).

Table 6.1: Summary of Measurement Endpoints, Analyses, and Results of Line Creek LAEMP, 2018

Key Questions	Water				Biological			
	Measurement Endpoint	Indicator	Analysis/Evaluation	Result	Measurement Endpoint	Indicator	Analysis/Evaluation	Result
Is AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations or concentrations of treatment-related constituents other than nutrients or selenium?	Temperature	Data loggers	Comparison downstream relative to upstream of the AWTF	Similar temperatures downstream of AWTF relative to upstream.	Benthic invertebrate community structure	Abundance	Comparison to past observations and reference normal range (NR)	No evidence of effect associated with changes in AWTF operational status on secondary productivity.
		Routine monitoring	Comparison to BCWQG	Temperatures within or below the optimum temperature ranges for both bull trout and westslope cutthroat trout				
	Dissolved oxygen		Comparison to BCWQG	Mean DO concentrations below 30-day criterion for sensitive life stages upstream and downstream of AWTF, suggesting DO below BCWQG not related to AWTF operation.		Richness	Comparison to past observations and reference normal range (NR)	All results within NR. No evidence of adverse effect associated with changes in AWTF operational status. Slight decrease (within NR) at RG_LILC3 and RG_LIDSL to values more similar to before AWTF operation
	Analytes with Early Warning Triggers		**1)** Comparison to past results **2)** Comparison to BCWQG **3)** Comparison to Water Quality Benchmarks	**1)** No obvious temporal increases in analyte concentrations associated with steady-state operation, and 2018 concentrations within the range of previous years. **2)** BCWQG exceedances for NO_3, total [Se], [Hg], and dissolved [Cd] upstream and downstream of AWTF discharge. NH_3 BCWQG exceedances upstream of AWTF only. **3)** Level 1 benchmark exceedances for dissolved [Cd]; Level 2 benchmark exceedances for NO_3, total [Se], [Ni]. Level 2 [Ni] exceedance upstream of AWTF discharge only.				
	Toxicity		Comparison of chronic and acute toxicity test results to reference, and past results	Results at Compliance Point similar to or showed less toxicity than past years (2015, 2016, 2017), suggesting no greater toxicity associated with changes in AWTF operational status.		%EPT, %E, %C	Comparison to past observations and reference normal range (NR)	%E and %EPT within range of previous years; no evidence of effect associated with changes in AWTF operational status. Slight increase in %C at exposed stations in 2018 compared to previous years.

Notes: Ref = Reference sampling station/area; Exp = Mine-exposed sampling station/area; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; Ephem = Ephemeroptera; BT = Bull trout; WCT = Westslope cutthroat trout. Water quality benchmarks are those outlined in Teck (2014).

biota than selenate. Concentrations of non-selenate forms of selenium in Line Creek were substantially decreased when the AWTF was not operational in 2018, and following the recommissioning of the AWTF with AOP. Benthic invertebrate tissue monitoring in Line Creek in 2018 identified decreased selenium concentrations during the shutdown of the AWTF and following the AWTF restart with AOP, compared to concentrations that were observed during steady-state operation of the AWTF. Benthic invertebrate tissue selenium concentrations in the Fording River were similar downstream from Line Creek compared to upstream, indicating that the effects of the AWTF on selenium accumulation were limited to Line Creek (summarized in Table 6.1). Selenium concentrations in bull trout and westslope cutthroat trout tissues were similar to those reported in 2017, but low sample sizes limited the conclusions that can be drawn from these data.

Overall, assessment of Study Question #2 in 2018 indicated that selenium concentrations in benthic invertebrates decreased when the AWTF was shut down. In addition, results following the restart of the AWTF with AOP indicated that the recommissioned facility is functioning to decrease the non-selenate species in AWTF effluent, and limit selenium bioavailability in Line Creek. Further monitoring during the growing season (i.e. September) while the plant is fully operational will be useful in confirming these results.

Evaluation of Study Question #3 (potential effects related to factors other than nutrients or selenium) indicated that AWTF operations in 2018 did not appear to affect water temperature or dissolved oxygen concentrations downstream in Line Creek. Evaluation of water quality analytes with early warning triggers also demonstrated no obvious increases in analyte concentrations during AWTF operation. Also, toxicity test data did not indicate greater toxicity in 2018 (when the AWTF was not operational for the majority of the year) compared to previous years. In other words, there do not appear to be influences associated with the WLC AWTF operations in 2018 that are not already being addressed through monitoring related to Study Questions #1 (productivity) and #2 (tissue selenium accumulation, see summary in Table 6.1).

The results from the Line Creek LAEMP provide supportive information to answer Management Question 5 from Teck's adaptive management program (Teck 2018) and Table 6.2 summarizes KU 5.1 material presented in this report.

Table 6.2: Summary of Line Creek LAEMP Activities Addressing AMP Key Uncertainty 5.1 (*How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?)*

Topics	Summary for KU 5.1
Activities undertaken to reduce the KU (and when), and any noteworthy deviations from activities that were planned	Water quality, periphyton productivity, benthic invertebrate community, benthic invertebrate selenium monitoring in September (consistent with previous LAEMP timing). Benthic invertebrate tissue selenium monitoring defined intervals following shutdown (0, 4, 8, 12 weeks) of the West Line Creek (WLC) Active Water Treatment Facility (AWTF) in March 2018, as per the Bypass Approval Authorization (ENV 2018), in September (consistent with previous LAEMP timing), and in December (5 weeks following initial discharge from the newly recommissioned AWTF with Advanced Oxidation Process [AOP]). Fish tissue selenium monitoring in spring (April/May) and fall (September), for bull trout and westslope cutthroat trout.
Results	***1. Is active water treatment affecting biological productivity downstream in Line Creek?*** Changes to the AWTF operational status in 2018 (the AWTF was not in operation for approximately 8 months and was then restarted with AOP) did not affect productivity (aqueous concentrations of total phosphorus and orthophosphate, periphyton productivity, and benthic invertebrate productivity) at monitoring areas downstream of the AWTF discharge. Benthic invertebrate community composition metrics were generally either within the range of previous monitoring years, or within the established normal range (defined as the 2.5th and 97.5th percentiles of 2012 and 2015 reference data from the RAEMP). ***2. Are tissue selenium concentrations reduced downstream from the WLC AWTF?*** Aqueous concentrations of selenite and other more bioavailable non-selenate species downstream of the AWTF were lower when the AWTF was not in operation (shutdown) and after the restart of the AWTF with AOP, compared to when the AWTF was fully operational (steady-state). Concentrations of selenium in benthic invertebrate tissue downstream of the AWTF were significantly lower during AWTF shutdown relative to steady-state, and lower following the restart of the AWTF with AOP compared to steady-state AWTF operation (4 of 5 areas) and AWTF shutdown (2 of 5 areas; compared to changes at reference during the same time period). ***3. Is WLC AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations, or concentrations of treatment-related constituents other than nutrients or selenium*?** No influences associated with AWTF operational changes that are not already being address through Key Questions 1 and 2 (i.e., no AWTF-related changes in dissolved oxygen, temperature, or aqueous concentrations of mine-related constituents.

Table 6.2: Summary of Line Creek LAEMP Activities Addressing AMP Key Uncertainty 5.1 (*How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?)*

Topics	Summary for KU 5.1
Responses to results (actions done, and still needed), including any adjustments	Anomalous selenium concentrations in composite-taxa benthic invertebrate tissue samples at a reference area (RG_LI24) in May 2018 prompted confirmatory sampling in September 2018. Samples were collected at RG_LI24, as well as an additional downstream location (which was still reference), that had not previously been sampled. Results indicated that the tissue concentrations at RG_LI24 in May 2018 were indeed anomalous, and likely reflective of potential laboratory analysis or field sampling error. Increased selenium concentrations in composite-taxa benthic invertebrate tissue samples in the Fording River upstream of Line Creek (RG_FRUL) in September 2018 prompted monitoring at a location further upstream in the Fording River (RG_FO9) in December 2018 to investigate the potential source of the increase. Benthic invertebrate selenium concentrations at the upstream area (RG_FO9) in December were not similarly elevated to results from RG_FRUL in September and December, suggesting an influence unrelated to Line Creek, and no further monitoring was conducted.
Future activities planned (and when (by year)) to reduce this KU	Monitoring for the LCO LAEMP in 2019, and will be similar to 2018. Periphyton productivity, benthic invertebrate community, and fish tissue selenium monitoring is planned for September (consistent with previous LAEMP monitoring). Benthic invertebrate tissue selenium sampling to monitor the stabilization of the AWTF with AOP operation was completed in mid-January and late February 2019, and is planned for late April, September, and early December 2019, as well as continuation in late February and late April 2020. Additional biological sampling may be conducted to further support understanding of the operation of the AWTF with AOP. Results from any additional monitoring will be presented to the EMC and will be included in the 2019 LCO LAEMP interpretive report.
How these future activities will contribute to reducing the KU	The future monitoring will contribute to reducing the Key uncertainty 5.1 (How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?) by providing continued chemical, physical and biological monitoring data. These data will be used in future LAEMP reports to assess spatial and/or temporal changes in biological endpoints, and will be used in the RAEMP to support answer RAEMP questions that feed directly into the AMP through Management Question 5.
What has been learned?	Overall, results indicate re-commissioning of AWTF with AOP is functioning to change selenium species in AWTF effluent back to a selenate-dominated condition and decreasing selenium accumulation in aquatic biota.
Have new KUs arisen from this work?	No new KUs have arisen from the Line Creek LAEMP.

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APPENDIX A
SUPPORTING DATA – PRODUCTIVITY EVALUATION

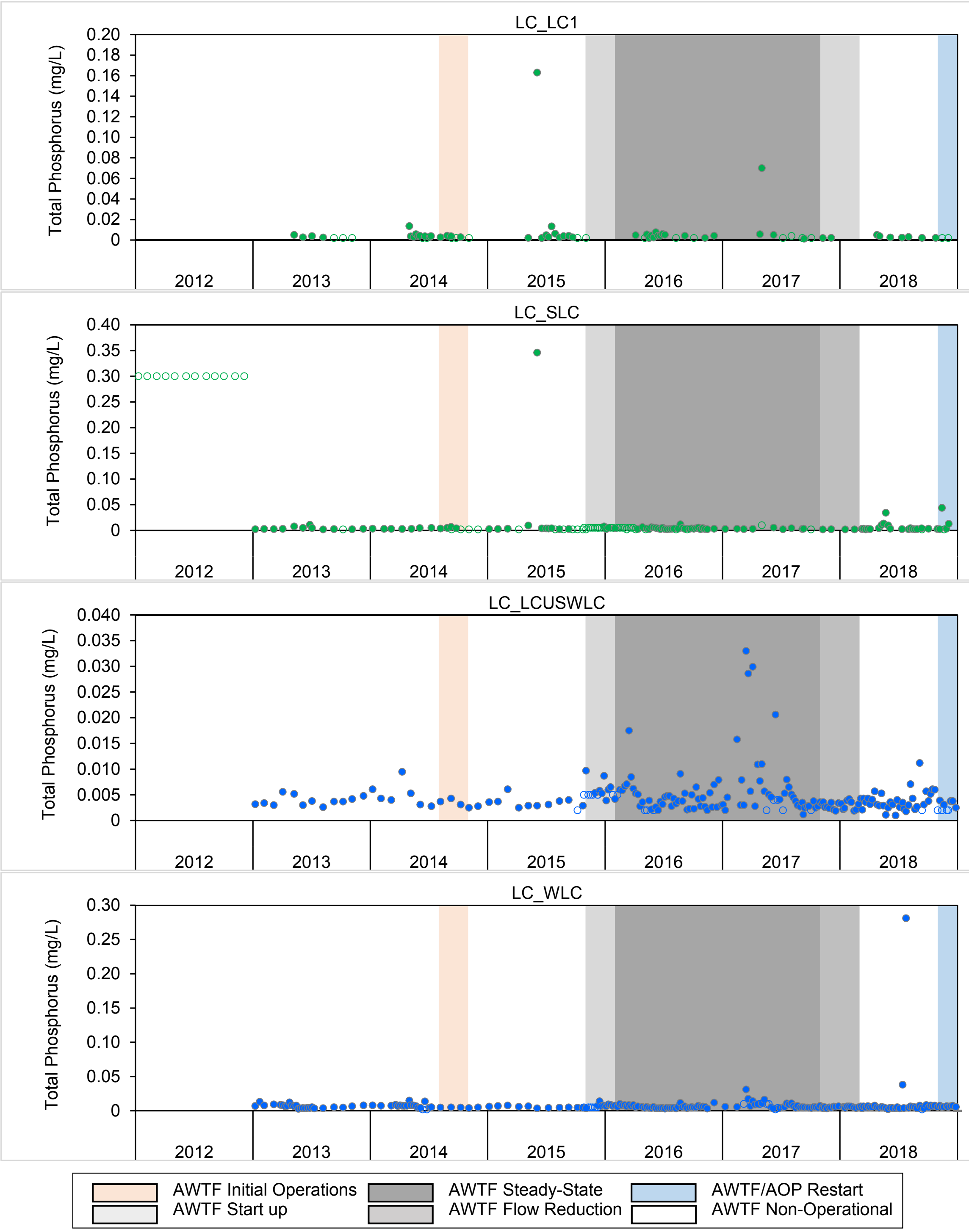
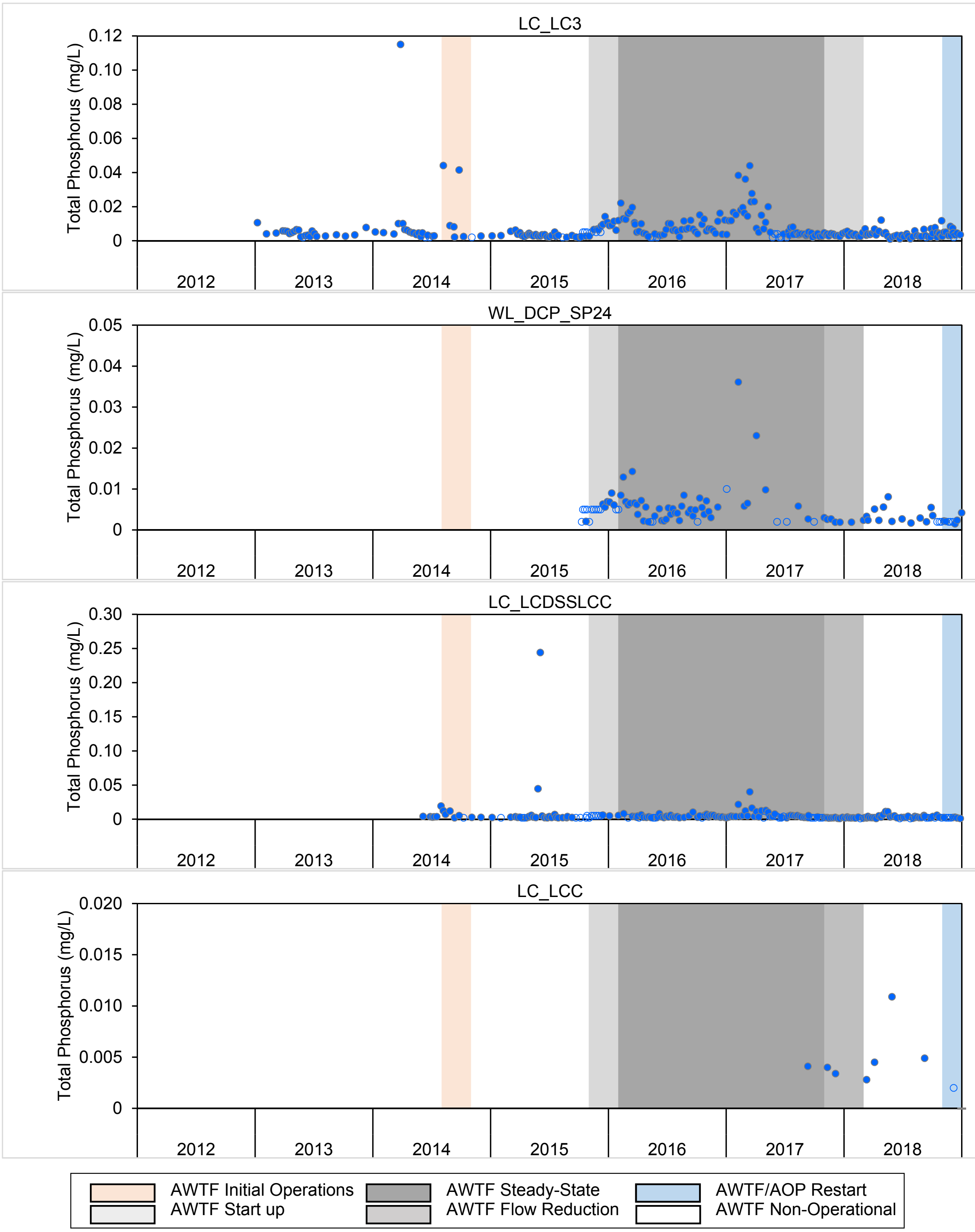


Figure A.1: Time Series Plots for Aqueous Total Phosphorus Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.



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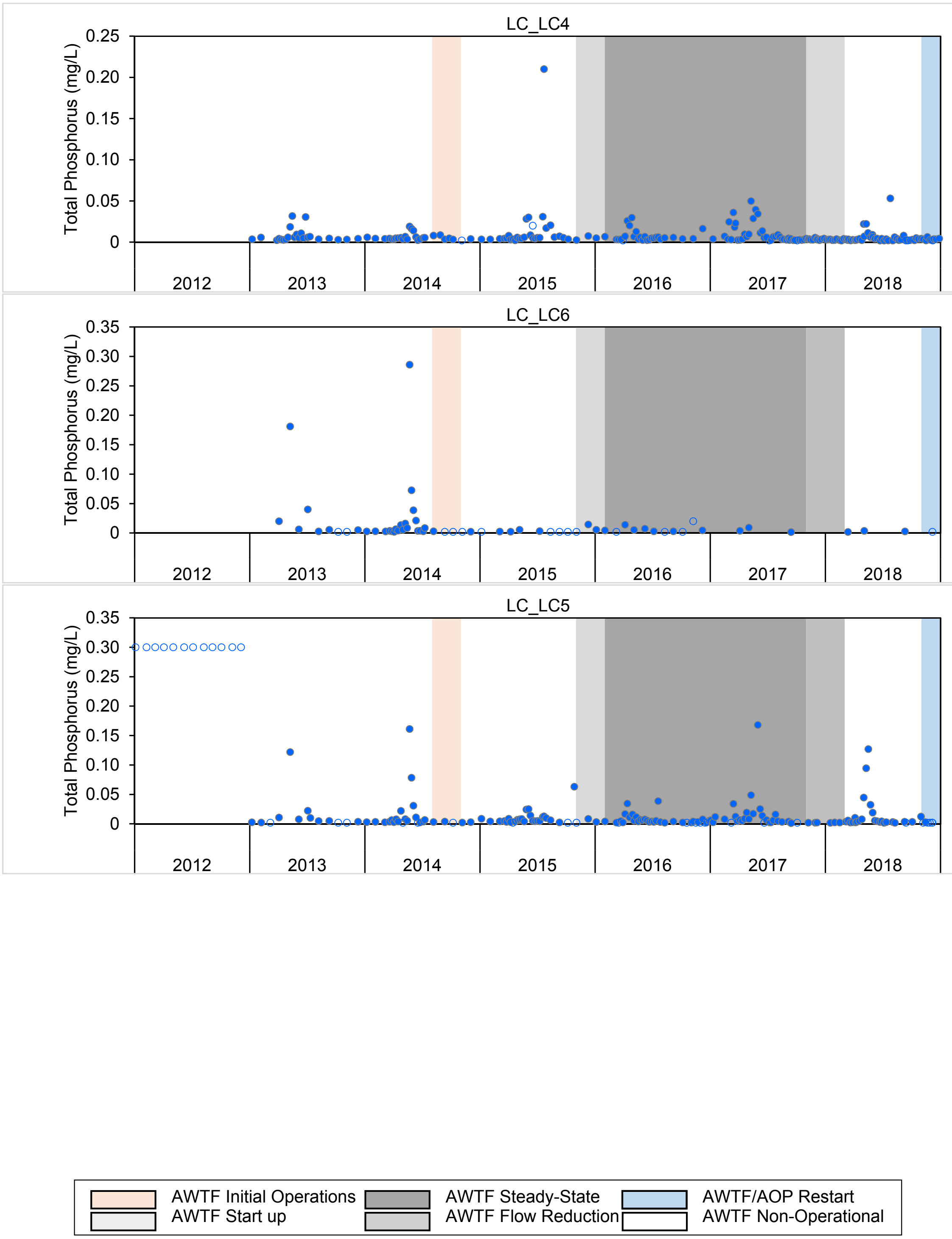

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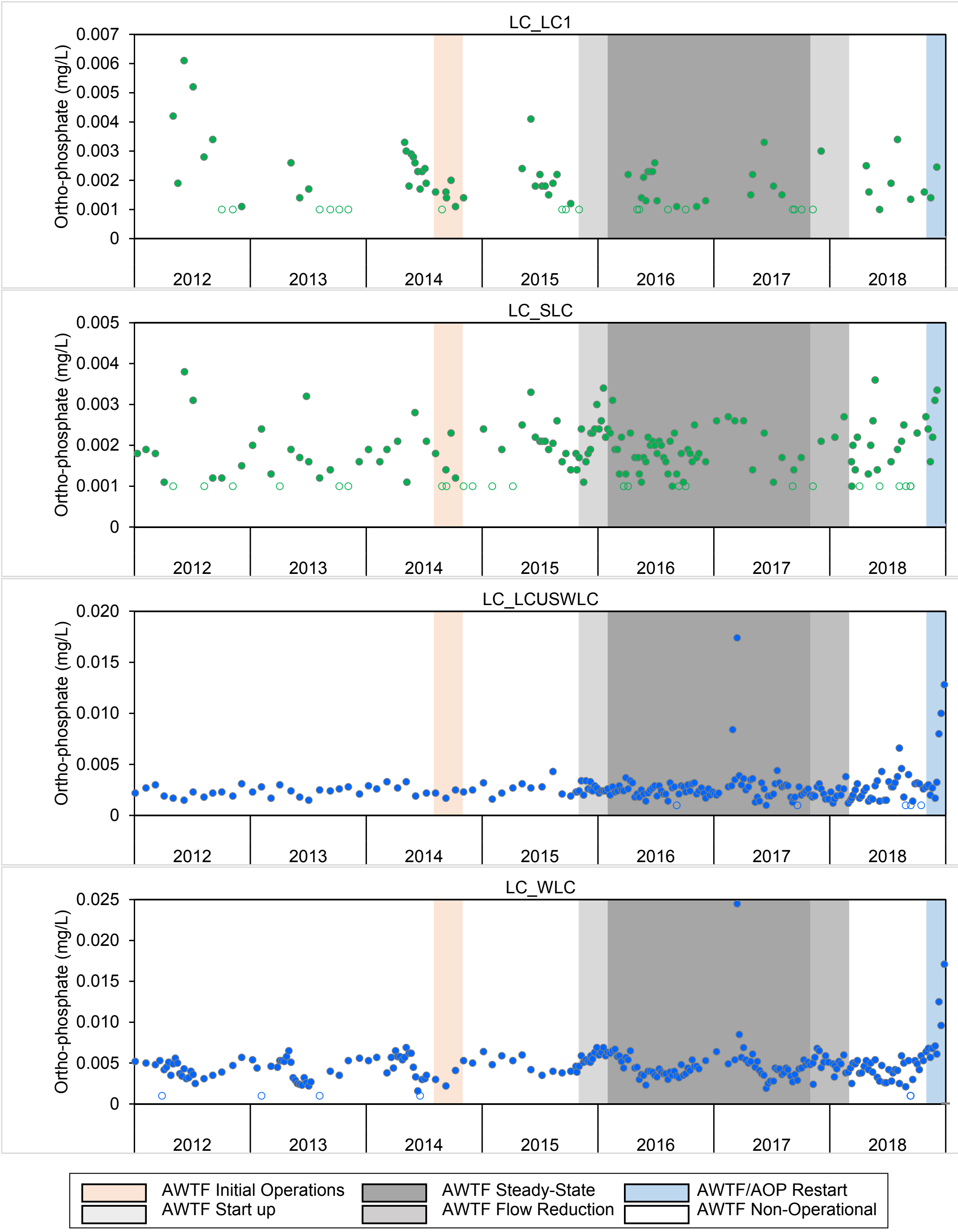
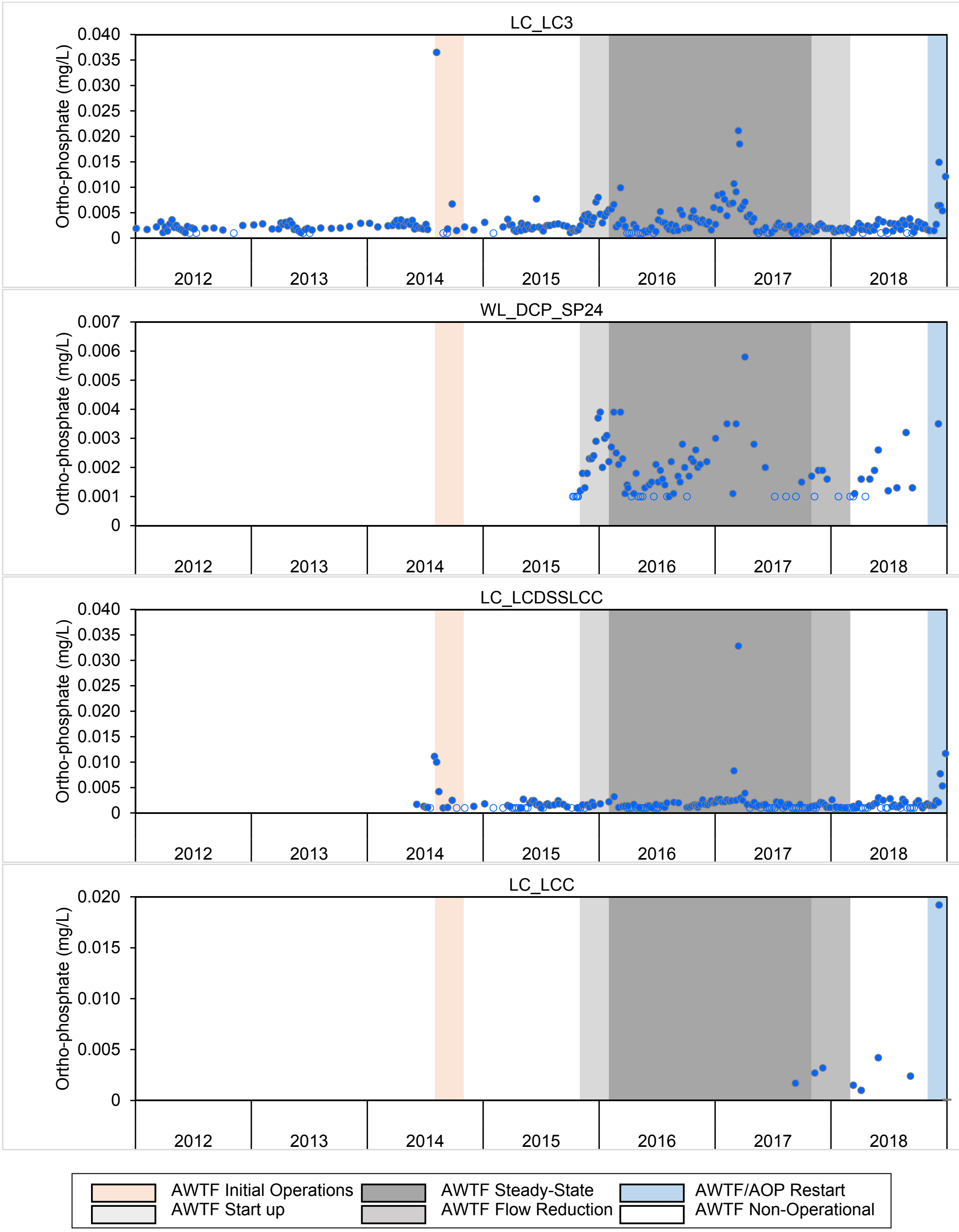


Figure A.2: Time Series Plots for Aqueous Total Orthophosphate Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge,



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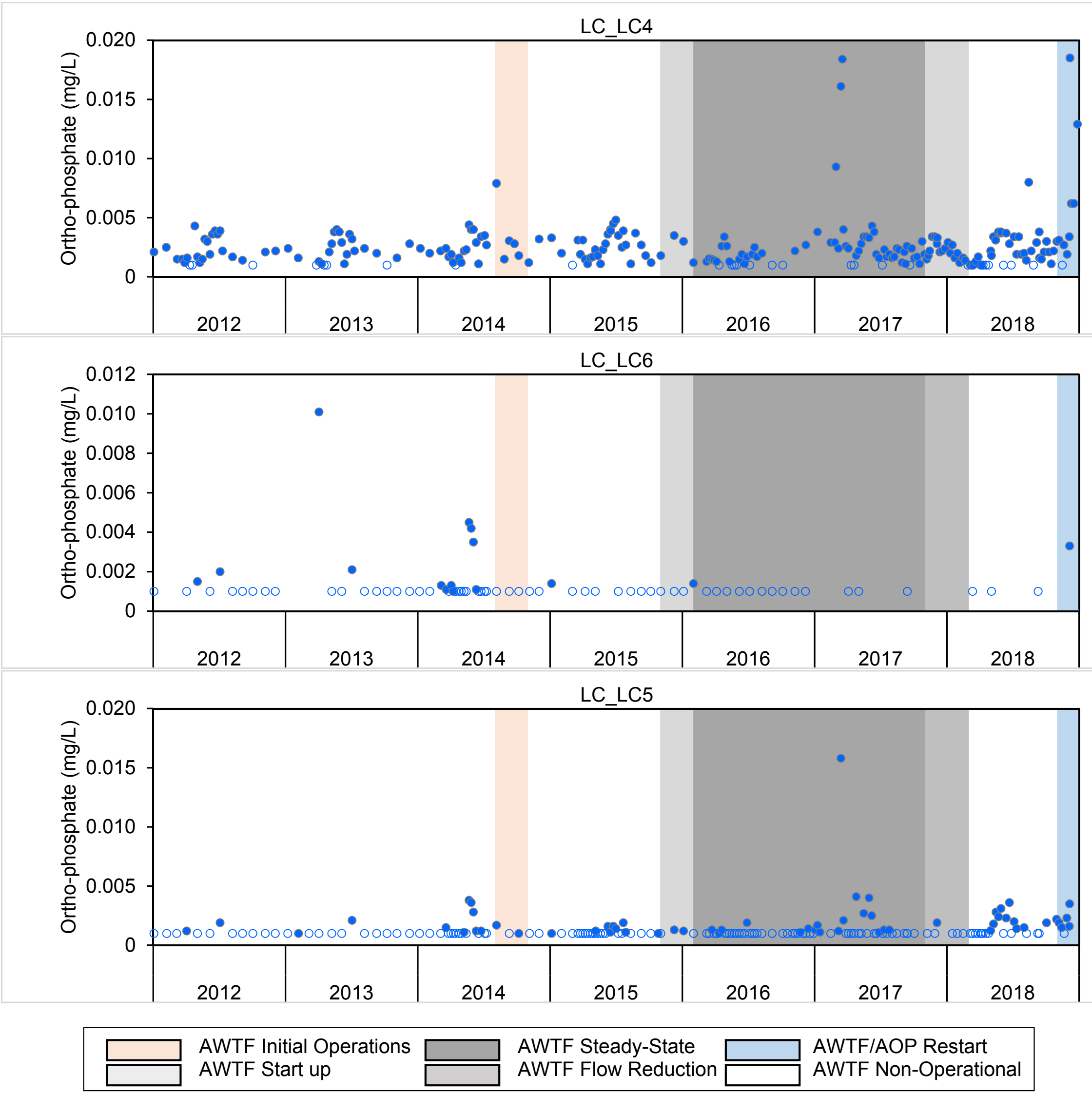

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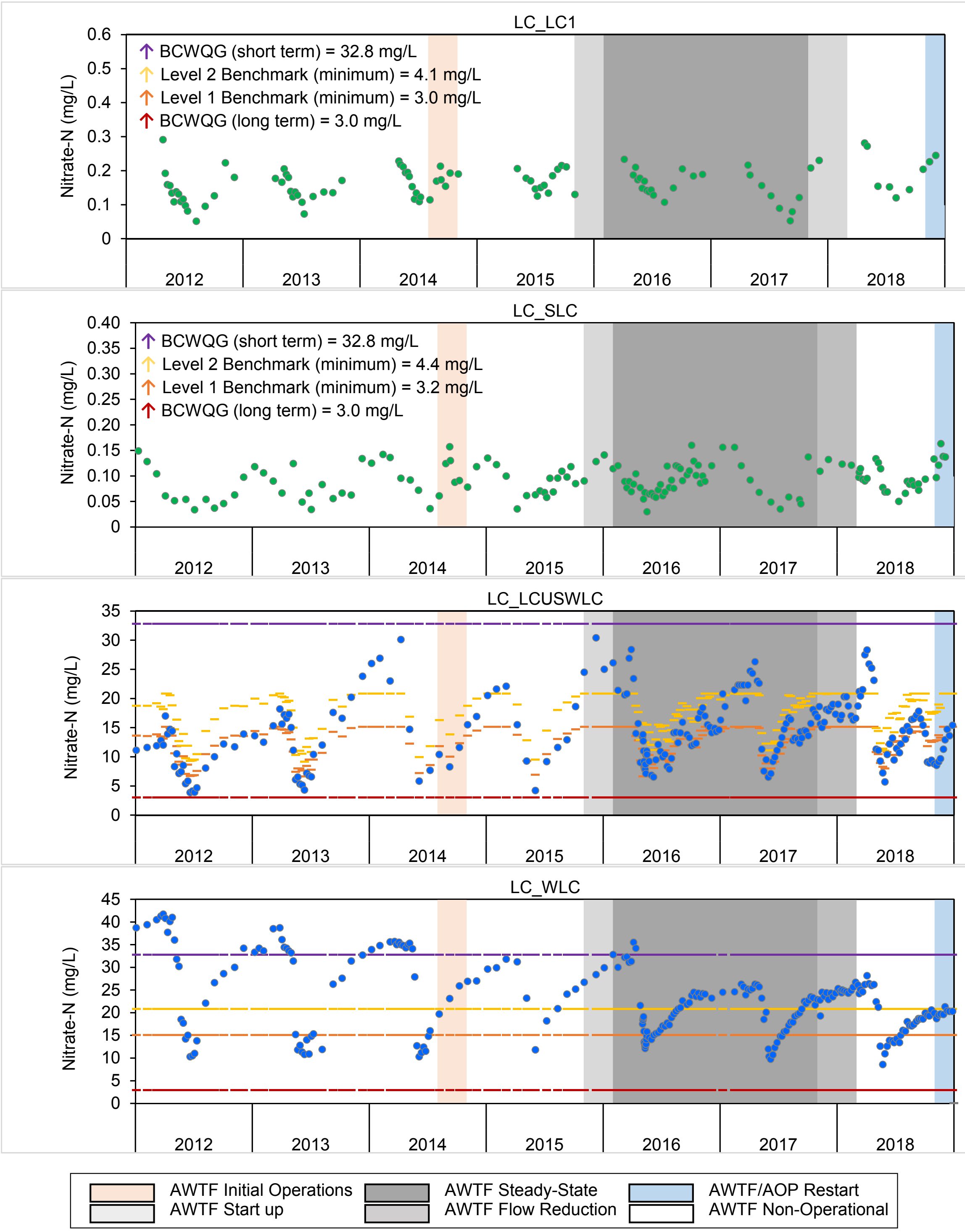

Figure A.3: Time Series Plots for Aqueous Nitrate-N Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

= BCWQG (long term); = BCWQG (short term); = Level 1 Benchmark; = Level 2 Benchmark.

= Mine-exposed; = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

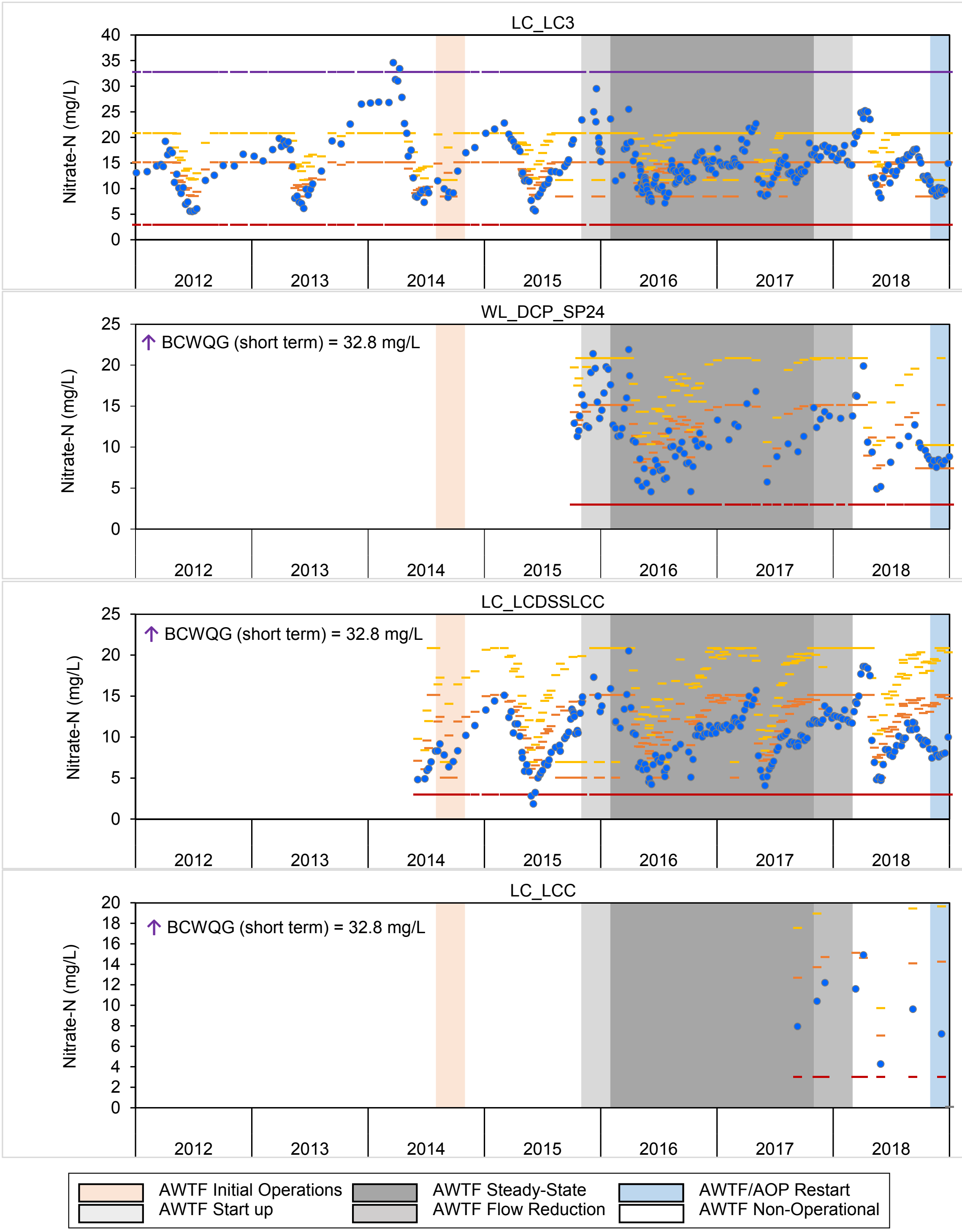

Figure A.3: Time Series Plots for Aqueous Nitrate-N Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark; – – = Level 2 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

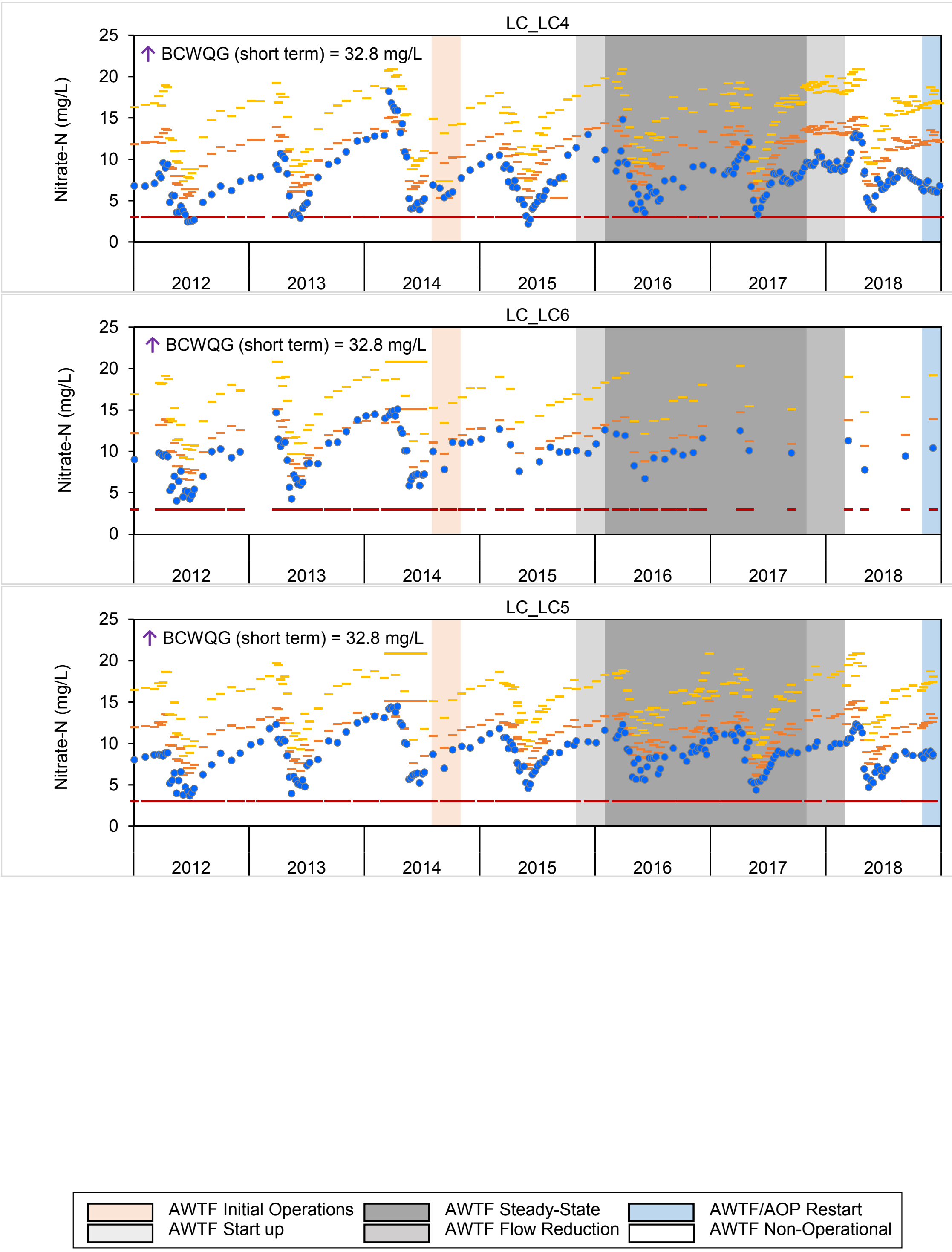

Figure A.3: Time Series Plots for Aqueous Nitrate-N Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark; – – = Level 2 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Figure A.4: Site Photograph and Periphyton Coverage at Station RG_LI24, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_LI24, bottom photo is a view of the sampling area looking downstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_SLINE, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_SLINE, bottom photo is a view of the sampling area looking downstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_LCUT, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_LCUT, bottom photo is a view of the sampling area looking upstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_LILC3, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_LILC3, bottom photo is a view of the sampling area looking downstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_LISP24, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_LISP24, bottom photo is a view of the sampling area looking downstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_LIDSL, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_LIDSL, bottom photo is a view of the sampling area looking upstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_LIDCOM, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_LIDCOM, bottom photo is a view of the sampling area looking downstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_LI8, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_LI8, bottom photo is a view of the sampling area looking downstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_FRUL, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_FRUL, bottom photo is a view of the sampling area looking upstream.

Figure A.4: Site Photograph and Periphyton Coverage at RG_FO23, September 2018

Note: Top photo is a representative photo of periphyton coverage at RG_FO23, bottom photo is a view of the sampling area looking upstream.

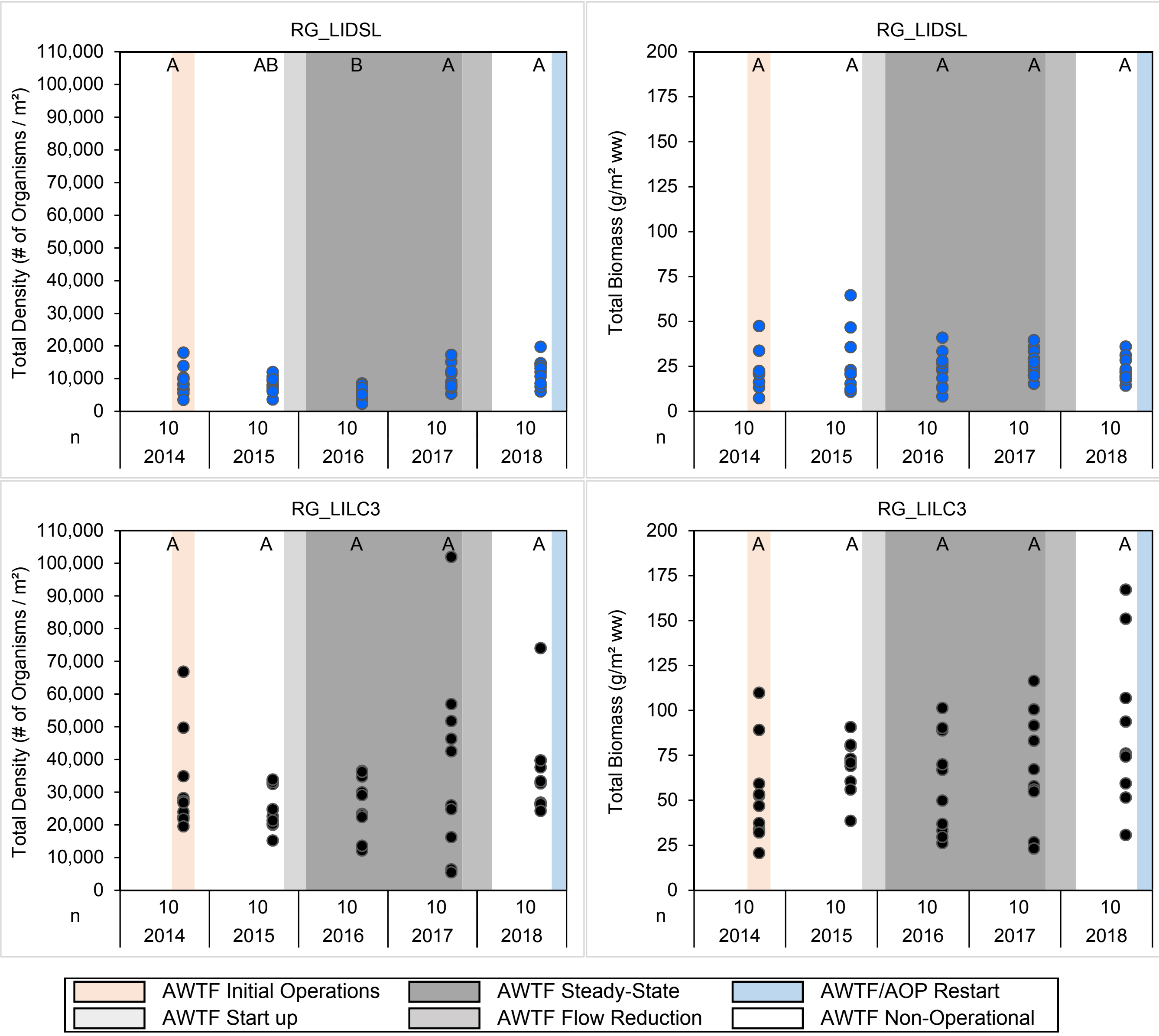

Figure A.5: Total Benthic Invertebrate Density and Biomass (Hess Sampling), for RG_LIDSL and RG_LILC3 Over Time, 2014 to 2018

Notes: Years that share a letter (e.g., A,B) are not significantly different (α=0.1). Letters assigned such that the year with the highest mean value is assigned the letter A.

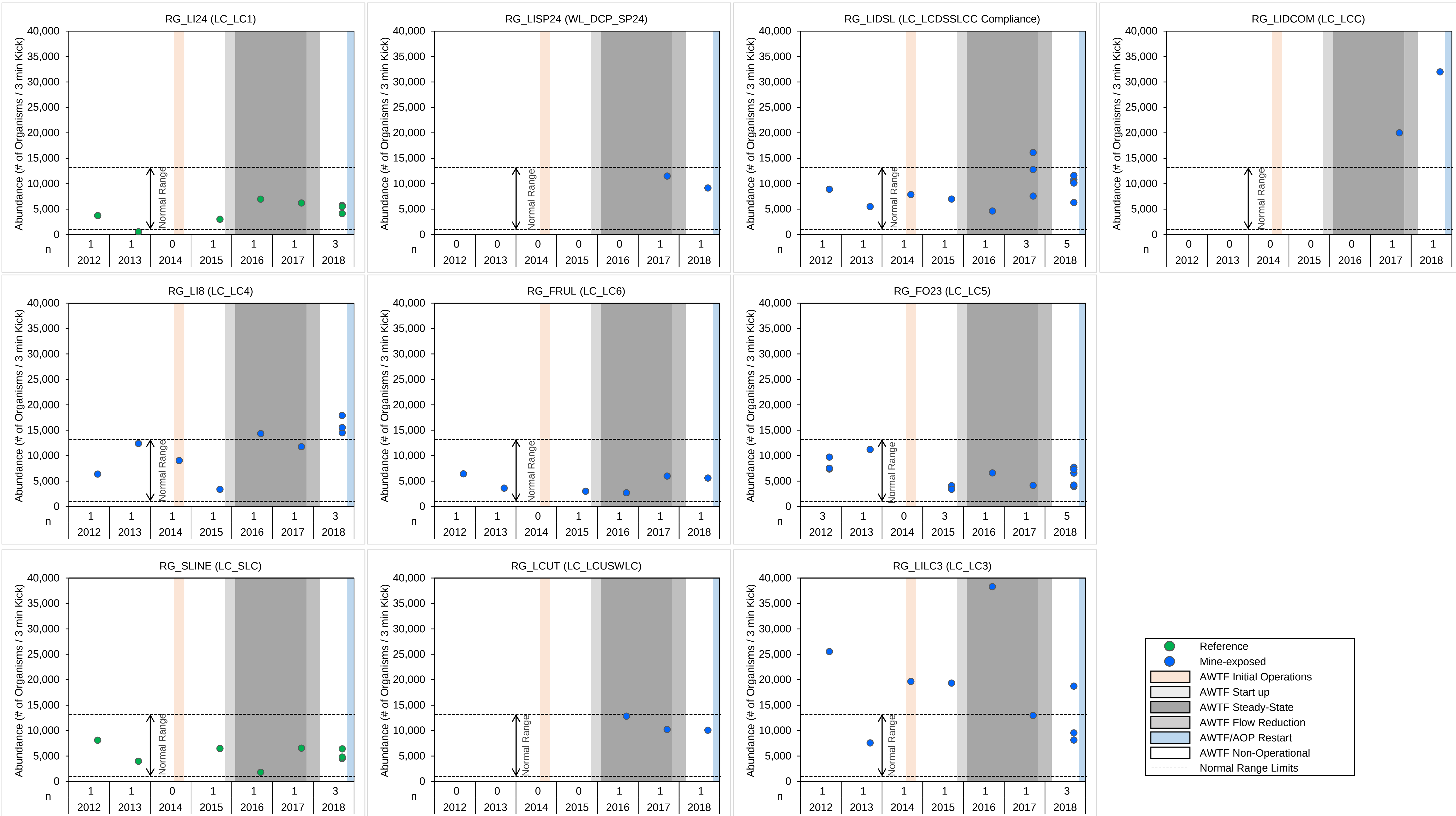

Figure A.6: Benthic Invertebrate Community Abundance (3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2018

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

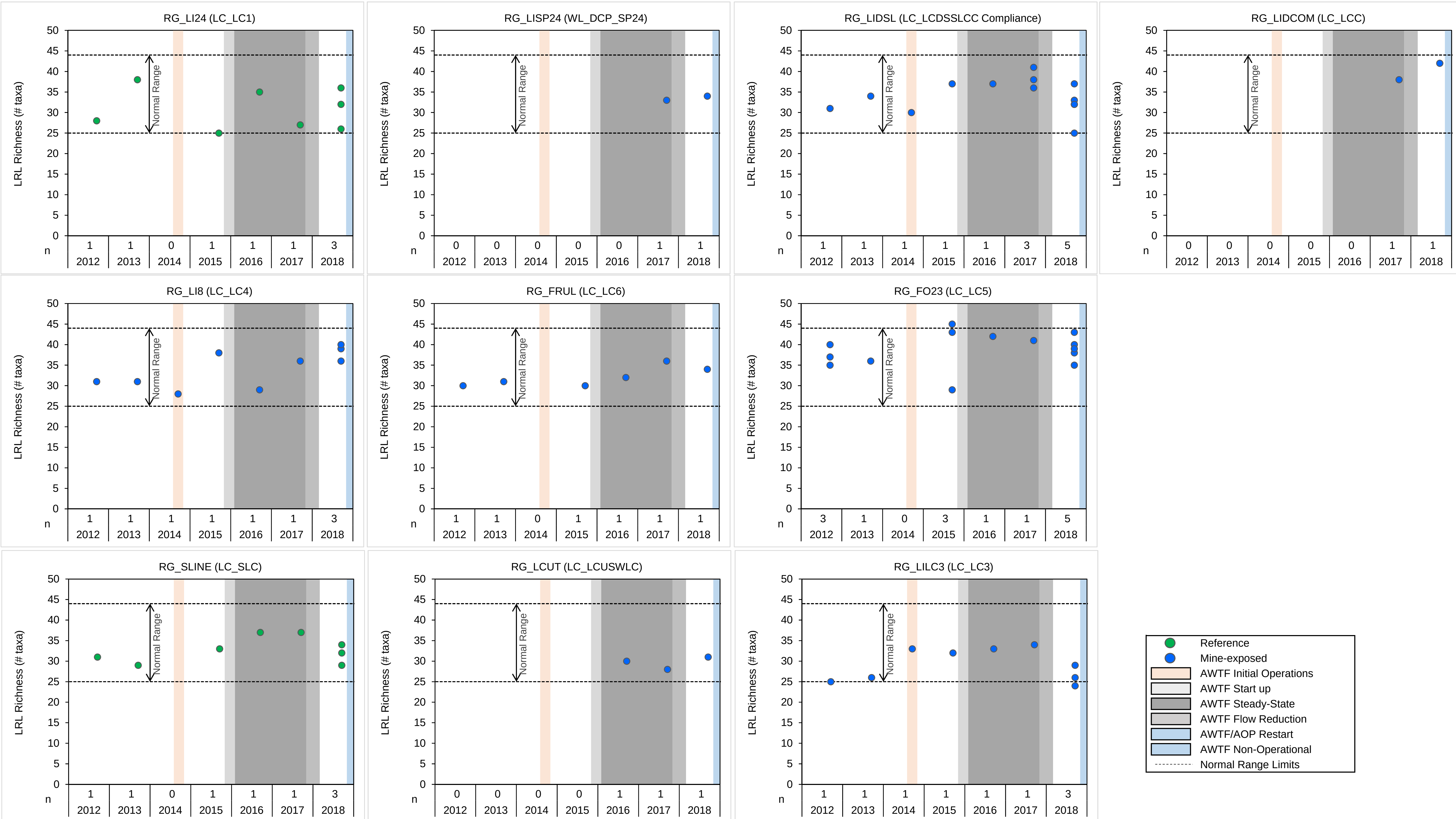

Figure A.7: Benthic Invertebrate Community Richness (Lowest Practicable Level; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2018

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

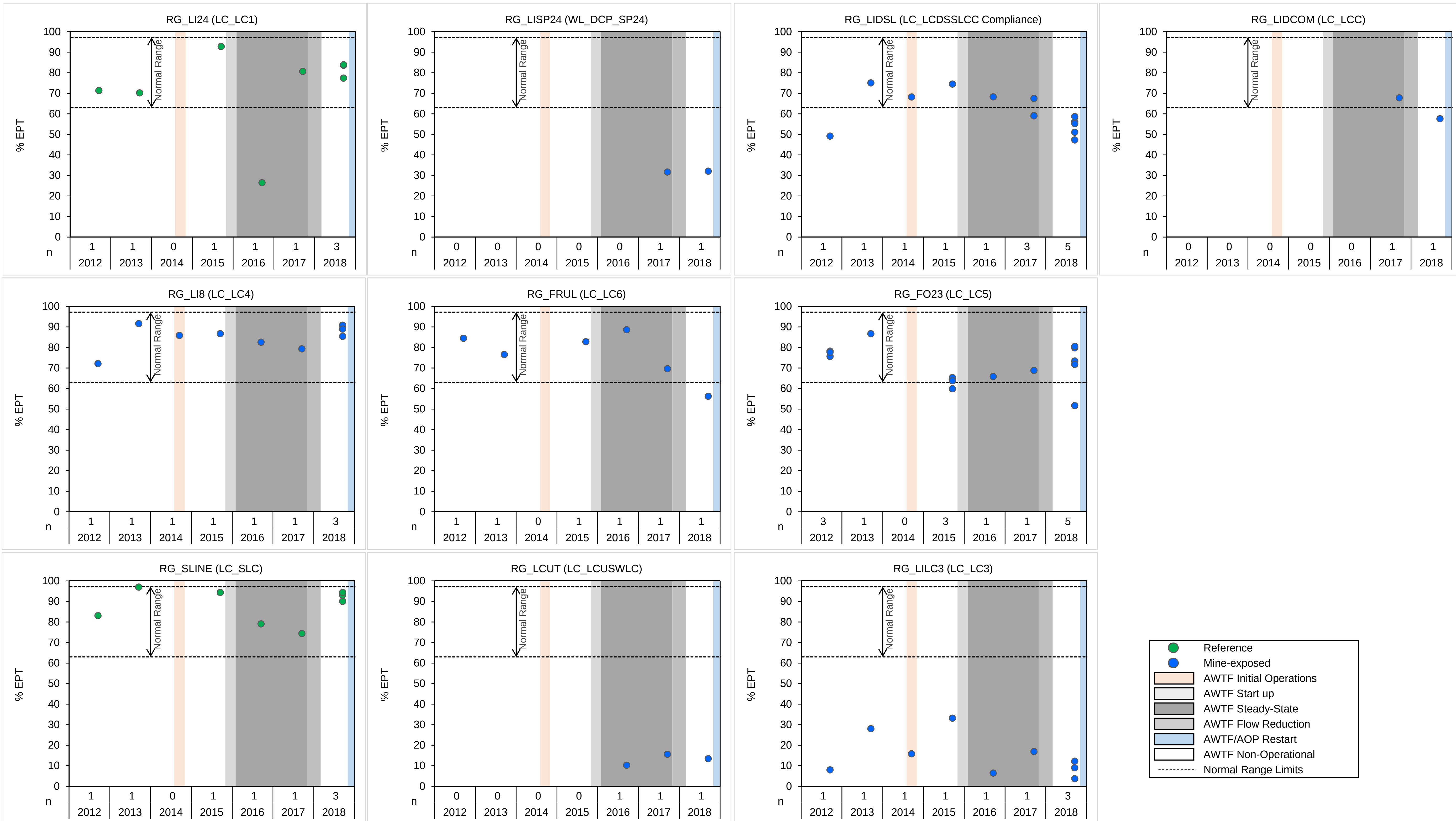

Figure A.8: Benthic Invertebrate Community Relative Ephemeroptera, Plecoptera, and Trichoptera Abundance (EPT%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2018

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

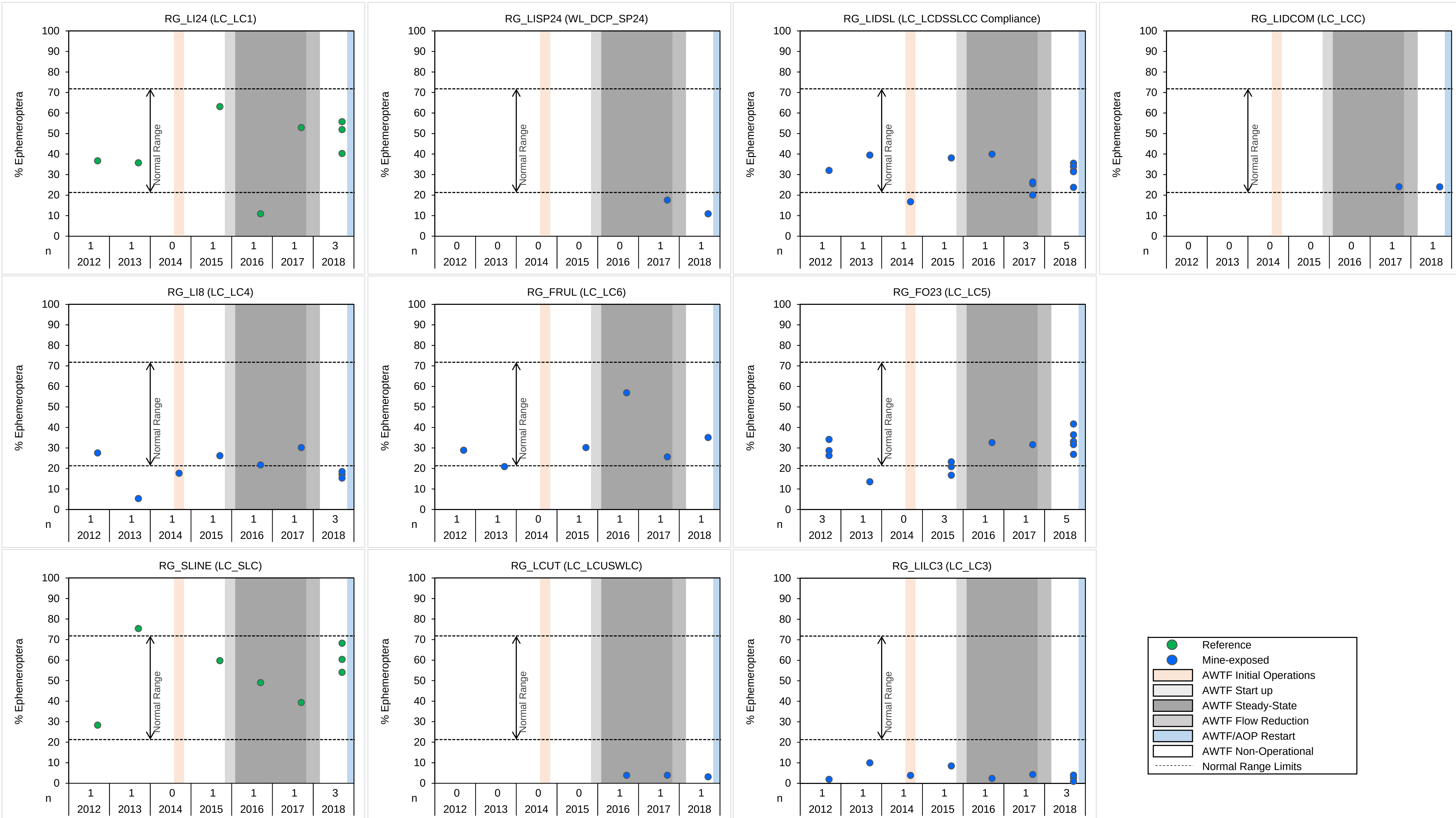

Figure A.9: Benthic Invertebrate Community Relative Ephemeroptera Abundance (E%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2018

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

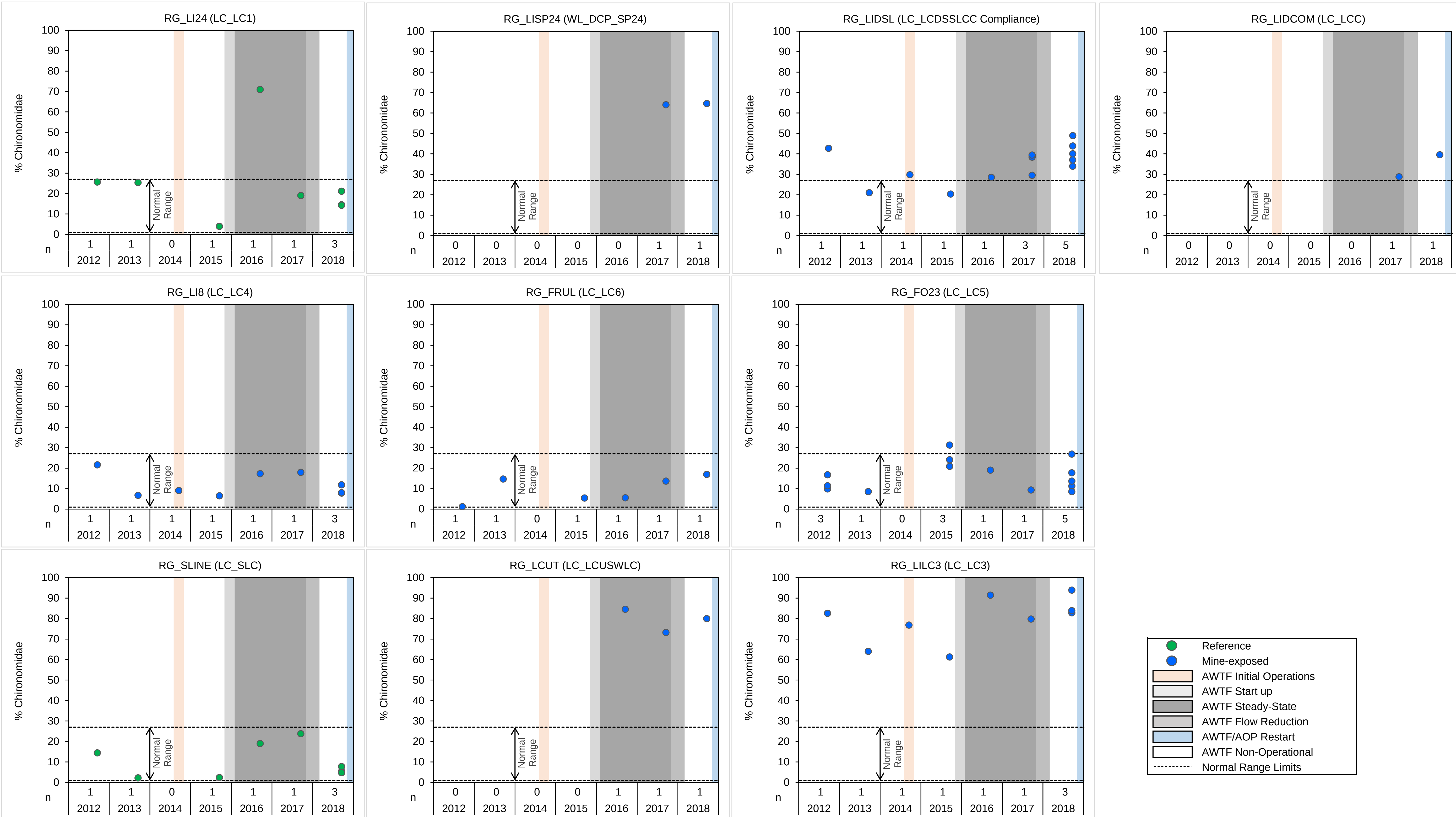

Figure A.10: Benthic Invertebrate Community Relative Chironomidae Abundance (%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2018

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Table A.1: **Flow Data (m^3/day), Total Phosphorus Concentrations (mg/L), and Total Phosphorus Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018**

Year	Month	Average Flow Rate (m^3/day)								
		LC_WLC	LC_LC3	LC_SLC	LC_LCDSSLCC	West Line Creek AWTF Influent (WL_WLCI_SP01)	Line Creek AWTF Influent (WL_LCI_SP02)	Line Creek AWTF Effluent (WL_BFWB_OUT_SP21)	*WLC Flow* [a]	*US Flow* [a]
2016	February	2,670	23,063	-	-	2,473	3,912	6,443	197	16,481
	March	2,338	24,940	-	-	2,160	2,983	5,203	178	19,619
	April	4,413	124,425	-	-	3,247	2,150	5,429	1166	117,862
	May	10,455	178,704	-	-	5,439	442	5,882	5016	167,807
	June	8,326	128,587	-	-	4,004	23.2	3,960	4323	120,237
	July	5,485	65,246	112,378	177,624	5,180	686	5,909	305	59,074
	August	4,545	46,108	32,474	78,582	3,954	1,211	5,345	591	40,351
	September	3,945	34,821	12,235	47,056	3,707	2,052	5,882	237	28,824
	October	3,648	50,480	81,254	131,734	3,589	2,023	5,949	59.5	44,809
	November	3,993	59,690	56,267	115,957	3,666	1,631	5,374	327	54,066
	December	3,846	42,875	-	-	3,489	1,862	5,355	357	37,167
2017	January	3,597	47,160	-	-	3,030	2,143	5,178	567	41,421
	February	3,349	34,334	-	-	2,837	2,439	5,274	512	28,545
	March	1,644	34,707	15,064	49,772	2,562	1,987	4,569	0	30,159
	April	3,193	53,463	7,940	61,403	2,846	2,569	5,470	346	47,702
	May	10,172	294,787	185,102	479,889	4,869	540	5,420	5303	284,075
	June	17,869	306,102	272,718	578,820	5,023	0	5,055	12847	288,233
	July	7,745	106,250	110,555	216,805	5,084	0.839	5,103	2661	98,504
	August	5,176	59,775	74,440	134,214	4,866	394	5,276	310	54,205
	September	4,135	44,991	68,177	113,168	4,054	1,256	5,332	81.1	39,600
	October	3,512	36,578	70,333	106,911	1,904	2,037	3,948	1607	31,029
	November	3,130	43,591	67,488	111,078	0	2,408	2,417	3,130	38,053
	December	2,859	43,228	-	-	0	2,489	2,523	2,859	37,880
2018	January	2,616	21,628	37,331	58,959	0	2,450	2,480	2,616	16,561
	February	2,424	18,880	22,463	41,343	0	2,349	2,379	2,424	14,108
	March	2,467	17,493	36,649	54,142	0	-	-	2,467	15,025
	April	2,807	35,334	61,739	97,073	0	-	-	2,807	32,528
	May	13,620	311,929	371,504	683,434	0	-	-	13,620	298,309
	June	9,805	157,353	198,206	355,559	0	-	-	9,805	147,548
	July	5,840	92,585	167,289	259,873	0	-	-	5,840	86,745
	August	4,403	41,886	-	-	0	-	-	4,403	37,483
	September	3,685	28,414	-	-	0	-	-	3,685	24,730
	October	3,267	49,748	-	-	1,553	119	1,763	1,715	46,362
	November	2,983	43,146	-	-	1,745	1,582	3,337	1,238	38,581
	December	2,742	21,864	-	-	2,247	2,269	4,518	496	16,853

Note: "-" = data not available.

[a] *WLC Flow* is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). *US Flow* is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] *West Line Creek Contribution* calculated as WLC Flow × [LC_WLC]; *Line Creek Contribution* calculated as US flow × [WL_LCI_SP02]; *Influent Input* calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); *AWTF Contribution* calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.1: Flow Data (m^3/day), Total Phosphorus Concentrations (mg/L), and Total Phosphorus Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018

Year	Month	Observed Total Phosphorus (mg/L)							
		LC_LCUSWLC	LC_WLC	West Line Creek AWTF Influent (WL_WLCI_SP01)	Line Creek AWTF Influent (WL_LCI_SP02)	Line Creek AWTF Effluent (WL_BFWB_OUT_SP21)	LC_LC3	LC_SLC	LC_LCDSSLCC
2016	February	0.00540	0.00798	0.00220	0.00350	-	0.0150	0.00390	0.00685
	March	0.00983	0.00743	0.00740	0.0130	-	0.0124	0.00200	0.00352
	April	0.00420	0.00567	0.00750	0.00410	0.0227	0.00598	0.00370	0.00348
	May	0.00242	0.00478	0.00480	0.00260	0.0319	0.00254	0.00384	0.00250
	June	0.00288	0.00390	0.00410	0.00300	0.0392	0.00423	0.00408	0.00423
	July	0.00425	0.00403	0.00600	0.00280	0.0497	0.00815	0.00260	0.00380
	August	0.00486	0.00608	-	-	0.0298	0.00656	0.00504	0.00293
	September	0.00368	0.00505	0.00590	0.00460	0.0346	0.00793	0.00288	0.00765
	October	0.00404	0.00580	0.00470	0.00320	0.0271	0.00944	0.00396	0.00452
	November	0.00318	0.00435	0.00330	0.00330	0.0348	0.00608	0.00240	0.00515
	December	0.00513	0.0119	0.00520	0.00260	0.0402	0.0109	0.00330	0.00308
2017	January	0.00320	0.00590	0.0157	0.0122	0.0472	0.0118	0.00260	0.00350
	February	0.00890	0.00550	0.00975	0.00673	0.0578	0.0256	0.00320	0.0108
	March	0.0176	0.0155	0.00800	0.00660	0.0462	0.0264	0.00240	0.0162
	April	0.0128	0.0106	0.00840	0.00800	0.0366	0.00855	0.00300	0.00720
	May	0.00568	0.00838	0.00630	0.00420	0.0286	0.00796	0.0100	0.00756
	June	0.00818	0.00298	0.00540	0.00275	0.0157	0.00250	0.00520	0.00227
	July	0.00545	0.00760	0.00585	0.00460	0.0120	0.00500	0.00210	0.00435
	August	0.00382	0.00684	0.00480	0.00490	0.0120	0.00398	0.00430	0.00402
	September	0.00256	0.00488	0.00310	0.00210	0.0133	0.00358	0.00300	0.00290
	October	0.00294	0.00528	0.00480	0.00180	0.0113	0.00348	0.00200	0.00240
	November	0.00290	0.00456	0.00600	0.00280	0.00888	0.00369	0.00190	0.00200
	December	0.00273	0.00580	0.00510	0.00230	0.00887	0.00324	0.00220	0.00195
2018	January	0.00320	0.00552	0.00660	0.00290	0.00814	0.00426	0.00190	0.00220
	February	0.00270	0.00498	0.00570	0.00240	0.00758	0.00340	0.00190	0.00180
	March	0.00372	0.00559	0.00570	0.00300	0.0136	0.00443	0.00276	0.00262
	April	0.00403	0.00568	0.00540	0.00390	-	0.00664	0.00323	0.00356
	May	0.00294	0.00417	-	0.00650	-	0.00301	0.0169	0.00735
	June	0.00293	0.00425	0.00310	0.00170	-	0.00255	0.00320	0.00263
	July	0.00255	0.0151	0.00240	0.00160	-	0.00263	0.00250	0.00258
	August	0.00386	0.00510	0.00630	0.00490	-	0.00326	0.00270	0.00260
	September	0.00550	0.00516	0.00810	0.00600	0.0236	0.00388	0.00300	0.00314
	October	0.00462	0.00634	0.00490	0.00460	0.0177	0.00518	0.00285	0.00336
	November	0.00275	0.00625	0.00700	0.00350	0.0128	0.00456	0.0128	0.00210
	December	0.00303	0.00615	0.00440	0.00230	0.00730	0.00428	0.0128	0.00205

Note: "-" = data not available.

[a] WLC Flow is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). US Flow is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] West Line Creek Contribution calculated as WLC Flow × [LC_WLC]; Line Creek Contribution calculated as US flow × [WL_LCI_SP02]; Influent Input calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); AWTF Contribution calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.1: Flow Data (m^3/day), Total Phosphorus Concentrations (mg/L), and Total Phosphorus Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018

Year	Month	Load (kg/day)									
		Observed Influent Flow WLC	Observed Influent Flow LC	Observed Effluent Discharge	Observed LC_LC3	Calculated LC_SLC	Observed LC_LCDSSLCC	*West Line Creek Contribution* [b]	*Line Creek Contribution* [b]	*Influent Input* [b]	*AWTF Contribution* [b]
2016	February	0.00544	0.0137	-	0.347	-	-	0.00158	0.0577	0.0191	-
	March	0.0160	0.0388	-	0.309	-	-	0.00132	0.255	0.0548	-
	April	0.0244	0.00881	0.123	0.743	-	-	0.00661	0.483	0.0332	0.0901
	May	0.0261	0.00115	0.188	0.454	-	-	0.0240	0.436	0.0273	0.161
	June	0.0164	0	0.155	0.543	-	-	0.0169	0.361	0.0165	0.139
	July	0.0311	0.00192	0.294	0.532	0.292	0.675	0.00123	0.165	0.0330	0.261
	August	-	-	0.159	0.302	0.164	0.231	0.00360	-	-	-
	September	0.0219	0.00944	0.204	0.276	0.0352	0.360	0.00120	0.133	0.0313	0.172
	October	0.0169	0.00647	0.161	0.477	0.322	0.595	0	0.143	0.0233	0.138
	November	0.0121	0.00538	0.187	0.363	0.135	0.597	0.00142	0.178	0.0175	0.170
	December	0.0181	0.00484	0.215	0.466	-	-	0.00425	0.0966	0.0230	0.192
2017	January	0.0474	0.0261	0.244	0.558	-	-	0.00334	0.505	0.0736	0.171
	February	0.0277	0.0164	0.305	0.880	-	-	0.00282	0.192	0.0441	0.261
	March	0.0205	0.0131	0.211	0.916	0.0362	0.805	0	0.199	0.0336	0.177
	April	0.0239	0.0206	0.200	0.457	0.0238	0.442	0.00367	0.382	0.0445	0.156
	May	0.0307	0.00227	0.155	2.35	1.85	3.63	0.0444	1.19	0.0329	0.122
	June	0.0271	0	0.0791	0.765	1.42	1.31	0.0382	0.793	0.0271	0.0520
	July	0.0297	0	0.0614	0.531	0.232	0.943	0.0202	0.453	0.0297	0.0317
	August	0.0234	0.00193	0.0634	0.238	0.320	0.540	0.00212	0.266	0.0253	0.0382
	September	0.0126	0.00264	0.0707	0.161	0.205	0.328	0	0.0832	0.0152	0.0555
	October	0.00914	0.00367	0.0447	0.127	0.141	0.257	0.00849	0.0559	0.0128	0.0319
	November	0	0.00674	0.0215	0.161	0.128	0.222	0.0143	0.107	0.00674	0.0147
	December	0	0.00572	0.0224	0.140	-	-	0.0166	0.0871	0.00572	0.0167
2018	January	0	0.00711	0.0202	0.0921	0.0709	0.130	0.0144	0.0480	0.00711	0.0131
	February	0	0.00564	0.0180	0.0642	0.0427	0.0744	0.0121	0.0339	0.00564	0.0124
	March	0	-	-	0.0775	0.101	0.142	0.0138	0.0451	-	-
	April	0	-	-	0.235	0.199	0.346	0.0159	0.127	-	-
	May	-	-	-	0.939	6.27	5.02	0.0568	1.94	-	-
	June	0	-	-	0.401	0.634	0.933	0.0417	0.251	-	-
	July	0	-	-	0.243	0.418	0.669	0.0880	0.139	-	-
	August	0	-	-	0.137	-	-	0.0225	0.184	-	-
	September	0	-	-	0.110	-	-	0.0190	0.148	-	-
	October	0.00761	0.00055	0.0312	0.257	-	-	0.0109	0.213	0.00815	0.0230
	November	0.0122	0.00554	0.0428	0.197	-	-	0.00774	0.135	0.0178	0.0250
	December	0.00989	0.00522	0.0330	0.0935	-	-	0.00305	0.0388	0.0151	0.0179

Note: "-" = data not available.

[a] WLC Flow is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). US Flow is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] West Line Creek Contribution calculated as WLC Flow × [LC_WLC]; Line Creek Contribution calculated as US flow × [WL_LCI_SP02]; Influent Input calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); AWTF Contribution calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.2: **Flow Data (m^3/day), Orthophsphate Concentrations (mg/L), and Orthophosphate Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018**

Year	Month	Average Flow Rate (m^3/day)								
		LC_WLC	LC_LC3	LC_SLC	LC_LCDSSLCC	West Line Creek AWTF Influent (WL_WLCI_SP01)	Line Creek AWTF Influent (WL_LCI_SP02)	Line Creek AWTF Effluent (WL_BFWB_OUT_SP21)	*WLC Flow* [a]	*US Flow* [a]
2016	February	2,670	23,063	-	-	2,473	3,912	6,443	197	16,481
	March	2,338	24,940	-	-	2,160	2,983	5,203	178	19,619
	April	4,413	124,425	-	-	3,247	2,150	5,429	1,166	117,862
	May	10,455	178,704	-	-	5,439	442	5,882	5,016	167,807
	June	8,326	128,587	-	-	4,004	23.2	3,960	4,323	120,237
	July	5,485	65,246	112,378	177,624	5,180	686	5,909	305	59,074
	August	4,545	46,108	32,474	78,582	3,954	1,211	5,345	591	40,351
	September	3,945	34,821	12,235	47,056	3,707	2,052	5,882	237	28,824
	October	3,648	50,480	81,254	131,734	3,589	2,023	5,949	59.5	44,809
	November	3,993	59,690	56,267	115,957	3,666	1,631	5,374	327	54,066
	December	3,846	42,875	-	-	3,489	1,862	5,355	357	37,167
2017	January	3,597	47,160	-	-	3,030	2,143	5,178	567	41,421
	February	3,349	34,334	-	-	2,837	2,439	5,274	512	28,545
	March	1,644	34,707	15,064	49,772	2,562	1,987	4,569	0	30,159
	April	3,193	53,463	7,940	61,403	2,846	2,569	5,470	346	47,702
	May	10,172	294,787	185,102	479,889	4,869	540	5,420	5,303	284,075
	June	17,869	306,102	272,718	578,820	5,023	0	5,055	12,847	288,233
	July	7,745	106,250	110,555	216,805	5,084	0.839	5,103	2,661	98,504
	August	5,176	59,775	74,440	134,214	4,866	394	5,276	310	54,205
	September	4,135	44,991	68,177	113,168	4,054	1,256	5,332	81.1	39,600
	October	3,512	36,578	70,333	106,911	1,904	2,037	3,948	1,607	31,029
	November	3,130	43,591	67,488	111,078	0	2,408	2,417	3,130	38,053
	December	2,859	43,228	-	-	0	2,489	2,523	2,859	37,880
2018	January	2,616	21,628	37,331	58,959	0	2,450	2,480	2,616	16,561
	February	2,424	18,880	22,463	41,343	0	2,349	2,379	2,424	14,108
	March	2,467	17,493	36,649	54,142	0	-	-	2,467	15,025
	April	2,807	35,334	61,739	97,073	0	-	-	2,807	32,528
	May	13,620	311,929	371,504	683,434	0	-	-	13,620	298,309
	June	9,805	157,353	198,206	355,559	0	-	-	9,805	147,548
	July	5,840	92,585	167,289	259,873	0	-	-	5,840	86,745
	August	4,403	41,886	-	-	0	-	-	4,403	37,483
	September	3,685	28,414	-	-	0	-	-	3,685	24,730
	October	3,267	49,748	-	-	1,553	119	1,763	1,715	46,362
	November	2,983	43,146	-	-	1,745	1,582	3,337	1,238	38,581
	December	2,742	21,864	-	-	2,247	2,269	4,518	496	16,853

Note: "-" = data not available.

