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Technical Report Overview

Report: Line Creek Operations Local Aquatic Effects Monitoring Program 2017 Report

Overview: This report presents the 2017 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

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minnow environmental inc.
A Trinity Consultants Company

Line Creek Local Aquatic Effects Monitoring Program (LAEMP) Report, 2017

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EXECUTIVE SUMMARY

A local aquatic effects monitoring program (LAEMP) for Teck's Line Creek Operation (LCO) was developed to monitor potential aquatic effects of the West Line Creek Active Water Treatment Facility (WLC AWTF). The Line Creek LAEMP was designed to evaluate potential influences of the WLC AWTF on biological productivity, tissue selenium accumulation, and/or other receiving environment characteristics (e.g., water temperatures) downstream from the WLC AWTF discharge. The AWTF was briefly operational in late 2014 (July to October), then was recommissioned starting on October 26, 2015, and began steady state operation at the end of January 2016. Steady state operation continued until October 2017 when shutdown of the AWTF was initiated in response to elevated concentrations of selenium measured in tissues of aquatic biota downstream. This report presents the fifth year of data (2017) collection for the Line Creek LAEMP, and incorporates results from monitoring proposed in the 2017 Line Creek LAEMP study design as well as from the monitoring plan approved by ENV to support the AWTF flow reduction and shutdown process.

Evaluation of potential influences to biological productivity indicated that aqueous total phosphorus and orthophosphate concentrations were significantly increased ($p<0.1$) in Line Creek immediately downstream from the discharge (LC_LC3) during AWTF operation (concentrations of 0.007 and 0.0028 mg/L, respectively) compared to before AWTF operation (0.004 and 0.0022 mg/L, respectively). Despite this, total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC) were consistently below the Site Performance Objective (SPO) of 0.02 mg/L during the 2017 growing season (June 15 to September 30). No changes in total phosphorus and orthophosphate concentrations were detected at the Compliance Point (LC_LCDSSLCC) or stations farther downstream relative to reference station concentrations during AWTF operation compared to before. 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 concentrations at the Compliance Point. Periphyton chlorophyll-a and ash-free dry mass levels did not change significantly ($p>0.1$) in Line Creek relative to reference area levels during AWTF operation (2016-2017) compared to previous years when the AWTF system was not operating (2013 and 2015). Variation in these periphyton endpoints was not explained by variation in aqueous nutrient concentrations (total phosphorus, orthophosphate, or nitrate) among areas or over time (i.e., no correlation). These findings confirm results from a previous analysis (Minnow 2017b), that resulted in removal of the periphyton chlorophyll-a SPO at the Compliance Point from Permit 107517 in October 2017. Benthic invertebrate biomass and density in Line Creek, as determined from Hess

sampling, also showed no significant change ($p>0.1$) during AWTF operation (2016-2017) compared to before (2015). Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, indicated no change in community characteristics during AWTF operation compared to before, other than possibly a small increase in larval chironomid (midge) proportions at sampling areas immediately downstream from the AWTF outfall. Overall, the data indicate that AWTF operation is not affecting biological productivity downstream from the AWTF.

Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate, with lesser amounts (~1-2%) of chemically reduced forms such as selenite. Although the WLC AWTF successfully reduced concentrations of total selenium in Line Creek, the effluent contained higher proportions of chemically reduced selenium species, resulting in increased concentrations of non-selenate selenium species in Line Creek. Some of the non-selenate species of selenium are more readily accumulated by aquatic biota than selenate. Benthic invertebrate tissue monitoring in Line Creek in 2016 and 2017 identified higher selenium concentrations downstream from the AWTF compared to upstream or before AWTF operation. Despite these increases in benthic invertebrate tissue concentrations, benthic invertebrate community characteristics were similar during AWTF steady-state operation compared to before. Selenium concentrations were also elevated in the tissues of some individual bull trout and westslope cutthroat trout in 2017 compared to concentrations observed prior to AWTF operation. Benthic invertebrate tissue selenium concentrations in the Fording River were similar downstream from Line Creek, compared to upstream, indicating that the effects of AWTF on aquatic food web accumulation were limited to Line Creek. In response to these results, a decision was made to shut down the WLC AWTF until a technical solution could be implemented. On October 16, 2017, AWTF operations were reduced by approximately half, from about 5,300 to 5,500 m^3/day throughput during steady-state operations to about 2,500 m^3/day. Intakes to the AWTF were closed February 27, 2018 once approval for the shutdown was received from ENV, and pumping of residual water in the system was completed March 8, 2018. The AWTF will remain shut down until it can be recommissioned with an advanced oxidation process (AOP) planned to begin in August 2018. The AOP is designed to reverse the shift in selenium species in ATWF effluent from chemically-reduced species back to a selenate-dominated condition. Depending on construction progress and plant startup timelines, discharge to the receiving environment with the AOP is currently anticipated to begin near the end of September 2018.

AWTF operation does not appear to have significantly affected water temperature or dissolved oxygen concentrations downstream in Line Creek. Also, toxicity testing does not indicate greater toxicity during AWTF operation compared to before. In general, there do not appear to be influences associated with WLC AWTF operation that are not already being addressed through monitoring related to Key Questions #1 (productivity) and #2 (tissue selenium accumulation), or that are being specifically addressed elsewhere (i.e., Compliance Action Plan for *D. magna* acute toxicity failures).

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ACRONYMS AND ABBREVIATIONS

AFDM – Ash Free Dry Mass

ANOVA – Analysis of Variance

AOP – Advanced Oxidation Process

APHA – American Public Health Association

AWTF – Active Water Treatment Facility

BACI – Before-After / Control-Impact

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

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 October 13, 2017) outlines the Line Creek LAEMP requirements 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[1] and submitted to the Director for approval by May 31 each year."*

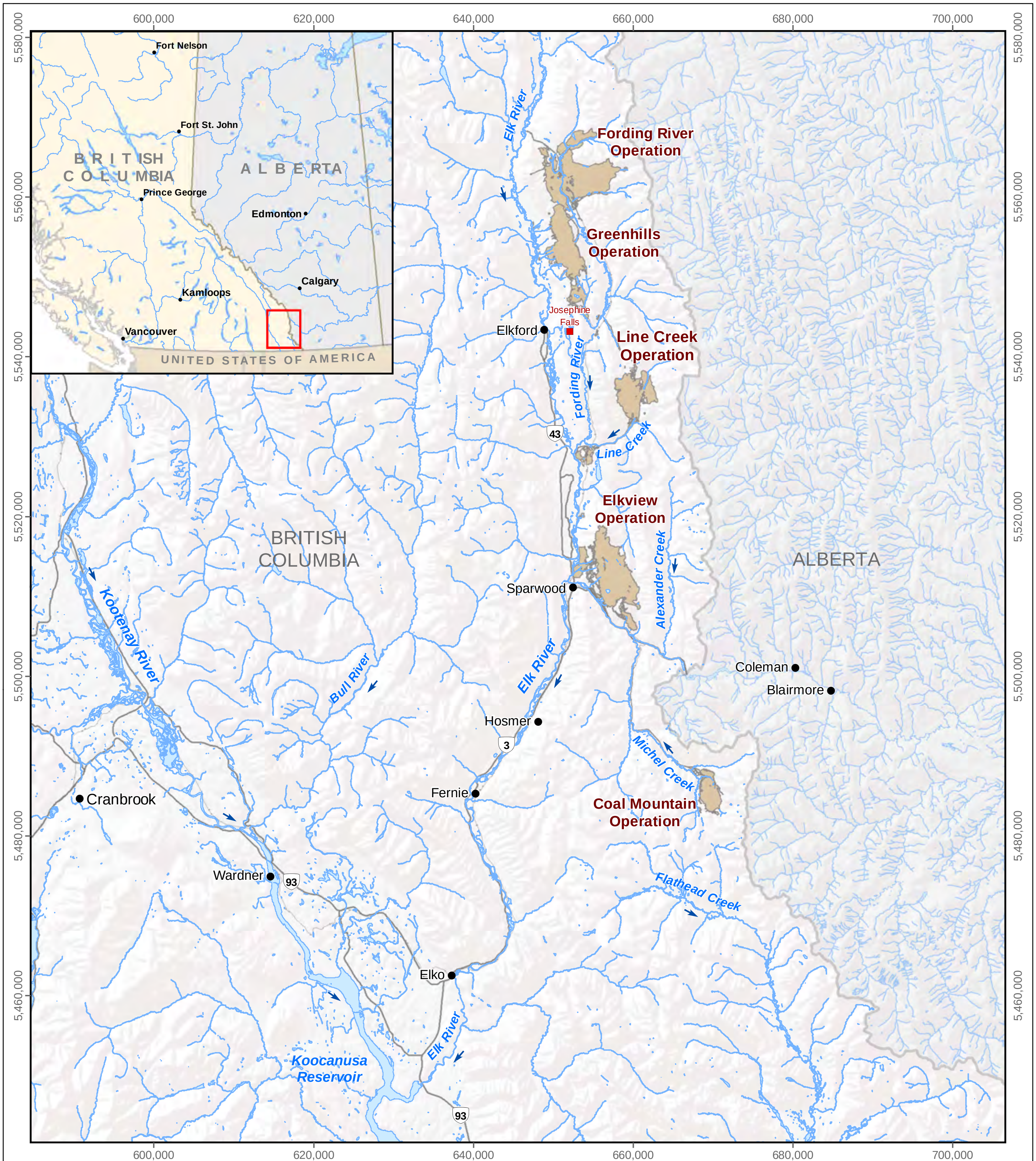
Also, Section 10.5 of Permit 107517 states:

> *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 May 31 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., every three years, with the most recent cycle of sampling completed in 2015). 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:

- Water Quality Monitoring

[1] 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 MOE Director regarding monitoring programs.



LEGEND

Teck Coal Mine Operation

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

Projection: North American Datum 1983 UTM Zone 11

Date: May 2018
Project 177202.0023

minnow environmental inc.

Figure 1.1

Document Path: S:\Projects\177202\177202.0023 - Teck 2017 Line Ck LAEMP Implementation - Privileged and Confidential\Mapping\Report\17-23 Fig 1.1 Teck Coal Limited Operation.mxd

- Calcite Monitoring
- Chronic Toxicity Testing Program
- Fish and Fish Habitat Management
- Tributary Evaluation and 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 Key Questions (Study Objectives)

The Line Creek LAEMP was designed to evaluate effects related to the commissioning of the West Line Creek Active Water Treatment Facility (WLC AWTF) at LCO. After a brief period of operation in late 2014 (July to October), the WLC AWTF was recommissioned starting on October 26, 2015 and commenced steady state operation by the end of January 2016 (Table 1.1).

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

Another concern with respect to operation of the AWTF was a potential change in the form of selenium that would be released into Line Creek from the WLC AWTF. Most of the selenium in surface waters downstream from Teck's mines has been in the form of selenate, as would be expected in the well-oxygenated, flowing stream habitats that dominate the Elk River watershed. At the WLC AWTF, selenium is removed via uptake into microorganisms within the treatment system that transform the selenium into chemically reduced forms. Therefore, some of the residual selenium in treated water is in the form of selenite or other species, some of which 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). As such, although the WLC AWTF was designed to reduce total selenium loads to Line Creek, a concern was that selenium concentrations may not be reduced in the tissues of aquatic biota downstream from the AWTF.

Based on the above, the Line Creek LAEMP was designed to evaluate biological productivity and tissue selenium accumulation downstream from the WLC AWTF discharge (Minnow 2014a) beginning with collection of baseline data in 2013, prior to commissioning of the WLC AWTF

Table 1.1: Dates Associated with Phases of WLC AWTF Operation

Phase	Start	End	Approximate Flow (m^3/day)
Initial AWTF Commissioning Phase	24-Jul-14	26-Aug-14	Variable flow
Initial AWTF Discharge	27-Aug-14	16-Oct-14	Variable flow
AWTF Shutdown (no flow)	17-Oct-14	26-Oct-15	0
AWTF Discharge Begins	26-Oct-15	30-Jan-16	Variable flow
AWTF Steady State Operation	31-Jan-16	15-Oct-17	~5,300 - 5,500
AWTF flow reduction	16-Oct-17	07-Mar-18	~2,500
AWTF Intakes Closed, System Dewatered	27-Feb-18	8-Mar-18	Variable flow
AWTF Shutdown (flow ceases)	8-Mar-18	scheduled as 23-Aug-18[a]	0
AWTF/AOP Recommissioning [a]	scheduled as 23-Aug-18	120 days after recommissioning date (~Feb 2019)	Variable flow
AWTF/AOP Discharge Begins [a]	120 days after recommissioning date (~Feb 2019)	~Oct 2019	~5,500 - 7,500
AWTF/AOP Steady State Operation [a]	~Oct 2019	indefinitely	~7,500

[a] Anticipated AWTF/AOP recommissioning schedule is displayed. If the actual date of recommissioning is later than anticipated, all subsequent AWTF/AOP operation dates will differ from those shown.

(Minnow 2015a). In 2015, the objectives for the Line Creek LAEMP were updated (in consultation with the Environmental Monitoring Committee [EMC]) and re-stated as key questions in the 2016 study design (Minnow 2016b):

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. Interpretive reports of the LAEMP results have been submitted annually beginning in May 2014 (Minnow 2015a, 2016a, 2017a).

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. 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 (data presented in this report), 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[2] 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).

The AWTF is scheduled to be recommissioned in August 2018. Recommissioning will include the addition of an advanced oxidation process (AOP[3]) to reverse the shift in selenium species in ATWF effluent from chemically reduced species back to a selenate-dominated condition.

[2] 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.

[3] AOP refers to the advanced oxidation process and all associated related AWTF process modifications.

Discharge from the AWTF with AOP to the receiving environment is currently anticipated to resume in late September 2018.

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 continual improvement of water quality management in the Elk Valley (Teck 2016b). Through EMC review of the 2016 AMP, it was determined that an update to the AMP was required to advance several elements that were in development at the time of the 2016 AMP submission. Teck is currently working in collaboration with the EMC to update AMP content and will submit an updated AMP for acceptance by the director by Dec 21, 2018. Data from the RAEMP (Minnow 2018a) and the various LAEMPs (including the present monitoring program) will feed into the adaptive management process to address a set of six overarching environmental Management Questions that collectively address the environmental management objectives of the AMP and the EVWQP (Teck 2014). In addition, the AMP identifies Key Uncertainties under each Management Question, which if reduced, either help confirm that Teck's current management actions are appropriate or lead to adjustments that would better satisfy EVWQP objectives.

As with the RAEMP, monitoring data and evaluations conducted within Line Creek LAEMP are designed primarily to provide supportive information to help answer AMP Management Question #5 (currently worded as "Does monitoring for mine-related effects indicate that the aquatic ecosystem is healthy?"), and Key Uncertainty 5.1 (currently worded as "How will monitoring data be used to identify potentially important mine-related effects on aquatic ecosystem health at a management unit scale?"). Data and analysis conducted under the LAEMP will also contribute to answering AMP Management Question #2, (currently worded as "Will aquatic ecosystem health be protected by meeting the long-term site performance objectives?) by assessing the aquatic ecosystem under a range of current conditions and identifying areas where biological effects may be occurring due to one or more mine-related parameters.

Data collected as part of the Line Creek LAEMP has followed and will continue to follow an adaptive management framework, as will decisions pertaining to management of the WLC AWTF. For example, additional aqueous selenium speciation monitoring and seasonal tissue sampling events were implemented in early 2017 following the identification of challenges with the performance of the WLC AWTF in 2016. Results from these additional sampling events informed the decision to obtain necessary authorizations to temporarily shut down the WLC AWTF until a technical solution could be implemented, in order to minimize chemically-reduced selenium species in Line Creek. The AWTF will remain shut down until it can be recommissioned with the AOP described in Section 1.3, and monitoring throughout the shutdown period has been implemented to evaluate conditions while the AWTF is offline and conditions prior to AWTF recommissioning. In addition, using an adaptive management framework, evaluation of data collected in 2017 for the Line Creek LAEMP has been used to inform amendments to the Line Creek study design in 2018. Should findings suggest that additional responses are necessary, further investigations or adjustments may be initiated.

2 METHODS

2.1 Overview

The general approach for the Line Creek LAEMP is summarized in Table 2.1, which explains the data that were collected and evaluated in relation to each of the key questions. 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 LCUT (LC_LCUSWLC) in 2016, and LISP23 (WL_LCUCP_SP23), LISP24 (WL_DCP_SP24), and LIDCOM (LC_LCC) in 2017. 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 flows are not being diverted to the AWTF for treatment. LISP23, LISP24, and LIDCOM are monitoring areas downstream from the WLC AWTF that were added to provide additional spatial resolution of selenium concentrations in water and the tissues of aquatic biota. Continuous water temperature monitoring locations are shown in Figure 2.2 and listed in Table 2.4.

To address the key questions described in Section 1.2, the 2017 Line Creek LAEMP included evaluation of the following components:

- Periphyton chlorophyll-a concentrations, ash free dry mass (AFDM), visual coverage scores, and tissue selenium concentrations;
- Benthic invertebrate biomass, community, and tissue selenium concentrations (composite and single-taxon samples);
- Concentrations of nutrients, total selenium, and selenium species in water based on routine water quality monitoring;
- *In situ* water quality (including temperature and dissolved oxygen) at routine water quality monitoring locations upstream and downstream from the AWTF;
- 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). Results are also presented for toxicity testing completed in accordance with LCO's Permit 106970.

Table 2.1: General Approach for Line Creek LAEMP, 2017, as Presented in the LAEMP Study Design (Minnow 2017c)

Key Questions	Assessment Endpoints	Measurement Endpoints[f]				How Data will be Evaluated to Address Key Question
		Water	Sampling Areas	Biological	Sampling Areas	
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_LCUSWLC, LC_LC3, WL_LCUCP_SP23, 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[c]	Biomass - LI24, SLINE, LILC3, LIDSL, LIDCOM Community - LI24, SLINE, LILC3, LISP23, LISP24, LIDSL, LIDCOM, LI8 (annually)	Determine if there is an increase in benthic invertebrate biomass, or shift in community structure that has been demonstrated to correspond with other measures of productivity (e.g., periphyton chlorophyll-a, AFDM), over time.
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_LCUSWLC, LC_LC3, WL_LCUCP_SP23, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.3[a] for timing)	Benthic invertebrate tissue selenium (composite and single taxon samples) Fish tissue selenium (Westslope cutthroat trout and bull trout)[d]	Benthic invertebrate - LI24, SLINE,LCUT, LILC3, LISP23, LISP24, LIDSL, LIDCOM, LI8, FRUL, FO23 (annually)[e] Fish - Area 1 (LILC3, LISP23, LISP24, LIDSL, LIDCOM) Area 2 (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	WL_WLCI_SP01, WL_LCI_SP02, WL_BFBW_SP21, LC_LC3, LC_LCDSSLCC, LC_LC4 (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	LILC3, LIDSL, LI8 (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	WL_LCI_SP02, WL_WLCI_SP01, WL_BFWB_OUT_SP21, LC_LC3 (LILC3), LC_LCDSSLCC (LIDSL), LC_LC4 (LI8) (see Table 2.3[a] for timing)	Benthic invertebrate community structure	LILC3, LIDSL, LI8 (annually)	
		Toxicity	WL_BFWB_OUT_SP21, LC_LCDSSLCC (LIDSL) (see Table 2.3[a] for timing)	Benthic invertebrate community structure	LI24, SLINE, LILC3, LIDSL, LI8, FRUL, FO23 (annually)	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 3.2 that was referenced in this table in the study design, except that water and biological sampling areas in the vicinity of temperature loggers were added to the figure.

[c] Monitoring of periphyton chlorophyll-a and ash-free dry mass were not proposed in the study design based on the rationale presented in the Proposal to Update the Site Performance Objectives Phosphorus Management in Line Creek (Minnow 2017b). However, ENV approval to eliminate the SPO for chlorophyll-a was not received from ENV until October 2017, so these endpoints were included in sampling completed in September 2017.

[d] Monitoring proposed to focus on benthic invertebrate and fish tissue selenium because periphyton samples were confounded by the presence of abiotic particulate matter containing selenium. However, at Teck's request, periphyton samples were also collected for tissue selenium analysis through early 2018.

[e] Although annual monitoring was identified in the study design, sampling was more frequent in 2017 and early 2018 to better understand seasonal variability relative to AWTF operation and shutdown.

[f] After the study design was submitted some monitoring endpoints, monitoring locations, and sampling events were added. All relevant available data have been incorporated in this report (e.g., see footnotes above).

Table 2.2: Monitoring Areas Associated with Line Creek LAEMP

Area		Biological Sampling			
		Biological Area Code	Location Description	UTM (11U)	
				Easting	Northing
Line Creek	Reference	LI24	Tornado Creek (south fork of upper Line Creek)	662214	5538393
		SLINE	South Line Creek upstream of Line Creek and LCO	660980	5531449
	Mine-exposed	LCUT	Line Creek downstream of rock drain, downstream of West Line Creek and upstream of AWTF outfall	660114	5532140
		LILC3	Line Creek downstream of West Line Creek and AWTF outfall	659911	5531818
		LISP23	Line Creek downstream of LC_WTF_OUT, downstream of confluence with South Line Creek, upstream of contingency pond discharge	659883	5531412
		LISP24	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	659710	5531221
		LIDSL	Line Creek downstream of South Line Creek confluence	659294	5530583
		LIDCOM	Line Creek downstream of the compliance point	658184	5529814
		LI8	Line Creek downstream of the canyon	655426	5528959
Fording River	Mine-exposed	FRUL	Fording River downstream of Grace Creek, upstream of Line Creek	654530	5530162
		FO23	Fording River downstream of Line Creek	652965	5528974

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 (11U)		Water Quality Samples			
			Easting	Northing	Exposure 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

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 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.

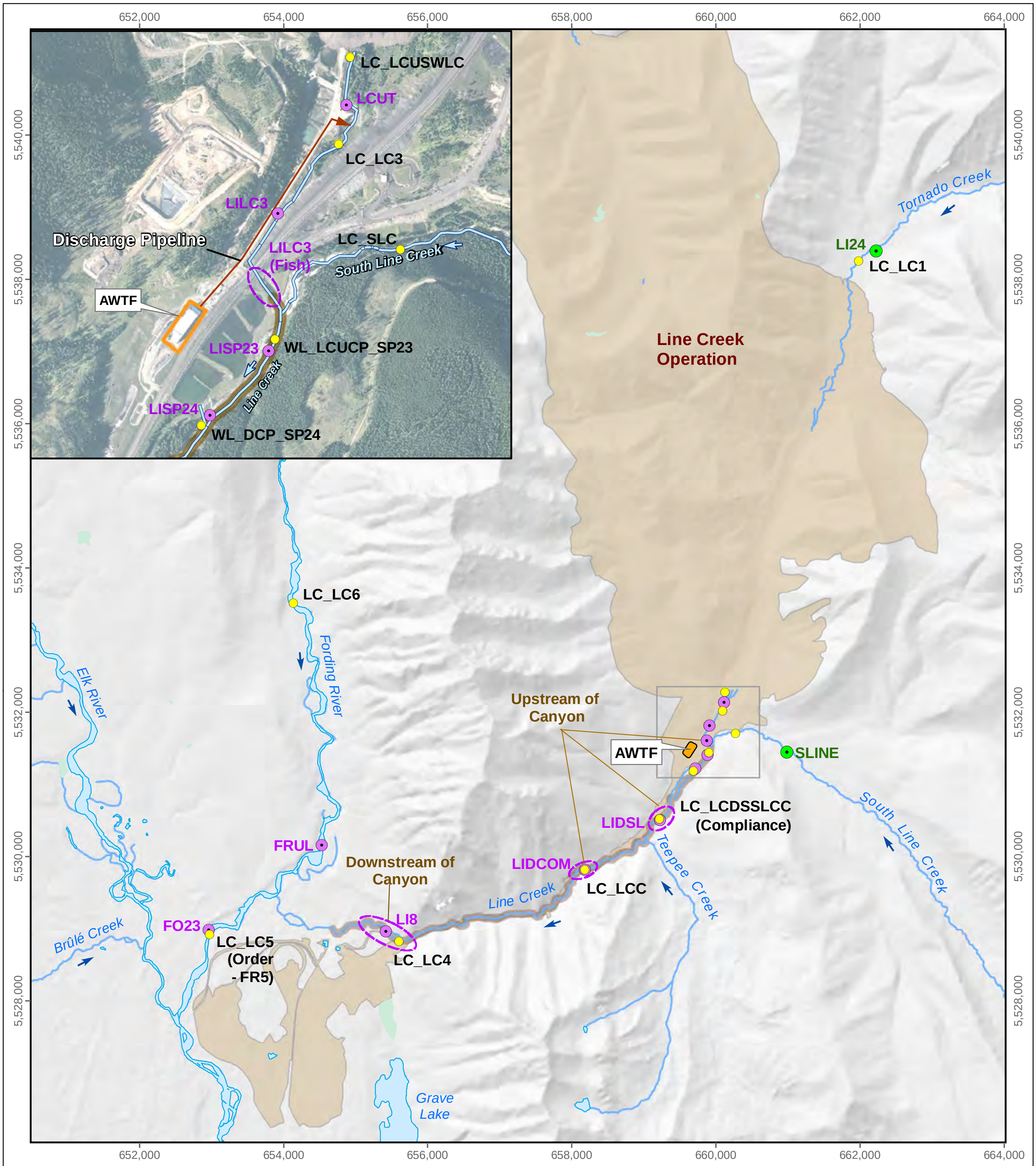
[b] Total and dissolved metals, total and dissolved organic carbon, nutrients, major ions, etc. as per Table 18 of Permit 107517.

[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)
- Bull Trout Spawning Area (Smithson and Robinson 2018)
- Teck Coal Mine Operation

Line Creek LAEMP Biological Monitoring Areas and Teck Water Quality Stations, 2017

0 1.25 2.5 5 km

N E S W

Map Projection: UTM Zone 11N NAD 1983
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Date: May 2018
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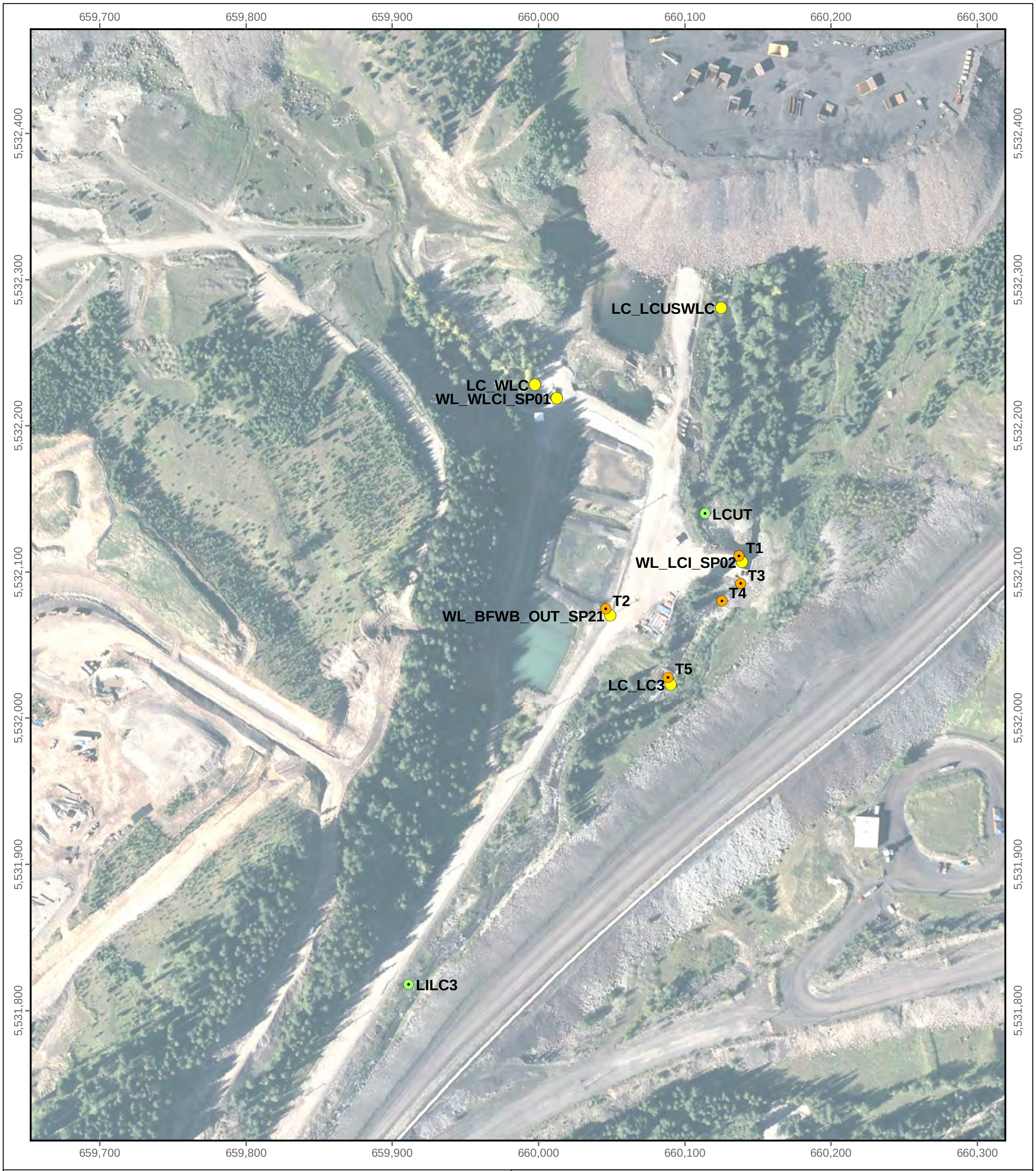
Figure 2.1

Document Path: S:\Projects\177202\177202.0023 - Teck 2017 Line Ck LAEMP Implementation - Privileged and Confidential\Mapping\Report\17-23 Fig 2.1 LAEMP Monitoring Areas and WQ.mxd



LEGEND

- Biological Monitoring Area
- Temperature Data Logger
- Teck Water Quality Station

Monitoring Locations Upper Line Creek

0 60 120 240 Meters

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 reserved.