[a] *WLC Flow* is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). *US Flow* is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] *West Line Creek Contribution* calculated as WLC Flow × [LC_WLC]; *Line Creek Contribution* calculated as US flow × [WL_LCI_SP02]; *Influent Input* calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); *AWTF Contribution* calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.2: **Flow Data (m³/day), Orthophsphate Concentrations (mg/L), and Orthophosphate Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018**

Year	Month	Observed Orthophosphate (mg/L)							
		LC_LCUSWLC	LC_WLC	West Line Creek AWTF Influent (WL_WLCI_SP01)	Line Creek AWTF Influent (WL_LCI_SP02)	Line Creek AWTF Effluent (WL_BFWB_OUT_SP21)	LC_LC3	LC_SLC	LC_LCDSSLCC
2016	February	0.00242	0.00630	0.00210	0.00380	-	0.00456	0.00232	0.00270
	March	0.00288	0.00530	0.00545	0.00285	-	0.00380	0.00145	0.00124
	April	0.00275	0.00543	0.00450	0.00200	0.00490	0.00170	0.00167	0.00118
	May	0.00198	0.00338	0.00490	0.00270	0.00920	0.00112	0.00148	0.00102
	June	0.00258	0.00385	0.00370	0.00200	0.00948	0.00150	0.00208	0.00127
	July	0.00233	0.00380	0.00390	0.00240	0.0273	0.00373	0.00190	0.00125
	August	0.00244	0.00362	-	-	0.00480	0.00208	0.00166	0.00205
	September	0.00220	0.00373	0.00560	0.00330	0.0116	0.00338	0.00130	0.00200
	October	0.00280	0.00444	0.00530	0.00330	0.00950	0.00350	0.00176	0.00134
	November	0.00235	0.00445	0.00320	0.00100	0.0158	0.00328	0.00175	0.00167
	December	0.00215	0.00530	0.00440	0.00200	0.0104	0.00338	0.00160	0.00200
2017	January	0.00210	0.00640	0.00620	0.00785	0.0229	0.00660	0.00260	0.00238
	February	0.00470	0.00490	0.00518	0.00258	0.0117	0.00710	0.00270	0.00390
	March	0.00695	0.0110	0.00430	0.00210	0.0148	0.0121	0.00260	0.0102
	April	0.00310	0.00563	0.00520	0.00310	0.0206	0.00478	0.00260	0.00205
	May	0.00226	0.00472	0.00510	0.00250	0.0101	0.00182	0.00140	0.00150
	June	0.00185	0.00268	0.00235	0.00135	0.00390	0.00130	0.00230	0.00114
	July	0.00320	0.00393	0.00360	0.00360	0.00320	0.00238	0.00110	0.00170
	August	0.00268	0.00388	0.00380	0.00200	0.00375	0.00207	0.00170	0.00132
	September	0.00172	0.00338	0.00130	0.00145	0.00205	0.00152	0.00120	0.00114
	October	0.00224	0.00490	0.00430	0.00180	0.00270	0.00180	0.00170	0.00106
	November	0.00232	0.00528	0.00530	0.00230	0.00110	0.00196	0.00100	0.00142
	December	0.00198	0.00514	0.00610	0.00310	0.00180	0.00205	0.00210	0.00145
2018	January	0.00194	0.00448	0.00520	0.00240	0.00130	0.00158	0.00220	0.00138
	February	0.00240	0.00465	0.00440	0.00100	0.00134	0.00158	0.00270	0.00100
	March	0.00216	0.00442	0.00320	0.00160	0.00193	0.00178	0.00164	0.00120
	April	0.00218	0.00436	0.00370	0.00200	-	0.00186	0.00115	0.00108
	May	0.00220	0.00435	-	0.00180	-	0.00227	0.00240	0.00205
	June	0.00218	0.00318	0.00190	0.00100	-	0.00165	0.00100	0.00138
	July	0.00303	0.00375	0.00370	0.00250	-	0.00233	0.00160	0.00173
	August	0.00356	0.00392	0.00340	0.00280	-	0.00234	0.00170	0.00163
	September	0.00238	0.00312	0.00480	0.00360	0.0146	0.00212	0.00100	0.00120
	October	0.00254	0.00534	0.00510	0.00300	0.00315	0.00246	0.00250	0.00164
	November	0.00235	0.00660	0.00510	0.00190	0.00165	0.00185	0.00233	0.00173
	December	0.00851	0.0113	0.00710	0.00440	0.00610	0.00904	0.00335	0.00670

Note: "-" = data not available.

[a] *WLC Flow* is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). *US Flow* is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] *West Line Creek Contribution* calculated as WLC Flow × [LC_WLC]; *Line Creek Contribution* calculated as US flow × [WL_LCI_SP02]; *Influent Input* calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); *AWTF Contribution* calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.2: **Flow Data (m^3/day), Orthophsphate Concentrations (mg/L), and Orthophosphate Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018**

Year	Month	Load (kg/day)									
		Observed Influent Flow WLC	Observed Influent Flow LC	Observed Effluent Discharge	Observed LC_LC3	Calculated LC_SLC	Observed LC_LCDSSLCC	*West Line Creek Contribution* [b]	*Line Creek Contribution* [b]	*Influent Input* [b]	*AWTF Contribution* [b]
2016	February	0.00519	0.0149	-	0.105	-	-	0.00124	0.0626	0.0201	-
	March	0.0118	0.00850	-	0.0948	-	-	0	0.0559	0.0203	-
	April	0.0146	0.00430	0.0266	0.212	-	-	0.00634	0.236	0.0189	0.00769
	May	0.0267	0.00119	0.0541	0.200	-	-	0.0170	0.453	0.0278	0.0263
	June	0.0148	0	0.0376	0.193	-	-	0.0166	0.240	0.0149	0.0227
	July	0.0202	0.00165	0.161	0.243	0.214	0.222	0.00116	0.142	0.0218	0.139
	August	-	-	0.0257	0.0959	0.0539	0.161	0.00214	-	-	-
	September	0.0208	0.00677	0.0679	0.118	0.0159	0.0941	0	0.0951	0.0275	0.0404
	October	0.0190	0.00668	0.0565	0.177	0.143	0.177	0	0.148	0.0257	0.0308
	November	0.0117	0.00163	0.0846	0.195	0.0985	0.193	0.00145	0.0541	0.0134	0.0713
	December	0.0154	0.00372	0.0557	0.145	-	-	0.00189	0.0743	0.0191	0.0366
2017	January	0.0188	0.0168	0.119	0.311	-	-	0.00363	0.325	0.0356	0.0830
	February	0.0147	0.00628	0.0617	0.244	-	-	0.00251	0.0735	0.0210	0.0407
	March	0.0110	0.00417	0.0676	0.421	0.0392	0.506	0	0.0633	0.0152	0.0524
	April	0.0148	0.00796	0.113	0.255	0.0206	0.126	0.00195	0.148	0.0228	0.0899
	May	0.0248	0.00135	0.0547	0.537	0.259	0.720	0.0250	0.710	0.0262	0.0286
	June	0.0118	0	0.0197	0.398	0.627	0.660	0.0344	0.389	0.0118	0.00791
	July	0.0183	0	0.0163	0.253	0.122	0.369	0.0104	0.355	0.0183	-0.00198
	August	0.0185	0	0.0198	0.124	0.127	0.177	0.00120	0.108	0.0193	0
	September	0.00527	0.00182	0.0109	0.0682	0.0818	0.129	0	0.0574	0.00709	0.00384
	October	0.00819	0.00367	0.0107	0.0658	0.120	0.113	0.00788	0.0559	0.0119	-0.00120
	November	0	0.00554	0.00266	0.0854	0.0675	0.158	0.0165	0.0875	0.00554	-0.00288
	December	0	0.00771	0.00454	0.0886	-	-	0.0147	0.117	0.00771	-0.00317
2018	January	0	0.00588	0.00322	0.0342	0.0821	0.0814	0.0117	0.0397	0.00588	-0.00266
	February	0	0.00235	0.00319	0.0297	0.0606	0.0413	0.0113	0.0141	0.00235	0
	March	0	-	-	0.0311	0.0601	0.0650	0.0109	0.0240	-	-
	April	0	-	-	0.0657	0.0710	0.105	0.0122	0.0651	-	-
	May	-	-	-	0.708	0.892	1.40	0.0592	0.537	-	-
	June	0	-	-	0.260	0.198	0.489	0.0311	0.148	-	-
	July	0	-	-	0.215	0.268	0.448	0.0219	0.217	-	-
	August	0	-	-	0.0980	-	-	0.0173	0.105	-	-
	September	0	-	-	0.0602	-	-	0.0115	0.0890	-	-
	October	0.00792	0	0.00555	0.122	-	-	0.00916	0.139	0.00827	-0.00272
	November	0.00890	0.00301	0.00551	0.0798	-	-	0.00817	0.0733	0.0119	-0.00640
	December	0.0160	0.00998	0.0276	0.198	-	-	0.00561	0.0742	0.0259	0.00163

Note: "-" = data not available.

[a] *WLC Flow* is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). *US Flow* is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] *West Line Creek Contribution* calculated as WLC Flow × [LC_WLC]; *Line Creek Contribution* calculated as US flow × [WL_LCI_SP02]; *Influent Input* calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); *AWTF Contribution* calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.3: **Flow Data (m^3/day), Nitrate Concentrations (mg/L), and Nitrate Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018**

Year	Month	Average Flow Rate (m^3/day)								
		LC_WLC	LC_LC3	LC_SLC	LC_LCDSSLCC	West Line Creek AWTF Influent (WL_WLCI_SP01)	Line Creek AWTF Influent (WL_LCI_SP02)	Line Creek AWTF Effluent (WL_BFWB_OUT_SP21)	*WLC Flow* [a]	*US Flow* [a]
	February	2,670	23,063	-	-	2,473	3,912	6,443	197	16,481
	March	2,338	24,940	-	-	2,160	2,983	5,203	178	19,619
	April	4,413	124,425	-	-	3,247	2,150	5,429	1,166	117,862
	May	10,455	178,704	-	-	5,439	442	5,882	5,016	167,807
	June	8,326	128,587	-	-	4,004	23.2	3,960	4,323	120,237
2016	July	5,485	65,246	112,378	177,624	5,180	686	5,909	305	59,074
	August	4,545	46,108	32,474	78,582	3,954	1,211	5,345	591	40,351
	September	3,945	34,821	12,235	47,056	3,707	2,052	5,882	237	28,824
	October	3,648	50,480	81,254	131,734	3,589	2,023	5,949	59.5	44,809
	November	3,993	59,690	56,267	115,957	3,666	1,631	5,374	327	54,066
	December	3,846	42,875	-	-	3,489	1,862	5,355	357	37,167
	January	3,597	47,160	-	-	3,030	2,143	5,178	567	41,421
	February	3,349	34,334	-	-	2,837	2,439	5,274	512	28,545
	March	1,644	34,707	15,064	49,772	2,562	1,987	4,569	0	30,159
	April	3,193	53,463	7,940	61,403	2,846	2,569	5,470	346	47,702
	May	10,172	294,787	185,102	479,889	4,869	540	5,420	5,303	284,075
	June	17,869	306,102	272,718	578,820	5,023	0	5,055	12,847	288,233
2017	July	7,745	106,250	110,555	216,805	5,084	0.839	5,103	2,661	98,504
	August	5,176	59,775	74,440	134,214	4,866	394	5,276	310	54,205
	September	4,135	44,991	68,177	113,168	4,054	1,256	5,332	81.1	39,600
	October	3,512	36,578	70,333	106,911	1,904	2,037	3,948	1,607	31,029
	November	3,130	43,591	67,488	111,078	0	2,408	2,417	3,130	38,053
	December	2,859	43,228	-	-	0	2,489	2,523	2,859	37,880
	January	2,616	21,628	37,331	58,959	0	2,450	2,480	2,616	16,561
	February	2,424	18,880	22,463	41,343	0	2,349	2,379	2,424	14,108
	March	2,467	17,493	36,649	54,142	0	-	-	2,467	15,025
	April	2,807	35,334	61,739	97,073	0	-	-	2,807	32,528
	May	13,620	311,929	371,504	683,434	0	-	-	13,620	298,309
	June	9,805	157,353	198,206	355,559	0	-	-	9,805	147,548
2018	July	5,840	92,585	167,289	259,873	0	-	-	5,840	86,745
	August	4,403	41,886	-	-	0	-	-	4,403	37,483
	September	3,685	28,414	-	-	0	-	-	3,685	24,730
	October	3,267	49,748	-	-	1,553	119	1,763	1,715	46,362
	November	2,983	43,146	-	-	1,745	1,582	3,337	1,238	38,581
	December	2,742	21,864	-	-	2,247	2,269	4,518	496	16,853

Note: "-" = data not available.

[a] WLC Flow is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). US Flow is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] West Line Creek Contribution calculated as WLC Flow × [LC_WLC]; Line Creek Contribution calculated as US flow × [WL_LCI_SP02]; Influent Input calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); AWTF Contribution calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.3: Flow Data (m^3/day), Nitrate Concentrations (mg/L), and Nitrate Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018

Year	Month	Observed Nitrate (as N, mg/L)							
		LC_LCUSWLC	LC_WLC	West Line Creek AWTF Influent (WL_WLCI_SP01)	Line Creek AWTF Influent (WL_LCI_SP02)	Line Creek AWTF Effluent (WL_BFWB_OUT_SP21)	LC_LC3	LC_SLC	LC_LCDSSLCC
2016	February	23.8	31.4	31.0	22.3	-	17.6	0.117	13.2
	March	24.2	31.7	31.8	23.7	-	18.5	0.0810	15.1
	April	15.5	30.4	29.0	19.4	0.0250	15.3	0.0883	10.2
	May	9.76	14.9	15.1	13.3	0.0264	10.9	0.0565	6.04
	June	9.75	15.6	14.6	10.1	0.0264	10.1	0.0685	5.86
	July	9.15	17.3	17.6	11.2	0.0327	9.17	0.0814	6.43
	August	12.9	20.2	20.5	14.6	0.0430	12.8	0.104	8.21
	September	14.3	22.2	22.2	15.7	0.0171	12.7	0.101	9.12
	October	14.1	23.9	23.2	15.4	0.0281	13.2	0.119	8.19
	November	16.5	24.2	23.2	18.4	0.0315	15.9	0.0947	10.7
	December	14.5	23.2	22.7	16.0	0.0146	14.5	0.120	10.8
2017	January	18.6	24.5	24.1	19.5	0.0265	15.4	0.156	11.3
	February	22.0	24.6	25.3	21.5	0.0337	14.9	0.156	11.7
	March	21.6	25.3	25.7	22.5	0.0916	16.7	0.120	12.2
	April	24.6	25.7	26.6	26.4	0.0479	20.9	0.0919	14.4
	May	11.5	19.9	20.6	16.6	0.0877	12.6	0.0678	7.71
	June	9.33	11.3	11.7	12.7	0.169	10.6	0.0488	6.28
	July	14.0	15.4	15.4	17.3	0.0308	14.6	0.0351	9.29
	August	14.4	18.4	18.2	16.2	0.0331	13.7	0.0584	9.76
	September	13.7	21.3	21.0	15.7	0.0843	12.7	0.0494	9.46
	October	16.3	22.8	21.9	17.9	0.189	16.1	0.137	10.9
	November	16.6	22.9	23.1	19.2	0.203	16.8	0.109	11.9
	December	18.2	23.8	24.0	20.0	0.225	17.5	0.132	13.1
2018	January	18.6	24.8	24.0	20.6	0.206	16.6	0.123	12.2
	February	17.2	25.4	25.1	19.4	0.166	15.8	0.121	12.2
	March	21.9	25.2	24.8	20.3	0.127	21.1	0.100	14.7
	April	25.6	26.7	23.8	23.0	-	24.5	0.114	16.5
	May	8.91	15.1	12.7	12.0	-	10.5	0.0964	5.31
	June	11.3	13.4	12.6	15.7	-	12.9	0.0684	7.86
	July	12.2	14.7	15.3	16.6	-	13.7	0.0502	8.74
	August	15.1	17.1	16.9	16.4	-	15.8	0.0822	10.2
	September	16.7	18.5	18.0	16.7	15.3	17.0	0.0782	11.1
	October	10.1	19.8	18.7	12.5	0.847	12.3	0.113	9.27
	November	9.66	19.4	19.5	12.1	0.225	9.73	0.130	7.85
	December	14.2	20.6	20.5	14.4	0.214	10.5	0.137	8.46

Note: "-" = data not available.

[a] WLC Flow is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). US Flow is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] West Line Creek Contribution calculated as WLC Flow × [LC_WLC]; Line Creek Contribution calculated as US flow × [WL_LCI_SP02]; Influent Input calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); AWTF Contribution calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.3: **Flow Data (m^3/day), Nitrate Concentrations (mg/L), and Nitrate Loads (kg/day) used in Mass-Balance Analysis for Line Creek, 2016 to 2018**

Year	Month	Load (kg/day)									
		Observed Influent Flow WLC	Observed Influent Flow LC	Observed Effluent Discharge	Observed LC_LC3	Calculated LC_SLC	Observed LC_LCDSSLCC	*West Line Creek Contribution* [b]	*Line Creek Contribution* [b]	*Influent Input* [b]	*AWTF Contribution* [b]
2016	February	76.7	87.2	-	405	-	-	6.20	367	164	-
	March	68.6	70.6	-	461	-	-	5.65	464	139	-
	April	94.1	41.7	0.136	1,907	-	-	35.5	2,287	136	-136
	May	82.0	5.87	0.155	1,955	-	-	74.8	2,226	87.9	-87.7
	June	58.6	0.234	0.105	1,294	-	-	67.2	1,211	58.9	-58.8
	July	91.3	7.69	0.193	598	9.15	1,142	5.27	662	99.0	-98.8
	August	81.0	17.6	0.230	589	3.37	645	11.9	588	98.7	-98.4
	September	82.2	32.2	0.101	443	1.23	429	5.28	452	114	-114
	October	83.4	31.2	0.167	668	9.70	1,079	1.42	690	115	-114
	November	84.9	30.0	0.169	946	5.33	1,245	7.89	995	115	-115
	December	79.3	29.8	0.0782	622	-	-	8.28	596	109	-109
2017	January	73.0	41.7	0.137	725	-	-	13.9	807	115	-115
	February	71.7	52.4	0.178	513	-	-	12.6	614	124	-124
	March	65.8	44.7	0.418	580	1.81	605	0	679	111	-110
	April	75.8	67.7	0.262	1,119	0.730	883	8.89	1,257	144	-143
	May	100	8.96	0.475	3,714	12.5	3,702	106	4,712	109	-109
	June	58.9	0	0.852	3,257	13.3	3,633	145	3,667	58.9	-58.0
	July	78.3	0.0146	0.157	1,555	3.88	2,013	40.8	1,709	78.3	-78.1
	August	88.5	6.39	0.175	816	4.35	1,310	5.69	880	94.9	-94.7
	September	85.1	19.7	0.450	572	3.37	1,071	1.73	622	105	-104
	October	41.7	36.5	0.744	587	9.64	1,170	36.7	556	78.2	-77.4
	November	0	46.4	0.492	732	7.36	1,317	71.7	732	46.4	-45.9
	December	0	49.8	0.568	756	-	-	67.9	758	49.8	-49.2
2018	January	0	50.5	0.511	359	4.59	719	64.9	341	50.5	-49.9
	February	0	45.7	0.395	297	2.72	505	61.5	274	45.7	-45.3
	March	0	-	-	369	3.68	797	62.3	304	-	-
	April	0	-	-	865	7.05	1,606	74.9	748	-	-
	May	0	-	-	3,270	35.8	3,632	206	3,586	-	-
	June	0	-	-	2,022	13.6	2,793	132	2,313	-	-
	July	0	-	-	1,266	8.40	2,271	85.7	1,440	-	-
	August	0	-	-	660	-	-	75.4	616	-	-
	September	0	-	-	483	-	-	68.2	414	-	-
	October	29.1	1.49	1.49	613	-	-	34.0	581	30.6	-29.1
	November	34.1	19.1	0.750	420	-	-	24.0	465	53.2	-52.4
	December	46.0	32.7	0.966	229	-	-	10.2	243	78.7	-77.7

Note: "-" = data not available.

[a] WLC Flow is the flow from West Line Creek that enters Line Creek directly, and was calculated as: (LC_WLC flow - WL_WLCI_SP01 flow). US Flow is the sum of AWTF effluent flow and upstream flow that was not diverted to the AWTF and was calculated as: LC_LC3 flow - total AWTF influent flow (WL_WLCI_SP01 flow + WL_LCI_SP02 flow+WLC Flow).

[b] West Line Creek Contribution calculated as WLC Flow × [LC_WLC]; Line Creek Contribution calculated as US flow × [WL_LCI_SP02]; Influent Input calculated as (WL_WLCI_SP01 flow × [WL_WLCI_SP01]) + (WL_LCI_SP02 flow × [WL_LCI_SP02]); AWTF Contribution calculated as total effluent load (WL_BLWB_OUT_SP21 flow × [WL_BLWB_OUT_SP21]) - total influent load (WL_WLCI_SP01 flow × [WL_WLCI_SP01] + WL_LCI_SP02 flow × [WL_LCI_SP02]).

Table A.4: Visual Periphyton Coverage Scores from Line Creek and Fording River, September 2018

Area		Biological Area Code	Replicate A	B	C	D	E	Mean	Standard Deviation
Line Creek	Reference	RG_LI24	3	2	3	3	2	3	0.5
		RG_SLINE	2	2	1	2	2	2	0.4
	Mine-exposed	RG_LCUT	3	2	3	3	3	3	0.4
		RG_LILC3	3	3	3	3	3	3	0
		RG_LISP23	-	-	-	-	-	-	-
		RG_LISP24	3	3	3	3	3	3	0
		RG_LIDSL	3	3	3	3	3	3	0
		RG_LIDCOM	3	4	3	3	4	3	0.5
		RG_LI8	2	3	2	2	1	2	0.7
Fording River	Mine-exposed	RG_FRUL	3	3	2	2	2	2	0.5
		RG_FO23	2	4	3	3	3	3	0.7

Periphyton Coverage Scores (Environment Canada, 2012):
1 = Rocks not slippery, no obvious colour (<0.5mm thick)
2 = Rocks slightly slippery, yellow-brown to light green colour (0.5-1mm thick)
3 = Rocks have noticeable slippery feel, patches of thicker green to brown algae (1-5mm thick)
4 = Rocks are very slippery, numerous clumps (5-20mm thick)
5 = Rocks mostly obscured by algae mat, may have long strands (>20mm thick)

Table A.5: Statistical Comparisons of Total Benthic Invertebrate Biomass (Hess Samples) Over Time at Exposed Areas RG_LIDSL and RG_LILC3 Relative to Reference (RG_SLINE and RG_LI24), 2014 to 2018

Area	Comparison	Term	DF	F-Statistic	P-value	Comparisons Among Years				
						2014	2015	2016	2017	2018
RG_LIDSL	RG_LIDSL over time	Year	4	0.51	0.731	A	A	A	A	A
	RG_LIDSL vs RG_SLINE and RG_LI24 over time	CI	1	193	<0.001					
		Year	4	3.97	0.005					
		Area(CI)	1	17.65	<0.001					
		CI×Year	4	1.42	0.232	A	A	A	A	A
		Area(CI)×Year	3	1.25	0.295					
		Error	104							
RG_LILC3	RG_LILC3 over time	Year	4	1.798	0.146	A	A	A	A	A
	RG_LILC3 vs RG_SLINE and RG_LI24 over time	CI	1	599	<0.001					
		Year	4	5.84	<0.001					
		Area(CI)	1	17.28	<0.001					
		CI×Year	4	0.60	0.663	A	A	A	A	A
		Area(CI)×Year	3	1.23	0.304					
		Error	104							

Area(CI)×Year P-value < 0.1. Analysis was then conducted separately by reference area.

Notes: Years that share a letter (e.g., A,B) are not significantly different (α=0.1). Letters assigned such that the year with the highest mean value (for the Year term) or highest difference between mine-exposed and reference (for the Area×Year term) is assigned the letter A. The p-value used to determine differences were adjusted using Tukey's honestly significant differences method (for the Year term) and Bonferroni method (for the Area×Year term).

Table A.6: Statistical Comparisons of Total Benthic Invertebrate Density (Hess Samples) Over Time at Exposed Area RG_LIDSL and RG_LILC3 Relative to Reference (RG_SLINE and RG_LI24), 2014 to 2018

Area	Comparison	Term	DF	F-Statistic	P-value	Comparisons Among Years				
						2014	2015	2016	2017	2018
RG_LIDSL	RG_LIDSL over time	Year	4	6.26	<0.001	A	AB	B	A	A
	RG_LIDSL vs RG_SLINE and RG_LI24 over time	CI	1	269	<0.001					
		Year	4	8.85	<0.001					
		Area(CI)	1	8.43	0.004					
		CI×Year	4	3.12	0.018					
		Area(CI)×Year	3	8.17	<0.001	CI×Year effect depends on Area				
		Error	104							
	RG_LIDSL vs RG_SLINE over time	Area	1	151	<0.001					
		Year	4	11.5	<0.001					
		Area×Year	4	6.55	<0.001	A	C	BC	AB	BC
		Error	78							
	RG_LIDSL vs RG_LI24 over time	Area	1	236	<0.001					
		Year	4	5.20	0.001					
		Area×Year	3	1.44	0.239	A	A	A	A	A
		Error	71							
RG_LILC3	RG_LILC3 over time	Year	4	0.752	0.562	A	A	A	A	A
	RG_LILC3 vs RG_SLINE and RG_LI24 over time	CI	1	792	<0.001					
		Year	4	3.39	0.012					
		Area(CI)	1	6.44	0.013					
		CI×Year	4	2.23	0.070					
		Area(CI)×Year	3	6.24	0.001	CI×Year effect depends on Area				
		Error	104							
	RG_LILC3 vs RG_SLINE over time	Area	1	490	<0.001					
		Year	4	4.35	0.003					
		Area×Year	4	5.10	0.001	A	B	AB	AB	B
		Error	78							
	RG_LILC3 vs RG_LI24 over time	Area	1	497	<0.001					
		Year	4	0.664	0.619					
		Area×Year	3	0.491	0.690	A	A	A	A	A
		Error	71							

(grey) Area×Year P-value < 0.1.

(blue) Area(CI)×Year P-value < 0.1. Analysis was then conducted separately by reference area.

Notes: Years that share a letter (e.g., A,B) are not significantly different (α=0.1). Letters assigned such that the year with the highest mean value (for the Year term) or highest difference between mine-exposed and reference (for the Area×Year term) is assigned the letter A. The p-value used to determine differences were adjusted using Tukey's honestly significant differences method (for the Year term) and Bonferroni method (for the Area×Year term).

Table A.7: Summary Metrics for Benthic Invertebrate Endpoints Collected by Hess Sampler at Line Creek, September 2018

Area	Biological Area Code	Sample Code	Total Density (org/m²)[a]	Biomass (g/m² ww)[a]	Total Density (org/m²)[b]	Family Richness	EPT		Ephemeroptera		Chironomidae	
							Density (org/m²)	Relative Density (%)	Density (org/m²)	Relative Density (%)	Density (org/m²)	Relative Density (%)
Reference	RG_LI24	RG_LI24-01	2,070	4.878	2,040	14	1,820	89.2	1,440	70.6	0	0
		RG_LI24-02	1,470	3.179	1,450	11	1,150	79.3	970	66.9	0	0
		RG_LI24-03	2,130	6.937	2,010	15	1,700	84.6	1,120	55.7	0	0
		RG_LI24-04	4,580	10.472	4,440	14	3,760	84.7	2,920	65.8	0	0
		RG_LI24-05	910	1.655	910	7	810	89.0	700	76.9	0	0
	RG_SLINE	RG_SLINE-01	4,540	13.962	4,100	18	3,520	85.9	1,640	40.0	0	0
		RG_SLINE-02	3,560	4.800	3,120	13	2,660	85.3	1,500	48.1	0	0
		RG_SLINE-03*	1,460*	2.536*	1,280	14	1,140	89.1	120	9.4	0	0
		RG_SLINE-04	7,520	27.332	7,140	22	6,560	91.9	4,460	62.5	0	0
		RG_SLINE-05	5,400	9.800	5,140	16	4,420	86.0	2,440	47.5	0	0
Mine-exposed	RG_LILC3	RG_LILC3-01	26,800	59.44	24,640	9	1,760	7.1	160	0.6	0	0
		RG_LILC3-02	32,730	151.067	29,010	19	3,410	11.8	840	2.9	0	0
		RG_LILC3-03	37,600	167.216	34,880	13	4,160	11.9	1,200	3.4	0	0
		RG_LILC3-04	26,110	51.505	23,990	13	1,790	7.5	520	2.2	0	0
		RG_LILC3-05	74,080	76.032	57,120	10	1,600	2.8	640	1.1	0	0
		RG_LILC3-06	39,720	93.868	31,600	13	1,840	5.8	400	1.3	0	0
		RG_LILC3-07	33,360	106.952	29,800	16	3,320	11.1	1,200	4.0	0	0
		RG_LILC3-08	26,440	75.076	23,880	15	2,760	11.6	1,320	5.5	0	0
		RG_LILC3-09	24,320	30.788	20,200	9	560	2.8	120	0.6	0	0
		RG_LILC3-10	39,720	74.444	30,040	14	1,800	6.0	440	1.5	0	0
	RG_LIDSL	RG_LIDSL-01	6,090	14.227	5,850	15	2,390	40.9	1,820	31.1	0	0
		RG_LIDSL-02	14,580	19.678	13,980	13	4,420	31.6	3,160	22.6	0	0
		RG_LIDSL-03	14,730	36.020	14,290	20	5,280	36.9	2,480	17.4	0	0
		RG_LIDSL-04	13,890	21.729	13,610	21	5,660	41.6	3,530	25.9	0	0
		RG_LIDSL-05	12,000	22.332	11,600	19	5,800	50.0	3,600	31.0	0	0
		RG_LIDSL-06	19,680	31.248	18,720	18	7,760	41.5	3,320	17.7	0	0
		RG_LIDSL-07	13,120	17.472	12,560	19	5,960	47.5	4,160	33.1	0	0
		RG_LIDSL-08	10,750	28.472	10,070	19	4,850	48.2	3,420	34.0	0	0
		RG_LIDSL-09	7,490	23.306	7,190	19	3,920	54.5	2,220	30.9	0	0
		RG_LIDSL-10	8,560	18.954	8,420	20	5,160	61.3	3,260	38.7	0	0

Note: Sample RG_SLINE-03 was excluded from statistical analyses due challenges with taxonomic analysis related to preservation.

[a] Total density and biomass are reported for all organisms in the sample.

[b] Total density reported after applying the same taxa exclusions used for the CABIN kick and sweep samples (so relative densities are comparable to the kick and sweep samples).

Table A.8: Summary of Benthic Invertebrate Endpoints Collected by 3-Minute Kick and Sweep Sampling at Line Creek and Fording River, September 2018

Area	Biological Area Code	Sample Code	Abundance (# org/ 3-min kick)	LPL Richness (# of taxa)	Family Richness	EPT		Ephemeroptera		Chrionomidae	
						Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)	Abundance (# org/ 3-min kick)	Relative Abundance (%)
Reference	RG_LI24	RG_LI24-01	5,751	26	15	4,451	77.4	2,316	40.3	1,216	21.1
		RG_LI24-02	4,139	36	20	3,458	83.5	2,302	55.6	604	14.6
		RG_LI24-03	5,498	32	18	4,614	83.9	2,857	52.0	785	14.3
	RG_SLINE	RG_SLINE-01	4,510	32	18	4,200	93.1	2,723	60.4	244	5.4
		RG_SLINE-02	6,420	34	19	5,780	90.0	4,380	68.2	500	7.8
		RG_SLINE-03	4,810	29	16	4,540	94.4	2,600	54.1	230	4.8
Mine-exposed	RG_LILC3	RG_LILC3-01	8,160	24	14	1,000	12.3	220	2.7	6,760	82.8
		RG_LILC3-02	18,760	29	17	700	3.7	180	1.0	17,620	93.9
		RG_LILC3-03	9,560	26	15	860	9.0	380	4.0	8,020	83.9
	RG_LIDSL	RG_LIDSL-01	10,800	37	19	6,060	56.1	3,840	35.6	4,000	37.0
		RG_LIDSL-02	11,600	32	15	6,800	58.6	3,940	34.0	3,940	34.0
		RG_LIDSL-03	10,260	25	11	5,240	51.1	2,440	23.8	4,500	43.9
		RG_LIDSL-04	10,140	33	15	5,600	55.2	3,220	31.8	4,060	40.0
		RG_LIDSL-05	6,300	32	15	2,980	47.3	1,980	31.4	3,080	48.9
	RG_LIDCOM	RG_LIDCOM-01	31,980	42	20	18,420	57.6	7,680	24.0	12,640	39.5
	RG_LCUT	RG_LCUT-01	10,100	31	17	1,360	13.5	320	3.2	8,080	80.0
	RG_LI8	RG_LI8-01	14,500	38	20	12,380	85.4	2,480	17.1	1,720	11.9
		RG_LI8-02	15,520	36	21	14,100	90.9	2,380	15.3	1,220	7.9
		RG_LI8-03	17,920	39	22	15,940	89.0	3,320	18.5	1,440	8.0
	RG_LISP24	RG_LISP24-01	9,160	34	16	2,940	32.1	1,000	10.9	5,920	64.6
	RG_FO23	RG_FO23-01	3,910	35	19	3,120	79.8	1,630	11.2	197	5.0
		RG_FO23-02	7,740	40	25	4,000	51.7	2,080	11.0	174	2.3
		RG_FO23-03	6,580	38	22	5,300	80.5	2,180	12.8	286	4.3
		RG_FO23-04	4,241	39	21	3,108	73.3	1,341	10.6	130	3.1
		RG_FO23-05	7,300	43	24	5,240	71.8	2,660	9.5	120	1.6
	RG_FRUL	RG_FRUL-01	5,602	34	20	3,150	56.2	1,967	35.1	952	17.0

Table A.9: Benthic Community Subsampling QA/QC

Sample Name		RG_SLINE3_BIC	RG_F023-1_BIC	RG_LIDSL2_BIC
Organisms in Subsample		471	393	583
		464	360	523
		481	377	621
		479	374	554
		476	351	596
		513	373	555
		514	375	547
		486	410	542
		418	400	565
		479	396	530
		-	-	580
		-	-	596
		-	-	571
		-	-	563
		-	-	578
		-	-	540
		-	-	587
		-	-	557
		-	-	583
		-	-	618
Sorter		DM	DM	KF
Time Sorted		1305	1415	2065
Actual Total		4781	3809	11389
Precision Error	Min (%)	0	0.267	0
	Max (%)	9.91	4.07	15.8
Accuracy Error	Min (%)	74.9	84.3	0.272
	Max (%)	115	115	9.05

Cordillera Consulting

Project: Teck Line Creek LAEMP 2018 (187202.0026) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2018	2018	2018	2018	2018	2018	2018	2018	2018
Sample:	RG_LIDSL1_BIC	RG_LIDSL2_BIC	RG_LIDSL3_BIC	RG_LIDSL4_BIC	RG_LIDSL5_BIC	RG_LIDCOM_BIC	RG_FO23-1_BIC	RG_FO23-2_BIC	RG_FO23-3_BIC
Sample Collection Date:	05-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	08-Sep-18	08-Sep-18	08-Sep-18
CC#:	CC191052	CC191053	CC191054	CC191055	CC191056	CC191057	CC191058	CC191059	CC191060
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: Ephemeroptera	0	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0
Ameletus	20	40	0	80	40	100	10	20	20
| Family: Baetidae	40	0	40	80	40	120	10	180	40
Acentrella	0	0	0	0	0	0	20	0	20
Baetis	60	220	280	100	180	340	100	280	140
Baetis rhodani group	1560	1180	860	1180	680	2620	890	1300	480
Baetis bicaudatus	0	0	0	0	0	0	0	0	0
Diphetor hageni	0	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	140	200	100	60	20	240	20	0	20
Drunella coloradensis	20	0	0	0	0	0	0	0	0
Drunella doddsii	360	280	100	160	120	1540	90	80	160
Drunella spinifera	0	0	0	0	0	0	0	20	0
Ephemerella	0	0	0	0	0	0	0	0	20
| Family: Heptageniidae	1220	1600	840	1220	740	2520	380	180	1100
Cinygmula	0	0	0	0	0	0	0	0	0
Epeorus	400	420	220	320	160	200	10	0	0
Rhithrogena	20	0	0	20	0	0	100	20	180
| Order: Plecoptera	0	0	0	0	0	60	10	0	0
| Family: Capniidae	0	0	0	0	0	0	20	60	20
| Family: Chloroperlidae	0	20	0	0	0	0	0	0	0
Haploperla	0	0	0	0	0	0	10	0	0
Paraperla	0	40	0	0	20	40	0	0	0
Sweltsa	20	60	0	20	0	100	130	20	260
| Family: Leuctridae	0	0	0	0	0	20	0	0	40
Paraleuctra	0	0	0	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	0	0	0
Zapada	940	420	400	660	140	2620	70	620	360
Zapada oregonensis group	240	380	160	220	100	520	0	20	20
Zapada cinctipes	20	40	0	0	0	140	200	660	260
Zapada columbiana	60	120	80	40	40	20	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0	0
Yoraperla	20	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	30	40	20
Hesperoperla	0	0	0	0	0	0	10	40	0
| Family: Perlodidae	40	0	20	20	0	20	20	20	20
Kogotus	40	80	60	40	20	100	10	40	40
Megarcys	60	40	40	20	20	180	0	0	40
Setvena	0	0	0	0	0	0	0	0	0
| Family: Taeniopterygidae	220	720	60	220	200	3240	900	160	1840
| Order: Trichoptera	80	540	1460	820	320	2620	0	60	20
| Family: Apataniidae	0	0	0	0	0	0	0	0	0
Apatania	20	0	0	0	0	60	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0	0	20	0
Brachycentrus americanus	0	0	0	20	0	0	30	0	20
Micrasema	0	0	0	0	0	0	0	20	0
| Family: Glossosomatidae	0	0	0	20	0	0	0	0	0
Glossosoma	0	0	0	0	0	0	0	0	60
| Family: Hydropsychidae	340	240	460	40	40	340	0	0	0
Parapsyche	20	0	0	60	0	0	0	0	0
Parapsyche elsis	40	20	0	100	20	20	0	0	0
| Family: Limnephilidae	0	0	0	0	0	40	10	0	0
Ecclisomyia	0	0	0	0	0	0	0	0	0
Homophylax	0	0	0	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0	0
Rhyacophila	40	60	40	0	20	400	30	120	20
Rhyacophila betteni group	20	40	0	0	20	100	0	0	0
Rhyacophila brunnea/vemna group	0	0	20	40	0	40	10	0	20
Rhyacophila hyalinata group	0	40	0	40	40	60	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	0	0
Rhyacophila atrata complex	0	0	0	0	0	0	0	20	60
Rhyacophila narvae	0	0	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	0	0	0	0	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: Dytiscidae	0	0	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0	20	0
| Family: Elmidae	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Family: Athericidae	0	0	0	0	0	0	0	0	0
Atherix	0	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0	20	20
| Family: Chironomidae	820	780	540	680	500	2600	60	140	120
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0
Microtendipes	0	0	0	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0	0
Micropsectra	60	0	0	60	20	40	30	0	280
Stempellinella	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	20	40	0	40	100	600	0	0	0
Pagastia	280	220	140	240	100	460	20	80	0
Pseudodiamesa	0	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	20	0	0	0
Eukiefferiella	540	480	280	380	300	1240	80	620	0
Hydrobaenus	0	0	40	60	20	20	0	0	0
Limnophyes	0	0	0	0	0	0	0	0	0

Cordillera Consulting

Project: Teck Line Creek LAEMP 2018 (187202.0026) - Kick Sampling Taxonomist: Scott Finlayson 250-494-7553 scottfinlayson@cordilleraconsulting.ca

Site:	2018	2018	2018	2018	2018	2018	2018	2018	2018
Sample:	RG_LIDSL1_BIC	RG_LIDSL2_BIC	RG_LIDSL3_BIC	RG_LIDSL4_BIC	RG_LIDSL5_BIC	RG_LIDCOM_BIC	RG_FO23-1_BIC	RG_FO23-2_BIC	RG_FO23-3_BIC
Sample Collection Date:	05-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	08-Sep-18	08-Sep-18	08-Sep-18
CC#:	CC191052	CC191053	CC191054	CC191055	CC191056	CC191057	CC191058	CC191059	CC191060
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Family: Chironomidae	820	780	540	680	500	2600	60	140	120
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0
Orthocladius complex	1360	1660	2680	1880	1760	5520	170	1100	40
Parorthocladius	0	0	20	0	20	20	0	0	0
Rheocricotopus	640	660	540	480	180	1680	30	20	60
Synorthocladius	0	20	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0	20
Tvetenia	280	80	260	220	80	440	50	120	40
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0	0
Nilotanypus	0	0	0	20	0	0	0	0	0
| Family: Empididae	20	20	0	0	0	40	0	0	0
Chelifera/ Metachela	0	0	0	0	0	0	0	0	40
Clinocera	0	0	0	0	0	0	10	40	0
Oreogeton	0	0	0	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0	20	80	0
Wiedemannia	0	0	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	20	0	0	0	0	60	90	100	340
| Family: Simuliidae	100	40	120	120	40	20	0	40	40
Simulium	520	680	360	280	140	300	80	220	0
| Family: Tipulidae	0	0	0	0	0	0	0	0	0
Antocha	0	0	0	0	0	0	0	0	0
Dicranota	0	0	0	0	0	0	0	0	0
Erioptera	0	0	0	0	0	0	0	0	20
Hexatoma	0	0	0	0	0	0	0	0	40
| Order: Thysanoptera	0	0	0	0	0	0	0	20	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	40	0	20	0	0	0	20	0
| Family: Aturidae	0	0	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0	20	0
| Family: Feltriidae	0	0	0	0	0	0	0	0	0
Feltria	20	0	0	0	20	60	0	60	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0	0
Albertathyas	0	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0	0
Lebertia	40	40	0	0	20	100	120	320	180
| Family: Sperchontidae	0	0	0	0	0	0	0	0	0
Sperchon	20	40	40	60	20	340	0	0	0
Sperchonopsis	0	0	0	0	0	0	0	40	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0	40	40
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0	0	20	0
| Family: Hydrozetidae	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: Lumbriculida	0	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0	0	0	0
Rhynchelmis	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	30	0	0
Nais	0	0	0	0	0	0	0	600	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0	20	0
Totals:	11620	12380	10800	10820	6800	34580	3970	7900	6700
Taxa present but not included:									
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	20	20	0	20	20	20	10	0	0
Phylum: Nemata	0	20	20	20	0	20	0	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	20	20	0	20	0	0	10	0	0
Totals:	40	60	20	60	20	40	20	0	0

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2018	2018	2018	2018	2018	2018	2018	2018	2018
Sample:	RG_FO23-4_BIC	RG_FO23-5_BIC	RG_FRUL_BIC	RG_LCUT_BIC	RG_LILC3-1_BIC	RG_LILC3-2_BIC	RG_LILC3-3_BIC	RG_SLINE1_BIC	RG_SLINE2_BIC
Sample Collection Date:	08-Sep-18	08-Sep-18	09-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	11-Sep-18	11-Sep-18
CC#:	CC191061	CC191062	CC191063	CC191064	CC191065	CC191066	CC191067	CC191068	CC191069
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: Ephemeroptera	0	20	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0
Ameletus	13	20	0	0	0	0	20	111	220
| Family: Baetidae	125	520	400	20	0	0	0	11	20
Acentrella	13	20	0	0	0	0	0	0	0
Baetis	38	80	333	0	20	0	20	0	0
Baetis rhodani group	713	1040	1017	60	80	80	140	89	140
Baetis bicaudatus	0	0	0	0	0	0	0	0	0
Diphetor hageni	13	20	0	0	0	0	0	0	0
| Family: Ephemerellidae	0	60	0	40	0	0	0	189	1480
Drunella coloradensis	0	0	0	0	0	0	0	11	0
Drunella doddsii	63	80	33	60	20	20	20	100	200
Drunella spinifera	0	0	0	0	0	0	0	0	0
Ephemerella	0	0	17	0	0	0	0	0	0
| Family: Heptageniidae	288	720	117	140	100	80	180	1356	2100
Cinygmula	0	0	0	0	0	0	0	0	0
Epeorus	0	0	17	0	0	0	0	678	100
Rhithrogena	75	100	33	0	0	0	0	178	120
| Order: Plecoptera	0	0	50	0	0	0	0	0	0
| Family: Capniidae	25	60	17	60	0	40	0	0	0
| Family: Chloroperlidae	0	0	0	0	0	0	0	0	20
Haploperla	0	0	33	20	0	0	0	0	0
Paraperla	0	0	0	0	40	0	0	111	40
Sweltsa	50	80	17	120	20	80	0	56	140
| Family: Leuctridae	0	0	0	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	0	0	0
Zapada	213	520	250	220	40	20	40	44	120
Zapada oregonensis group	13	0	0	60	20	180	180	33	40
Zapada cinctipes	338	920	400	0	0	20	0	0	0
Zapada columbiana	0	0	0	0	0	0	20	178	60
| Family: Peltoperlidae	0	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0	0
| Family: Perlidae	100	100	100	0	20	0	0	0	0
Hesperoperla	63	120	83	0	0	0	0	0	0
| Family: Perlodidae	13	40	33	20	0	0	0	22	0
Kogotus	0	80	17	20	0	40	0	0	0
Megarcys	0	40	0	120	0	0	20	67	80
Setvena	0	0	0	0	0	0	0	0	0
| Family: Taeniopterygidae	788	420	100	100	20	0	20	344	300
| Order: Trichoptera	50	20	17	20	320	0	20	111	200
| Family: Apataniidae	0	0	0	0	0	0	0	0	0
Apatania	0	0	0	0	0	0	0	0	20
| Family: Brachycentridae	0	0	0	0	0	0	0	0	0
Brachycentrus	25	60	33	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0	0	0
Micrasema	0	40	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0	0	0	0
Glossosoma	25	0	0	0	0	0	0	56	60
| Family: Hydropsychidae	0	0	0	100	40	0	80	222	120
Parapsyche	0	0	0	20	0	20	60	0	0
Parapsyche elsis	0	0	0	60	240	100	20	11	40
| Family: Limnephilidae	0	0	0	0	0	20	20	22	20
Ecclisomyia	0	0	0	0	0	0	0	0	20
Homophylax	0	0	0	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0	0
Rhyacophila	13	20	33	80	0	0	0	56	20
Rhyacophila betteni group	0	0	0	0	0	0	0	0	0
Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	44	40
Rhyacophila hyalinata group	0	0	0	20	20	0	0	78	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	11	40
Rhyacophila atrata complex	38	40	0	0	0	0	0	0	0
Rhyacophila narvae	13	0	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0	0
Oligophlebodes	0	20	0	0	0	0	0	0	0
| Family: Uenoidae	0	0	0	0	0	0	0	0	0
Neothremma	0	0	0	0	0	0	0	11	20
| Order: Coleoptera	0	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Family: Athericidae	0	0	0	0	0	0	0	0	0
Atherix	0	40	17	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0	0
Mallochohelea	0	20	0	0	0	0	0	0	0
| Family: Chironomidae	150	60	117	1100	720	2000	940	56	140
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0
Microtendipes	0	0	0	0	0	20	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0	0
Micropsectra	113	160	17	0	0	780	40	0	20
Stempellinella	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	0	0	0	160	140	40	280	0	0
Pagastia	13	60	67	760	380	640	420	0	0
Pseudodiamesa	0	0	0	0	0	40	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0	0
Eukiefferiella	113	80	250	600	340	380	240	0	20
Hydrobaenus	13	0	17	180	60	2860	100	0	20
Limnophyes	0	0	0	0	0	0	0	0	0

Cordillera Consulting

Project: Teck Line Creek LAEMP 2018 (187202.0026) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2018	2018	2018	2018	2018	2018	2018	2018	2018
Sample:	RG_FO23-4_BIC	RG_FO23-5_BIC	RG_FRUL_BIC	RG_LCUT_BIC	RG_LILC3-1_BIC	RG_LILC3-2_BIC	RG_LILC3-3_BIC	RG_SLINE1_BIC	RG_SLINE2_BIC
Sample Collection Date:	08-Sep-18	08-Sep-18	09-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	11-Sep-18	11-Sep-18
CC#:	CC191061	CC191062	CC191063	CC191064	CC191065	CC191066	CC191067	CC191068	CC191069
| Order: Diptera	0	0	0	0	0	0	0	0	0
| Family: Chironomidae	150	60	117	1100	720	2000	940	56	140
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0
Orthocladius complex	275	440	417	4340	4460	9040	5080	44	20
Parorthocladius	0	0	0	0	0	20	0	0	0
Rheocricotopus	13	40	0	600	420	1440	660	111	280
Synorthocladius	0	0	0	0	0	0	0	0	0
Thienemanniella	0	20	0	20	0	0	0	0	0
Tvetenia	63	140	67	320	240	360	260	33	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0	0
Nilotanypus	0	0	0	0	0	0	0	0	0
| Family: Empididae	13	20	0	20	0	20	20	11	0
Chelifera/ Metachela	13	0	33	0	0	0	0	0	40
Clinocera	0	40	0	0	0	0	0	0	0
Oreogeton	0	0	0	0	0	0	0	11	20
Roederiodes	13	60	33	0	0	0	0	0	0
Wiedemannia	13	80	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0	0	0
Limnophora	0	0	0	20	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	113	100	0	0	0	0	0	0	0
| Family: Simuliidae	13	80	133	0	20	0	0	0	0
Simulium	25	0	867	20	200	20	220	11	0
| Family: Tipulidae	0	20	0	0	0	0	0	0	0
Antocha	25	20	0	0	0	0	0	0	0
Dicranota	0	0	0	0	0	0	0	0	40
Erioptera	0	0	0	0	0	0	0	0	0
Hexatoma	13	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	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0	0
Feltria	0	0	17	60	120	60	200	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0	0
Albertathyas	0	0	0	0	0	0	0	22	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0	0
Lebertia	63	320	100	120	20	80	60	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0	0
Sperchon	13	40	0	420	40	180	180	11	0
Sperchonopsis	0	0	0	0	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0	0
Testudacarus	0	20	50	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	17	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	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: Lumbriculida	0	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0	0	0	0
Rhynchelmis	0	0	0	0	0	20	0	0	20
| Order: Tubificida	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	60	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0	0
Nais	63	200	233	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0	0	0
Totals:	**4391**	**7380**	**5719**	**11200**	**8880**	**20760**	**10500**	**4566**	**6560**
Taxa present but not included:									
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	13	20	0	20	20	20	20	11	20
Phylum: Nemata	0	0	17	20	20	20	20	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	0	20	0	20	20	20	20	11	0
Totals:	**13**	**40**	**17**	**60**	**60**	**60**	**60**	**22**	**20**

Cordillera Consulting

Project: Teck Line Creek LAEMP 2018 (187202.0026) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2018	2018	2018	2018	2018	2018	2018	2018
Sample:	RG_SLINE3_BIC	RG_LI24-1_BIC	RG_LI24-2_BIC	RG_LI24-3_BIC	RG_LI8-1_BIC	RG_LI8-2_BIC	RG_LI8-3_BIC	RG_LISP24-1_BIC
Sample Collection Date:	11-Sep-18	12-Sep-18	12-Sep-18	12-Sep-18	13-Sep-18	13-Sep-18	13-Sep-18	13-Sep-18
CC#:	CC191070	CC191071	CC191072	CC191073	CC191074	CC191075	CC191076	CC191077
Phylum: Arthropoda	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	13	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	140	50	463	143	100	160	40	40
| Family: Baetidae	0	33	0	0	40	20	0	80
Acentrella	0	0	0	0	0	0	0	0
Baetis	10	0	0	0	20	60	80	80
Baetis rhodani group	80	0	0	14	520	500	360	200
Baetis bicaudatus	0	0	13	14	0	0	0	0
Diphetor hageni	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	360	200	125	229	20	40	100	80
Drunella coloradensis	0	0	0	0	0	0	0	0
Drunella doddsii	80	250	300	186	180	180	380	40
Drunella spinifera	0	0	0	0	0	0	0	0
Ephemerella	0	0	0	0	0	0	20	0
| Family: Heptageniidae	1630	1550	1200	1929	1540	1260	2280	440
Cinygmula	0	0	0	14	0	0	0	0
Epeorus	160	200	163	271	40	80	20	40
Rhithrogena	140	33	38	57	20	80	40	0
| Order: Plecoptera	0	0	0	0	0	0	20	20
| Family: Capniidae	0	0	13	0	40	20	40	20
| Family: Chloroperlidae	10	17	0	0	0	20	0	0
Haploperla	0	0	0	0	0	0	0	0
Paraperla	50	0	0	14	20	0	0	0
Sweltsa	100	67	25	0	20	20	20	20
| Family: Leuctridae	0	67	13	29	0	0	0	0
Paraleuctra	10	0	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	40	0	0	0
Visoka cataractae	0	0	0	0	20	0	0	0
Zapada	60	200	138	100	1780	1540	3160	460
Zapada oregonensis group	40	100	38	114	320	540	440	180
Zapada cinctipes	0	0	0	0	420	300	300	20
Zapada columbiana	90	533	250	743	60	80	20	20
| Family: Peltoperlidae	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	20	0
Hesperoperla	0	0	0	0	0	0	0	0
| Family: Perlodidae	0	117	38	100	0	0	0	0
Kogotus	0	0	0	0	80	40	20	40
Megarcys	30	67	188	157	180	100	120	20
Setvena	0	0	0	57	0	0	0	0
| Family: Taeniopterygidae	190	783	263	300	3680	2460	5360	40
| Order: Trichoptera	1030	117	88	43	2180	4500	1940	1020
| Family: Apataniidae	0	0	0	0	0	0	0	0
Apatania	0	0	0	0	40	40	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0	0
| Family: Glossosomatidae	10	0	0	0	0	0	0	0
Glossosoma	30	0	0	0	0	0	20	0
| Family: Hydropsychidae	130	0	13	29	100	60	180	60
Parapsyche	0	0	0	0	0	0	40	20
Parapsyche elsis	0	0	13	0	0	20	0	0
| Family: Limnephilidae	20	0	0	14	0	0	0	0
Ecclisomyia	0	0	38	0	0	20	0	0
Homophylax	0	17	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila	0	0	0	0	60	160	200	0
Rhyacophila betteni group	0	0	0	0	0	0	20	0
Rhyacophila brunnea/vemna group	10	17	25	43	60	100	80	0
Rhyacophila hyalinata group	80	0	0	0	20	0	40	0
Rhyacophila vofixa group	40	0	0	0	0	0	0	0
Rhyacophila atrata complex	10	0	0	0	40	20	0	0
Rhyacophila narvae	0	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	740	1680	580	0
| Family: Uenoidae	0	0	0	0	0	0	0	0
Neothremma	0	33	13	14	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	20	0	0
| Order: Diptera	0	0	13	0	0	0	0	0
| Family: Athericidae	0	0	0	0	0	0	0	0
Atherix	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0	0
| Family: Chironomidae	70	133	88	29	800	660	880	840
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Microtendipes	0	0	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0
Micropsectra	0	0	13	0	40	40	0	180
Stempellinella	0	0	0	0	0	0	0	20
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Diamesa	0	67	25	100	0	0	20	120
Pagastia	0	33	0	0	0	0	0	220
Pseudodiamesa	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	13	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0
Eukiefferiella	20	67	75	71	40	60	20	160
Hydrobaenus	0	0	13	14	120	40	20	560
Limnophyes	0	0	13	0	0	20	0	20

Cordillera Consulting

Project: Teck Line Creek LAEMP 2018 (187202.0026) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2018	2018	2018	2018	2018	2018	2018	2018
Sample:	RG_SLINE3_BIC	RG_LI24-1_BIC	RG_LI24-2_BIC	RG_LI24-3_BIC	RG_LI8-1_BIC	RG_LI8-2_BIC	RG_LI8-3_BIC	RG_LISP24-1_BIC
Sample Collection Date:	11-Sep-18	12-Sep-18	12-Sep-18	12-Sep-18	13-Sep-18	13-Sep-18	13-Sep-18	13-Sep-18
CC#:	CC191070	CC191071	CC191072	CC191073	CC191074	CC191075	CC191076	CC191077
| Order: Diptera	0	0	13	0	0	0	0	0
| Family: Chironomidae	70	133	88	29	800	660	880	840
| Subfamily: Orthocladiinae	0	0	13	0	0	0	0	0
Orthocladius complex	60	333	250	371	20	0	0	2800
Parorthocladius	0	0	13	43	0	0	0	20
Rheocricotopus	70	50	25	43	660	400	420	740
Synorthocladius	0	0	0	0	0	0	0	0
Thienemanniella	0	0	13	0	0	0	0	0
Tvetenia	10	533	50	114	40	0	80	240
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0
Nilotanypus	0	0	0	0	0	0	0	0
| Family: Empididae	0	0	13	0	0	20	40	20
Chelifera/ Metachela	0	0	0	0	0	0	0	0
Clinocera	0	0	0	0	0	0	0	0
Oreogeton	10	0	0	14	0	0	0	0
Roederiodes	0	0	0	0	0	0	0	0
Wiedemannia	0	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	0	0	14	100	40	200	20
| Family: Simuliidae	0	0	0	0	20	20	20	0
Simulium	0	0	0	0	60	20	20	60
| Family: Tipulidae	0	0	0	0	0	0	0	0
Antocha	0	0	0	0	0	0	0	0
Dicranota	0	0	0	0	0	0	20	0
Erioptera	0	0	0	0	0	0	0	0
Hexatoma	0	0	0	0	20	0	0	0
| Order: Thysanoptera	0	17	0	0	0	20	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0
Albertathyas	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	0	17	13	57	20	0	20	60
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	0	67	25	14	60	40	80	140
Sperchonopsis	0	0	0	0	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	13	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	40	40	100	0
Rhynchelmis	30	0	13	0	80	0	40	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0	0
Totals:	**4880**	**5901**	**4266**	**5527**	**15300**	**16200**	**18800**	**10000**
Taxa present but not included:								
Phylum: Arthropoda	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0
| Class: Ostracoda	10	17	13	0	20	20	20	20
Phylum: Nemata	0	0	13	14	0	0	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0
| Class: Turbellaria	0	0	0	0	20	20	20	20
Totals:	**10**	**17**	**26**	**14**	**40**	**40**	**40**	**40**

Benthic Macroinvertebrates Collected Through Hess Sampling (Sampling Area = 0.1m^2) from Teck Line Creek, 2018 (Densities Expressed per Sampled Area)

Station	RG_LILC3																			
	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	72	0.0136	56	0.0068	192	0.0256	40	0.004	64	0.0160	120	0.0212	68	0.0168	44	0.0148	32	0.0044	24	0.0048
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	16	0.0464	24	0.0880	48	0.1200	52	0.096	144	0.2304	68	0.1564	128	0.2564	80	0.1952	56	0.4120	156	0.3996
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	4	0.0004	-	-	-	-	4	0.0004	-	-	-	-	-	-
F. Lumbriculidae	8	0.0064	32	0.0880	-	-	16	0.0924	64	0.3424	4	0.0484	24	0.1520	4	0.0328	12	0.0428	16	0.0464
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	-	-	-	-	8	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	8	0.0032	8	0.0008	8	0.0032	32	0.0104	32	0.0096	36	0.0172	16	0.0072	24	0.0064	4	0.0004	20	0.0076
F. Sperchonidae	32	0.0144	48	0.0188	-	-	100	0.0692	48	0.0256	72	0.0336	24	0.0108	40	0.0192	20	0.0096	28	0.0156
F. Torrenticolidae	-	-	-	-	8	0.0008	-	-	-	-	4	0.0004	-	-	-	-	-	-	-	-
SEED SHRIMPS																				
Cl. Ostracoda	128	0.0272	292	0.0776	32	0.0088	120	0.0340	1488	0.3792	624	0.1684	160	0.0512	132	0.0460	324	0.0808	788	0.1944
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Baetidae	16	0.0128	4	0.0056	56	0.0536	4	0.0072	32	0.0176	-	-	16	0.0140	20	0.0256	-	-	4	0.0008
F. Ephemerellidae	-	-	16	0.0212	-	-	12	0.0052	-	-	-	-	8	0.0096	12	0.0120	-	-	4	0.0032
F. Heptageniidae	-	-	64	0.0160	64	0.0384	36	0.0104	32	0.0176	40	0.0164	96	0.0260	100	0.0264	12	0.0036	36	0.0116
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	-	-	8	0.0204	8	0.0112	-	-	-	-	-	-	4	0.0100	4	0.0148	-	-	-	-
F. Chloroperlidae	88	0.0992	76	0.1192	16	0.0352	16	0.0556	16	0.0864	32	0.0956	76	0.2256	36	0.1500	16	0.0240	44	0.1144
F. Leuctridae	8	0.0016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Nemouridae	16	0.0456	32	0.1220	72	0.4592	48	0.2844	-	-	36	0.1936	36	0.1744	44	0.3764	20	0.1204	36	0.2492
F. Perlodidae	-	-	1	0.3812	-	-	-	-	-	-	4	0.0024	12	0.0864	4	0.0428	-	-	4	0.0560
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	-	-	4	0.0004	8	0.0024	-	-	-	-	-	-	12	0.0016	-	-	-	-	-	-
CADDISFLIES																				
O. Trichoptera																				
immature **	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0004	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	4	0.0028	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	8	0.0824	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0188	-	-	-	-
F. Hydropsychidae	-	-	13	1.4041	152	11.9616	53	1.6975	16	1.3200	32	2.9820	24	1.9256	32	2.8668	4	0.4816	20	1.1388
F. Hydroptilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	-	-	4	0.0008	-	-	-	-	32	0.0144	4	0.0028	-	-	-	-	-	-	4	0.0004
F. Rhyacophilidae	40	1.8152	115	9.1162	40	1.2112	10	0.1126	32	0.9616	36	2.5124	48	3.4972	16	0.9368	4	0.0880	28	2.1244
F. Uenoidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRUE FLIES																				
O. Diptera																				
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Chironomidae	2240	3.7760	2440	3.5748	2808	2.0872	2048	2.6400	5392	4.1136	2840	3.1076	2508	4.0696	2008	2.6516	1908	1.7580	2732	3.0376
F. Empididae	-	-	12	0.0188	8	0.0208	8	0.0200	16	0.0688	12	0.0172	28	0.0568	8	0.0172	20	0.0532	24	0.0380
F. Muscidae	-	-	12	0.0132	8	0.0488	-	-	-	-	4	0.0108	-	-	-	-	-	-	4	0.0016
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	-	-	-	-	-	-	-	-	-	-	4	0.0004	-	-	-	-	-	-	-	-
F. Simuliidae	-	-	4	0.0076	224	0.6328	12	0.0104	-	-	-	-	44	0.1036	28	0.0536	-	-	-	-
F. Tipulidae	-	-	4	0.0024	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS PER SAMPLE	2680		3273		3760		2611		7408		3972		3336		2644		2432		3972	
TOTAL NUMBER OF TAXA [a]	13		23		18		17		14		18		20		20		13		18	
TOTAL BIOMASS (g)		5.9440		15.1067		16.7216		5.1505		7.6032		9.3868		10.6952		7.5076		3.0788		7.4444

[a] Bold excluded from taxa count
* preservative issues
**Immature Trichoptera excluded from taxa count if Uenoidae were also present in sample

Benthic Macroinvertebrates Collected Through Hess Sampling (Sampling Area = 0.1m^2) from Teck Line Creek, 2018 (Densities Expressed per Sampled Area)

Station	RG_LIDSL																			
	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	-	-	-	-	12	0.0004	4	0.0006	-	-	8	0.0008	8	0.0004	-	-	-	-	-	-
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	2	0.0004	-	-	-	-	2	0.0058	8	0.0024	8	0.0112	4	0.0032	4	0.0100	4	0.0120	6	0.0028
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	-	-	-	-	4	0.0624	-	-	-	-	-	-	4	0.0120	-	-	6	0.0366	10	0.0358
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	2	0.0002	-	-	8	0.0020	2	0.0006	-	-	20	0.0084	-	-	-	-	2	0.0004	6	0.0020
F. Sperchonidae	2	0.0002	-	-	4	0.0020	4	0.0120	8	0.0044	12	0.0064	8	0.0040	2	0.0006	2	0.0012	4	0.0012
F. Torrenticolidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS																				
Cl. Ostracoda	22	0.0036	60	0.0148	32	0.0100	22	0.0062	32	0.0068	80	0.0304	44	0.0132	64	0.0146	26	0.0072	8	0.0016
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0012	2	0.0014	-	-	-	-
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	-	-	16	0.0024	8	0.0012	18	0.0076	20	0.0044	16	0.0120	16	0.0096	14	0.0034	2	0.0004	6	0.0040
F. Baetidae	24	0.0646	32	0.0840	12	0.0332	30	0.1100	64	0.1696	60	0.1332	4	0.0096	16	0.0492	26	0.0698	14	0.0178
F. Ephemerellidae	30	0.0158	32	0.0268	12	0.0212	9	0.1589	28	0.0284	20	0.0128	36	0.0324	24	0.0146	34	0.0172	46	0.1042
F. Heptageniidae	128	0.0752	236	0.2132	216	0.2536	296	0.1368	248	0.3136	236	0.1200	360	0.2572	288	0.1406	160	0.1278	260	0.1302
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	2	0.0018	4	0.0088	4	0.0028	2	0.0060	-	-	-	-	-	-	-	-	2	0.0064	2	0.0002
F. Chloroperlidae	4	0.0030	60	0.1416	37	0.1153	32	0.0570	28	0.0888	124	0.2168	88	0.1844	52	0.1862	46	0.1286	32	0.0788
F. Leuctridae	-	-	8	0.0064	12	0.0112	10	0.0038	16	0.0232	-	-	12	0.0012	2	0.0002	-	-	2	0.0032
F. Nemouridae	24	0.0688	40	0.0892	104	0.2552	64	0.3646	52	0.1680	72	0.3296	36	0.0504	36	0.0942	36	0.1408	52	0.1910
F. Perlodidae	-	-	-	-	-	-	10	0.0580	12	0.1456	12	0.0460	4	0.2716	4	0.0292	6	0.1012	10	0.1072
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	4	0.0004	-	-	8	0.0004	12	0.0026	64	0.0084	16	0.0096	8	0.0012	8	0.0010	2	0.0002	24	0.0042
CADDISFLIES																				
O. Trichoptera																				
immature **	2	0.0002	8	0.0004	84	0.0040	56	0.0034	8	0.0020	136	0.0060	-	-	-	-	46	0.0014	24	0.0010
pupae	2	0.0156	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	2	0.0002	-	-	4	0.0012	4	0.0014	12	0.0096	16	0.0060	16	0.0032	14	0.2736	-	-	-	-
F. Glossosomatidae	-	-	-	-	-	-	2	0.0114	-	-	4	0.0284	-	-	-	-	6	0.0128	4	0.0070
F. Hydropsychidae	6	0.6739	5	0.2140	26	1.4196	11	0.6227	20	0.4796	12	0.0388	4	0.1476	13	0.7208	15	0.8675	18	0.2734
F. Hydroptilidae	2	0.0006	-	-	-	-	-	-	-	-	-	-	4	0.0016	-	-	-	-	-	-
F. Limnephilidae	-	-	-	-	-	-	-	-	-	-	8	0.0036	-	-	4	0.2736	-	-	-	-
F. Rhyacophilidae	9	0.1274	1	0.0490	1	0.0600	8	0.0898	8	0.0840	32	1.0096	8	0.1892	10	0.2717	11	0.2652	22	0.4214
F. Uenoidae	-	-	-	-	-	-	2	0.0002	-	-	12	0.0008	-	-	-	-	-	-	-	-
TRUE FLIES																				
O. Diptera																				
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0014	6	0.0038
F. Chironomidae	336	0.3382	936	1.1008	832	0.8720	760	0.4144	516	0.4648	1040	1.0568	632	0.5368	500	0.4714	306	0.2812	290	0.4754
F. Empididae	4	0.0062	8	0.0156	12	0.0288	12	0.0188	12	0.0332	20	0.0364	8	0.0120	-	-	4	0.0076	6	0.0148
F. Muscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Pelecorhyncidae	2	0.0264	-	-	4	0.0048	6	0.0076	8	0.0080	-	-	-	-	2	0.0010	-	-	-	-
F. Psychodidae	-	-	12	0.0008	32	0.0056	10	0.0018	12	0.0020	4	0.0012	-	-	12	0.0020	2	0.0002	-	-
F. Simuliidae	-	-	-	-	4	0.0020	-	-	8	0.0212	-	-	-	-	-	-	-	-	2	0.0052
F. Tipulidae	-	-	-	-	1	0.4331	1	0.0709	16	0.1652	-	-	4	0.0052	4	0.2879	3	0.2435	2	0.0092
TOTAL NUMBER OF ORGANISMS PER SAMPLE	609		1458		1473		1389		1200		1968		1312		1075		749		856	
TOTAL NUMBER OF TAXA [a]	19		15		24		25		22		22		22		21		23		24	
TOTAL BIOMASS (g)		1.4227		1.9678		3.6020		2.1729		2.2332		3.1248		1.7472		2.8472		2.3306		1.8954

[a] Bold excluded from taxa count
* preservative issues
**Immature Trichoptera excluded from taxa count if Uenoidae were also present in sample

Benthic Macroinvertebrates Collected Through Hess Sampling (Sampling Area = 0.1m^2) from Teck Line Creek, 2018 (Densities Expressed per Sampled Area)

Station	RG_LI24										RG_SLINE									
	1		2		3		4		5		1		2		3*		4		5	
ROUNDWORMS																				
P. Nemata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0002	4	0.0012
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0086	-	-	2	0.0108	-	-
<u>ANNELIDS</u>																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	-	-	-	-	-	-	-	-	-	-	-	-	12	0.0486	-	-	16	0.2884	42	0.1684
<u>ARTHROPODS</u>																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydryphantidae	-	-	-	-	-	-	2	0.0004	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	1	0.0004	-	-	-	-	2	0.0004	1	0.0004	2	0.0004	2	0.0006	-	-	2	0.0008	2	0.0004
F. Sperchonidae	-	-	1	0.0006	1	0.0007	2	0.0012	1	0.0004	-	-	-	-	-	-	-	-	-	-
F. Torrenticolidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS																				
Cl. Ostracoda	3	0.0007	2	0.0004	12	0.0030	14	0.0028	-	-	44	0.0122	42	0.0090	18	0.0044	34	0.0060	22	0.0048
<u>INSECTS</u>																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	8	0.0153	38	0.0580	1	0.0001	62	0.0892	11	0.0234	4	0.0006	-	-	-	-	12	0.0642	2	0.0124
F. Baetidae	2	0.0213	-	-	-	-	-	-	-	-	-	-	2	0.0094	-	-	2	0.0068	-	-
F. Ephemerellidae	27	0.1799	8	0.0319	12	0.0614	10	0.0192	8	0.0334	40	0.0650	8	0.0040	6	0.0008	106	0.1008	28	0.0368
F. Heptageniidae	107	0.0599	51	0.0580	99	0.0601	220	0.2146	51	0.0440	120	0.1596	140	0.1524	6	0.0004	326	0.1092	214	0.3022
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	3	0.0043	1	0.0001	-	-	2	0.0042	-	-	-	-	-	-	-	-	2	0.0002	-	-
F. Chloroperlidae	14	0.0400	3	0.0083	17	0.0308	14	0.0516	-	-	66	0.0892	56	0.0828	72	0.1242	26	0.0232	98	0.1668
F. Leuctridae	3	0.0041	-	-	5	0.0100	6	0.0104	-	-	14	0.0192	-	-	2	0.0030	-	-	2	0.0002
F. Nemouridae	5	0.0111	7	0.0170	20	0.0355	28	0.0692	8	0.0268	2	0.0036	4	0.0028	6	0.0108	12	0.0226	10	0.0222
F. Perlodidae	7	0.1406	5	0.1180	7	0.1391	12	0.2600	3	0.0324	2	0.0128	2	0.0234	4	0.0616	2	0.0324	4	0.0336
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	2	0.0164	-	-	-	-	2	0.0166	-	-
F. Taeniopterygidae	2	0.0005	-	-	2	0.0004	-	-	-	-	10	0.0004	-	-	-	-	6	0.0002	6	0.0008
CADDISFLIES																				
O. Trichoptera																				
immature **	1	0.0001	-	-	-	-	-	-	-	-	-	-	10	0.0004	-	-	-	-	6	0.0004
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	-	-	-	-	-	-	34	0.0028	-	-	8	0.0008	124	0.2786	-	-
F. Glossosomatidae	-	-	-	-	1	0.0001	-	-	-	-	30	0.0532	20	0.0546	2	0.0108	18	0.3482	50	0.1168
F. Hydropsychidae	-	-	-	-	1	0.0002	-	-	-	-	8	0.7614	8	0.0010	-	-	-	-	12	0.0020
F. Hydroptilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	1	0.0008	2	0.0089	-	-	20	0.2892	-	-	2	0.0002	-	-	2	0.0004	2	0.0002	-	-
F. Rhyacophilidae	2	0.0005	-	-	5	0.1713	2	0.0016	-	-	12	0.1676	16	0.0286	2	0.0130	12	0.3390	6	0.0952
F. Uenoidae	-	-	-	-	-	-	-	-	-	-	6	0.0012	-	-	4	0.0018	4	0.2806	4	0.0024
<u>TRUE FLIES</u>																				
O. Diptera																				
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Chironomidae	21	0.0083	28	0.0165	27	0.0106	58	0.0230	8	0.0047	52	0.0156	20	0.0198	6	0.0060	28	0.2868	24	0.0074
F. Empididae	-	-	-	-	1	0.0030	2	0.0090	-	-	4	0.0148	12	0.0340	6	0.0084	4	0.0058	4	0.0060
F. Muscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0072	2	0.0056	-	-
F. Psychodidae	-	-	1	0.0002	-	-	2	0.0012	-	-	-	-	-	-	-	-	2	0.0004	-	-
F. Simuliidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	-	-	-	-	2	0.1674	-	-	-	-	-	-	-	-	-	-	4	0.5056	-	-
TOTAL NUMBER OF ORGANISMS PER SAMPLE	207		147		213		458		91		454		356		146		752		540	
TOTAL NUMBER OF TAXA [a]	16		12		16		17		8		19		16		15		25		18	
TOTAL BIOMASS (g)		0.4878		0.3179		0.6937		1.0472		0.1655		1.3962		0.4800		0.2536		2.7332		0.9800

[a] Bold excluded from taxa count
* preservative issues
**Immature Trichoptera excluded from taxa count if Uenoidae were also present in sample

APPENDIX B

SUPPORTING DATA – SELENIUM MONITORING

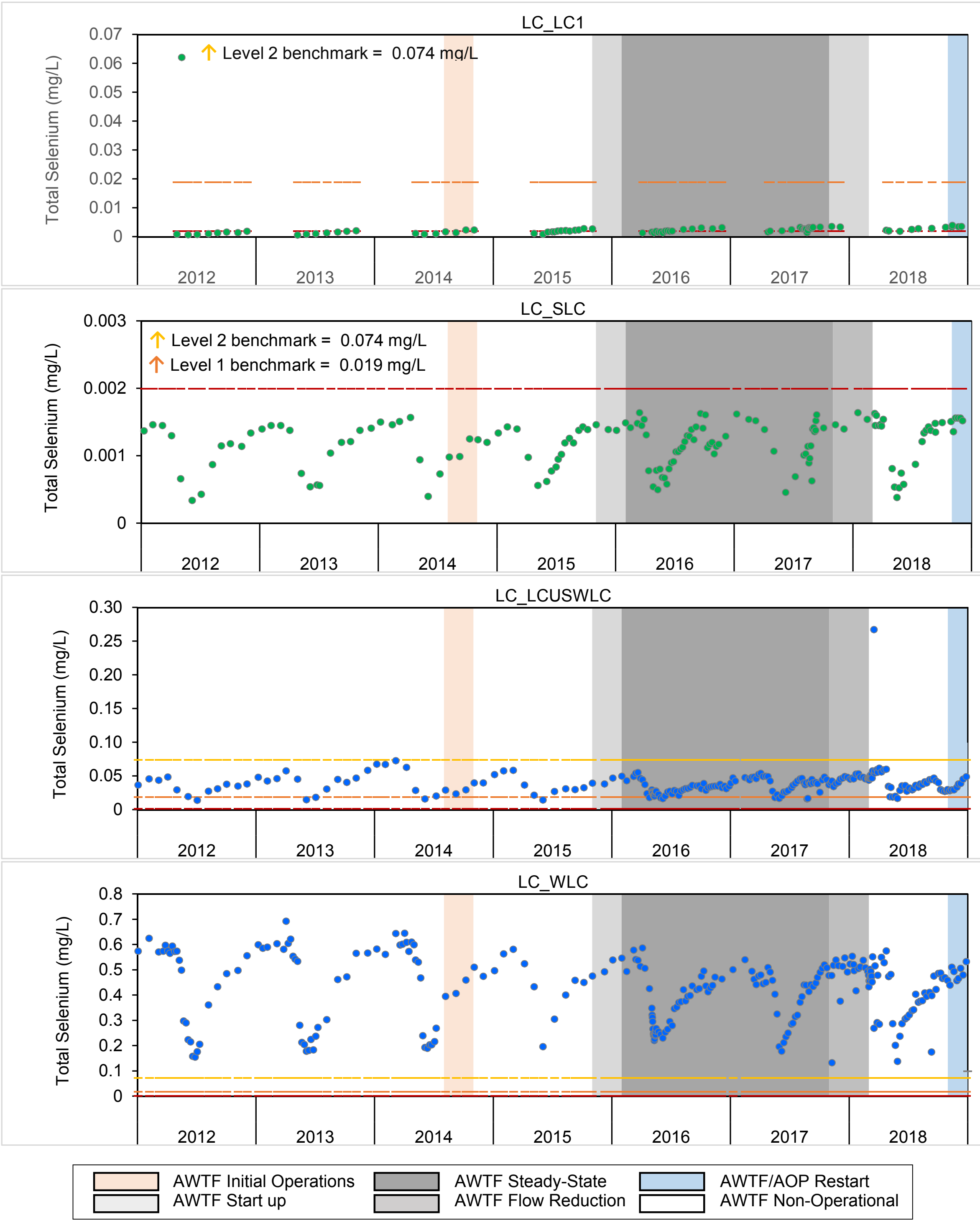

Figure B.1: Time Series Plots for Aqueous Total Selenium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

--- = BCWQG (long term); --- = Level 1 Benchmark; --- = Level 2 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge

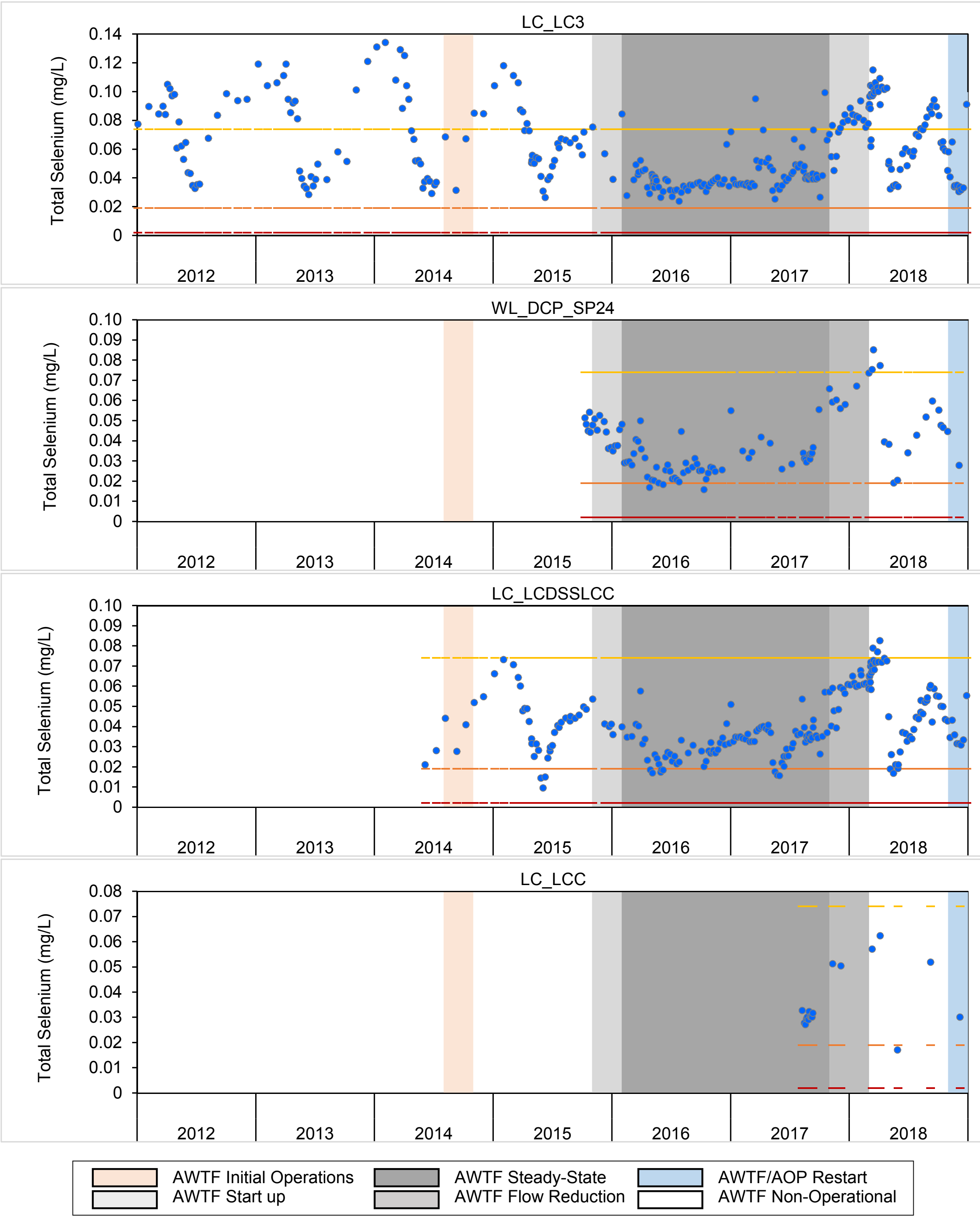

Figure B.1: Time Series Plots for Aqueous Total Selenium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

= BCWQG (long term); = Level 1 Benchmark; = Level 2 Benchmark.