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Figure 2.2

Document Path: S:\Projects\177202\177202.0023 - Teck 2017 Line Ck LAEMP Implementation - Privileged and Confidential\Mapping\Report\17-23 Fig 2.2 LAEMP Monitoring Areas.mxd

Table 2.4: Temperature Data Logger Locations, 2017

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

Sampling completed in 2017 and early 2018 is summarized in Table 2.5 relative to the study designs approved for the 2017 LAEMP (Minnow 2017c) and the WLC AWTF shutdown (ENV 2018). Sampling events in February-March and April 2017 were added by Teck in response to water quality and tissue selenium monitoring results in late 2016 (i.e., these sampling events were not specified in previously approved designs); the results of which were included in the Line Creek LAEMP report submitted in May 2017 (Minnow 2017a). Results of additional tissue selenium and aqueous selenium speciation sampling completed up to March 2018 are presented in this report, while all other results are presented for the 2017 calendar year only. Historical data are also presented in tables and figures where appropriate.

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 directly by Teck (Table 2.3), and for water samples collected at the biological monitoring stations concurrently with biological sampling (Table 2.2; Figure 2.1)[4]. Water quality data were downloaded from Teck's EQuIS™ database, including:

- Nutrient concentrations (i.e., nitrate, nitrite, ammonia, total Kjeldahl nitrogen [TKN], total phosphorus, and ortho-phosphate), total nickel concentrations, total and dissolved selenium concentrations, and selenium speciation data (i.e., concentrations of selenate, selenite, dimethylselenoxide, methylseleninic acid, selenocyanate, selenomethionine, and selenosulfate); and
- *In situ* water quality data (i.e., temperature, pH, conductivity, and dissolved oxygen).

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

Table 2.5: Sampling Completed In Line Creek, 2017-2018 Compared to Proposed Sampling Designs

Exposure Type	Biological Area Code	EMS Number	Teck Water Station Code	2017 – AWTF Operating (this sampling was done in addition to study design commitments for the Line Creek LAEMP and results were previously reported (Minnow 2017a)) – Feb 28-Mar 2 – Tissue Selenium					2017 – AWTF Operating (this sampling was done in addition to study design commitments for the Line Creek LAEMP and results were previously reported (Minnow 2017a)) – Apr 25-27 – Tissue Selenium							
		Water Quality Sampling Station		Scrapings from individual rocks	Composite Taxa	*Parapsyche* sp.	Rhyacophilidae	Chironomidae	Scrapings from individual rocks	Composite Taxa	*Parapsyche* sp.	Rhyacophilidae	Ephemeroptera	Chironomidae	Westslope Cutthroat Trout	Bull Trout
		Number of samples per area (n)		10	5	5	1	1	15	10	10	1	1	1	1	1
Reference	RG_SLINE	E282149	LC_SLC	-	-	-	-	-	√	√	√	√	√	-	-	-
Reference	RG_LI24	E216142	LC_LC1	-	-	-	-	-	-	-	-	-	-	-	-	-
Mine-exposed	RG_LCUT	E293369	LC_LCUSWLC / LC_WLC	√	√	√	√	√	√	√	√	√	√	√	-	-
Mine-exposed	RG_LILC3	0200337	LC_LC3	√	√	√	-	√	√	√	√	√	√	√	-	√
Mine-exposed	RG_LISP23	-	WL_LCUCP_SP23	-	-	-	-	-	-	-	-	-	-	-	-	-
Mine-exposed	RG_LISP24	-	WL_DCP_SP24	-	-	-	-	-	-	-	-	-	-	-	-	-
Mine-exposed	RG_LIDSL	E297110	LC_LCDSSLCC (compliance)	√	√	√	√	-	√	√	√	√	√	√	√	-
Mine-exposed	RG_LIDCOM	-	LC_LCC	-	-	-	-	-	-	-	-	-	-	-	√	-
Mine-exposed	RG_LI8	0200044	LC_LC4	√	√	√	√	-	√	√	√	√	√	√	-	-
Mine-exposed	RG_FRUL	0200338	LC_LC6	-	-	-	-	-	√	√	-	-	√	-	-	-
Mine-exposed	RG_FO23	0200028	LC_LC5	-	-	-	-	-	√	√	-	-	√	-	-	-

Biological Area Code	2017 – AWTF Operating – Sep 7-13 (regular LAEMP timing) – Tissue Selenium								2017 – AWTF Operating – Sep 7-13 (regular LAEMP timing) – Productivity/Community				
	Scrapings from individual rocks	Composite Taxa	*Parapsyche* sp.	Rhyacophilidae	Ephemeroptera	Chironomidae	Westslope Cutthroat Trout	Bull Trout	Visual Coverage Score (Productivity)	Chlorophyll-a (Productivity)	AFDM (Productivity)	Kick Sampling (Community)	Hess Sampling (Biomass, Community)
Number of samples per area (n)	15	10	5	1	1	1	5	5	5	1/5[c]	1/5[c]	1/3[d]	5/10[e]
RG_SLINE	√	√	√	√	√	-	-	-	√	√	√	√	√
RG_LI24	√	√	√	√	√	-	-	-	√	√	√	√	√
RG_LCUT	√	√	√	√	√	√	-	-	√	√	√	√	-
RG_LILC3	√	√	√	√	√	√			√	√	√	√	√
RG_LISP23	-	√	√	-	-	-			√	-	-	√	-
RG_LISP24	-	√	√	-	-	-	√	√	√	-	-	√	-
RG_LIDSL	√	√	√	√	√	√			√	√	√	√	√
RG_LIDCOM	-	√	√	-	-	-			√	-	-	√	√
RG_LI8	√	√	√	√	√	-	√	0	√	√	√	√	-
RG_FRUL	-	√	3	√	√	0	-	-	√	-	-	√	-
RG_FO23	-	√	√	√	√	√	-	-	√	-	-	√	-

Biological Area Code	2017 – After AWTF Flow Reduction – 3 weeks – Nov 9-11 – Tissue Selenium		2017 – After AWTF Flow Reduction – 7 weeks – Dec 4-5 – Tissue Selenium		2018 – After AWTF Shutdown[b] – 0 weeks – Mar 8-11[a] – Tissue Selenium						2018 – After AWTF Shutdown[b] – 4 weeks – Apr 3-5 – Tissue Selenium		2018 – After AWTF Shutdown[b] – 8 weeks – Apr 30-May 4[b] – Tissue Selenium				2018 – After AWTF Shutdown[b] – 12 weeks – ~Jun 1 – Tissue Selenium	
	Scrapings from individual rocks	Composite Taxa	Scrapings from individual rocks	Composite Taxa	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
Number of samples per area (n)	15	10	15	10	15	10	10	1	1	1	15	10	15	10	8	8	15	10
RG_SLINE	-	-	-	-	√	√	6	√	√	0	-	-	√	√	-	-	-	-
RG_LI24	-	-	-	-	0 (frozen)						-	-	√	√	-	-	-	-
RG_LCUT	√	√	√	√	√	√	√	√	√	√	√	√	√	√	-	-	T	T
RG_LILC3	√	√	√	√	√	√	√	√	√	√	√	√	√	√			T	T
RG_LISP23	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
RG_LISP24	√	√	√	√	√	√	√	√	√	√	√	√	√	√	1	4	T	T
RG_LIDSL	√	√	√	√	√	√	√	√	√	√	√	√	√	√			T	T
RG_LIDCOM	√	√	√	√	√	√	√	√	√	√	√	√	√	√			T	T
RG_LI8	√	√	√	√	√	√	√	√	√	√	√	√	√	√	0	0	T	T
RG_FRUL	-	-	-	-	√	√	3	√	√	√	-	-	-	√	0	0	-	-
RG_FO23	-	-	-	-	√	√	7	√	√	√	√	√	0	√	0	0	T	T

√ - target sample size was met, otherwise the actual number of samples collected is shown. T - target sample size

[a] Corresponds to late-February/early-March sampling proposed in the Line Creek LAEMP study design (Minnow 2017c)

[b] This sampling period represents both the "8-week" and "April/May (Target)" sampling specified in the ATWF shutdown plan

[c] 1 sample at all areas except 5 at Compliance Point (LIDSL/LC_LCDSSLCC)

[d] 1 sample at all areas except 3 samples at Compliance Point (LIDSL/LC_LCDSSLCC)

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

(blue) Samples that were collected in addition to those in approved study designs

(green) Sampling associated with Line Creek LAEMP study design (Minnow 2017c)

(yellow) Sampling associated with approved AWTF shutdown plan (ENV 2018)

Quality assurance and quality control (QA/QC) associated with routine water quality monitoring were discussed in the annual water quality report for Permit 107517 (e.g., Teck 2018).

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 four samples of AWTF influent and 18 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}) *Daphnia* spp.; Report EPS 1/RM/11 July 1990 (with May 1996 amendments; Environment Canada 1996).

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;
- 30-day early life stage toxicity tests using rainbow trout, *Oncorhynchus mykiss* (EPS 1/RM/28-1E; Environment Canada 1998) are conducted semi-annually (once in spring, once in fall).

Further chronic toxicity tests were completed on samples collected twice annually at the AWTF effluent outfall (WL_BFWB_OUT_SP21) and at the Compliance Point (LC_LCDSSLCC) based on requirements of Permit 106970:

- 7-day test of reproduction and survival using the cladoceran, *Ceriodaphnia dubia (*Report EPS 1/RM/21; Environment Canada 2007c);
- 7-day test of embryo viability using rainbow trout, *Oncorhynchus mykiss* (Report EPS 1/RM/28; Environment Canada 1998);

- 7-day test for measuring the inhibition of growth using the freshwater macrophyte, *Lemna minor (*Report EMS 1/RM/37; Environment Canada 2007d); and
- a 72-hour growth inhibition test using a freshwater alga, *Pseudokirchneriella subcapitata* (Report EPS 1/RM/25; Environment Canada 2007b).

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 Permit 107517 (Golder 2018b) and Permit 106970 (Nautilus 2017, 2018). Applicable results (i.e., for monitoring stations in Line Creek) are summarized in this report.

2.3 Primary Productivity

Periphyton samples were collected for analysis of chlorophyll-a and AFDM at six areas in September 2017 (Table 2.5). Three areas were situated downstream from the WLC AWTF on Line Creek: LILC3 (LC_LC3), LIDSL (LC_LDCSSLCC), and LI8 (LC_LC4), and one area was located upstream of the AWTF: LCUT (LC_LCUSWLC, LC_WLC). Two reference areas in the Line Creek watershed were also sampled: LI24 (LC_LC1) and SLINE (LC_SLC; Figure 2.1). All productivity endpoints were measured in September, however periphyton chlorophyll-a was also evaluated three additional times (n=5) at LIDSL (LC_LCDSSLCC) during the growing season (July to Sept) in accordance with the SPO in Permit 107517[5], which stipulates a minimum of three sampling events between July 15 and September 30.

Periphyton samples were collected from riffle habitats with a water depth of at least 10 cm and uniform substrate characteristics. When a sampling area with such characteristics was identified, a relatively flat rock of at least 12 cm in length was sampled. If a rock chosen by this method was judged unsuitable for sampling (e.g., highly angular, or uncharacteristic surface texture), an alternative rock in close proximity, having visibly similar periphyton coverage, was sampled instead. This approach was used to minimize the variability in chlorophyll-a and AFDM that is attributable to variations in natural habitat to facilitate detection of differences among areas that may be due to mining or AWTF operation.

For each periphyton chlorophyll-a sample, a total of five suitable rocks were selected and taken to shore for sampling. A thin acetate template with a 4 cm^2 opening was placed on the rock, and all periphyton within the opening was removed from the rock using a scalpel. This process was repeated on each of the five rocks, and all five scrapings were placed on a wetted Whatman® GF/F glass fiber filter (e.g., 90 mm diameter, 0.7 µm pore size) to provide a single, composite sample per station. The filter paper containing the sample was then folded in half twice and tightly

[5] The requirement for periphyton chlorophyll-a sampling was removed from Permit 107517 in October 2017.

wrapped in aluminum foil. The foil wrapped samples were placed in labelled Whirl-Pak® bags and stored in a cooler with freezer packs (in the field) until transfer to a freezer later in the day. Samples can be stored frozen for up to 30 days as long as they are not exposed to light (APHA et al. 1998).

The same rocks sampled for chlorophyll-a analysis were also used to collect separate scrapings for analysis of AFDM. Each composite sample for AFDM analysis was placed in a small sealed container and kept cool until transfer to a freezer later in the day.

Samples for AFDM and chlorophyll-a analysis were shipped frozen to ALS Environmental (Calgary, AB or Burnaby, BC). Analysis of chlorophyll-a was completed using procedures adapted from EPA Method 445.0; involving routine acetone extraction followed by fluorescence detection using a non-acidification procedure (a method that is not subject to interferences from chlorophyll-b). Analysis of AFDM followed procedures modified from American Public Health Association (APHA) Method 10300 C. Total AFDM was calculated as the difference between the dried sample weight and the ash weight, both of which were determined gravimetrically. Dry weight was determined by drying the sample at 105°C, and the ash weight was subsequently determined by ashing the dried sample at 500°C.

Periphyton coverage was also visually scored at five stations in each area where benthic invertebrates were collected by kick sampling in September. The sores were based on the categories defined in the Canadian Aquatic Biomonitoring Network (CABIN) sampling method (Environment Canada 2012):

1. Rocks not slippery, no obvious color (<0.5 mm thick)
2. Rocks slightly slippery, yellow-brown to light green color (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 2017 from three areas in Line Creek downstream from the WLC AWTF (LILC3, LIDSL, and LIDCOM), and at two reference areas (SLINE and 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. Any gravel or cobble enclosed within the Hess sampler was carefully washed while allowing the current to carry dislodged organisms into the mesh collection net. All 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 level 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. All 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 (preservative) 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)

A single sample was collected in each of ten areas during the September 2017 sampling event, as well as three samples collected at the Compliance Point (LIDSL/LC_LCDSSLCC; Table 2.5), for a total of eleven areas. 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 in a 10% buffered formalin solution.

2.6 Tissue Selenium Concentrations

2.6.1 Overview

Monitoring data from September 2016 indicated that discharge of non-selenate forms of selenium in WLC AWTF effluent were causing selenium to be elevated in the tissues of aquatic biota downstream from the AWTF (Minnow 2017a). Additional sampling events were implemented in February-March and in April 2017, which involved more within-area sample replication and confirmed the noted elevated tissue selenium concentrations from the previous September. These results were presented in the Line Creek LAEMP report submitted in May 2017 (Minnow 2017a), but are also summarized in this report as applicable.

Further sampling for tissue selenium analysis was undertaken in September, November and December 2017 and approximately monthly between early March and the end of May 2018 in accordance with the 2017 Line Creek LAEMP study design (Minnow 2017c), and the approved plan for the AWTF shutdown (ENV 2018; Table 2.5). Additional sampling is also planned for early June, 2018 (ENV 2018; Table 2.5). Data from sampling events completed up to and including March 2018 are presented in this report, including samples collected in December 2017 which were not required to be collected under approved designs. Sampling areas are indicated in Table 2.5 and Figure 2.1.

2.6.2 Periphyton

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 0.5 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 analysis (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 included collection of a composite sample of a variety of benthic invertebrate taxa. 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 events in September 2017 and March 2018 included collection of samples comprising each of four representative benthic invertebrate taxa, where available (i.e., Chironomidae, Ephemeroptera, *Parapsyche* sp., and Rhyacophilidae). These samples were the legacy 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 such sampling is being discontinued in

Teck's monitoring programs (e.g., April, May, and June sampling events in Table 2.5). However, data are presented in this report for samples collected up to March 2018.

For composite samples, as many organisms as possible were carefully removed from the sample using tweezers until about 2 g of wet tissue was obtained. For representative taxa samples, 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 in Excel spreadsheets and provided to Minnow. Water quality results for samples collected concurrently with biological sampling were visually examined relative to routine monitoring results for a number of parameters. Results were generally similar between the two sample types (routine monitoring and collected concurrently with biological samples) despite slight differences in sampling location[6] (Appendix Figures A.1 to A.5). Therefore, all data analyses described below included routine monitoring data only.

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 for a given day, the first value was used in data plots and statistical analyses. If the daily replicates included both values above and below the Laboratory Reporting Limit (LRL) the first detected value was used. Monthly means were calculated using the Kaplan-Meier (K-M) method. This method involves 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 involves calculating the area under the K-M survival curve. The K-M method is non-parametric and can accommodate multiple LRLs.

[6] Parameters examined included total phosphorus, orthophosphate, nitrate, temperature, and dissolved oxygen. Total selenium was not examined due to known differences in exposure to inputs from West Line Creek depending on AWTF operational status (see Section 2.1).

Potential effects of AWTF operation on nutrient concentrations, temperature, and dissolved oxygen concentrations in Line Creek were analyzed among areas and years using a before-after/control-impact (BACI) Analysis of Variance (ANOVA) model (Underwood 1992). The BACI model assesses changes in the difference in concentration between control (i.e., reference) and impact (i.e., mine-exposed) areas in one time period ("after" an event, in this case the onset of AWTF operation) compared to another (e.g., "before" AWTF operation).

For BACI analysis of water quality, monthly means using data from January 2012 to December 2017 were used. Data from 2012 to 2015 were used to represent the period "before" AWTF operation, excluding data from 2014 when the AWTF operated for several months. Data from 2016 and 2017 represented the "after" period (AWTF operation). Water quality data were not available for December to March at reference station LC_LC1 (frozen) so BACI analyses of aqueous nutrient concentrations (nitrate, total phosphorus, orthophosphate), temperature, and dissolved oxygen concentrations were first done by including data for both reference stations (LC_LC1 and LC_SLC), but excluding data for winter months. This avoided biasing the results due to seasonal effects. Based on indications from data plots that winter values of total phosphorus, orthophosphate, temperature, and dissolved oxygen may influence BACI results, the analyses were repeated to include data for winter months, which necessitated exclusion of data for LC_LC1 (i.e., changes at mine-exposed areas over time were evaluated relative to LC_SLC alone).

Data for LC_LCDSSLCC were only available from 2014 to 2017. Thus, to include this station, another BACI analysis was completed that included 2015 as the "before" AWTF operation and 2016 and 2017 as the "after" AWTF operation. Analyses with (LC_SLC as reference) and without (LC_SLC and LC_LC1 as reference) winter months were completed.

The BACI model that was fit to the data was:

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

where:

- Y = response variable;
- BA = a fixed factor for time period with two levels (before and after);
- CI = a fixed factor for area type with two levels (control and impact);
- $BA \times CI$ = the interaction between BA and CI;
- $Area(CI)$ = a fixed factor for area when there are more than two areas (nested in CI because each area can only be assigned to one level of CI);

- $Year(BA)$ = a fixed categorical factor for year when there are more than two years in the before period or more than two years in the after period (nested in BA because each year can only be assigned to one level of BA);
- $CI \times Year(BA)$ = the interaction between CI and $Year$;
- $BA \times Area(CI)$ = the interaction between BA and $Area$;
- $Area(CI) \times Year(BA)$ = the interaction between $Area$ and $Year$; and
- ϵ = the error term.

The BACI model was used to test for BACI effects (i.e., changes in the difference between mine-exposed and reference areas over time). The BACI effects were assessed by testing the significance of the interaction terms containing the BA and CI terms. A p-value 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 $Year(BA)$. If the interaction was significant then the differences among areas changed over time (i.e., a BACI effect), but it depended on which years and areas were compared. In that case, contrasts were conducted to determine the areas and years that caused the significant difference.

If the interaction term was not significant, then the interpretation of the ANOVA table continued by assessing the significance of the interaction between CI and $Year(BA)$ and the interaction between BA and$Area(CI)$. These terms in the model assess whether the relative differences among areas depended on which year and group (control or impact) were compared (i.e., there was a BACI effect that depended on which years were compared) and whether a change in the differences between exposed and reference areas depended on which area and period (before or after) were compared (i.e., there was a BACI effect that depended on which areas were compared). If these interaction terms were significant, then contrasts were conducted to determine where the interaction was occurring.

If these interaction terms were not significant, then the interaction between BA and CI was assessed for significance. If it was significant, then the relative differences between the control and impact areas depended on the time period (before or after), indicating that the impact areas responded similarly in showing a greater or lesser difference from reference areas in the after period compared to the before period (i.e., there is a consistent BACI effect that does not depend on which year and group are compared).

Testing the significance of the interaction terms is the key hypothesis of interest in the BACI 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 BACI effects (i.e., in this project, that there is no effect of AWTF operation). A BACI effect was considered to be relevant if it detected a difference in the same direction between an exposed and reference area in 2016 to 2017 compared to before years (2012 to 2015, excluding 2014, to the extent data were available for each year).

Data were transformed (log_{10}) as required to meet the assumption of normality for the residuals of the BACI model. If normality could not be met the with the model residuals, the model was run using rank-transformed values (i.e., non-parametric test). If the parametric and non-parametric results had the same patterns, the results of the parametric test with the best transformation were presented to allow for easier interpretation. The BACI models and contrasts were conducted in R (R Core Team 2016) using customized scripts.

The magnitude of difference for a significant BACI effect was expressed in terms of the number of standard deviations and as a percentage change and was calculated as follows:

Magnitude of Difference = $\frac{(\bar{X}_{AI}-\bar{X}_{AC})-(\bar{X}_{BI}-\bar{X}_{BC})}{S_r}$

where:

- $\bar{X}_{AI}$ = the mean for the mine-exposed area in the after period;
- $\bar{X}_{AC}$ = the mean for the reference area in the after period;
- $\bar{X}_{BI}$ = the mean for the mine-exposed area in the before period;
- $\bar{X}_{BC}$ = the mean for in reference area in the before period; and
- S_r= the standard deviation of the residuals in the BACI model (i.e., the pooled within area/year standard deviation).

Magnitude of Difference = $\frac{(\bar{X}_{AI}-\bar{X}_{AIpred})}{\bar{X}_{AIpred}} \cdot 100\%$

where $\bar{X}_{AIpred}$ = the predicted mean for the mine-exposed area in the after period if there was no BACI effect (i.e., $\bar{X}_{AIpred} = (\bar{X}_{BI} - \bar{X}_{BC}) + \bar{X}_{AC}$). The $\bar{X}_{AI}$ and $\bar{X}_{AIpred}$ means were back transformed when the data were transformed for analysis.

The relationship between nitrate, total phosphorus and orthophosphate with periphyton chlorophyll-a for eight monitoring areas (LI24, LI24, SLINE, LCUT, LILC3, LIDSL, LI8, FO23, and FRUL) was tested using Spearman rank correlations (α = 0.05). Separate correlation analyses were included with nutrient concentrations at the most recent sampling event prior to the collection of the periphyton chlorophyll-a sample and an average concentration of the preceding 60 days.

The method described in Minnow (2017b) was used to visually explore temporal changes in total phosphorous and orthophosphate concentrations after the AWTF operation. The method involves two steps. First, the monthly upper limits of phosphorus and orthophosphate concentrations (97.5th 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 97.5th percentile of the concentrations. These trend plots help visualize deviations from the pre-AWTF range.

The temporal analysis for selenium at LC_LC1 was conducted using an ANOVA on monthly mean concentrations among years. The analysis included only months for which data were collected in all years (i.e. May to November). When the overall ANOVA was significant, *post hoc* contrasts were conducted to test for specific temporal changes: linear trends and step changes. The contrasts were conducted in Microsoft Excel, following the methods described in Oehlert (2010). When more than one contrast hypothesis was identified as statistically significant ($\alpha = 0.1$), then the contrast with the best fit was used for interpretation. The contrast with the best fit was defined to be the contrast with the largest difference in the numerator of the test statistic (equivalent to selecting the contrast with the smallest p-value). The magnitude of difference for linear contrasts was calculated as:

$$(\bar{x}_{2017} - \bar{x}_{2012})/\bar{x}_{2012} \times 100\%$$

where $\bar{x}_{2017}$ is the observed mean for 2017 and $\bar{x}_{2012}$ is the observed mean in 2012 (i.e. the predicted mean for 2017, assuming that there was no temporal change since 2012). The magnitude of difference for step change contrasts was calculated similarly as:

$$(\bar{x}_{(Post-Step)} - \bar{x}_{(Pre-Step)}) \ / \times \ \bar{x}_{(Pre-Step)} 100\%$$

where $\bar{x}_{(Post-Step)}$ is the observed mean after the step change and $\bar{x}_{(Pre-Step)}$ is observed mean before the step change.

Routine water quality monitoring results were screened against British Columbia Water Quality Guidelines (BCWQG; BCMOE 2018) as part of Teck's Annual Water Quality Monitoring Report under Permit 107517 (Teck 2018). In addition, further screening was completed for total aqueous nickel[7]. This additional evaluation was based on the results of 2017 quarterly chronic toxicity sampling which showed adverse effects in invertebrates at nickel concentrations below the BCWQG. Preliminary screening values (IC25) for nickel toxicity were determined through Toxicity Identification Evaluations (TIEs) completed by Nautilus in 2018; the preliminary nickel IC25 values developed based on the results of the TIEs were 22.4 and 10.8 µg/L for *Hyalella* and

[7] Evaluation of aqueous nickel does not relate directly to the key questions of the LAEMP, therefore results of this evaluation are presented in Appendix C and not discussed.

Ceriodaphnia, respectively. Ongoing work to evaluate potential nickel toxicity is being completed, including the development of additional screening values based on species sensitivity distribution (SSD) curves developed by Golder in 2018. As these investigations are refined, the results will be incorporated into future evaluations.

Temperature and dissolved oxygen concentrations in Line Creek were further 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).

2.7.2 Primary and Secondary Productivity Endpoints

Laboratory data for periphyton chlorophyll-a and AFDM as well as benthic invertebrate results for Hess samples were converted to units of "per metre squared" based on the known area sampled.

Individual periphyton chlorophyll-a concentrations at the Compliance Point (LC_LCDSSLCC/ LIDSL) were plotted relative to the SPO and BCWQG of 100 mg/m^3, as well as the annual grand mean (mean of all sampling event means within each year).

BACI analyses were completed for periphyton chlorophyll-a, AFDM, and benthic invertebrate biomass and density to evaluate potential effects of AWTF operation. Data were included for two reference areas (SLINE and LI24) and three mine-exposed areas (LIDSL, LILC3, and LI8), if available. Data from September 2013 and 2015 were used to represent the "before" period (prior to AWTF operation)[8], whereas data from September 2016 and 2017 were used to represent the "after" period. BACI analyses were performed as described above for water quality data.

[8] Commissioning-phase discharge from the AWTF began August 27, 2014, and the facility was shut down on October 17, 2014. Biological sampling in 2014 was conducted between September 2nd and 8th. Due to the brief period of exposure to less-than-capacity AWTF effluent, biological data from 2014 are not considered representative of steady-state AWTF operation but also do not represent a no-discharge condition. Recommissioning of the AWTF occurred in October 2015, after the periphyton growing season; therefore, biological data from 2013 and 2015 are considered baseline ("before"). Therefore, BACI analyses were performed twice, to include versus exclude data from September 2014 in the "before" period. Data analysis and interpretation discussed in Section 3 focuses on the BACI that excluded data from 2014 but results for the BACI that included data from 2014 are also presented in Appendix A.

2.7.3 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, as well as Ephemeroptera and Rhyacophilidae using BACI analyses described above for water quality and biological productivity endpoints. However, for some years only one data point was collected for a given year and area (i.e., no replicate sampling), and thus means were calculated and used as data points where replicate sample results were available. This avoided assuming that variation was consistent across years and areas. Because replicates within areas were not available, an $\mathrm{Area(CI)} \times \mathrm{Year(BA)}$ interaction could not be tested, and this term was excluded from the model.

In total, replicate samples were collected from 12 areas (L124, SLINE, LCUT, LILC3, LISP23, LISP24, LIDSL, LIDCOM, LI8, FRUL, FO23) in September 2017. Spatial differences in concentrations among areas were tested using an ANOVA. When the overall ANOVA was significant ($P < 0.1$), a Tukey's *post hoc* test was conducted for all pairwise comparisons. Outliers with studentized residuals with magnitude greater than four were removed from the analysis.

Composite-taxa benthic invertebrate tissue selenium results since 2012 were plotted relative to aqueous total selenium concentrations measured in water samples collected at or near the same time as the tissue samples. A line representing the regional one-step water-to-invertebrate selenium accumulation model[9] was also presented on the plot (Golder 2018a).