= Mine-exposed; = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge

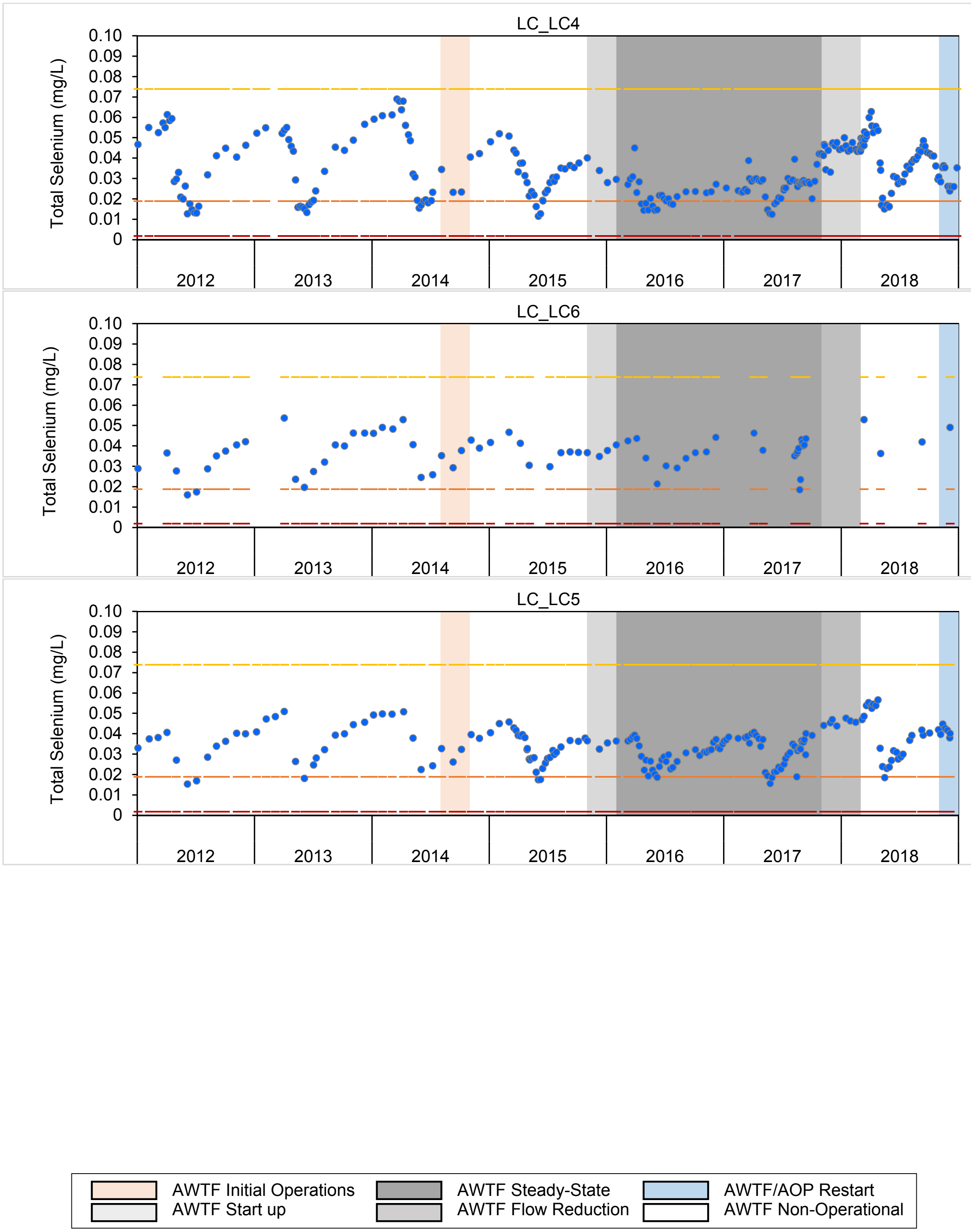

Figure B.1: Time Series Plots for Aqueous Total Selenium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge

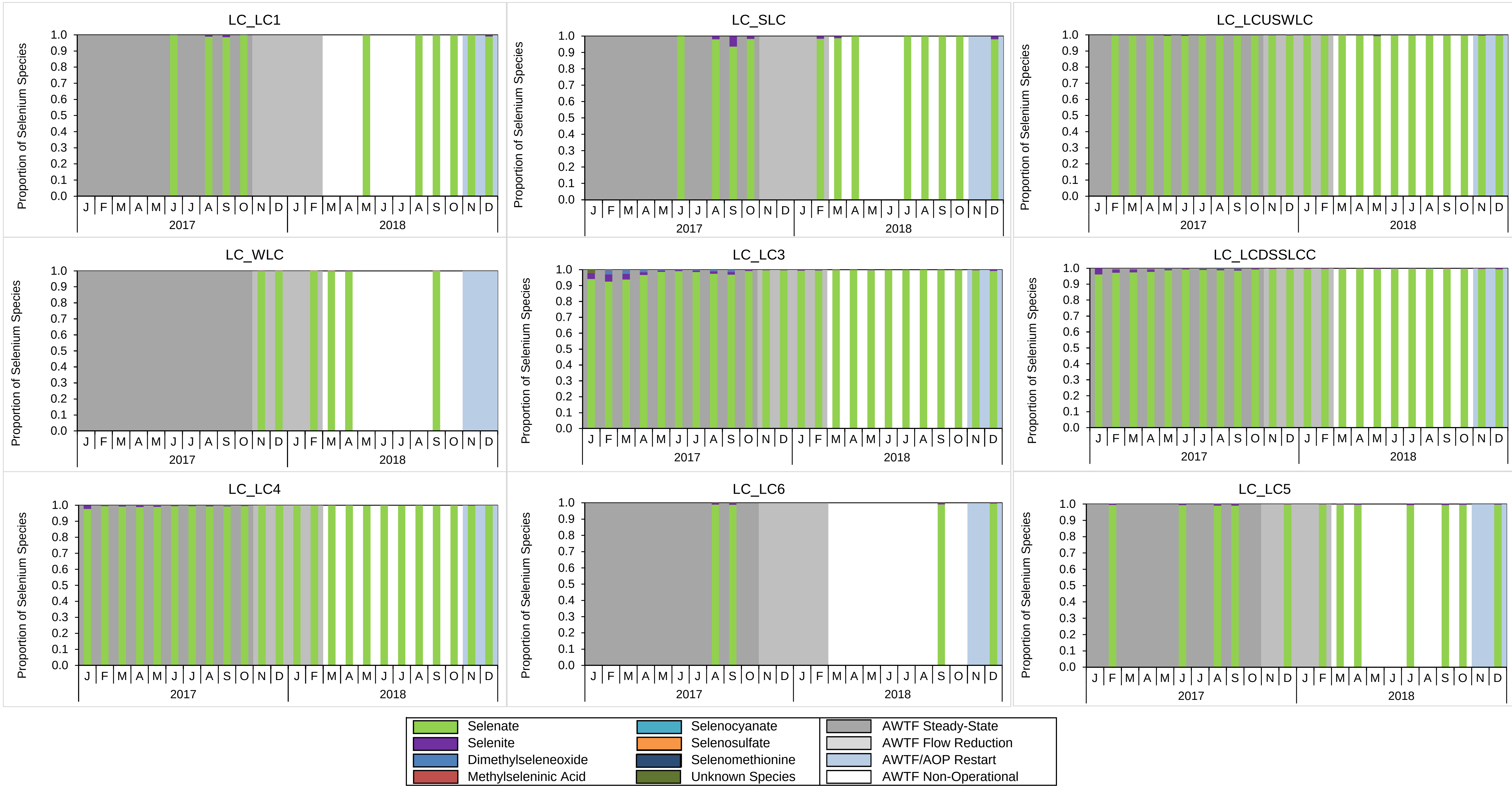

Figure B.2: Proportion of Aqueous Selenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) and Reference (LC_LC1, LC_SLC) Stations in Line Creek and Fording River, January 2017 to December 2018

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

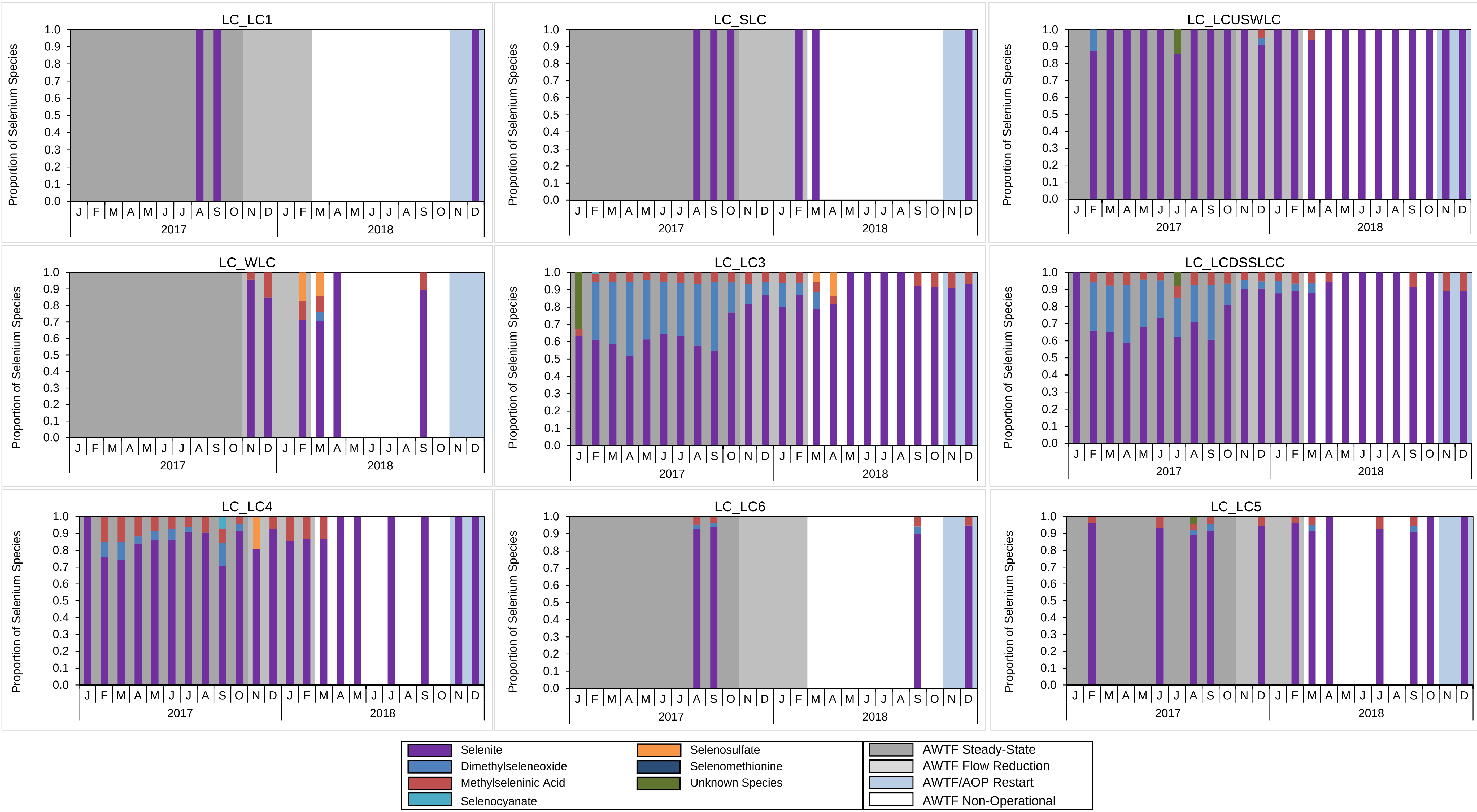

Figure B.3: **Proportion of Aqueous Non-selenate Selenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) and Reference (LC_LC1, LC_SLC) Stations Line Creek and Fording River, January 2017 to December 2018**

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

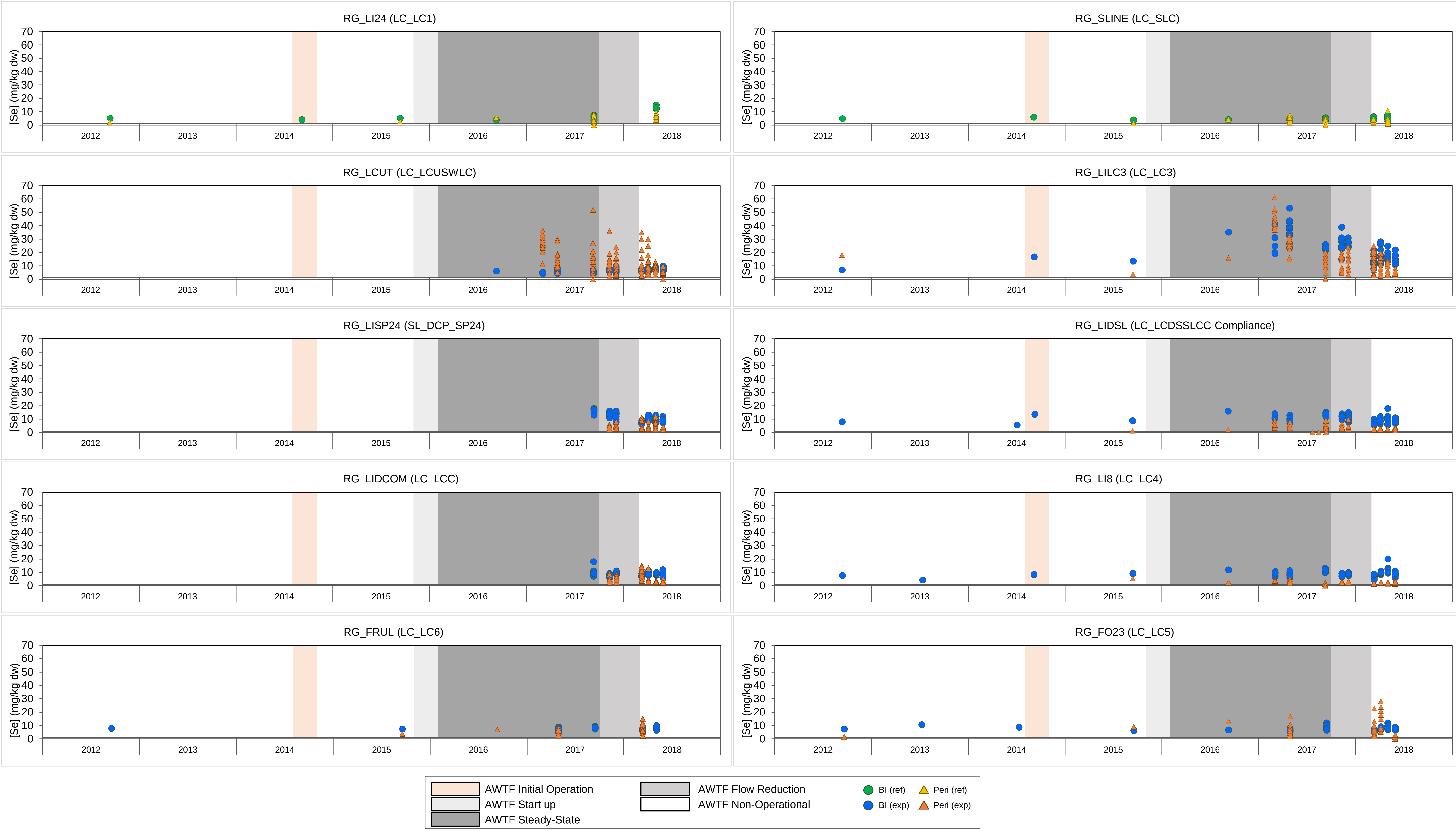

Figure B.4: Tissue Selenium Concentrations Observed in Benthic Invertebrate (BI) Composite-Taxa Samples and in Periphyton (Peri) Samples from Line Creek and Fording River, 2006 to 2018

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, March to December, 2018

Water-body		Teck Water Station Code	Sample Date	Selenium Species (µg/L)								
				Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Unknown Species	Sum of Species
Line Creek	Reference	LC_LC1 (LI24)	1-May-18	1.74	< 0.050	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	1.74
			1-Aug-18	2.95	< 0.050	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	2.95
			12-Sep-18	2.55	< 0.050	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	2.55
			25-Oct-18	2.43	< 0.050	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	2.43
			13-Nov-18	3.32	< 0.050	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	3.32
			3-Dec-18	3.52	< 0.050	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	3.52
			12-Dec-18	3.45	< 0.050	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	3.45
		LC_SLC (SLINE)	9-Mar-18	1.36	<0.0150	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	1.36
			29-Mar-18	1.26	0.0180	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	1.28
			30-Apr-18	0.639	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	0.639
			11-Jul-18	0.871	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	0.871
			28-Aug-18	1.35	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	1.35
			11-Sep-18	1.26	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	1.26
			2-Oct-18	1.50	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	1.50
			4-Dec-18	1.61	0.0310	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	1.64
	Mine-exposed	LC_LCUSWLC (LCUT)	1-Mar-18	29.5	0.0720	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	29.6
			2-Mar-18	29.7	0.0730	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	29.8
			3-Mar-18	47.3	0.0970	<0.005000	0.00600	<0.0150	<0.005000	<0.0150	<0.0150	47.4
			4-Mar-18	42.0	0.117	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	42.1
			5-Mar-18	53.8	0.102	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	53.9
			6-Mar-18	53.8	0.0840	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	53.9
			7-Mar-18	48.7	0.0680	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	48.8
			8-Mar-18	39.5	0.0640	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	39.6
			9-Mar-18	49.1	0.0960	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	49.2
			11-Mar-18	50.3	0.0750	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	50.4
			14-Mar-18	390	0.0870	<0.005000	0.0120	<0.0150	<0.005000	<0.0150	<0.0150	390
			17-Mar-18	53.4	0.0820	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	53.5
			19-Mar-18	35.7	0.0890	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	35.8
			29-Mar-18	48.8	0.117	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	48.9
			9-Apr-18	53.8	0.100	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	53.9
			17-Apr-18	50.3	0.0960	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	50.4
			24-Apr-18	51.3	0.105	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	51.4
			30-Apr-18	30.0	0.0980	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	30.1
			5-May-18	9.67	0.0840	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	9.75
			8-May-18	21.1	0.108	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	21.2
			14-May-18	11.7	0.0910	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	11.8
			29-May-18	14.3	0.116	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	14.4
			5-Jun-18	23.9	0.104	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	24.0
			12-Jun-18	32.2	0.103	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	32.3
			21-Jun-18	31.6	0.0890	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	31.7
			26-Jun-18	25.2	0.0910	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	25.3
			4-Jul-18	26.0	0.0690	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	26.1
			13-Jul-18	27.5	0.0690	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	27.6
			17-Jul-18	29.2	0.0640	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	29.3
			24-Jul-18	32.7	0.0590	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	32.8
			1-Aug-18	34.0	0.0550	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	34.1
			7-Aug-18	30.2	0.0530	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	30.3
			14-Aug-18	41.3	0.0705	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	41.3
			27-Aug-18	44.2	0.0790	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	44.3
			5-Sep-18	38.4	0.0620	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	38.5
			12-Sep-18	46.7	0.0720	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	46.8
			18-Sep-18	39.9	0.0760	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	40.0
			25-Sep-18	45.0	0.0810	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	45.1
			2-Oct-18	39.4	0.0660	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	39.5
			9-Oct-18	29.6	0.0700	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	29.7
			15-Oct-18	34.3	0.0790	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	34.4
			22-Oct-18	28.8	0.0900	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	28.9
			31-Oct-18	23.2	0.0700	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	23.3
			7-Nov-18	29.7	0.109	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	29.8
			13-Nov-18	26.6	0.119	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	26.7
			19-Nov-18	25.0	0.110	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	25.1
			3-Dec-18	22.1	0.0930	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	22.2
			10-Dec-18	38.0	0.106	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	38.1
			17-Dec-18	44.7	0.0640	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	44.8
		LC_WLC (LCUT)	28-Feb-18	507	0.0990	<0.005000	0.0160	<0.0150	<0.005000	0.0240	<0.0150	507
			1-Mar-18	371	0.0740	<0.00500	0.0150	<0.0150	<0.00500	0.0200	<0.0150	371
			2-Mar-18	500	0.0910	<0.00500	0.0100	<0.0150	<0.00500	0.0210	<0.0150	500
			3-Mar-18	502	0.0950	<0.00500	0.0160	<0.0150	<0.00500	0.0170	<0.0150	502
			4-Mar-18	437	0.0810	<0.00500	0.0130	<0.0150	<0.00500	0.0240	<0.0150	437
			5-Mar-18	505	0.0940	<0.00500	0.0100	<0.0150	<0.00500	<0.0150	<0.0150	505
			6-Mar-18	506	0.0950	<0.00500	0.0120	<0.0150	<0.00500	<0.0150	<0.0150	506
			7-Mar-18	468	0.0870	<0.00500	0.0140	<0.0150	<0.00500	<0.0150	<0.0150	468
			8-Mar-18	455	0.0820	<0.00500	0.0130	<0.0150	<0.00500	<0.0150	<0.0150	455
			9-Mar-18	457	0.0780	0.00600	0.0140	<0.0150	<0.00500	<0.0150	<0.0150	457
			11-Mar-18	361	0.0730	0.00700	0.0130	<0.0150	<0.00500	<0.0150	<0.0150	361
			14-Mar-18	40.2	0.0620	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	40.3
			17-Mar-18	364	0.0730	<0.00500	0.0120	<0.0150	<0.00500	<0.0150	<0.0150	364
			27-Mar-18	40.8	0.0900	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	40.9
			29-Mar-18	478	0.0810	0.0130	0.0110	<0.0150	<0.00500	<0.0150	<0.0150	478
			3-Apr-18	49.4	0.0990	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	49.5
			12-Sep-18	385	0.0940	<0.0100	0.0110	<0.0400	<0.0100	< 0.060	<0.0600	385

Notes: Results for samples collected in 2018 prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). The sum of species was calculated using zero for values reported as < LRL. Water at the sampling area RG_LCUT was exposed to effluent from West Line Creek during AWTF shutdown (March 8th to Oct 28th, 2018) and was representative of water quality at LC_WLC. RG_LCUT was not exposed to effluent during AWTF restart (Oct 29th to present), and was representative of upstream of West Line Creek (LC_LCUSWLC).

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, March to December, 2018

Water-body		Teck Water Station Code	Sample Date	Selenium Species (µg/L)								
				Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Unknown Species	Sum of Species
Line Creek	Mine-exposed	LC_LC3 (LILC3)	1-Mar-18	52.5	0.0850	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	52.6
			2-Mar-18	95.0	0.134	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	95.1
			3-Mar-18	95.4	0.140	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	95.5
			4-Mar-18	96.2	0.137	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	96.3
			5-Mar-18	109	0.147	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	109
			6-Mar-18	67.5	0.927	0.148	0.0720	<0.0150	<0.00500	<0.0150	<0.0150	68.6
			7-Mar-18	64.6	0.734	0.200	0.0750	<0.0150	<0.00500	<0.0150	<0.0150	65.6
			8-Mar-18	92.0	0.160	<0.00500	0.0120	<0.0150	<0.00500	<0.0150	<0.0150	92.2
			9-Mar-18	98.1	0.142	<0.00500	0.0120	<0.0150	<0.00500	<0.0150	<0.0150	98.3
			11-Mar-18	101	0.144	<0.00500	0.0120	<0.0150	<0.00500	<0.0150	<0.0150	101
			14-Mar-18	91.7	0.111	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	91.8
			17-Mar-18	86.0	0.106	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	86.1
			19-Mar-18	86.9	0.119	<0.00500	0.00600	<0.0150	<0.00500	<0.0150	<0.0150	87.0
			27-Mar-18	83.0	0.120	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	83.1
			29-Mar-18	85.5	0.112	<0.00500	<0.00500	<0.0150	<0.00500	0.0260	<0.0150	85.6
			3-Apr-18	87.3	0.129	<0.00500	<0.00500	<0.0150	<0.00500	0.0280	<0.0150	87.5
			9-Apr-18	88.1	0.129	<0.00500	0.00800	<0.0150	<0.00500	<0.0150	<0.0150	88.2
			17-Apr-18	89.1	0.114	<0.00500	0.00600	<0.0150	<0.00500	<0.0150	<0.0150	89.2
			24-Apr-18	66.4	0.0950	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	66.5
			30-Apr-18	43.1	0.105	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	43.2
			5-May-18	16.9	0.0760	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	17.0
			8-May-18	35.7	0.128	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	35.8
			14-May-18	32.7	0.121	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	32.8
			29-May-18	28.2	0.112	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	< 0.240	28.3
			5-Jun-18	44.1	0.102	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	44.2
			12-Jun-18	46.4	0.0940	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	46.5
			21-Jun-18	52.4	0.0940	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	52.5
			26-Jun-18	42.3	0.104	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	42.4
			4-Jul-18	47.7	0.0810	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	47.8
			13-Jul-18	50.9	0.0810	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	51.0
			17-Jul-18	55.5	0.0780	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	55.6
			24-Jul-18	63.3	0.0790	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	63.4
			1-Aug-18	68.8	0.0780	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	68.9
			7-Aug-18	71.5	0.0830	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	71.6
			14-Aug-18	78.5	0.0990	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	78.6
			21-Aug-18	83.0	0.0930	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	83.1
			27-Aug-18	88.7	0.110	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	88.8
			5-Sep-18	86.6	0.107	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	86.7
			10-Sep-18	70.3	0.107	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	70.4
			12-Sep-18	88.7	0.161	<0.0100	0.0130	<0.0400	<0.0100	<0.0600	<0.0600	88.9
			18-Sep-18	96.1	0.139	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	96.2
			25-Sep-18	93.4	0.118	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	93.5
			2-Oct-18	85.9	0.113	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	86.0
			9-Oct-18	64.4	0.0970	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	64.4
			15-Oct-18	74.5	0.102	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	74.6
			16-Oct-18	63.3	0.108	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	63.4
			22-Oct-18	60.2	0.0940	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	60.3
			30-Oct-18	47.6	0.149	<0.0100	0.0105	<0.0400	<0.0100	<0.0600	<0.0600	47.7
			6-Nov-18	23.1	0.0975	<0.0100	0.0140	<0.0400	<0.0100	<0.0600	<0.0600	23.2
			13-Nov-18	62.9	0.110	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	63.0
			20-Nov-18	23.0	0.124	<0.0100	0.0150	<0.0400	<0.0100	<0.0600	<0.0600	23.1
			27-Nov-19	31.3	0.176	<0.0100	0.0110	<0.0400	<0.0100	<0.0600	<0.0600	31.5
			3-Dec-18	18.6	0.155	<0.0100	0.0160	<0.0400	<0.0100	<0.0600	<0.0600	18.8
			6-Dec-18	33.0	0.204	<0.0100	0.0310	<0.0400	<0.0100	<0.0600	<0.0600	33.2
			10-Dec-18	31.6	0.250	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	31.9
			17-Dec-18	31.5	0.313	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	31.8
		WL_LCUCP_SP23 (LISP23)	14-Mar-18	70.1	0.131	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	70.2
		WL_DCP_SP24 (LISP24)	10-Mar-18	72.5	0.155	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	72.7
			28-May-18	19.2	0.0810	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	19.3
			13-Sep-18	62.8	0.148	<0.0100	0.0140	<0.0400	<0.0100	<0.0600	<0.0600	63.0
			2-Oct-18	58.9	0.123	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	59.0
			9-Oct-18	48.2	0.119	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	48.3
			16-Oct-18	47.3	0.122	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	47.4
			30-Oct-18	44.9	0.134	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	45.0
			4-Dec-18	26.2	0.180	<0.0100	0.0250	<0.0400	<0.0100	<0.0600	<0.0600	26.4
		LC_LCDSSLCC (Compliance) (LIDSL)	4-Jan-18	51.4	0.156	0.0120	0.0110	<0.0150	<0.005000	<0.0150	<0.0150	51.6
			11-Jan-18	52.4	0.153	0.0130	0.00900	<0.0150	<0.005000	<0.0150	<0.0150	52.6
			16-Jan-18	50.4	0.167	<0.005000	0.00900	<0.0150	<0.005000	<0.0150	<0.0150	50.6
			23-Jan-18	57.1	0.186	0.0210	0.00900	<0.0150	<0.005000	<0.0150	<0.0150	57.3
			30-Jan-18	35.3	0.137	0.0130	0.00900	<0.0150	<0.005000	<0.0150	<0.0150	35.5
			6-Feb-18	58.7	0.184	0.00600	0.0130	<0.0150	<0.005000	<0.0150	<0.0150	58.9
			13-Feb-18	54.8	0.184	0.0160	0.0130	<0.0150	<0.005000	<0.0150	<0.0150	55.0
			19-Feb-18	62.7	0.183	<0.005000	0.0140	<0.0150	<0.005000	<0.0150	<0.0150	62.9

Notes: Results for samples collected in 2018 prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). The sum of species was calculated using zero for values reported as < LRL. Water at the sampling area RG_LCUT was exposed to effluent from West Line Creek during AWTF shutdown (March 8th to Oct 28th, 2018) and was representative of water quality at LC_WLC. RG_LCUT was not exposed to effluent during AWTF restart (Oct 29th to present), and was representative of upstream of West Line Creek (LC_LCUSWLC).

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, March to December, 2018

Water-body	Exposure	Teck Water Station Code	Sample Date	Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Unknown Species	Sum of Species
				Selenium Species (µg/L)								
Line Creek	Mine-exposed	LC_LCDSSLCC (Compliance) (LIDSL)	27-Feb-18	57.8	0.191	0.00800	0.0140	<0.0150	<0.005000	<0.0150	<0.0150	58.0
			28-Feb-18	66.3	0.193	0.00800	0.0150	<0.0150	<0.005000	<0.0150	<0.0150	66.5
			1-Mar-18	72.9	0.132	<0.00500	0.00900	<0.0150	<0.00500	<0.0150	<0.0150	73.0
			2-Mar-18	70.8	0.131	<0.00500	0.00600	<0.0150	<0.00500	<0.0150	<0.0150	70.9
			3-Mar-18	69.5	0.137	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	69.6
			4-Mar-18	71.3	0.132	<0.00500	0.00900	<0.0150	<0.00500	<0.0150	<0.0150	71.4
			5-Mar-18	70.8	0.114	<0.00500	0.00600	<0.0150	<0.00500	<0.0150	<0.0150	70.9
			6-Mar-18	73.1	0.152	<0.00500	0.0100	<0.0150	<0.00500	<0.0150	<0.0150	73.3
			7-Mar-18	57.9	0.278	0.0570	0.0270	<0.0150	<0.00500	<0.0150	<0.0150	58.3
			8-Mar-18	71.2	0.160	0.00600	0.0130	<0.0150	<0.00500	<0.0150	<0.0150	71.4
			10-Mar-18	65.6	0.105	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	65.7
			11-Mar-18	68.9	0.120	<0.00500	0.0110	<0.0150	<0.00500	<0.0150	<0.0150	69.0
			14-Mar-18	56.7	0.0890	<0.00500	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	56.8
			17-Mar-18	77.5	0.118	<0.00500	0.0110	<0.0150	<0.00500	<0.0150	<0.0150	77.6
			19-Mar-18	73.5	0.110	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	73.6
			29-Mar-18	61.9	0.0940	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	62.0
			9-Apr-18	53.3	0.0890	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	53.4
			17-Apr-18	66.3	0.0970	<0.00500	0.00600	<0.0150	<0.00500	<0.0150	<0.0150	66.4
			24-Apr-18	59.8	0.103	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	59.9
			30-Apr-18	38.3	0.0900	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	38.4
			5-May-18	15.6	0.0590	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	15.7
			8-May-18	22.6	0.0750	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	22.7
			15-May-18	15.6	0.0620	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	15.7
			29-May-18	17.5	0.0710	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	< 0.180	17.6
			5-Jun-18	26.1	0.0560	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	26.2
			12-Jun-18	22.0	0.0530	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	22.1
			21-Jun-18	32.5	0.0570	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	32.6
			26-Jun-18	29.5	0.0680	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	29.6
			4-Jul-18	31.1	0.0550	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	31.2
			11-Jul-18	38.2	0.0780	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	38.3
			17-Jul-18	30.3	0.0630	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	30.4
			24-Jul-18	42.0	0.0710	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	42.1
			1-Aug-18	44.5	0.0810	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	44.6
			7-Aug-18	40.7	0.0750	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	40.8
			14-Aug-18	53.8	0.0930	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	53.9
			21-Aug-18	55.5	0.100	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	55.6
			27-Aug-18	59.9	0.105	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	60.0
			5-Sep-18	37.9	0.118	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	38.0
			7-Sep-18	40.4	0.0810	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	40.5
			12-Sep-18	62.6	0.151	<0.0100	0.0120	<0.0400	<0.0100	<0.0600	<0.0600	62.8
			18-Sep-18	50.4	0.101	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	50.5
			25-Sep-18	55.1	0.103	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	55.2
			2-Oct-18	53.7	0.0990	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	53.8
			9-Oct-18	49.1	0.0930	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	49.2
			15-Oct-18	59.1	0.111	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	59.2
			22-Oct-18	43.9	0.0990	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	44.0
			30-Oct-18	37.4	0.0890	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	37.5
			6-Nov-18	17.6	0.0600	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	17.7
			13-Nov-18	43.9	0.0990	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	44.0
			20-Nov-18	31.2	0.120	<0.0100	0.0160	<0.0400	<0.0100	<0.0600	<0.0600	31.3
			27-Nov-18	29.7	0.130	<0.0100	0.0130	<0.0400	<0.0100	<0.0600	<0.0600	29.8
			4-Dec-18	32.3	0.137	<0.0100	0.0200	<0.0400	<0.0100	<0.0600	<0.0600	32.5
			10-Dec-18	16.0	0.0950	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	16.1
			17-Dec-18	32.6	0.165	<0.0100	0.0190	<0.0400	<0.0100	<0.0600	<0.0600	32.8
		LC_LCC (LIDCOM)	10-Mar-18	54.1	0.0860	<0.00500	0.00600	<0.0150	<0.00500	<0.0150	<0.0150	54.2
			28-May-18	16.0	0.0570	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	16.1
			7-Sep-18	43.4	0.0820	<0.0100	0.0110	<0.0400	<0.0100	<0.0600	<0.0600	43.5
			6-Dec-18	28.8	0.109	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	28.9
		LC_LC4 (LI8)	4-Jan-18	37.4	0.0250	<0.005000	0.00700	<0.0150	<0.00500	<0.0150	<0.0150	37.4
			11-Jan-18	39.9	0.0190	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	39.9
			16-Jan-18	40.2	0.0290	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	40.2
			23-Jan-18	42.3	0.0310	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	42.3
			30-Jan-18	42.2	0.0610	<0.005000	0.00600	<0.0150	<0.005000	<0.0150	<0.0150	42.3
			5-Feb-18	42.7	0.0240	<0.005000	0.00700	<0.0150	<0.005000	<0.0150	<0.0150	42.7
			14-Feb-18	43.7	0.0360	<0.005000	0.00600	<0.0150	<0.005000	<0.0150	<0.0150	43.7
			19-Feb-18	41.3	0.0350	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	41.3
			26-Feb-18	43.5	0.0370	<0.005000	<0.005000	<0.0150	<0.005000	<0.0150	<0.0150	43.5
			28-Feb-18	44.9	0.0760	<0.005000	0.00900	<0.0150	<0.005000	<0.0150	<0.0150	45.0
			1-Mar-18	51.3	0.0280	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	51.3
			2-Mar-18	50.8	0.0250	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	50.8
			3-Mar-18	51.0	0.0310	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	51.0
			4-Mar-18	50.5	0.0400	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	50.5

Notes: Results for samples collected in 2018 prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). The sum of species was calculated using zero for values reported as < LRL. Water at the sampling area RG_LCUT was exposed to effluent from West Line Creek during AWTF shutdown (March 8th to Oct 28th, 2018) and was representative of water quality at LC_WLC. RG_LCUT was not exposed to effluent during AWTF restart (Oct 29th to present), and was representative of upstream of West Line Creek (LC_LCUSWLC).

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, March to December, 2018

Water-body		Teck Water Station Code	Sample Date	Selenium Species (µg/L)								
				Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Unknown Species	Sum of Species
Line Creek	Mine-exposed	LC_LC4 (LI8)	5-Mar-18	46.7	0.0270	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	46.7
			6-Mar-18	50.2	0.0400	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	50.2
			7-Mar-18	48.6	0.0240	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	48.6
			8-Mar-18	45.4	0.0270	<0.00500	0.00600	<0.0150	<0.00500	<0.0150	<0.0150	45.4
			10-Mar-18	47.0	0.0260	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	47.0
			11-Mar-18	41.0	0.0330	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	41.0
			14-Mar-18	40.0	0.0260	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	40.0
			17-Mar-18	44.2	0.0410	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	44.2
			19-Mar-18	45.0	0.0400	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	45.0
			27-Mar-18	56.6	0.0960	<0.00500	0.00800	<0.0150	<0.00500	<0.0150	<0.0150	56.7
			3-Apr-18	67.9	0.0950	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	68.0
			9-Apr-18	50.4	0.0400	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	50.4
			17-Apr-18	49.8	0.0280	<0.00500	<0.00500	<0.0150	<0.00500	<0.0150	<0.0150	49.8
			24-Apr-18	48.0	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	48.0
			30-Apr-18	32.5	0.0700	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	32.6
			5-May-18	8.78	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	8.78
			8-May-18	20.0	0.0730	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	20.1
			14-May-18	14.6	0.0640	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	14.7
			28-May-18	15.1	0.0570	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	15.2
			29-May-18	14.9	0.0510	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	15.0
			5-Jun-18	18.2	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	18.2
			12-Jun-18	28.2	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	28.2
			21-Jun-18	27.1	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	27.1
			26-Jun-18	25.1	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	25.1
			4-Jul-18	11.9	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	11.9
			11-Jul-18	26.0	0.0760	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	26.1
			17-Jul-18	30.3	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	30.3
			24-Jul-18	25.8	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	25.8
			1-Aug-18	36.3	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	36.3
			7-Aug-18	37.0	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	37.0
			14-Aug-18	41.7	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	41.7
			21-Aug-18	44.6	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	44.6
			31-Aug-18	41.3	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	41.3
			5-Sep-18	36.3	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	36.3
			12-Sep-18	25.5	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	25.5
			13-Sep-18	43.1	0.110	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	43.2
			18-Sep-18	37.7	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	37.7
			25-Sep-18	45.6	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	45.6
			2-Oct-18	42.1	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	42.1
			9-Oct-18	40.2	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	40.2
			15-Oct-18	49.0	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	49.0
			22-Oct-18	38.5	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	38.5
			31-Oct-18	20.6	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	20.6
			6-Nov-18	14.0	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	14.0
			12-Nov-18	35.9	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	35.9
			19-Nov-18	28.7	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	28.7
			28-Nov-18	17.2	0.0720	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	17.3
			4-Dec-18	25.8	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	25.8
			6-Dec-18	26.2	0.0250	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	26.2
			10-Dec-18	26.1	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	26.1
			17-Dec-18	25.5	<0.0500	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	25.5
Fording River		LC_LC5 (FO23)	11-Mar-18	44.8	0.157	0.00600	0.00900	<0.0150	<0.00500	<0.0150	<0.0150	45.0
			30-Apr-18	27.6	0.153	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	27.8
			4-Jul-18	28.9	0.196	<0.0100	0.0160	<0.0400	<0.0100	<0.0600	<0.0600	29.1
			8-Sep-18	35.7	0.248	0.0100	0.0150	<0.0400	<0.0100	<0.0600	<0.0600	36.0
			2-Oct-18	40.0	0.207	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	40.2
			5-Dec-18	34.3	0.153	<0.0100	<0.0100	<0.0400	<0.0100	<0.0600	<0.0600	34.5
		RG_FO9	5-Dec-18	52.6	0.290	<0.0100	0.0100	<0.0400	<0.0100	<0.0600	<0.0600	52.9

Notes: Results for samples collected in 2018 prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). The sum of species was calculated using zero for values reported as < LRL. Water at the sampling area RG_LCUT was exposed to effluent from West Line Creek during AWTF shutdown (March 8th to Oct 28th, 2018) and was representative of water quality at LC_WLC. RG_LCUT was not exposed to effluent during AWTF restart (Oct 29th to present), and was representative of upstream of West Line Creek (LC_LCUSWLC).

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March to May 2018

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Reference	RG_LI24 (LC_LC1)	RG_LI24-PERT-01	3-May-18	4.8	5.0	3.5	9.5	5.7	1.7
			RG_LI24-PERT-02	3-May-18	3.5					
			RG_LI24-PERT-03	3-May-18	3.9					
			RG_LI24-PERT-04	3-May-18	5.6					
			RG_LI24-PERT-05	3-May-18	4.9					
			RG_LI24-PERT-06	3-May-18	4.0					
			RG_LI24-PERT-07	3-May-18	5.0					
			RG_LI24-PERT-08	3-May-18	6.6					
			RG_LI24-PERT-09	3-May-18	8.0					
			RG_LI24-PERT-10	3-May-18	4.9					
			RG_LI24-PERT-11	3-May-18	9.5					
			RG_LI24-PERT-12	3-May-18	7.6					
			RG_LI24-PERT-13	3-May-18	7.3					
			RG_LI24-PERT-14	3-May-18	4.4					
			RG_LI24-PERT-15	3-May-18	6.1					
		RG_SLINE (LC_SLC)	RG_SLINE-PERT-01	8-Mar-18	2.4	3.5	1.5	4.2	3.3	0.74
			RG_SLINE-PERT-02	8-Mar-18	3.6					
			RG_SLINE-PERT-03	8-Mar-18	3.6					
			RG_SLINE-PERT-04	8-Mar-18	3.7					
			RG_SLINE-PERT-05	8-Mar-18	3.2					
			RG_SLINE-PERT-06	8-Mar-18	1.5					
			RG_SLINE-PERT-07	8-Mar-18	3.0					
			RG_SLINE-PERT-08	8-Mar-18	3.5					
			RG_SLINE-PERT-09	8-Mar-18	3.8					
			RG_SLINE-PERT-10	8-Mar-18	3.5					
			RG_SLINE-PERT-11	8-Mar-18	2.3					
			RG_SLINE-PERT-12	8-Mar-18	2.8					
			RG_SLINE-PERT-13	8-Mar-18	3.9					
			RG_SLINE-PERT-14	8-Mar-18	3.9					
			RG_SLINE-PERT-15	8-Mar-18	4.2					
			RG_SLINE-PERT-01	30-Apr-18	1.1	2.1	0.90	11	2.6	2.5
			RG_SLINE-PERT-02	30-Apr-18	11					
			RG_SLINE-PERT-03	30-Apr-18	2.2					
			RG_SLINE-PERT-04	30-Apr-18	1.6					
			RG_SLINE-PERT-05	30-Apr-18	3.3					
			RG_SLINE-PERT-06	30-Apr-18	0.90					
			RG_SLINE-PERT-07	30-Apr-18	2.1					
			RG_SLINE-PERT-08	30-Apr-18	1.0					
			RG_SLINE-PERT-09	30-Apr-18	4.7					
			RG_SLINE-PERT-10	30-Apr-18	2.1					
			RG_SLINE-PERT-11	30-Apr-18	1.5					
			RG_SLINE-PERT-12	30-Apr-18	1.7					
			RG_SLINE-PERT-13	30-Apr-18	0.90					
			RG_SLINE-PERT-14	30-Apr-18	3.4					
			RG_SLINE-PERT-15	30-Apr-18	2.2					
	Mine-exposed	RG_LCUT (LC_LCUSWLC/LC_WLC)	RG_LCUT-PERT-01	9-Mar-18	8.2	9.1	2.5	35	14	11
			RG_LCUT-PERT-02	9-Mar-18	9.1					
			RG_LCUT-PERT-03	9-Mar-18	16					
			RG_LCUT-PERT-04	9-Mar-18	30					
			RG_LCUT-PERT-05	9-Mar-18	2.7					
			RG_LCUT-PERT-06	9-Mar-18	3.2					
			RG_LCUT-PERT-07	9-Mar-18	2.8					
			RG_LCUT-PERT-08	9-Mar-18	6.7					
			RG_LCUT-PERT-09	9-Mar-18	2.5					
			RG_LCUT-PERT-10	9-Mar-18	11					
			RG_LCUT-PERT-11	9-Mar-18	35					
			RG_LCUT-PERT-12	9-Mar-18	30					
			RG_LCUT-PERT-13	9-Mar-18	22					
			RG_LCUT-PERT-14	9-Mar-18	22					
			RG_LCUT-PERT-15	9-Mar-18	5.1					
			RG_LCUT-PERT-01	3-Apr-18	3.2	7.1	3.1	30	11	8.1
			RG_LCUT-PERT-02	3-Apr-18	5.6					
			RG_LCUT-PERT-03	3-Apr-18	14					
			RG_LCUT-PERT-04	3-Apr-18	18					
			RG_LCUT-PERT-05	3-Apr-18	6.1					
			RG_LCUT-PERT-06	3-Apr-18	7.1					
			RG_LCUT-PERT-07	3-Apr-18	3.1					
			RG_LCUT-PERT-08	3-Apr-18	9.6					
			RG_LCUT-PERT-09	3-Apr-18	25					
			RG_LCUT-PERT-10	3-Apr-18	4.9					
			RG_LCUT-PERT-11	3-Apr-18	30					
			RG_LCUT-PERT-12	3-Apr-18	6.1					
			RG_LCUT-PERT-13	3-Apr-18	9.1					
			RG_LCUT-PERT-14	3-Apr-18	3.8					
			RG_LCUT-PERT-15	3-Apr-18	13					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March to May 2018

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LCUT (LC_LCUSWLC/LC_WLC; continued)	RG_LCUT-PERT-01	1-May-18	10	7.0	3.0	13	7.7	2.5
			RG_LCUT-PERT-02	1-May-18	8.5					
			RG_LCUT-PERT-03	1-May-18	9.5					
			RG_LCUT-PERT-04	1-May-18	5.4					
			RG_LCUT-PERT-05	1-May-18	3.0					
			RG_LCUT-PERT-06	1-May-18	5.0					
			RG_LCUT-PERT-07	1-May-18	9.7					
			RG_LCUT-PERT-08	1-May-18	6.8					
			RG_LCUT-PERT-09	1-May-18	13					
			RG_LCUT-PERT-10	1-May-18	6.8					
			RG_LCUT-PERT-11	1-May-18	6.0					
			RG_LCUT-PERT-12	1-May-18	8.4					
			RG_LCUT-PERT-13	1-May-18	10					
			RG_LCUT-PERT-14	1-May-18	7.0					
			RG_LCUT-PERT-15	1-May-18	6.5					
			RG_LCUT-PERT-01	29-May-18	9.9	5.1	3.6	10	5.2	1.5
			RG_LCUT-PERT-02	29-May-18	<5.0					
			RG_LCUT-PERT-03	29-May-18	3.6					
			RG_LCUT-PERT-04	29-May-18	5.0					
			RG_LCUT-PERT-05	29-May-18	5.0					
			RG_LCUT-PERT-06	29-May-18	4.0					
			RG_LCUT-PERT-07	29-May-18	5.2					
			RG_LCUT-PERT-08	29-May-18	4.0					
			RG_LCUT-PERT-09	29-May-18	5.0					
			RG_LCUT-PERT-10	29-May-18	4.0					
			RG_LCUT-PERT-11	29-May-18	4.8					
			RG_LCUT-PERT-12	29-May-18	6.0					
			RG_LCUT-PERT-13	29-May-18	6.0					
			RG_LCUT-PERT-14	29-May-18	5.0					
			RG_LCUT-PERT-15	29-May-18	5.0					
		RG_LILC3 (LC_LC3)	RG_LILC3-PERT-1	9-Mar-18	22	13	2.7	25	13	7.5
			RG_LILC3-PERT-2	9-Mar-18	18					
			RG_LILC3-PERT-3	9-Mar-18	18					
			RG_LILC3-PERT-4	9-Mar-18	9.1					
			RG_LILC3-PERT-5	9-Mar-18	19					
			RG_LILC3-PERT-6	9-Mar-18	25					
			RG_LILC3-PERT-7	9-Mar-18	16					
			RG_LILC3-PERT-8	9-Mar-18	21					
			RG_LILC3-PERT-9	9-Mar-18	4.4					
			RG_LILC3-PERT-10	9-Mar-18	13					
			RG_LILC3-PERT-11	9-Mar-18	4.2					
			RG_LILC3-PERT-12	9-Mar-18	3.4					
			RG_LILC3-PERT-13	9-Mar-18	2.7					
			RG_LILC3-PERT-14	9-Mar-18	11					
			RG_LILC3-PERT-15	9-Mar-18	6.9					
			RG_LILC3-PERT-1	4-Apr-18	16	14	2.5	20	12	5.7
			RG_LILC3-PERT-2	4-Apr-18	14					
			RG_LILC3-PERT-3	4-Apr-18	19					
			RG_LILC3-PERT-4	4-Apr-18	20					
			RG_LILC3-PERT-5	4-Apr-18	7.4					
			RG_LILC3-PERT-6	4-Apr-18	15					
			RG_LILC3-PERT-7	4-Apr-18	5.2					
			RG_LILC3-PERT-8	4-Apr-18	2.5					
			RG_LILC3-PERT-9	4-Apr-18	14					
			RG_LILC3-PERT-10	4-Apr-18	19					
			RG_LILC3-PERT-11	4-Apr-18	3.7					
			RG_LILC3-PERT-12	4-Apr-18	11					
			RG_LILC3-PERT-13	4-Apr-18	8.3					
			RG_LILC3-PERT-14	4-Apr-18	14					
			RG_LILC3-PERT-15	4-Apr-18	16					
			RG_LILC3-PERT-1	1-May-18	3.9	10	3.1	14	9.2	4.1
			RG_LILC3-PERT-2	1-May-18	6.8					
			RG_LILC3-PERT-3	1-May-18	10					
			RG_LILC3-PERT-4	1-May-18	4.4					
			RG_LILC3-PERT-5	1-May-18	11					
			RG_LILC3-PERT-6	1-May-18	4.1					
			RG_LILC3-PERT-7	1-May-18	3.1					
			RG_LILC3-PERT-8	1-May-18	9.6					
			RG_LILC3-PERT-9	1-May-18	13					
			RG_LILC3-PERT-10	1-May-18	6.0					
			RG_LILC3-PERT-11	1-May-18	14					
			RG_LILC3-PERT-12	1-May-18	14					
			RG_LILC3-PERT-13	1-May-18	13					
			RG_LILC3-PERT-14	1-May-18	13					
			RG_LILC3-PERT-15	1-May-18	12					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March to May 2018

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LILC3 (LC_LC3; Continued)	RG_LILC3-PERT-1	29-May-18	4.0	5.0	3.0	8.0	5.2	1.2
			RG_LILC3-PERT-2	29-May-18	6.0					
			RG_LILC3-PERT-3	29-May-18	4.7					
			RG_LILC3-PERT-4	29-May-18	3.0					
			RG_LILC3-PERT-5	29-May-18	5.0					
			RG_LILC3-PERT-6	29-May-18	5.0					
			RG_LILC3-PERT-7	29-May-18	5.0					
			RG_LILC3-PERT-8	29-May-18	8.0					
			RG_LILC3-PERT-9	29-May-18	6.0					
			RG_LILC3-PERT-10	29-May-18	4.0					
			RG_LILC3-PERT-11	29-May-18	6.0					
			RG_LILC3-PERT-12	29-May-18	5.0					
			RG_LILC3-PERT-13	29-May-18	5.0					
			RG_LILC3-PERT-14	29-May-18	6.0					
			RG_LILC3-PERT-15	29-May-18	6.0					
		RG_LISP24 (WL_DCP_SP24)	RG_LISP24-PERT-01	10-Mar-18	11	3.2	2.2	11	4.0	2.5
			RG_LISP24-PERT-02	10-Mar-18	4.0					
			RG_LISP24-PERT-03	10-Mar-18	3.2					
			RG_LISP24-PERT-04	10-Mar-18	8.8					
			RG_LISP24-PERT-05	10-Mar-18	2.2					
			RG_LISP24-PERT-06	10-Mar-18	2.8					
			RG_LISP24-PERT-07	10-Mar-18	3.3					
			RG_LISP24-PERT-08	10-Mar-18	3.4					
			RG_LISP24-PERT-09	10-Mar-18	3.0					
			RG_LISP24-PERT-10	10-Mar-18	3.8					
			RG_LISP24-PERT-11	10-Mar-18	2.6					
			RG_LISP24-PERT-12	10-Mar-18	2.5					
			RG_LISP24-PERT-13	10-Mar-18	4.0					
			RG_LISP24-PERT-14	10-Mar-18	2.6					
			RG_LISP24-PERT-15	10-Mar-18	2.9					
			RG_LISP24-PERT-01	4-Apr-18	2.3	2.9	2.2	8.2	3.4	1.5
			RG_LISP24-PERT-02	4-Apr-18	3.9					
			RG_LISP24-PERT-03	4-Apr-18	4.4					
			RG_LISP24-PERT-04	4-Apr-18	8.2					
			RG_LISP24-PERT-05	4-Apr-18	3.4					
			RG_LISP24-PERT-06	4-Apr-18	3.0					
			RG_LISP24-PERT-07	4-Apr-18	3.3					
			RG_LISP24-PERT-08	4-Apr-18	2.2					
			RG_LISP24-PERT-09	4-Apr-18	2.9					
			RG_LISP24-PERT-10	4-Apr-18	3.7					
			RG_LISP24-PERT-11	4-Apr-18	2.6					
			RG_LISP24-PERT-12	4-Apr-18	2.8					
			RG_LISP24-PERT-13	4-Apr-18	2.6					
			RG_LISP24-PERT-14	4-Apr-18	2.4					
			RG_LISP24-PERT-15	4-Apr-18	2.6					
			RG_LISP24-PERT-01	1-May-18	5.9	4.5	2.2	12	5.4	3.0
			RG_LISP24-PERT-02	1-May-18	11					
			RG_LISP24-PERT-03	1-May-18	12					
			RG_LISP24-PERT-04	1-May-18	4.5					
			RG_LISP24-PERT-05	1-May-18	5.5					
			RG_LISP24-PERT-06	1-May-18	8.1					
			RG_LISP24-PERT-07	1-May-18	6.4					
			RG_LISP24-PERT-08	1-May-18	7.2					
			RG_LISP24-PERT-09	1-May-18	3.7					
			RG_LISP24-PERT-10	1-May-18	2.8					
			RG_LISP24-PERT-11	1-May-18	2.2					
			RG_LISP24-PERT-12	1-May-18	3.5					
			RG_LISP24-PERT-13	1-May-18	2.6					
			RG_LISP24-PERT-14	1-May-18	3.8					
			RG_LISP24-PERT-15	1-May-18	2.5					
			RG_LISP24-PERT-01	28-May-18	3.0	3.7	2.0	4.0	3.4	0.78
			RG_LISP24-PERT-02	28-May-18	3.7					
			RG_LISP24-PERT-03	28-May-18	4.0					
			RG_LISP24-PERT-04	28-May-18	2.0					
			RG_LISP24-PERT-05	28-May-18	4.0					
			RG_LISP24-PERT-06	28-May-18	4.0					
			RG_LISP24-PERT-07	28-May-18	3.0					
			RG_LISP24-PERT-08	28-May-18	4.0					
			RG_LISP24-PERT-09	28-May-18	2.2					
			RG_LISP24-PERT-10	28-May-18	4.0					
			RG_LISP24-PERT-11	28-May-18	4.0					
			RG_LISP24-PERT-12	28-May-18	3.7					
			RG_LISP24-PERT-13	28-May-18	2.9					
			RG_LISP24-PERT-14	28-May-18	2.0					
			RG_LISP24-PERT-15	28-May-18	4.0					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March to May 2018

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LIDSL (LC_LCDSSLCC) Compliance	RG_LIDSL-PERT-01	10-Mar-18	2.6	2.6	1.6	3.0	2.4	0.41
			RG_LIDSL-PERT-02	10-Mar-18	1.7					
			RG_LIDSL-PERT-03	10-Mar-18	1.6					
			RG_LIDSL-PERT-04	10-Mar-18	2.6					
			RG_LIDSL-PERT-05	10-Mar-18	2.6					
			RG_LIDSL-PERT-06	10-Mar-18	2.1					
			RG_LIDSL-PERT-07	10-Mar-18	2.6					
			RG_LIDSL-PERT-08	10-Mar-18	2.3					
			RG_LIDSL-PERT-09	10-Mar-18	2.7					
			RG_LIDSL-PERT-10	10-Mar-18	2.8					
			RG_LIDSL-PERT-11	10-Mar-18	2.6					
			RG_LIDSL-PERT-12	10-Mar-18	2.6					
			RG_LIDSL-PERT-13	10-Mar-18	3.0					
			RG_LIDSL-PERT-14	10-Mar-18	1.9					
			RG_LIDSL-PERT-15	10-Mar-18	2.2					
			RG_LIDSL-PERT-01	3-Apr-18	2.0	2.3	1.9	3.4	2.5	0.41
			RG_LIDSL-PERT-02	3-Apr-18	2.3					
			RG_LIDSL-PERT-03	3-Apr-18	3.0					
			RG_LIDSL-PERT-04	3-Apr-18	2.1					
			RG_LIDSL-PERT-05	3-Apr-18	2.4					
			RG_LIDSL-PERT-06	3-Apr-18	2.6					
			RG_LIDSL-PERT-07	3-Apr-18	2.3					
			RG_LIDSL-PERT-08	3-Apr-18	3.0					
			RG_LIDSL-PERT-09	3-Apr-18	2.3					
			RG_LIDSL-PERT-10	3-Apr-18	2.3					
			RG_LIDSL-PERT-11	3-Apr-18	2.7					
			RG_LIDSL-PERT-12	3-Apr-18	3.4					
			RG_LIDSL-PERT-13	3-Apr-18	1.9					
			RG_LIDSL-PERT-14	3-Apr-18	2.6					
			RG_LIDSL-PERT-15	3-Apr-18	2.3					
			RG_LIDSL-PERT-01	30-Apr-18	2.2	2.2	2.0	3.0	2.3	0.29
			RG_LIDSL-PERT-02	30-Apr-18	2.2					
			RG_LIDSL-PERT-03	30-Apr-18	2.3					
			RG_LIDSL-PERT-04	30-Apr-18	2.1					
			RG_LIDSL-PERT-05	30-Apr-18	2.6					
			RG_LIDSL-PERT-06	30-Apr-18	2.1					
			RG_LIDSL-PERT-07	30-Apr-18	2.2					
			RG_LIDSL-PERT-08	30-Apr-18	2.1					
			RG_LIDSL-PERT-09	30-Apr-18	2.6					
			RG_LIDSL-PERT-10	30-Apr-18	2.3					
			RG_LIDSL-PERT-11	30-Apr-18	2.2					
			RG_LIDSL-PERT-12	30-Apr-18	3.0					
			RG_LIDSL-PERT-13	30-Apr-18	2.2					
			RG_LIDSL-PERT-14	30-Apr-18	2.0					
			RG_LIDSL-PERT-15	30-Apr-18	2.8					
			RG_LIDSL-PERT-01	29-May-18	3.8	2.8	1.4	4.0	2.9	0.63
			RG_LIDSL-PERT-02	29-May-18	3.0					
			RG_LIDSL-PERT-03	29-May-18	3.2					
			RG_LIDSL-PERT-04	29-May-18	2.8					
			RG_LIDSL-PERT-05	29-May-18	4.0					
			RG_LIDSL-PERT-06	29-May-18	2.8					
			RG_LIDSL-PERT-07	29-May-18	3.5					
			RG_LIDSL-PERT-08	29-May-18	2.2					
			RG_LIDSL-PERT-09	29-May-18	2.6					
			RG_LIDSL-PERT-10	29-May-18	3.2					
			RG_LIDSL-PERT-11	29-May-18	2.8					
			RG_LIDSL-PERT-12	29-May-18	2.8					
			RG_LIDSL-PERT-13	29-May-18	2.6					
			RG_LIDSL-PERT-14	29-May-18	1.4					
			RG_LIDSL-PERT-15	29-May-18	2.9					
		RG_LIDCOM (LC_LCC)	RG_LIDCOM-PERT-01	10-Mar-18	13	7.0	3.3	15	7.8	4.2
			RG_LIDCOM-PERT-02	10-Mar-18	3.8					
			RG_LIDCOM-PERT-03	10-Mar-18	3.8					
			RG_LIDCOM-PERT-04	10-Mar-18	7.0					
			RG_LIDCOM-PERT-05	10-Mar-18	15					
			RG_LIDCOM-PERT-06	10-Mar-18	3.3					
			RG_LIDCOM-PERT-07	10-Mar-18	9.0					
			RG_LIDCOM-PERT-08	10-Mar-18	4.9					
			RG_LIDCOM-PERT-09	10-Mar-18	3.6					
			RG_LIDCOM-PERT-10	10-Mar-18	12					
			RG_LIDCOM-PERT-11	10-Mar-18	5.9					
			RG_LIDCOM-PERT-12	10-Mar-18	11					
			RG_LIDCOM-PERT-13	10-Mar-18	7.2					
			RG_LIDCOM-PERT-14	10-Mar-18	3.6					
			RG_LIDCOM-PERT-15	10-Mar-18	14					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March to May 2018

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LIDCOM (LC_LCC; Continued)	RG_LIDCOM-PERT-01	4-Apr-18	3.0	3.2	2.4	13	4.0	2.6
			RG_LIDCOM-PERT-02	4-Apr-18	2.6					
			RG_LIDCOM-PERT-03	4-Apr-18	13					
			RG_LIDCOM-PERT-04	4-Apr-18	2.6					
			RG_LIDCOM-PERT-05	4-Apr-18	4.9					
			RG_LIDCOM-PERT-06	4-Apr-18	2.4					
			RG_LIDCOM-PERT-07	4-Apr-18	3.7					
			RG_LIDCOM-PERT-08	4-Apr-18	2.9					
			RG_LIDCOM-PERT-09	4-Apr-18	4.0					
			RG_LIDCOM-PERT-10	4-Apr-18	4.0					
			RG_LIDCOM-PERT-11	4-Apr-18	3.4					
			RG_LIDCOM-PERT-12	4-Apr-18	4.4					
			RG_LIDCOM-PERT-13	4-Apr-18	3.2					
			RG_LIDCOM-PERT-14	4-Apr-18	3.2					
			RG_LIDCOM-PERT-15	4-Apr-18	3.1					
			RG_LIDCOM-PERT-01	3-May-18	3.0	3.0	2.0	3.8	3.0	0.57
			RG_LIDCOM-PERT-02	3-May-18	3.7					
			RG_LIDCOM-PERT-03	3-May-18	3.8					
			RG_LIDCOM-PERT-04	3-May-18	2.8					
			RG_LIDCOM-PERT-05	3-May-18	2.8					
			RG_LIDCOM-PERT-06	3-May-18	3.1					
			RG_LIDCOM-PERT-07	3-May-18	2.8					
			RG_LIDCOM-PERT-08	3-May-18	3.6					
			RG_LIDCOM-PERT-09	3-May-18	3.7					
			RG_LIDCOM-PERT-10	3-May-18	3.6					
			RG_LIDCOM-PERT-11	3-May-18	2.0					
			RG_LIDCOM-PERT-12	3-May-18	2.0					
			RG_LIDCOM-PERT-13	3-May-18	3.0					
			RG_LIDCOM-PERT-14	3-May-18	3.0					
			RG_LIDCOM-PERT-15	3-May-18	2.7					
			RG_LIDCOM-PERT-01	28-May-18	2.0	2.5	1.6	5.2	2.7	0.92
			RG_LIDCOM-PERT-02	28-May-18	2.5					
			RG_LIDCOM-PERT-03	28-May-18	2.0					
			RG_LIDCOM-PERT-04	28-May-18	3.3					
			RG_LIDCOM-PERT-05	28-May-18	1.6					
			RG_LIDCOM-PERT-06	28-May-18	2.0					
			RG_LIDCOM-PERT-07	28-May-18	2.6					
			RG_LIDCOM-PERT-08	28-May-18	3.6					
			RG_LIDCOM-PERT-09	28-May-18	2.1					
			RG_LIDCOM-PERT-10	28-May-18	2.1					
			RG_LIDCOM-PERT-11	28-May-18	3.0					
			RG_LIDCOM-PERT-12	28-May-18	3.4					
			RG_LIDCOM-PERT-13	28-May-18	2.0					
			RG_LIDCOM-PERT-14	28-May-18	5.2					
			RG_LIDCOM-PERT-15	28-May-18	2.5					
		RG_LI8 (LC_LC4)	RG_LI8-PERT-01	10-Mar-18	2.0	1.8	1.4	2.2	1.7	0.22
			RG_LI8-PERT-02	10-Mar-18	2.2					
			RG_LI8-PERT-03	10-Mar-18	2.0					
			RG_LI8-PERT-04	10-Mar-18	1.6					
			RG_LI8-PERT-05	10-Mar-18	1.8					
			RG_LI8-PERT-06	10-Mar-18	1.5					
			RG_LI8-PERT-07	10-Mar-18	1.5					
			RG_LI8-PERT-08	10-Mar-18	1.8					
			RG_LI8-PERT-09	10-Mar-18	1.8					
			RG_LI8-PERT-10	10-Mar-18	1.8					
			RG_LI8-PERT-11	10-Mar-18	1.4					
			RG_LI8-PERT-12	10-Mar-18	1.8					
			RG_LI8-PERT-13	10-Mar-18	1.5					
			RG_LI8-PERT-14	10-Mar-18	1.8					
			RG_LI8-PERT-15	10-Mar-18	1.7					
			RG_LI8-PERT-01	5-Apr-18	2.3	2.2	1.9	2.5	2.2	0.21
			RG_LI8-PERT-02	5-Apr-18	2.2					
			RG_LI8-PERT-03	5-Apr-18	2.0					
			RG_LI8-PERT-04	5-Apr-18	2.2					
			RG_LI8-PERT-05	5-Apr-18	1.9					
			RG_LI8-PERT-06	5-Apr-18	1.9					
			RG_LI8-PERT-07	5-Apr-18	2.0					
			RG_LI8-PERT-08	5-Apr-18	2.3					
			RG_LI8-PERT-09	5-Apr-18	2.5					
			RG_LI8-PERT-10	5-Apr-18	2.5					
			RG_LI8-PERT-11	5-Apr-18	2.3					
			RG_LI8-PERT-12	5-Apr-18	2.0					
			RG_LI8-PERT-13	5-Apr-18	2.1					
			RG_LI8-PERT-14	5-Apr-18	2.4					
			RG_LI8-PERT-15	5-Apr-18	2.4					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

Table B.2: **Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March to May 2018**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LI8 (LC_LC4; Continued)	RG_LI8-PERT-01	2-May-18	1.9	2.0	1.4	2.5	2.0	0.27
			RG_LI8-PERT-02	2-May-18	2.1					
			RG_LI8-PERT-03	2-May-18	2.3					
			RG_LI8-PERT-04	2-May-18	1.8					
			RG_LI8-PERT-05	2-May-18	1.9					
			RG_LI8-PERT-06	2-May-18	2.3					
			RG_LI8-PERT-07	2-May-18	2.0					
			RG_LI8-PERT-08	2-May-18	1.4					
			RG_LI8-PERT-09	2-May-18	2.0					
			RG_LI8-PERT-10	2-May-18	2.0					
			RG_LI8-PERT-11	2-May-18	1.8					
			RG_LI8-PERT-12	2-May-18	2.5					
			RG_LI8-PERT-13	2-May-18	2.3					
			RG_LI8-PERT-14	2-May-18	2.1					
			RG_LI8-PERT-15	2-May-18	1.9					
			RG_LI8-PERT-01	28-May-18	1.3	2.6	1.3	3.8	2.5	0.65
			RG_LI8-PERT-02	28-May-18	2.0					
			RG_LI8-PERT-03	28-May-18	3.0					
			RG_LI8-PERT-04	28-May-18	3.0					
			RG_LI8-PERT-05	28-May-18	3.0					
			RG_LI8-PERT-06	28-May-18	3.0					
			RG_LI8-PERT-07	28-May-18	1.8					
			RG_LI8-PERT-08	28-May-18	3.8					
			RG_LI8-PERT-09	28-May-18	3.0					
			RG_LI8-PERT-10	28-May-18	2.2					
			RG_LI8-PERT-11	28-May-18	2.0					
			RG_LI8-PERT-12	28-May-18	2.1					
			RG_LI8-PERT-13	28-May-18	2.3					
			RG_LI8-PERT-14	28-May-18	2.6					
			RG_LI8-PERT-15	28-May-18	3.0					
		RG_FRUL (LC_LC6)	RG_FRUL-PERT-01	11-Mar-18	5.0	7.0	2.3	15	7.6	3.2
			RG_FRUL-PERT-02	11-Mar-18	7.6					
			RG_FRUL-PERT-03	11-Mar-18	7.9					
			RG_FRUL-PERT-04	11-Mar-18	12					
			RG_FRUL-PERT-05	11-Mar-18	9.2					
			RG_FRUL-PERT-06	11-Mar-18	3.9					
			RG_FRUL-PERT-07	11-Mar-18	8.7					
			RG_FRUL-PERT-08	11-Mar-18	5.4					
			RG_FRUL-PERT-09	11-Mar-18	2.3					
			RG_FRUL-PERT-10	11-Mar-18	11					
			RG_FRUL-PERT-11	11-Mar-18	7.0					
			RG_FRUL-PERT-12	11-Mar-18	15					
			RG_FRUL-PERT-13	11-Mar-18	6.5					
			RG_FRUL-PERT-14	11-Mar-18	6.7					
			RG_FRUL-PERT-15	11-Mar-18	6.1					
		RG_FO23 (LC_LC5)	RG_FO23-PERT-01	11-Mar-18	4.2	6.7	1.9	23	7.6	5.5
			RG_FO23-PERT-02	11-Mar-18	5.0					
			RG_FO23-PERT-03	11-Mar-18	6.9					
			RG_FO23-PERT-04	11-Mar-18	3.8					
			RG_FO23-PERT-05	11-Mar-18	6.7					
			RG_FO23-PERT-06	11-Mar-18	3.2					
			RG_FO23-PERT-07	11-Mar-18	2.5					
			RG_FO23-PERT-08	11-Mar-18	7.2					
			RG_FO23-PERT-09	11-Mar-18	7.5					
			RG_FO23-PERT-10	11-Mar-18	13					
			RG_FO23-PERT-11	11-Mar-18	1.9					
			RG_FO23-PERT-12	11-Mar-18	6.0					
			RG_FO23-PERT-13	11-Mar-18	23					
			RG_FO23-PERT-14	11-Mar-18	10					
			RG_FO23-PERT-15	11-Mar-18	13					
			RG_FO23-PERT-01	5-Apr-18	5.3	15	5.1	28	14	7.9
			RG_FO23-PERT-02	5-Apr-18	5.8					
			RG_FO23-PERT-03	5-Apr-18	15					
			RG_FO23-PERT-04	5-Apr-18	21					
			RG_FO23-PERT-05	5-Apr-18	8.1					
			RG_FO23-PERT-06	5-Apr-18	6.0					
			RG_FO23-PERT-07	5-Apr-18	21					
			RG_FO23-PERT-08	5-Apr-18	21					
			RG_FO23-PERT-09	5-Apr-18	24					
			RG_FO23-PERT-10	5-Apr-18	18					
			RG_FO23-PERT-11	5-Apr-18	28					
			RG_FO23-PERT-12	5-Apr-18	5.1					
			RG_FO23-PERT-13	5-Apr-18	18					
			RG_FO23-PERT-14	5-Apr-18	8.4					
			RG_FO23-PERT-15	5-Apr-18	7.5					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March to May 2018

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_FO23 (LC_LC5; continued)	RG_FO23-PERT-01	29-May-18	1.2	1.5	1.0	3.0	1.6	0.48
			RG_FO23-PERT-02	29-May-18	1.6					
			RG_FO23-PERT-03	29-May-18	1.5					
			RG_FO23-PERT-04	29-May-18	1.4					
			RG_FO23-PERT-05	29-May-18	1.7					
			RG_FO23-PERT-06	29-May-18	1.5					
			RG_FO23-PERT-07	29-May-18	1.4					
			RG_FO23-PERT-08	29-May-18	1.0					
			RG_FO23-PERT-09	29-May-18	<5.0					
			RG_FO23-PERT-10	29-May-18	<5.0					
			RG_FO23-PERT-11	29-May-18	1.5					
			RG_FO23-PERT-12	29-May-18	1.7					
			RG_FO23-PERT-13	29-May-18	1.8					
			RG_FO23-PERT-14	29-May-18	1.3					
			RG_FO23-PERT-15	29-May-18	3.0					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018d). Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

Table B.3: **Mean[a] Selenium Concentrations (mg/kg dw) in Periphyton Tissue Samples Collected from Line Creek and Fording River, Line Creek LAEMP, 2012 to 2018**

Area		Biological Area Code	Teck Water Station Code	Prior to AWTF Operation	No AWTF Operation (Oct 17, 2014 to Oct 26, 2015)	AWTF Steady State Operation (Jan 31, 2016 to Oct 15, 2017)				AWTF Flow Reduction (Oct 16, 2017 to Mar 7, 2018)		AWTF Operation Suspended (Mar 8 to Oct 29, 2018)			
				2012 (September)	2015 (September)	2016 (September)	2017 (February/ March)	2017 (April)	2017 (September)	2017 (November)	2017 (December)	2018 (Mar 8 - 11) 0 weeks	2018 (Apr 3 - 5) 4 weeks	2018 (Apr 30 - May 4) 8 weeks	2018 (May 28 - 29) 12 weeks
Sample Size (n)				1	1	1	14	15	15	15	15	15	15	15	15
Line Creek	Reference	RG_LI24	LC_LC1 (Reference)	2.1	2.9	5.5	-	-	3.8	-	-	-	-	5.7	-
Line Creek	Reference	RG_SLINE	LC_SLC (Reference)	-	1.5	4.1	-	4.0	3.9	-	-	3.3	-	2.6	-
Line Creek	Mine-exposed	RG_LCUT	LC_LCUSWLC/ LC_WLC	-	-	-	27	14	18	12	9.7	14	11	7.7	5.2
Line Creek	Mine-exposed	RG_LILC3	LC_LC3	18	3.8	16	45	25	13	13	12	13	12	9.2	5.2
Line Creek	Mine-exposed	RG_LISP24	WL_DCP_SP24	-	-	-	-	-	-	-	-	4.0	3.4	5.4	3.4
Line Creek	Mine-exposed	RG_LIDSL	LC_LCDSSLCC (Compliance Point)	-	1.4	2.0	5.6	4.6	4.8	4.1	3.7	2.4	2.5	2.3	2.9
Line Creek	Mine-exposed	RG_LIDCOM	LC_LCC	-	-	-	-	-	-	-	-	7.8	4.0	3.0	2.7
Line Creek	Mine-exposed	RG_LI8	LC_LC4	-	5.3	2.6	3.2	3.0	1.6	2.3	2.6	1.7	2.2	2.0	2.5
Fording River	Mine-exposed	RG_FRUL	LC_LC6	-	3.7	7.1	-	5.1	-	-	-	7.6	-	-	-
Fording River	Mine-exposed	RG_FO23	LC_LC5	1.6	9.1	13	-	5.5	-	-	-	7.6	14	-	1.6

Notes: FRUL=FOUL prior to 2016. Periphyton tissue selenium monitoring was discontinued after May 2018 because results are confounded by the presence of abiotic particulate matter containing selenium, and data are redundant with benthic invertebrate selenium results.

[a] Means are only presented where the number of samples was > 1.

Table B.4: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Reference	RG_LI24 (LC_LC1)	RG_LI24-1-INV	03-May-18	13.0	13	12	15	13	0.82
			RG_LI24-2-INV	03-May-18	13.0					
			RG_LI24-3-INV	03-May-18	13.0					
			RG_LI24-4-INV	03-May-18	13.0					
			RG_LI24-5-INV	03-May-18	13.0					
			RG_LI24-6-INV	03-May-18	15.0					
			RG_LI24-7-INV	03-May-18	12.0					
			RG_LI24-8-INV	03-May-18	13.0					
			RG_LI24-9-INV	03-May-18	12.0					
			RG_LI24-10-INV	03-May-18	13.0					
			RG_LI24-1-INV	12-Sep-18	6.6	7.3	4.8	8.6	7.0	1.1
			RG_LI24-2-INV	12-Sep-18	7.5					
			RG_LI24-3-INV	12-Sep-18	7.3					
			RG_LI24-4-INV	12-Sep-18	7.9					
			RG_LI24-5-INV	12-Sep-18	7.0					
			RG_LI24-6-INV	12-Sep-18	6.5					
			RG_LI24-7-INV	12-Sep-18	5.2					
			RG_LI24-8-INV	12-Sep-18	7.4					
			RG_LI24-9-INV	12-Sep-18	8.3					
			RG_LI24-10-INV	12-Sep-18	4.8					
			RG_DSLI24-1-INV	12-Sep-18	8.6					
			RG_DSLI24-2-INV	12-Sep-18	7.1					
			RG_DSLI24-3-INV	12-Sep-18	7.4					
			RG_LI24-1-INV	03-Dec-18	6.4	5.1	4.2	8.5	5.6	1.3
			RG_LI24-2-INV	03-Dec-18	4.9					
			RG_LI24-3-INV	03-Dec-18	4.6					
			RG_LI24-4-INV	03-Dec-18	5.2					
			RG_LI24-5-INV	03-Dec-18	5.0					
			RG_LI24-6-INV	03-Dec-18	8.5					
			RG_LI24-7-INV	03-Dec-18	4.6					
			RG_LI24-8-INV	03-Dec-18	5.4					
			RG_LI24-9-INV	03-Dec-18	6.7					
			RG_LI24-10-INV	03-Dec-18	4.2					
		RG_SLINE (LC_SLC)	RG_SLINE-1-INV	08-Mar-18	4.6	5.5	3.6	6.4	5.2	1.0
			RG_SLINE-2-INV	08-Mar-18	5.4					
			RG_SLINE-3-INV	08-Mar-18	6.4					
			RG_SLINE-4-INV	08-Mar-18	6.2					
			RG_SLINE-5-INV	08-Mar-18	4.4					
			RG_SLINE-6-INV	08-Mar-18	6.1					
			RG_SLINE-7-INV	08-Mar-18	5.5					
			RG_SLINE-8-INV	08-Mar-18	6.0					
			RG_SLINE-9-INV	08-Mar-18	3.6					
			RG_SLINE-10-INV	08-Mar-18	3.9					
			RG_SLINE-1-INV	30-Apr-18	7.6	5.7	2.8	7.8	5.7	1.7
			RG_SLINE-2-INV	30-Apr-18	5.3					
			RG_SLINE-3-INV	30-Apr-18	7.8					
			RG_SLINE-4-INV	30-Apr-18	6.3					
			RG_SLINE-5-INV	30-Apr-18	7.7					
			RG_SLINE-6-INV	30-Apr-18	5.1					
			RG_SLINE-7-INV	30-Apr-18	6.0					
			RG_SLINE-8-INV	30-Apr-18	4.3					
			RG_SLINE-9-INV	30-Apr-18	2.8					
			RG_SLINE-10-INV	30-Apr-18	4.5					
			RG_SLINE-1-INV	11-Sep-18	8.3	6.6	5.0	8.3	6.6	1.0
			RG_SLINE-2-INV	11-Sep-18	6.0					
			RG_SLINE-3-INV	11-Sep-18	6.5					
			RG_SLINE-4-INV	11-Sep-18	6.0					
			RG_SLINE-5-INV	11-Sep-18	6.6					
			RG_SLINE-6-INV	11-Sep-18	8.0					
			RG_SLINE-7-INV	11-Sep-18	5.0					
			RG_SLINE-8-INV	11-Sep-18	7.0					
			RG_SLINE-9-INV	11-Sep-18	6.6					
			RG_SLINE-10-INV	11-Sep-18	6.0					
			RG_SLINE-1-INV	04-Dec-18	3.5	4.3	3.0	6.5	4.3	1.1
			RG_SLINE-2-INV	04-Dec-18	4.3					
			RG_SLINE-3-INV	04-Dec-18	3.5					
			RG_SLINE-4-INV	04-Dec-18	3.1					
			RG_SLINE-5-INV	04-Dec-18	4.3					
			RG_SLINE-6-INV	04-Dec-18	3.0					
			RG_SLINE-7-INV	04-Dec-18	4.2					
			RG_SLINE-8-INV	04-Dec-18	6.5					
			RG_SLINE-9-INV	04-Dec-18	5.8					
			RG_SLINE-10-INV	04-Dec-18	4.6					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Reference	RG_SLINE (LC_SLC)	RG_SLINE1_INV	14-Jan-19	4.6	3.9	2.8	5.4	4.0	0.7
			RG_SLINE2_INV	14-Jan-19	5.4					
			RG_SLINE3_INV	14-Jan-19	3.7					
			RG_SLINE4_INV	14-Jan-19	3.8					
			RG_SLINE5_INV	14-Jan-19	3.7					
			RG_SLINE6_INV	14-Jan-19	3.9					
			RG_SLINE7_INV	14-Jan-19	2.8					
			RG_SLINE8_INV	14-Jan-19	3.4					
			RG_SLINE9_INV	14-Jan-19	4.0					
			RG_SLINE10_INV	14-Jan-19	4.7					
			RG_SLINE1_INV	25-Feb-19	4.7	4.8	4.0	6.6	4.9	0.8
			RG_SLINE2_INV	25-Feb-19	5.8					
			RG_SLINE3_INV	25-Feb-19	4.0					
			RG_SLINE4_INV	25-Feb-19	4.4					
			RG_SLINE5_INV	25-Feb-19	4.2					
			RG_SLINE6_INV	25-Feb-19	4.4					
			RG_SLINE7_INV	25-Feb-19	5.0					
			RG_SLINE8_INV	25-Feb-19	6.6					
			RG_SLINE9_INV	25-Feb-19	5.3					
			RG_SLINE10_INV	25-Feb-19	4.9					
	Mine-exposed	RG_LCUT (LC_LCUSWLC / LC_WLC)	RG_LCUT1-INV	09-Mar-18	5.4	6.4	5.4	7.9	6.3	0.7
			RG_LCUT2-INV	09-Mar-18	7.9					
			RG_LCUT3-INV	09-Mar-18	5.4					
			RG_LCUT4-INV	09-Mar-18	5.8					
			RG_LCUT5-INV	09-Mar-18	6.7					
			RG_LCUT6-INV	09-Mar-18	6.5					
			RG_LCUT7-INV	09-Mar-18	6.4					
			RG_LCUT8-INV	09-Mar-18	6.6					
			RG_LCUT9-INV	09-Mar-18	6.0					
			RG_LCUT10-INV	09-Mar-18	6.4					
			RG_LCUT1-INV	03-Apr-18	5.4	7.3	5.4	8.3	7.0	0.9
			RG_LCUT2-INV	03-Apr-18	7.2					
			RG_LCUT3-INV	03-Apr-18	8.3					
			RG_LCUT4-INV	03-Apr-18	6.4					
			RG_LCUT5-INV	03-Apr-18	7.7					
			RG_LCUT6-INV	03-Apr-18	7.3					
			RG_LCUT7-INV	03-Apr-18	6.3					
			RG_LCUT8-INV	03-Apr-18	7.8					
			RG_LCUT9-INV	03-Apr-18	7.4					
			RG_LCUT10-INV	03-Apr-18	6.1					
			RG_LCUT1-INV	01-May-18	8.7	7.6	6.2	9.2	7.6	0.9
			RG_LCUT2-INV	01-May-18	6.3					
			RG_LCUT3-INV	01-May-18	7.6					
			RG_LCUT4-INV	01-May-18	7.5					
			RG_LCUT5-INV	01-May-18	7.3					
			RG_LCUT6-INV	01-May-18	6.2					
			RG_LCUT7-INV	01-May-18	7.8					
			RG_LCUT8-INV	01-May-18	9.2					
			RG_LCUT9-INV	01-May-18	8.0					
			RG_LCUT10-INV	01-May-18	7.6					
			RG_LCUT1-INV	29-May-18	7.8	7.1	6.1	10.0	7.5	1.2
			RG_LCUT2-INV	29-May-18	7.0					
			RG_LCUT3-INV	29-May-18	6.2					
			RG_LCUT4-INV	29-May-18	6.8					
			RG_LCUT5-INV	29-May-18	10.0					
			RG_LCUT6-INV	29-May-18	6.1					
			RG_LCUT7-INV	29-May-18	7.0					
			RG_LCUT8-INV	29-May-18	7.2					
			RG_LCUT9-INV	29-May-18	8.5					
			RG_LCUT10-INV	29-May-18	8.3					
			RG_LCUT1-INV	11-Sep-18	8.3	7.9	6.5	9.0	7.9	0.8
			RG_LCUT2-INV	11-Sep-18	9.0					
			RG_LCUT3-INV	11-Sep-18	6.5					
			RG_LCUT4-INV	11-Sep-18	8.5					
			RG_LCUT5-INV	11-Sep-18	7.7					
			RG_LCUT6-INV	11-Sep-18	8.0					
			RG_LCUT7-INV	11-Sep-18	8.7					
			RG_LCUT8-INV	11-Sep-18	7.8					
			RG_LCUT9-INV	11-Sep-18	6.6					
			RG_LCUT10-INV	11-Sep-18	7.7					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LCUT (LC_LCUSWLC / LC_WLC)	RG_LCUT1-INV	03-Dec-18	6.1	6.1	4.5	11.0	6.5	1.7
			RG_LCUT2-INV	03-Dec-18	7.0					
			RG_LCUT3-INV	03-Dec-18	5.8					
			RG_LCUT4-INV	03-Dec-18	6.2					
			RG_LCUT5-INV	03-Dec-18	5.9					
			RG_LCUT6-INV	03-Dec-18	6.1					
			RG_LCUT7-INV	03-Dec-18	5.5					
			RG_LCUT8-INV	03-Dec-18	4.5					
			RG_LCUT9-INV	03-Dec-18	11.0					
			RG_LCUT10-INV	03-Dec-18	7.0					
			RG_LCUT1-INV	17-Jan-19	6.3	5.9	4.9	7.1	6.1	0.7
			RG_LCUT2-INV	17-Jan-19	5.5					
			RG_LCUT3-INV	17-Jan-19	7.1					
			RG_LCUT4-INV	17-Jan-19	5.9					
			RG_LCUT5-INV	17-Jan-19	5.8					
			RG_LCUT6-INV	17-Jan-19	4.9					
			RG_LCUT7-INV	17-Jan-19	6.3					
			RG_LCUT8-INV	17-Jan-19	5.7					
			RG_LCUT9-INV	17-Jan-19	7.1					
		RG_LILC3 (LC_LC3)	RG_LILC3-1-INV	09-Mar-18	8.0	14.0	8.0	22.0	14.4	4.0
			RG_LILC3-2-INV	09-Mar-18	19.0					
			RG_LILC3-3-INV	09-Mar-18	12.0					
			RG_LILC3-4-INV	09-Mar-18	11.0					
			RG_LILC3-5-INV	09-Mar-18	14.0					
			RG_LILC3-6-INV	09-Mar-18	14.0					
			RG_LILC3-7-INV	09-Mar-18	13.0					
			RG_LILC3-8-INV	09-Mar-18	22.0					
			RG_LILC3-9-INV	09-Mar-18	14.0					
			RG_LILC3-10-INV	09-Mar-18	17.0					
			RG_LILC3-1-INV	04-Apr-18	18.0	17.0	11.0	28.0	18.5	6.7
			RG_LILC3-2-INV	04-Apr-18	12.0					
			RG_LILC3-3-INV	04-Apr-18	11.0					
			RG_LILC3-4-INV	04-Apr-18	22.0					
			RG_LILC3-5-INV	04-Apr-18	12.0					
			RG_LILC3-6-INV	04-Apr-18	13.0					
			RG_LILC3-7-INV	04-Apr-18	16.0					
			RG_LILC3-8-INV	04-Apr-18	26.0					
			RG_LILC3-9-INV	04-Apr-18	28.0					
			RG_LILC3-10-INV	04-Apr-18	27.0					
			RG_LILC3-1-INV	01-May-18	18.0	17.5	14.0	25.0	18.4	4.1
			RG_LILC3-2-INV	01-May-18	14.0					
			RG_LILC3-3-INV	01-May-18	14.0					
			RG_LILC3-4-INV	01-May-18	20.0					
			RG_LILC3-5-INV	01-May-18	16.0					
			RG_LILC3-6-INV	01-May-18	25.0					
			RG_LILC3-7-INV	01-May-18	20.0					
			RG_LILC3-8-INV	01-May-18	17.0					
			RG_LILC3-9-INV	01-May-18	25.0					
			RG_LILC3-10-INV	01-May-18	15.0					
			RG_LILC3-1-INV	29-May-18	22.0	15.0	11.0	22.0	15.2	3.4
			RG_LILC3-2-INV	29-May-18	15.0					
			RG_LILC3-3-INV	29-May-18	14.0					
			RG_LILC3-4-INV	29-May-18	12.0					
			RG_LILC3-5-INV	29-May-18	15.0					
			RG_LILC3-6-INV	29-May-18	11.0					
			RG_LILC3-7-INV	29-May-18	12.0					
			RG_LILC3-8-INV	29-May-18	15.0					
			RG_LILC3-9-INV	29-May-18	18.0					
			RG_LILC3-10-INV	29-May-18	18.0					
			RG_LILC3-1-INV	10-Sep-18	10.0	10.0	8.7	13.0	10.3	1.2
			RG_LILC3-2-INV	10-Sep-18	10.0					
			RG_LILC3-3-INV	10-Sep-18	8.7					
			RG_LILC3-4-INV	10-Sep-18	9.4					
			RG_LILC3-5-INV	10-Sep-18	11.0					
			RG_LILC3-6-INV	10-Sep-18	10.0					
			RG_LILC3-7-INV	10-Sep-18	11.0					
			RG_LILC3-8-INV	10-Sep-18	10.0					
			RG_LILC3-9-INV	10-Sep-18	13.0					
			RG_LILC3-10-INV	10-Sep-18	10.0					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LILC3 (LC_LC3)	RG_LILC3-1-INV	06-Dec-18	7.0	8.5	6.7	9.3	8.2	1.0
			RG_LILC3-2-INV	06-Dec-18	6.7					
			RG_LILC3-3-INV	06-Dec-18	9.3					
			RG_LILC3-4-INV	06-Dec-18	8.9					
			RG_LILC3-5-INV	06-Dec-18	7.8					
			RG_LILC3-6-INV	06-Dec-18	8.3					
			RG_LILC3-7-INV	06-Dec-18	7.1					
			RG_LILC3-8-INV	06-Dec-18	8.7					
			RG_LILC3-9-INV	06-Dec-18	9.3					
			RG_LILC3-10-INV	06-Dec-18	9.2					
			RG_LILC3-1-INV	17-Jan-19	8.8	8.7	6.7	10.0	8.5	1.0
			RG_LILC3-2-INV	17-Jan-19	7.6					
			RG_LILC3-3-INV	17-Jan-19	9.6					
			RG_LILC3-4-INV	17-Jan-19	9.2					
			RG_LILC3-5-INV	17-Jan-19	9.0					
			RG_LILC3-6-INV	17-Jan-19	7.4					
			RG_LILC3-7-INV	17-Jan-19	8.5					
			RG_LILC3-8-INV	17-Jan-19	8.2					
			RG_LILC3-9-INV	17-Jan-19	6.7					
			RG_LILC3-10-INV	17-Jan-19	10.0					
		RG_LISP24 (WL_DCP_SP24)	RG_LISP24-1-INV	10-Mar-18	7.8	7.5	6.3	9.2	7.4	0.9
			RG_LISP24-2-INV	10-Mar-18	7.4					
			RG_LISP24-3-INV	10-Mar-18	7.6					
			RG_LISP24-4-INV	10-Mar-18	6.9					
			RG_LISP24-5-INV	10-Mar-18	6.9					
			RG_LISP24-6-INV	10-Mar-18	6.5					
			RG_LISP24-7-INV	10-Mar-18	8.1					
			RG_LISP24-8-INV	10-Mar-18	7.7					
			RG_LISP24-9-INV	10-Mar-18	9.2					
			RG_LISP24-10-INV	10-Mar-18	6.3					
			RG_LISP24-1-INV	04-Apr-18	11.0	10.5	8.4	13.0	10.7	1.6
			RG_LISP24-2-INV	04-Apr-18	8.4					
			RG_LISP24-3-INV	04-Apr-18	9.0					
			RG_LISP24-4-INV	04-Apr-18	13.0					
			RG_LISP24-5-INV	04-Apr-18	12.0					
			RG_LISP24-6-INV	04-Apr-18	10.0					
			RG_LISP24-7-INV	04-Apr-18	10.0					
			RG_LISP24-8-INV	04-Apr-18	11.0					
			RG_LISP24-9-INV	04-Apr-18	13.0					
			RG_LISP24-10-INV	04-Apr-18	10.0					
			RG_LISP24-1-INV	01-May-18	8.0	10.5	6.9	13.0	10.2	2.0
			RG_LISP24-2-INV	01-May-18	10.0					
			RG_LISP24-3-INV	01-May-18	8.6					
			RG_LISP24-4-INV	01-May-18	11.0					
			RG_LISP24-5-INV	01-May-18	6.9					
			RG_LISP24-6-INV	01-May-18	12.0					
			RG_LISP24-7-INV	01-May-18	11.0					
			RG_LISP24-8-INV	01-May-18	12.0					
			RG_LISP24-9-INV	01-May-18	13.0					
			RG_LISP24-10-INV	01-May-18	9.2					
			RG_LISP24-1-INV	28-May-18	8.6	8.6	7.1	12.0	8.9	1.3
			RG_LISP24-2-INV	28-May-18	12.0					
			RG_LISP24-3-INV	28-May-18	9.9					
			RG_LISP24-4-INV	28-May-18	8.3					
			RG_LISP24-5-INV	28-May-18	8.3					
			RG_LISP24-6-INV	28-May-18	8.0					
			RG_LISP24-7-INV	28-May-18	7.1					
			RG_LISP24-8-INV	28-May-18	8.8					
			RG_LISP24-9-INV	28-May-18	8.6					
			RG_LISP24-10-INV	28-May-18	9.6					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LISP24 (WL_DCP_SP24)	RG_LISP24-1-INV	13-Sep-18	8.7	8.3	7.1	9.0	8.2	0.6
			RG_LISP24-2-INV	13-Sep-18	8.6					
			RG_LISP24-3-INV	13-Sep-18	9.0					
			RG_LISP24-4-INV	13-Sep-18	8.4					
			RG_LISP24-5-INV	13-Sep-18	8.4					
			RG_LISP24-6-INV	13-Sep-18	8.2					
			RG_LISP24-7-INV	13-Sep-18	8.0					
			RG_LISP24-8-INV	13-Sep-18	7.1					
			RG_LISP24-9-INV	13-Sep-18	7.3					
			RG_LISP24-10-INV	13-Sep-18	7.9					
			RG_LISP24-1-INV	04-Dec-18	6.9	6.7	6.0	7.7	6.7	0.5
			RG_LISP24-2-INV	04-Dec-18	7.7					
			RG_LISP24-3-INV	04-Dec-18	6.2					
			RG_LISP24-4-INV	04-Dec-18	6.7					
			RG_LISP24-5-INV	04-Dec-18	6.0					
			RG_LISP24-6-INV	04-Dec-18	6.7					
			RG_LISP24-7-INV	04-Dec-18	6.3					
			RG_LISP24-8-INV	04-Dec-18	6.4					
			RG_LISP24-9-INV	04-Dec-18	7.1					
			RG_LISP24-10-INV	04-Dec-18	7.1					
			RG_LISP24-1-INV	17-Jan-19	7.2	6.0	4.9	7.5	6.2	0.9
			RG_LISP24-2-INV	17-Jan-19	5.6					
			RG_LISP24-3-INV	17-Jan-19	5.4					
			RG_LISP24-4-INV	17-Jan-19	6.6					
			RG_LISP24-5-INV	17-Jan-19	7.0					
			RG_LISP24-6-INV	17-Jan-19	5.9					
			RG_LISP24-7-INV	17-Jan-19	5.7					
			RG_LISP24-8-INV	17-Jan-19	6.1					
			RG_LISP24-9-INV	17-Jan-19	7.5					
			RG_LISP24-10-INV	17-Jan-19	4.9					
		RG_LIDSL (LC_LCDSSLCC) Compliance	RG_LIDSL1-INV	10-Mar-18	5.7	6.0	5.3	10.0	6.6	1.4
			RG_LIDSL2-INV	10-Mar-18	5.8					
			RG_LIDSL3-INV	10-Mar-18	5.3					
			RG_LIDSL4-INV	10-Mar-18	7.3					
			RG_LIDSL5-INV	10-Mar-18	10.0					
			RG_LIDSL6-INV	10-Mar-18	7.5					
			RG_LIDSL7-INV	10-Mar-18	5.5					
			RG_LIDSL8-INV	10-Mar-18	6.1					
			RG_LIDSL9-INV	10-Mar-18	6.4					
			RG_LIDSL10-INV	10-Mar-18	5.9					
			RG_LIDSL1-INV	03-Apr-18	8.6	8.8	6.4	12.0	9.3	1.7
			RG_LIDSL2-INV	03-Apr-18	6.4					
			RG_LIDSL3-INV	03-Apr-18	11.0					
			RG_LIDSL4-INV	03-Apr-18	8.6					
			RG_LIDSL5-INV	03-Apr-18	8.9					
			RG_LIDSL6-INV	03-Apr-18	12.0					
			RG_LIDSL7-INV	03-Apr-18	10.0					
			RG_LIDSL8-INV	03-Apr-18	11.0					
			RG_LIDSL9-INV	03-Apr-18	8.0					
			RG_LIDSL10-INV	03-Apr-18	8.6					
			RG_LIDSL1-INV	30-Apr-18	11.0	10.0	5.6	18.0	10.1	3.7
			RG_LIDSL2-INV	30-Apr-18	12.0					
			RG_LIDSL3-INV	30-Apr-18	9.4					
			RG_LIDSL4-INV	30-Apr-18	10.0					
			RG_LIDSL5-INV	30-Apr-18	12.0					
			RG_LIDSL6-INV	30-Apr-18	6.8					
			RG_LIDSL7-INV	30-Apr-18	5.6					
			RG_LIDSL8-INV	30-Apr-18	10.0					
			RG_LIDSL9-INV	30-Apr-18	18.0					
			RG_LIDSL10-INV	30-Apr-18	5.8					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LIDSL (LC_LCDSSLCC) Compliance; Continued	RG_LIDSL1-INV	29-May-18	9.5	9.2	6.6	11.0	9.3	1.4
			RG_LIDSL2-INV	29-May-18	8.0					
			RG_LIDSL3-INV	29-May-18	11.0					
			RG_LIDSL4-INV	29-May-18	9.6					
			RG_LIDSL5-INV	29-May-18	8.8					
			RG_LIDSL6-INV	29-May-18	6.6					
			RG_LIDSL7-INV	29-May-18	11.0					
			RG_LIDSL8-INV	29-May-18	8.8					
			RG_LIDSL9-INV	29-May-18	8.6					
			RG_LIDSL10-INV	29-May-18	11.0					
			RG_LIDSL1-INV	06-Sep-18	8.0	7.2	6.0	8.2	7.2	0.8
			RG_LIDSL2-INV	06-Sep-18	7.5					
			RG_LIDSL3-INV	06-Sep-18	6.1					
			RG_LIDSL4-INV	06-Sep-18	7.0					
			RG_LIDSL5-INV	06-Sep-18	8.0					
			RG_LIDSL6-INV	06-Sep-18	8.2					
			RG_LIDSL7-INV	06-Sep-18	7.0					
			RG_LIDSL8-INV	06-Sep-18	6.0					
			RG_LIDSL9-INV	06-Sep-18	7.2					
			RG_LIDSL10-INV	06-Sep-18	7.1					
			RG_LIDSL1-INV	04-Dec-18	7.8	6.7	6.0	7.8	6.7	0.5
			RG_LIDSL2-INV	04-Dec-18	6.7					
			RG_LIDSL3-INV	04-Dec-18	6.7					
			RG_LIDSL4-INV	04-Dec-18	6.6					
			RG_LIDSL5-INV	04-Dec-18	6.2					
			RG_LIDSL6-INV	04-Dec-18	6.7					
			RG_LIDSL7-INV	04-Dec-18	7.1					
			RG_LIDSL8-INV	04-Dec-18	6.0					
			RG_LIDSL9-INV	04-Dec-18	6.5					
			RG_LIDSL10-INV	04-Dec-18	6.9					
			RG_LIDSL1-INV	16-Jan-19	4.9	5.8	4.0	7.2	5.7	1.1
			RG_LIDSL2-INV	16-Jan-19	5.8					
			RG_LIDSL3-INV	16-Jan-19	5.2					
			RG_LIDSL4-INV	16-Jan-19	4.4					
			RG_LIDSL5-INV	16-Jan-19	7.2					
			RG_LIDSL6-INV	16-Jan-19	6.8					
			RG_LIDSL7-INV	16-Jan-19	4.0					
			RG_LIDSL8-INV	16-Jan-19	5.7					
			RG_LIDSL9-INV	16-Jan-19	5.9					
			RG_LIDSL10-INV	16-Jan-19	7.1					
		RG_LIDCOM (LC_LCC)	RG_LIDCOM1-INV	10-Mar-18	9.0	7.7	6.4	9.2	7.7	1.0
			RG_LIDCOM2-INV	10-Mar-18	9.0					
			RG_LIDCOM3-INV	10-Mar-18	7.8					
			RG_LIDCOM4-INV	10-Mar-18	7.8					
			RG_LIDCOM5-INV	10-Mar-18	7.5					
			RG_LIDCOM6-INV	10-Mar-18	6.9					
			RG_LIDCOM7-INV	10-Mar-18	9.2					
			RG_LIDCOM8-INV	10-Mar-18	6.4					
			RG_LIDCOM9-INV	10-Mar-18	6.4					
			RG_LIDCOM10-INV	10-Mar-18	7.3					
			RG_LIDCOM1-INV	04-Apr-18	11.0	9.5	7.8	11.0	9.3	1.0
			RG_LIDCOM2-INV	04-Apr-18	8.4					
			RG_LIDCOM3-INV	04-Apr-18	10.0					
			RG_LIDCOM4-INV	04-Apr-18	8.0					
			RG_LIDCOM5-INV	04-Apr-18	7.8					
			RG_LIDCOM6-INV	04-Apr-18	9.9					
			RG_LIDCOM7-INV	04-Apr-18	9.2					
			RG_LIDCOM8-INV	04-Apr-18	10.0					
			RG_LIDCOM9-INV	04-Apr-18	9.7					
			RG_LIDCOM10-INV	04-Apr-18	8.8					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LIDCOM (LC_LCC)	RG_LIDCOM1-INV	03-May-18	9.0	9.2	8.0	10.0	9.1	0.7
			RG_LIDCOM2-INV	03-May-18	8.0					
			RG_LIDCOM3-INV	03-May-18	8.1					
			RG_LIDCOM4-INV	03-May-18	9.6					
			RG_LIDCOM5-INV	03-May-18	9.3					
			RG_LIDCOM6-INV	03-May-18	8.7					
			RG_LIDCOM7-INV	03-May-18	8.9					
			RG_LIDCOM8-INV	03-May-18	10.0					
			RG_LIDCOM9-INV	03-May-18	9.8					
			RG_LIDCOM10-INV	03-May-18	10.0					
			RG_LIDCOM1-INV	28-May-18	8.3	9.4	6.3	12.0	9.4	1.7
			RG_LIDCOM2-INV	28-May-18	9.3					
			RG_LIDCOM3-INV	28-May-18	11.0					
			RG_LIDCOM4-INV	28-May-18	10.0					
			RG_LIDCOM5-INV	28-May-18	12.0					
			RG_LIDCOM6-INV	28-May-18	6.3					
			RG_LIDCOM7-INV	28-May-18	9.1					
			RG_LIDCOM8-INV	28-May-18	9.4					
			RG_LIDCOM9-INV	28-May-18	7.4					
			RG_LIDCOM10-INV	28-May-18	11.0					
			RG_LIDCOM1-INV	07-Sep-18	7.3	7.9	6.8	8.8	7.7	0.6
			RG_LIDCOM2-INV	07-Sep-18	8.3					
			RG_LIDCOM3-INV	07-Sep-18	7.0					
			RG_LIDCOM4-INV	07-Sep-18	7.7					
			RG_LIDCOM5-INV	07-Sep-18	8.0					
			RG_LIDCOM6-INV	07-Sep-18	7.0					
			RG_LIDCOM7-INV	07-Sep-18	8.0					
			RG_LIDCOM8-INV	07-Sep-18	6.8					
			RG_LIDCOM9-INV	07-Sep-18	8.8					
			RG_LIDCOM10-INV	07-Sep-18	8.0					
			RG_LIDCOM1-INV	06-Dec-18	6.9	7.3	5.9	8.6	7.4	0.8
			RG_LIDCOM2-INV	06-Dec-18	5.9					
			RG_LIDCOM3-INV	06-Dec-18	8.6					
			RG_LIDCOM4-INV	06-Dec-18	6.8					
			RG_LIDCOM5-INV	06-Dec-18	7.2					
			RG_LIDCOM6-INV	06-Dec-18	6.8					
			RG_LIDCOM7-INV	06-Dec-18	7.4					
			RG_LIDCOM8-INV	06-Dec-18	8.4					
			RG_LIDCOM9-INV	06-Dec-18	8.3					
			RG_LIDCOM10-INV	06-Dec-18	7.4					
			RG_LIDCOM1-INV	16-Jan-19	7.5	7.4	6.0	7.6	7.0	0.6
			RG_LIDCOM2-INV	16-Jan-19	7.3					
			RG_LIDCOM3-INV	16-Jan-19	6.6					
			RG_LIDCOM4-INV	16-Jan-19	7.4					
			RG_LIDCOM5-INV	16-Jan-19	7.5					
			RG_LIDCOM6-INV	16-Jan-19	6.6					
			RG_LIDCOM7-INV	16-Jan-19	7.4					
			RG_LIDCOM8-INV	16-Jan-19	7.6					
			RG_LIDCOM9-INV	16-Jan-19	6.4					
			RG_LIDCOM10-INV	16-Jan-19	6.0					
		RG_LI8 (LC_LC4)	RG_LI8-1-INV	10-Mar-18	6.4	7.1	4.3	8.8	6.9	1.4
			RG_LI8-2-INV	10-Mar-18	7.7					
			RG_LI8-3-INV	10-Mar-18	5.3					
			RG_LI8-4-INV	10-Mar-18	7.3					
			RG_LI8-5-INV	10-Mar-18	6.7					
			RG_LI8-6-INV	10-Mar-18	7.1					
			RG_LI8-7-INV	10-Mar-18	7.0					
			RG_LI8-8-INV	10-Mar-18	4.3					
			RG_LI8-9-INV	10-Mar-18	8.8					
			RG_LI8-10-INV	10-Mar-18	8.7					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LI8 (LC_LC4); Continued	RG_LI8-1-INV	05-Apr-18	11.0	9.9	8.5	11.0	10.0	0.9
			RG_LI8-2-INV	05-Apr-18	9.8					
			RG_LI8-3-INV	05-Apr-18	8.5					
			RG_LI8-4-INV	05-Apr-18	11.0					
			RG_LI8-5-INV	05-Apr-18	11.0					
			RG_LI8-6-INV	05-Apr-18	9.1					
			RG_LI8-7-INV	05-Apr-18	11.0					
			RG_LI8-8-INV	05-Apr-18	9.4					
			RG_LI8-9-INV	05-Apr-18	9.3					
			RG_LI8-10-INV	05-Apr-18	10.0					
			RG_LI8-1-INV	02-May-18	12.0	12.0	9.5	20.0	12.1	3.1
			RG_LI8-2-INV	02-May-18	20.0					
			RG_LI8-3-INV	02-May-18	13.0					
			RG_LI8-4-INV	02-May-18	13.0					
			RG_LI8-5-INV	02-May-18	9.6					
			RG_LI8-6-INV	02-May-18	9.5					
			RG_LI8-7-INV	02-May-18	9.6					
			RG_LI8-8-INV	02-May-18	12.0					
			RG_LI8-9-INV	02-May-18	12.0					
			RG_LI8-10-INV	02-May-18	10.0					
			RG_LI8-1-INV	28-May-18	9.0	8.6	5.8	11.0	8.6	1.3
			RG_LI8-2-INV	28-May-18	9.2					
			RG_LI8-3-INV	28-May-18	11.0					
			RG_LI8-4-INV	28-May-18	8.4					
			RG_LI8-5-INV	28-May-18	7.5					
			RG_LI8-6-INV	28-May-18	5.8					
			RG_LI8-7-INV	28-May-18	8.5					
			RG_LI8-8-INV	28-May-18	8.6					
			RG_LI8-9-INV	28-May-18	8.2					
			RG_LI8-10-INV	28-May-18	9.4					
			RG_LI8-1-INV	13-Sep-18	9.0	9.0	8.2	10.0	9.0	0.5
			RG_LI8-2-INV	13-Sep-18	8.2					
			RG_LI8-3-INV	13-Sep-18	10.0					
			RG_LI8-4-INV	13-Sep-18	9.0					
			RG_LI8-5-INV	13-Sep-18	9.0					
			RG_LI8-6-INV	13-Sep-18	9.0					
			RG_LI8-7-INV	13-Sep-18	9.2					
			RG_LI8-8-INV	13-Sep-18	8.5					
			RG_LI8-9-INV	13-Sep-18	8.7					
			RG_LI8-10-INV	13-Sep-18	9.3					
			RG_LI8-1-INV	06-Dec-18	6.3	7.1	5.8	8.4	7.2	0.9
			RG_LI8-2-INV	06-Dec-18	6.8					
			RG_LI8-3-INV	06-Dec-18	5.8					
			RG_LI8-4-INV	06-Dec-18	7.4					
			RG_LI8-5-INV	06-Dec-18	6.8					
			RG_LI8-6-INV	06-Dec-18	8.2					
			RG_LI8-7-INV	06-Dec-18	8.4					
			RG_LI8-8-INV	06-Dec-18	8.3					
			RG_LI8-9-INV	06-Dec-18	6.7					
			RG_LI8-10-INV	06-Dec-18	7.4					
			RG_LI8-1-INV	16-Jan-19	6.4	5.7	5.0	6.7	5.8	0.6
			RG_LI8-2-INV	16-Jan-19	5.1					
			RG_LI8-3-INV	16-Jan-19	5.7					
			RG_LI8-4-INV	16-Jan-19	6.7					
			RG_LI8-5-INV	16-Jan-19	5.0					
			RG_LI8-6-INV	16-Jan-19	5.6					
			RG_LI8-7-INV	16-Jan-19	5.8					
			RG_LI8-8-INV	16-Jan-19	5.4					
			RG_LI8-9-INV	16-Jan-19	6.6					
			RG_LI8-10-INV	16-Jan-19	5.2					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Fording River	Mine-exposed	RG_FRUL (LC_LC6)	RG_FRUL1-INV	11-Mar-18	6.5	6.6	5.7	7.9	6.9	0.8
			RG_FRUL2-INV	11-Mar-18	7.9					
			RG_FRUL3-INV	11-Mar-18	6.5					
			RG_FRUL4-INV	11-Mar-18	6.6					
			RG_FRUL5-INV	11-Mar-18	6.6					
			RG_FRUL6-INV	11-Mar-18	7.7					
			RG_FRUL7-INV	11-Mar-18	7.9					
			RG_FRUL8-INV	11-Mar-18	5.7					
			RG_FRUL9-INV	11-Mar-18	7.1					
			RG_FRUL10-INV	11-Mar-18	6.2					
			RG_FRUL1-INV	02-May-18	7.4	7.9	6.6	10.0	8.1	1.2
			RG_FRUL2-INV	02-May-18	8.2					
			RG_FRUL3-INV	02-May-18	10.0					
			RG_FRUL4-INV	02-May-18	7.1					
			RG_FRUL5-INV	02-May-18	7.6					
			RG_FRUL6-INV	02-May-18	6.6					
			RG_FRUL7-INV	02-May-18	6.7					
			RG_FRUL8-INV	02-May-18	8.8					
			RG_FRUL9-INV	02-May-18	8.2					
			RG_FRUL10-INV	02-May-18	10.0					
			RG_FRUL1-INV	09-Sep-18	12.0	11.0	10.0	13.0	11.3	0.8
			RG_FRUL2-INV	09-Sep-18	10.0					
			RG_FRUL3-INV	09-Sep-18	11.0					
			RG_FRUL4-INV	09-Sep-18	11.0					
			RG_FRUL5-INV	09-Sep-18	11.0					
			RG_FRUL6-INV	09-Sep-18	13.0					
			RG_FRUL7-INV	09-Sep-18	12.0					
			RG_FRUL8-INV	09-Sep-18	11.0					
			RG_FRUL9-INV	09-Sep-18	11.0					
			RG_FRUL10-INV	09-Sep-18	11.0					
			RG_FRUL1-INV	05-Dec-18	8.6	9.7	8.2	12.0	9.8	1.1
			RG_FRUL2-INV	05-Dec-18	10.0					
			RG_FRUL3-INV	05-Dec-18	12.0					
			RG_FRUL4-INV	05-Dec-18	8.2					
			RG_FRUL5-INV	05-Dec-18	9.7					
			RG_FRUL6-INV	05-Dec-18	9.1					
			RG_FRUL7-INV	05-Dec-18	9.6					
			RG_FRUL8-INV	05-Dec-18	9.4					
			RG_FRUL9-INV	05-Dec-18	11.0					
			RG_FRUL10-INV	05-Dec-18	10.0					
			RG_FRUL1-INV	15-Jan-19	10.0	6.9	6.4	10.0	7.5	1.44
			RG_FRUL2-INV	15-Jan-19	6.4					
			RG_FRUL3-INV	15-Jan-19	6.9					
			RG_FRUL4-INV	15-Jan-19	6.8					
			RG_FRUL5-INV	15-Jan-19	7.3					
		RG_FO23 (LC_LC5)	RG_F023-1-INV	11-Mar-18	6.3	6.3	5.2	7.2	6.4	0.6
			RG_F023-2-INV	11-Mar-18	5.2					
			RG_F023-3-INV	11-Mar-18	6.3					
			RG_F023-4-INV	11-Mar-18	6.0					
			RG_F023-5-INV	11-Mar-18	6.1					
			RG_F023-6-INV	11-Mar-18	6.1					
			RG_F023-7-INV	11-Mar-18	6.5					
			RG_F023-8-INV	11-Mar-18	6.7					
			RG_F023-9-INV	11-Mar-18	7.1					
			RG_F023-10-INV	11-Mar-18	7.2					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.4: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, March 2018 to January 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Fording River	Mine-Exposed	RG_FO23 (LC_LC5); Continued	RG_F023-1-INV	05-Apr-18	8.7	7.8	7.0	9.1	7.9	0.7
			RG_F023-2-INV	05-Apr-18	7.7					
			RG_F023-3-INV	05-Apr-18	9.1					
			RG_F023-4-INV	05-Apr-18	7.4					
			RG_F023-5-INV	05-Apr-18	7.3					
			RG_F023-6-INV	05-Apr-18	7.4					
			RG_F023-7-INV	05-Apr-18	7.0					
			RG_F023-8-INV	05-Apr-18	7.9					
			RG_F023-9-INV	05-Apr-18	7.9					
			RG_F023-10-INV	05-Apr-18	8.1					
			RG_F023-1-INV	30-Apr-18	12.0	8.1	7.1	12.0	8.7	1.5
			RG_F023-2-INV	30-Apr-18	7.1					
			RG_F023-3-INV	30-Apr-18	10.0					
			RG_F023-4-INV	30-Apr-18	9.4					
			RG_F023-5-INV	30-Apr-18	8.0					
			RG_F023-6-INV	30-Apr-18	7.9					
			RG_F023-7-INV	30-Apr-18	8.1					
			RG_F023-8-INV	30-Apr-18	7.3					
			RG_F023-9-INV	30-Apr-18	9.7					
			RG_F023-10-INV	30-Apr-18	7.6					
			RG_F023-1-INV	29-May-18	8.5	7.4	6.7	8.8	7.6	0.8
			RG_F023-2-INV	29-May-18	6.7					
			RG_F023-3-INV	29-May-18	6.9					
			RG_F023-4-INV	29-May-18	7.2					
			RG_F023-5-INV	29-May-18	7.6					
			RG_F023-6-INV	29-May-18	7.1					
			RG_F023-7-INV	29-May-18	6.7					
			RG_F023-8-INV	29-May-18	8.4					
			RG_F023-9-INV	29-May-18	8.8					
			RG_F023-10-INV	29-May-18	8.3					
			RG_F023-1-INV	08-Sep-18	11.0	10.0	6.8	11.0	9.4	1.6
			RG_F023-2-INV	08-Sep-18	11.0					
			RG_F023-3-INV	08-Sep-18	6.8					
			RG_F023-4-INV	08-Sep-18	7.3					
			RG_F023-5-INV	08-Sep-18	9.9					
			RG_F023-6-INV	08-Sep-18	10.0					
			RG_F023-7-INV	08-Sep-18	11.0					
			RG_F023-8-INV	08-Sep-18	9.0					
			RG_F023-9-INV	08-Sep-18	7.8					
			RG_F023-10-INV	08-Sep-18	10.0					
			RG_F023-1-INV	05-Dec-18	9.5	9.9	7.2	12.0	9.8	1.4
			RG_F023-2-INV	05-Dec-18	9.5					
			RG_F023-3-INV	05-Dec-18	9.9					
			RG_F023-4-INV	05-Dec-18	11.0					
			RG_F023-5-INV	05-Dec-18	11.0					
			RG_F023-6-INV	05-Dec-18	8.1					
			RG_F023-7-INV	05-Dec-18	10.0					
			RG_F023-8-INV	05-Dec-18	12.0					
			RG_F023-9-INV	05-Dec-18	7.2					
			RG_F023-10-INV	05-Dec-18	9.9					
			RG_F023-1-INV	15-Jan-19	6.1	7.3	6.1	8.7	7.3	0.9
			RG_F023-2-INV	15-Jan-19	6.9					
			RG_F023-3-INV	15-Jan-19	8.7					
			RG_F023-4-INV	15-Jan-19	7.5					
			RG_F023-5-INV	15-Jan-19	7.0					
			RG_F023-6-INV	15-Jan-19	8.0					
			RG_F023-7-INV	15-Jan-19	8.5					
			RG_F023-8-INV	15-Jan-19	6.2					
			RG_F023-9-INV	15-Jan-19	7.0					
			RG_F023-10-INV	15-Jan-19	7.5					
		RG_FO9	RG_FO9-1-INV	05-Dec-18	7.0	7.3	4.7	12.0	7.4	1.8
			RG_FO9-2-INV	05-Dec-18	12.0					
			RG_FO9-3-INV	05-Dec-18	7.0					
			RG_FO9-4-INV	05-Dec-18	6.2					
			RG_FO9-5-INV	05-Dec-18	6.9					
			RG_FO9-6-INV	05-Dec-18	7.5					
			RG_FO9-7-INV	05-Dec-18	7.8					
			RG_FO9-8-INV	05-Dec-18	4.7					
			RG_FO9-9-INV	05-Dec-18	7.5					
			RG_FO9-10-INV	05-Dec-18	7.8					

Notes: Tissue selenium concentrations are displayed starting in March 2018. Results from 2018 collected prior to March were presented in the 2017 Line Creek LAEMP report (Minnow 2018). Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24. RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled.

Table B.5: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_LCUT Relative to Reference Areas (RG_LI24 and RG_SLINE)

Term	DF	F-Ratio	P-Value
Period	2	31.5	<0.001
CI	1	80.9	<0.001
Period×CI	2	1.66	0.194
Time(Period)	5	5.97	<0.001
Time(Period)×CI	5	1.71	0.136
Error	159		

(grey)	P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1
(blue)	Contrast P-value < 0.1 and in an increasing direction.
(green)	Contrast P-value < 0.1 and in a decreasing direction.

Notes: Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

Table B.6: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Before (B), Initial Operation (IO), Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_LILC3 Relative to Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	4	45.3	<0.001
CI	1	1,161	<0.001
Period×CI	4	68.3	<0.001
Time(Period)	5	2.07	0.071
Time(Period)×CI	5	15.3	<0.001
Error	162		

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[a]**
B(2012)	IO	0.013	-
	SS(2016)	<0.001	9.1 SD
	SS(4-2017)	<0.001	9.0 SD
	SS(9-2017)	<0.001	6.1 SD
	SD(3-2018)	0.014	-
	SD(5-2018)	0.002	4.2 SD
	SD(9-2018)	0.771	-
	RS(2018)	0.438	-
	RS(2019)	0.114	-
IO	SS(2016)	0.007	-
	SS(4-2017)	<0.001	4.7 SD
	SS(9-2017)	0.174	-
	SD(3-2018)	0.388	-
	SD(5-2018)	0.872	-
	SD(9-2018)	0.002	-4.0 SD
	RS(2018)	0.010	-
	RS(2019)	0.081	-
SS (2016)	SD(3-2018)	<0.001	-5.9 SD
	SD(5-2018)	<0.001	-4.9 SD
	SD(9-2018)	<0.001	-8.7 SD
	RS(2018)	<0.001	-8.1 SD
	RS(2019)	<0.001	-7.0 SD
SS (4-2017)	SD(3-2018)	<0.001	-5.8 SD
	SD(5-2018)	<0.001	-4.9 SD
	SD(9-2018)	<0.001	-8.6 SD
	RS(2018)	<0.001	-8.0 SD
	RS(2019)	<0.001	-6.9 SD
SS (9-2017)	SD(3-2018)	<0.001	-2.9 SD
	SD(5-2018)	0.001	-2.0 SD
	SD(9-2018)	<0.001	-5.7 SD
	RS(2018)	<0.001	-5.1 SD
	RS(2019)	<0.001	-4.0 SD
RS(2018)	SD(3-2018)	<0.001	2.2 SD
	SD(5-2018)	<0.001	3.2 SD
	SD(9-2018)	0.250	-
RS(2019)	SD(3-2018)	0.068	-
	SD(5-2018)	0.001	2.1 SD
	SD(9-2018)	0.004	-

(grey) P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.
(blue) Contrast P-value < 0.1/38 and in an increasing direction.
(green) Contrast P-value < 0.1/38 and in a decreasing direction.

Notes: SD = standard deviation. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error. Analysis also excluded all results from 2015.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.7: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_LISP24 Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	2	46.6	<0.001
CI	1	261	<0.001
Period×CI	2	49.1	<0.001
Time(Period)	3	7.82	<0.001
Time(Period)×CI	3	4.67	0.004
Error	141		

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[a]**
SS (9-2017)	SD(3-2018)	<0.001	-4.3 SD
	SD(5-2018)	<0.001	-3.1 SD
	SD(9-2018)	<0.001	-5.2 SD
	RS(2018)	<0.001	-4.4 SD
	RS(2019)	<0.001	-3.9 SD
RS(2018)	SD(3-2018)	0.820	-
	SD(5-2018)	0.028	-
	SD(9-2018)	0.132	-
RS(2019)	SD(3-2018)	0.546	-
	SD(5-2018)	0.211	-
	SD(9-2018)	0.024	-

(grey) P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1.
(blue) Contrast P-value < 0.1/11 and in an increasing direction.
(green) Contrast P-value < 0.1/11 and in a decreasing direction.

Notes: SD = standard deviation. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.8: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Before (B), Initial Operation (IO), Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_LIDSL Relative to Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	4	15.2	<0.001
CI	1	255	<0.001
Period×CI	4	26.4	<0.001
Time(Period)	5	8.24	<0.001
Time(Period)×CI	5	3.84	0.003
Error	162		

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[a]**
B(2012)	IO	0.133	-
	SS(2016)	0.012	-
	SS(4-2017)	0.108	-
	SS(9-2017)	0.046	-
	SD(3-2018)	0.354	-
	SD(5-2018)	0.819	-
	SD(9-2018)	0.114	-
	RS(2018)	0.607	-
	RS(2019)	0.631	-
IO	SS(2016)	0.301	-
	SS(4-2017)	0.697	-
	SS(9-2017)	0.980	-
	SD(3-2018)	0.004	-
	SD(5-2018)	0.078	-
	SD(9-2018)	<0.001	-4.6 SD
	RS(2018)	0.012	-
	RS(2019)	0.014	-
SS (2016)	SD(3-2018)	<0.001	-5.6 SD
	SD(5-2018)	0.002	-4.1 SD
	SD(9-2018)	<0.001	-6.4 SD
	RS(2018)	<0.001	-5.1 SD
	RS(2019)	<0.001	-5.0 SD
SS (4-2017)	SD(3-2018)	<0.001	-3.3 SD
	SD(5-2018)	0.005	-
	SD(9-2018)	<0.001	-4.1 SD
	RS(2018)	<0.001	-2.8 SD
	RS(2019)	<0.001	-2.7 SD
SS (9-2017)	SD(3-2018)	<0.001	-3.8 SD
	SD(5-2018)	<0.001	-2.3 SD
	SD(9-2018)	<0.001	-4.6 SD
	RS(2018)	<0.001	-3.2 SD
	RS(2019)	<0.001	-3.2 SD
RS(2018)	SD(3-2018)	0.353	-
	SD(5-2018)	0.106	-
	SD(9-2018)	0.012	-
RS(2019)	SD(3-2018)	0.356	-
	SD(5-2018)	0.145	-
	SD(9-2018)	0.018	-

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

(blue) Contrast P-value < 0.1 and in an increasing direction.

(green) Contrast P-value < 0.1 and in a decreasing direction.

Notes: SD = standard deviation. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error. Analysis also excluded all results from 2015.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.9: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_LIDCOM Relative to Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	2	20.1	<0.001
CI	1	172	<0.001
Period×CI	2	7.09	0.001
Time(Period)	3	4.87	0.003
Time(Period)×CI	3	4.52	0.005
Error	141	-	

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[a]**
SS (9-2017)	SD(3-2018)	0.044	-
	SD(5-2018)	0.242	-
	SD(9-2018)	<0.001	-2.6 SD
	RS(2018)	0.055	-
	RS(2019)	0.567	-
RS(2018)	SD(3-2018)	0.808	-
	SD(5-2018)	0.540	-
	SD(9-2018)	0.005	-1.6 SD
RS(2019)	SD(3-2018)	0.175	-
	SD(5-2018)	0.574	-
	SD(9-2018)	<0.001	-2.3 SD

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

(blue) Contrast P-value < 0.1/11 and in an increasing direction.

(green) Contrast P-value < 0.1/11 and in a decreasing direction.

Notes: SD = standard deviation. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.10: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Before (B), Initial Operation (IO), Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_LI8 Relative to Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	4	19	<0.001
CI	1	313	<0.001
Period×CI	4	9	<0.001
Time(Period)	5	13	<0.001
Time(Period)×CI	5	5	<0.001
Error	162		

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[a]**
B(2012)	IO	0.766	-
	SS(2016)	0.054	-
	SS(4-2017)	0.253	-
	SS(9-2017)	0.112	-
	SD(3-2018)	0.529	-
	SD(5-2018)	0.216	-
	SD(9-2018)	0.518	-
	RS(2018)	0.892	-
	RS(2019)	0.779	-
IO	SS(2016)	0.103	-
	SS(4-2017)	0.454	-
	SS(9-2017)	0.234	-
	SD(3-2018)	0.306	-
	SD(5-2018)	0.399	-
	SD(9-2018)	0.295	-
	RS(2018)	0.591	-
	RS(2019)	0.499	-
SS (2016)	SD(3-2018)	0.002	-4.2 SD
	SD(5-2018)	0.184	-
	SD(9-2018)	0.001	-4.2 SD
	RS(2018)	0.007	-
	RS(2019)	0.005	-
SS (4-2017)	SD(3-2018)	<0.001	-2.3 SD
	SD(5-2018)	0.847	-
	SD(9-2018)	<0.001	-2.3 SD
	RS(2018)	0.005	-
	RS(2019)	0.004	-
SS (9-2017)	SD(3-2018)	<0.001	-2.9 SD
	SD(5-2018)	0.465	-
	SD(9-2018)	<0.001	-2.9 SD
	RS(2018)	<0.001	-2.2 SD
	RS(2019)	<0.001	-2.4 SD
RS(2018)	SD(3-2018)	0.275	-
	SD(5-2018)	0.003	-
	SD(9-2018)	0.228	-
RS(2019)	SD(3-2018)	0.472	-
	SD(5-2018)	0.002	2.0 SD
	SD(9-2018)	0.430	-

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

(blue) Contrast P-value < 0.1 and in an increasing direction.

(green) Contrast P-value < 0.1 and in a decreasing direction.

Notes: SD = standard deviation. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error. Analysis also excluded all results from 2015.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.11: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Before (B), Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_FRUL Relative to Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	3	15.3	<0.001
CI	1	282	<0.001
Period×CI	3	4.58	0.004
Time(Period)	4	18.4	<0.001
Time(Period)×CI	4	1.14	0.340
Error	155		

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[a]**
B	SS	0.934	-
	SD	0.598	-
	RS	0.366	-
SS	SD	0.043	-
	RS	0.016	1.0 SD
SD	RS	<0.001	1.8 SD

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

Contrast P-value < 0.1/6 and in an increasing direction.

Contrast P-value < 0.1/6 and in a decreasing direction.

Notes: SD = standard deviation. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error. Analysis also excluded all results from 2015.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.12: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Concentrations During the Before (B), Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_FO23 Relative to Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	3	11.9	<0.001
CI	1	261	<0.001
Period×CI	3	7.96	<0.001
Time(Period)	5	14.0	<0.001
Time(Period)×CI	5	1.05	0.392
Error	161		

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[a]**
B	SS	0.677	-
	SD	0.592	-
	RS	0.349	-
SS	SD	0.001	-1.2 SD
	RS	0.105	-
SD	RS	<0.001	1.9 SD

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

(blue) Contrast P-value < 0.1/6 and in an increasing direction.

(green) Contrast P-value < 0.1/6 and in a decreasing direction.

Notes: SD = standard deviation. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error. Analysis also excluded all results from 2015.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.13: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium During the Before (B), Steady State (SS), Shut Down (SD), and Restart (RS) Periods at RG_FO23 (Impacted) Relative to RG_FRUL (Upstream Control)

ANOVA Model			
Term	DF	F-Ratio	P-Value
Period	3	6	<0.001
CI	1	1	0.284
Period×CI	3	1	0.532
Time(Period)	4	37	<0.001
Time(Period)×CI	4	3	0.038
Error	121	-	

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD**[a]
B (2012)	SS(4-2017)	0.933	-
	SS(9-2017)	0.524	-
	SD(3-2018)	0.945	-
	SD(5-2018)	0.527	-
	SD(9-2018)	0.531	-
	RS(2018)	0.770	-
	RS(2019)	0.821	-
SS (4-2017)	SD(3-2018)	0.720	-
	SD(5-2018)	0.199	-
	SD(9-2018)	0.098	-
	RS(2018)	0.624	-
	RS(2019)	0.756	-
SS (9-2017)	SD(3-2018)	0.099	-
	SD(5-2018)	0.993	-
	SD(9-2018)	0.004	-1.9 SD
	RS(2018)	0.419	-
	RS(2019)	0.396	-
RS(2018)	SD(3-2018)	0.397	-
	SD(5-2018)	0.424	-
	SD(9-2018)	0.033	-
RS(2019)	SD(3-2018)	0.529	-
	SD(5-2018)	0.400	-
	SD(9-2018)	0.074	-

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

(blue) Contrast P-value < 0.1/23 and in an increasing direction.

(green) Contrast P-value < 0.1/23 and in a decreasing direction.

Notes: SD = standard deviation. Analysis also excluded all results from 2015.

[a] Magnitude of difference (MOD) calculated as (Period 2 − Period 1)/SD×100%.

Table B.14: Results Table for the ANOVA Model Comparing Benthic Invertebrate Selenium Between Steady State (SS), Initial Operation (IO), Shut Down (SD) and Restart (RS) Period for the RG_LILC3 Area Relative to the Reference (RG_LI24 and RG_SLINE) Areas

ANOVA Model			
Term	**DF**	**F-Ratio**	**P-Value**
Period	4	45.3	<0.001
CI	1	1,161	<0.001
Period×CI	4	68.3	<0.001
Time(Period)	5	2.07	0.071
Time(Period)×CI	5	15.3	<0.001
Error	162	-	

Contrasts (P-value and Magnitude of Difference) [a]				
Period 1	**Period 2**	**Weeks after SD (Period 2)**	**P-value**	**MOD**
SS	SD(3-2018)	0	<0.001	-4.3 SD
	SD(5-2018)	8	<0.001	-3.4 SD
	SD(9-2018)	26	<0.001	-7.1 SD
SD(3-2018)	SD(5-2018)	8	0.148	-
	SD(9-2018)	26	<0.001	-2.9 SD
SD (5-2018)	SD(9-2018)	26	<0.001	-3.8 SD

Grey	P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1
Blue	Contrast P-value < 0.1/6 and in an increasing direction
Green	Contrast P-value < 0.1/6 and in a decreasing direction

Notes: Contrasts only shown for comparisons of SS and SD, and among SD periods to highlight the changes in tissue concentrations after Active Water Treatment Facility (AWTF) shutdown.

Table B.15. **Temporal Changes in Aqueous Total Selenium at LC_LC1 (Reference Area) in Line Creek, 2012 - 2018**

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 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2018 vs. 2012-2017	2018 vs. 2017
Total Selenium	Reference	LC_LC1 no outlier [d]	6	<0.001	b	8.0	15.5	32.3	40	50	53	D	CD	C	B	AB	A	A	-	-
		LC_LC1 with outlier	6	0.049	b	-13.2	-7.2	6	14	22	23	A	A	A	A	A	A	A	-	-

(grey)	P-value < 0.05 (annual variation)
(very light blue)	> 25% Increase in concentration
(light blue)	> 50% Increase in concentration
(medium blue)	> 25% Increase in concentration
(dark blue)	> 50% Increase in concentration
*** Bold**	Significant increase or decrease from base year (b)

Notes: Values shaded in blue are significantly greater than all historical years (or 2017). "-" = no data/not recorded.

[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] One outlier with a value of 0.031 mg/L in May 2012 was removed from the analysis.

Table B.16: Meristics and Tissue Selenium Concentrations for Bull Trout Sampled from Line Creek, 2006 to 2018

AWTF Operation Phase	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Gonad Weight	Liver Weight	Sex[a]	Life Stage	Age	Tissue Selenium Concentration (mg/kg dw)			
			Easting	Northing				(cm)	(cm)	(g)	(g)	(g)				Muscle	Ovary	Ovary (Estimated[b])	Liver
Prior to AWTF Operation	RG_LI8	2006	656892	5529139	Minnow et al. 2007	23-Aug-06	LI8101	-	74.0	4,309	-	-	M	A	-	4.7	-	-	-
	RG_LI8	2006	656892	5529139		23-Aug-06	LI8102	-	63.3	2,948	-	-	F	A	-	4.0	-	13	-
	RG_LI8	2006	656892	5529139		23-Aug-06	LI8103	-	63.5	2,722	-	-	F	A	-	3.1	-	10	-
	RG_LI8	2006	656892	5529139		23-Aug-06	LI8104	-	23.3	162	-	-	U	J	-	4.4	-	-	-
AWTF Steady State Operation	RG_LILC3	2017	659887	5531590	2017 LC LAEMP (Minnow 2018d)	27-Apr-17	LILC3-ST-01	40.0	38.5	550	-	-	-	J	-	26	-	-	-
	RG_LIDCOM	2017	658185	5529820		10-Sep-17	LIDCOM-BT-07	77.6	75.2	4,220	49	37	M	A	10	5.6	-	-	30
	RG_LIDCOM	2017	658185	5529820		11-Sep-17	LIDCOM-BT-11	65.9	63.2	2,660	356	23	F	A	-	4.8	16	-	-
	RG_LIDCOM	2017	658185	5529820		11-Sep-17	LIDCOM-BT-12	73.6	68.5	3,160	-	-	F	A	-	4.4	16	-	-
	RG_LILC3	2017	659892	5531560		10-Sep-17	LILC3-BT-06	63.1	60.5	2,260	356	23	F	A	8	4.8	12	-	16
	RG_LILC3	2017	659892	5531560		11-Sep-17	LILC3-BT-08	61.8	60.0	2,080	-	-	F	A	-	3.9	14	-	-
	RG_LILC3	2017	659892	5531560		11-Sep-17	LILC3-BT-10	63.2	61.9	1,840	-	-	F	A	-	4.5	15	-	-
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-01	25.5	24.2	146	0.8	1.7	M	YM	3	21	-	-	58
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-02	27.9	26.6	210	1.1	2.8	M	YM	3	19	-	-	65
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-03	27.8	26.1	199	1.0	3.0	M	YM	3	28	-	-	61
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-04	28.0	26.6	209	0.9	2.5	M	YM	3	20	-	-	63
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-05	32.3	30.9	342	0.9	4.9	M	YM	4	27	-	-	100
AWTF Shutdown	RG_LILC3	2018	659880	5531582	2018 LC LAEMP	30-Apr-18	LILC3-BT-01	45.9	44.1	800	-	-	M	YM	-	21	-	-	-
	RG_LILC3	2018	659880	5531582		2-May-18	LILC3-BT-02	44.0	42.0	939	-	-	M	YM	-	45	-	-	-
	RG_LILC3	2018	659880	5531582		2-May-18	LILC3-BT-03	26.6	25.5	155	-	-	U	J	-	37	-	-	-
	RG_LILC3	2018	659880	5531582		3-May-18	LILC3-BT-04	39.3	37.7	669	-	-	U	J	-	46	-	-	-
	Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_BT-1-M_20180821	-	20.2	87.0	-	-	U	J	-	7.6	-	-	-

Ovary selenium concentration exceeding the Level 1 site-specific benchmark for "other fish" of 18 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the US EPA Effect Concentration (EC10) of 56.2 mg/kg dw for Dolly Varden trout (USEPA 2016).

[a] F = female, M = male; U = unknown, sex of fish could not be determined, either because fish was not sufficiently mature or samples were collected non-lethally. A = adult; J = juvenile; YM = young male.

[b] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 3.3:1 (Minnow 2018). Ovary selenium was estimated only for adult individuals lacking measured ovary concentrations if female or if sex of an adult individual was unknown because sampling was non-lethal.

Table B.17: Meristics and Tissue Selenium Concentrations for Westslope Cutthroat Trout Sampled from Line Creek, 2001 to 2018

AWTF Operation Phase	Waterbody	Area	Year	Capture Location UTM (NAD83, 11U) Easting	Northing	Study	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Sex[a]	Age	Tissue Selenium (mg/kg dw) Muscle	Gonad	Ovary	Estimated Ovary [b]
Prior to AWTF Operation	Line Creek	RG_LI8	2001	654480	5529034	Golder 2005	Apr-2001	L1-1	-	34.0	530	M	5	9.2	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-2	-	32.0	475	M	3	8.1	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-4	-	34.6	680	M	4	8.5	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-3	-	36.1	725	F	4	8.4	15	15	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-5	-	32.9	550	F	4	9.8	16	16	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-6	-	32.5	500	F	5	8.5	16	16	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-1	-	38.5	780	M	7	8.0	5.0	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-2	-	39.0	750	F	7	16	20	20	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-3	-	34.7	615	F	5	7.0	14	14	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-4	-	32.5	480	F	6	8.0	19	19	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-5	-	34.5	550	F	7	7.0	14	14	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-6	-	37.8	785	F	6	7.0	14	14	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-7	-	38.5	850	F	7	9.0	16	16	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-8	-	33.6	525	F	6	7.0	13	13	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-9	-	30.1	400	F	5	7.0	14	14	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-10	-	37.8	675	F	6	8.0	14	14	-
		RG_LIDSL	2003	659281	5530548	Minnow 2004	Jul-2003	LC-CT1	-	39.1	800	M	6	7.2	-	-	-
		RG_LIDSL	2003	659281	5530548		Jul-2003	LC-CT2	-	34.8	700	F	4	6.4	-	-	10
		RG_LIDSL	2003	659281	5530548		Jul-2003	LC-CT3	-	31.5	470	F	4	7.4	-	-	12
		RG_LI8	2006	657406	5529218	Minnow et al. 2007	Apr-2006	LI8001	-	30.6	435	F	5	7.9	11	11	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8002	-	31.7	427	F	5	7.7	11	11	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8003	-	27.4	288	F	5	7.4	21	21	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8004	-	21.4	132	F	6	15	11	11	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8005	-	20.5	117	F	5	13	15	15	-
		RG_LI8	2009	657406	5529218	Minnow et al. 2011	Sep-2009	LI8a	-	30.5	435	F	5	12	-	-	18
		RG_LI8	2009	657406	5529218		Sep-2009	LI8b	-	28.8	327	F	6	11	-	-	17
		RG_LI8	2009	657406	5529218		Sep-2009	LI8c	-	22.1	184	F	6	11	-	-	18
		RG_LI8	2009	657406	5529218		Sep-2009	LI8d	-	21.2	112	F	4	14	-	-	22
		RG_LI8	2009	657406	5529218		Sep-2009	LI8e	-	21.3	132	F	4	13	-	-	21
		RG_LILC3	2012	660085	5532021	Minnow 2014	24-May-12	LILC3-WCT1	-	21.1	135	F	-	10	-	-	16
		RG_LILC3	2012	660085	5532021		24-May-12	LILC3-WCT2	-	18.2	63	U	-	7.2	-	-	12
		RG_LILC3	2012	660085	5532021		24-May-12	LILC3-WCT3	-	18.0	58	U	-	9.2	-	-	15
		RG_LILC3	2012	660085	5532021		24-May-12	LILC3-WCT4	-	17.7	57	U	-	6.8	-	-	11
		RG_LILC3	2012	660085	5532021		1-Jun-12	LILC3-WCT5	-	20.0	79	M	-	6.6	-	-	-

Muscle selenium concentration exceeding the site-specific benchmark for WCT of 15.5 mg/kg dw (Nautilus and Interior Reforestation 2011).

Ovary selenium concentration exceeding the Level 1 site-specific benchmark (equivalent of EC_{10}) for WCT of 25 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 2 site-specific benchmark (equivalent of EC_{20}) for WCT of 27 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 3 site-specific benchmark (equivalent of EC_{50}) for WCT of 33 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

[a] F = female, M = male; U = unknown, sex of fish could not be determined, either because fish was not sufficiently mature or samples were collected non-lethally.

[b] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation (2011). Ovary selenium was estimated only for individuals lacking measured ovary concentrations if female or if sex was unknown because sampling was non-lethal.

Table B.17: Meristics and Tissue Selenium Concentrations for Westslope Cutthroat Trout Sampled from Line Creek, 2001 to 2018

AWTF Operation Phase	Waterbody	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Sex[a]	Age	Tissue Selenium (mg/kg dw)			
				Easting	Northing				(cm)	(cm)	(g)			Muscle	Gonad	Ovary	Estimated Ovary [b]
AWTF Steady State Operation	Line Creek	RG_LI8	2017	655320	5529059	2017 LCO LAEMP (Minnow 2018d)	7-Sep-17	LI8-WCT-01	36.7	35.1	645	U	-	6.9	-	-	11
		RG_LI8	2017	655320	5529059		7-Sep-17	LI8-WCT-02	44.6	42.8	1,005	U	-	7.8	-	-	12
		RG_LI8	2017	655320	5529059		7-Sep-17	LI8-WCT-03	32.1	30.4	382	U	-	7.8	-	-	12
		RG_LI8	2017	655320	5529059		8-Sep-17	LI8-WCT-04	40.1	38.7	750	U	-	7.8	-	-	12
		RG_LI8	2017	655320	5529059		8-Sep-17	LI8-WCT-05	31.7	30.5	355	U	-	8.6	-	-	14
		RG_LIDCOM	2017	658185	5529820		28-Apr-17	LIDCOM-WCT-01	36.5	35.5	570	U	-	12	-	-	20
		RG_LIDSL	2017	659293	5530590		26-Apr-17	LIDSL-WCT-01	27.0	26.5	220	U	-	25	-	-	40
		RG_LIDSL	2017	659293	5530590		8-Sep-17	LIDSL-WCT-01	41.4	39.8	885	U	-	34	-	-	54
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-02	30.7	29.4	345	U	-	26	-	-	42
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-03	26.2	25.3	230	U	-	14	-	-	22
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-04	27.4	26.2	230	U	-	24	-	-	38
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-05	23.4	22.2	122	U	-	42	-	-	67
AWTF Shutdown	Line Creek	RG_LIDCOM	2018	658135	5529841	2018 LCO LAEMP	30-Apr-18	LIDCOM-WCT-01	35.2	34.6	450	U	-	14	-	-	22
		RG_LIDSL	2018	659232	5530500		20-Aug-18	RG_LIDSL_WCT-2-M_20180820	-	17.8	83	U	-	11	-	-	18
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-2-M_20180821	-	19.5	99	U	-	7.9	-	-	13
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-3-M_20180821	-	30.3	315	U	-	8.7	-	-	14
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-4-M_20180821	-	32	414	U	-	9.8	-	-	16
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-5-M_20180821	-	24.6	182	U	-	8.8	-	-	14
		RG_LIDCOM	2018	658185	5529798		12-Sep-18	RG_LIDCOM_WCT-1-M_20180912	30.4	29.1	345	U	-	25	-	-	40
		RG_LI8	2018	654584	5529020		12-Sep-18	RG_LI8_WCT-1-M_20180912	26.2	24.9	210	U	-	9.5	-	-	15
	Fording River	RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-1-M_20180905	40.0	38.5	710	U	-	10	-	-	16
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-2-M_20180905	41.4	38.8	730	U	-	7.2	-	-	12
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-3-M_20180905	34.9	33.4	455	U	-	7.0	-	-	11
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-4-M_20180905	32.4	30.3	310	U	-	9.5	-	-	15
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-5-M_20180905	22.7	21.5	121	U	-	7.5	-	-	12
		RG_FO23	2018	652874	5528402		05-Sep-18	RG_FO23_WCT-6-M_20180905	42.0	40.2	750	U	-	9.0	-	-	14
		RG_FO23	2018	652874	5528402		05-Sep-18	RG_FO23_WCT-7-M_20180905	33.2	31.4	385	U	-	6.0	-	-	10
		RG_FO23	2018	652874	5528402		05-Sep-18	RG_FO23_WCT-8-M_20180905	30.8	29.2	315	U	-	13	-	-	21

Muscle selenium concentration exceeding the site-specific benchmark for WCT of 15.5 mg/kg dw (Nautilus and Interior Reforestation 2011).

Ovary selenium concentration exceeding the Level 1 site-specific benchmark (equivalent of EC_{10}) for WCT of 25 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 2 site-specific benchmark (equivalent of EC_{20}) for WCT of 27 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 3 site-specific benchmark (equivalent of EC_{50}) for WCT of 33 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

[a] F = female, M = male; U = unknown, sex of fish could not be determined, either because fish was not sufficiently mature or samples were collected non-lethally.

[b] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation (2011). Ovary selenium was estimated only for individuals lacking measured ovary concentrations if female or if sex was unknown because sampling was non-lethal.

APPENDIX C

SUPPORTING DATA – OTHER POTENTIAL EFFECTS OF AWTF OPERATION

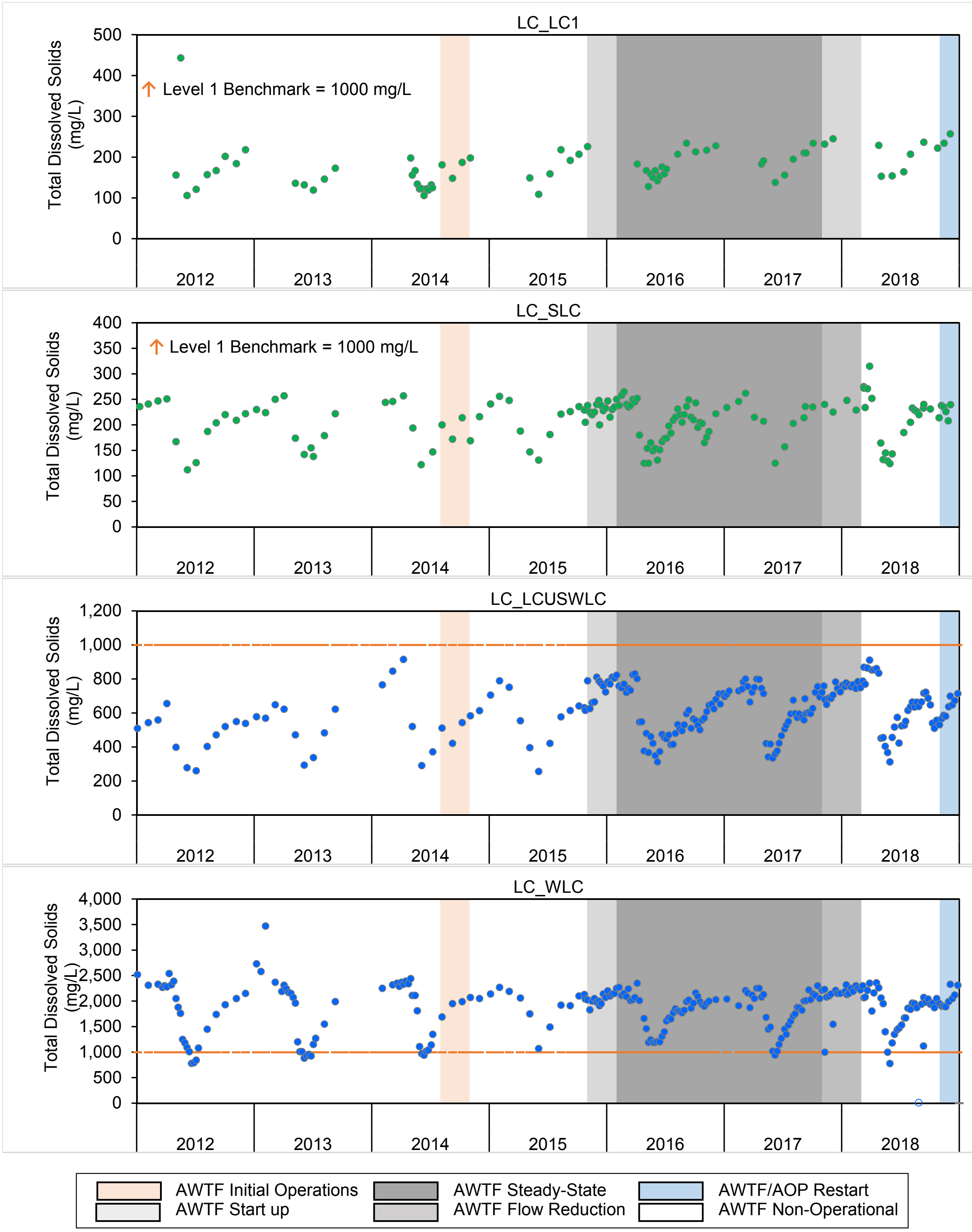

Figure C.1: Time Series Plots for Aqueous Total Dissolved Soilds Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

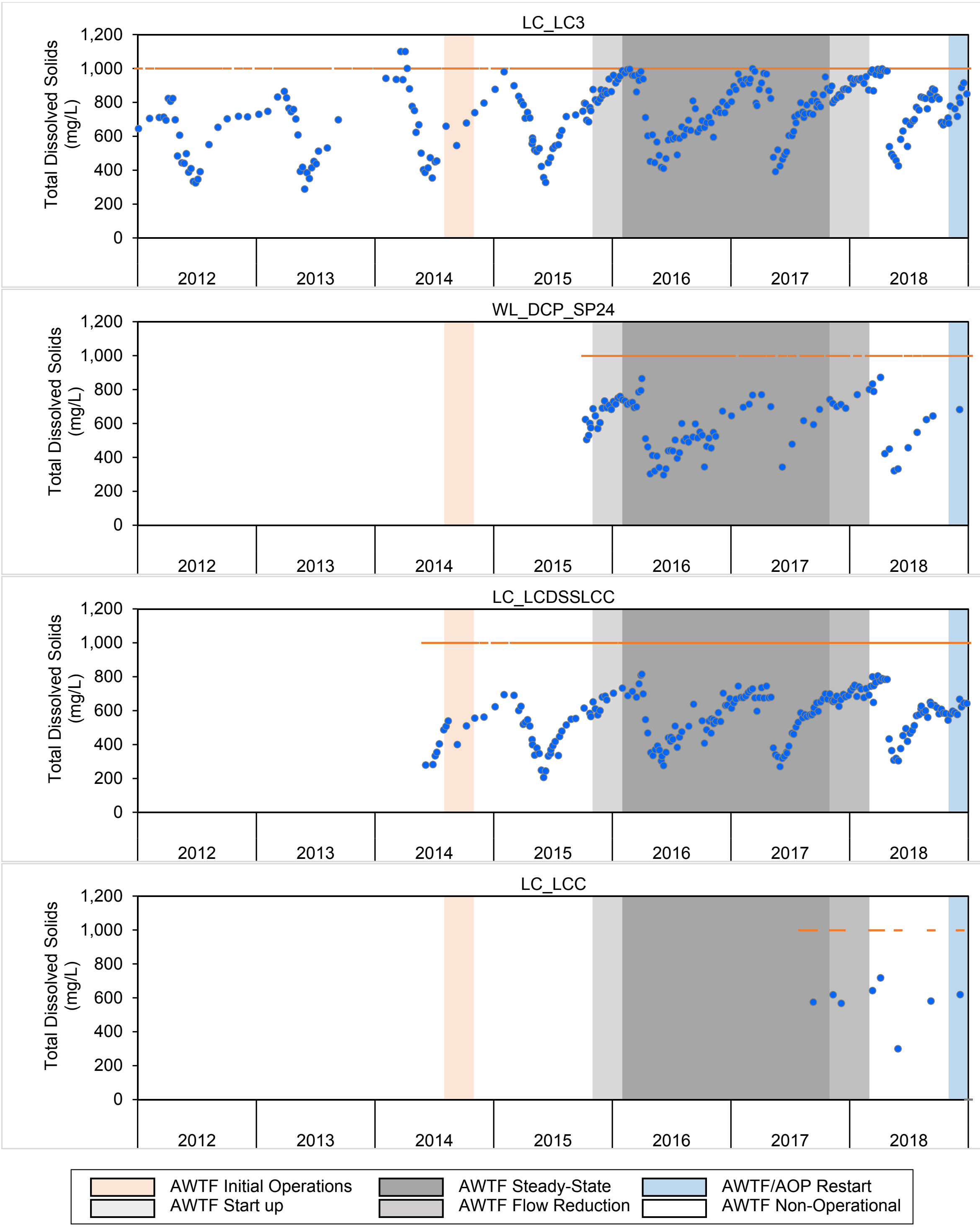

Figure C.1: Time Series Plots for Aqueous Total Dissolved Soilds Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

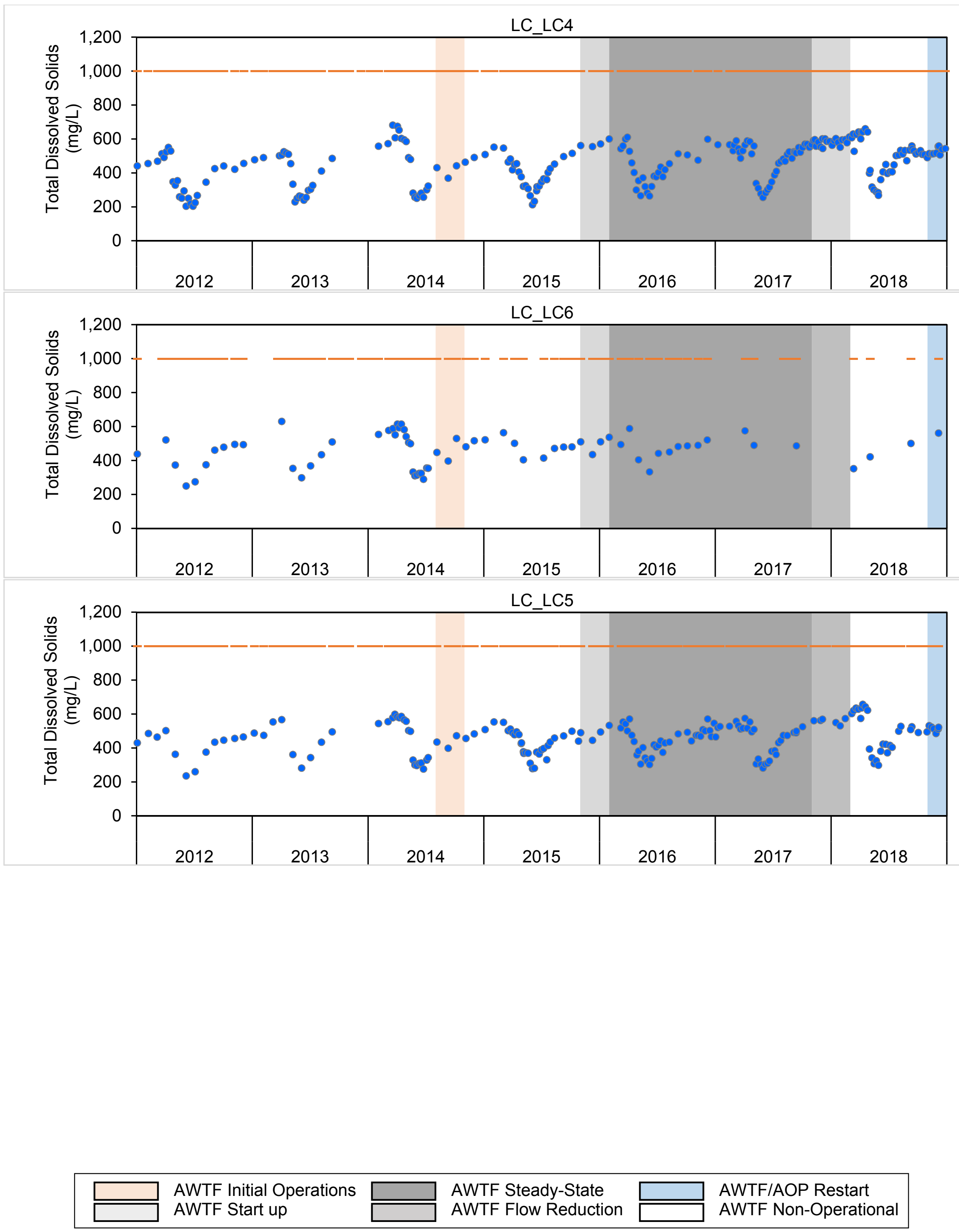

Figure C.1: Time Series Plots for Aqueous Total Dissolved Soilds Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

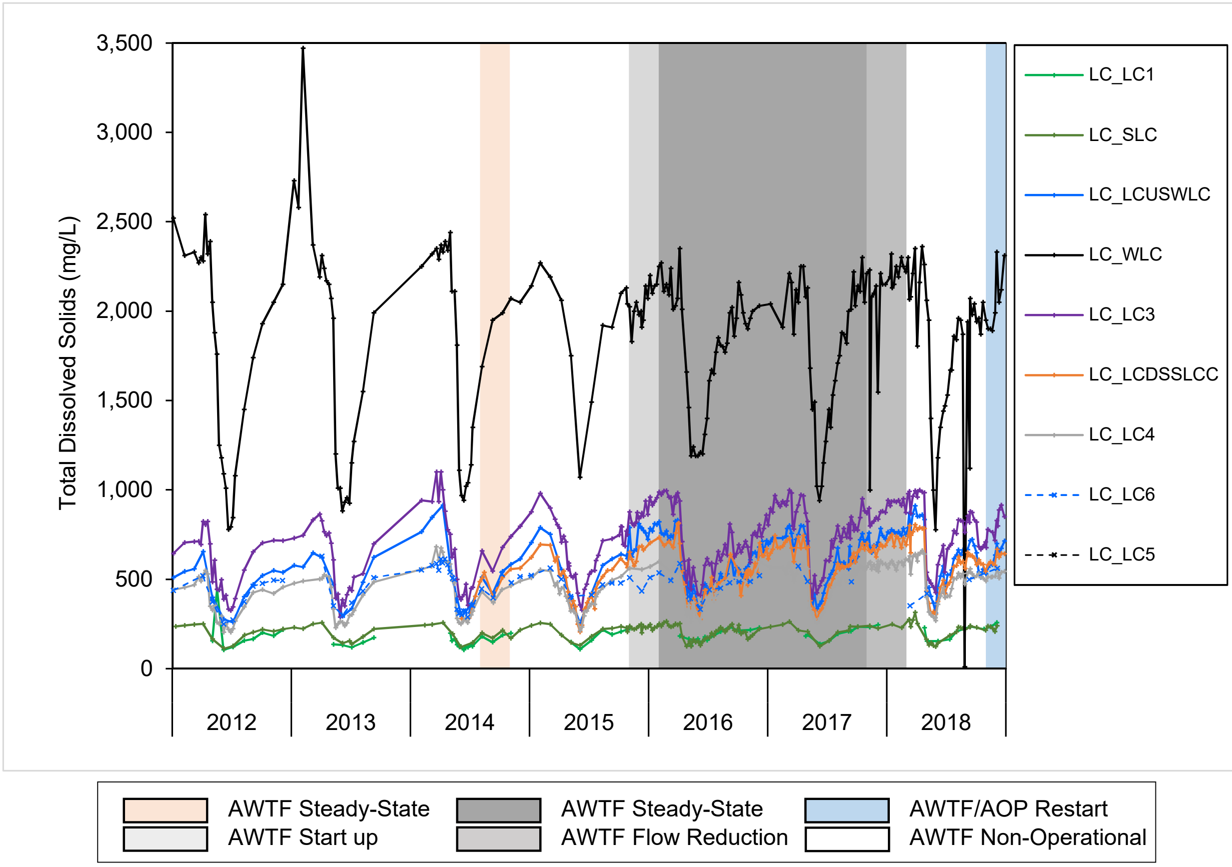

Figure C.2: Time Series Plots for Aqueous Total Dissolved Solids from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 10 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

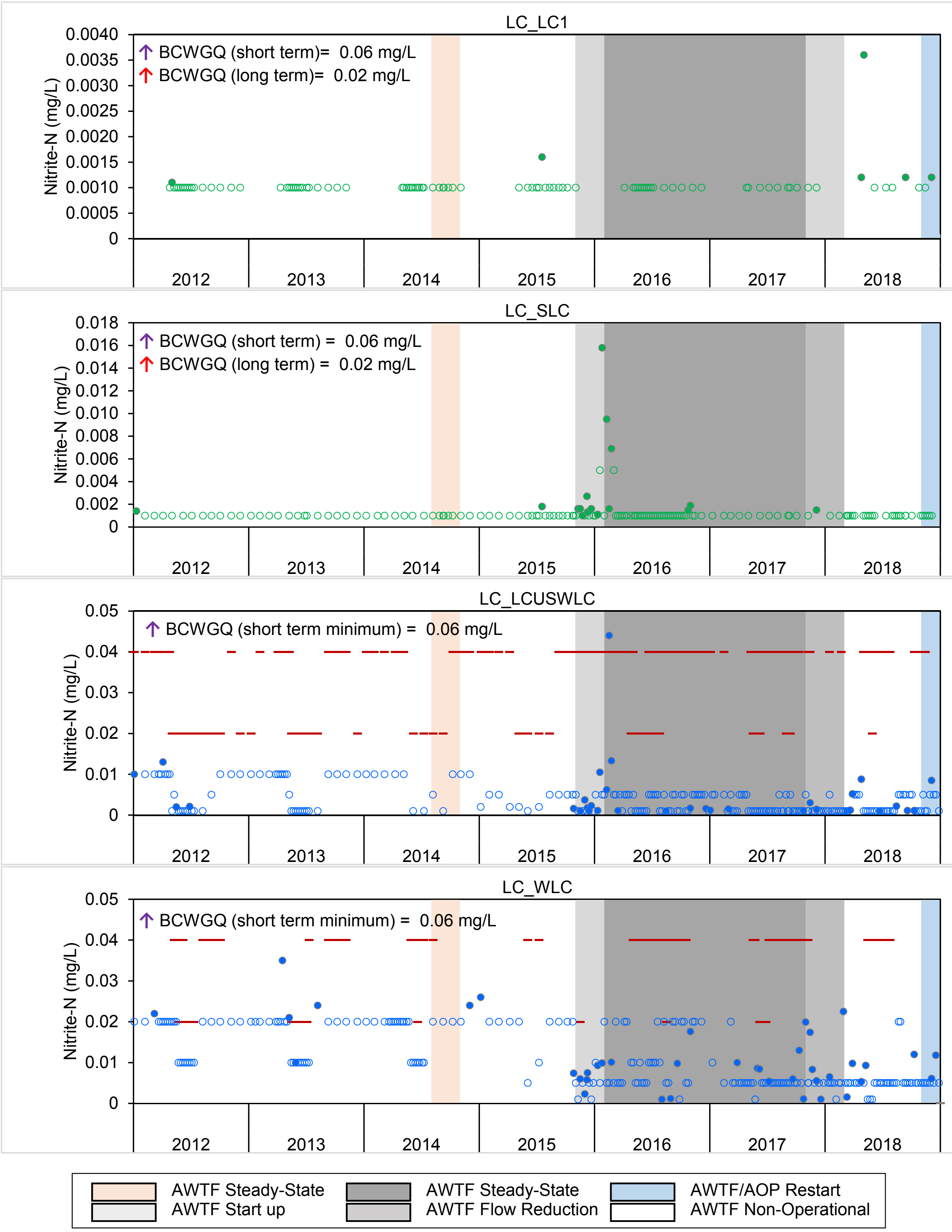

Figure C.3: Time Series Plots for Aqueous Total Nitrite Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