2.7.4 Benthic Invertebrate Community Data

Community endpoints that were evaluated included density (Hess samples) or sample abundance (kick and sweep 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 and sweep samples were plotted to show changes over time relative to normal ranges computed from reference area data in the RAEMP (Minnow 2018a).

[9] Due to a reporting error, the equation used for the one-step water-to-invertebrate selenium bioaccumulation model differs from that reported by Golder (2018a). This error will be resolved in an updated version of the Golder 2018a report. The equation used for calculation in the present report is consistent with that reported in Teck (2014).

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	13	Site-specific benchmark	Level 1 (~10% effect) benchmark for growth, reproduction and survival of invertebrates	Golder (2014)
	Whole body	20	Site-specific benchmark	Level 2 (~20% effect) benchmark for growth, reproduction and survival of invertebrates	Teck (2014)
	Whole body	11	Site-specific benchmark	Level 1 (~10% effect) benchmark for dietary effects to juvenile fish (growth)	Golder (2014)
	Whole body	18 [a]	Site-specific benchmark	Level 2 (~20% effect) benchmark for dietary effects to juvenile fish	Teck (2014)
	Whole body	15	Site-specific benchmark	Level 1 (~10% 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	Golder (2014)
	Egg/ovary	27	Site-specific benchmark	Level 2 (~20% effect) benchmark for westslope cutthroat trout reproduction	Teck (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 and 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	Golder (2014)
	Egg/ovary	22	Site-specific benchmark	Level 2 (~10% effect) benchmark for reproduction effects to other species than westslope cutthroat trout	Teck (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).

3 PRODUCTIVITY

3.1 Overview

Monitoring data are evaluated in this section to address Key Question #1: Is active water treatment affecting biological productivity downstream in Line Creek? To address this key question, a number of primary and secondary productivity monitoring endpoints were evaluated. If a potential influence on productivity was identified, the possible causes of these changes were investigated and discussed in relation to AWTF operation status (i.e., aqueous nutrient concentrations during the different operational phases of the AWTF).

3.2 Primary Productivity Indicators and Site Performance Objectives

Visual scores of periphyton indicated that coverage was moderate at both mine-exposed and reference areas (Appendix Figure A.6 Appendix Table A.2), with the majority of 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]).

In 2017, based on an evaluation of monitoring results since the AWTF came into operation, Teck submitted a request to amend Permit 107517 to remove the SPO requirement for periphyton chlorophyll-a measurements (Minnow 2017b). The permit was amended in October, 2017, to remove the periphyton chlorophyll-a SPO, therefore data from the 2017 growing season represents completion of reporting requirements for this SPO. Periphyton chlorophyll-a concentrations at the Compliance Point (LC_LCDSSLCC/LIDSL) varied over the 2017 growing season, but the grand mean concentration in 2017 (139 mg/m^2) was greater than the SPO (100 mg/m^2), and also higher than grand mean concentrations in 2015 and 2016 (87.2 mg/m^2 and 32.1 mg/m^2, respectively; Figure 3.1). The exceedance of the chlorophyll-a SPO in 2017 was due primarily to the unusually high chlorophyll-a results reported in July (Figure 3.1). However, aqueous total phosphorus concentrations at the Compliance Point were consistently below the SPO of 0.02 mg/L during the 2017 growing season, (June 15 to September 30), as they were during in the growing season of previous years (Figure 3.2; Appendix Figure A.8). Two elevated total phosphorus values in 2015 (no AWTF operation) and one in 2017 (during AWTF operation) occurred outside of the growing season.

An increasing pattern of periphyton chlorophyll-a concentrations over time was reported at the Compliance Point in the 2016 LAEMP report (Minnow 2017a,b) and continued to be evident in 2017 (Figure 3.3). A similar pattern was observed at the reference areas with values in either 2016 (LI24) or 2017 (SLINE) being greater than in previous years (Figure 3.3). Chlorophyll-a concentrations in 2017 were above the BCWQG (100 mg/m^2; BCMOE 2001a) at the mine-exposed stations LCUT, LIDSL, and LI8, and the reference station SLINE (Figure 3.3).

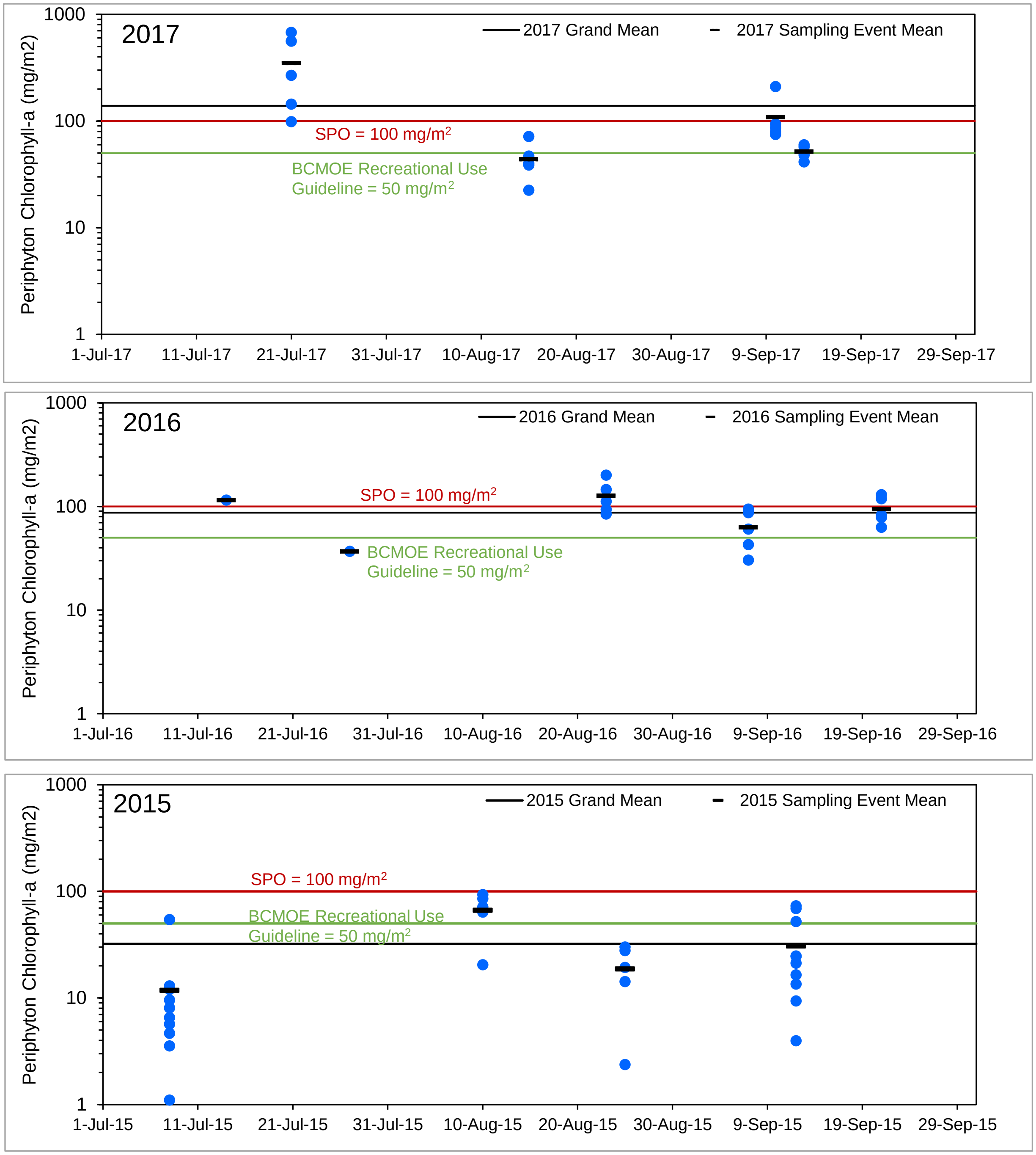


Figure 3.1: Seasonal Periphyton Chlorophyll-a Concentrations at LIDSL (LC_LCDSSLCC) in 2017 Compared to 2016 and 2015

Notes: Sample sizes of n = 5 per event, with the exception of July 8 and September 12, 2015 (n = 10); July 14 and July 27, 2016 (n = 1).

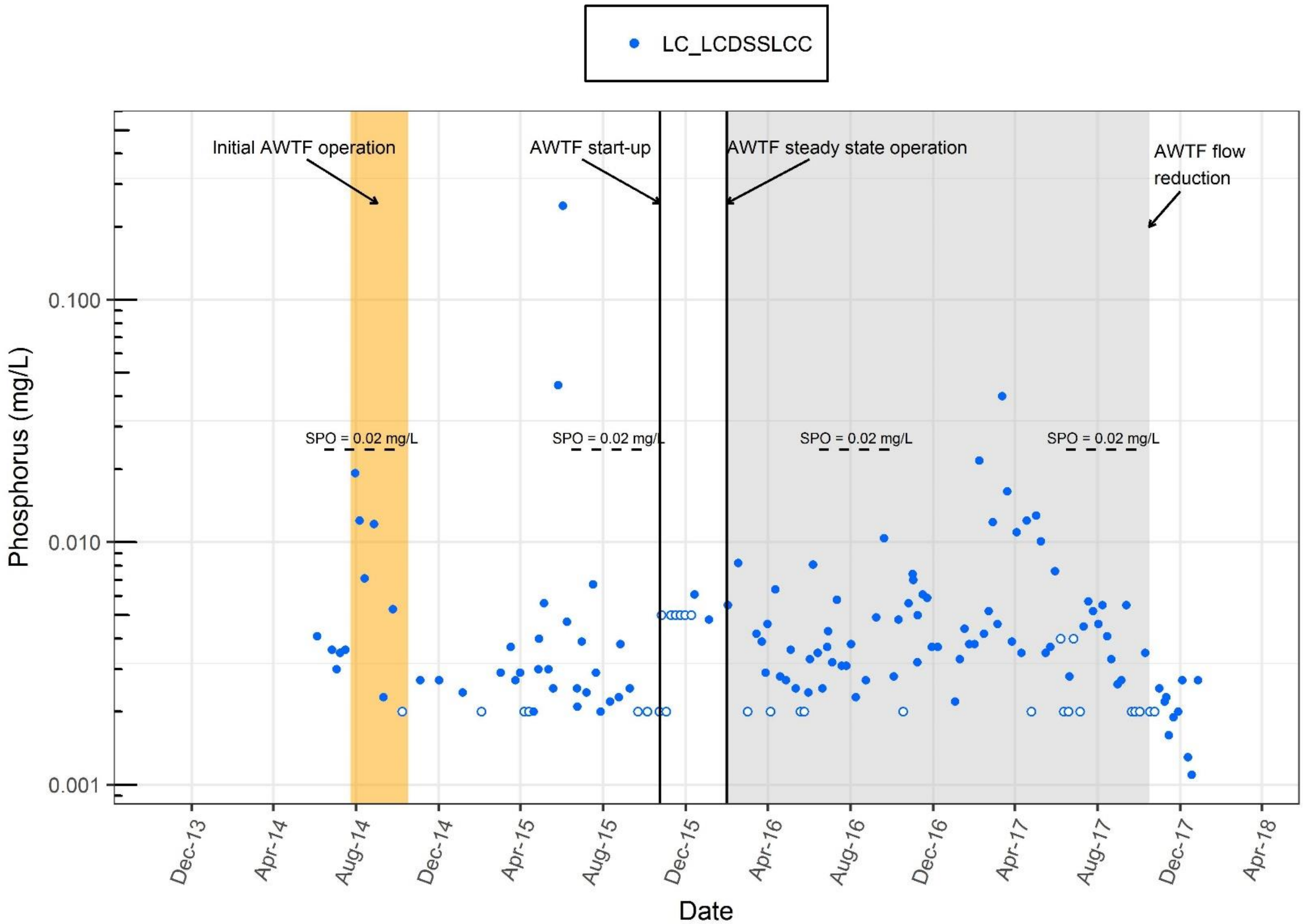


Figure 3.2: Total Phosphorus Concentrations in Water Collected from the Line Creek Compliance Point (LC_LCDSSLCC), 2013 to 2017

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 first entry in the database was presented. AWTF discharge during steady state operation (indicated by grey shading) was ~5,300 to 5,500 m^3/day. Hollow symbols represent results below the laboratory reporting limit (LRL).

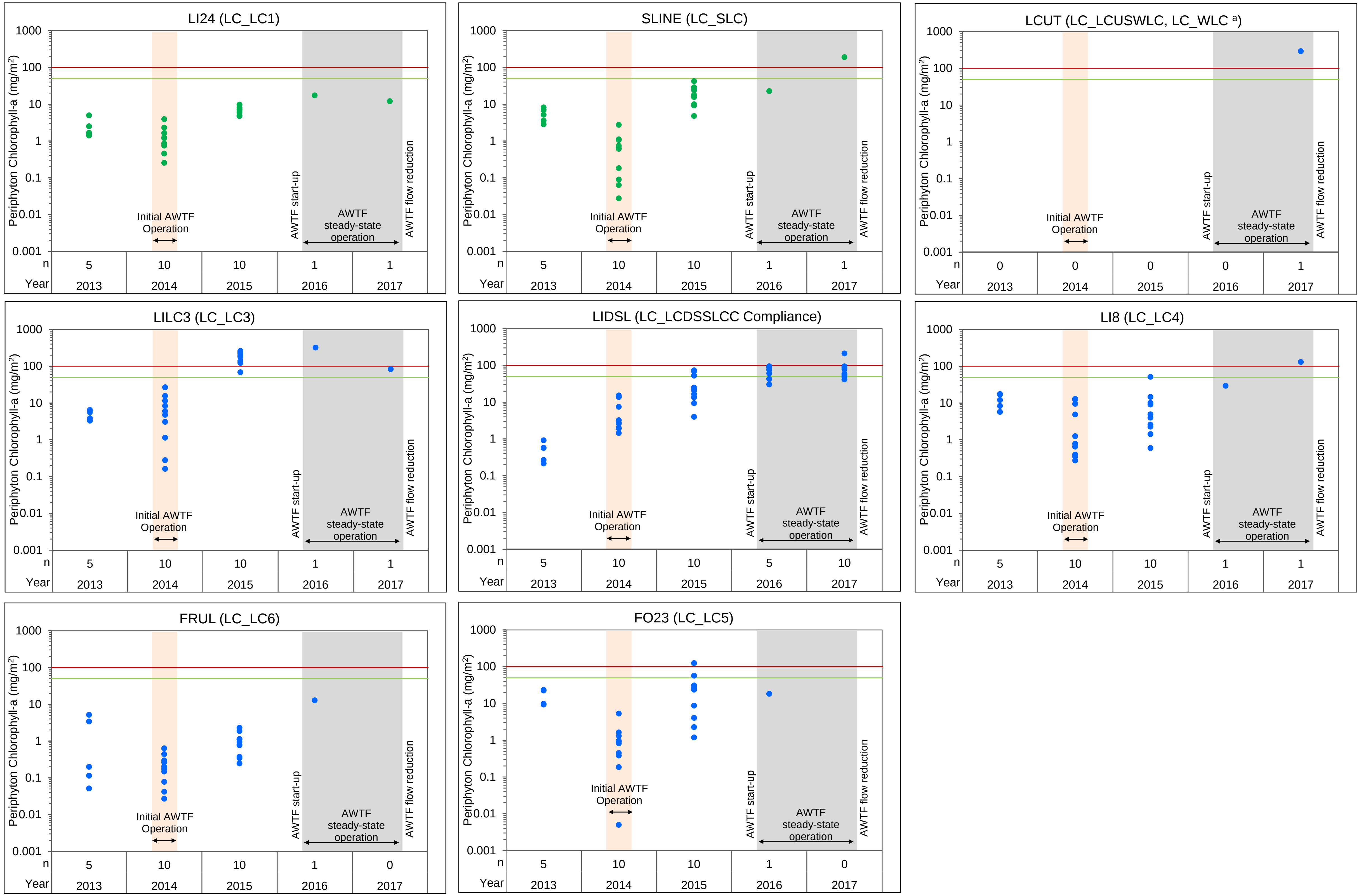


Figure 3.3: Periphyton Chlorophyll-a Concentrations measured in September, 2013 to 2017, Line Creek and Fording River

British Columbia Water Quality Guideline (BCWQG), Aquatic Life = 100 mg/m^2

British Columbia Water Quality Guideline (BCWQG), Recreational Use Guideline = 50 mg/m^2

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations.

[a] Water quality at LCUT also reflects inputs from LC_WLC when AWTF is not operating at full capacity.

BACI analysis showed that periphyton chlorophyll-a and AFDM levels were similar at areas downstream of the WLC AWTF outfall (LILC3, LIDSL, and LI8), relative to reference areas, during (2016 to 2017) compared to before (2013 and 2015[10]) steady-state operation of the WLC AWTF (Figure 3.4; Appendix Table A.3). These results indicate that operation of the AWTF did not affect these primary productivity endpoints.

3.3 Aqueous Nutrient Concentrations Relative to AWTF Operation

A previous evaluation that used data available to the end of 2016 concluded that the temporal increases in periphyton chlorophyll-a were not associated with trends in concentrations of aqueous nitrate, total phosphorus, or orthophosphate (Minnow 2017b). However, the analysis did show that total phosphorus and orthophosphate concentrations at LC_LC3 (the monitoring station located closest downstream of the AWTF outfall) were more increased relative to reference area concentrations during AWTF operation than prior to AWTF operation (Minnow 2017b). Concentrations of both total phosphorus and orthophosphate at Compliance Point LC_LCDSSLCC were not significantly different from concentrations at reference areas in 2016 (Minnow 2017b).

In this report, BACI analyses that included additional monitoring data from 2017 were used to re-evaluate potential effects of AWTF operation on aqueous concentrations of total phosphorus, orthophosphate, and nitrate. Initially, winter (December to March) sampling results were excluded so that data could be included for both reference stations (i.e., winter sample data were not available for LC_LC1), as well as three mine-exposed stations (LC_LC3, LC_LC4, and LC_LC5[11]). The overall ANOVA indicated no significant change in aqueous total phosphorus at mine-exposed stations relative to reference stations during AWTF operation compared to before (Figure 3.5; Appendix Table A.5a). However, a significant BACI effect for nitrate was detected that depended on year. Nitrate concentrations were significantly higher at all mine-exposed stations in 2017 relative to concentrations at reference, compared to 2015 but not compared to other before years (2012 or 2013; Figure 3.6; Appendix Table A.6). The absence of a significant difference with the other before years indicates the BACI effect is likely related to a decrease in nitrate concentrations in 2015, rather than an influence associated to AWTF operation. A significant BACI effect was also detected for orthophosphate that depended on area and year (Appendix Table A.5b). *Post hoc* contrasts indicated there was less difference in orthophosphate

[10] The analysis was also completed by including data from 2014 (when the AWTF operated only temporarily), along with 2013 and 2015 in the “before” period, which yielded the same result (Appendix Table A.4).

[11] Data were not available for Compliance Point LC_LCDSSLCC prior to 2014, so data for this station were not included in this version of the BACI. However, other versions of the BACI were run using fewer years, which allowed for data from LC_LCDSSLCC to also be included. Results are presented and discussed where applicable.

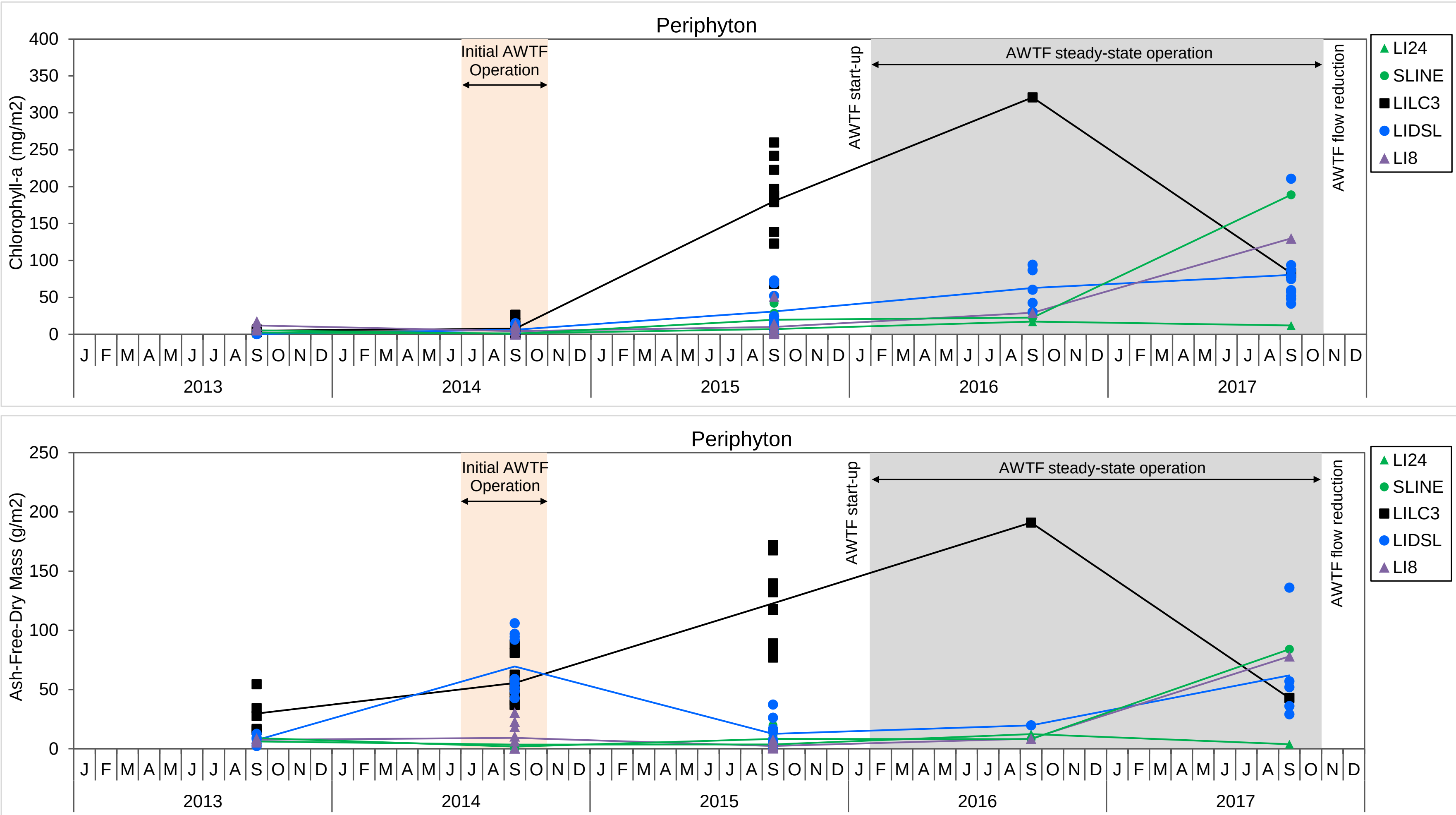


Figure 3.4: Periphyton Chlorophyll-a and Ash-Free Dry Mass in Line Creek Before (2013 and 2015) and After (2016 and 2017) Operation of the Line Creek AWTF

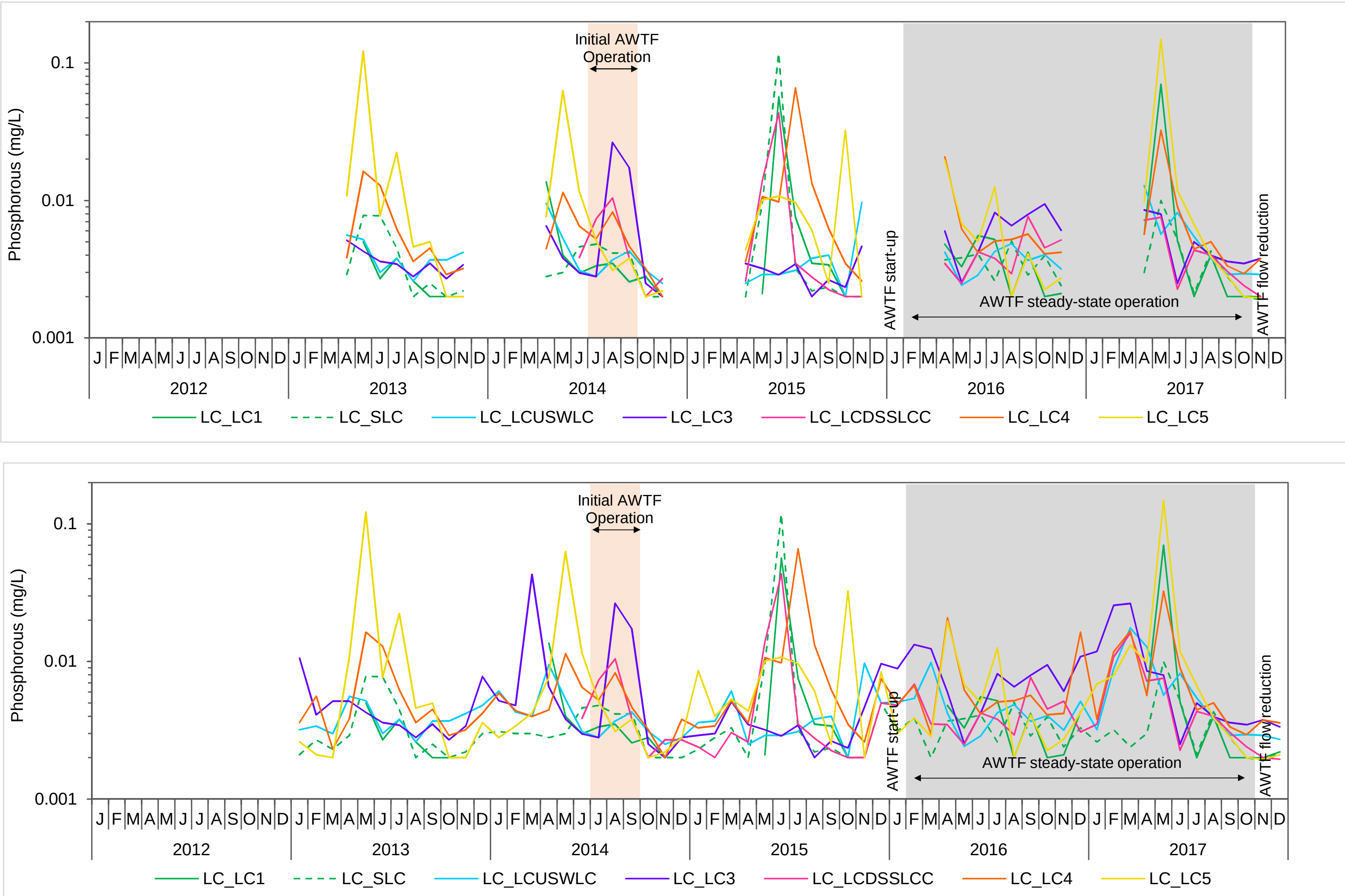


Figure 3.5: Monthly Mean Aqueous Total Phosphorus Concentrations in Line Creek Before and After Operation of the Line Creek AWTF

Notes: Reference stations plotted in green. Non-detect samples plotted at the Laboratory Reporting Limit (LRL). 2012 samples excluded due to high LRL. Top panel reflects data set used in BACI when both reference areas were included but winter data were excluded. Bottom panel reflects all available data.