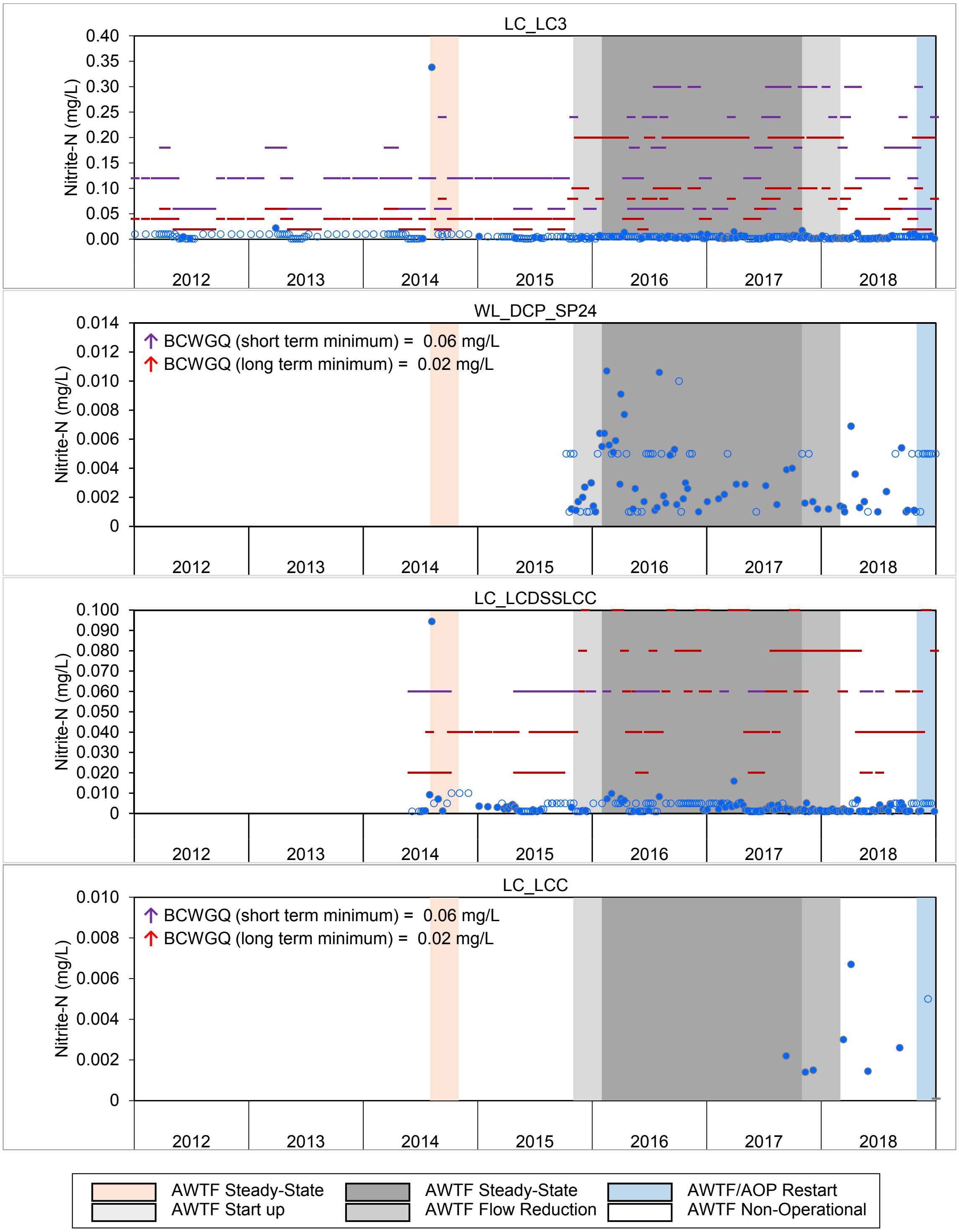

Figure C.3: Time Series Plots for Aqueous Total Nitrite Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

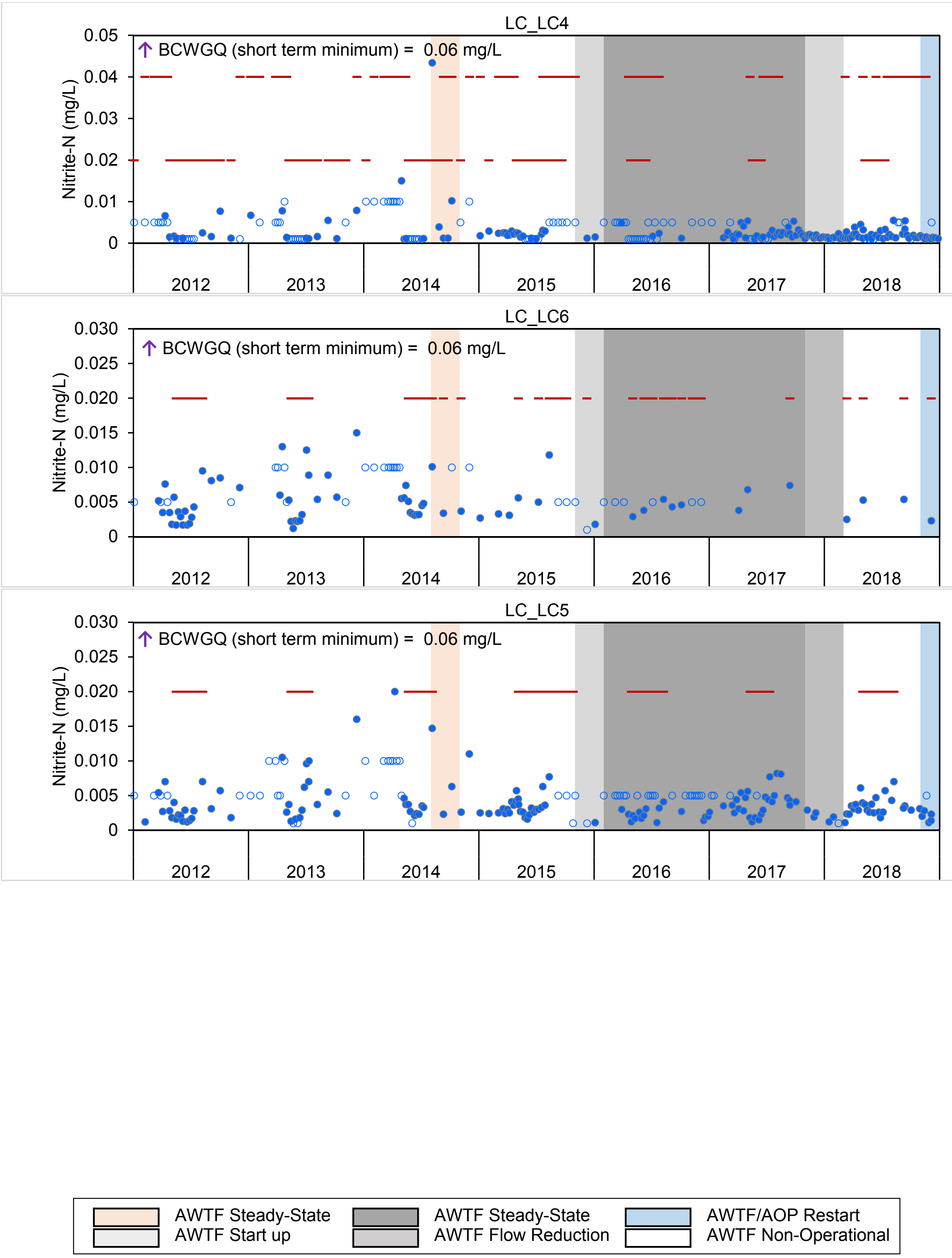

Figure C.3: Time Series Plots for Aqueous Total Nitrite Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

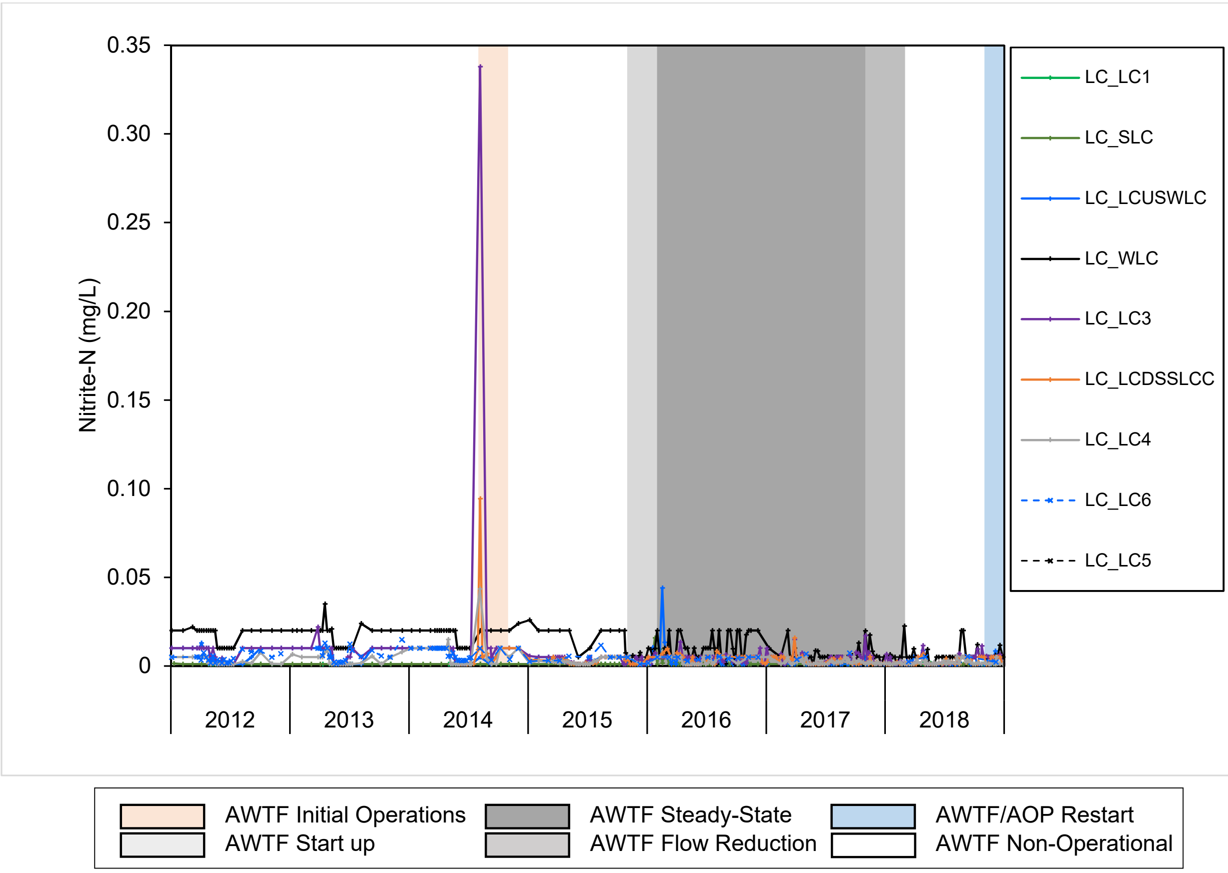

Figure C.4: Time Series Plots for Aqueous Nitrite-N from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.001 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

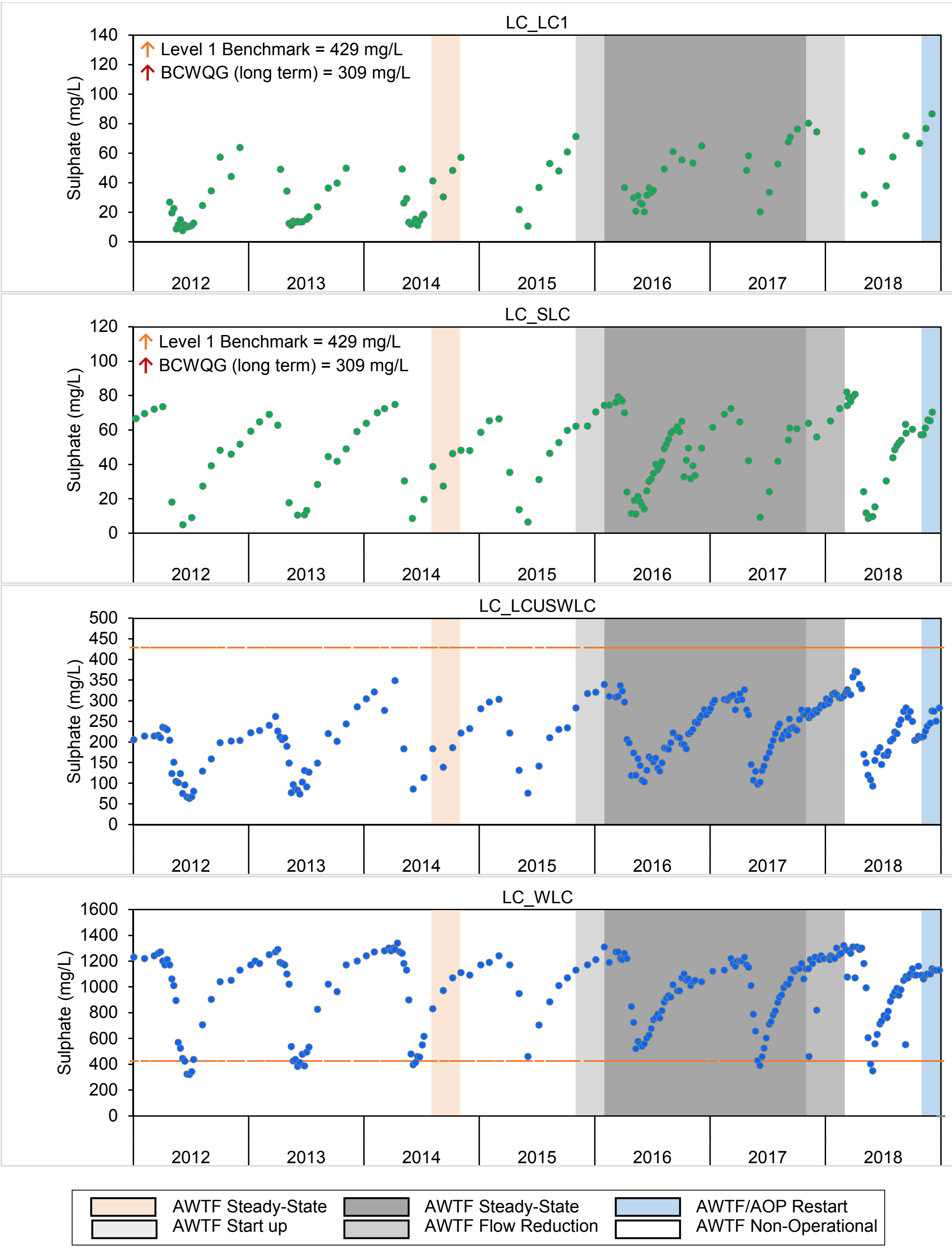

Figure C.5: Time Series Plots for Aqueous Sulphate Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term); -- = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge. When BCWQG and Level 1 Benchmark overlap, only one is visible.

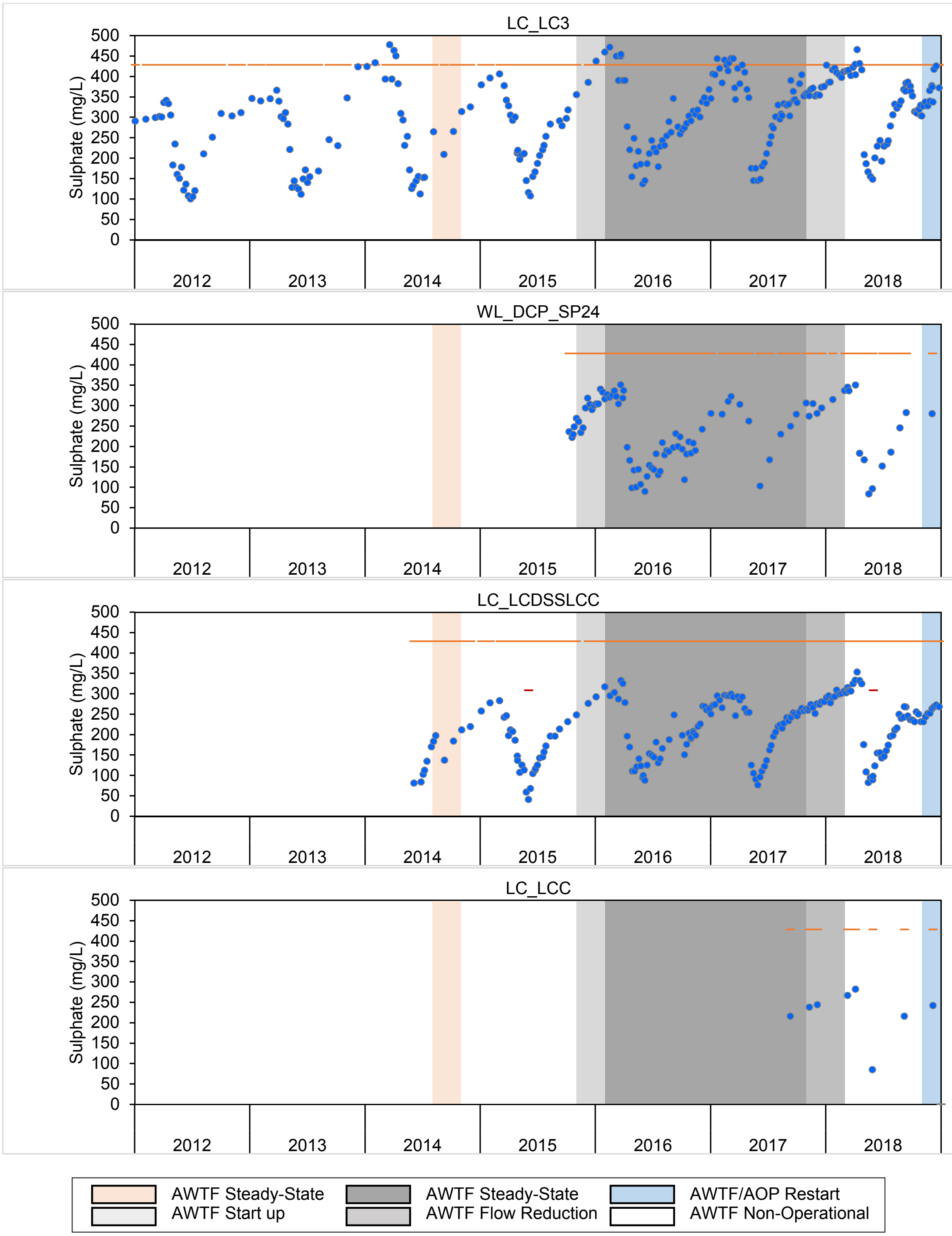

Figure C.5: Time Series Plots for Aqueous Sulphate Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge. When BCWQG and Level 1 Benchmark overlap, only one is visible.

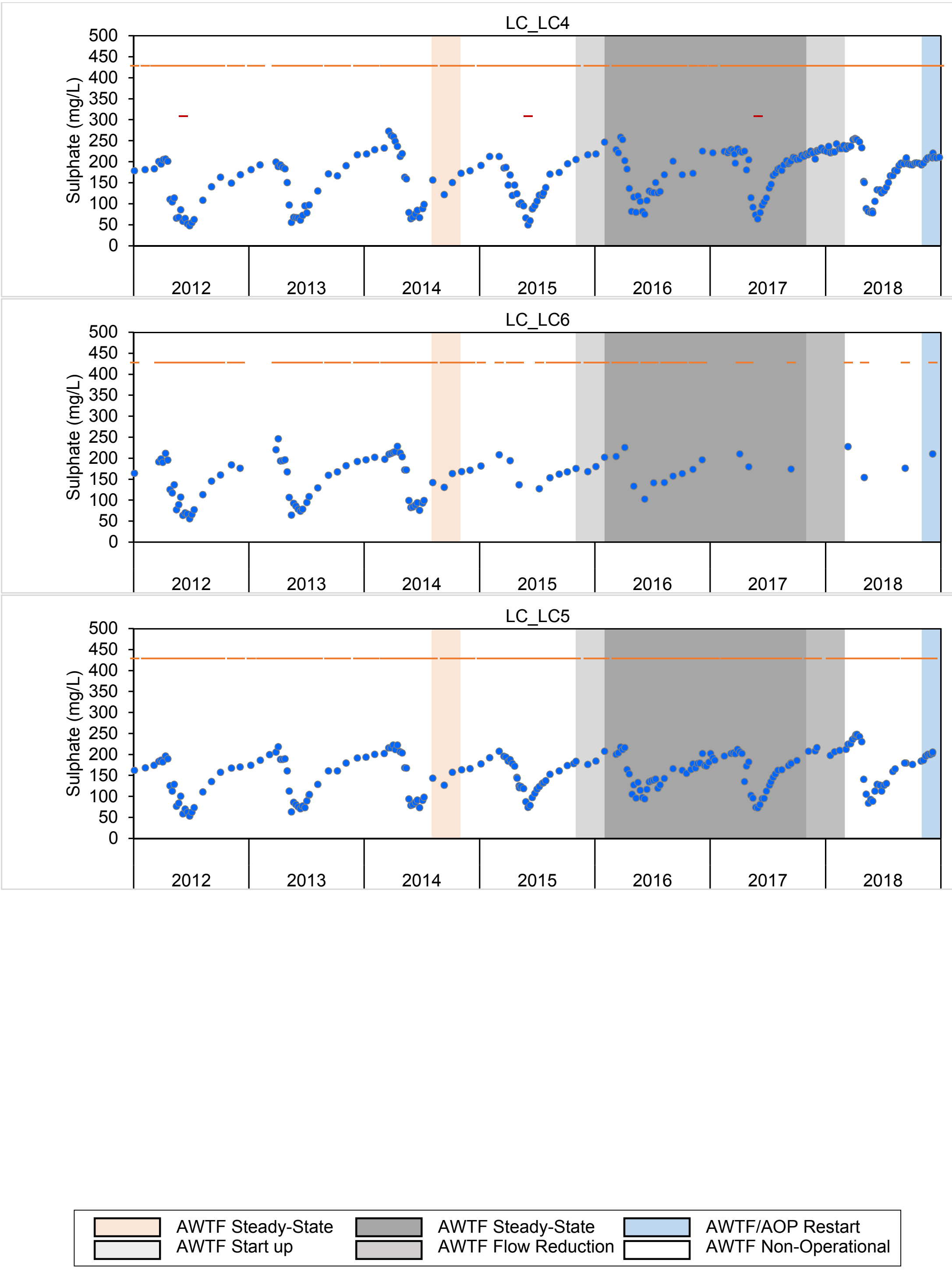

Figure C.5: Time Series Plots for Aqueous Sulphate Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge. When BCWQG and Level 1 Benchmark overlap, only one is visible.

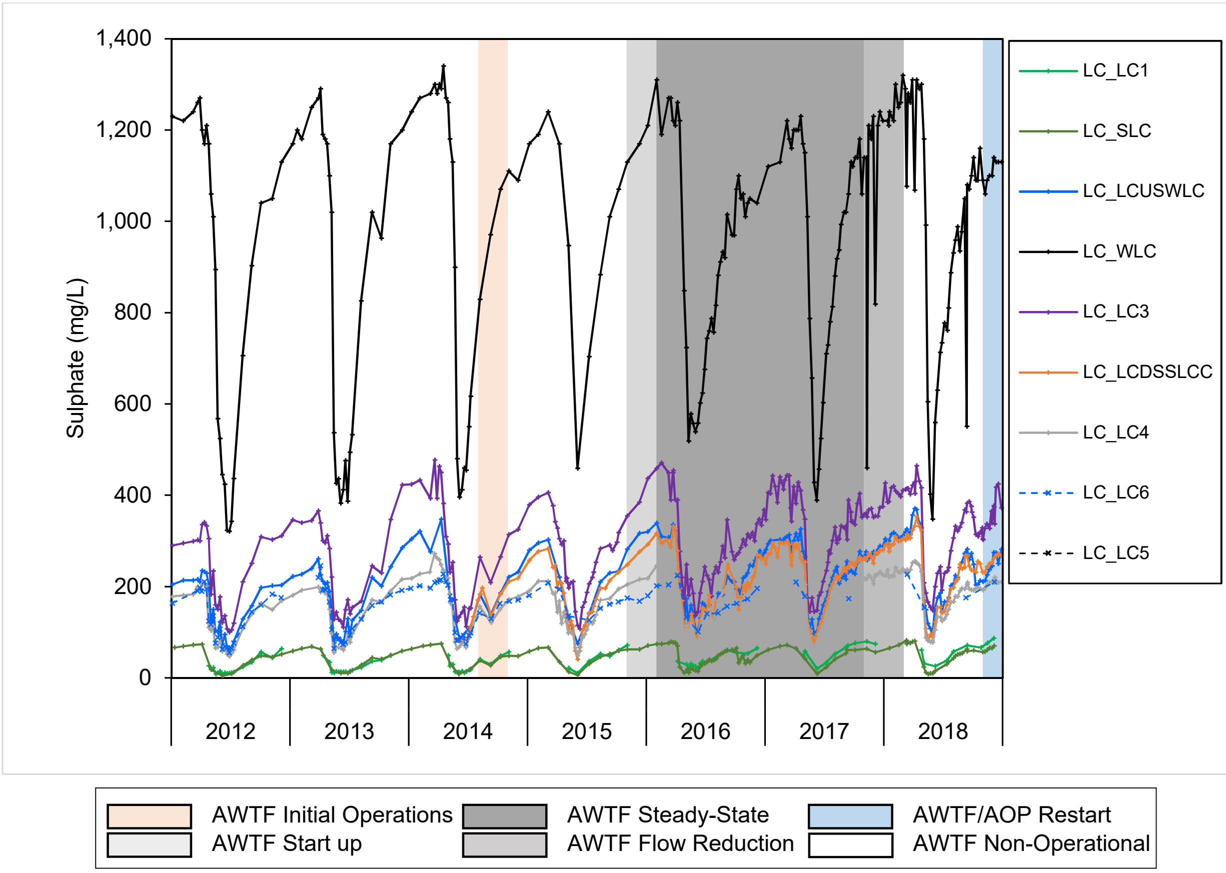

Figure C.6: Time Series Plots for Aqueous Sulphate from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 4.87 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Figure C.7: Time Series Plots for Aqueous Total Antimony Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

- - = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

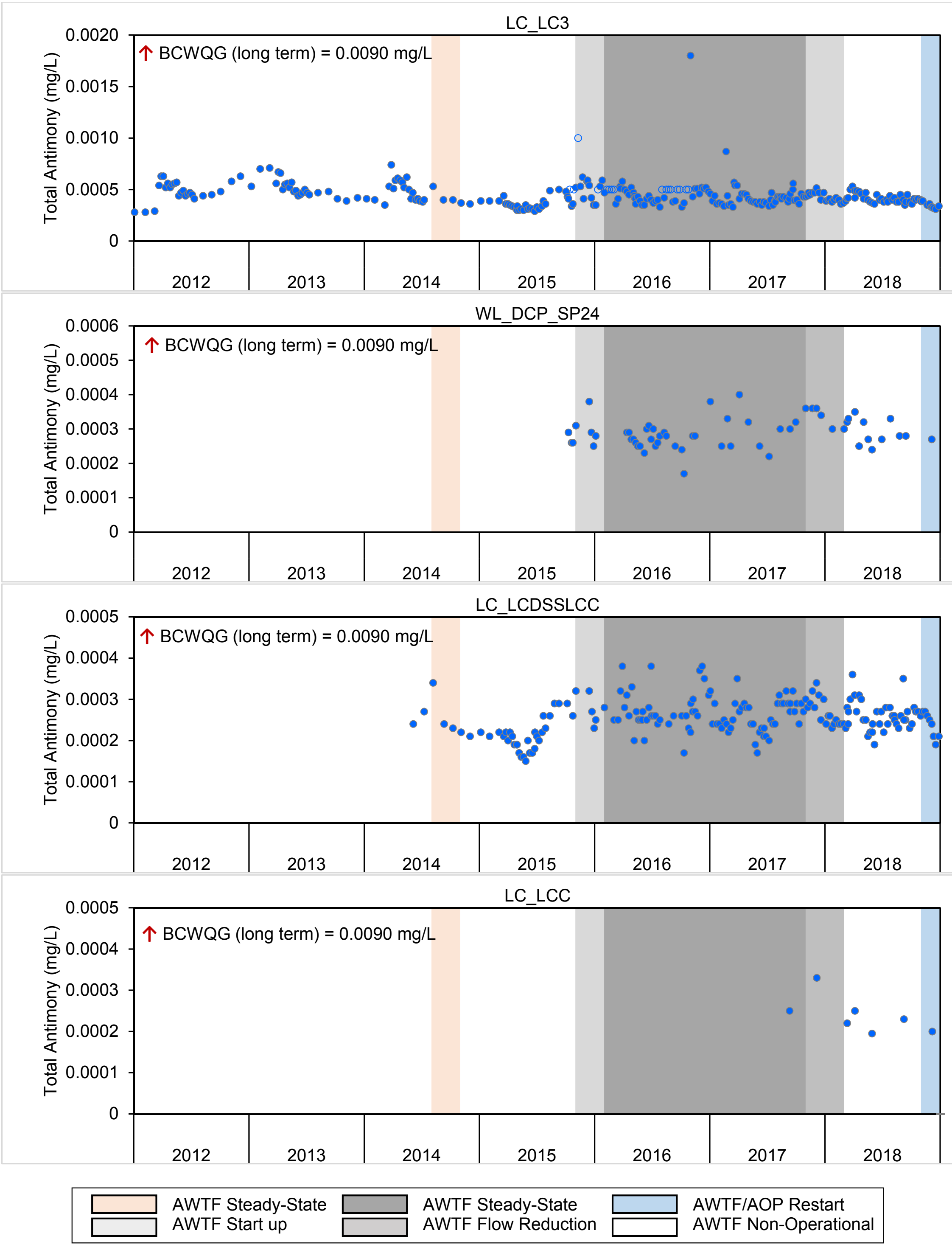

Figure C.7: Time Series Plots for Aqueous Total Antimony Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

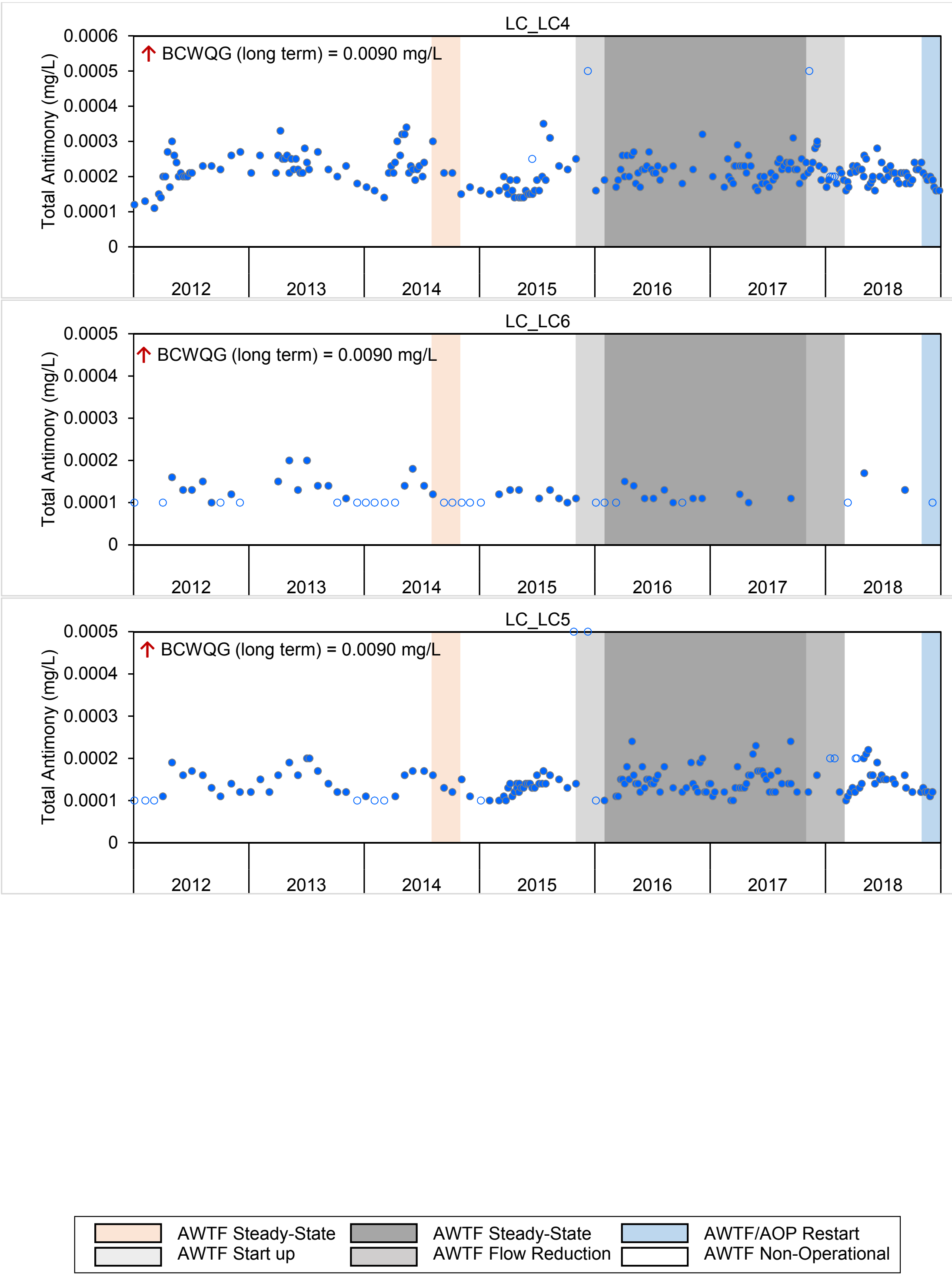

Figure C.7: Time Series Plots for Aqueous Total Antimony Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

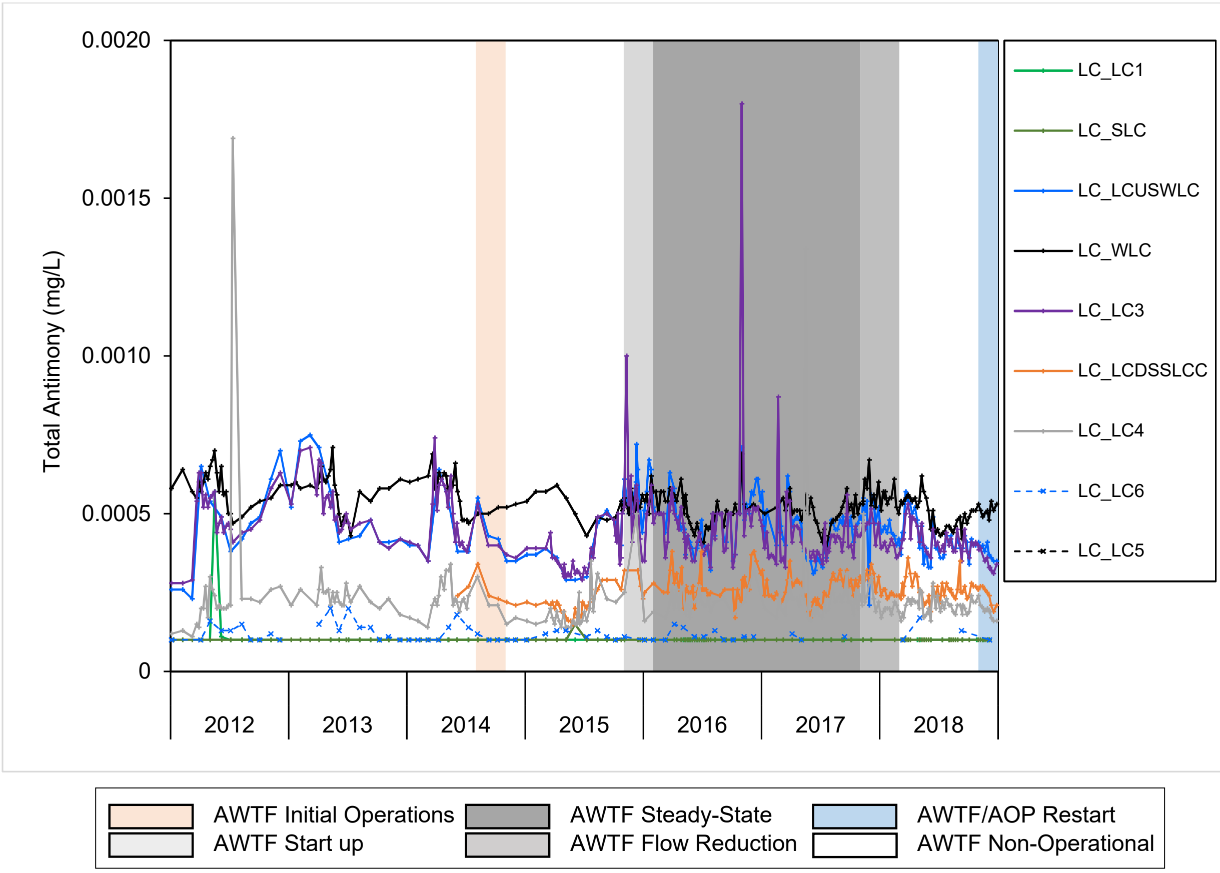

Figure C.8: Time Series Plots for Aqueous Total Antimony from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.0001 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

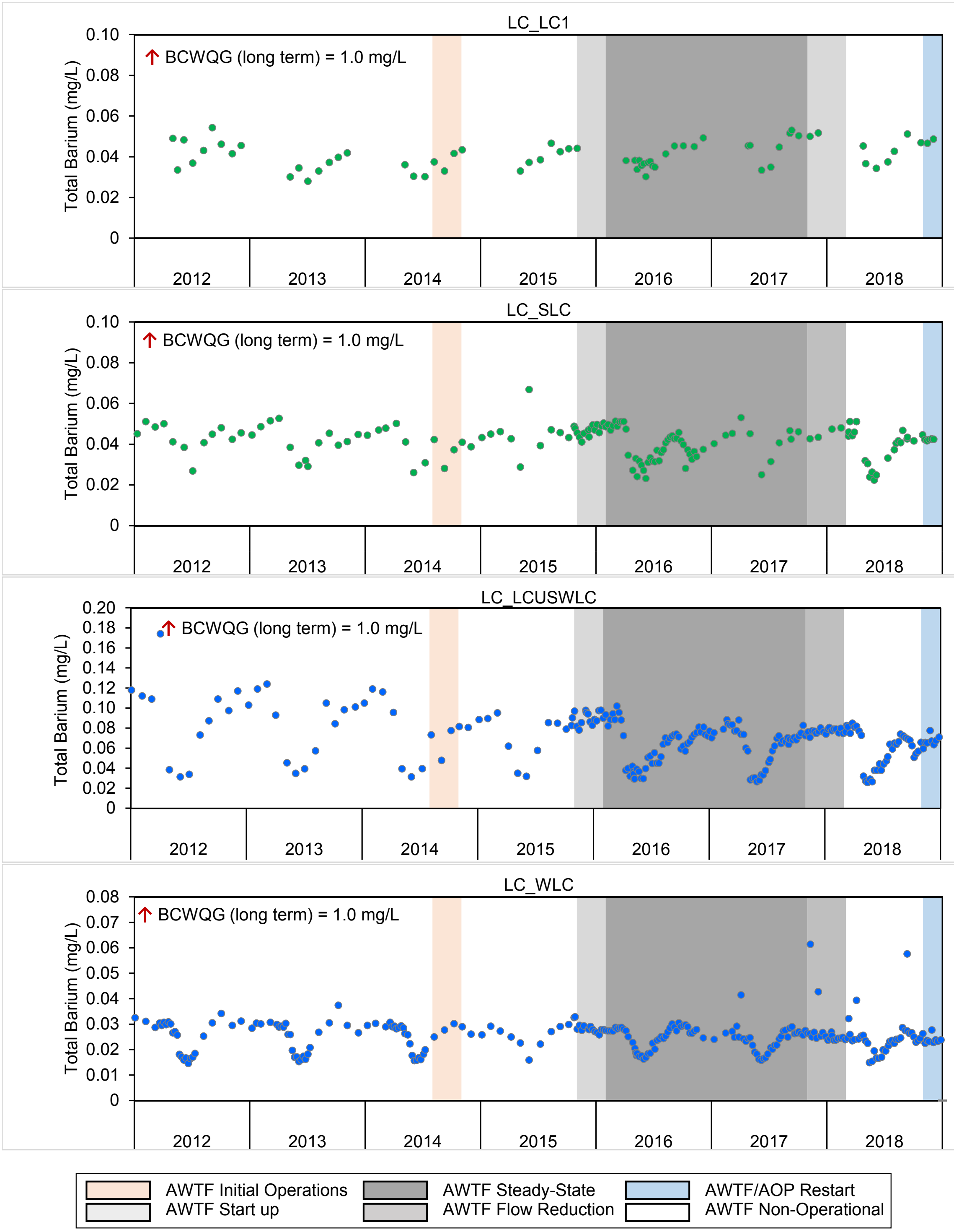

Figure C.9: Time Series Plots for Aqueous Total Barium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

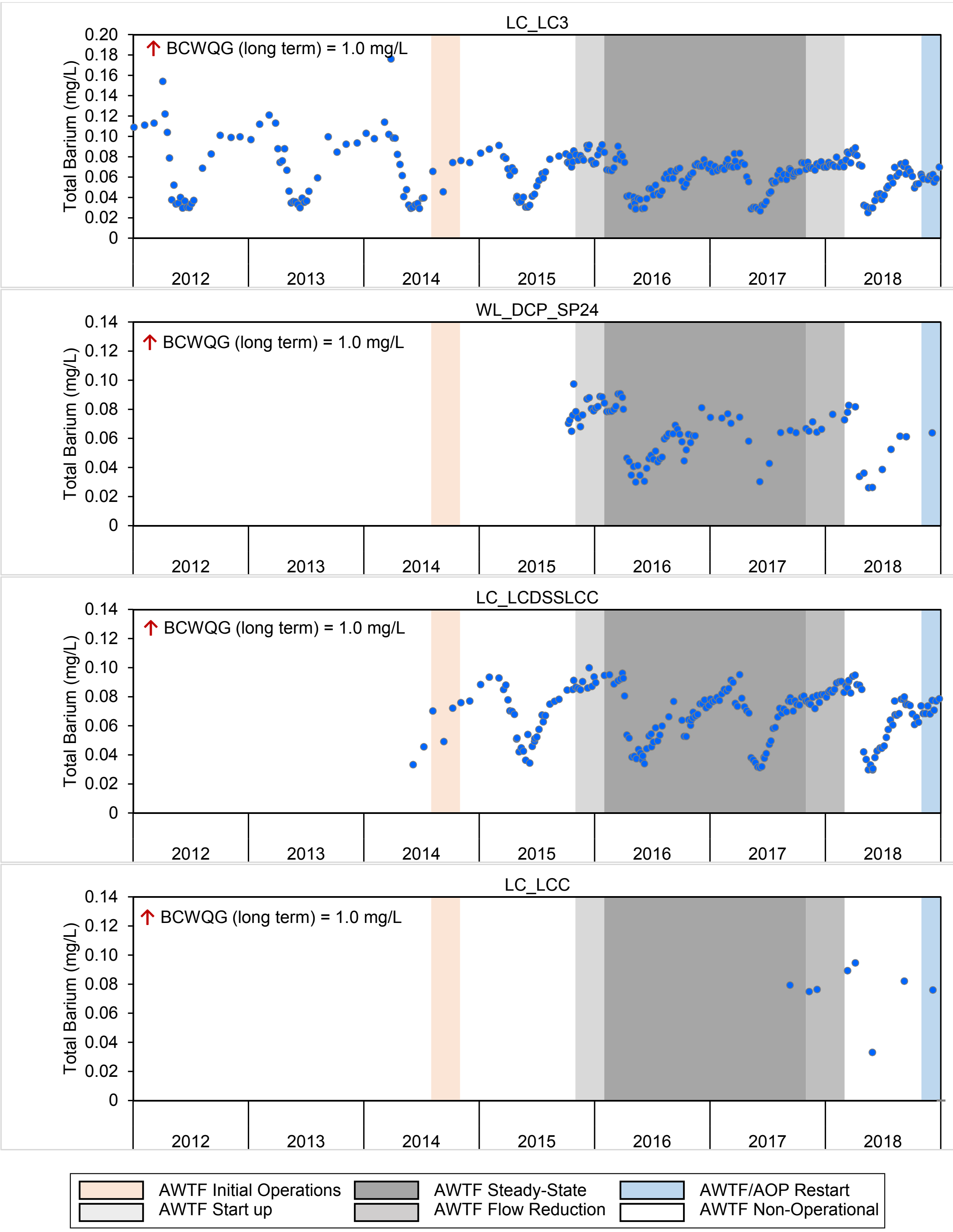

Figure C.9: Time Series Plots for Aqueous Total Barium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Figure C.9: Time Series Plots for Aqueous Total Barium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

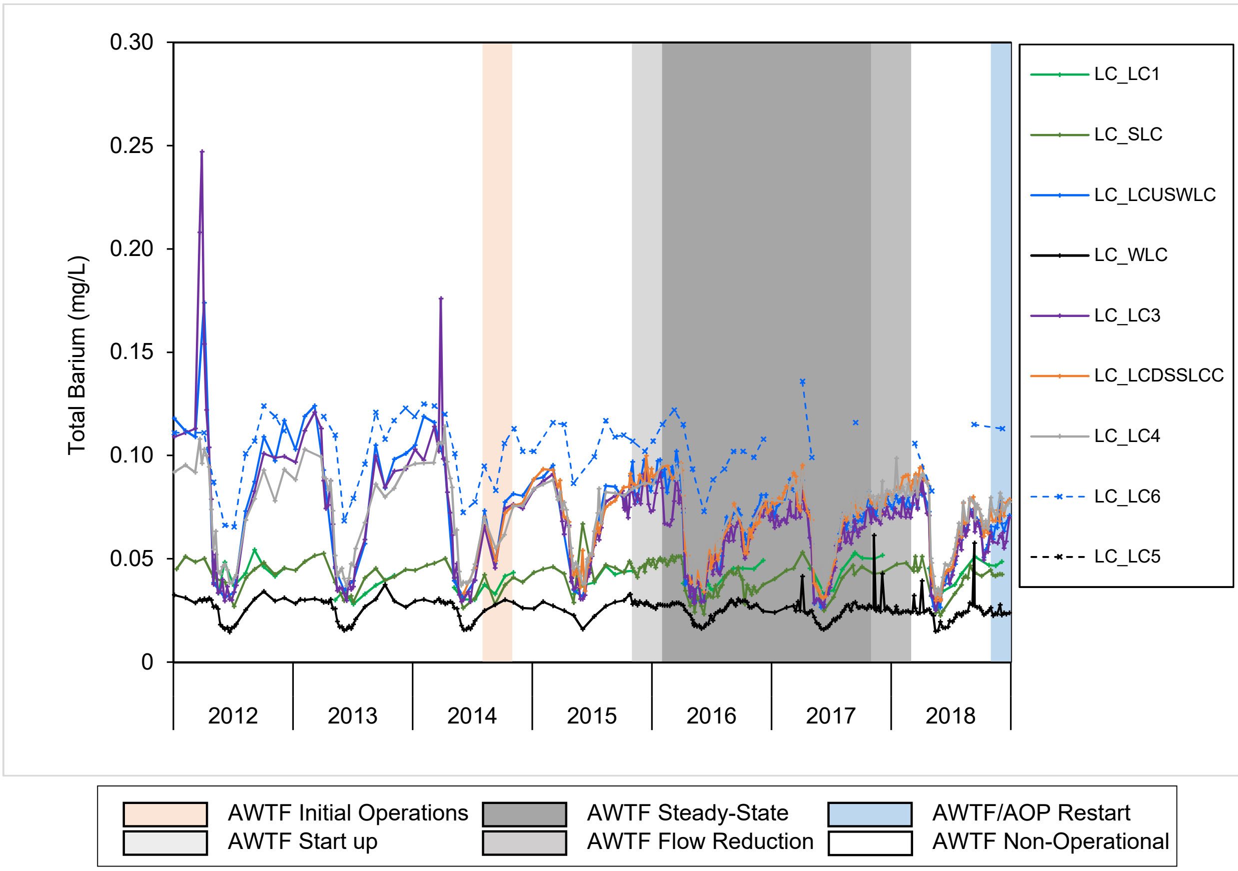

Figure C.10: Time Series Plots for Aqueous Total Barium from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.00856 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

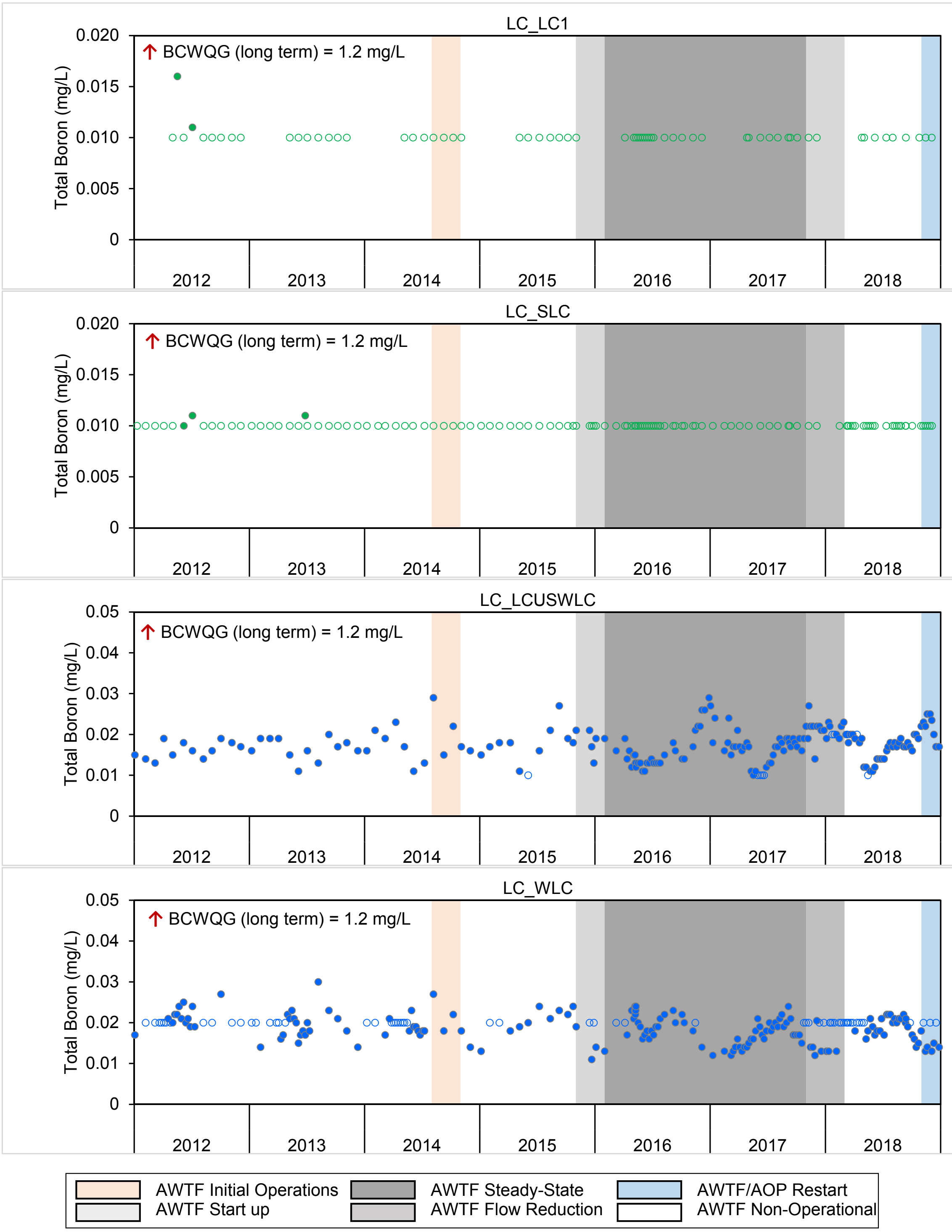

Figure C.11: Time Series Plots for Aqueous Total Boron Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

- - = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

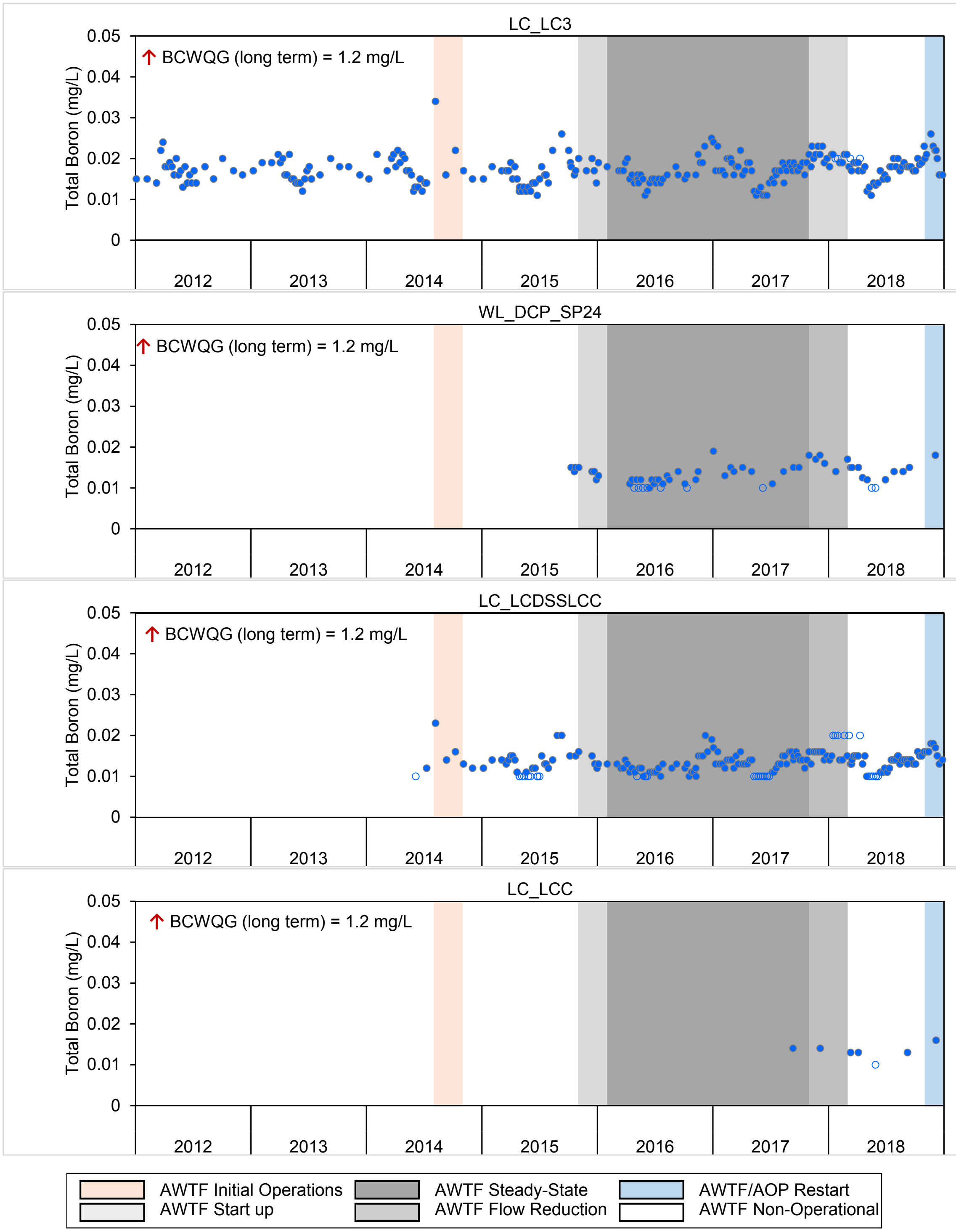

Figure C.11: Time Series Plots for Aqueous Total Boron Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

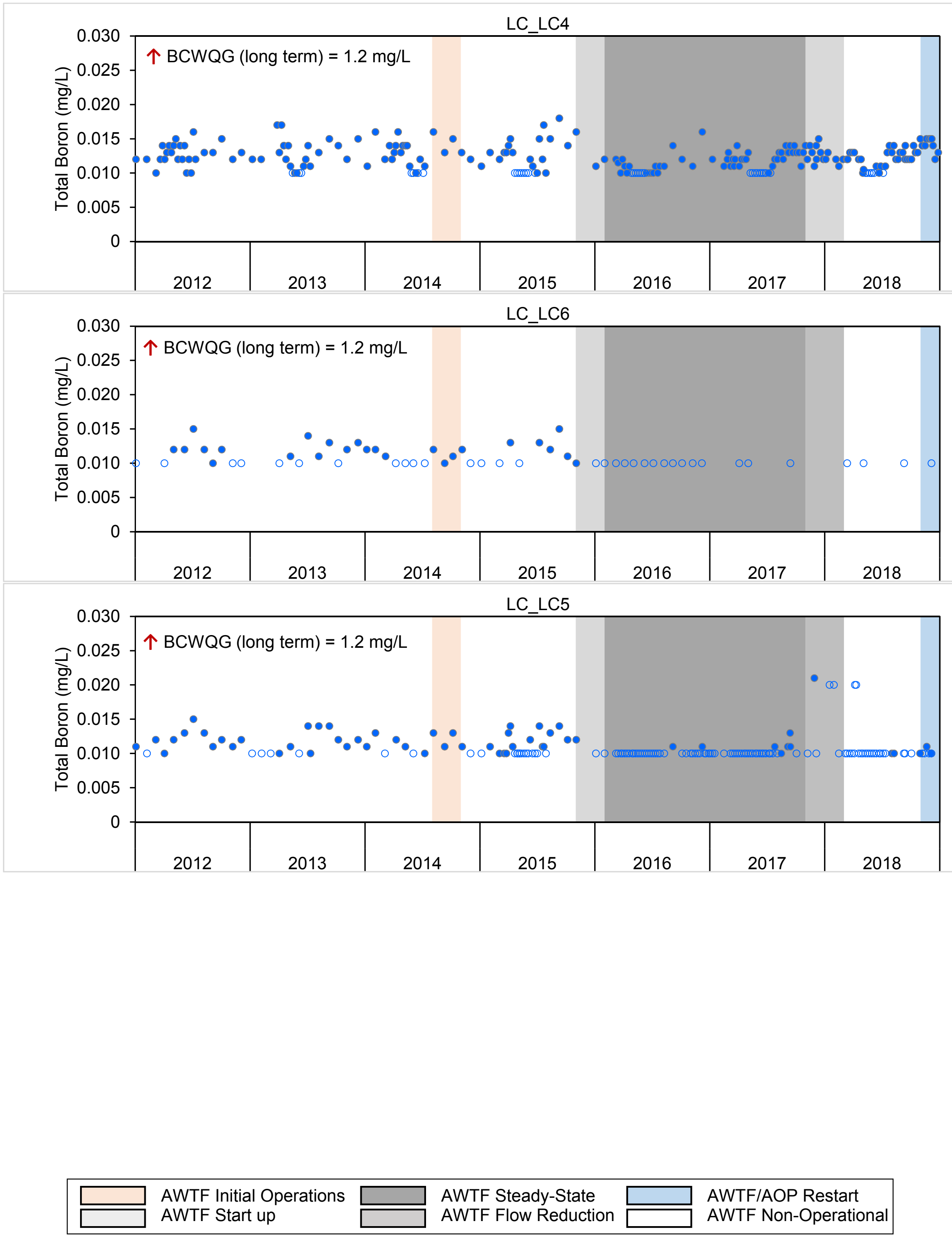

Figure C.11: Time Series Plots for Aqueous Total Boron Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

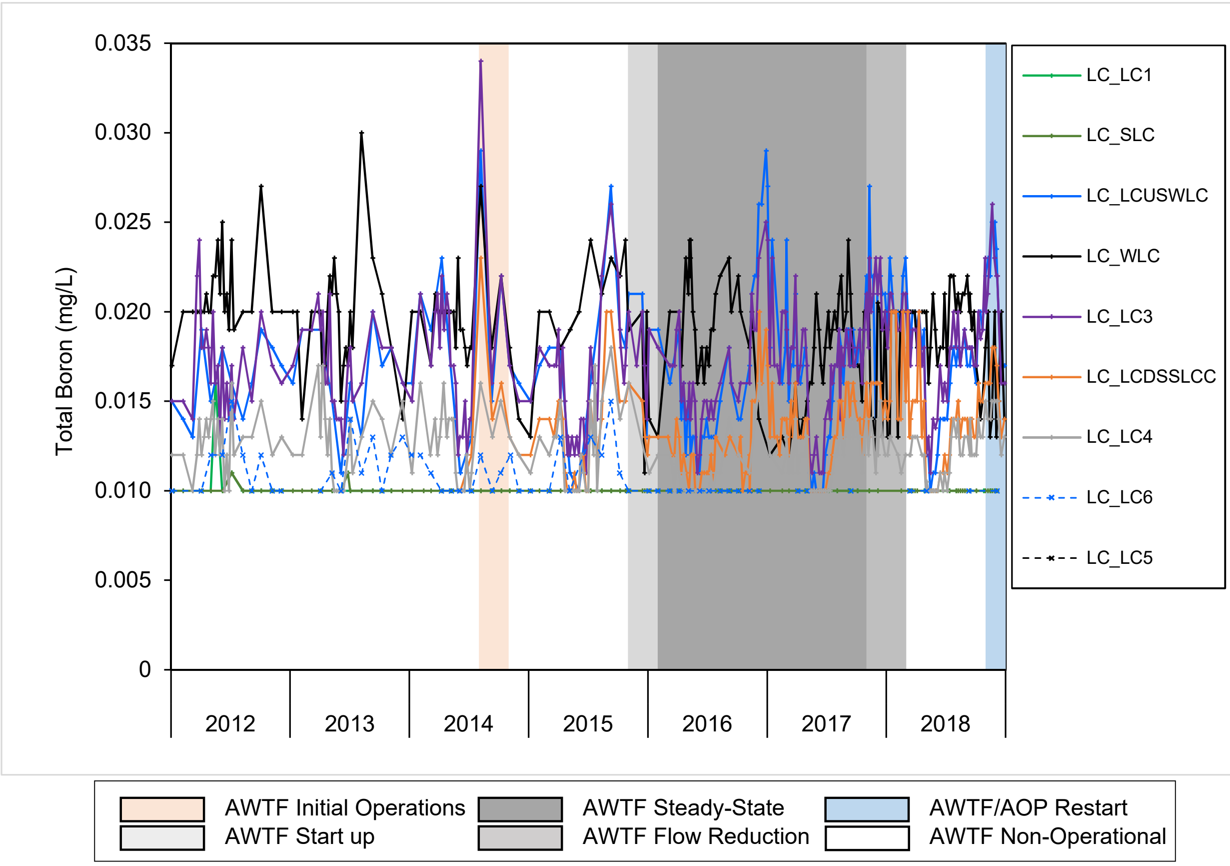

Figure C.12: Time Series Plots for Aqueous Total Boron from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.01 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

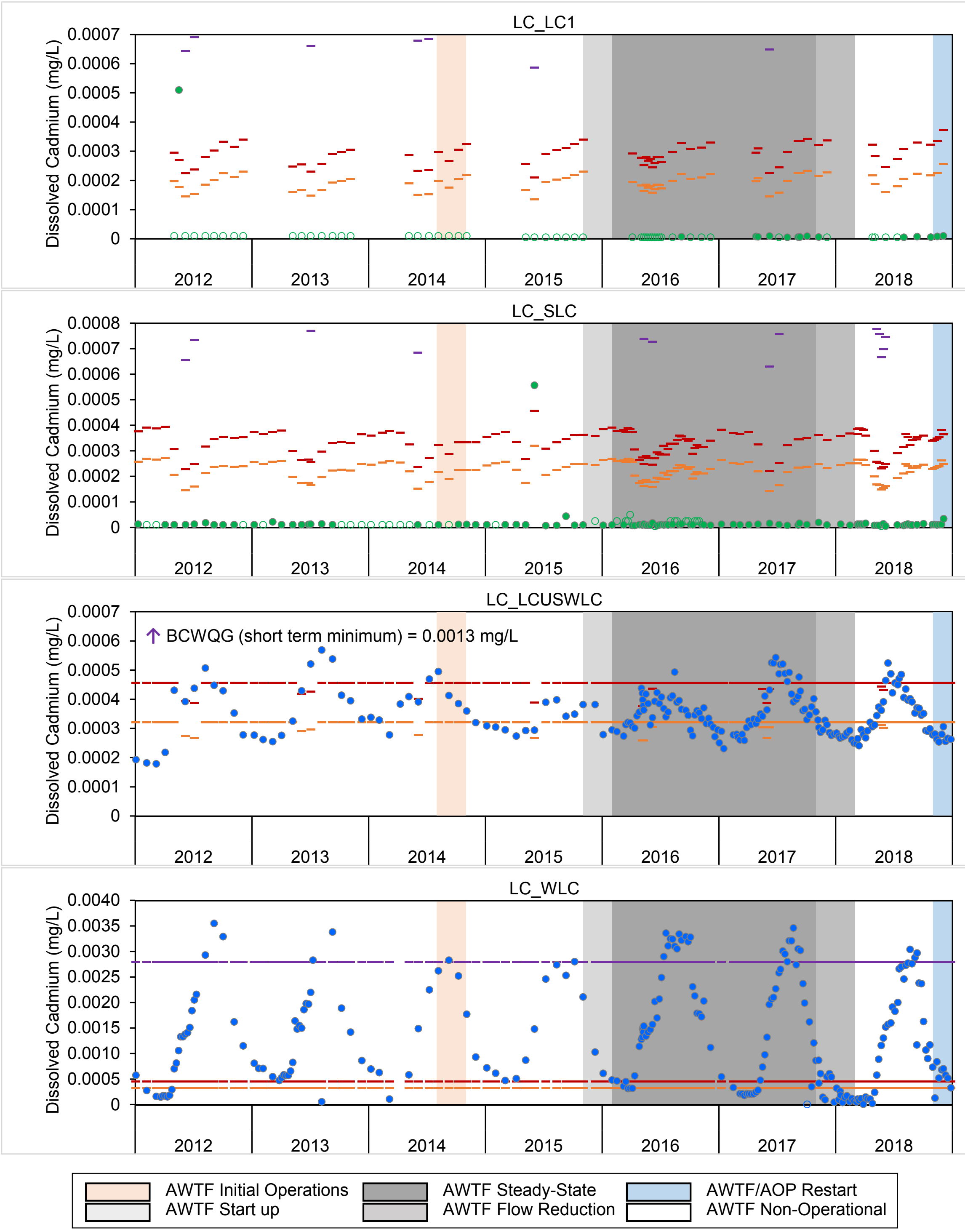

Figure C.13: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

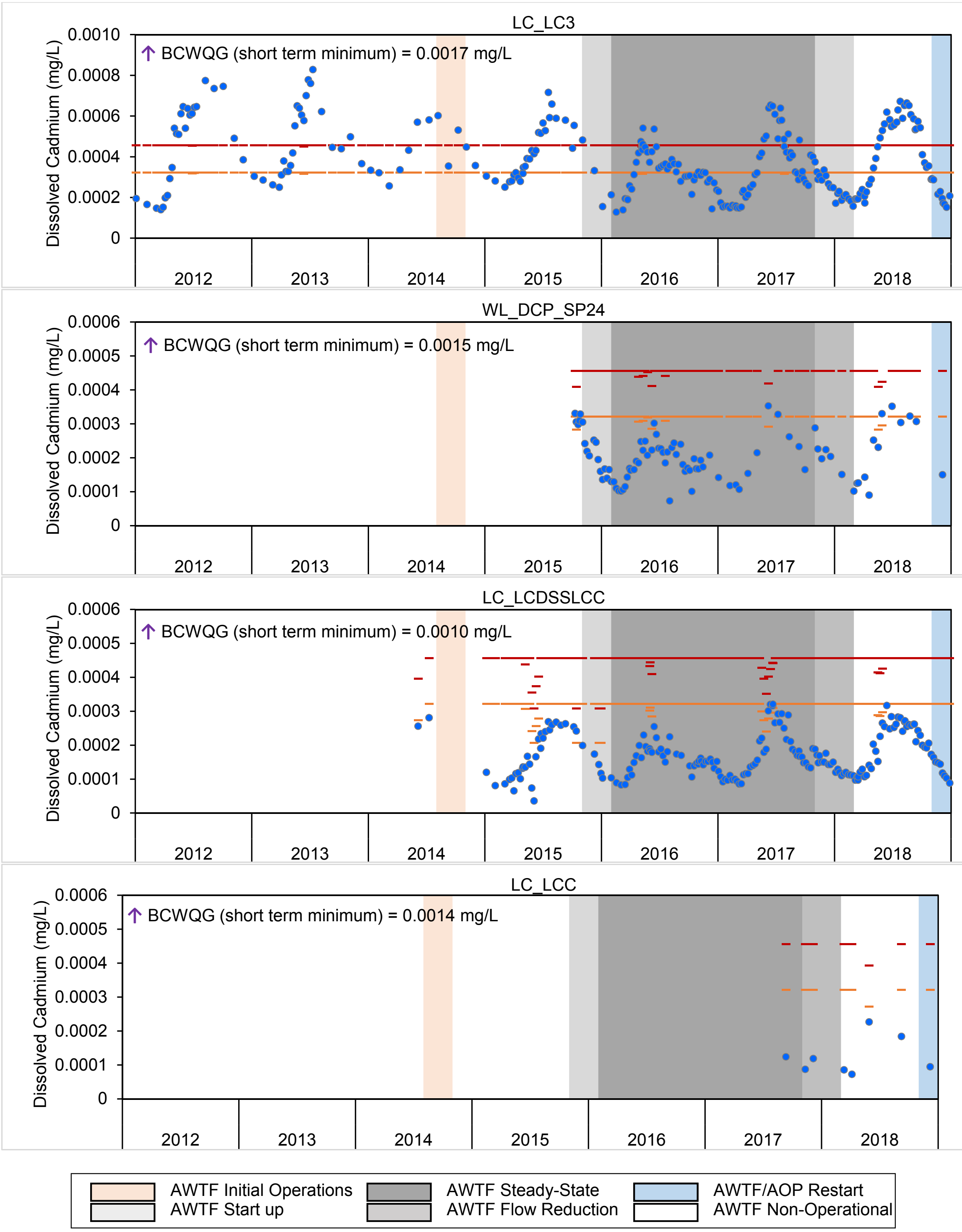

Figure C.13: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

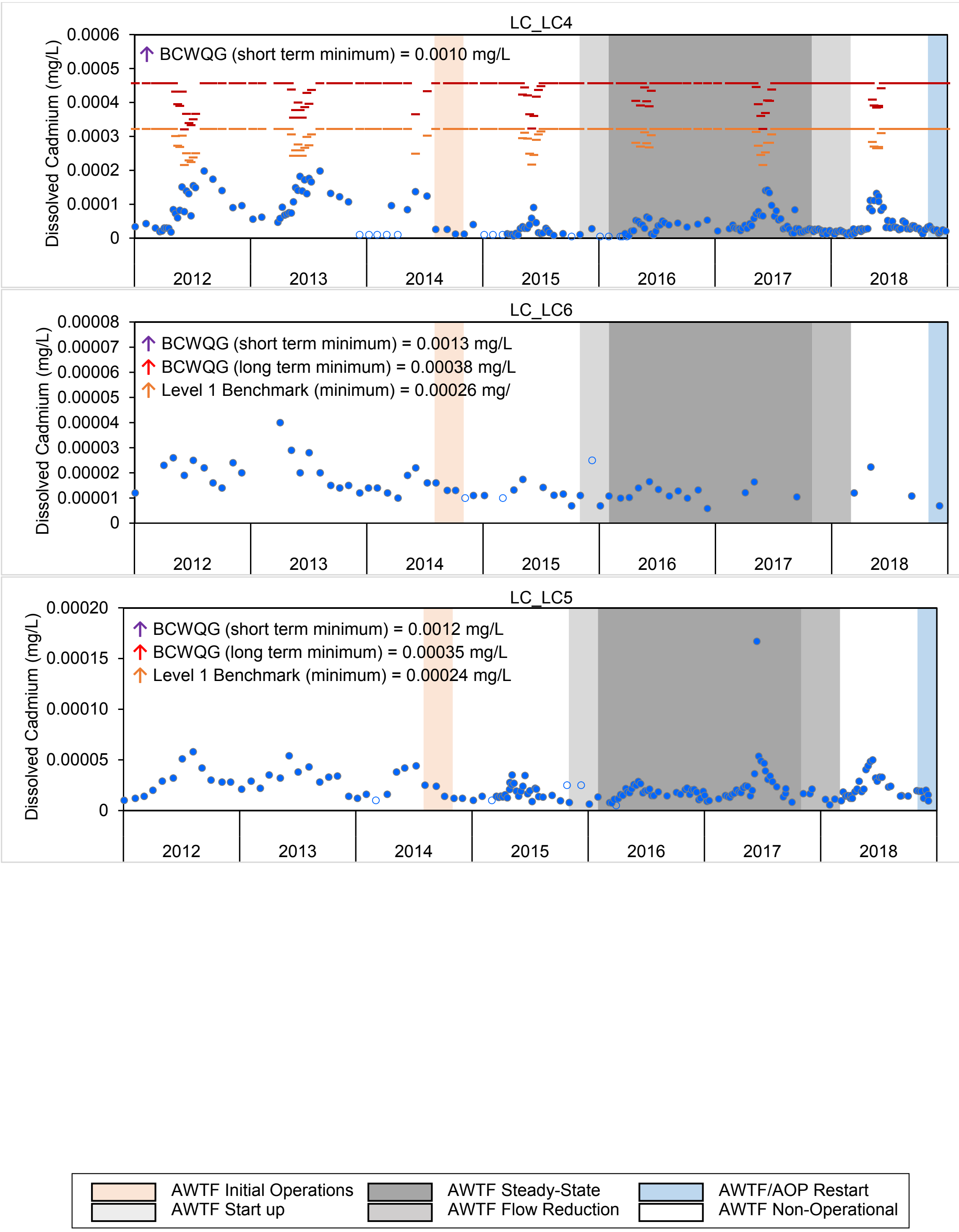

Figure C.13: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

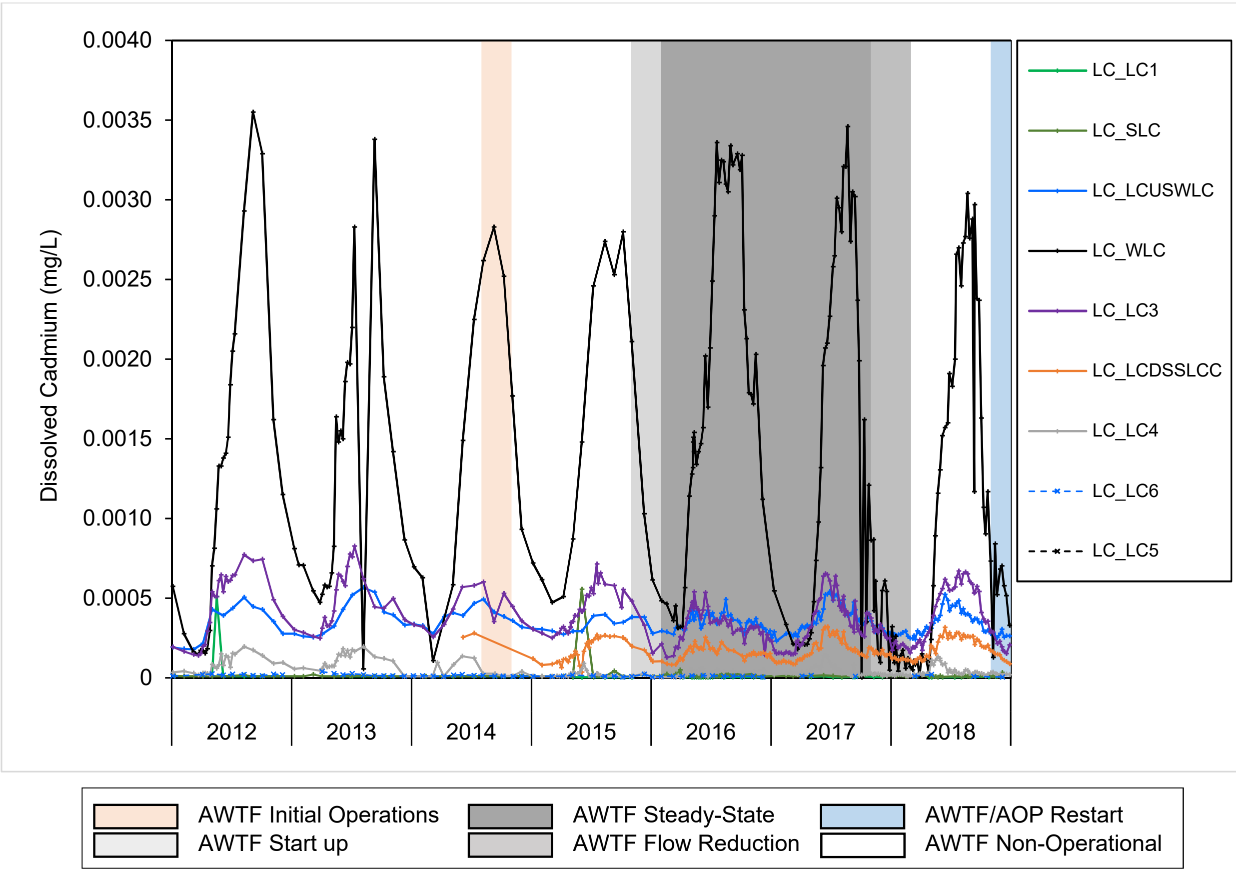

Figure C.14: Time Series Plots for Aqueous Dissolved Cadmium from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.000005 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

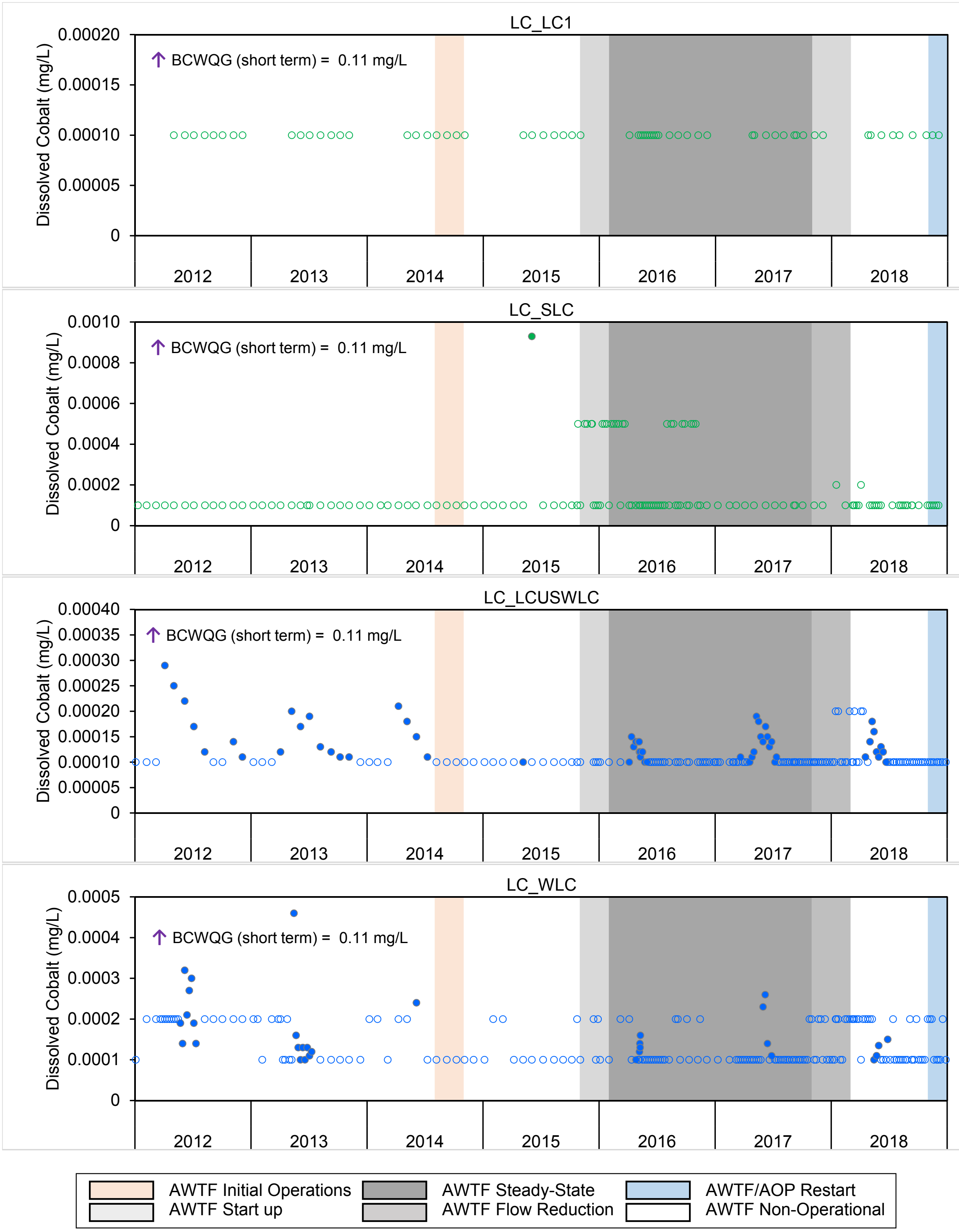

Figure C.15: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

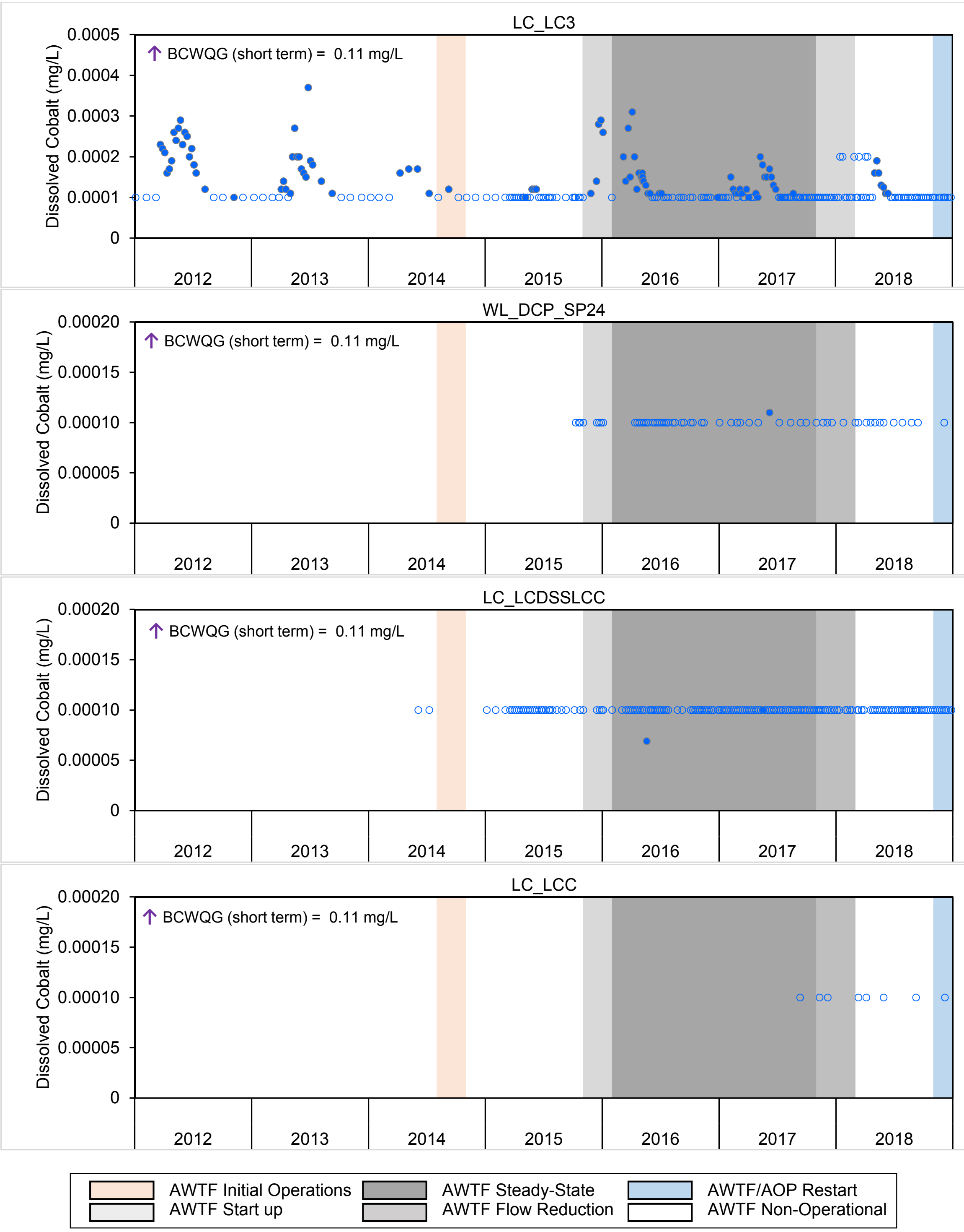

Figure C.15: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

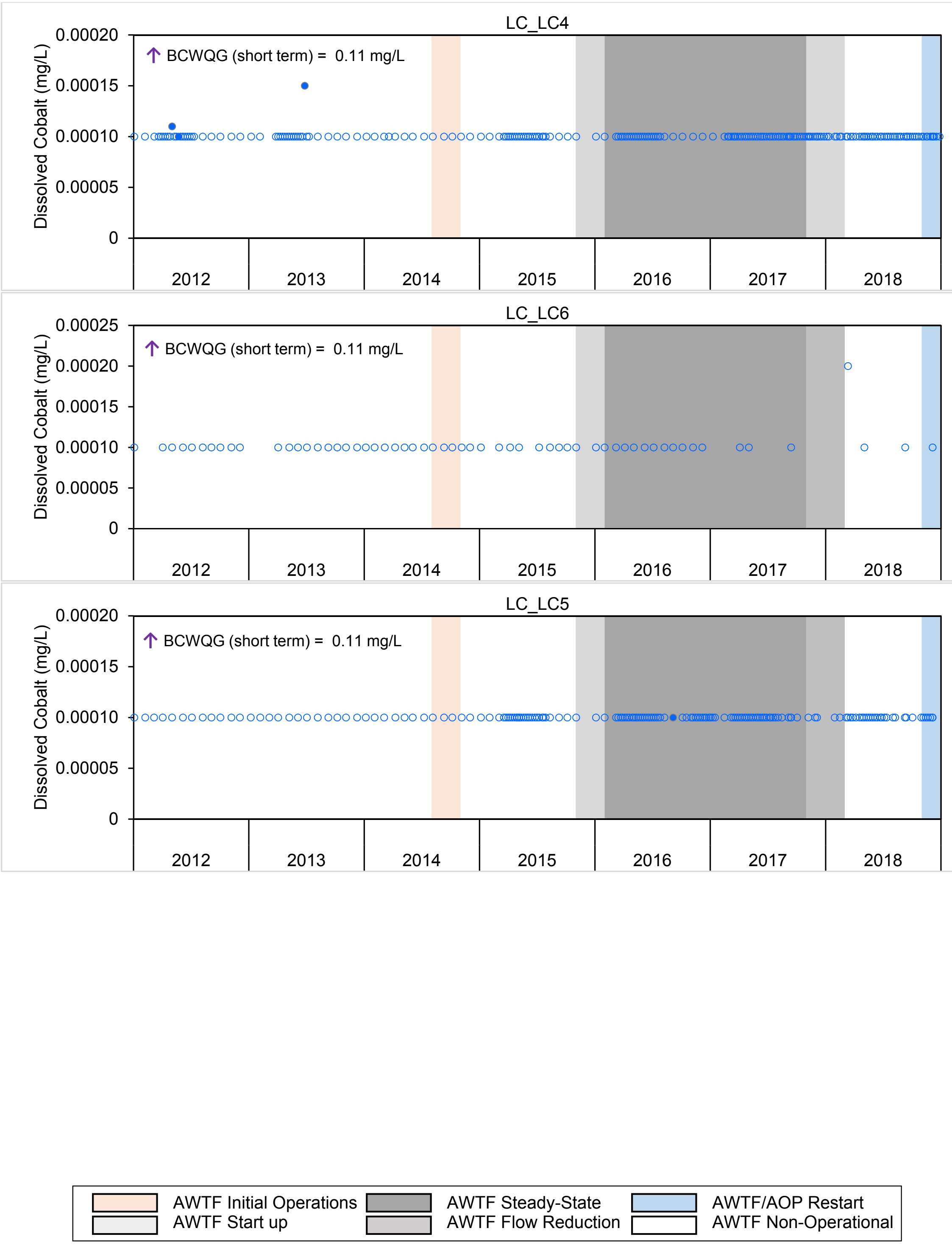

Figure C.15: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

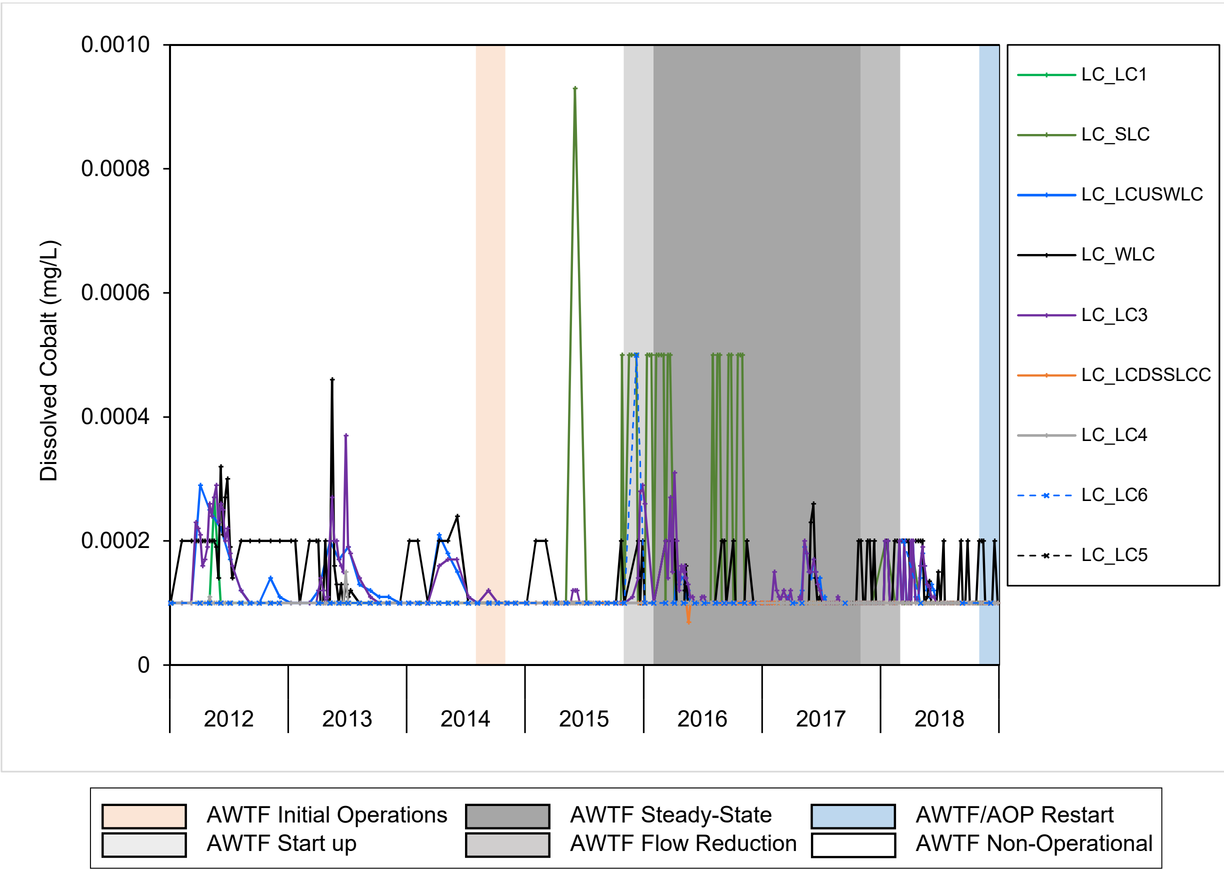

Figure C.16: Time Series Plots for Aqueous Dissolved Cobalt from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.000069 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

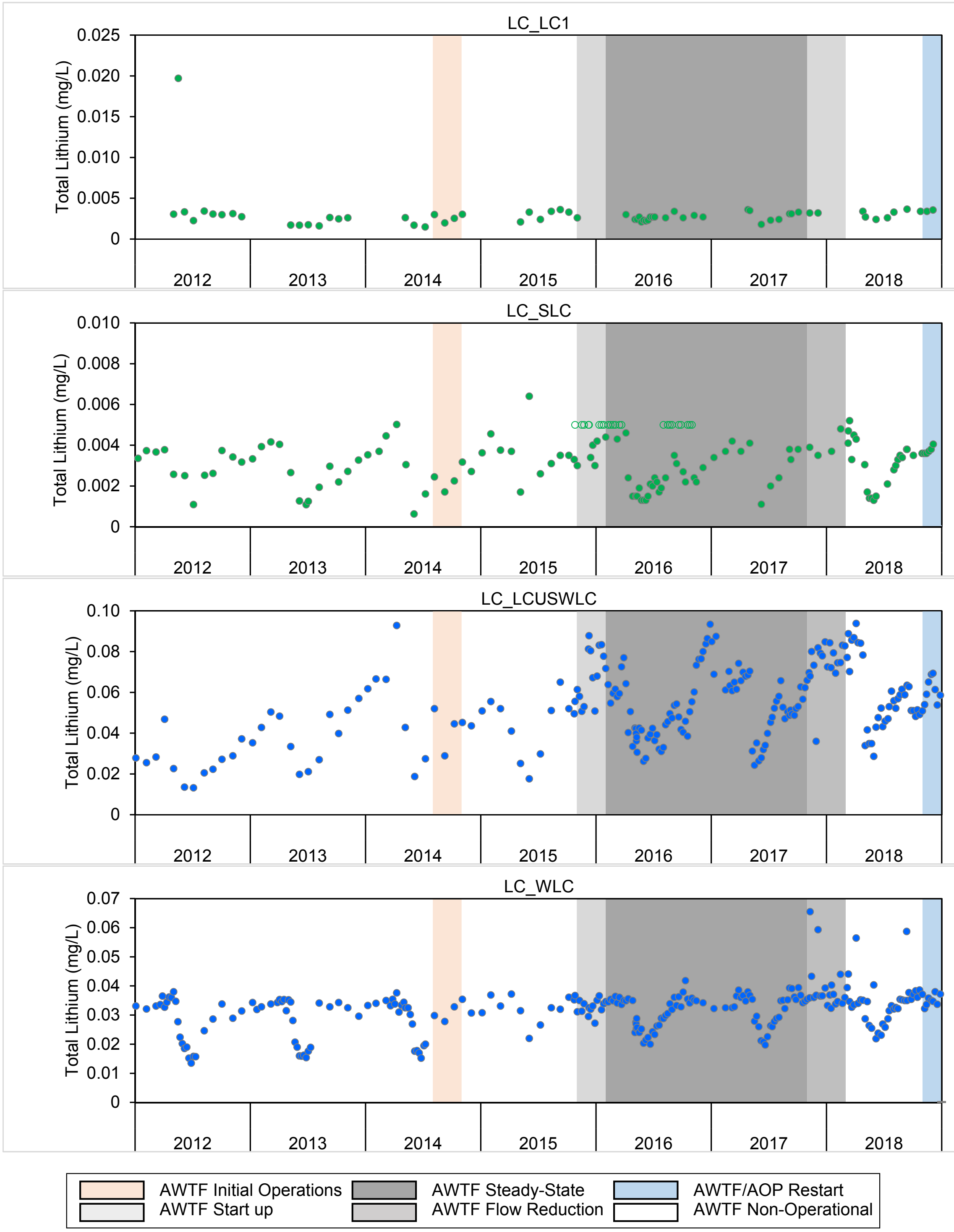

Figure C.17: Time Series Plots for Aqueous Total Lithium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

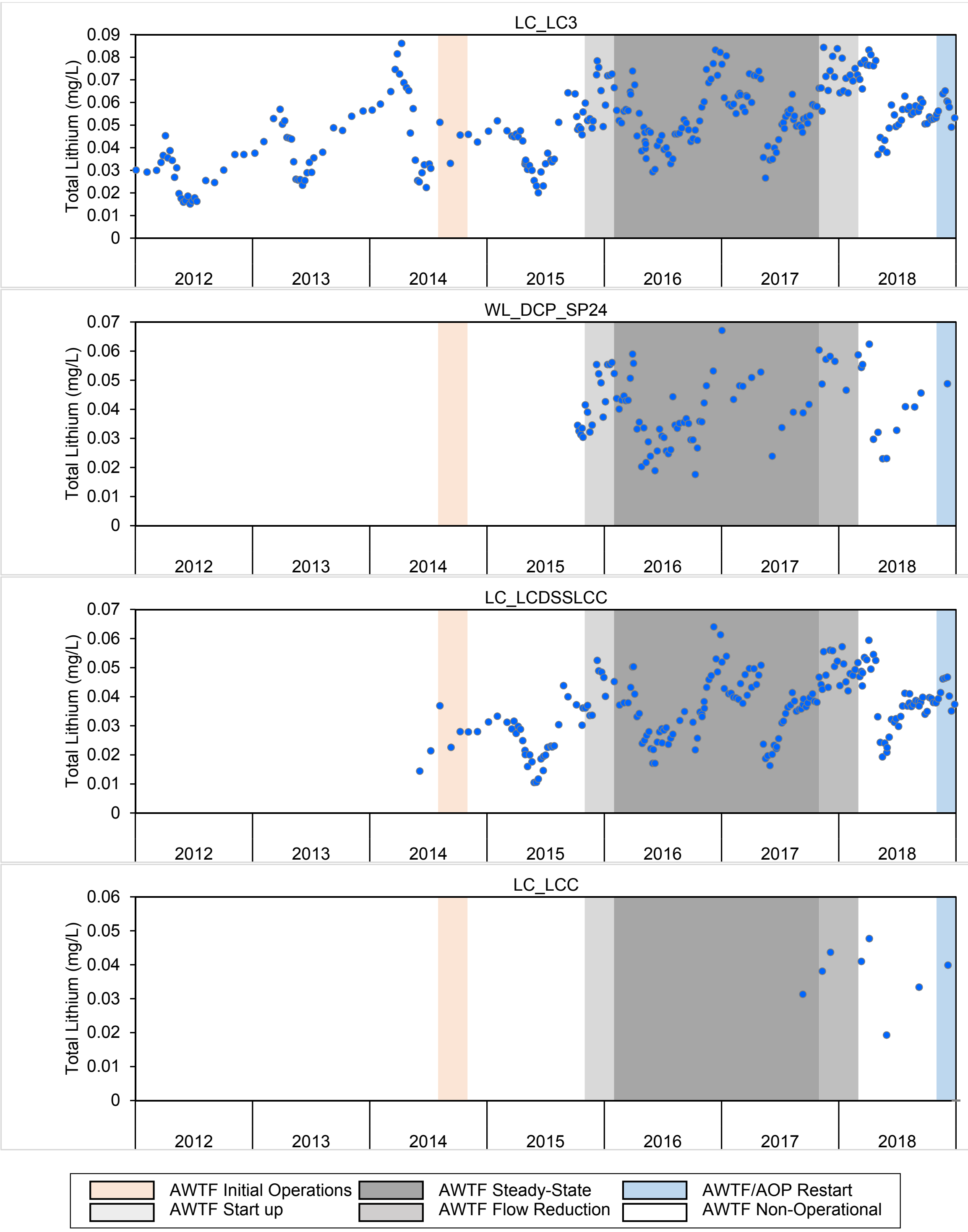

Figure C.17: Time Series Plots for Aqueous Total Lithium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

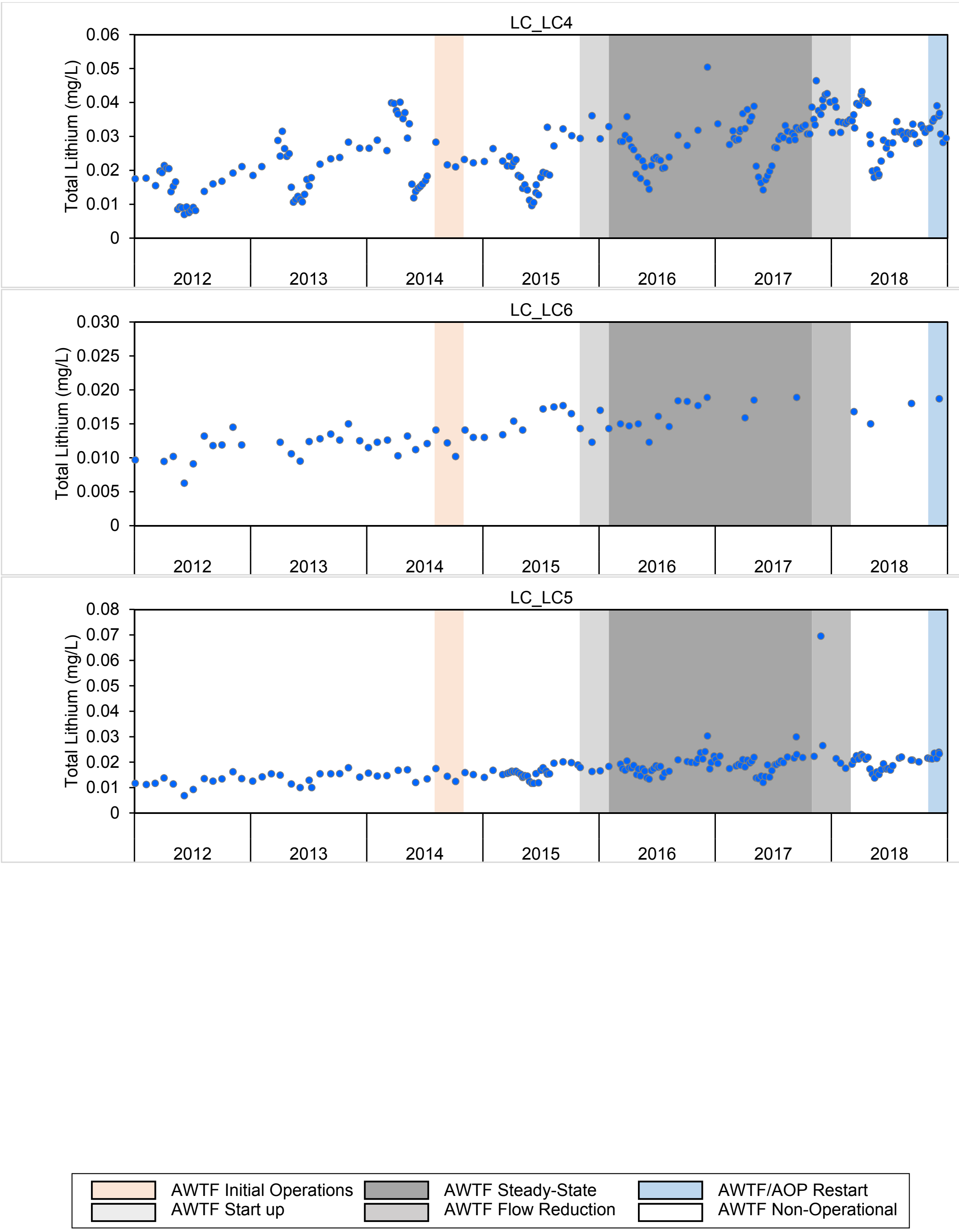

Figure C.17: Time Series Plots for Aqueous Total Lithium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

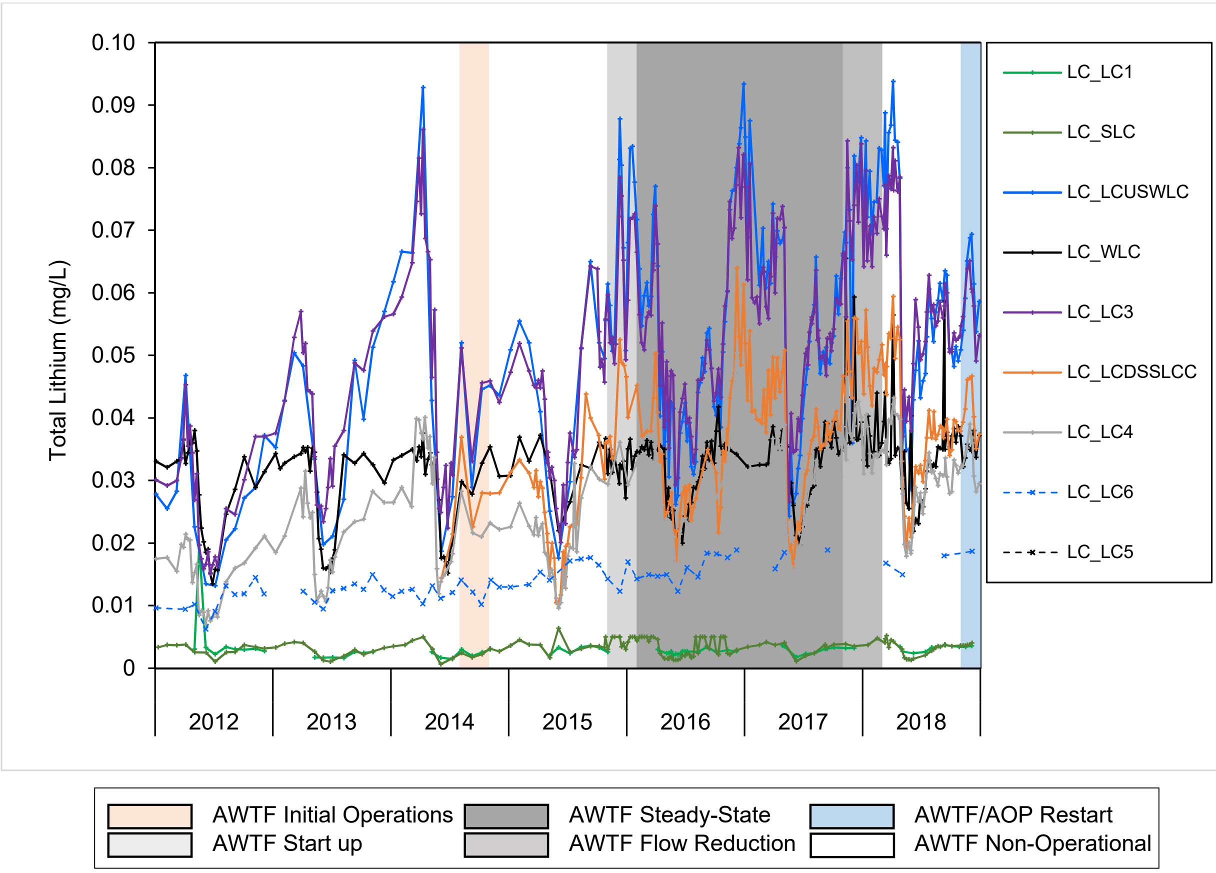

Figure C.18: Time Series Plots for Aqueous Total Lithium from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.00063 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

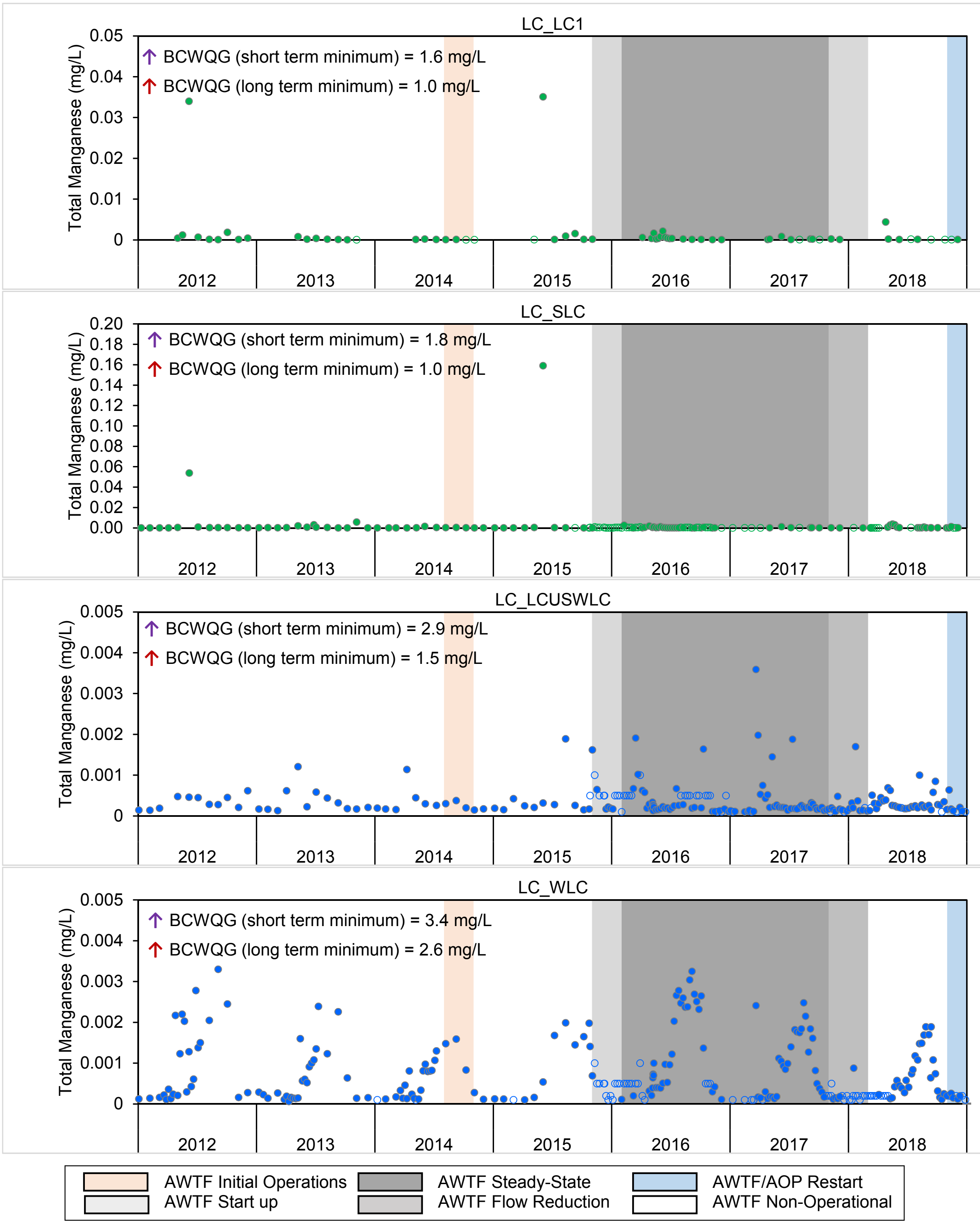

Figure C.19: Time Series Plots for Aqueous Total Manganese Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term).
● = Mine-exposed; ● = Reference.
Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

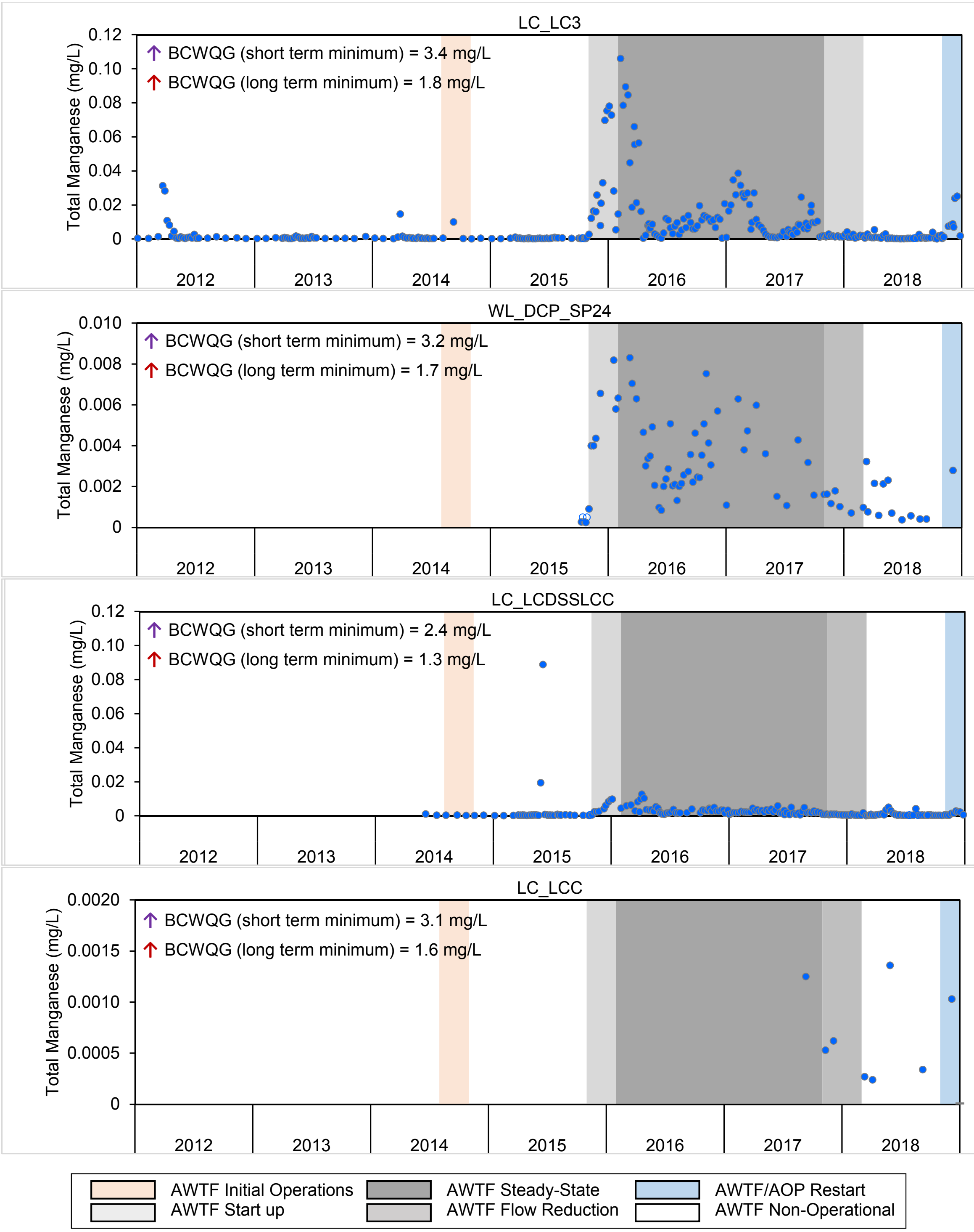

Figure C.19: Time Series Plots for Aqueous Total Manganese Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term); -- = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

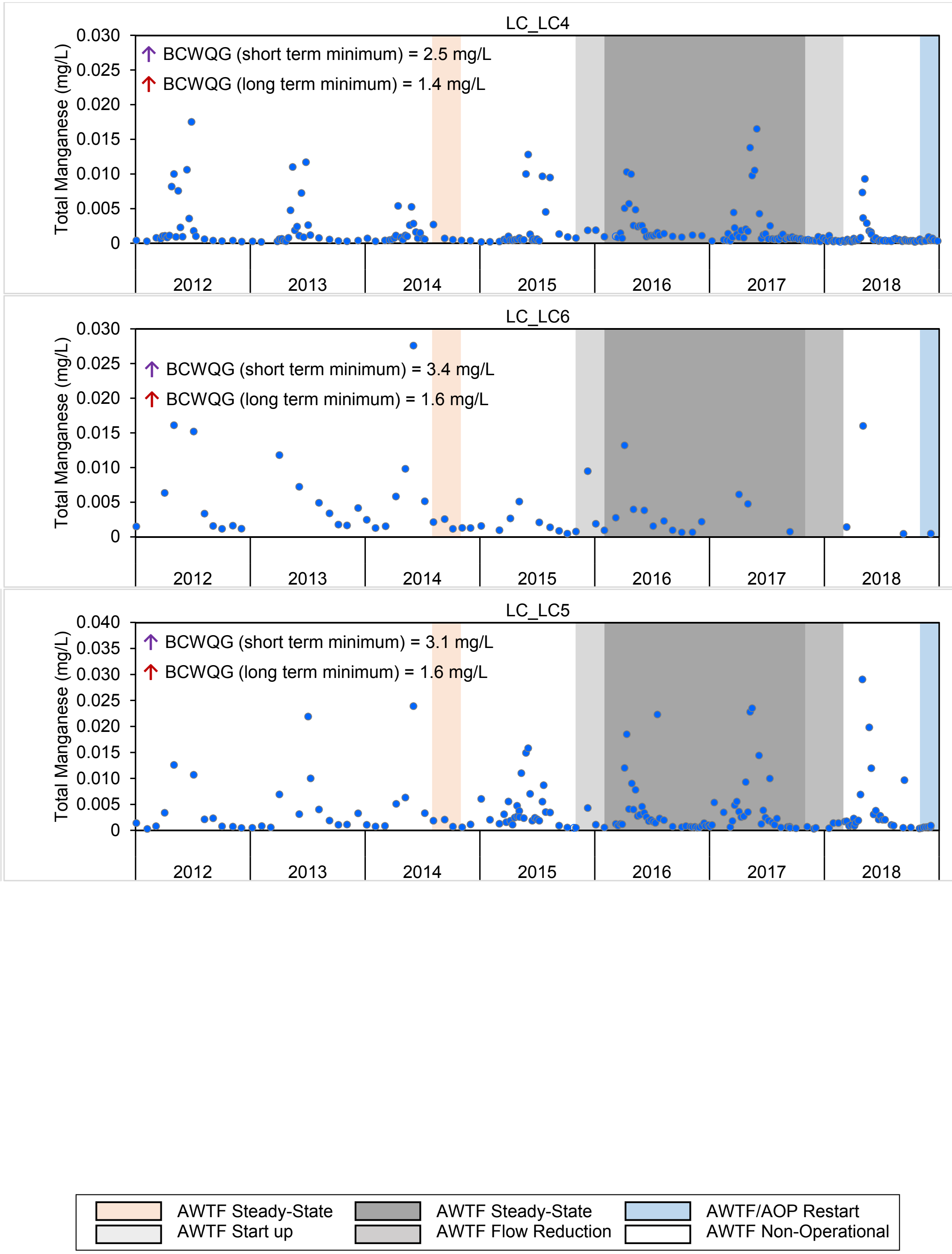

Figure C.19: Time Series Plots for Aqueous Total Manganese Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term); -- = BCWQG (short term).
● = Mine-exposed; ● = Reference.
Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

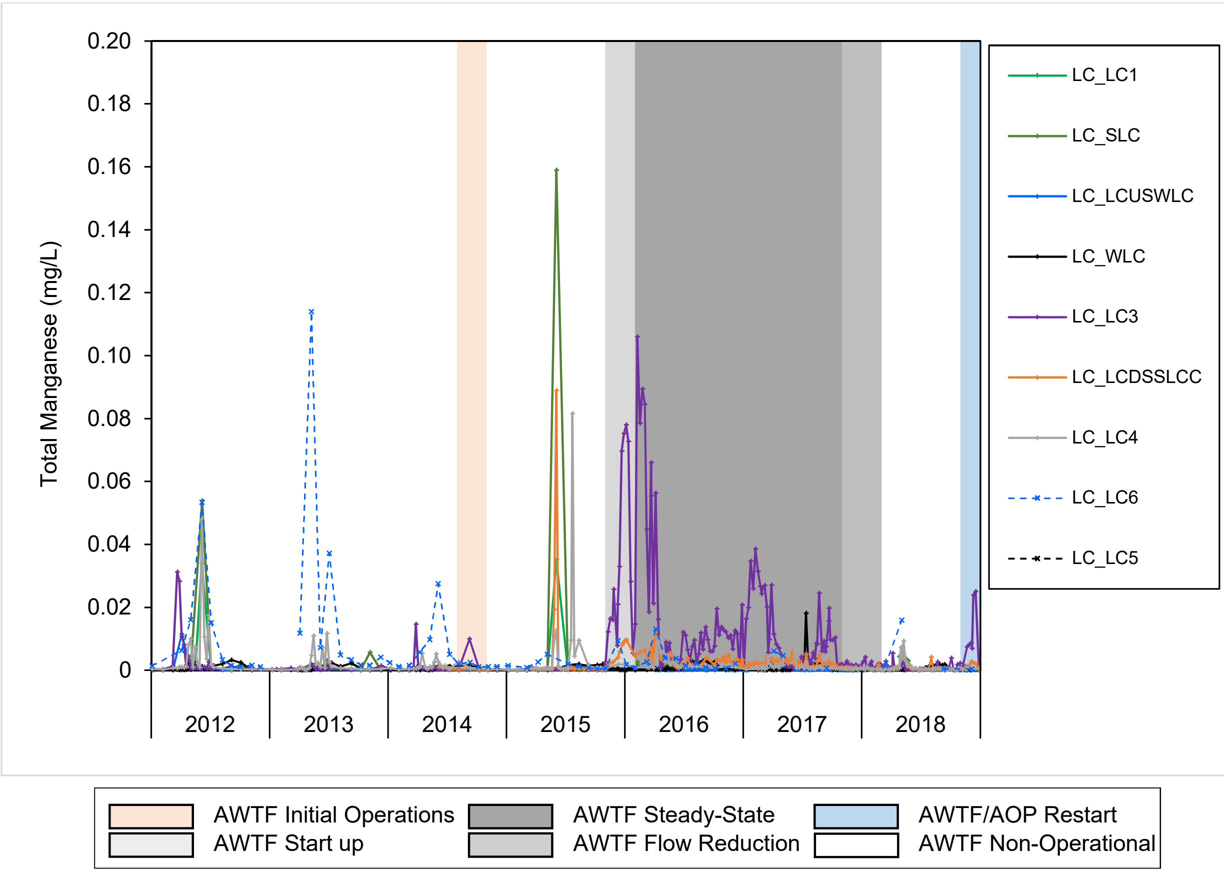

Figure C.20: Time Series Plots for Aqueous Total Manganese from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.00005 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

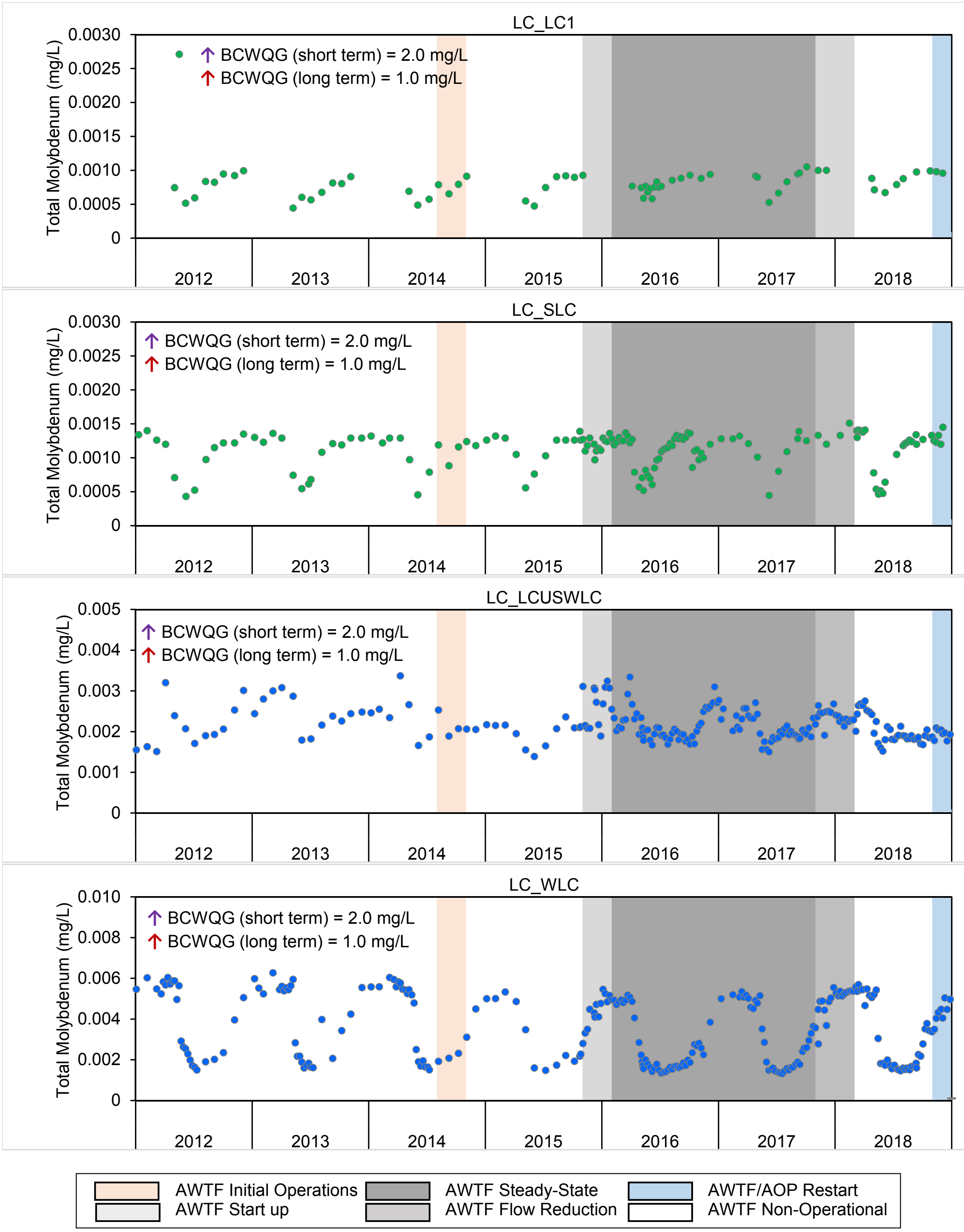

Figure C.21: Time Series Plots for Aqueous Total Molybdenum Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

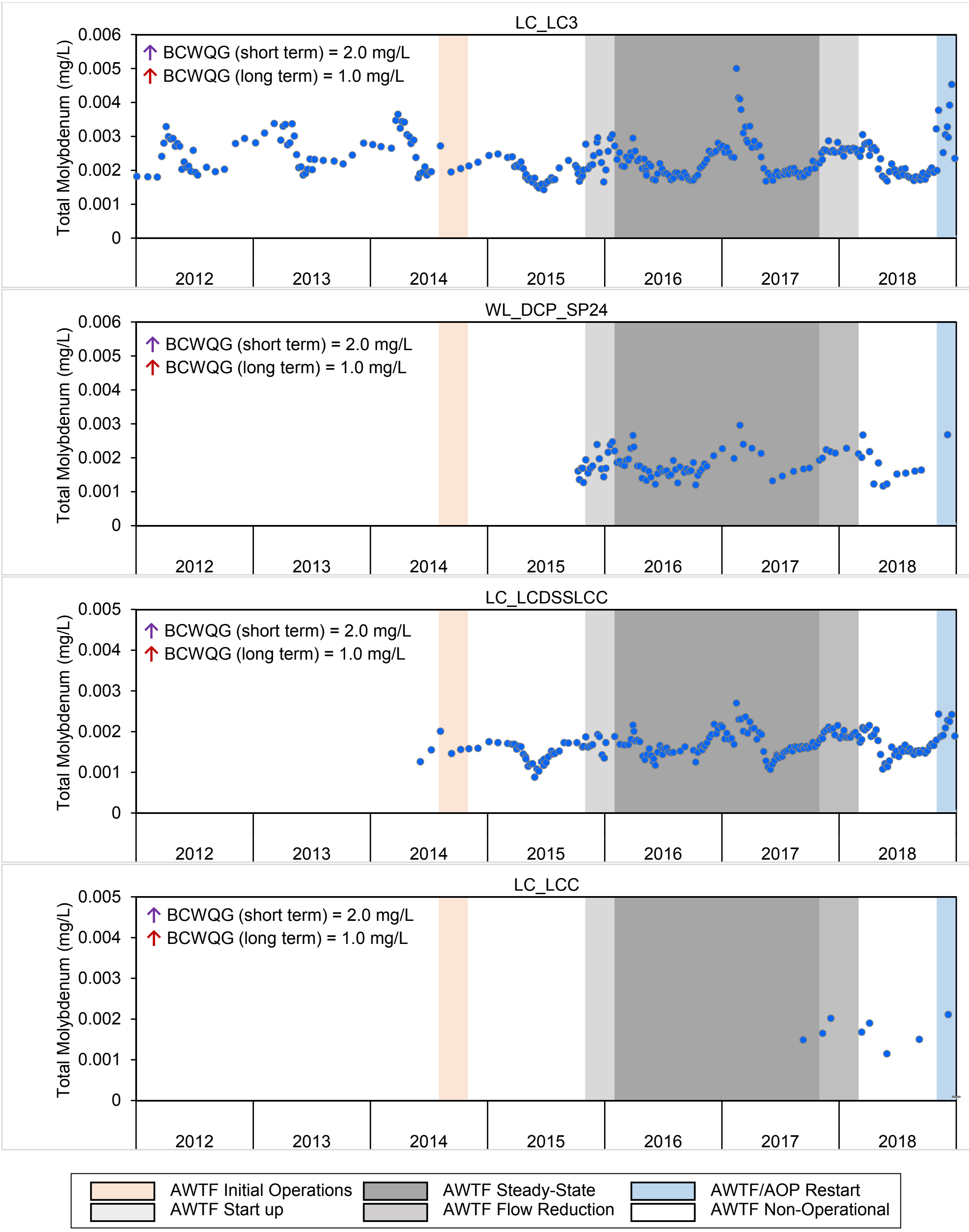

Figure C.21: Time Series Plots for Aqueous Total Molybdenum Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term); -- = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

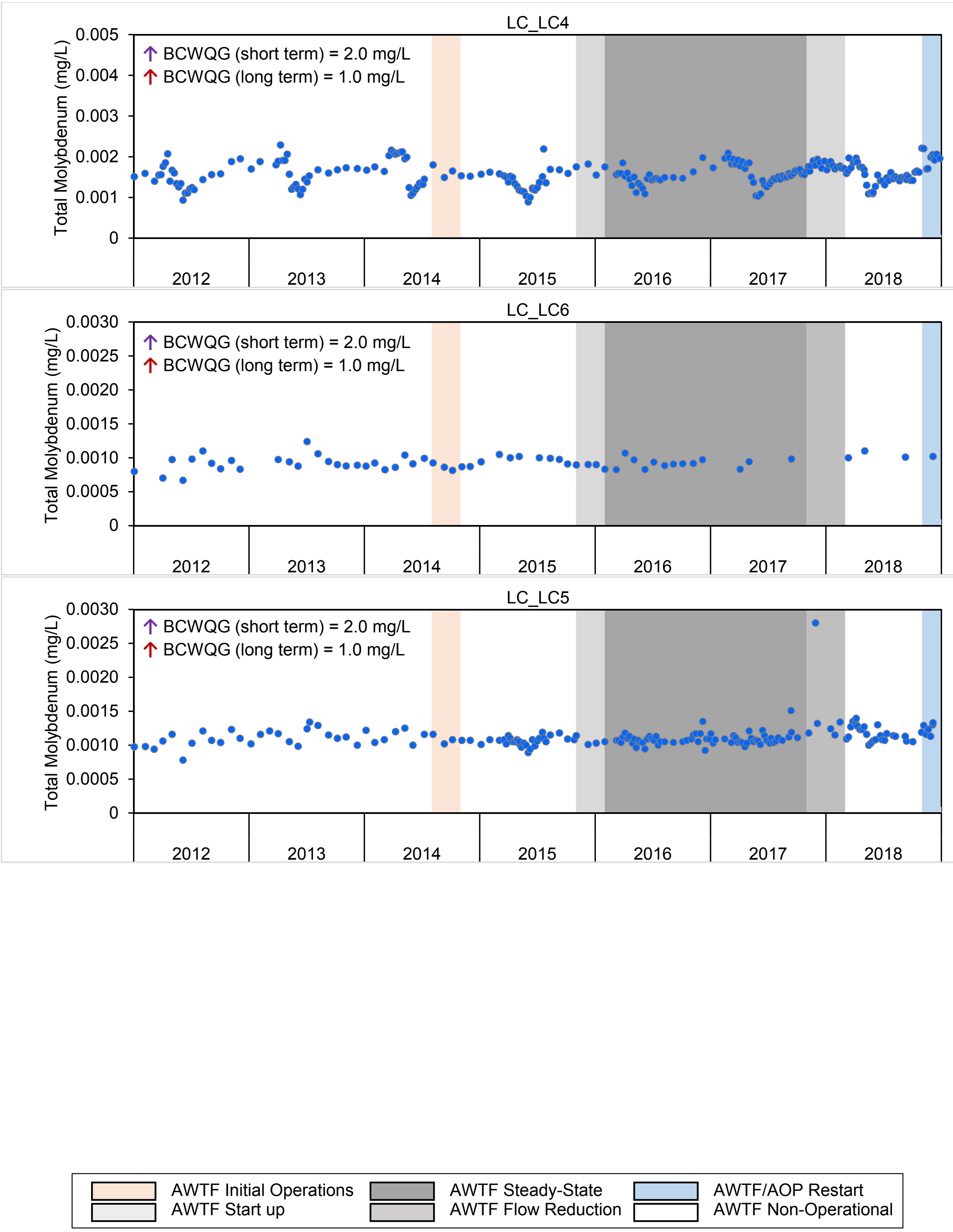

Figure C.21: Time Series Plots for Aqueous Total Molybdenum Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

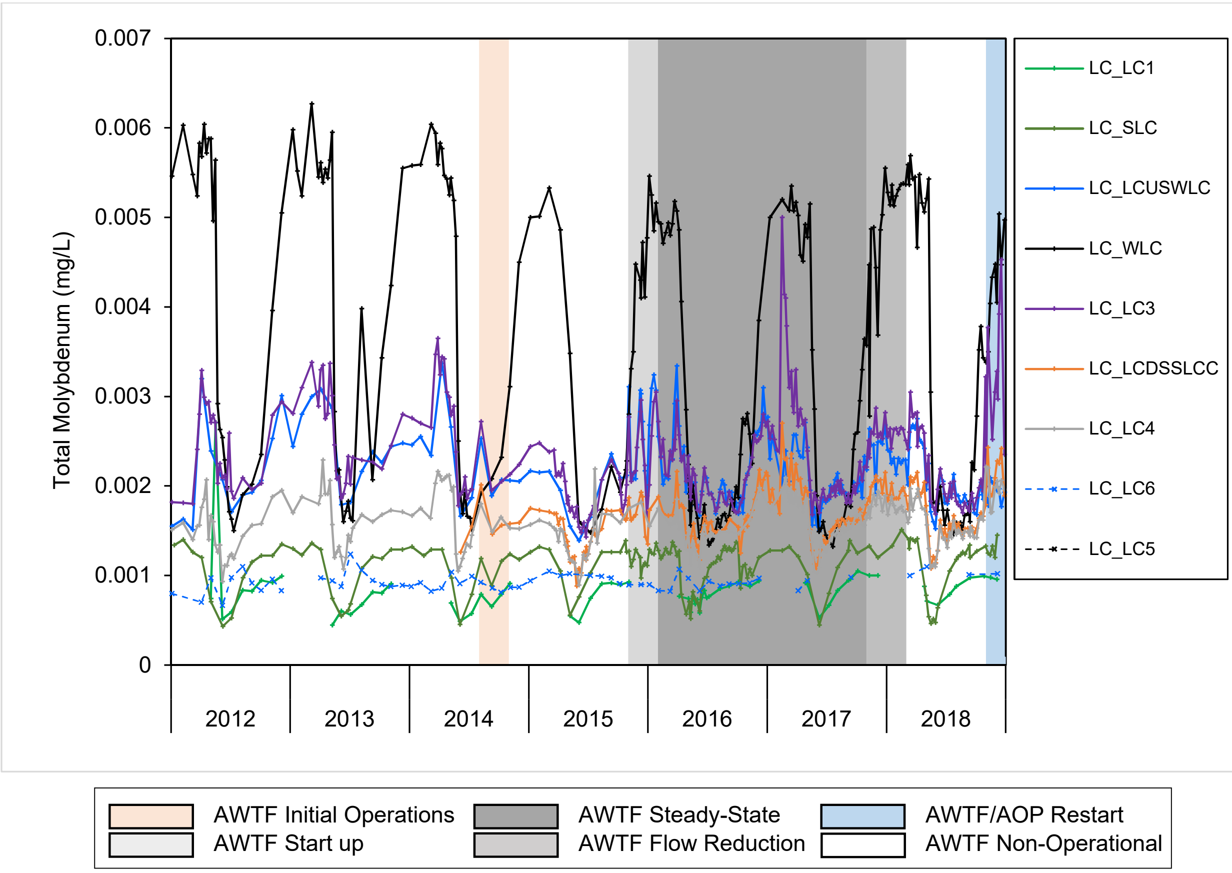

Figure C.22: Time Series Plots for Aqueous Total Molybdenum from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.00043 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

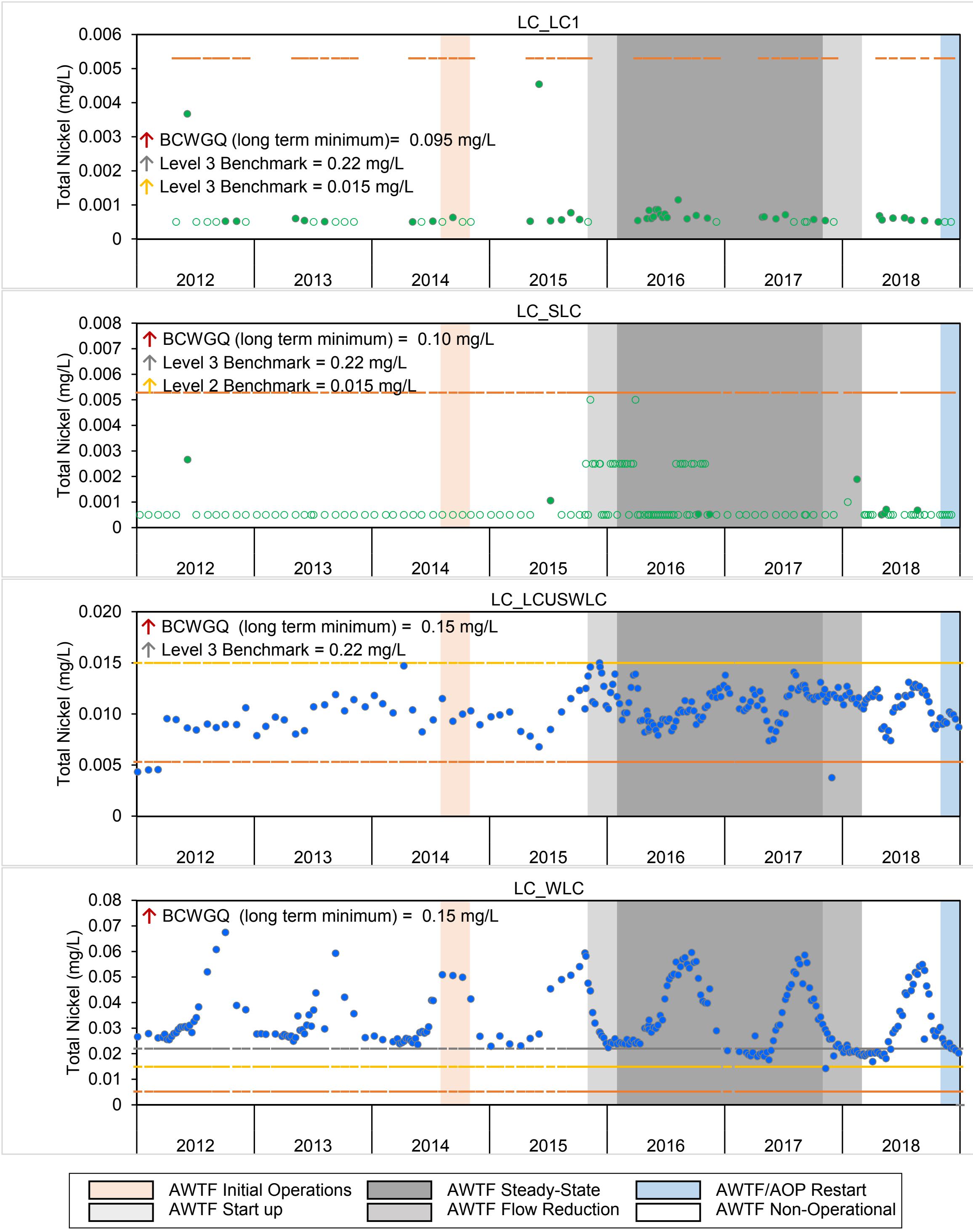

Figure C.23: Time Series Plots for Aqueous Total Nickel Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark; – – = Level 3 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

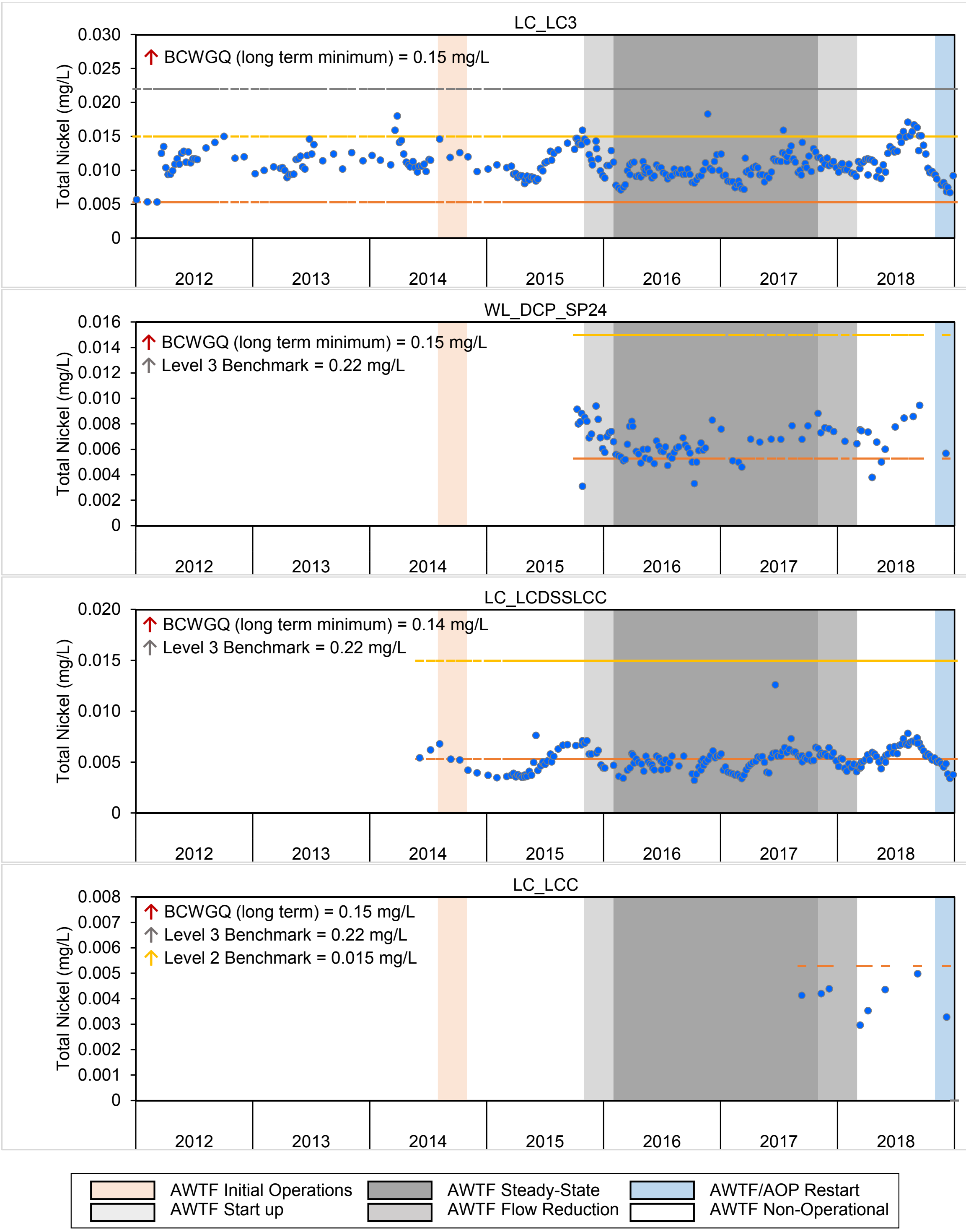

Figure C.23: Time Series Plots for Aqueous Total Nickel Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

= BCWQG (long term); = Level 1 Benchmark; = Level 2 Benchmark; = Level 3 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

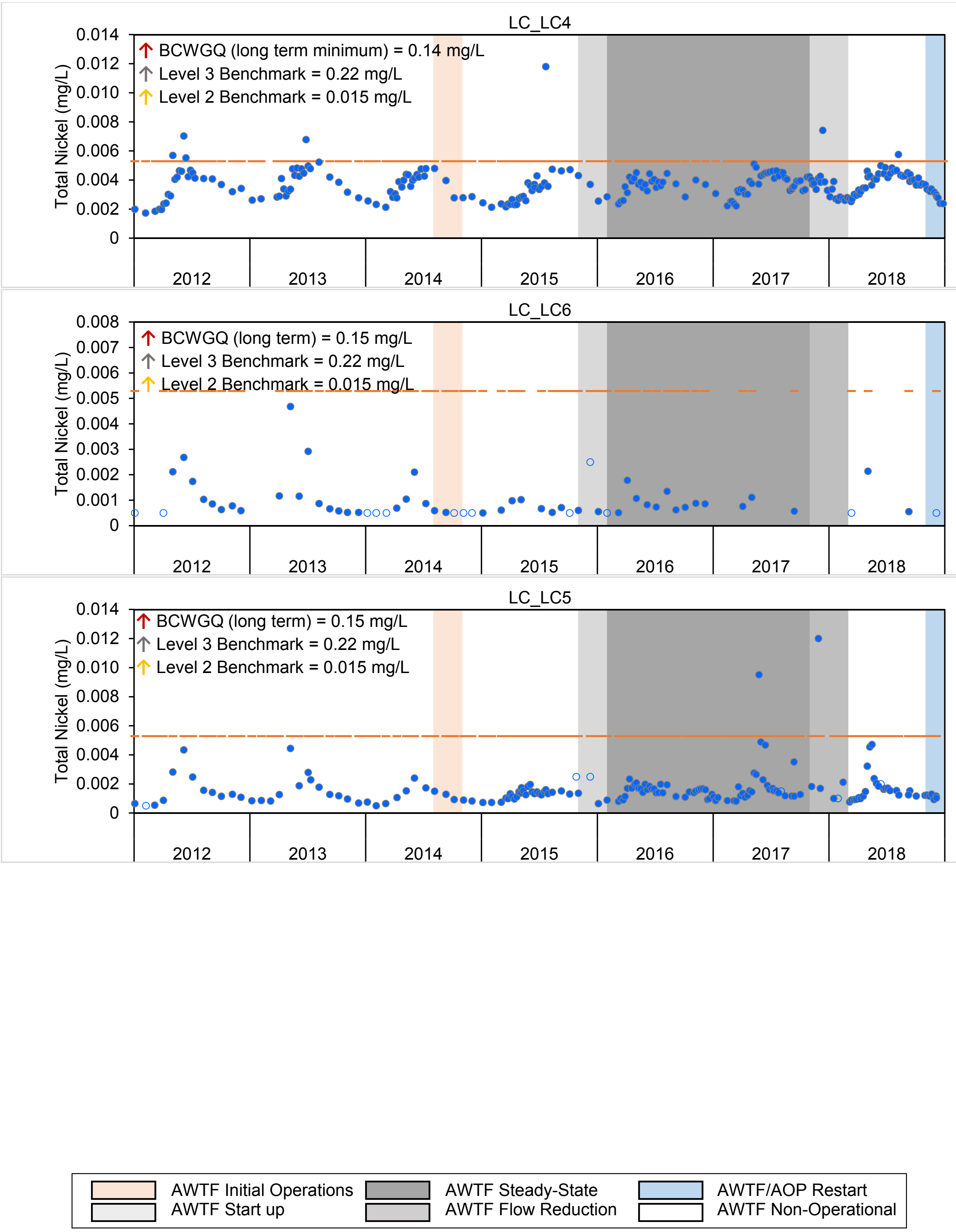

Figure C.23: Time Series Plots for Aqueous Total Nickel Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term); -- = Level 1 Benchmark; -- = Level 2 Benchmark; -- = Level 3 Benchmark.

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

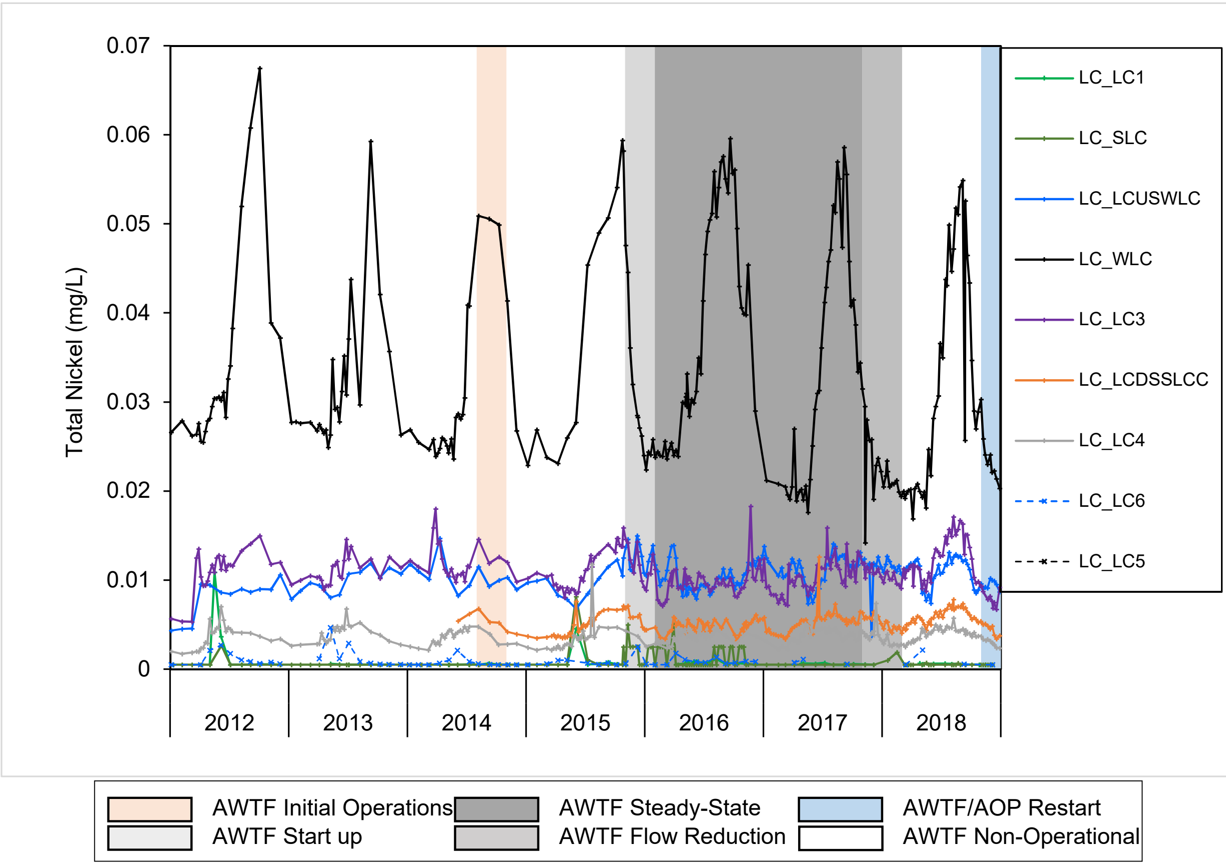

Figure C.24: Time Series Plots for Aqueous Total Nickel from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.0005 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.”

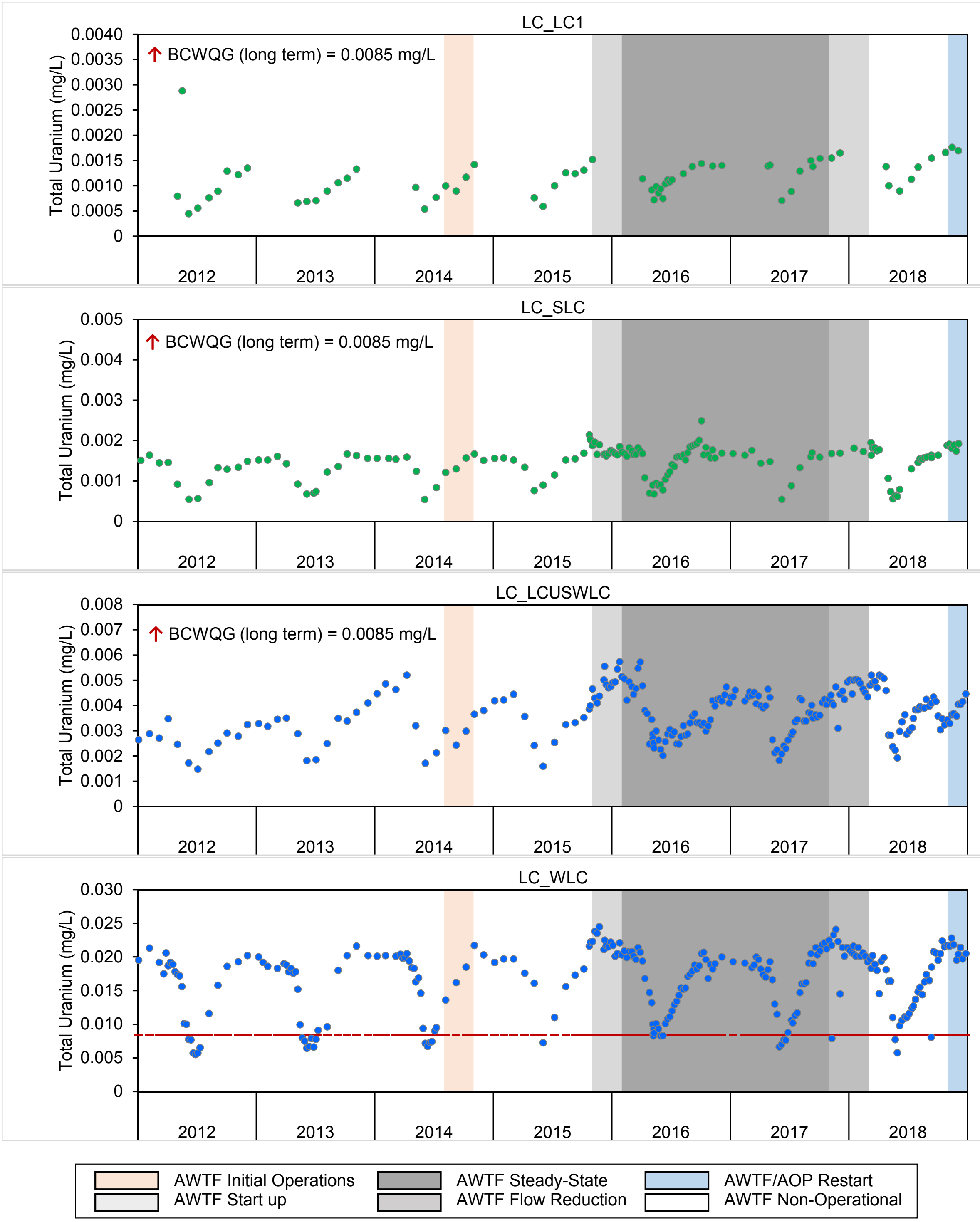

Figure C.25: Time Series Plots for Aqueous Total Uranium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

- - = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

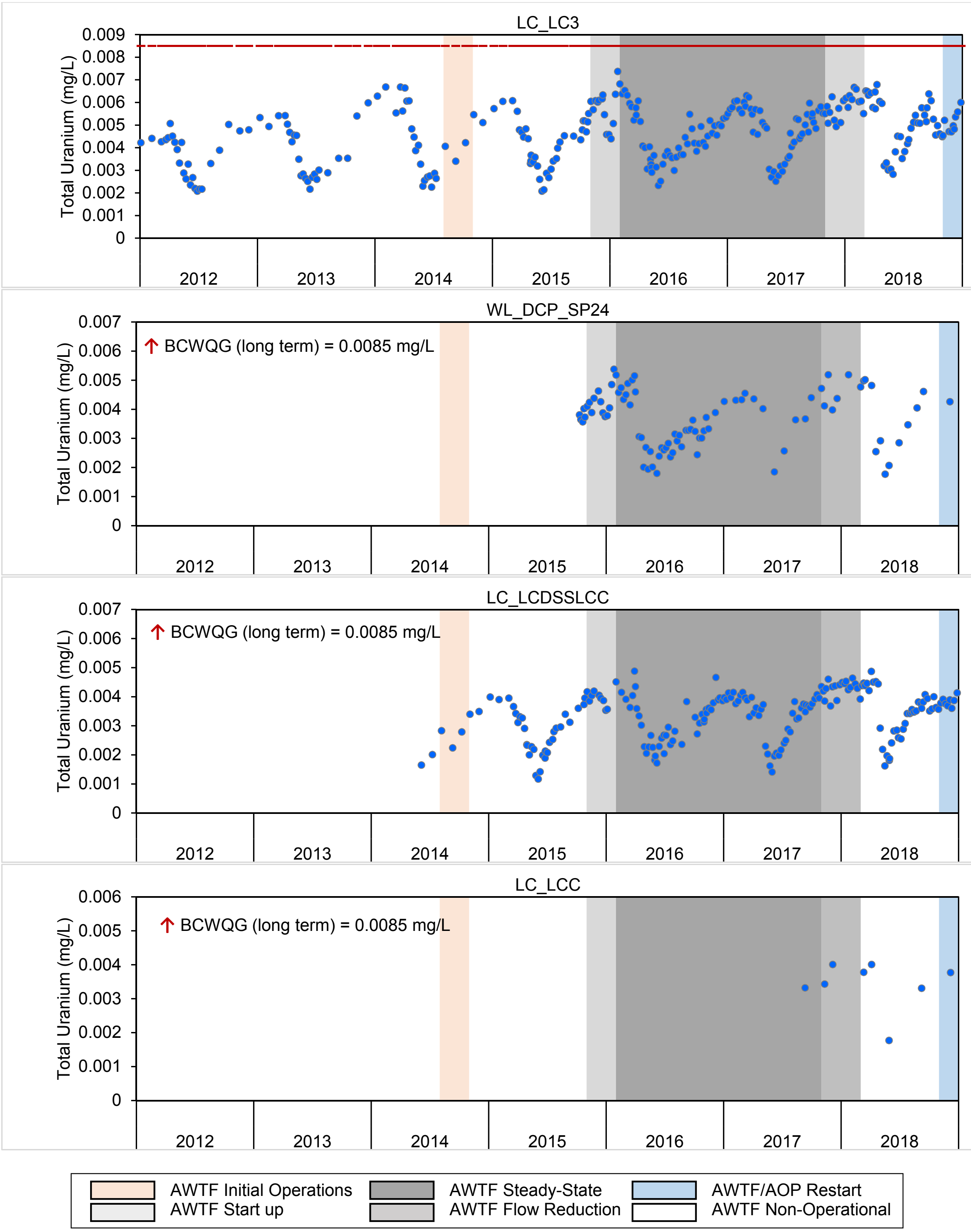

Figure C.25: Time Series Plots for Aqueous Total Uranium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

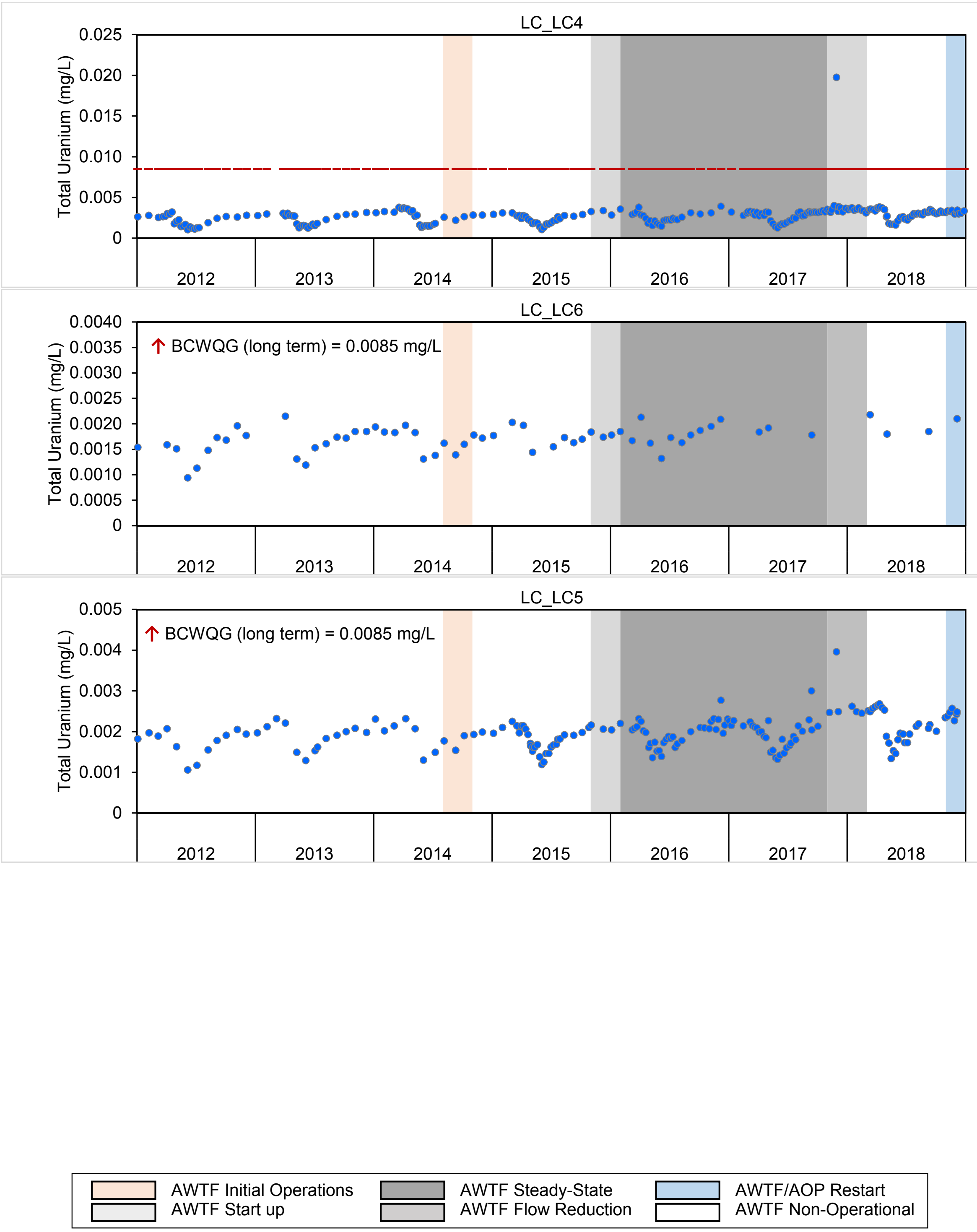

Figure C.25: Time Series Plots for Aqueous Total Uranium Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term).