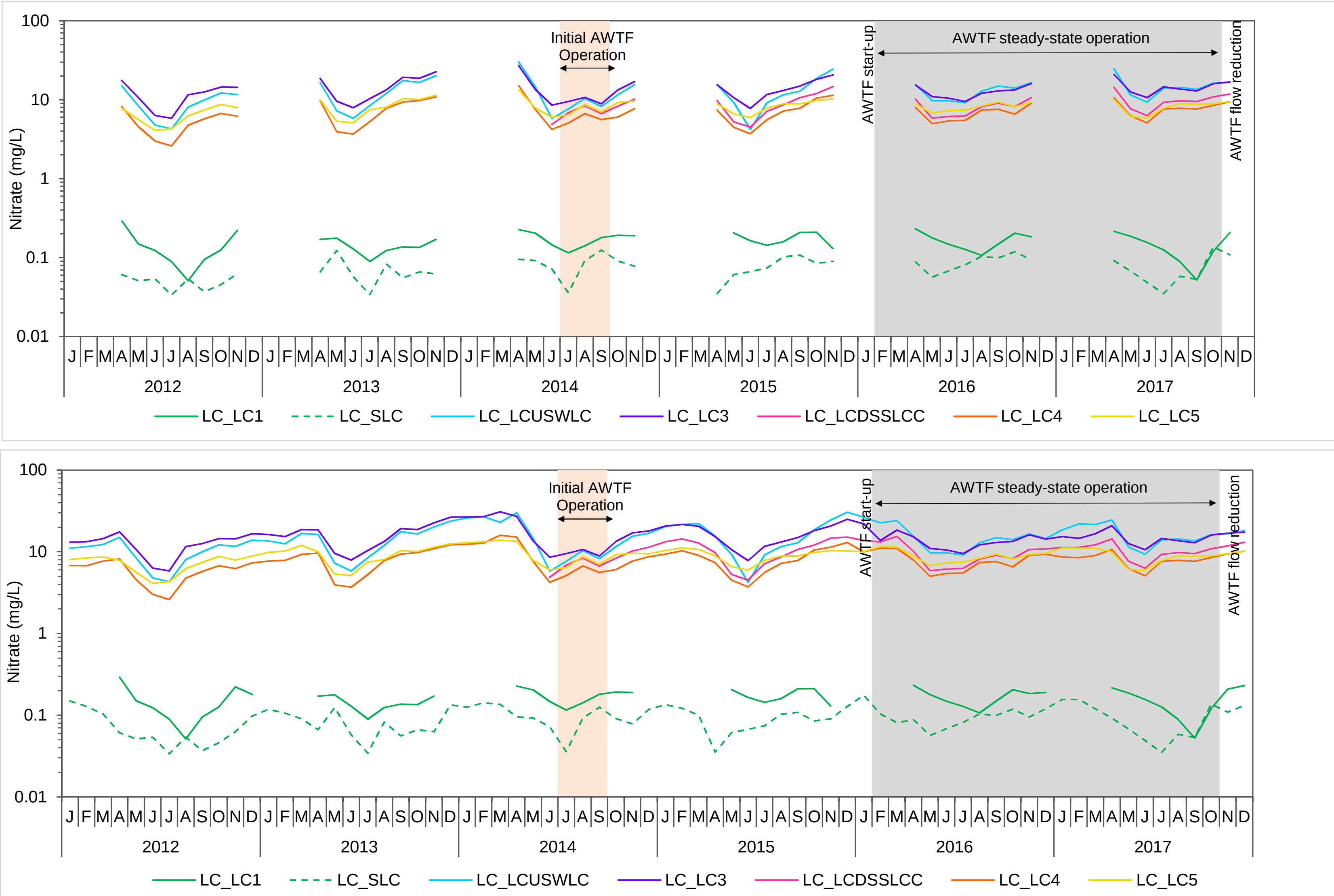


Figure 3.6: Monthly Mean Aqueous Nitrate Concentrations in Line Creek Before and After Operation of the Line Creek AWTF

Notes: Reference stations plotted in green. Non-detect samples plotted at the Laboratory Reporting Limit (LRL). Top panel reflects data set used in BACI when both reference areas were included but winter data were excluded. Bottom panel reflects all available data.

concentrations between reference stations LC_LC1 and LC_SLC in 2016 (during AWTF operation) compared to 2012 (prior to AWTF operation) (Appendix Table A.5b). A plot of the data showed that orthophosphate concentrations at LC_LC1 were unusually high in 2012 compared to other years (Figure 3.7). As a result, reference data were not pooled and contrasts for mine-exposed areas were made relative to each reference area and year separately. The only significant contrasts out of 42 contrasts in total were comparisons involving LC_LC1 in 2012 (Appendix Table A.5b). This was interpreted as a temporal change in concentrations at LC_LC1 (2012 compared to other years) rather than an effect of AWTF operation on concentrations on orthophosphate concentrations.

Lack of BACI effect for total phosphorus and orthophosphate was contrary to results reported by Minnow (2017b), which indicated that concentrations of both parameters had increased at LC_LC3 during AWTF operation (based on data to the end of 2016). For further evaluation, the BACI analyses were repeated for total phosphorus and orthophosphate to include winter data, which necessitated exclusion of reference station LC_LC1. Significant changes in total phosphorus and orthophosphate concentrations were detected at the mine exposed stations relative to concentrations at reference station LC_SLC during AWTF operation compared to before (Appendix Table A.7a,b). *Post hoc* contrasts indicated that concentrations of total phosphorus (p=0.007), but not orthophosphate (p=0.147) were elevated at LC_LC3 only. The contrast results were supported by elevated mean total phosphorus concentrations at LC_LC3 in 2016 and 2017, relative to the baseline (pre-AWTF) period and reference area concentrations (Table 3.1).

A BACI was also run to include data for the Compliance Point (LC_LCDSSLCC), where monitoring began in 2014. As observed in other BACI analyses that included data for more years but excluded LC_LCDSSLCC (above), the overall ANOVA for total phosphorus was significant (p=0.065). *Post hoc* contrasts again indicated a significant increase in total phosphorus (p=0.006) at LC_LC3 during AWTF operation, but no change at LC_LCDSSLCC (p=0.303; Appendix Table A.8a,b).

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 that might allow for early detection of a potential changes in concentrations of these aqueous nutrients downstream of the AWTF (Minnow 2017b[12]). 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-

[12] Included as Appendix C in Minnow (2017a).

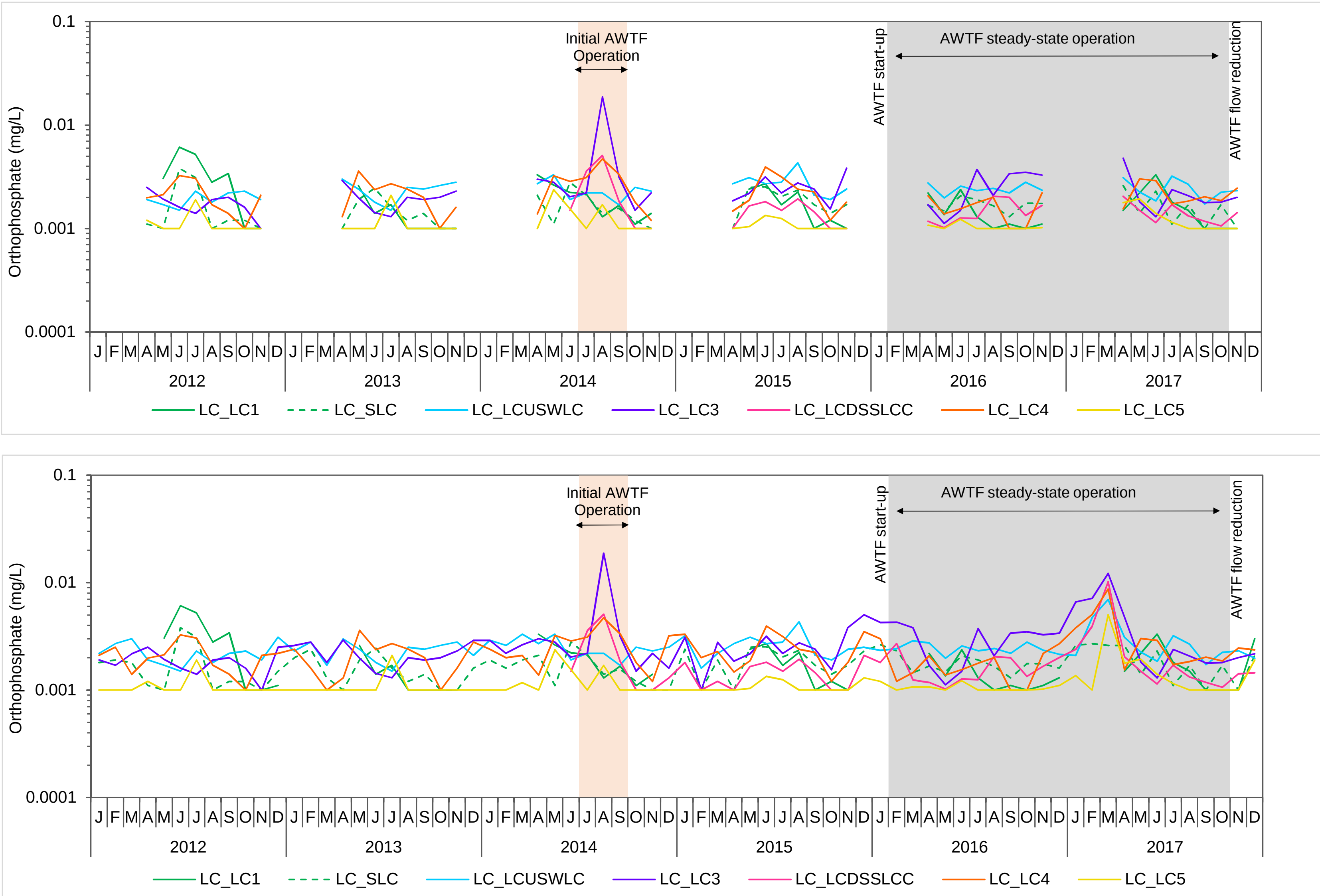


Figure 3.7: Monthly Mean Aqueous Orthophosphate Concentrations in Line Creek Before and After Operation of the Line Creek

Notes: Reference stations plotted in green. Non-detect samples plotted at the Laboratory Reporting Limit (LRL). Top panel reflects data set used in BACI when both reference areas were included but winter data were excluded. Bottom panel reflects all available data.

Table 3.1: Summary of Mean Total Phosphorus and Orthophosphate Concentrations at Reference and Near-Field Monitoring Stations in Line Creek

Analyte	Station	Geometric Mean[a] (of monthly means) (mg/L)				
		Pre-Operational Baseline[b]	2016		2017	
			Annual	Growing Season[c]	Annual	Growing Season[c]
Total Phosphorus	Pooled Reference (LC_LC1, LC_SLC)	0.0035	0.0033	0.0037	0.0034	0.0027
	LC_LC3	0.0040	0.0073	0.0068	0.0064	0.0038
	LC_LCDSSLCC	0.0038	0.0042	0.0042	0.0043	0.0034
Orthophosphate	Pooled Reference (LC_LC1, LC_SLC)	0.0018	0.0016	0.0015	0.0017	0.0013
	LC_LC3	0.0022	0.0028	0.0025	0.0030	0.0018
	LC_LCDSSLCC	0.0014	0.0015	0.0016	0.0019	0.0013

[a] Geometric mean to support statistical analyses (BACI) performed on log_{10}-transformed data.

[b] Pre-Operational Baseline was calculated for orthophosphate using monthly means from January 2012 to October 2015, but excluding July to October 2014 due to temporary AWTF operation. Total phosphorus data from 2012 were excluded due to elevated Laboratory Reporting Limits (LRL).

[c] Growing season was defined in Permit 107517 as June 15th to September 30th, so growing season averages were based on monthly mean values for June that excluded values for samples collected prior to the 15th.

AWTF) period at LC_LC3 (upper panels in Figures 3.8 and 3.9). Monthly mean concentrations were then expressed as a ratio of the baseline 97.5th percentile for each month (bottom panels in Figures 3.8 and 3.9).

Figure 3.8 indicates that total phosphorus concentrations at LC_LC3 in 2016 and 2017 were above the baseline 97.5th percentiles in 14 of 21 months (67%) of steady-state AWTF operation (Figure 3.8), which corresponds with higher mean values during AWTF operation compared to before (Table 3.1). However, the data did not suggest a temporal trend, because data points did not show a consistent pattern of deviation away from the line in the bottom panel of Figure 3.8. Despite total phosphorus concentrations greater than the baseline 97.5th percentiles, concentrations at the Compliance Point were consistently below the SPO of 0.02 mg/L during the 2016 and 2017 growing seasons, as previously indicated (Section 3.2; Figure 3.2; Appendix Figure A.8).

Figure 3.9 (bottom panel) also indicated that more samples at LC_LC3 contained elevated orthophosphate concentrations during AWTF operation than in any year during the baseline period, but months with elevated concentrations (in 2016-2017) were offset by some months with

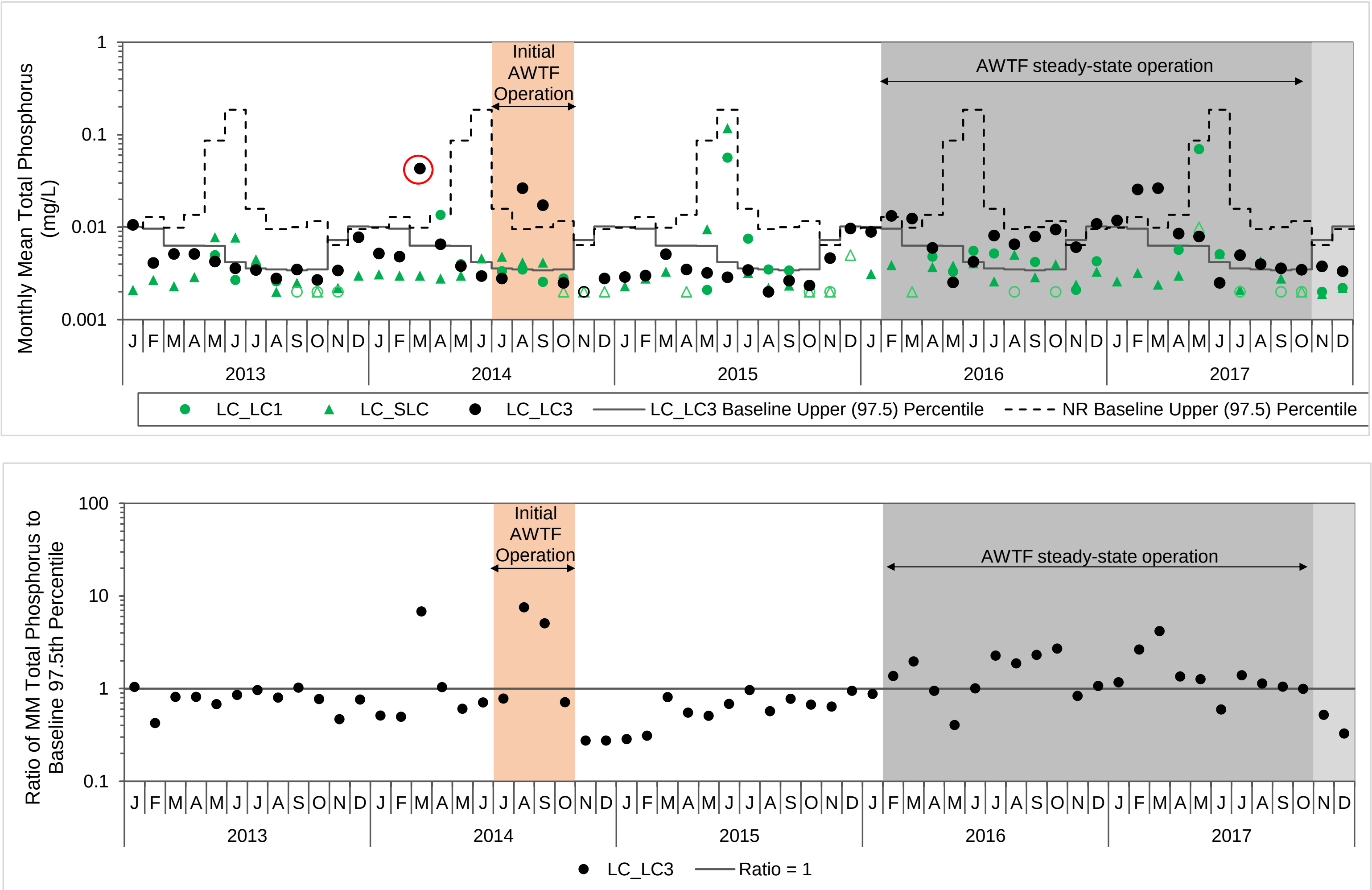
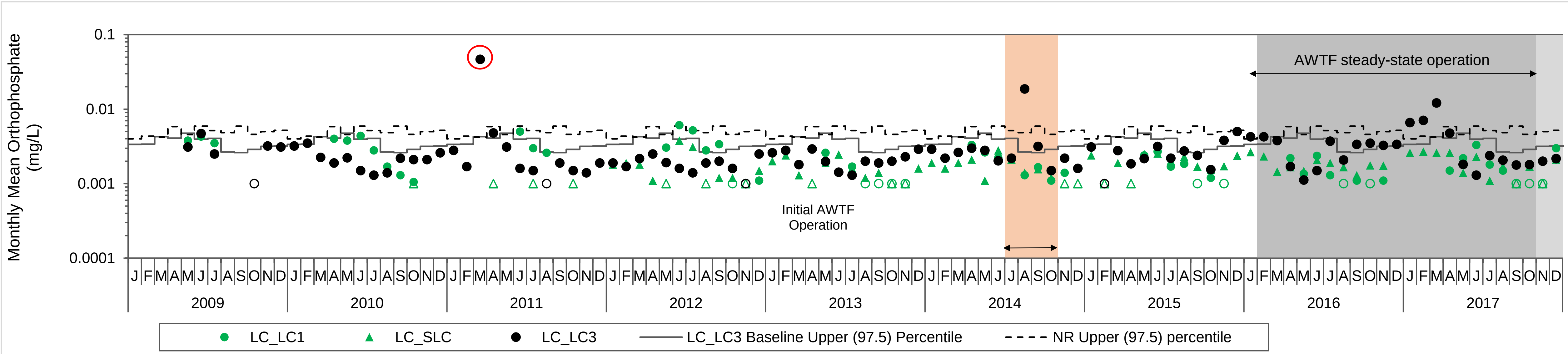