● = Mine-exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

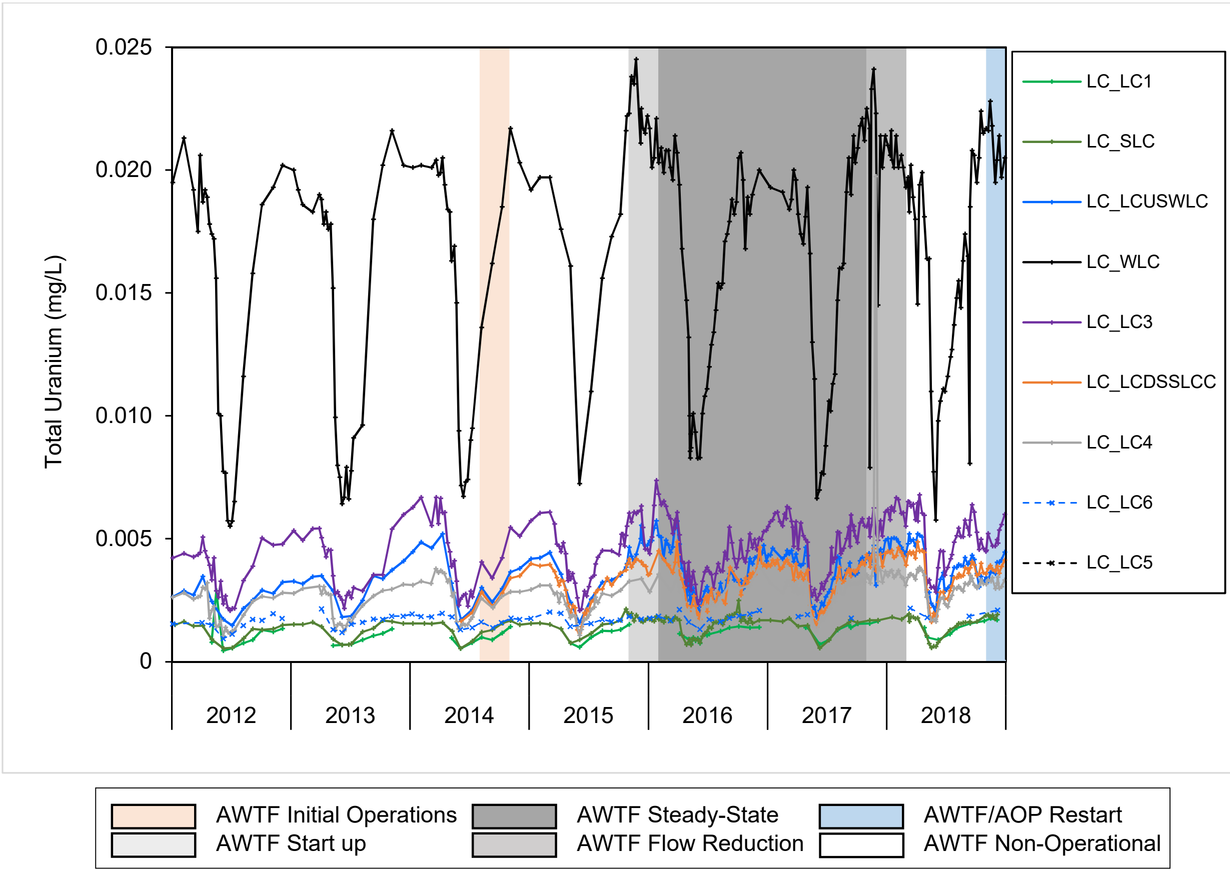

Figure C.26: Time Series Plots for Aqueous Total Uranium from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.000447 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

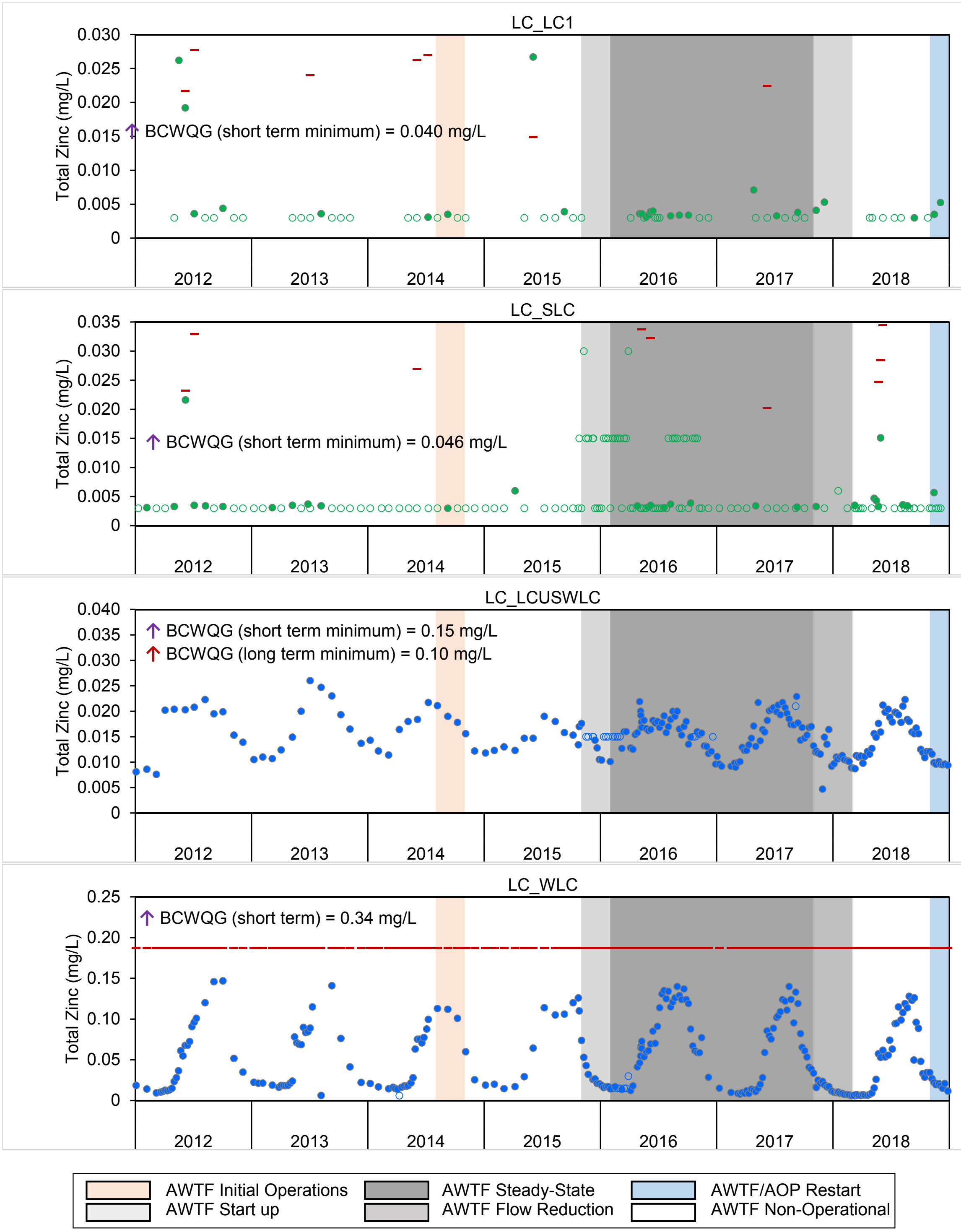

Figure C.27: Time Series Plots for Aqueous Total Zinc Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

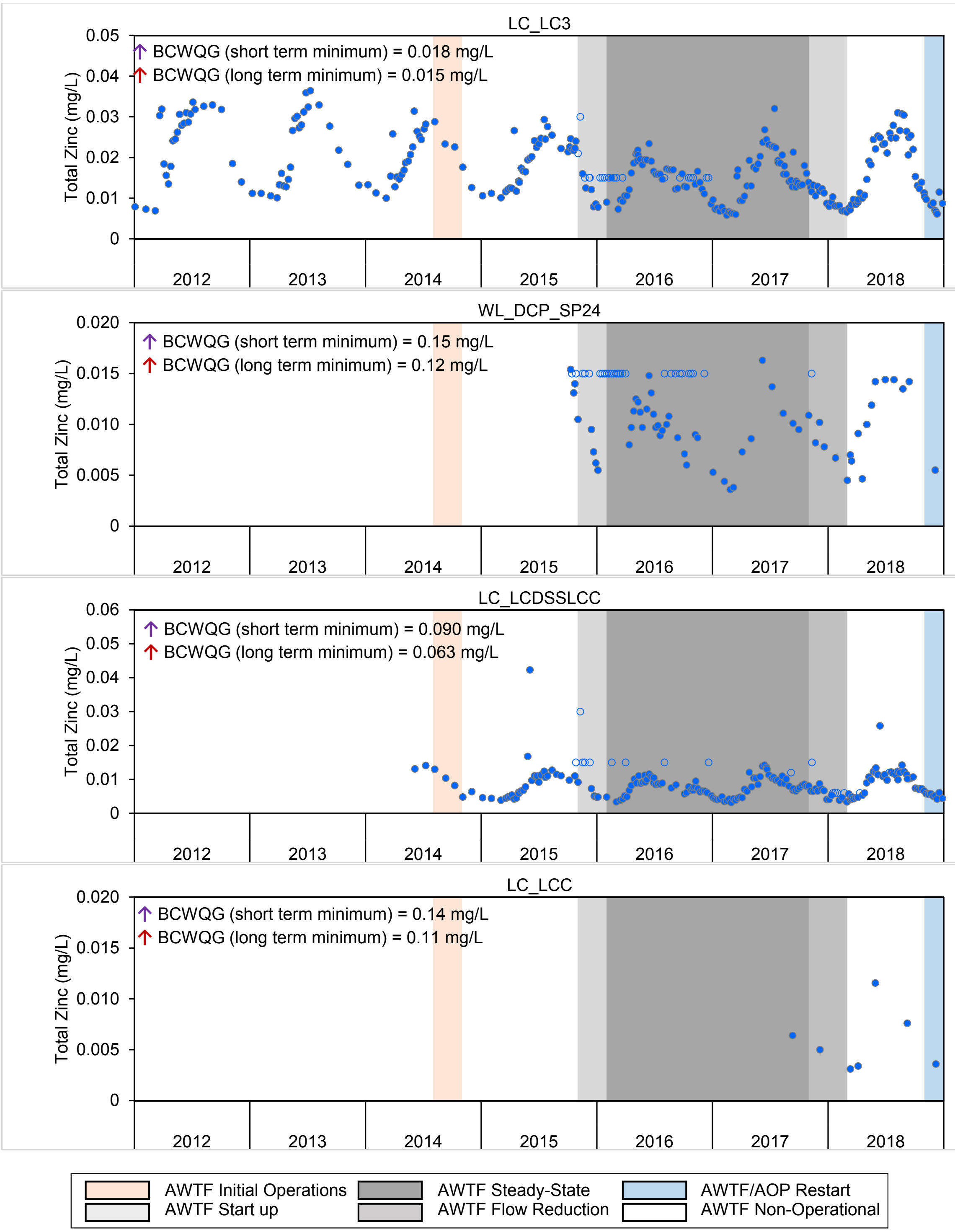

Figure C.27: Time Series Plots for Aqueous Total Zinc Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term); -- = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

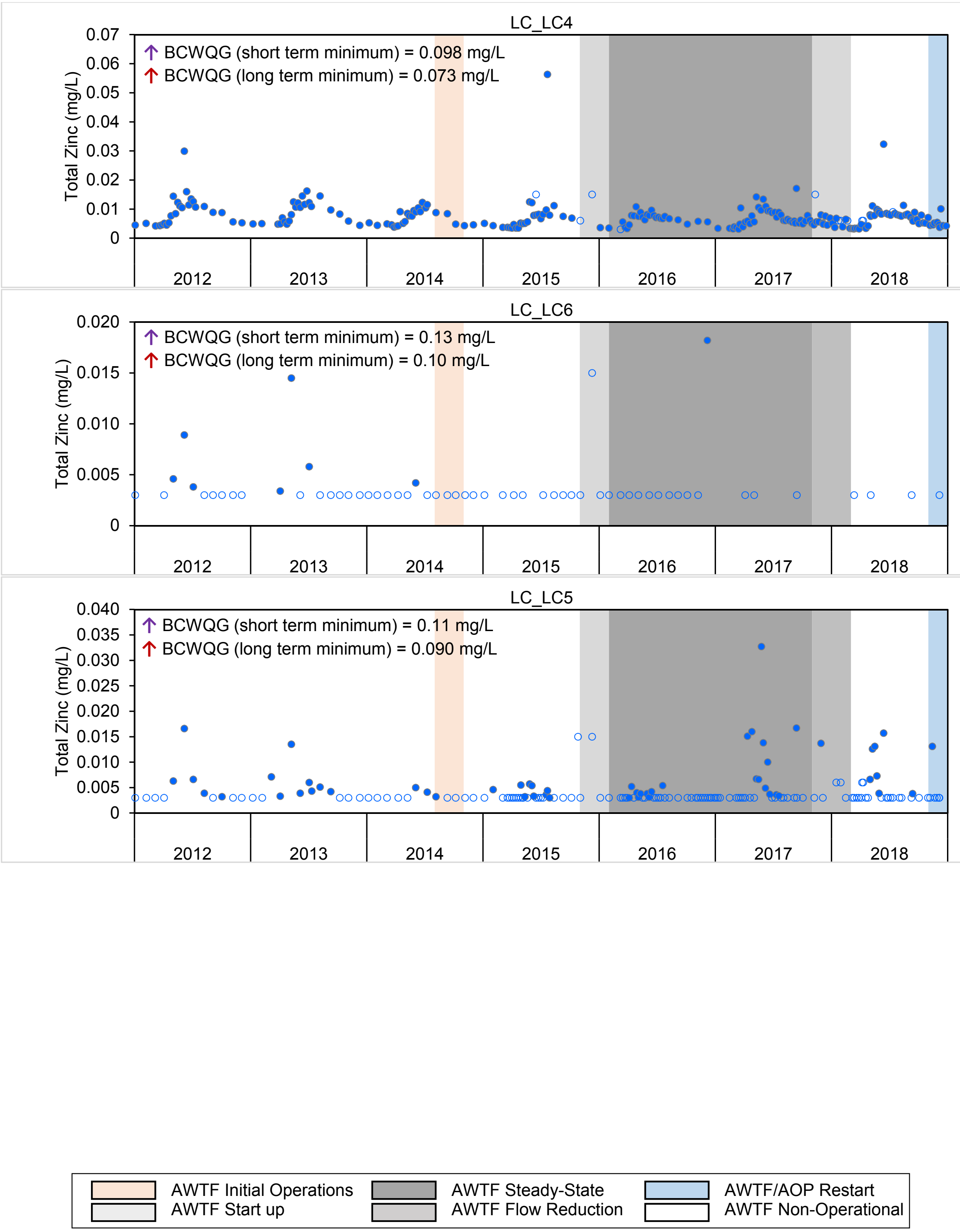

Figure C.27: Time Series Plots for Aqueous Total Zinc Concentrations from Line Creek LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term); -- = BCWQG (short term).

● = Mine-exposed; ● = Reference.

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

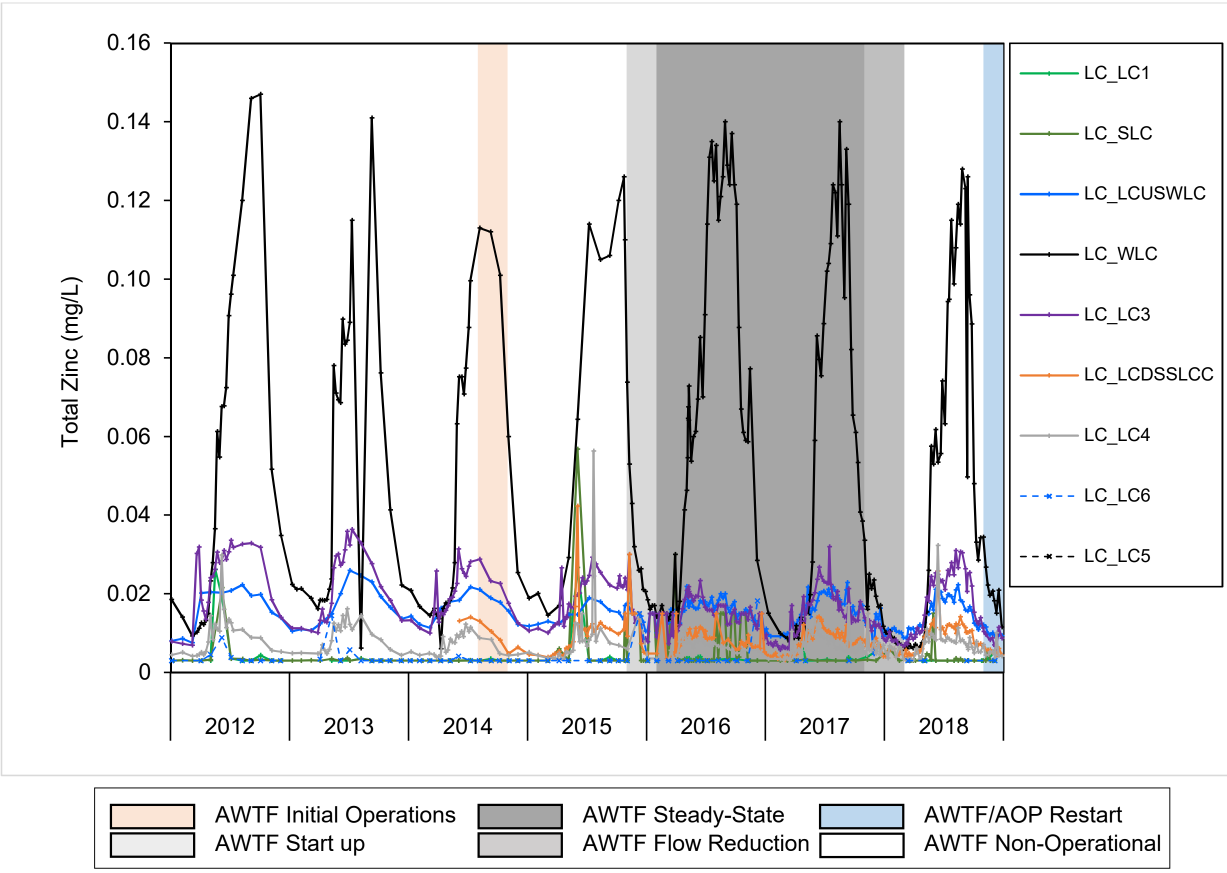

Figure C.28: Time Series Plots for Aqueous Total Zinc from Line Creek LAEMP Stations, 2012 to 2018

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.003 mg/L).
West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

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)
LC_LC1 (RG_LI24)	n	9	9	16	16	9	9	9	9
	Annual Minimum	153	8.00	7.98	8.82	108	0.120	<0.00100	0.00600
	Annual Maximum	257	8.41	8.40	13.1	143	0.281	0.00360	0.0349
	Annual Mean	206	8.28	8.26	11.1	120	0.200	0.00136	0.0157
	Annual Median	222	8.28	8.25	11.6	115	0.204	<0.00100	0.0136
	% < LRL	0%	0%	0%	0%	0%	0%	56%	0%
	% > BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_SLC (RG_SLINE)	n	29	29	25	25	29	29	29	29
	Annual Minimum	124	7.69	7.85	9.07	100	0.0502	<0.00100	<0.00500
	Annual Maximum	315	8.55	8.54	14.1	167	0.163	<0.00100	0.0641
	Annual Mean	217	8.29	8.20	11.5	137	0.101	<0.00100	0.0155
	Annual Median	229	8.30	8.22	11.6	142	0.0949	<0.00100	0.0119
	% < LRL	0%	0%	0%	0%	0%	0%	100%	24%
	% > BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LCUSWLC (RG_LCUT)	n	53	53	62	63	53	53	53	53
	Annual Minimum	312	7.93	6.44	8.75	145	5.68	<0.00100	<0.00500
	Annual Maximum	911	8.56	8.26	13.1	304	28.3	0.00880	0.0394
	Annual Mean	652	8.28	7.85	10.6	205	15.1	0.00141	0.0121
	Annual Median	663	8.31	7.90	10.6	204	14.7	<0.00100	0.00780
	% < LRL	0%	0%	0%	0%	0%	0.0%	83%	19%
	% > BCWQG[a]	-	0%	2%	0%	0%	100%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	64%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	13%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_WLC (RG_LCUT)	n	54	54	60	61	54	55	54	53
	Annual Minimum	<10.0	8.04	7.54	9.10	209	8.58	<0.00100	<0.00500
	Annual Maximum	2,360	8.47	8.39	13.1	432	28.2	0.0225	0.0376
	Annual Mean	1,890	8.26	8.03	11.1	324	20.2	0.00253	0.0116
	Annual Median	1,970	8.25	8.02	11.1	320	19.9	<0.00100	0.00850
	% < LRL	2%	0%	0%	0%	0%	0.0%	83%	17%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	94%	-	-	-	-	82%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	40%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC3 (RG_LILC3)	n	56	56	62	63	63	63	63	63
	Annual Minimum	425	8.01	7.67	9.33	155	8.19	<0.00100	<0.00500
	Annual Maximum	998	8.57	8.23	13.4	281	25.2	0.0116	0.0597
	Annual Mean	799	8.30	7.98	11.3	217	14.8	0.00232	0.0149
	Annual Median	828	8.31	7.95	11.3	220	14.6	0.00150	0.0105
	% < LRL	0%	0%	0%	0%	0%	0%	54%	14%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	22%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	22%
	% > Level 1 Benchmark	0%	-	-	-	-	54%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	17%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
WL_DCP_SP24 (RG_LISP24)	n	14	14	8	8	26	26	26	26
	Annual Minimum	321	7.13	7.66	10.6	107	4.90	<0.00100	<0.00500
	Annual Maximum	872	8.41	8.34	12.3	255	19.9	0.00690	0.160
	Annual Mean	610	8.24	7.99	11.6	196	10.2	0.00177	0.0209
	Annual Median	634	8.36	7.98	11.6	200	9.14	0.00120	0.0140
	% < LRL	0%	0%	0%	0%	0%	0.0%	46%	19%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	62%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	4%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LCDSSLCC (RG_LIDSL)	n	56	56	64	65	56	57	56	56
	Annual Minimum	304	7.97	7.75	8.07	138	4.71	<0.00100	<0.00500
	Annual Maximum	805	8.55	9.62	14.6	361	18.6	0.00660	0.0330
	Annual Mean	610	8.35	8.26	11.4	200	10.6	0.00175	0.0123
	Annual Median	620	8.37	8.26	11.6	198	9.88	0.00120	0.00995
	% < LRL	0%	0%	0%	0%	0%	0.0%	43%	14%
	% > BCWQG[a]	-	0%	2%	0%	0%	100%	0%	4%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	4%
	% > Level 1 Benchmark	0%	-	-	-	-	9%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > 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
[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

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)
LC_LCC (RG_LIDCOM)	n	5	5	3	3	5	5	5	5
	Annual Minimum	300	8.21	7.62	11.7	152	4.26	0.00145	<0.00500
	Annual Maximum	718	8.51	8.38	14.1	209	14.9	0.00670	0.0529
	Annual Mean	572	8.36	8.09	12.8	192	9.52	0.00322	0.0149
	Annual Median	619	8.41	8.26	12.6	200	9.62	0.00260	0.00540
	% < LRL	0%	0%	0%	0%	0%	0.0%	20%	20%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	20%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC4 (RG_LI8)	n	58	58	65	66	58	58	58	58
	Annual Minimum	268	7.91	7.51	9.48	129	3.98	<0.00100	<0.00500
	Annual Maximum	660	8.55	8.60	14.2	327	13.1	0.00550	0.0446
	Annual Mean	512	8.37	8.35	11.7	185	8.07	0.00182	0.0149
	Annual Median	528	8.39	8.40	11.7	185	7.81	0.00140	0.0115
	% < LRL	0%	0%	0%	0%	0%	0.0%	14%	10%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC6 (RG_FRUL)	n	4	4	2	2	4	4	4	4
	Annual Minimum	352	8.28	7.12	11.2	164	7.77	0.00230	<0.00500
	Annual Maximum	561	8.47	7.53	13.8	202	11.3	0.00540	0.0395
	Annual Mean	458	8.39	7.32	12.5	189	9.73	0.00388	0.0144
	Annual Median	460	8.40	7.32	12.5	195	9.92	0.00390	0.00645
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	25%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC5 (RG_FO23)	n	35	35	34	34	35	35	35	35
	Annual Minimum	298	8.09	7.65	8.48	141	4.70	<0.00100	<0.00500
	Annual Maximum	657	8.51	8.53	14.0	255	12.4	0.00700	0.434
	Annual Mean	499	8.36	8.27	11.4	186	8.68	0.00303	0.0229
	Annual Median	513	8.38	8.36	11.3	188	8.68	0.00290	0.00900
	% < LRL	0%	0%	0%	0%	0%	0.0%	6%	17%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > 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

[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: **Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018**

Station	Summary Statistic	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)
LC_LC1 (RG_LI24)	n	9	9	9	9	9	9	9	9
	Annual Minimum	26.0	<0.500	0.274	<0.000100	0.000140	0.0343	<0.0000200	<0.0100
	Annual Maximum	86.6	<0.500	0.450	<0.000100	<0.000400	0.0512	<0.0000200	<0.0100
	Annual Mean	57.2	<0.500	0.365	<0.000100	0.000182	0.0433	<0.0000200	<0.0100
	Annual Median	61.1	<0.500	0.394	<0.000100	0.000188	0.0453	<0.0000200	<0.0100
	% < LRL	0%	100%	0%	100%	11%	0%	100%	100%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_SLC (RG_SLINE)	n	29	29	29	28	29	29	29	28
	Annual Minimum	8.43	0.360	0.180	<0.000100	0.000100	0.0224	<0.0000200	<0.0100
	Annual Maximum	82.0	0.545	0.384	<0.000100	0.000245	0.0511	<0.0000400	<0.0100
	Annual Mean	52.6	0.391	0.309	<0.000100	0.000143	0.0400	<0.0000200	<0.0100
	Annual Median	58.1	0.380	0.318	<0.000100	0.000140	0.0423	<0.0000200	<0.0100
	% < LRL	0%	79%	0%	100%	3%	0%	100%	100%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LCUSWLC (RG_LCUT)	n	53	53	53	53	53	53	47	53
	Annual Minimum	93.0	1.78	<0.100	0.000330	0.000110	0.0257	<0.0000200	<0.0100
	Annual Maximum	371	10.0	0.266	0.000570	0.000230	0.0849	<0.0000200	0.0250
	Annual Mean	248	4.69	0.213	0.000415	0.000155	0.0632	<0.0000200	0.0179
	Annual Median	250	4.25	0.230	0.000410	0.000160	0.0671	<0.0000200	0.0180
	% < LRL	0%	0%	2%	0%	11%	0%	100%	9%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_WLC (RG_LCUT)	n	54	54	54	55	55	55	55	55
	Annual Minimum	348	2.05	<0.100	0.000420	0.000145	0.0149	<0.0000200	0.0130
	Annual Maximum	1,320	7.60	<0.400	0.000620	0.000440	0.0576	<0.0000400	0.0220
	Annual Mean	1,040	4.85	0.180	0.000509	0.000265	0.0245	<0.0000200	0.0171
	Annual Median	1,090	4.90	0.170	0.000510	0.000270	0.0239	<0.0000200	0.0170
	% < LRL	0%	0%	6%	0%	5%	0%	100%	36%
	% > BCWQG[a]	96%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	96%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC3 (RG_LILC3)	n	63	56	56	56	56	56	56	56
	Annual Minimum	148	2.30	0.102	0.000310	<0.000100	0.0251	<0.0000200	0.0110
	Annual Maximum	465	26.9	0.270	0.000530	0.000220	0.0888	<0.0000400	0.0260
	Annual Mean	338	8.21	0.206	0.000401	0.000157	0.0616	<0.0000200	0.0181
	Annual Median	352	5.83	0.220	0.000400	0.000160	0.0629	<0.0000200	0.0180
	% < LRL	0%	0%	0%	0%	13%	0%	100%	7%
	% > BCWQG[a]	3%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	3%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
WL_DCP_SP24 (RG_LISP24)	n	14	14	14	14	14	14	14	14
	Annual Minimum	83.6	1.46	0.140	0.000240	<0.000100	0.0261	<0.0000200	<0.0100
	Annual Maximum	350	11.0	0.260	0.000350	0.000510	0.0827	<0.0000200	0.0180
	Annual Mean	240	4.83	0.211	0.000294	0.000171	0.0565	<0.0000200	0.0138
	Annual Median	262	4.45	0.216	0.000290	0.000140	0.0613	<0.0000200	0.0140
	% < LRL	0%	0%	0%	0%	7%	0%	100%	14%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LCDSSLCC (RG_LIDSL)	n	57	56	56	57	57	57	57	57
	Annual Minimum	81.9	1.44	0.119	0.000190	0.000100	0.0297	<0.0000200	<0.0100
	Annual Maximum	353	12.5	0.270	0.000360	0.000250	0.0948	<0.0000400	<0.0200
	Annual Mean	238	5.12	0.217	0.000255	0.000153	0.0695	<0.0000200	0.0136
	Annual Median	250	4.28	0.230	0.000250	0.000140	0.0740	<0.0000200	0.0140
	% < LRL	0%	0%	0%	0%	9%	0%	100%	21%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-

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Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline
[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)
LC_LCC (RG_LIDCOM)	n	5	5	5	5	5	5	5	5
	Annual Minimum	84.6	1.34	0.186	0.000195	0.000100	0.0331	<0.0000200	<0.0100
	Annual Maximum	282	8.70	0.240	0.000250	0.000195	0.0946	<0.0000200	0.0160
	Annual Mean	218	4.89	0.223	0.000219	0.000151	0.0750	<0.0000200	0.0130
	Annual Median	242	4.74	0.231	0.000220	0.000160	0.0821	<0.0000200	0.0130
	% < LRL	0%	0%	0%	0%	0%	0%	100%	20%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC4 (RG_LI8)	n	58	58	58	58	58	58	58	51
	Annual Minimum	77.8	1.25	0.199	0.000160	0.000100	0.0323	<0.0000200	<0.0100
	Annual Maximum	255	8.66	0.307	0.000280	0.000300	0.0987	<0.0000400	0.0150
	Annual Mean	191	4.11	0.259	0.000201	0.000149	0.0702	<0.0000200	0.0123
	Annual Median	201	3.66	0.266	0.000200	0.000140	0.0748	<0.0000200	0.0120
	% < LRL	0%	0%	0%	5%	10%	0%	100%	14%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC6 (RG_FRUL)	n	4	4	4	4	4	4	4	4
	Annual Minimum	154	1.46	0.121	<0.000100	0.000130	0.0829	<0.0000200	<0.0100
	Annual Maximum	227	1.99	0.192	0.000170	0.000240	0.115	<0.0000200	<0.0100
	Annual Mean	192	1.75	0.170	0.000125	0.000165	0.104	<0.0000200	<0.0100
	Annual Median	193	1.77	0.184	0.000115	0.000145	0.110	<0.0000200	<0.0100
	% < LRL	0%	0%	0%	50%	0%	0%	100%	100%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC5 (RG_FO23)	n	35	35	35	35	35	35	34	35
	Annual Minimum	83.3	0.960	0.131	0.000100	0.000100	0.0581	<0.0000200	<0.0100
	Annual Maximum	247	4.20	0.239	0.000220	0.000710	0.112	0.0000780	<0.0200
	Annual Mean	177	2.34	0.196	0.000141	0.000184	0.0916	0.0000233	0.0100
	Annual Median	186	2.48	0.209	0.000130	0.000140	0.0983	<0.0000200	<0.0100
	% < LRL	0%	0%	0%	11%	11%	0%	88%	86%
	% > BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-

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[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)
LC_LC1 (RG_LI24)	n	9	9	9	9	9	9	9	10
	Annual Minimum	0.000200	<0.000100	<0.000500	<0.0100	<0.0000500	0.00240	<0.000100	<0.000000500
	Annual Maximum	0.000370	<0.000100	0.000600	0.0120	<0.0000500	0.00365	0.00442	0.000000520
	Annual Mean	0.000265	<0.000100	0.000511	0.0102	<0.0000500	0.00316	0.000611	0.000000502
	Annual Median	0.000250	<0.000100	<0.000500	<0.0100	<0.0000500	0.00340	0.000130	<0.000000500
	% < LRL	0%	100%	89%	89%	100%	0%	44%	90%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	0%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_SLC (RG_SLINE)	n	29	29	29	29	29	29	29	29
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.00130	<0.000100	<0.000000500
	Annual Maximum	0.000760	<0.000200	0.00110	0.0980	<0.000100	0.00520	0.00372	0.00000166
	Annual Mean	0.000230	<0.000100	0.000521	0.0192	0.0000523	0.00333	0.000568	0.000000611
	Annual Median	0.000190	<0.000100	<0.000500	<0.0100	<0.0000500	0.00360	0.000150	<0.000000500
	% < LRL	3%	100%	97%	76%	90%	0%	31%	83%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	7%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LCUSWLC (RG_LCUT)	n	53	53	53	53	53	53	53	52
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.0286	<0.000100	<0.000000500
	Annual Maximum	0.000970	0.000220	<0.00100	0.0440	<0.000100	0.0938	0.00170	0.000000840
	Annual Mean	0.000201	0.000111	0.000524	0.0131	0.0000506	0.0617	0.000306	0.000000527
	Annual Median	0.000170	<0.000100	<0.000500	<0.0100	<0.0000500	0.0591	0.000220	<0.000000500
	% < LRL	21%	74%	85%	68%	96%	0%	13%	88%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	0%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_WLC (RG_LCUT)	n	55	55	55	55	55	55	55	55
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.0219	<0.000100	0.000000540
	Annual Maximum	0.000730	<0.000200	0.00157	0.0230	<0.000100	0.0587	0.00189	0.00000200
	Annual Mean	0.000159	0.000102	0.000958	0.0112	<0.0000500	0.0348	0.000460	0.00000113
	Annual Median	0.000130	<0.000100	0.000940	<0.0100	<0.0000500	0.0347	0.000160	0.00000117
	% < LRL	51%	96%	36%	80%	100%	0%	40%	0%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	7%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC3 (RG_LILC3)	n	56	56	56	56	56	56	56	57
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.0370	0.000150	<0.000000500
	Annual Maximum	<0.000500	0.000420	0.00111	0.0760	0.000152	0.0832	0.0251	0.00000100
	Annual Mean	0.000180	0.000114	0.000544	0.0199	0.0000523	0.0605	0.00253	0.000000551
	Annual Median	0.000150	<0.000100	<0.000500	0.0120	<0.0000500	0.0583	0.000855	<0.000000500
	% < LRL	20%	71%	75%	46%	96%	0%	2%	75%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	0%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
WL_DCP_SP24 (RG_LISP24)	n	14	14	14	14	14	14	14	14
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.0230	0.000370	<0.000000500
	Annual Maximum	0.000440	0.000160	<0.000500	0.0380	<0.0000500	0.0624	0.00323	0.00000125
	Annual Mean	0.000187	0.000107	<0.000500	0.0156	<0.0000500	0.0424	0.00129	0.000000596
	Annual Median	0.000170	<0.000100	<0.000500	0.0125	<0.0000500	0.0432	0.000735	<0.000000500
	% < LRL	7%	86%	100%	43%	100%	0%	0%	79%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	0%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LCDSSLCC (RG_LIDSL)	n	57	57	57	57	57	57	57	56
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.0193	0.000150	<0.000000500
	Annual Maximum	0.00286	<0.000200	0.00110	0.266	<0.000100	0.0594	0.00504	0.00000132
	Annual Mean	0.000240	0.000103	0.000520	0.0194	0.0000511	0.0402	0.000873	0.000000551
	Annual Median	0.000160	<0.000100	<0.000500	<0.0100	<0.0000500	0.0394	0.000420	<0.000000500
	% < LRL	16%	95%	93%	77%	95%	0%	4%	91%
	% > BCWQG[a]	2%	0%	0%	-	0%	-	0%	2%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-

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Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline
[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: **Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018**

Station	Summary Statistic	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)
LC_LCC (RG_LIDCOM)	n	5	5	5	5	5	5	5	5
	Annual Minimum	0.000220	<0.000100	<0.000500	<0.0100	<0.0000500	0.0193	0.000240	<0.000000500
	Annual Maximum	0.000250	<0.000100	<0.000500	0.0235	<0.0000500	0.0477	0.00136	0.000000820
	Annual Mean	0.000231	<0.000100	<0.000500	0.0127	<0.0000500	0.0363	0.000648	0.000000564
	Annual Median	0.000230	<0.000100	<0.000500	<0.0100	<0.0000500	0.0399	0.000340	<0.000000500
	% < LRL	0%	100%	100%	80%	100%	0%	0%	80%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	0%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC4 (RG_LI8)	n	58	58	58	58	58	58	58	58
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.0179	0.000190	<0.000000500
	Annual Maximum	0.000590	0.000200	0.00110	0.235	0.000195	0.0432	0.00928	0.00000210
	Annual Mean	0.000215	0.000104	0.000521	0.0215	0.0000568	0.0318	0.000857	0.000000598
	Annual Median	0.000190	<0.000100	<0.000500	<0.0100	<0.0000500	0.0314	0.000400	<0.000000500
	% < LRL	14%	95%	95%	67%	90%	0%	5%	84%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	5%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC6 (RG_FRUL)	n	4	4	4	4	4	4	4	4
	Annual Minimum	0.000120	<0.000100	<0.000500	<0.0100	<0.0000500	0.0150	0.000440	<0.000000500
	Annual Maximum	0.000470	0.000190	0.000730	0.252	0.000195	0.0187	0.0160	0.00000197
	Annual Mean	0.000258	0.000122	0.000558	0.0723	0.0000863	0.0171	0.00458	0.000000868
	Annual Median	0.000220	<0.000100	<0.000500	0.0135	<0.0000500	0.0174	0.000940	<0.000000500
	% < LRL	0%	75%	75%	50%	75%	0%	0%	75%
	% > BCWQG[a]	0%	0%	0%	-	0%	-	0%	25%
	% > BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
LC_LC5 (RG_FO23)	n	35	35	35	35	35	35	35	35
	Annual Minimum	0.000110	<0.000100	<0.000500	<0.0100	<0.0000500	0.0138	0.000360	<0.000000500
	Annual Maximum	0.00147	0.000710	0.00192	1.46	0.000992	0.0239	0.0817	0.00000644
	Annual Mean	0.000297	0.000144	0.000604	0.132	0.000120	0.0200	0.00746	0.000000955
	Annual Median	0.000190	<0.000100	<0.000500	0.0230	<0.0000500	0.0208	0.00146	<0.000000500
	% < LRL	9%	80%	86%	37%	80%	0%	0%	71%
	% > BCWQG[a]	6%	0%	0%	-	0%	-	0%	11%
	% > BCWQG[b]	-	0%	0%	6%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-

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Notes: "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline
[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Total Molybdenum (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Sliver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)
LC_LC1 (RG_LI24)	n	9	9	12	9	9	9	9	9
	Annual Minimum	0.000672	<0.000500	0.00187	<0.0000100	<0.0000100	0.000896	<0.00300	<0.00300
	Annual Maximum	0.000992	0.000680	0.00390	<0.0000100	<0.0000100	0.00176	0.00525	<0.00300
	Annual Mean	0.000871	0.000562	0.00283	<0.0000100	<0.0000100	0.00138	0.00331	<0.00300
	Annual Median	0.000880	0.000550	0.00286	<0.0000100	<0.0000100	0.00138	<0.00300	<0.00300
	% < LRL	0%	22%	0%	100%	100%	0%	67%	100%
	% > BCWQG[a]	0%	0%	83%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
LC_SLC (RG_SLINE)	n	29	29	30	29	29	29	29	29
	Annual Minimum	0.000464	<0.000500	0.000382	<0.0000100	<0.0000100	0.000560	<0.00300	<0.00300
	Annual Maximum	0.00151	0.00189	0.00164	<0.0000200	<0.0000200	0.00195	0.0151	0.00540
	Annual Mean	0.00115	0.000564	0.00128	<0.0000100	<0.0000100	0.00151	0.00369	0.00318
	Annual Median	0.00125	<0.000500	0.00144	<0.0000100	<0.0000100	0.00164	<0.00300	<0.00300
	% < LRL	0%	83%	0%	100%	100%	0%	72%	86%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
LC_LCUSWLC (RG_LCUT)	n	53	53	68	53	53	53	53	53
	Annual Minimum	0.00152	0.00739	0.0167	<0.0000100	0.0000110	0.00192	0.00870	<0.00300
	Annual Maximum	0.00275	0.0131	0.267	<0.0000200	0.0000230	0.00520	0.0223	0.00310
	Annual Mean	0.00206	0.0108	0.0445	<0.0000100	0.0000159	0.00396	0.0136	0.00300
	Annual Median	0.00197	0.0110	0.0441	<0.0000100	0.0000160	0.00397	0.0119	<0.00300
	% < LRL	0%	0%	0%	100%	11%	0%	0%	98%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	100%	97%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	1%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
LC_WLC (RG_LCUT)	n	55	55	65	55	55	55	55	55
	Annual Minimum	0.00146	0.0169	0.138	<0.0000100	<0.0000200	0.00576	<0.00600	<0.00300
	Annual Maximum	0.00569	0.0549	0.575	<0.0000200	0.0000330	0.0228	0.128	<0.00300
	Annual Mean	0.00365	0.0290	0.431	<0.0000100	0.0000275	0.0174	0.0419	<0.00300
	Annual Median	0.00404	0.0234	0.466	<0.0000100	0.0000280	0.0194	0.0222	<0.00300
	% < LRL	0%	0%	0%	100%	4%	0%	2%	100%
	% > BCWQG[a]	0%	0%	100%	0%	0%	95%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	100%	100%	-	-	-	-	-
	% > Level 2 Benchmark	-	100%	100%	-	-	-	-	-
	% > Level 3 Benchmark	-	58%	-	-	-	-	-	-
LC_LC3 (RG_LILC3)	n	56	56	74	56	56	56	56	56
	Annual Minimum	0.00168	0.00671	0.0304	<0.0000100	<0.0000100	0.00282	0.00610	<0.00300
	Annual Maximum	0.00453	0.0171	0.282	<0.0000200	0.0000200	0.00679	0.0310	0.00440
	Annual Mean	0.00237	0.0113	0.0753	<0.0000100	0.0000148	0.00521	0.0154	0.00302
	Annual Median	0.00234	0.0110	0.0772	<0.0000100	0.0000150	0.00531	0.0114	<0.00300
	% < LRL	0%	0%	0%	100%	16%	0%	0%	98%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	100%	100%	-	-	-	-	-
	% > Level 2 Benchmark	-	14%	54%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
WL_DCP_SP24 (RG_LISP24)	n	14	14	18	14	14	14	14	14
	Annual Minimum	0.00117	0.00380	0.0190	<0.0000100	<0.0000100	0.00177	0.00450	<0.00300
	Annual Maximum	0.00268	0.00946	0.0851	<0.0000100	0.0000130	0.00519	0.0144	0.00620
	Annual Mean	0.00184	0.00691	0.0503	<0.0000100	0.0000111	0.00381	0.00975	0.00323
	Annual Median	0.00174	0.00700	0.0471	<0.0000100	0.0000105	0.00416	0.00955	<0.00300
	% < LRL	0%	0%	0%	100%	36%	0%	0%	93%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	86%	94%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	17%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
LC_LCDSSLCC (RG_LIDSL)	n	57	57	72	57	57	57	57	56
	Annual Minimum	0.00108	0.00341	0.0168	<0.0000100	<0.0000100	0.00162	0.00340	<0.00300
	Annual Maximum	0.00243	0.00782	0.0825	<0.0000200	0.000106	0.00487	0.0258	<0.00300
	Annual Mean	0.00174	0.00552	0.0524	<0.0000100	0.0000118	0.00365	0.00806	<0.00300
	Annual Median	0.00174	0.00537	0.0552	<0.0000100	<0.0000100	0.00378	0.00660	<0.00300
	% < LRL	0%	0%	0%	100%	81%	0%	11%	100%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	53%	97%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	4%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-

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Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Total Molybdenum (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Sliver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)
LC_LCC (RG_LIDCOM)	n	5	5	5	5	5	5	5	5
	Annual Minimum	0.00115	0.00296	0.0171	<0.0000100	<0.0000100	0.00177	0.00310	<0.00300
	Annual Maximum	0.00211	0.00498	0.0623	<0.0000100	0.0000105	0.00401	0.0116	0.00300
	Annual Mean	0.00167	0.00382	0.0437	<0.0000100	0.0000101	0.00333	0.00585	0.00300
	Annual Median	0.00168	0.00353	0.0519	<0.0000100	<0.0000100	0.00377	0.00360	<0.00300
	% < LRL	0%	0%	0%	100%	80%	0%	0%	80%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	80%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
LC_LC4 (RG_LI8)	n	58	58	73	58	58	58	58	58
	Annual Minimum	0.00109	0.00238	0.0151	<0.0000100	<0.0000100	0.00163	0.00320	<0.00300
	Annual Maximum	0.00221	0.00575	0.0628	<0.0000200	<0.0000200	0.00383	0.0323	0.00690
	Annual Mean	0.00164	0.00365	0.0393	<0.0000100	0.0000103	0.00306	0.00663	0.00307
	Annual Median	0.00165	0.00365	0.0422	<0.0000100	<0.0000100	0.00318	0.00590	<0.00300
	% < LRL	0%	0%	0%	100%	93%	0%	10%	97%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	2%	93%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
LC_LC6 (RG_FRUL)	n	4	4	4	4	4	4	4	4
	Annual Minimum	0.000999	<0.000500	0.0363	<0.0000100	<0.0000100	0.00180	<0.00300	<0.00300
	Annual Maximum	0.00110	0.00214	0.0530	<0.0000100	0.0000110	0.00218	<0.00300	<0.00300
	Annual Mean	0.00103	0.000922	0.0451	<0.0000100	0.0000102	0.00198	<0.00300	<0.00300
	Annual Median	0.00102	0.000525	0.0456	<0.0000100	<0.0000100	0.00198	<0.00300	<0.00300
	% < LRL	0%	50%	0%	100%	75%	0%	100%	100%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	100%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
LC_LC5 (RG_FO23)	n	35	35	35	35	35	35	35	35
	Annual Minimum	0.00100	0.000760	0.0185	<0.0000100	<0.0000100	0.00134	<0.00300	0.00140
	Annual Maximum	0.00140	0.00471	0.0567	0.0000230	0.0000410	0.00268	0.0157	0.00775
	Annual Mean	0.00119	0.00156	0.0400	0.0000108	0.0000121	0.00221	0.00449	0.00158
	Annual Median	0.00116	0.00123	0.0404	<0.0000100	<0.0000100	0.00234	<0.00300	0.00140
	% < LRL	0%	9%	0%	91%	86%	0%	77%	94%
	% > BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	97%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-

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[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Iron (mg/L)
LC_LC1 (RG_LI24)	n	9	9	9
	Annual Minimum	<0.00000500	<0.000100	<0.0100
	Annual Maximum	0.00000990	<0.000100	<0.0100
	Annual Mean	0.00000620	<0.000100	<0.0100
	Annual Median	0.00000510	<0.000100	<0.0100
	% < LRL	44%	100%	100%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_SLC (RG_SLINE)	n	29	29	29
	Annual Minimum	<0.00000500	<0.000100	<0.0100
	Annual Maximum	0.0000340	<0.000200	<0.0200
	Annual Mean	0.0000114	<0.000100	<0.0100
	Annual Median	0.0000110	<0.000100	<0.0100
	% < LRL	3%	100%	100%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_LCUSWLC (RG_LCUT)	n	53	53	47
	Annual Minimum	0.000241	<0.000100	<0.0100
	Annual Maximum	0.000524	<0.000200	<0.0100
	Annual Mean	0.000333	0.000106	<0.0100
	Annual Median	0.000299	<0.000100	<0.0100
	% < LRL	0%	83%	100%
	% > BCWQG[a]	9%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	42%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_WLC (RG_LCUT)	n	55	55	55
	Annual Minimum	0.0000100	<0.000100	<0.0100
	Annual Maximum	0.00304	<0.000200	<0.0200
	Annual Mean	0.00105	0.000103	0.0101
	Annual Median	0.000703	<0.000100	<0.0100
	% < LRL	0%	93%	98%
	% > BCWQG[a]	60%	-	-
	% > BCWQG[b]	5%	0%	0%
	% > Level 1 Benchmark	64%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_LC3 (RG_LILC3)	n	56	56	56
	Annual Minimum	0.000152	<0.000100	<0.0100
	Annual Maximum	0.000672	<0.000200	<0.0200
	Annual Mean	0.000367	0.000106	<0.0100
	Annual Median	0.000291	<0.000100	<0.0100
	% < LRL	0%	88%	100%
	% > BCWQG[a]	36%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	48%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
WL_DCP_SP24 (RG_LISP24)	n	14	13	14
	Annual Minimum	0.0000900	<0.000100	<0.0100
	Annual Maximum	0.000352	<0.000100	<0.0200
	Annual Mean	0.000213	<0.000100	<0.0100
	Annual Median	0.000191	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	21%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_LCDSSLCC (RG_LIDSL)	n	56	49	49
	Annual Minimum	0.0000882	<0.000100	<0.0100
	Annual Maximum	0.000317	<0.000100	<0.0100
	Annual Mean	0.000181	<0.000100	<0.0100
	Annual Median	0.000168	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > 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
[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Iron (mg/L)
LC_LCC (RG_LIDCOM)	n	5	5	5
	Annual Minimum	0.0000726	<0.000100	<0.0100
	Annual Maximum	0.000227	<0.000100	<0.0100
	Annual Mean	0.000133	<0.000100	<0.0100
	Annual Median	0.0000948	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_LC4 (RG_LI8)	n	58	52	58
	Annual Minimum	0.00000930	<0.000100	<0.0100
	Annual Maximum	0.000132	<0.000100	<0.0200
	Annual Mean	0.0000378	<0.000100	<0.0100
	Annual Median	0.0000270	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_LC6 (RG_FRUL)	n	4	4	4
	Annual Minimum	0.00000690	<0.000100	<0.0100
	Annual Maximum	0.0000223	<0.000200	<0.0200
	Annual Mean	0.0000130	<0.000100	<0.0100
	Annual Median	0.0000114	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
LC_LC5 (RG_FO23)	n	35	32	35
	Annual Minimum	0.00000550	<0.000100	<0.0100
	Annual Maximum	0.0000499	<0.000100	0.0270
	Annual Mean	0.0000213	<0.000100	0.0105
	Annual Median	0.0000187	<0.000100	<0.0100
	% < LRL	0%	100%	97%
	% > BCWQG[a]	0%	-	-
	% > BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > 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

[a] Long-term average BCQWG for the Protection of Aquatic Life. [b] Short-term maximum BCQWG for the Protection of Aquatic Life. 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.

Table C.2: Acute Toxicity Results for Line Creek Operations, 2018

Water Station		*Daphnia magna*		*Oncorhynchus mykiss*	
Teck Code	Description	Date	Percent Mortality	Date	Percent Mortality
LC_LCUSWLC	Line Creek upstream of West Line Creek, below rock drain	15-Jan-18	0	15-Jan-18	0
LC_WLC	West Line Creek	15-Jan-18	0	15-Jan-18	0
WL_WLCI_SP01	West Line Creek AWTF influent	26-Jun-18	0	26-Jun-18	-
WL_BFWB_OUT_SP21	West Line Creek AWTF effluent outfall	2-Jan-18	0	2-Jan-18	0
		8-Jan-18	-	8-Jan-18	0
		8-Jan-18	0	8-Jan-18	10
		15-Jan-18	20	15-Jan-18	0
		22-Jan-18	0	22-Jan-18	0
		25-Jan-18	0	25-Jan-18	10
		29-Jan-18	0	29-Jan-18	0
		5-Feb-18	0	5-Feb-18	20
		13-Feb-18	0	13-Feb-18	0
		19-Feb-18	0	19-Feb-18	0
		26-Feb-19	0	26-Feb-19	0
		28-Feb-19	0	28-Feb-19	0
		6-Mar-18	10	6-Mar-18	0
		7-Mar-18	0	7-Mar-18	10
		8-Mar-18	0	8-Mar-18	0
		12-Sep-18	0	12-Sep-18	0
		29-Oct-18	0	29-Oct-18	0
		1-Nov-18	3	1-Nov-18	0
		6-Nov-18	0	6-Nov-18	0
		14-Nov-18	0	14-Nov-18	0
		19-Nov-18	0	19-Nov-18	0
		26-Nov-19	0	26-Nov-19	0
		3-Dec-18	0	3-Dec-18	0
		10-Dec-18	0	10-Dec-18	0
		17-Dec-18	0	17-Dec-18	0
		24-Dec-18	0	24-Dec-18	0
		31-Dec-18	0	31-Dec-18	0
LC_LC3	Line Creek downstream of West Line Creek and AWTF outfall	1-Nov-18	0	1-Nov-18	0
		13-Nov-18	0	13-Nov-18	0
LC_LCDSSLCC (Compliance)	Line Creek immediately downstream of South Line Creek confluence	30-Jan-18	0	30-Jan-18	0
		13-Feb-18	0	13-Feb-18	0
		5-Mar-18	0	5-Mar-18	0
LC_LC5	Fording River downstream of Line Creek	30-Jan-18	0	30-Jan-18	-
		14-Feb-18	0	14-Feb-18	0
		5-Mar-18	0	5-Mar-18	0

APPENDIX D
OTHER SUPPORTING INFORMATION

Table D.1: ***In Situ*** **Water Quality Measures Collected for the Line Creek LAEMP, 2018**

Month	Exposure	Station	Easting	Northing	Sampling Date	Temperature	Dissolved Oxygen	Dissolved Oxygen	Specific Conductivity	pH	ORP
						°C	mg/L	%	μS/cm	pH units	mV
March 2018	Reference	RG_SLINE	661106	5531373	8-Mar-18	0.500	13.3	92.3	362	8.19	-176
	Mine-exposed Line Creek	RG_LCUT	660121	5532132	9-Mar-18	2.90	13.6	101	209	8.17	73.5
		RG_LILC3	659931	5531848	9-Mar-18	3.40	13.1	98.6	1193	8.19	111
		RG_LISP24	659902	5531445	10-Mar-18	1.70	14.8	106	1049	8.16	74.2
		RG_LIDSL	659218	5530522	10-Mar-18	1.90	14.6	106	985	8.27	76.4
		RG_LIDCOM	658184	5529814	10-Mar-18	2.00	14.1	105	867	8.38	50.1
		RG_LI8	655426	5528959	10-Mar-18	2.20	14.6	106	796	8.49	25.3
	Mine-exposed Fording River	RG_FO23	652965	5528974	11-Mar-18	-0.100	15.0	103	844	8.12	-70.2
		RG_FRUL	654530	5530162	11-Mar-18	0.300	14.3	98.5	847	8.12	-21.6
April 2018	Mine-exposed Line Creek	RG_LCUT	654530	5532132	3-Apr-18	2.30	12.4	90.7	1757	8.18	-132
		RG_LILC3	659931	5531848	4-Apr-18	2.10	12.0	88.3	1269	8.10	-244
		RG_LISP24	659902	5531445	4-Apr-18	2.40	14.8	93.8	1137	8.01	-14.5
		RG_LIDSL	659218	5530522	3-Apr-18	3.00	12.0	89.9	1100	8.01	-152
		RG_LIDCOM	658184	5529814	4-Apr-18	2.70	12.6	89.9	968	8.26	-300
		RG_LI8	655426	5528959	5-Apr-18	1.80	11.7	84.1	895	8.03	108
	Mine-exposed Fording River	RG_FO23	652965	5528974	5-Apr-18	0.300	12.3	84.1	886	8.01	83.4
April/May 2018	Reference	RG_LI24	-	-	3-May-18	2.10	11.5	83.5	266	8.26	217
		RG_SLINE	661106	5531373	30-Apr-18	2.70	11.2	82.3	264	8.30	253
	Mine-exposed Line Creek	RG_LCUT	660121	5532132	1-May-18	4.30	10.4	80.3	949	7.82	221
		RG_LILC3	659931	5531848	1-May-18	4.10	10.7	81.9	686	8.05	211
		RG_LISP24	659902	5531445	1-May-18	4.00	11.1	84.8	657	8.18	221
		RG_LIDSL	659218	5530522	30-Apr-18	4.30	10.9	84.0	673	8.21	231
		RG_LIDCOM	658184	5529814	3-May-18	4.40	10.8	83.6	649	8.41	170
		RG_LI8	655426	5528959	2-May-18	5.20	11.0	86.9	615	8.50	198
	Mine-exposed Fording River	RG_FO23	652965	5528974	30-Apr-18	5.10	10.9	85.6	581	8.38	210
		RG_FRUL	654530	5530162	2-May-18	3.30	11.3	84.9	614	8.37	215
May 2018	Mine-exposed Line Creek	RG_LCUT	660121	5532132	29-May-18	4.60	13.7	107	825	7.62	101
		RG_LILC3	659931	5531848	29-May-18	5.00	14.5	114	652	7.90	108
		RG_LISP24	659902	5531445	28-May-18	4.50	12.6	96.9	487	8.08	74.9
		RG_LIDSL	659218	5530522	29-May-18	5.40	12.7	101	474	8.14	-
		RG_LIDCOM	658184	5529814	28-May-18	5.60	12.6	100	445	8.24	59.4
		RG_LI8	655426	5528959	28-May-18	6.80	12.8	105	429	8.37	72.7
	Mine-exposed Fording River	RG_FO23	652965	5528974	29-May-18	8.30	13.4	114	470	8.40	-
September 2018	Reference	RG_LI24_1	662165	5538411	12-Sep-18	4.68	12.9	99.5	212	7.41	-
		RG_LI24_2	662214	5538393	12-Sep-18	4.52	14.4	111	209	8.01	-
		RG_LI24_3	662221	5538429	12-Sep-18	4.81	12.0	95.0	212	8.00	-
		RG_SLINE_1	660901	5531552	11-Sep-18	4.77	11.7	90.9	218	7.94	-
		RG_SLINE_2	660923	5531487	11-Sep-18	5.66	9.55	76.0	223	7.95	-
		RG_SLINE_3	660979	5531450	11-Sep-18	5.31	12.6	99.0	220	7.95	-
	Mine-exposed Line Creek	RG_LCUT	660113	5532141	10-Sep-18	5.73	12.0	96.0	874	7.72	-
		RG_LILC3_1	659916	5531825	10-Sep-18	5.62	11.6	91.3	681	7.19	-
		RG_LILC3_2	659949	5531825	10-Sep-18	5.95	11.9	96.2	685	7.77	-
		RG_LILC3_3	659869	5531744	10-Sep-18	6.23	11.8	94.0	690	7.86	-
		RG_LISP24	659674	5531168	13-Sep-18	6.13	12.9	103	557	8.21	-
		RG_LIDSL_1	659262	5530513	5-Sep-18	9.28	11.5	101	599	8.08	-
		RG_LIDSL_2	659279	5530568	6-Sep-18	6.26	8.65	70.1	549	8.11	-
		RG_LIDSL_3	659309	5530613	6-Sep-18	8.83	11.2	96.6	590	7.91	-
		RG_LIDSL_4	659335	5530652	7-Sep-18	5.36	12.9	102	544	7.46	-
		RG_LIDSL_5	659309	5530613	7-Sep-18	5.53	10.6	84.4	548	7.77	-
		RG_L18_1	655426	5528959	13-Sep-18	5.28	11.8	92.2	461	8.24	-
		RG_L18_2	655501	5528890	13-Sep-18	5.39	12.2	97.3	456	8.35	-
		RG_L18_3	655560	5528835	13-Sep-18	5.80	11.2	93.0	460	726	8.42
		RG_LIDCOM	658183	5529815	7-Sep-18	7.44	11.7	97.8	526	792	7.62
	Mine-exposed Fording River	RG_FO23_1	659869	5531744	10-Sep-18	6.23	11.8	94.0	690	7.86	-
		RG_FO23_2	659674	5531168	13-Sep-18	6.13	12.9	103	557	8.21	-
		RG_FO23_3	659869	5531744	10-Sep-18	6.23	11.8	94.0	690	7.86	-
		RG_FO23_4	659674	5531168	13-Sep-18	6.13	12.9	103	557	8.21	-
		RG_FO23_5	659674	5531168	13-Sep-18	6.13	12.9	103	557	8.21	-
		RG_LIDSL	659262	5530513	5-Sep-18	9.28	11.5	101	599	8.08	-
December 2018	Reference	RG_LI24	662214	5538393	3-Dec-18	0.310	12.0	83.0	0.190	391	-
		RG_SLINE	661122	5531374	4-Dec-18	-0.100	11.7	80.2	-	376	12.2
	Mine-exposed Line Creek	RG_LCUT	660114	5532140	3-Dec-18	3.59	11.6	87.8	998	8.03	-
		RG_LILC3	659911	5531818	6-Dec-18	2.50	12.2	89.7	1013	7.66	22.3
		RG_LISP24	659674	5531168	4-Dec-18	2.10	11.6	84.5	900	8.36	30.0
		RG_LIDSL	659294	5530583	4-Dec-18	2.50	11.2	82.1	857	8.37	28.3
		RG_LIDCOM	658184	5529814	6-Dec-18	0.200	13.2	91.3	819	7.71	40.4
		RG_L18	655426	5528959	6-Dec-18	0.100	12.3	84.0	491	7.62	38.3
	Mine-exposed Fording River	RG_FRUL	654530	5530162	5-Dec-18	0	13.8	94.8	833	7.53	83.7
		RG_FO9	652235	5540141	5-Dec-18	0	13.5	91.6	859	7.41	86.2
		RG_FO23	652808	5528334	5-Dec-18	0	14.0	95.6	804	7.68	91.2

Table D.2: **Supporting Substrate and Calcite Measures for Sampling Area RG_LI24, Line Creek, 2018**

RG_LI24_BIC_1					RG_LI24_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	7.6	-	1	0	0	21.7	-
2	0	0	10.4	-	2	0	0	5.4	-
3	0	0	4.3	-	3	0	0	5.1	-
4	0	0	5.6	-	4	0	0	18.9	-
5	0	0	25.3	-	5	0	0	8.5	-
6	0	0	10.7	-	6	0	0	14.2	-
7	0	0	6.5	-	7	0	0	1.8	-
8	0	0	7.3	-	8	0	0	19.4	-
9	0	0	28.5	-	9	0	0	75.0	-
10	0	0	21.0	0.25	10	0	0	4.4	0
11	0	0	5.9	-	11	0	0	7.2	-
12	0	0	18.4	-	12	0	0	5.1	-
13	0	0	4.3	-	13	0	0	1.9	-
14	0	0	17.7	-	14	0	0	2.1	-
15	0	0	11.5	-	15	0	0	6.1	-
16	0	0	4.2	-	16	0	0	9.8	-
17	0	0	14.4	-	17	0	0	12.8	-
18	0	0	13.2	-	18	0	0	6.1	-
19	0	0	8.9	-	19	0	0	4.8	-
20	0	0	5.5	0.5	20	0	0	7.3	0.25
21	0	0	18.1	-	21	0	0	13.6	-
22	0	0	4.4	-	22	0	0	4.4	-
23	0	0	6.8	-	23	0	0	15.4	-
24	0	0	5.6	-	24	0	0	38.3	-
25	0	0	6.7	-	25	0	0	4.8	-
26	0	0	8.9	-	26	0	0	10.2	-
27	0	0	3.7	-	27	0	0	4.4	-
28	0	0	9.2	-	28	0	0	13.5	-
29	0	0	4.8	-	29	0	0	5.1	-
30	0	0	5.3	0	30	0	0	12.6	0.75
31	0	0	10.0	-	31	0	0	7.0	-
32	0	0	4.0	-	32	0	0	7.1	-
33	0	0	6.1	-	33	0	0	3.4	-
34	0	0	7.3	-	34	0	0	6.9	-
35	0	0	10.2	-	35	0	0	3.2	-
36	0	0	5.4	-	36	0	0	15.8	-
37	0	0	9.8	-	37	0	0	4.9	-
38	0	0	6.0	-	38	0	0	5.5	-
39	0	0	5.4	-	39	0	0	5.2	-
40	0	0	5.3	0	40	0	0	6.2	0
41	0	0	5.6	-	41	0	0	8.0	-
42	0	0	4.7	-	42	0	0	5.1	-
43	0	0	5.8	-	43	0	0	30.2	-
44	0	0	5.4	-	44	0	0	2.3	-
45	0	0	9.6	-	45	0	0	29.6	-
46	0	0	9.7	-	46	0	0	8.2	-
47	0	0	3.5	-	47	0	0	14.3	-
48	0	0	5.2	-	48	0	0	11.9	-
49	0	0	9.9	-	49	0	0	12.0	-
50	0	0	10.1	0.25	50	0	0	6.0	0.25
51	0	0	14.6	-	51	0	0	27.6	-
52	0	0	9.8	-	52	0	0	2.4	-
53	0	0	4.4	-	53	0	0	8.5	-
54	0	0	3.8	-	54	0	0	19.3	-
55	0	0	2.1	-	55	0	0	6.7	-
56	0	0	6.9	-	56	0	0	3.2	-
57	0	0	12.9	-	57	0	0	15.6	-
58	0	0	11.6	-	58	0	0	4.1	-
59	0	0	3.6	-	59	0	0	4.0	-
60	0	0	3.8	0	60	0	0	5.8	0.5
61	0	0	4.2	-	61	0	0	9.9	-
62	0	0	5.3	-	62	0	0	2.5	-
63	0	0	8.1	-	63	0	0	5.5	-
64	0	0	8.2	-	64	0	0	3.4	-
65	0	0	14.5	-	65	0	0	5.9	-
66	0	0	11.4	-	66	0	0	8.2	-
67	0	0	6.4	-	67	0	0	6.7	-
68	0	0	10.6	-	68	0	0	11.3	-
69	0	0	3.8	-	69	0	0	32.2	-
70	0	0	12.2	0.25	70	0	0	14.6	0.5
71	0	0	5.1	-	71	0	0	9.2	-
72	0	0	4.7	-	72	0	0	6.8	-
73	0	0	4.6	-	73	0	0	6.2	-
74	0	0	4.6	-	74	0	0	6.8	-
75	0	0	8.5	-	75	0	0	3.1	-
76	0	0	10.3	-	76	0	0	2.6	-
77	0	0	10.8	-	77	0	0	13.5	-
78	0	0	6.4	-	78	0	0	18.2	-
79	0	0	7.7	-	79	0	0	5.6	-
80	0	0	3.9	0	80	0	0	2.3	0
81	0	0	33.5	-	81	0	0	13.5	-
82	0	0	4.6	-	82	0	0	2.9	-
83	0	0	6.4	-	83	0	0	15.7	-
84	0	0	4.7	-	84	0	0	11.3	-
85	0	0	5.4	-	85	0	0	9.2	-
86	0	0	6.4	-	86	0	0	15.6	-
87	0	0	4.5	-	87	0	0	9.3	-
88	0	0	7.3	-	88	0	0	6.8	-
89	0	0	7.1	-	89	0	0	5.4	-
90	0	0	4.9	0.25	90	0	0	2.8	0
91	0	0	12.7	-	91	0	0	5.0	-
92	0	0	19.6	-	92	0	0	13.6	-
93	0	0	10.7	-	93	0	0	6.9	-
94	0	0	3.9	-	94	0	0	5.4	-
95	0	0	5.6	-	95	0	0	4.1	-
96	0	0	8.5	-	96	0	0	6.1	-
97	0	0	10.6	-	97	0	0	8.3	-
98	0	0	6.7	-	98	0	0	23.6	-
99	0	0	5.8	-	99	0	0	6.3	-
100	0	0	17.8	0.5	100	0	0	6.4	0
Minimum	**0**	**0**	**2.1**	**0**	**Minimum**	**0**	**0**	**1.8**	**0**
Maximum	**0**	**0**	**33.5**	**0.5**	**Maximum**	**0**	**0**	**75.0**	**0.8**
Mean	**0**	**0**	**8.6**	**0.2**	**Mean**	**0**	**0**	**10.0**	**0.2**
Median	**0**	**0**	**6.7**	**0.3**	**Median**	**0**	**0**	**6.8**	**0.1**
Standard Dev.	**0**	**0**	**5.40**	**0.197**	**Standard Dev.**	**0**	**0**	**9.6**	**0.3**

Table D.2: Supporting Substrate and Calcite Measures for Sampling Area RG_LI24, Line Creek, 2018

RG_LI24_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	2.4	-
2	0	0	10.6	-
3	0	0	7.4	-
4	0	0	7.4	-
5	0	0	26.3	-
6	0	0	2.6	-
7	0	0	6.0	-
8	0	0	8.3	-
9	0	0	4.3	-
10	0	0	9.4	0
11	0	0	5.7	-
12	0	0	5.6	-
13	0	0	12.8	-
14	0	0	4.2	-
15	0	0	6.8	-
16	0	0	3.4	-
17	0	0	24.4	-
18	0	0	5.5	-
19	0	0	20.2	-
20	0	0	7.3	0
21	0	0	6.9	-
22	0	0	6.3	-
23	0	0	14.2	-
24	0	0	7.9	-
25	0	0	33.5	-
26	0	0	6.3	-
27	0	0	13.6	-
28	0	0	4.5	-
29	0	0	5.6	-
30	0	0	9.1	0
31	0	0	6.5	-
32	0	0	4.2	-
33	0	0	14.8	-
34	0	0	6.4	-
35	0	0	17.2	-
36	0	0	4.1	-
37	0	0	6.7	-
38	0	0	4.0	-
39	0	0	7.9	-
40	0	0	5.2	0
41	0	0	3.2	-
42	0	0	6.5	-
43	0	0	35.3	-
44	0	0	3.2	-
45	0	0	2.7	-
46	0	0	6.7	-
47	0	0	8.2	-
48	0	0	9.6	-
49	0	0	4.1	-
50	0	0	3.6	0
51	0	0	4.2	-
52	0	0	9.7	-
53	0	0	4.7	-
54	0	0	7.8	-
55	0	0	7.4	-
56	0	0	9.2	-
57	0	0	11.9	-
58	0	0	11.9	-
59	0	0	2.5	-
60	0	0	5.0	0
61	0	0	8.5	-
62	0	0	4.0	-
63	0	0	13.5	-
64	0	0	7.6	-
65	0	0	7.8	-
66	0	0	9.5	-
67	0	0	4.1	-
68	0	0	4.7	-
69	0	0	8.3	-
70	0	0	6.7	0.25
71	0	0	8.6	-
72	0	0	11.5	-
73	0	0	4.5	-
74	0	0	7.7	-
75	0	0	8.5	-
76	0	0	7.9	-
77	0	0	8.4	-
78	0	0	8.3	-
79	0	0	28.2	-
80	0	0	4.7	0
81	0	0	6.5	-
82	0	0	5.0	-
83	0	0	9.6	-
84	0	0	12.4	-
85	0	0	4.7	-
86	0	0	5.6	-
87	0	0	8.6	-
88	0	0	10.2	-
89	0	0	9.7	-
90	0	0	8.6	0
91	0	0	10.1	-
92	0	0	41.8	-
93	0	0	6.8	-
94	0	0	10.7	-
95	0	0	9.0	-
96	0	0	8.0	-
97	0	0	4.2	-
98	0	0	8.5	-
99	0	0	8.1	-
100	0	0	3.3	0
Minimum	**0**	**0**	**2.4**	**0**
Maximum	**0**	**0**	**41.8**	**0.3**
Mean	**0**	**0**	**8.9**	**0**
Median	**0**	**0**	**7.5**	**0**
Standard Dev.	**0**	**0**	**6.8**	**0.1**

Table D.3: Supporting Substrate and Calcite Measures for Sampling Area RG_SLINE, Line Creek, 2018

RG_SLINE_BIC_1					RG_SLINE_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	4.1	-	1	0	0	4.5	-
2	0	0	9.5	-	2	0	0	7.3	-
3	0	0	11.3	-	3	0	0	4.6	-
4	0	0	8.6	-	4	0	0	2.8	-
5	0	0	5.4	-	5	0	0	13.6	-
6	0	0	6.7	-	6	0	0	7.9	-
7	0	0	33.2	-	7	0	0	5.3	-
8	0	0	17.9	-	8	0	0	14.2	-
9	0	0	10.1	-	9	0	0	15.1	-
10	0	0	5.0	0	10	0	0	8.9	0.5
11	0	0	15.1	-	11	0	0	14.6	-
12	0	0	6.5	-	12	0	0	6.1	-
13	0	0	15.4	-	13	0	0	10.6	-
14	0	0	10.9	-	14	0	0	10.7	-
15	0	0	9.3	-	15	0	0	33.5	-
16	0	0	61.5	-	16	0	0	5.4	-
17	0	0	16.5	-	17	0	0	7.4	-
18	0	0	13.6	-	18	0	0	9.7	-
19	0	0	22.5	-	19	0	0	16.2	-
20	0	0	11.6	0	20	0	0	4.8	0.5
21	0	0	16.4	-	21	0	0	8.2	-
22	0	0	14.6	-	22	0	0	7.8	-
23	0	0	7.4	-	23	0	0	14.7	-
24	0	0	8.3	-	24	0	0	9.0	-
25	0	0	8.5	-	25	0	0	5.2	-
26	0	0	7.2	-	26	0	0	8.3	-
27	0	0	15.5	-	27	0	0	5.7	-
28	0	0	11.2	-	28	0	0	3.2	-
29	0	0	11.1	-	29	0	0	15.6	-
30	0	0	20.4	0.75	30	0	0	11.3	0.5
31	0	0	7.3	-	31	0	1	9.4	-
32	0	0	9.3	-	32	0	0	4.6	-
33	0	0	18.5	-	33	0	0	8.5	-
34	0	0	8.3	-	34	0	0	8.2	-
35	0	0	16.8	-	35	0	0	8.2	-
36	0	0	9.0	-	36	0	0	12.5	-
37	0	0	7.0	-	37	0	0	10.5	-
38	0	0	11.6	-	38	0	0	7.3	-
39	0	0	9.2	-	39	0	0	7.5	-
40	0	0	10.7	0.25	40	0	0	5.4	-
41	0	0	31.7	-	41	0	0	24.0	-
42	0	0	10.4	-	42	0	0	4.3	0
43	0	0	18.4	-	43	0	0	31.9	-
44	0	0	12.6	-	44	0	0	8.5	-
45	0	0	11.8	-	45	0	0	5.8	-
46	0	0	10.4	-	46	0	0	9.8	-
47	0	0	9.3	-	47	0	0	3.2	-
48	0	0	11.8	-	48	0	0	2.5	-
49	0	0	9.2	-	49	0	0	19.3	-
50	0	0	12.3	0.5	50	0	0	10.4	0.5
51	0	0	18.3	-	51	0	0	6.1	-
52	0	0	8.3	-	52	0	0	16.7	-
53	0	0	5.1	-	53	0	0	19.8	-
54	0	0	10.9	-	54	0	0	11.6	-
55	0	0	9.0	-	55	0	0	20.5	-
56	0	0	30.4	-	56	0	0	7.3	-
57	0	0	10.3	-	57	0	0	28.2	-
58	0	0	19.7	-	58	0	0	7.4	-
59	0	0	7.1	-	59	0	0	6.9	-
60	0	0	25.2	0.5	60	0	0	7.9	0
61	0	0	7.3	-	61	0	0	17.2	-
62	0	0	23.4	-	62	0	0	7.9	-
63	0	0	20.2	-	63	0	0	7.5	-
64	0	0	7.1	-	64	0	0	3.8	-
65	0	0	4.3	-	65	0	0	6.2	-
66	0	0	9.9	-	66	0	0	4.3	-
67	0	0	19.8	-	67	0	0	27.2	-
68	0	0	7.7	-	68	0	0	12.9	-
69	0	0	10.9	-	69	0	0	5.9	-
70	0	0	12.5	0.25	70	0	0	3.0	0
71	0	0	19.8	-	71	0	0	10.0	-
72	0	0	13.0	-	72	0	0	11.4	-
73	0	0	14.7	-	73	0	0	6.5	-
74	0	0	9.6	-	74	0	0	4.4	-
75	0	0	19.5	-	75	0	0	4.7	-
76	0	0	12.3	-	76	0	0	2.3	-
77	0	0	4.5	-	77	0	0	2.8	-
78	0	0	27.5	-	78	0	0	6.0	-
79	0	0	24.2	-	79	0	0	37.3	-
80	0	0	7.8	0	80	0	0	6.2	0
81	0	0	12.3	-	81	0	0	11.3	-
82	0	0	11.4	-	82	0	0	7.0	-
83	0	0	11.4	-	83	0	0	2.0	-
84	0	0	6.9	-	84	0	0	11.2	-
85	0	0	21.0	-	85	0	0	11.8	-
86	0	0	3.2	-	86	0	0	9.3	-
87	0	0	13.3	-	87	0	0	11.9	-
88	0	0	7.7	-	88	0	0	13.0	-
89	0	0	12.4	-	89	0	0	6.6	-
90	0	0	6.4	0.25	90	0	0	21.4	0.75
91	0	0	8.3	-	91	0	0	5.0	-
92	0	0	4.9	-	92	0	0	9.4	-
93	0	0	14.2	-	93	0	0	11.6	-
94	0	0	5.6	-	94	0	0	3.4	-
95	0	0	8.4	-	95	0	0	7.9	-
96	0	0	14.5	-	96	0	0	9.0	-
97	0	0	8.8	-	97	0	0	3.2	-
98	0	0	5.8	-	98	0	0	22.1	-
99	0	0	11.0	-	99	0	0	2.3	-
100	0	0	10.4	0.25	100	0	0	20.1	0
Minimum	**0**	**0**	**3.2**	**0**	**Minimum**	**0**	**0**	**2.0**	**0**
Maximum	**0**	**0**	**61.5**	**0.8**	**Maximum**	**0**	**1.0**	**37.3**	**0.8**
Mean	**0**	**0**	**12.8**	**0.3**	**Mean**	**0**	**0**	**10.1**	**0.3**
Median	**0**	**0**	**10.9**	**0.3**	**Median**	**0**	**0**	**8.2**	**0.3**
Standard Dev.	**0**	**0**	**7.9**	**0.2**	**Standard Dev.**	**0**	**0.1**	**7.0**	**0.3**

Table D.3: **Supporting Substrate and Calcite Measures for Sampling Area RG_SLINE, Line Creek, 2018**

RG_SLINE_BIC_3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	6.5	-
2	0	0	26.2	-
3	0	0	14.1	-
4	0	0	11.0	-
5	0	0	19.0	-
6	0	0	16.6	-
7	0	0	12.8	-
8	0	0	5.5	-
9	0	0	12.1	-
10	0	0	10.5	0.5
11	0	0	23.5	-
12	0	0	5.0	-
13	0	0	8.1	-
14	0	0	9.6	-
15	0	0	9.7	-
16	0	0	8.0	-
17	0	0	9.2	-
18	0	0	11.4	-
19	0	0	7.5	-
20	0	0	14.0	0.25
21	0	0	17.2	-
22	0	0	11.8	-
23	0	0	13.4	-
24	0	0	14.0	-
25	0	0	4.7	-
26	0	0	4.3	-
27	0	0	11.1	-
28	0	0	19.8	-
29	0	0	6.9	-
30	0	0	7.5	0
31	0	0	4.4	-
32	0	0	11.8	-
33	0	0	7.7	-
34	0	0	10.8	-
35	0	0	20.5	-
36	0	0	8.5	-
37	0	0	11.2	-
38	0	0	19.8	-
39	0	0	31.9	-
40	0	0	4.2	0
41	0	0	5.9	-
42	0	0	10.5	-
43	0	0	8.9	-
44	0	0	9.9	-
45	0	0	17.3	-
46	0	0	13.9	-
47	0	0	38.4	-
48	0	0	13.8	-
49	0	0	16.2	-
50	0	0	9.2	0.25
51	0	0	9.0	-
52	0	0	3.2	-
53	0	0	6.3	-
54	0	0	11.4	-
55	0	0	3.8	-
56	0	0	7.2	-
57	0	0	7.2	-
58	0	0	4.0	-
59	0	0	16.1	-
60	0	0	29.6	0.25
61	0	0	3.7	-
62	0	0	7.0	-
63	0	0	9.6	-
64	0	0	12.5	-
65	0	0	5.0	-
66	0	0	31.0	-
67	0	0	4.5	-
68	0	0	9.2	-
69	0	0	25.9	-
70	0	0	5.8	0
71	0	0	1.8	-
72	0	0	40.0	-
73	0	0	13.8	-
74	0	0	12.2	-
75	0	0	17.7	-
76	0	0	13.5	-
77	0	0	13.6	-
78	0	0	2.6	-
79	0	0	19.3	-
80	0	0	13.5	0.75
81	0	0	12.7	-
82	0	0	7.7	-
83	0	0	3.9	-
84	0	0	42.5	-
85	0	0	26.3	-
86	0	0	9.8	-
87	0	0	11.3	-
88	0	0	9.0	-
89	0	0	5.1	-
90	0	0	3.5	0
91	0	0	9.0	-
92	0	0	4.1	-
93	0	0	15.2	-
94	0	0	28.5	-
95	0	0	16.8	-
96	0	0	7.8	-
97	0	0	9.4	-
98	0	0	4.9	-
99	0	0	6.2	-
100	0	0	5.9	0
Minimum	**0**	**0**	**1.8**	**0**
Maximum	**0**	**0**	**42.5**	**0.8**
Mean	**0**	**0**	**12.3**	**0.2**
Median	**0**	**0**	**10.2**	**0.1**
Standard Dev.	**0**	**0**	**8.2**	**0.3**

Table D.4: Supporting Substrate and Calcite Measures for Sampling Area RG_LCUT, Line Creek, 2018

RG_LCUT_BIC_1				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	15.6	-
2	0	1	18.2	-
3	0	1	7.1	-
4	0	1	7.5	-
5	0	1	7.9	-
6	0	1	20.7	-
7	0	1	2.4	-
8	0	1	18.0	-
9	0	1	3.9	-
10	0	1	6.3	0
11	0	1	18.9	-
12	0	1	12.5	-
13	0	1	3.3	-
14	0	1	2.4	-
15	0	1	4.2	-
16	0	1	5.2	-
17	0	1	9.8	-
18	0	1	17.4	-
19	0	1	11.9	-
20	0	1	14.1	0
21	0	1	6.7	-
22	0	1	5.1	-
23	0	1	12.2	-
24	0	1	22.0	-
25	0	1	8.2	-
26	0	1	9.9	-
27	0	1	10.5	-
28	0	1	6.2	-
29	0	1	9.1	-
30	0	1	16.8	0.25
31	0	0	1.9	-
32	0	1	10.8	-
33	0	1	5.2	-
34	0	1	8.8	-
35	0	1	10.1	-
36	0	1	8.3	-
37	0	1	7.4	-
38	0	1	8.4	-
39	1	1	3.4	-
40	0	1	10.0	0
41	0	1	7.1	-
42	0	1	11.5	-
43	0	1	5.9	-
44	0	1	8.2	-
45	0	1	6.9	-
46	0	1	6.2	-
47	0	1	14.5	-
48	0	1	6.2	-
49	0	1	13.9	-
50	0	1	12.1	0
51	0	1	7.4	-
52	0	1	6.8	-
53	0	1	9.9	-
54	0	1	4.9	-
55	0	1	12.8	-
56	0	1	4.9	-
57	0	0	2.2	-
58	0	1	6.4	-
59	0	1	6.4	-
60	0	1	12.9	0.25
61	0	1	6.8	-
62	1	1	34.8	-
63	0	1	9.7	-
64	0	1	14.5	-
65	0	1	17.7	-
66	0	1	15.2	-
67	1	1	11.7	-
68	0	1	9.2	-
69	0	1	10.1	-
70	0	1	6.5	0
71	0	1	6.7	-
72	0	1	9.1	-
73	0	1	4.3	-
74	0	1	9.5	-
75	1	1	10.8	-
76	0	1	6.6	-
77	0	1	6.1	-
78	0	1	12.3	-
79	0	1	10.5	-
80	0	1	16.1	0
81	0	1	11.3	-
82	0	1	15.2	-
83	1	1	17.2	-
84	0	1	10.4	-
85	0	1	4.8	-
86	0	1	8.4	-
87	0	1	7.5	-
88	0	1	12.0	-
89	0	1	15.7	-
90	0	1	20.5	0
91	0	1	8.5	-
92	0	1	13.6	-
93	0	1	5.0	-
94	0	1	8.3	-
95	2	1	7.7	-
96	-	-	sand	-
97	0	0	15.7	-
98	0	0	8.0	-
99	0	0	5.0	-
100	0	0	19.3	0.5
Minimum	**0**	**0**	**1.9**	**0**
Maximum	**2.0**	**1.0**	**34.8**	**0.5**
Mean	**0.1**	**0.9**	**10.1**	**0.1**
Median	**0**	**1.0**	**9.1**	**0**
Standard Dev.	**0.3**	**0.2**	**5.3**	**0.2**

Table D.5: Supporting Substrate and Calcite Measures for Sampling Area RG_LILC3, Line Creek, 2018

RG_LILC3_BIC_1					RG_LILC3_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	11.9	-	1	0	1	9.0	-
2	0	1	6.5	-	2	0	1	8.9	-
3	0	1	15.5	-	3	0	1	10.6	-
4	0	1	8.9	-	4	0	1	10.2	-
5	0	1	9.0	-	5	0	1	6.4	-
6	0	1	6.8	-	6	0	1	10.6	-
7	0	1	3.3	-	7	0	1	11.1	-
8	0	1	19.0	-	8	0	1	7.3	-
9	0	1	14.8	-	9	0	1	8.7	-
10	0	1	14.5	0	10	0	1	4.8	0.5
11	0	1	6.9	-	11	0	1	24.0	-
12	0	1	6.6	-	12	0	1	11.9	-
13	0	1	12.5	-	13	0	1	14.1	-
14	0	1	7.8	-	14	0	1	16.9	-
15	0	1	18.8	-	15	0	1	8.6	-
16	0	1	8.5	-	16	0	1	2.9	-
17	0	1	4.5	-	17	0	1	4.8	-
18	0	1	18.0	-	18	0	1	9.5	-
19	0	1	15.4	-	19	0	1	10.8	-
20	0	1	13.8	0.25	20	0	1	11.3	0.5
21	0	1	27.5	-	21	0	1	7.5	-
22	0	1	24.5	-	22	0	1	12.8	-
23	0	1	6.7	-	23	0	1	11.4	-
24	0	1	21.3	-	24	0	1	9.9	-
25	0	1	9.5	-	25	0	1	8.4	-
26	0	1	6.8	-	26	0	1	6.8	-
27	0	1	21.0	-	27	0	1	9.4	-
28	0	1	5.7	-	28	0	1	9.8	-
29	0	1	20.5	-	29	0	1	6.8	-
30	0	1	9.9	0	30	0	1	7.4	0
31	0	1	5.5	-	31	0	1	11.8	-
32	0	1	26.5	-	32	0	1	7.4	-
33	0	1	29.3	-	33	0	1	9.6	-
34	0	1	20.5	-	34	0	1	11.8	-
35	0	1	16.0	-	35	0	1	6.6	-
36	0	1	7.0	-	36	0	1	55.3	-
37	0	1	2.5	-	37	0	1	9.1	-
38	0	1	3.0	-	38	0	1	5.5	-
39	0	1	13.5	-	39	0	1	4.0	-
40	0	1	10.0	0	40	0	1	7.1	0
41	0	1	6.3	-	41	0	1	10.8	-
42	0	1	9.5	-	42	0	1	15.5	-
43	0	1	10.0	-	43	0	1	11.2	-
44	0	1	5.4	-	44	0	1	6.6	-
45	0	1	13.6	-	45	0	1	7.0	-
46	0	1	5.9	-	46	0	1	9.3	-
47	0	1	16.5	-	47	0	1	8.4	-
48	0	1	9.5	-	48	0	1	9.5	-
49	0	1	10.2	-	49	0	1	16.5	-
50	0	1	3.4	0	50	0	1	15.3	0
51	0	1	8.7	-	51	0	1	12.8	-
52	0	1	12.3	-	52	0	1	17.5	-
53	0	1	7.3	-	53	0	1	12.0	-
54	0	1	6.7	-	54	0	1	6.6	-
55	0	1	13.8	-	55	0	1	2.9	-
56	0	1	5.6	-	56	0	1	7.5	-
57	0	1	6.9	-	57	0	1	8.4	-
58	0	1	16.5	-	58	0	1	24.4	-
59	0	1	8.6	-	59	0	1	7.0	-
60	0	1	19.4	0	60	0	1	7.0	0.25
61	0	1	71.0	-	61	0	1	24.1	-
62	0	1	20.0	-	62	0	1	8.9	-
63	0	1	9.0	-	63	0	1	7.2	-
64	0	1	20.0	-	64	0	1	7.1	-
65	0	1	14.5	-	65	0	1	9.5	-
66	0	1	8.0	-	66	0	1	17.8	-
67	0	1	5.8	-	67	0	1	8.0	-
68	0	1	8.8	-	68	0	1	6.5	-
69	0	1	10.4	-	69	0	1	10.5	-
70	0	1	12.8	0.5	70	0	1	13.0	0
71	0	1	9.9	-	71	0	1	64.5	-
72	0	1	9.0	-	72	0	1	13.6	-
73	0	1	12.8	-	73	0	1	10.9	-
74	0	1	7.6	-	74	0	1	29.5	-
75	0	1	16.0	-	75	0	1	10.1	-
76	0	1	7.9	-	76	0	1	6.8	-
77	0	1	12.6	-	77	0	1	14.2	-
78	0	1	7.3	-	78	0	1	15.0	-
79	0	1	6.9	-	79	0	1	10.5	-
80	0	1	13.4	0	80	0	1	19.0	0
81	0	1	9.2	-	81	0	1	15.8	-
82	0	1	11.9	-	82	0	1	13.3	-
83	0	1	8.6	-	83	0	1	15.7	-
84	0	1	7.3	-	84	0	1	8.6	-
85	0	1	28.5	-	85	0	1	5.6	-
86	0	1	12.5	-	86	0	1	5.0	-
87	0	1	10.9	-	87	0	1	10.4	-
88	0	1	17.9	-	88	0	1	10.4	-
89	0	1	8.5	-	89	0	1	21.5	-
90	0	1	14.8	0	90	0	1	16.6	0.25
91	0	1	29.5	-	91	0	1	12.3	-
92	0	1	22.0	-	92	0	1	7.5	-
93	0	1	15.8	-	93	0	1	9.6	-
94	0	1	16.5	-	94	0	1	7.5	-
95	0	1	11.0	-	95	0	1	7.7	-
96	0	1	37.5	-	96	0	1	13.0	-
97	0	1	2.8	-	97	0	1	14.3	-
98	0	1	14.4	-	98	0	1	10.3	-
99	0	1	6.5	-	99	0	1	15.9	-
100	0	1	6.2	0	100	0	1	14.2	0
Minimum	**0**	**1.0**	**2.5**	**0**	**Minimum**	**0**	**1.0**	**2.9**	**0**
Maximum	**0**	**1.0**	**71.0**	**0.5**	**Maximum**	**0**	**1.0**	**64.5**	**0.5**
Mean	**0**	**1.0**	**12.8**	**0.1**	**Mean**	**0**	**1.0**	**11.8**	**0.2**
Median	**0**	**1.0**	**10.1**	**0**	**Median**	**0**	**1.0**	**10.0**	**0**
Standard Dev.	**0**	**0**	**8.9**	**0.2**	**Standard Dev.**	**0**	**0**	**8.4**	**0.2**

Table D.5: Supporting Substrate and Calcite Measures for Sampling Area RG_LILC3, Line Creek, 2018

RG_LILC3_BIC_3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	7.0	-
2	0	1	14.0	-
3	0	1	15.0	-
4	0	1	9.5	-
5	0	1	19.4	-
6	0	1	10.2	-
7	0	1	11.8	-
8	0	1	7.4	-
9	0	1	15.9	-
10	0	1	4.3	0.5
11	0	1	15.7	-
12	0	1	22.5	-
13	0	1	4.6	-
14	0	1	17.0	-
15	0	1	15.1	-
16	0	1	12.2	-
17	0	1	23.5	-
18	0	1	11.8	-
19	0	1	13.9	-
20	0	1	8.1	0
21	0	1	8.8	-
22	0	1	10.5	-
23	0	0	7.7	-
24	0	1	10.4	-
25	0	0	41.0	-
26	0	1	6.6	-
27	0	1	9.2	-
28	0	1	7.8	-
29	0	1	6.4	-
30	0	1	9.6	0
31	0	1	4.5	-
32	0	1	15.5	-
33	0	1	8.1	-
34	0	1	6.4	-
35	0	1	30.5	-
36	0	1	13.5	-
37	0	1	17.2	-
38	0	1	14.5	-
39	0	1	11.4	-
40	0	1	12.0	0.75
41	0	1	44.0	-
42	0	1	15.0	-
43	0	1	7.9	-
44	0	1	3.9	-
45	0	1	6.2	-
46	0	1	12.5	-
47	0	1	16.9	-
48	0	1	6.1	-
49	0	1	7.1	-
50	0	1	11.8	0
51	0	1	30.0	-
52	0	1	9.8	-
53	0	1	5.9	-
54	0	1	10.5	-
55	0	1	9.8	-
56	0	1	6.4	-
57	0	1	5.1	-
58	0	1	10.4	-
59	0	1	8.1	-
60	0	1	16.4	0
61	0	1	12.7	-
62	0	1	11.4	-
63	0	1	14.6	-
64	0	1	10.4	-
65	0	1	19.0	-
66	0	1	20.3	-
67	0	1	15.7	-
68	0	1	15.9	-
69	0	1	11.5	-
70	0	1	14.0	0
71	0	1	24.8	-
72	0	1	12.4	-
73	0	1	6.6	-
74	0	1	9.5	-
75	0	1	9.4	-
76	0	1	6.6	-
77	0	1	6.2	-
78	0	1	6.2	-
79	0	1	10.9	-
80	0	1	18.1	0.5
81	0	1	11.2	-
82	0	1	10.6	-
83	0	1	10.4	-
84	0	1	6.5	-
85	0	1	7.4	-
86	0	1	6.1	-
87	0	1	6.3	-
88	0	1	25.0	-
89	0	1	4.3	-
90	0	1	12.3	0.25
91	0	1	21.5	-
92	0	1	18.4	-
93	0	1	13.5	-
94	0	1	18.8	-
95	0	1	19.5	-
96	0	1	13.8	-
97	0	1	4.8	-
98	0	1	72.0	-
99	0	1	11.8	-
100	0	1	11.4	0.25
Minimum	**0**	**0**	**3.9**	**0**
Maximum	**0**	**1.0**	**72.0**	**0.8**
Mean	**0**	**1.0**	**13.2**	**0.2**
Median	**0**	**1.0**	**11.4**	**0.1**
Standard Dev.	**0**	**0.1**	**9.2**	**0.3**

Table D.6: Supporting Substrate and Calcite Measures for Sampling Area RG_LISP24, Line Creek, 2018

RG_LISP24_BIC_1				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	4.3	-
2	0	1	7.4	-
3	0	1	10.2	-
4	0	1	9.8	-
5	0	0	4.4	-
6	0	0	4.2	-
7	0	1	8.3	-
8	0	1	6.4	-
9	0	1	5.6	-
10	0	1	13.0	0.25
11	0	0	8.8	-
12	0	1	19.8	-
13	0	1	21.2	-
14	0	1	9.1	-
15	0	1	27.4	-
16	0	1	11.4	-
17	0	1	8.0	-
18	0	1	20.8	-
19	0	0	3.8	-
20	0	1	17.2	0.25
21	0	1	11.1	-
22	0	1	15.7	-
23	0	1	8.6	-
24	0	1	16.8	-
25	0	1	13.7	-
26	0	1	10.0	-
27	0	1	19.3	-
28	0	1	13.4	-
29	0	1	17.2	-
30	0	1	17.5	0
31	0	0	22.9	-
32	0	1	10.8	-
33	0	1	8.4	-
34	0	1	10.6	-
35	0	1	12.4	-
36	0	0	5.3	-
37	0	1	10.5	-
38	0	1	4.8	-
39	0	1	18.4	-
40	0	1	7.4	0.5
41	0	0	23.0	-
42	0	1	26.5	-
43	0	1	20.0	-
44	0	1	9.1	-
45	0	0	7.8	-
46	0	1	19.8	-
47	0	1	26.4	-
48	0	0	40.5	-
49	0	1	22.2	-
50	0	1	14.8	0.5
51	0	1	11.1	-
52	0	1	18.8	-
53	0	1	7.3	-
54	0	1	12.0	-
55	0	1	15.2	-
56	0	1	8.2	-
57	0	0	6.4	-
58	1	1	10.0	-
59	0	1	8.3	-
60	0	1	6.2	0.25
61	0	1	19.2	-
62	0	1	16.7	-
63	0	1	10.8	-
64	0	1	23.4	-
65	0	1	12.4	-
66	0	1	9.5	-
67	0	1	11.8	-
68	0	1	7.8	-
69	0	1	14.5	-
70	0	1	14.0	0
71	0	1	10.1	-
72	0	1	6.0	-
73	0	1	12.7	-
74	0	1	10.2	-
75	0	1	18.0	-
76	0	1	17.5	-
77	0	1	23.2	-
78	0	1	11.1	-
79	0	1	13.5	-
80	0	1	7.4	0
81	0	1	7.3	-
82	0	1	21.8	-
83	0	1	15.8	-
84	0	1	8.6	-
85	0	0	9.7	-
86	0	1	22.4	-
87	0	1	5.2	-
88	0	0	7.9	-
89	0	1	20.1	-
90	0	1	19.5	0.25
91	0	1	14.0	-
92	0	1	18.6	-
93	0	1	10.1	-
94	0	1	13.8	-
95	0	1	15.3	-
96	0	1	7.6	-
97	0	1	14.2	-
98	0	0	5.0	-
99	0	1	15.5	-
100	0	1	10.5	0
Minimum	**0**	**0**	**3.8**	**0**
Maximum	**1.0**	**1.0**	**40.5**	**0.5**
Mean	**0**	**0.9**	**13.2**	**0.2**
Median	**0**	**1.0**	**11.6**	**0.3**
Standard Dev.	**0.1**	**0.3**	**6.4**	**0.2**

Table D.7: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDSL, Line Creek, 2018

RG_LIDSL_BIC_1					RG_LIDSL_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	6.6	-	1	0	1	15.3	-
2	0	1	10.7	-	2	0	0	7.9	-
3	0	1	11.4	-	3	0	1	24.5	-
4	0	0	4.3	-	4	0	1	11.0	-
5	0	1	8.7	-	5	0	1	15.4	-
6	0	1	7.5	-	6	0	1	15.9	-
7	0	1	23.0	-	7	0	0	9.7	-
8	0	0	5.6	-	8	0	1	20.1	-
9	0	0	4.4	-	9	0	1	18.4	-
10	0	1	3.3	0	10	0	1	25.2	0.5
11	0	0	2.4	-	11	0	0	3.8	-
12	0	1	9.4	-	12	0	1	12.8	-
13	0	0	5.5	-	13	0	1	6.4	-
14	0	1	3.9	-	14	0	0	10.0	-
15	0	0	6.7	-	15	0	1	14.0	-
16	0	0	4.8	-	16	0	1	6.1	-
17	0	1	8.1	-	17	0	1	10.0	-
18	0	0	4.4	-	18	0	1	14.1	-
19	0	1	7.2	-	19	0	1	6.2	-
20	0	1	26.1	0.5	20	0	1	7.8	0
21	0	1	11.6	-	21	0	1	11.3	-
22	0	1	6.8	-	22	0	1	9.2	-
23	0	0	4.9	-	23	0	1	5.8	-
24	0	1	7.0	-	24	0	1	14.5	-
25	0	1	8.1	-	25	0	1	12.5	-
26	0	1	26.7	-	26	0	1	33.0	-
27	0	1	10.8	-	27	0	1	10.4	-
28	0	1	13.6	-	28	0	1	19.3	-
29	0	1	7.2	-	29	0	1	17.7	-
30	0	1	8.0	0.5	30	0	1	10.5	0.5
31	0	1	10.3	-	31	0	1	24.4	-
32	0	1	19.0	-	32	0	1	11.3	-
33	0	1	9.0	-	33	0	1	14.6	-
34	0	0	7.8	-	34	0	1	10.0	-
35	0	1	6.7	-	35	0	1	16.2	-
36	0	1	20.4	-	36	0	1	12.3	-
37	0	1	16.8	-	37	0	1	21.5	-
38	0	1	16.7	-	38	0	0	2.9	-
39	0	1	8.6	-	39	0	1	12.7	-
40	0	1	5.1	0.5	40	0	1	24.0	0.5
41	0	1	3.5	-	41	0	1	13.5	-
42	0	1	11.8	-	42	0	1	14.4	-
43	0	1	11.7	-	43	0	1	14.7	-
44	0	0	2.9	-	44	0	1	16.1	-
45	0	0	4.0	-	45	0	1	9.4	-
46	0	1	12.5	-	46	0	1	20.2	-
47	0	1	5.0	-	47	0	1	20.6	-
48	0	1	18.5	-	48	0	1	10.2	-
49	0	1	4.6	-	49	0	1	21.0	-
50	0	1	7.9	0.25	50	0	1	14.1	0
51	0	1	12.3	-	51	0	1	17.6	-
52	0	1	8.3	-	52	0	0	5.7	-
53	0	1	4.6	-	53	0	1	16.5	-
54	0	1	18.1	-	54	0	1	12.8	-
55	0	1	8.8	-	55	0	1	15.3	-
56	0	1	7.8	-	56	0	0	5.5	-
57	0	1	5.9	-	57	0	1	12.1	-
58	0	1	12.0	-	58	0	1	38.9	-
59	0	1	12.2	-	59	0	1	8.9	-
60	0	1	10.4	0.75	60	0	1	11.4	0.25
61	0	1	10.0	-	61	0	1	22.7	-
62	0	1	12.2	-	62	0	1	10.5	-
63	0	1	17.5	-	63	0	1	14.0	-
64	0	0	4.1	-	64	0	1	12.3	-
65	0	1	8.3	-	65	0	1	18.6	-
66	0	1	5.4	-	66	0	1	9.0	-
67	0	1	21.3	-	67	0	1	9.4	-
68	0	1	8.4	-	68	0	1	7.2	-
69	0	1	25.9	-	69	0	1	11.0	-
70	0	1	8.8	0.25	70	0	1	12.3	0
71	0	1	6.5	-	71	0	1	17.5	-
72	0	0	7.2	-	72	0	1	11.3	-
73	0	1	8.8	-	73	0	1	11.7	-
74	0	1	10.5	-	74	0	1	7.0	-
75	0	0	4.7	-	75	0	0	6.6	-
76	0	1	6.2	-	76	0	1	10.6	-
77	0	1	11.0	-	77	0	1	8.3	-
78	0	1	6.0	-	78	0	0	5.1	-
79	0	0	4.6	-	79	0	1	6.0	-
80	0	1	8.5	0.25	80	0	1	23.5	0.75
81	0	0	3.1	-	81	0	1	8.5	-
82	0	0	3.0	-	82	0	1	11.8	-
83	0	1	5.5	-	83	0	1	9.8	-
84	0	1	7.6	-	84	0	1	13.6	-
85	0	1	3.5	-	85	0	1	9.4	-
86	0	1	10.0	-	86	0	1	14.3	-
87	0	1	6.9	-	87	0	1	8.5	-
88	0	1	16.5	-	88	0	1	20.3	-
89	0	1	8.9	-	89	0	1	11.0	-
90	0	1	7.0	0.25	90	0	1	8.7	0.25
91	0	1	15.5	-	91	0	1	10.1	-
92	0	1	9.8	-	92	0	0	3.6	-
93	0	1	9.0	-	93	0	1	11.2	-
94	0	1	17.0	-	94	0	0	6.5	-
95	0	0	3.4	-	95	0	0	5.8	-
96	0	0	12.0	-	96	0	1	31.1	-
97	0	1	10.2	-	97	0	1	18.5	-
98	0	1	11.1	-	98	0	0	5.6	-
99	0	1	15.3	-	99	0	1	9.8	-
100	0	1	8.3	0	100	0	1	5.9	0
Minimum	**0**	**0**	**2.4**	**0**	**Minimum**	**0**	**0**	**2.9**	**0**
Maximum	**0**	**1.0**	**26.7**	**0.8**	**Maximum**	**0**	**1.0**	**38.9**	**0.8**
Mean	**0**	**0.8**	**9.5**	**0.3**	**Mean**	**0**	**0.9**	**13.1**	**0.3**
Median	**0**	**1.0**	**8.3**	**0.3**	**Median**	**0**	**1.0**	**11.6**	**0.3**
Standard Dev.	**0**	**0.4**	**5.4**	**0.2**	**Standard Dev.**	**0**	**0.3**	**6.4**	**0.3**

Table D.7: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDSL, Line Creek, 2018

RG_LIDSL_BIC_3					RG_LIDSL_BIC_4				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	14.4	-	1	0	0	3.1	-
2	0	1	17.3	-	2	0	0	19.5	-
3	0	1	11.1	-	3	0	1	10.0	-
4	0	1	7.5	-	4	0	1	7.0	-
5	0	1	7.1	-	5	0	1	7.5	-
6	0	1	6.3	-	6	0	1	21.5	-
7	0	0	7.2	-	7	0	1	9.9	-
8	0	1	8.1	-	8	0	0	5.4	-
9	0	1	7.8	-	9	0	1	5.0	-
10	0	1	14.7	0.5	10	0	1	15.0	0.75
11	0	1	8.4	-	11	0	1	18.2	-
12	0	1	9.6	-	12	0	1	9.0	-
13	0	0	7.0	-	13	0	1	10.3	-
14	0	1	6.9	-	14	0	1	10.9	-
15	0	1	6.5	-	15	0	1	10.2	-
16	0	1	5.6	-	16	0	1	9.8	-
17	0	0	7.8	-	17	0	0	2.1	-
18	0	1	7.4	-	18	0	1	16.7	-
19	0	1	12.0	-	19	0	1	12.9	-
20	0	1	5.9	0	20	0	1	11.0	0.75
21	0	1	8.2	-	21	0	1	19.7	-
22	0	1	6.1	-	22	0	1	6.6	-
23	0	1	9.9	-	23	0	1	13.2	-
24	0	1	8.3	-	24	0	0	4.1	-
25	0	1	48.0	-	25	0	1	11.0	-
26	0	1	13.5	-	26	0	0	7.5	-
27	0	1	24.2	-	27	0	1	9.6	-
28	0	0	5.5	-	28	0	1	7.9	-
29	0	1	15.0	-	29	0	1	15.5	-
30	0	0	5.5	0.75	30	0	1	24.8	0.25
31	0	1	19.3	-	31	0	0	8.2	-
32	0	0	5.0	-	32	0	1	11.2	-
33	0	1	32.8	-	33	0	1	11.4	-
34	0	1	19.4	-	34	0	1	3.8	-
35	0	0	2.5	-	35	0	1	12.1	-
36	0	1	19.5	-	36	0	1	9.3	-
37	0	1	13.5	-	37	0	1	15.3	-
38	0	1	6.6	-	38	0	1	8.0	-
39	0	1	10.6	-	39	0	1	11.7	-
40	0	1	12.3	0.25	40	0	1	6.3	0
41	0	1	13.4	-	41	0	1	8.8	-
42	0	0	9.1	-	42	0	1	5.7	-
43	0	1	7.6	-	43	0	1	7.1	-
44	0	1	15.4	-	44	0	1	22.2	-
45	0	1	8.1	-	45	0	1	17.8	-
46	0	0	8.9	-	46	0	1	41.5	-
47	0	1	11.9	-	47	0	0	40.6	-
48	0	1	14.6	-	48	1	1	12.4	-
49	0	1	3.1	-	49	1	1	10.4	-
50	0	1	9.2	0	50	1	1	15.1	0.5
51	0	1	17.2	-	51	0	1	15.5	-
52	0	1	10.5	-	52	1	1	4.5	-
53	0	1	6.1	-	53	0	1	3.3	-
54	0	1	14.6	-	54	0	1	13.7	-
55	0	1	6.3	-	55	0	1	10.7	-
56	0	1	4.5	-	56	0	1	10.9	-
57	0	1	10.0	-	57	0	1	5.6	-
58	0	1	7.3	-	58	0	1	27.3	-
59	0	1	18.6	-	59	0	1	6.5	-
60	0	1	3.0	0	60	0	1	7.4	0
61	0	1	5.5	-	61	0	1	7.6	-
62	0	1	11.9	-	62	0	1	10.2	-
63	0	1	10.2	-	63	0	1	12.6	-
64	0	1	11.6	-	64	0	1	10.7	-
65	0	0	8.8	-	65	0	1	14.9	-
66	0	1	9.3	-	66	0	1	8.7	-
67	0	1	16.0	-	67	0	0	4.0	-
68	0	1	24.0	-	68	0	1	5.4	-
69	0	0	10.7	-	69	0	0	6.6	-
70	0	1	7.8	0.25	70	0	1	11.6	0.25
71	0	1	12.3	-	71	0	1	8.0	-
72	0	1	15.0	-	72	0	1	24.4	-
73	0	1	14.6	-	73	0	1	5.9	-
74	0	1	18.5	-	74	0	1	7.0	-
75	0	1	18.8	-	75	0	1	13.5	-
76	0	1	18.0	-	76	0	1	5.3	-
77	0	1	12.5	-	77	0	1	6.9	-
78	0	1	9.6	-	78	0	1	41.0	-
79	0	1	15.6	-	79	0	1	5.4	-
80	0	1	29.5	0.25	80	0	1	14.5	0
81	0	1	15.5	-	81	0	0	8.8	-
82	0	1	19.3	-	82	0	1	17.5	-
83	0	1	12.3	-	83	0	1	17.7	-
84	0	1	11.6	-	84	0	1	7.4	-
85	0	0	5.4	-	85	0	1	20.1	-
86	0	0	6.7	-	86	0	1	23.4	-
87	0	1	9.0	-	87	0	1	9.3	-
88	0	1	9.2	-	88	0	1	24.2	-
89	0	1	13.1	-	89	1	1	7.6	-
90	0	1	7.9	0	90	0	1	4.5	0
91	0	1	9.9	-	91	0	1	10.5	-
92	0	1	8.5	-	92	0	1	9.9	-
93	0	1	13.5	-	93	0	1	16.2	-
94	0	1	7.3	-	94	0	1	7.2	-
95	0	1	9.1	-	95	0	1	6.4	-
96	0	1	5.6	-	96	0	1	12.3	-
97	0	1	22.0	-	97	0	1	9.0	-
98	0	1	15.2	-	98	0	0	5.5	-
99	0	1	10.6	-	99	0	1	3.9	-
100	0	1	10.6	0.25	100	0	0	6.7	0
Minimum	**0**	**0**	**2.5**	**0**	**Minimum**	**0**	**0**	**2.1**	**0**
Maximum	**0**	**1.0**	**48.0**	**0.8**	**Maximum**	**1.0**	**1.0**	**41.5**	**0.8**
Mean	**0**	**0.9**	**11.7**	**0.2**	**Mean**	**0.1**	**0.9**	**11.7**	**0.3**
Median	**0**	**1.0**	**10.0**	**0.3**	**Median**	**0**	**1.0**	**10.0**	**0.1**
Standard Dev.	**0**	**0.3**	**6.6**	**0.2**	**Standard Dev.**	**0.2**	**0.3**	**7.5**	**0.3**

Table D.7: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDSL, Line Creek, 2018

RG_LIDSL_BIC_5				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	8.9	-
2	0	1	26.5	-
3	0	1	9.8	-
4	0	1	13.2	-
5	0	1	8.5	-
6	0	1	14.5	-
7	0	1	10.6	-
8	0	1	13.0	-
9	0	1	16.4	-
10	0	1	16.2	0.5
11	0	1	13.0	-
12	0	1	18.0	-
13	0	1	13.9	-
14	0	1	10.5	-
15	0	1	13.1	-
16	0	1	9.9	-
17	0	1	18.0	-
18	0	1	29.2	-
19	0	0	4.0	-
20	0	1	10.9	0.5
21	0	1	13.0	-
22	0	1	9.7	-
23	0	1	12.0	-
24	0	0	8.3	-
25	0	0	2.6	-
26	0	1	6.2	-
27	0	1	6.7	-
28	0	1	12.5	-
29	0	1	9.0	-
30	0	0	7.4	0.25
31	0	1	8.2	-
32	0	1	11.2	-
33	0	1	35.3	-
34	0	1	4.3	-
35	0	0	3.2	-
36	0	1	8.5	-
37	0	1	14.6	-
38	0	0	13.2	-
39	0	1	12.6	-
40	0	1	3.2	0.5
41	0	1	31.0	-
42	0	1	15.3	-
43	0	1	11.8	-
44	0	1	11.3	-
45	0	0	5.9	-
46	0	1	9.0	-
47	0	0	4.5	-
48	0	1	12.0	-
49	0	1	31.8	-
50	0	1	17.0	0.25
51	0	1	10.5	-
52	0	0	2.3	-
53	0	0	6.0	-
54	0	0	5.5	-
55	0	0	8.1	-
56	0	1	32.4	-
57	0	1	7.9	-
58	0	1	19.8	-
59	0	1	20.5	-
60	0	1	4.4	0
61	0	1	24.5	-
62	0	1	6.8	-
63	0	1	29.8	-
64	0	1	29.8	-
65	0	0	2.4	-
66	0	0	4.5	-
67	0	0	2.4	-
68	0	1	8.9	-
69	0	0	9.5	-
70	0	1	10.9	0.25
71	0	1	23.4	-
72	0	0	11.6	-
73	0	1	6.7	-
74	0	1	8.0	-
75	0	1	7.4	-
76	0	0	6.5	-
77	0	1	26.3	-
78	0	1	6.0	-
79	0	0	7.7	-
80	0	1	25.8	0.75
81	0	1	35.0	-
82	0	0	3.4	-
83	0	1	10.4	-
84	0	1	11.8	-
85	0	1	28.7	-
86	0	1	27.2	-
87	0	1	21.4	-
88	0	0	1.2	-
89	0	0	3.6	-
90	0	1	7.5	0.5
91	0	1	16.5	-
92	0	1	12.5	-
93	0	0	6.0	-
94	0	1	27.9	-
95	0	0	9.8	-
96	0	1	10.2	-
97	0	0	7.5	-
98	0	0	11.6	-
99	0	0	3.5	-
100	0	1	26.2	0.25
Minimum	**0**	**0**	**1.2**	**0**
Maximum	**0**	**1.0**	**35.3**	**0.8**
Mean	**0**	**0.7**	**12.9**	**0.4**
Median	**0**	**1.0**	**10.6**	**0.4**
Standard Dev.	**0**	**0**	**8.5**	**0.2**

Table D.8: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDCOM, Line Creek, 2018

RG_LIDCOM_BIC_1				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	12.0	-
2	0	1	0.9	-
3	0	0	4.8	-
4	0	1	7.3	-
5	0	0	2.1	-
6	0	0	3.6	-
7	0	1	2.5	-
8	0	0	6.6	-
9	0	0	4.5	-
10	0	1	5.1	0
11	0	1	7.1	-
12	0	1	4.6	-
13	0	1	8.6	-
14	0	1	12.5	-
15	0	1	25.5	-
16	0	1	5.0	-
17	0	1	6.5	-
18	0	1	13.7	-
19	0	1	-	-
20	0	1	10.8	0.25
21	0	1	9.1	-
22	0	1	12.7	-
23	0	1	3.2	-
24	0	1	15.5	-
25	0	1	10.4	-
26	0	1	3.9	-
27	0	0	6.9	-
28	0	0	3.0	-
29	0	0	3.0	-
30	0	0	3.2	0
31	0	0	3.6	-
32	0	1	9.9	-
33	0	1	9.0	-
34	0	1	46.2	-
35	0	1	6.4	-
36	0	0	1.1	-
37	0	0	2.2	-
38	0	1	14.2	-
39	0	1	19.6	-
40	0	1	22.1	0.25
41	0	0	3.2	-
42	0	1	9.9	-
43	0	1	39.0	-
44	0	1	8.1	-
45	0	1	10.8	-
46	0	1	19.5	-
47	0	1	52.0	-
48	0	0	3.3	-
49	0	0	8.9	-
50	0	1	8.4	0.25
51	0	0	4.6	-
52	0	0	4.5	-
53	0	1	6.4	-
54	0	1	7.7	-
55	0	1	12.5	-
56	0	1	7.4	-
57	0	1	29.4	-
58	0	1	7.7	-
59	0	1	38.6	-
60	0	1	9.8	0.25
61	0	1	29.5	-
62	0	1	14.2	-
63	0	1	10.7	-
64	0	1	18.5	-
65	0	1	11.1	-
66	0	1	6.6	-
67	0	0	8.4	-
68	0	0	2.4	-
69	0	0	2.9	-
70	0	1	10.4	0.25
71	0	1	13.5	-
72	0	1	9.0	-
73	0	0	7.0	-
74	0	1	13.5	-
75	0	1	15.5	-
76	0	1	4.3	-
77	0	1	27.0	-
78	0	1	22.3	-
79	0	1	58.5	-
80	0	1	4.4	0
81	0	0	6.5	-
82	0	1	16.2	-
83	0	1	9.5	-
84	0	0	2.0	-
85	0	0	5.5	-
86	0	0	6.3	-
87	0	1	7.9	-
88	0	1	15.0	-
89	0	1	8.3	-
90	0	1	12.0	-
91	0	1	14.5	0
92	0	1	14.2	-
93	0	1	16.5	-
94	0	1	14.2	-
95	0	1	7.7	-
96	0	1	9.2	-
97	0	1	54.5	-
98	0	1	44.5	-
99	0	1	15.6	-
100	0	1	13.0	0.25
Minimum	**0**	**0**	**0.9**	**0**
Maximum	**0**	**1.0**	**58.5**	**0.3**
Mean	**0**	**0.8**	**12.4**	**0.2**
Median	**0**	**1.0**	**9.0**	**0.3**
Standard Dev.	**0**	**0.4**	**11.6**	**0.1**

Table D.9: **Supporting Substrate and Calcite Measures for Sampling Area RG_LI8, Line Creek, 2018**

RG_LI8_BIC_1					RG_LI8_BIC_2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	13.7	-	1	0	0	5.8	-
2	0	0	7.1	-	2	0	1	15.4	-
3	0	1	7.5	-	3	0	1	8.4	-
4	0	1	14.0	-	4	0	1	12.8	-
5	0	0	6.6	-	5	0	0	9.0	-
6	0	1	33.2	-	6	0	0	8.3	-
7	0	0	11.4	-	7	0	0	20.7	-
8	0	0	8.8	-	8	0	1	34.0	-
9	0	1	22.4	-	9	0	1	13.1	-
10	0	1	11.6	0.5	10	0	1	16.7	0.25
11	0	0	5.7	-	11	0	0	8.7	-
12	0	1	15.1	-	12	0	0	19.8	-
13	0	0	5.8	-	13	0	1	3.9	-
14	0	0	30.0	-	14	0	0	5.2	-
15	0	0	29.5	-	15	0	1	18.4	-
16	0	1	10.2	-	16	0	0	9.1	-
17	0	1	6.5	-	17	0	1	9.8	-
18	0	1	9.7	-	18	0	1	14.9	-
19	0	1	9.3	-	19	0	1	22.6	-
20	0	1	25.0	0.25	20	0	1	12.0	0
21	0	0	12.1	-	21	0	0	7.7	-
22	0	0	7.9	-	22	0	1	18.4	-
23	0	1	22.3	-	23	0	1	28.6	-
24	0	0	8.2	-	24	0	1	35.5	-
25	0	0	20.8	-	25	0	0	15.7	-
26	0	1	11.9	-	26	0	0	8.0	-
27	0	0	19.6	-	27	0	0	17.8	-
28	0	0	6.3	-	28	0	0	9.4	-
29	0	0	9.5	-	29	0	0	7.2	-
30	0	1	9.8	0.25	30	0	0	11.9	0
31	0	0	6.9	-	31	0	1	8.6	-
32	0	1	11.3	-	32	0	1	5.3	-
33	0	0	7.9	-	33	0	1	16.5	-
34	0	1	12.7	-	34	0	0	7.8	-
35	0	0	10.7	-	35	0	0	5.2	-
36	0	0	5.6	-	36	0	0	18.5	-
37	0	0	3.6	-	37	0	0	8.0	-
38	0	0	6.8	-	38	0	1	17.4	-
39	0	0	19.5	-	39	0	0	16.2	-
40	0	0	12.7	0.5	40	0	1	7.4	0
41	0	1	6.4	-	41	0	1	32.2	-
42	0	0	11.3	-	42	0	0	3.6	-
43	0	0	5.5	-	43	0	0	7.6	-
44	0	0	8.8	-	44	0	0	7.2	-
45	0	0	7.6	-	45	0	1	41.5	-
46	0	1	17.4	-	46	0	0	17.4	-
47	0	0	12.5	-	47	0	0	3.0	-
48	0	1	15.5	-	48	0	0	14.6	-
49	0	0	9.4	-	49	0	0	10.3	-
50	0	1	7.8	0.25	50	0	1	8.3	0.25
51	0	1	15.1	-	51	0	1	14.0	-
52	0	1	46.2	-	52	0	0	10.8	-
53	0	0	5.9	-	53	0	0	31.0	-
54	0	0	12.7	-	54	0	0	3.8	-
55	0	0	11.4	-	55	0	0	10.5	-
56	0	0	5.6	-	56	0	1	15.1	-
57	0	0	19.0	-	57	0	0	15.8	-
58	0	1	8.8	-	58	0	0	4.4	-
59	0	0	5.4	-	59	0	0	4.2	-
60	0	1	14.4	0.5	60	0	0	19.3	0.25
61	0	0	8.5	-	61	0	1	11.2	-
62	0	1	7.3	-	62	0	0	4.8	-
63	0	0	6.9	-	63	0	0	9.3	-
64	0	0	7.7	-	64	0	0	9.0	-
65	0	1	6.5	-	65	0	0	5.3	-
66	0	0	6.2	-	66	0	0	5.8	-
67	0	0	15.0	-	67	0	0	8.4	-
68	0	1	30.0	-	68	0	0	4.9	-
69	0	0	6.3	-	69	0	0	9.0	-
70	0	1	13.6	0	70	0	1	45.5	0.25
71	0	1	24.2	-	71	0	0	23.5	-
72	0	0	3.9	-	72	0	0	8.3	-
73	0	1	13.2	-	73	0	0	15.9	-
74	0	1	15.5	-	74	0	1	50.0	-
75	0	0	9.2	-	75	0	0	19.5	-
76	0	0	6.4	-	76	0	0	9.1	-
77	0	1	11.3	-	77	0	1	39.0	-
78	0	1	8.1	-	78	0	0	9.5	-
79	0	0	2.6	-	79	0	0	13.3	-
80	0	1	6.6	0.5	80	0	0	10.4	0.25
81	0	1	16.2	-	81	0	1	13.4	-
82	0	0	7.7	-	82	0	1	11.5	-
83	0	1	12.0	-	83	0	0	9.4	-
84	0	0	5.5	-	84	0	0	6.6	-
85	0	0	5.0	-	85	0	0	12.1	-
86	0	1	33.5	-	86	0	1	15.4	-
87	0	0	2.8	-	87	0	0	8.5	-
88	0	0	5.4	-	88	0	0	8.5	-
89	0	1	14.6	-	89	0	0	4.7	-
90	0	1	10.7	0	90	0	1	21.0	0.5
91	0	0	3.6	-	91	0	1	11.2	-
92	0	1	40.5	-	92	0	0	12.7	-
93	0	0	24.3	-	93	0	0	9.5	-
94	0	0	9.8	-	94	0	1	6.9	-
95	0	1	34.4	-	95	0	0	14.8	-
96	0	0	5.9	-	96	0	0	12.8	-
97	0	0	4.5	-	97	0	1	11.4	-
98	0	0	7.4	-	98	0	-	-	-
99	0	0	17.7	-	99	0	1	16.6	-
100	0	0	9.1	0	100	0	0	12.4	0
Minimum	**0**	**0**	**2.6**	**0**	**Minimum**	**0**	**0**	**3.0**	**0**
Maximum	**0**	**1.0**	**46.2**	**0.5**	**Maximum**	**0**	**1.0**	**50.0**	**0.5**
Mean	**0**	**0.4**	**12.3**	**0.3**	**Mean**	**0**	**0.4**	**13.7**	**0.2**
Median	**0**	**0**	**9.6**	**0.3**	**Median**	**0**	**0**	**11.2**	**0.3**
Standard Dev.	**0**	**0.5**	**8.4**	**0.2**	**Standard Dev.**	**0**	**0.5**	**9.2**	**0.2**

Table D.9: **Supporting Substrate and Calcite Measures for Sampling Area RG_LI8, Line Creek, 2018**

RG_LI8_BIC_3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	15.7	-
2	0	1	12.6	-
3	0	1	12.2	-
4	0	1	11.0	-
5	0	1	10.6	-
6	0	1	9.4	-
7	0	1	5.5	-
8	0	1	12.8	-
9	0	1	12.4	-
10	0	1	12.3	0.25
11	0	1	57.1	-
12	0	0	8.3	-
13	0	0	12.3	-
14	0	1	24.4	-
15	0	1	17.8	-
16	0	0	16.5	-
17	0	1	27.2	-
18	0	1	11.4	-
19	0	1	12.6	-
20	0	0	4.4	0
21	0	1	15.2	-
22	0	0	7.0	-
23	0	1	25.2	-
24	0	1	7.6	-
25	0	1	24.1	-
26	0	1	10.2	-
27	0	1	12.8	-
28	0	1	12.5	-
29	0	1	26.2	-
30	0	0	10.0	0.25
31	0	1	9.6	-
32	0	1	19.3	-
33	0	1	14.4	-
34	0	1	42.0	-
35	0	1	12.0	-
36	0	1	14.5	-
37	0	1	23.8	-
38	0	1	10.7	-
39	0	1	14.7	-
40	0	1	4.5	0
41	0	0	4.8	-
42	0	0	6.6	-
43	0	1	33.0	-
44	0	0	25.2	-
45	0	1	20.2	-
46	0	0	8.6	-
47	0	0	7.6	-
48	0	0	9.3	-
49	0	0	7.9	-
50	0	1	25.2	0
51	0	0	6.8	-
52	0	0	12.4	-
53	0	0	10.9	-
54	0	0	12.4	-
55	0	1	15.8	-
56	0	0	9.9	-
57	0	0	13.2	-
58	0	0	30.0	-
59	0	0	5.2	-
60	0	0	13.2	0.5
61	0	0	14.8	-
62	0	0	6.3	-
63	0	0	12.7	-
64	0	0	7.3	-
65	0	0	19.8	-
66	0	0	11.3	-
67	0	0	13.6	-
68	0	0	27.9	-
69	0	0	7.5	-
70	0	0	8.3	0
71	0	0	8.8	-
72	0	0	41.8	-
73	0	0	32.5	-
74	0	1	8.3	-
75	0	1	11.0	-
76	0	0	12.0	-
77	0	1	36.2	-
78	0	1	20.8	-
79	0	1	15.6	-
80	0	1	24.0	0.25
81	0	0	6.8	-
82	0	0	7.3	-
83	0	0	7.2	-
84	0	0	12.0	-
85	0	0	15.8	-
86	0	0	8.7	-
87	0	1	16.0	-
88	0	1	26.5	-
89	0	1	11.8	-
90	0	1	12.3	0
91	0	1	22.5	-
92	0	1	7.9	-
93	0	1	12.1	-
94	0	1	14.0	-
95	0	1	13.4	-
96	0	0	10.3	-
97	0	1	21.0	-
98	0	1	11.5	-
99	0	0	8.3	-
100	0	1	3.9	0.25
Minimum	**0**	**0**	**3.9**	**0**
Maximum	**0**	**1.0**	**57.1**	**0.5**
Mean	**0**	**0.6**	**14.9**	**0.2**
Median	**0**	**1.0**	**12.4**	**0.1**
Standard Dev.	**0**	**0.5**	**9.1**	**0.2**

Table D.10: Supporting Substrate and Calcite Measures for Sampling Area RG_FRUL, Line Creek, 2018

RG_FRUL_BIC_1				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	9.7	-
2	0	1	17.9	-
3	0	0	12.8	-
4	0	0	18.3	-
5	0	0	7.0	-
6	0	0	13.6	-
7	0	0	4.7	-
8	0	0	35.8	-
9	0	0	6.0	-
10	0	0	4.2	0
11	0	0	5.1	-
12	0	0	12.8	-
13	0	0	10.4	-
14	0	0	16.1	-
15	0	1	20.2	-
16	0	0	10.8	-
17	0	0	20.0	-
18	0	0	6.4	-
19	0	0	4.4	-
20	0	0	7.5	0.5
21	0	0	11.5	-
22	0	0	6..3	-
23	0	0	12.6	-
24	0	0	2.7	-
25	0	0	7.6	-
26	0	1	7.9	-
27	0	0	7.2	-
28	0	0	8.7	-
29	0	0	10.8	-
30	0	0	5.9	0
31	0	0	8.1	-
32	0	0	7.6	-
33	0	0	6.1	-
34	0	0	5.0	-
35	0	0	3.2	-
36	0	0	9.7	-
37	0	0	7.9	-
38	0	0	20.2	-
39	0	0	25.8	-
40	0	0	7.0	0.5
41	0	0	4.8	-
42	0	0	8.7	-
43	0	0	7.6	-
44	0	0	1.7	-
45	0	0	4.8	-
46	0	0	7.6	-
47	0	0	6.7	-
48	0	0	8.6	-
49	0	0	3.7	-
50	0	0	3.2	0
51	0	0	17.8	-
52	0	0	4.5	-
53	0	0	4.5	-
54	0	0	12.7	-
55	0	0	5.9	-
56	0	0	6.1	-
57	0	0	14.6	-
58	0	0	12.4	-
59	0	0	17.1	-
60	0	0	6.3	0.25
61	0	0	10.6	-
62	0	0	4.6	-
63	0	0	8.9	-
64	0	0	9.9	-
65	0	0	8.2	-
66	0	0	15.5	-
67	0	0	6.9	-
68	0	0	6.8	-
69	0	1	10.0	-
70	0	0	6.6	0
71	0	0	7.9	-
72	0	0	6.0	-
73	0	0	10.3	-
74	0	0	16.1	-
75	0	0	9.8	-
76	0	0	5.0	-
77	0	0	5.7	-
78	0	0	6.0	-
79	0	0	7.1	-
80	0	0	5.4	0
81	0	0	5.4	-
82	0	0	18.2	-
83	0	0	10.5	-
84	0	0	12.0	-
85	0	0	3.4	-
86	0	0	6.6	-
87	0	0	4.1	-
88	0	0	3.9	-
89	0	0	7.2	-
90	0	0	9.0	0.25
91	0	0	6.5	-
92	0	0	5.7	-
93	0	0	4.5	-
94	0	0	2.5	-
95	0	0	4.0	-
96	0	0	12.0	-
97	0	0	11.2	-
98	0	0	7.9	-
99	0	0	4.4	-
100	0	0	4.5	0.75
Minimum	**0**	**0**	**1.7**	**0**
Maximum	**0**	**1.0**	**35.8**	**0.8**
Mean	**0**	**0**	**9.0**	**0.2**
Median	**0**	**0**	**7.6**	**0.1**
Standard Dev.	**0**	**0.2**	**5.4**	**0.3**

Table D.11: Supporting Substrate and Calcite Measures for Sampling Area RG_FO23, Line Creek, 2018

RG_FO23_BIC_1					RG_FO23_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	15.4	-	1	0	1	13.2	-
2	0	0	1.7	-	2	0	1	15.4	-
3	0	0	11.4	-	3	0	1	38.5	-
4	0	0	11.9	-	4	0	1	15.3	-
5	0	0	8.5	-	5	0	1	30.0	-
6	0	0	10.2	-	6	0	1	18.7	-
7	0	1	11.2	-	7	0	1	11.1	-
8	0	0	4.2	-	8	0	1	20.8	-
9	0	0	9.5	-	9	0	1	16.1	-
10	0	0	14.4	0.75	10	0	0	4.2	0
11	0	1	51.0	-	11	0	1	23.0	-
12	0	0	19.5	-	12	0	1	11.1	-
13	0	0	1.9	-	13	0	1	14.0	-
14	0	1	10.5	-	14	0	1	18.0	-
15	0	0	12.2	-	15	0	1	10.2	-
16	0	0	3.9	-	16	0	0	3.9	-
17	0	0	6.1	-	17	0	1	13.8	-
18	0	0	21.0	-	18	0	1	12.1	-
19	0	0	11.8	-	19	0	0	5.3	
20	0	0	5.8	0	20	0	1	25.2	0.5
21	0	0	12.7	-	21	0	1	27.4	-
22	0	0	7.5	-	22	0	1	38.2	-
23	0	1	22.8	-	23	0	1	15.7	-
24	0	0	7.1	-	24	0	1	17.5	-
25	0	1	6.6	-	25	0	1	26.1	-
26	0	0	0.9	-	26	0	1	6.9	-
27	0	1	17.9	-	27	0	1	9.8	-
28	0	1	11.6	-	28	0	1	13.8	-
29	0	0	15.8	-	29	0	1	7.8	-
30	0	1	7.9	0	30	0	0	17.5	0.25
31	0	0	7.7	-	31	0	1	13.5	-
32	0	1	21.0	-	32	0	1	16.0	-
33	0	1	7.3	-	33	0	1	12.2	-
34	0	0	15.6	-	34	0	1	34.0	-
35	0	1	12.3	-	35	0	1	38.5	-
36	0	1	10.9	-	36	0	1	7.0	-
37	0	0	12.5	-	37	0	1	5.4	-
38	0	0	20.3	-	38	0	1	23.5	-
39	0	0	6.8	-	39	0	1	11.6	-
40	0	1	24.5	0.5	40	0	1	14.2	0.5
41	0	0	5.1	-	41	0	1	17.0	-
42	0	0	7.9	-	42	0	1	12.2	-
43	0	0	8.2	-	43	0	1	19.3	-
44	0	1	14.0	-	44	0	1	21.5	-
45	0	0	4.6	-	45	0	1	16.9	-
46	0	1	13.6	-	46	0	1	6.3	-
47	0	1	14.5	-	47	0	1	24.3	-
48	0	0	7.2	-	48	0	0	11.3	-
49	0	0	11.1	-	49	0	1	27.5	-
50	0	0	3.4	0	50	0	1	5.8	0.5
51	0	0	9.9	-	51	0	1	7.7	-
52	0	0	7.3	-	52	0	1	3.8	-
53	0	0	2.7	-	53	0	1	37.4	-
54	0	0	23.5	-	54	0	1	8.3	-
55	0	1	28.5	-	55	0	1	5.8	-
56	0	0	14.0	-	56	0	1	9.9	-
57	0	1	14.2	-	57	0	1	19.8	-
58	0	0	9.2	-	58	0	1	13.2	-
59	0	1	26.8	-	59	0	1	12.3	-
60	0	0	13.0	0.25	60	0	1	11.2	0.25
61	0	0	12.5	-	61	0	0	13.1	-
62	0	0	21.5	-	62	0	1	31.0	-
63	0	0	6.5	-	63	0	1	26.4	-
64	0	1	21.0	-	64	0	1	5.2	-
65	0	0	6.7	-	65	0	1	9.8	-
66	0	0	4.0	-	66	0	1	5.7	-
67	0	0	5.0	-	67	0	1	10.6	-
68	0	0	8.9	-	68	0	1	4.3	-
69	0	0	15.9	-	69	0	0	1.7	-
70	0	0	10.9	0.25	70	0	1	31.5	0.75
71	0	0	21.0	-	71	0	1	9.4	-
72	0	0	9.9	-	72	0	0	2.0	-
73	0	1	21.5	-	73	0	1	29.3	-
74	0	0	6.5	-	74	0	1	6.6	-
75	0	0	3.2	-	75	0	1	13.3	-
76	0	1	15.7	-	76	0	1	18.3	-
77	0	0	19.0	-	77	0	1	6.7	-
78	0	0	6.0	-	78	0	1	9.5	-
79	0	0	6.9	-	79	0	1	5.7	-
80	0	0	9.4	0.75	80	0	1	4.4	-
81	0	0	3.2	-	81	0	1	10.8	0.5
82	0	0	22.3	-	82	0	1	18.3	-
83	0	0	13.7	-	83	0	1	11.3	-
84	0	0	8.4	-	84	0	1	4.2	-
85	0	1	17.5	-	85	0	1	12.7	-
86	0	0	5.7	-	86	0	1	6.4	-
87	0	0	12.0	-	87	0	1	16.5	-
88	0	0	8.6	-	88	0	1	22.4	-
89	0	1	27.7	-	89	0	1	19.6	-
90	0	1	9.4	0	90	0	1	5.4	0.75
91	0	1	13.8	-	91	0	1	11.3	-
92	0	0	17.0	-	92	0	1	25.5	-
93	0	1	10.9	-	93	0	1	27.8	-
94	0	0	5.9	-	94	0	1	11.9	-
95	0	0	10.0	-	95	0	1	10.4	-
96	0	1	7.8	-	96	0	1	16.9	-
97	0	0	6.7	-	97	0	1	13.5	-
98	0	1	38.5	-	98	0	1	9.0	-
99	0	0	13.6	-	99	0	1	7.7	-
100	0	1	11.4	0	100	0	1	5.5	0
Minimum	**0**	**0**	**0.9**	**0**	**Minimum**	**0**	**0**	**1.7**	**0**
Maximum	**0**	**1.0**	**51.0**	**0.8**	**Maximum**	**0**	**1.0**	**38.5**	**0.8**
Mean	**0**	**0.3**	**12.3**	**0.3**	**Mean**	**0**	**0.9**	**14.8**	**0.4**
Median	**0**	**0**	**10.9**	**0.1**	**Median**	**0**	**1.0**	**12.9**	**0.5**
Standard Dev.	**0**	**0.5**	**7.8**	**0.3**	**Standard Dev.**	**0**	**0.3**	**8.9**	**0.3**

Table D.11: Supporting Substrate and Calcite Measures for Sampling Area RG_FO23, Line Creek, 2018

RG_FO23_BIC_3					RG_FO23_BIC_4				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	3.6	-	1	0	0	3.6	-
2	0	0	17.0	-	2	0	0	5.6	-
3	0	0	6.1	-	3	0	0	7.1	-
4	0	0	3.4	-	4	0	0	8.3	-
5	0	0	6.6	-	5	0	1	18.3	-
6	0	0	13.5	-	6	0	0	6.2	-
7	0	0	5.9	-	7	0	0	18.4	-
8	0	0	7.5	-	8	0	0	10.9	-
9	0	0	8.8	-	9	0	0	11.2	-
10	0	0	9.5	0.5	10	0	0	4.5	0
11	0	0	15.5	-	11	0	0	8.6	-
12	0	0	35.3	-	12	0	0	3.9	-
13	0	0	2.8	-	13	0	0	6.0	-
14	0	0	6.2	-	14	0	1	16.5	-
15	0	0	23.5	-	15	0	1	15.8	-
16	0	0	3.9	-	16	0	0	7.9	-
17	0	0	2.7	-	17	0	0	3.6	-
18	0	0	8.0	-	18	0	0	3.9	-
19	0	0	3.0	-	19	0	0	5.6	-
20	0	0	6.7	0.75	20	0	1	13.3	0.5
21	0	0	3.5	-	21	0	0	2.6	-
22	0	0	2.2	-	22	0	0	4.1	-
23	0	0	11.8	-	23	0	1	13.6	-
24	0	0	4.8	-	24	0	0	12.4	-
25	0	0	9.2	-	25	0	1	15.8	-
26	0	1	6.5	-	26	0	0	2.8	-
27	0	1	17.4	-	27	0	1	15.7	-
28	0	1	12.6	-	28	0	0	11.0	-
29	0	0	13.0	-	29	0	0	13.8	-
30	0	0	6.6	0.75	30	0	0	13.7	0
31	0	0	4.5	-	31	0	0	6.3	-
32	0	0	9.0	-	32	0	1	8.7	-
33	0	0	3.8	-	33	0	0	8.9	-
34	0	0	7.8	-	34	0	1	13.0	-
35	0	0	6.5	-	35	0	1	9.3	-
36	0	0	6.4	-	36	0	1	30.3	-
37	0	0	5.3	-	37	0	0	11.4	-
38	0	1	10.8	-	38	0	1	16.4	-
39	0	0	1.7	-	39	0	0	6.5	-
40	0	1	21.3	0.75	40	0	1	8.5	0.25
41	0	0	3.4	-	41	0	0	7.6	-
42	0	0	4.7	-	42	0	0	13.0	-
43	0	0	1.8	-	43	0	0	8.4	-
44	0	0	9.5	-	44	0	1	22.7	-
45	0	0	2.2	-	45	0	0	7.4	-
46	0	0	4.3	-	46	0	0	7.2	-
47	0	0	5.3	-	47	0	0	8.9	-
48	0	0	3.8	-	48	1	1	29.5	-
49	0	0	3.3	-	49	1	0	4.4	-
50	0	1	27.7	0.25	50	1	1	7.6	0
51	0	0	2.8	-	51	0	0	3.8	-
52	0	0	1.6	-	52	1	0	2.8	-
53	0	0	4.2	-	53	0	0	7.1	-
54	0	0	5.0	-	54	0	0	1.4	-
55	0	0	3.2	-	55	0	1	11.8	-
56	0	0	3.7	-	56	0	0	2.6	-
57	0	0	3.8	-	57	0	1	15.3	-
58	0	0	5.7	-	58	0	0	7.8	-
59	0	0	1.8	-	59	0	0	5.3	-
60	0	0	1.9	0	60	0	0	2.9	0
61	0	0	4.6	-	61	0	1	13.6	-
62	0	0	3.1	-	62	0	0	6.5	-
63	0	0	8.6	-	63	0	1	16.3	-
64	0	0	3.4	-	64	0	0	4.4	-
65	0	0	4.2	-	65	0	0	8.9	-
66	0	0	2.4	-	66	0	1	11.8	-
67	0	0	3.3	-	67	0	0	6.9	-
68	0	0	2.3	-	68	0	1	10.4	-
69	0	0	26.8	-	69	0	0	7.3	-
70	0	0	1.9	0	70	0	1	8.9	0.25
71	0	0	4.6	-	71	0	1	14.3	-
72	0	0	4.7	-	72	0	1	14.5	-
73	0	0	4.9	-	73	0	0	7.5	-
74	0	0	5.0	-	74	0	0	7.3	-
75	0	0	2.8	-	75	0	0	8.9	-
76	0	0	2.0	-	76	0	0	5.2	-
77	0	0	4.7	-	77	0	0	6.0	-
78	0	0	29.2	-	78	0	0	8.4	-
79	0	0	2.4	-	79	0	0	5.5	-
80	0	0	4.7	0	80	0	0	4.6	0
81	0	0	6.3	-	81	0	0	5.7	-
82	0	0	3.9	-	82	0	0	5.7	-
83	0	0	7.0	-	83	0	1	11.4	-
84	0	0	7.6	-	84	0	0	12.8	-
85	0	0	2.6	-	85	0	0	8.7	-
86	0	0	5.5	-	86	0	0	5.0	-
87	0	0	2.9	-	87	0	0	10.6	-
88	0	0	1.7	-	88	0	0	9.1	-
89	0	0	44.0	-	89	1	0	14.7	-
90	0	0	1.1	-	90	0	1	11.7	0.25
91	0	0	3.2	-	91	0	0	8.3	-
92	0	0	3.9	-	92	0	0	3.9	-
93	0	0	1.2	-	93	0	1	13.5	-
94	0	0	15.4	-	94	0	0	4.5	-
95	0	1	5.3	-	95	0	1	23.1	-
96	0	1	17.3	-	96	0	0	15.8	-
97	0	0	5.9	-	97	0	1	12.7	-
98	0	0	4.2	-	98	0	1	18.2	-
99	0	0	6.1	-	99	0	0	5.6	-
100	0	0	3.4	0	100	0	0	3.7	0
Minimum	**0**	**0**	**1.1**	**0**	**Minimum**	**0**	**0**	**1.4**	**0**
Maximum	**0**	**1.0**	**44.0**	**0.8**	**Maximum**	**1.0**	**1.0**	**30.3**	**0.5**
Mean	**0**	**0.1**	**7.3**	**0.3**	**Mean**	**0.1**	**0.3**	**9.6**	**0.1**
Median	**0**	**0**	**4.7**	**0.3**	**Median**	**0**	**0**	**8.5**	**0**
Standard Dev.	**0**	**0.3**	**7.4**	**0.4**	**Standard Dev.**	**0.2**	**0.5**	**5.5**	**0.2**

Table D.11: Supporting Substrate and Calcite Measures for Sampling Area RG_FO23, Line Creek, 2018

RG_FO23_BIC_5				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	7.9	-
2	0	0	8.2	-
3	0	0	6.1	-
4	0	0	7.0	-
5	0	0	5.2	-
6	0	1	9.3	-
7	0	0	10.0	-
8	0	0	7.2	-
9	0	0	3.0	-
10	0	0	6.1	0
11	0	0	6.4	-
12	0	0	5.1	-
13	0	0	7.1	-
14	0	0	10.9	-
15	0	0	5.0	-
16	0	0	4.3	-
17	0	1	21.2	-
18	0	1	7.7	-
19	0	0	8.1	-
20	0	1	8.5	0
21	0	0	9.6	-
22	0	0	6.8	-
23	0	1	23.4	-
24	0	1	21.5	-
25	0	1	5.9	-
26	0	0	2.8	-
27	0	0	5.3	-
28	0	1	37.5	-
29	0	0	6.8	-
30	0	0	6.6	0
31	0	0	6.9	-
32	0	1	7.4	-
33	0	1	13.5	-
34	0	1	8.2	-
35	0	0	14.0	-
36	0	1	18.5	-
37	0	0	9.7	-
38	0	1	13.5	-
39	0	1	32.3	-
40	0	1	19.2	0.5
41	0	0	2.3	-
42	0	1	6.6	-
43	0	1	5.6	-
44	0	1	9.8	-
45	0	1	10.7	-
46	0	0	9.3	-
47	0	0	8.5	-
48	0	1	13.8	-
49	0	0	7.2	-
50	0	1	8.3	0.75
51	0	1	32.8	-
52	0	1	5.3	-
53	0	1	24.5	-
54	0	0	11.4	-
55	0	0	7.5	-
56	0	0	6.1	-
57	0	1	56.3	-
58	0	1	10.9	-
59	0	0	4.0	-
60	0	1	34.3	0
61	0	0	6.8	-
62	0	0	15.5	-
63	0	0	9.3	-
64	0	0	4.8	-
65	0	0	4.0	-
66	0	1	7.8	-
67	0	0	9.2	-
68	0	0	8.6	-
69	0	0	3.8	-
70	0	0	7.5	0
71	0	0	5.3	-
72	0	0	6.6	-
73	0	1	11.5	-
74	0	0	11.2	-
75	0	0	3.5	-
76	0	0	6.9	-
77	0	0	4.3	-
78	0	0	10.9	-
79	0	0	7.8	-
80	0	0	5.3	0.25
81	0	1	15.2	-
82	0	0	6.0	-
83	0	0	3.1	-
84	0	1	10.2	-
85	0	1	13.1	-
86	0	1	27.5	-
87	0	1	7.2	-
88	0	0	7.8	-
89	0	0	5.5	-
90	0	0	3.9	0
91	0	0	10.1	-
92	0	1	36.2	-
93	0	0	6.0	-
94	0	1	6.2	-
95	0	0	4.4	-
96	0	0	10.2	-
97	0	0	4.3	-
98	0	1	17.5	-
99	0	1	8.5	-
100	0	1	20.5	0.5
Minimum	**0**	**0**	**2.3**	**0**
Maximum	**0**	**1.0**	**56.3**	**0.8**
Mean	**0**	**0.4**	**10.7**	**0.2**
Median	**0**	**0**	**7.8**	**0**
Standard Dev.	**0**	**0.5**	**8.8**	**0.3**

Table D.12: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2018

Reference	RG_LI24	**Sample ID: RG_L124_1_BIC**					
		Date		12-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		11:21	1	16.0	0.419
		UTM	Easting	662165	2	10.0	0.645
			Northing	5538411	3	15.0	0.187
		Total Kick Distance (m)		12	4	12.0	0.478
		Sampling Time (min)		3	5	10.0	0.198
		Full Transect?		No			
		# Transects		4			
		Sample ID: RG_L124_2_BIC					
		Date		12-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		13:38	1	17.0	0.128
		UTM	Easting	662214	2	12.0	0.032
			Northing	5538393	3	22.0	0.177
		Total Kick Distance (m)		12	4	25.0	0.425
		Sampling Time (min)		3	5	19.0	0.447
		Full Transect?		Yes			
		# Transects		4.5			
		Sample ID: RG_L124_3_BIC					
		Date		12-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		15:33	1	18.0	0.106
		UTM	Easting	662221	2	24.0	0.388
			Northing	5538429	3	22.0	0.217
		Total Kick Distance (m)		10	4	20.0	0.512
		Sampling Time (min)		3	5	13.0	0.706
		Full Transect?		No			
		# Transects		4			
	RG_SLINE	**Sample ID: RG_SLINE_1_BIC**					
		Date		11-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		11:28	1	17.0	0.116
		UTM	Easting	660901	2	18.0	0.372
			Northing	5531552	3	22.0	0.467
		Total Kick Distance (m)		8	4	24.0	0.314
		Sampling Time (min)		3	5	22.0	0.545
		Full Transect?		No			
		# Transects		4			
		Sample ID: RG_SLINE_2_BIC					
		Date		11-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:07	1	19.0	0.497
		UTM	Easting	660923	2	19.0	0.209
			Northing	5531487	3	15.0	0.354
		Total Kick Distance (m)		18	4	26.0	0.657
		Sampling Time (min)		3	5	23.0	0.358
		Full Transect?		Yes			
		# Transects		1.5			
		Sample ID: RG_SLINE_3_BIC					
		Date		11-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		16:37	1	16.0	0.526
		UTM	Easting	660979	2	23.0	0.368
			Northing	5531450	3	22.0	0.186
		Total Kick Distance (m)		12	4	19.0	0.421
		Sampling Time (min)		3	5	24.0	0.197
		Full Transect?		Yes			
		# Transects		2.5			
Mine-exposed (Line Cree	RG_GRCK	**Sampling ID: LC_GRCK_1_BIC**					
		Date		9-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		8:30	1	26.0	0.149
		UTM	Easting	654282	2	13.0	0.197
			Northing	5540739	3	24.0	0.308
		Total Kick Distance (m)		15	4	13.0	0.260
		Sampling Time (min)		3	5	13.0	0.714
		Full Transect?		Yes			
		# Transects		10			

Table D.12: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2018

Mine-exposed (Line Creek)

RG_LCUT

Sampling ID: RG_LCUT_1_BIC					
Date		10-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
Time		15:45	1	13.0	0.190
UTM	Easting	660113	2	16.0	0.561
	Northing	5532141	3	20.0	0.302
Total Kick Distance (m)		14	4	15.0	0.172
Sampling Time (min)		3	5	24.0	0.579
Full Transect?		Yes			
# Transects		6			

RG_LILC3

Sample ID: LILC3_1_BIC					
Date		10-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
Time		9:52	1	24.0	0.723
UTM	Easting	659916	2	33.0	0.383
	Northing	5531825	3	37.0	0.135
Total Kick Distance (m)		15	4	38.0	0.200
Sampling Time (min)		3	5	25.0	0.383
Full Transect?		-			
# Transects		4			

Sample ID: LILC3_2_BIC					
Date		10-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
Time		11:40	1	15.0	0.284
UTM	Easting	659949	2	23.0	0.330
	Northing	5531825	3	28.0	0.394
Total Kick Distance (m)		17.5	4	40.0	0.128
Sampling Time (min)		3	5	36.0	0.116
Full Transect?		Yes			
# Transects		3.5			

RG_LILC3

Sample ID: LILC3_3_BIC					
Date		10-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
Time		13:50	1	18.0	0.111
UTM	Easting	659869	2	35.0	0.273
	Northing	5531744	3	37.0	0.854
Total Kick Distance (m)		12	4	24.0	0.491
Sampling Time (min)		3	5	13.0	0.101
Full Transect?		Yes			
# Transects		4			

RG_LISP24

Sample ID: RG_LISP24_1_BIC					
Date		13-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
Time		13:13	1	18.0	0.239
UTM	Easting	659674	1	38.0	0.333
	Northing	5531168	1	20.0	0.576
Total Kick Distance (m)		14	1	36.0	0.125
Sampling Time (min)		3	1	13.0	0.328
Full Transect?		Yes			
# Transects		1.5			

Sample ID: RG_LIDSL_1_BIC					
Date		5-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
Time		15:13	1	20.0	0.370
UTM	Easting	659262	2	27.5	0.310
	Northing	5530513	3	29.0	0.390
Total Kick Distance (m)		25	4	20.0	0.680
Sampling Time (min)		3	5	32.0	0.460
Full Transect?		No			
# Transects		2			

Table D.12: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2018

Area	Station	Measure		Value	Replicate	Depth (cm)	Velocity (m/s)
Mine-exposed (Line Creek)	RG_LIDSL	**Sample ID: RG_LIDSL_2_BIC**					
		Date		6-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		11:00	1	24.0	0.697
		UTM	Easting	659279	2	24.0	0.318
			Northing	5530568	3	19.0	0.548
		Total Kick Distance (m)		25	4	21.0	0.380
		Sampling Time (min)		3	5	18.0	0.221
		Full Transect?		Yes			
		# Transects		2.5			
		Sample ID: RG_LIDSL_3_BIC					
		Date		6-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:00	1	21.0	0.301
		UTM	Easting	659309	2	25.0	0.515
			Northing	5530613	3	33.0	0.798
		Total Kick Distance (m)		25	4	36.0	1.002
		Sampling Time (min)		3	5	34.0	0.443
		Full Transect?		Yes			
		# Transects		2.5			
		Sample ID: RG_LIDSL_4_BIC					
		Date		7-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		8:46	1	30.5	0.511
		UTM	Easting	659335	2	32.0	0.902
			Northing	5530652	3	22.0	0.322
		Total Kick Distance (m)		25	4	18.0	0.491
		Sampling Time (min)		3	5	16.0	0.190
		Full Transect?		Yes			
		# Transects		2.5			
		Sample ID: RG_LIDSL_5_BIC					
		Date		7-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		9:50	1	25.0	0.282
		UTM	Easting	659351	2	35.0	0.351
			Northing	5530700	3	34.0	0.209
		Total Kick Distance (m)		32	4	39.0	0.483
		Sampling Time (min)		3	5	27.0	0.198
		Full Transect?		Yes			
		# Transects		3			
	RG_LI8	**Sample ID: RG_LI8_1_BIC**					
		Date		13-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		8:03	1	20.0	0.626
		UTM	Easting	655426	2	32.0	0.502
			Northing	5528959	3	12.0	0.254
		Total Kick Distance (m)		16	4	25.0	0.150
		Sampling Time (min)		3	5	32.0	0.407
		Full Transect?		Yes			
		# Transects		1.5			
		Sample ID: RG_LI8_2_BIC					
		Date		13-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		9:34	1	19.0	0.118
		UTM	Easting	655501	2	13.0	0.485
			Northing	5528890	3	18.0	0.399
		Total Kick Distance (m)		15	4	35.0	0.830
		Sampling Time (min)		3	5	22.0	0.459
		Full Transect?		Yes			
		# Transects		1.5			
		Sample ID: RG_LI8_3_BIC					
		Date		13-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		11:08	1	15.0	0.442
		UTM	Easting	655560	2	25.0	0.614
			Northing	5528835	3	19.0	0.190
		Total Kick Distance (m)		15	4	30.0	0.577
		Sampling Time (min)		3	5	23.0	0.913
		Full Transect?		Yes			
		# Transects		1.25			

Table D.12: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2018

Area	Station	Parameter		Value	Replicate	Depth (cm)	Velocity (m/s)
Mine Exposed (Line Creek)	RG_LIDCOM	**Sampling ID: RG_LIDCOM_1_BIC**					
		Date		7-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		12:30	1	18.0	0.428
		UTM	Easting	658183	2	27.0	0.749
			Northing	5529815	3	23.0	0.596
		Total Kick Distance (m)		28	4	37.0	0.509
		Sampling Time (min)		3	5	37.0	0.659
		Full Transect?		Yes			
		# Transects		2.5			
Mine-exposed (Fording River)	RG_FO23	**Sampling ID: RG_FO23_1_BIC**					
		Date		8-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		8:50	1	32.0	0.265
		UTM	Easting	652994	2	41.0	0.562
			Northing	5528938	3	58.0	0.639
		Total Kick Distance (m)		20	4	58.0	0.594
		Sampling Time (min)		3	5	39.0	0.536
		Full Transect?		Yes			
		# Transects		2			
		Sampling ID: RG_FO23_2_BIC					
		Date		8-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		10:03	1	21.0	0.876
		UTM	Easting	653010	2	39.0	0.413
			Northing	5528992	3	55.0	0.866
		Total Kick Distance (m)		15	4	45.0	1.328
		Sampling Time (min)		3	5	37.0	0.882
		Full Transect?		No			
		# Transects		5			
		Sampling ID: RG_FO23_3_BIC					
		Date		8-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		12:30	1	18.0	0.768
		UTM	Easting	653048	2	29.0	0.848
			Northing	5529008	3	26.0	0.733
		Total Kick Distance (m)		30	4	27.0	0.342
		Sampling Time (min)		3	5	38.0	0.214
		Full Transect?		No			
		# Transects		10			
		Sampling ID: RG_FO23_4_BIC					
		Date		8-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		13:53	1	26.0	0.446
		UTM	Easting	653097	2	40.0	0.661
			Northing	5529034	3	48.0	0.401
		Total Kick Distance (m)		20	4	41.0	0.606
		Sampling Time (min)		3	5	36.0	0.586
		Full Transect?		Yes			
		# Transects		1			
		Sampling ID: RG_FO23_5_BIC					
		Date		8-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		15:32	1	17.0	0.253
		UTM	Easting	653169	2	23.0	0.600
			Northing	5529044	3	30.0	0.364
		Total Kick Distance (m)		16	4	25.0	0.277
		Sampling Time (min)		3	5	25.0	0.392
		Full Transect?		Yes			
		# Transects		1.5			
	RG_FRUL	**Sampling ID: RG_FRUL_1_BIC**					
		Date		9-Sep-18	Replicate	Depth (cm)	Velocity (m/s)
		Time		11:38	1	21.0	0.771
		UTM	Easting	654529	2	42.0	0.580
			Northing	5530163	3	44.0	0.964
		Total Kick Distance (m)		18	4	35.0	0.513
		Sampling Time (min)		3	5	36.0	0.595
		Full Transect?		Yes			
		# Transects		1.25			

Table D.13: Supporting Measures Associated with Hess Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2018

Replicate				1	2	3	4	5	6	7	8	9	10
Reference	RG_LI24	Date		12-Sep-18	12-Sep-18	12-Sep-18	12-Sep-18	12-Sep-18	-	-	-	-	-
		Time		11:33	12:20	12:36	14:36	15:02	-	-	-	-	-
		UTM	Easting	662168	662177	662190	662218	662222	-	-	-	-	-
			Northing	5538397	5538393	5538392	5538390	5538402	-	-	-	-	-
		Depth (cm)		17	20	17	22	17	-	-	-	-	-
		Velocity (m/s)		0.269	0.181	0.260	0.250	0.338	-	-	-	-	-
	RG_SLINE	Date		11-Sep-18	11-Sep-18	11-Sep-18	11-Sep-18	11-Sep-18	-	-	-	-	-
		Time		-	12:26	14:18	14:56	16:54	-	-	-	-	-
		UTM	Easting	660904	660902	660933	660930	660969	-	-	-	-	-
			Northing	5531549	5531547	5531485	5531484	5531448	-	-	-	-	-
		Depth (cm)		17.000	28.000	24.000	19.000	20.000	-	-	-	-	-
		Velocity (m/s)		0.216	0.36	0.29	0.39	0.42	-	-	-	-	-
Mine-Exposed	RG_LILC3	Date		10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18	10-Sep-18
		Time		9:37	10:22	11:09	11:37	12:04	12:40	13:26	13:34	14:15	14:52
		UTM	Easting	659919	659926	659938	659934	659955	659960	659878	659891	659902	659902
			Northing	5531825	5531827	5531836	5531849	5531856	5531869	5531758	5531767	5531788	5531794
		Depth (cm)		23	23	18	17	23	23	25	20	22	24
		Velocity (m/s)		0.589	0.576	0.505	0.512	0.125	0.217	0.587	0.444	0.224	0.303
	RG_LIDSL	Date		06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18	06-Sep-18
		Time		8:40	9:12	10:00	10:43	12:40	13:02	13:40	14:30	15:10	15:39
		UTM	Easting	659277	659274	659276	659303	659299	659305	659313	659319	659328	659329
			Northing	5530518	5530538	5530543	5530581	5530585	5530600	5530606	5530620	5530621	5530634
		Depth (cm)		21	25	22	23	22	26	23	22	20	17
		Velocity (m/s)		0.278	0.302	0.278	0.242	0.323	0.268	0.295	0.355	0.258	0.269

Table D.14: Habitat Information Associated with Benthic Invertebrate Community Sampling at Mine-Exposed and Reference Areas at Line Creek, September 2018

Station ID		Reference		Mine-exposed Line Creek			
		RG_LI24	RG_SLINE	RG_LCUT	RG_LILC3	RG_LISP24	RG_LIDSL
Waterbody		Line Creek	South Line Creek	Line Creek	Line Creek	Line Creek	Line Creek
Date Sampled		12-Sep-18	11-Sep-18	10-Sep-18	10-Sep-18	12-Sep-18	5-Sep-18
UTM (NAD83, 11U)	Easting	662214	660979	660113	659910	659674	659294
	Northing	5538393	5531450	5532141	5531819	5531168	5530583
Elevation		1,664	1,483	1,451	1,442	1,419	1,398
Habitat Characteristics							
Surrounding Land Use		forest, logging	forest	mining	mining	mining	forest, mining
Anthropogenic Influences		access road, otherwise no obvious influences, drone flight completed	bridge upstream of sites, no other influences observed	drainage from rock dump upstream, and influence of AWTF	effluent discharge upstream with AWTF influence	contingency pond of AWTF outlet upstream, mine effluent discharge	mining upstream and effluent discharge
Length of Reach Assessed (m)		30	30	30	50	100	50
Substrate	% Bedrock	0	0	0	0	0	0
	% Boulder	10	10	10	15	10	30
	% Cobble	40	65	75	75	50	55
	% Gravel	50	15	10	10	30	10
	% Sand/Finer	0	5	5	0	10	5
	% Fines	0	5	0	0	0	0
Canopy Coverage (%)		0	48	0	0	0	0
Bank Stability		unstable, substantial erosion	unstable, substantial erosion	stable, no erosion	moderate	unstable, substantial erosion	moderate
Water Colour & Clarity		colourless, clear	colourless, clear	colourless, clear	colourless, clear	colourless, clear	colourless, clear
Channel Measurements	Bankfull Width (m)	6.5	6.5	8.2	7.4	16.2	11.7
	Wetted Width (m)	3.1	4.6	5.8	5.6	15.2	9.2
	Bankfull-Wetted Depth (cm)	53	30	44	56	34	32
	Gradient (%)	2	3	4	-	-	1
Comments/Notes		Drone flight completed to investigate potential influences to area.	Sampling completed downstream of bridge which is not where sampling was completed between 2012 and 2017.	Benthic tissue samples collected between holding pond and AWTF input.	-	Sampling location moved ~64m downstream of study design coordinates, to be located approximately 50 m downstream of contingency pond outlet.	Water samples collected by Mine staff. Sample collections at area started September 5 completed September 7, 2018.

Table D.14: Habitat Information Associated with Benthic Invertebrate Community Sampling at Mine-Exposed and Reference Areas at Line Creek, September 2018

Station ID		Mine-exposed Line Creek		Mine-exposed Fording River	
		RG_LIDCOM	RG_LI8	RG_FRUL	RG_FO23
Waterbody		Line Creek	Line Creek	Fording River	Fording River
Date Sampled		7-Sep-18	13-Sep-18	9-Sep-18	8-Sep-18
UTM (NAD83, 11U)	Easting	658183	655426	654529	652956
	Northing	5529815	5528959	5530163	5529117
Elevation		1,374	1,285	1,244	1,227
Habitat Characteristics					
Surrounding Land Use		forest, mining	mining	forest, mining	forest, mining
Anthropogenic Influences		mine operations upstream, access road on side of area	upstream effluent discharge, adjacent mine access road	upstream mining operations, Fording and Greenhills	mining operations upstream
Length of Reach Assessed (m)		50	50	-	100
Substrate	% Bedrock	5	0	0	5
	% Boulder	40	25	20	30
	% Cobble	40	50	60	40
	% Gravel	10	20	10	20
	% Sand/Finer	5	5	5	5
	% Fines	0	0	5	0
Canopy Coverage (%)		0	27	0	0
Bank Stability		stable, no erosion	stable, no erosion	unstable, substantial erosion	unstable, substantial erosion
Water Colour & Clarity		colourless, clear	colourless, clear	colourless, clear	colourless, clear
Channel Measurements	Bankfull Width (m)	14.8	13.2	64.0	37.6
	Wetted Width (m)	11.7	10.2	14.0	35.0
	Bankfull-Wetted Depth (cm)	92	48	150	82
	Gradient (%)	1	1.5	1.5	1
Comments/Notes		All benthic invertebrate tissue selenium samples collected from extended riffle upstream of the kick and sweep benthic invertebrate community stations.	-	Input drainage noted, and photos and location UTM coordinates recorded. Recorded periphyton coverage measures are average, all sites had limited periphyton coverage on one side of river and heavier periphyton coverage on the other (east) side.	Substantial bank erosion near bridge. Side channels not sampled for benthic invertebrate community.

Table D.15: **Angling Records for Fish Tissue Sampling in April and May, 2018**

Station ID	UTM (NAD83, Zone 11U)		Set Date	Angling Hours (hrs)	No. of Lines	Effort (angler days)	Bull Trout			Westslope Cutthroat Trout		
	Easting	Northing					Catch	Mortalities	CPUE [a]	Catch	Mortalities	CPUE [a]
RG_LILC3	6659876	5531586	30-Apr-18	-	2	-	1	0	-	0	0	-
			2-May-18	2	2	0.17	1	0	6	0	0	0
			3-May-18	1	2	0.08	1	0	12	0	0	0
			4-May-18	4	2	0.30	0	0	0	0	0	0
			9-May-18	2	2	0.15	0	0	0	0	0	0
			10-May-18	-	2	-	0	0	-	0	0	-
RG_LIDCOM	658135	5529841	30-Apr-18	-	2	-	0	0	-	1	0	-
			2-May-18	2	2	0.13	0	0	0	0	0	0
			3-May-18	1	2	0.08	0	0	0	0	0	0
			4-May-18	1	2	0.06	0	0	0	0	0	0
			9-May-18	1	2	0.10	0	0	0	0	0	0
			10-May-18	-	2	-	0	0	-	0	0	-
RG_LI8	-	-	2-May-18	1	2	0.08	0	0	0	0	0	0
			3-May-18	1	2	0.08	0	0	0	0	0	0
			10-May-18	-	2	-	0	0	-	0	0	-
RG_LIDSL	659248	550307	3-May-18	2	2	0.19	0	0	0	0	0	0
Bypass	-	-	9-May-18	0	2	0.03	0	0	0	0	0	0
					Total	**1.45**	**3**	**0**	**2.1**	**1**	**0**	**0.69**

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort.

[a] CPUE is calculated as the number of fish captured per angler day.

Table D.16: Hoop Net Catch Data for Fish Tissue Sampling in Line Creek, May 2018

Net ID	UTM (NAD83, Zone 10U)		Set Date	Lift Date	Set Time	Removal Time	Depth Range (m)		Effort (Fishing days)	Bull Trout			Westslope Cutthroat Trout		
	Easting	Northing								Catch	Mortalities	CPUE[a]	Catch	Mortalities	CPUE[a]
LILC3 - 1	6659876	5531586	02-May-18	03-May-18	14:21	9:32	-	-	0.80	0	0	0	0	0	0
LILC3 - 2							-	-	0.80	0	0	0	0	0	0
LILC3 - 3			03-May-18	04-May-18	11:15	9:14	-	-	0.92	1	0	1.1	0	0	0
LILC3 - 4							-	-	0.92	0	0	0	0	0	0
LILC3 - 5			09-May-18	10-May-18	13:30	12:08	-	-	0.94	0	0	0	0	0	0
								Total	**4.4**	**1**	**0**	**0.23**	**0**	**0**	**0**

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; ft = feet; hrs = hours; m = metres; CPUE = catch-per-unit-effort; - = no data/not recorded.

[a] Total catch-per-unit-effort (CPUE) = total # of fish / trap*days.

Table D.17: Electrofishing Catch Results for Fish Tissue Sampling in Line Creek, August 2018

Station	UTM (NAD83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (sec)	Bull Trout		Westslope Cutthroat Trout	
	Easting	Northing						Catch	Mortalities	Catch	Mortalities
PES3-SC	659232	5530500	20-Aug-18	30.6	2.80	pass 1	337	0	0	1	0
						Total	**337**	**0**	**0**	**1**	**0**
PES2-G	656825	5529140	21-Aug-18	10.2	5.40	pass 1	339	1	0	3	0
						pass 2	234	0	0	1	0
						Total	**573**	**1**	**0**	**4**	**0**

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum. Catch results only reflect fish that were retained for non-lethal tissue collection.

Table D.18: **Angling Records for Fish Tissue Sampling in Line Creek in September, 2018**

Area	Station ID	UTM (NAD83, Zone 11U)		Set Date	Angling Hours (hrs)	No. of Lines	Effort (angler days)	Westslope Cutthroat Trout		
		Easting	Northing					Catch	Mortalities	CPUE [a]
Line Creek	RG_LI8	654427	5528996	13-Sep-18	1.9	2	0.16	0	0	-
	RG_LIDCOM	658121	5529820	13-Sep-18	0.3	2	0.03	0	0	0
	Contingency Pond	659890	5531554	13-Sep-18	2.3	2	0.19	0	0	0
	RG_LIDCOM	658121	5529820	14-Sep-18	0.5	2	0.04	0	0	0
	Contingency Pond	659890	5531554	14-Sep-18	4.3	2	0.35	0	0	0
Fording River	RG_FO23	653015	5528896	14-Sep-18	0.7	2	0.06	1	0	0
				14-Sep-18	0.3	2	0.02	0	0	0
						Total	**0.85**	**1**	**0**	**1.2**

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort.

[a] CPUE is calculated as the number of fish captured per angler day.