Figure 3.8: Total Phosphorus at LC_LC3 During AWTF Operation Relative to Pre-Operational Baseline Concentrations

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 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.



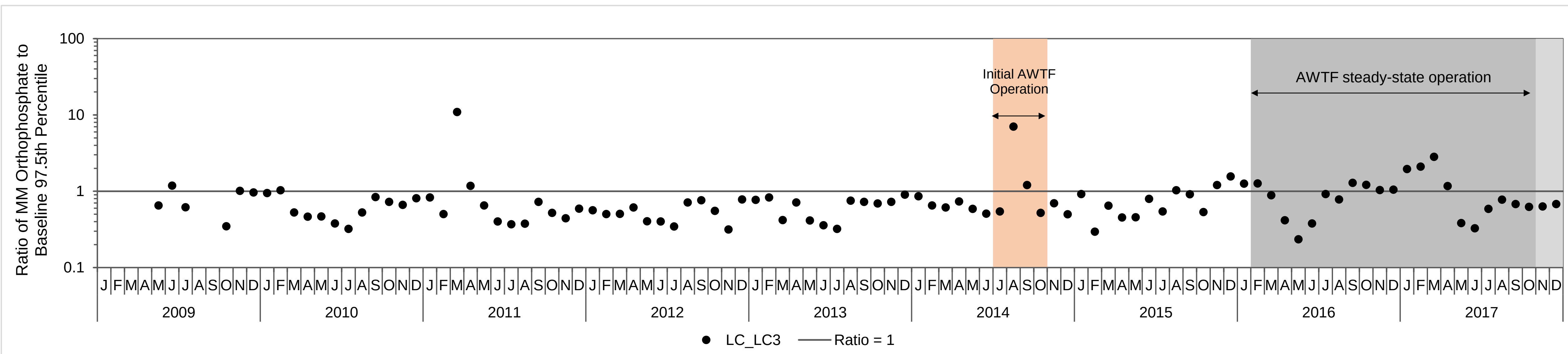


Figure 3.9: **Orthophosphate at LC_LC3 During AWTF Operation Relative to Pre-Operational Baseline Concentrations**

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 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.

low concentrations, such that mean annual concentrations in 2016 (0.0028 mg/L) and 2017 (0.0030 mg/L) were only slightly higher than the baseline mean (0.0022 mg/L) (Table 3.1).

3.4 Potential Relationships Between Nutrient and Chlorophyll-a Concentrations

With one exception, periphyton chlorophyll-a results for monitoring areas in Line Creek (2012 to 2017) did not correlate with nutrient concentrations in water samples collected at the same time as periphyton sampling, or with average nutrient concentrations collected over the 60-day period preceding each periphyton sampling event. Nitrate concentrations in water samples collected on or near the same day as periphyton chlorophyll-a sampling correlated weakly ($p=0.025$; $r = 0.37$; Appendix Table A.9). However, this sole significant result was based on two separate clusters of points for reference areas (low nitrate concentrations) versus mine-exposed areas (high nitrate concentrations) rather than a continuous relationship (Appendix Figure A.13), suggesting against a causal relationship. These findings agree with results of correlation analysis reported previously as part of the justification to eliminate the Permit 107517 chlorophyll-a SPO at WLC AWTF (Minnow 2017b). In summary, variation in periphyton chlorophyll-a concentrations was not explained by variation in aqueous nutrient concentrations or AWTF operation.

3.5 Secondary Productivity Indicators

BACI analyses showed no significant difference in benthic invertebrate biomass (based on Hess sampling) during AWTF steady-state operation (2016-2017) compared to before (2015; Figure 3.10; Appendix Table A.10). BACI analyses for benthic invertebrate density were performed both including and excluding an outlying value for the reference area SLINE in 2017 (Figure 3.10; Appendix Table A.10[13]). With the outlier included, density was significantly increased at all mine-exposed areas relative to SLINE during AWTF steady-state operation (2016-2017) compared to before (2015), but the difference was larger in 2017 (383%) than in 2016 (69%) compared to 2015 (Figure 3.10; Appendix Table A.10). With the outlier removed, density was increased relative to reference area SLINE during AWTF operation at LILC3 (2016 and 2017) and LIDSL (2017) compared to 2015 (Figure 3.10; Appendix Table A.10). This appears to be related to a decline in mean densities at the SLINE reference area during AWTF operation (2016-2017) compared to before (2015) rather than an increase at mine-exposed areas (Table 3.2; Appendix Figure A.17).

Benthic invertebrate abundance in kick and sweep samples was above the regional normal range (>97.5th percentile) at LILC3 in 2017, but within the range of observations for that area in previous years (Appendix Figure A.18). Kick sample abundance was also above the normal range for 2

[13] The BACI analyses for both benthic biomass and density were also completed by including data from 2014 in the before period (Appendix Table A.11).

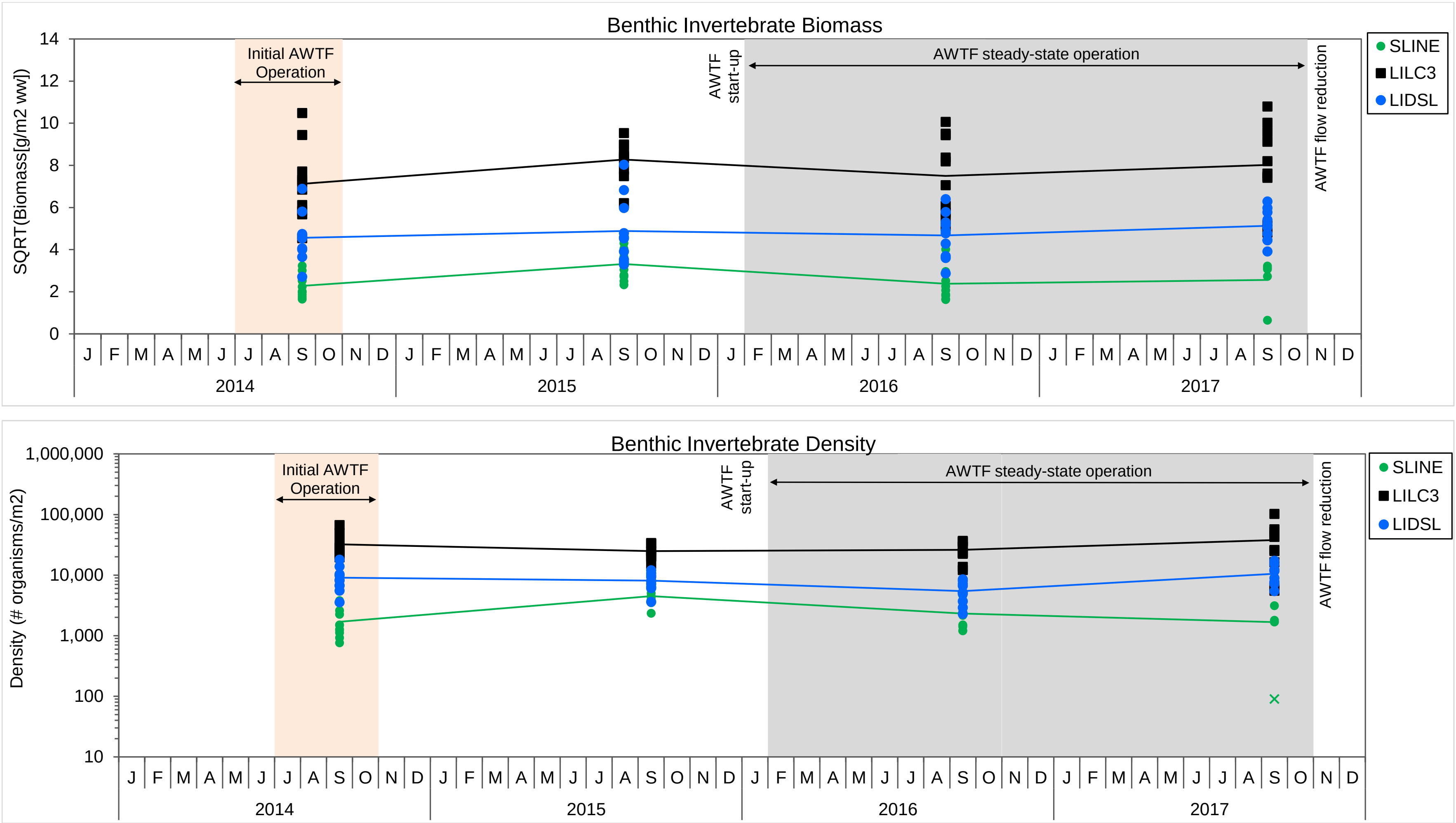


Figure 3.10: Benthic Invertebrate Density and Biomass for Stations in Line Creek Before (2015) and After (2016 and 2017) Operation of the Line Creek AWTF

Notes: Outlier plotted with open X symbol. Means calculated without outlier. 2014 data was not included in BACI ANOVA due to temporary operation.

Table 3.2: Geometric Means of Benthic Invertebrate Density for Hess Sampling in Areas of Line Creek, 2014 to 2017

Area	Benthic Density (# organisms/m2)			
	Brief AWTF Operation	No AWTF Operation	Steady State AWTF Operation	
	2014	2015	2016	2017
LI24	2,120	2,028	-	1,723
SLINE	1,508	4,300	2,072	1,072
SLINE [a]	1,508	4,300	2,072	1,993
LILC3	29,805	24,136	24,564	27,162
LIDSL	8,276	7,690	5,024	9,910

[a] One outlier removed in 2017

of 3 kick samples collected at LIDSL in 2017, as well as the single sample collected farther downstream at LIDCOM (Appendix Figure A.18).

In summary, monitoring data indicate that AWTF operation has not affected secondary productivity in Line Creek.

3.6 Benthic Invertebrate Community Structure

Endpoints related to benthic invertebrate community structure were also evaluated relative to normal (regional reference area) ranges defined in the 2015 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 2017 (Appendix Figure A.19), indicating good community diversity and no evidence of change related to AWTF operation. Percent Ephemeroptera (mayflies) values were less than the reference area normal range at all reference and mine-exposed areas in 2017, but values for both % Ephemeroptera and % EPT (mayflies, stoneflies, and caddisflies) in 2017 were within ranges observed at each area in previous years (Appendix Figures A.20 and A.21). 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 (LCUT) and downstream from the AWTF (particularly LILC3, LISP23, and LISP24: Appendix Figure A.22). At the mine-exposed areas and at reference area SLINE, chironomid proportions were similar or slightly higher during AWTF operation compared to before (Appendix Figure A.22).

3.7 Summary

Total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC) were consistently below the SPO of 0.02 mg/L during the 2017 growing season, (June 15 to September 30), as they were during previous years. Evaluation of temporal changes in total phosphorus and orthophosphate concentrations indicated a significant increase in both analytes ($p<0.1$) in Line Creek immediately downstream from the discharge (LC_LC3) during AWTF operation (concentrations of 0.007 and 0.0028 mg/L, respectively) compared to before AWTF operation (0.004 and 0.0022 mg/L, respectively). However, no changes in total phosphorus and orthophosphate concentrations were detected at the Compliance Point (LC_LCDSSLCC) or stations farther downstream relative to reference station concentrations during AWTF operation compared to before. 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).

Periphyton chlorophyll-a and AFDM levels did not change significantly ($p>0.1$) in Line Creek relative to reference area levels during AWTF operation (2016 to 2017) compared to previous years when the AWTF system was not operating (2013 and 2015). Variation in these periphyton endpoints was not explained by variation in aqueous nutrient concentrations (total phosphorus, orthophosphate, or nitrate) among areas or over time (i.e., no correlation). These findings confirm results from a previous analysis (Minnow 2017b), that resulted in removal of the periphyton chlorophyll-a SPO at the Compliance Point from Permit 107517 in October 2017.

Benthic invertebrate biomass and density in Line Creek, as determined from Hess sampling, also showed no significant change ($p>0.1$) during AWTF operation (2016-2017) compared to before (2015). Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, indicated no change in community characteristics during AWTF compared to before, other than possibly a small increase in larval chironomid (midge) proportions at sampling areas immediately downstream from the AWTF outfall.

Overall, the data indicate that AWTF is not affecting biological productivity downstream from the WLC AWTF.

4 SELENIUM CONCENTRATIONS

4.1 Overview

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

4.2 Composite Benthic Invertebrate Selenium Concentrations

Composite-taxa benthic invertebrate tissue selenium concentrations were slightly elevated downstream of the AWTF (e.g., LILC3 and 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; Appendix Table B.3). AWTF discharge resumed October 26, 2015 and treatment operations were stabilized by the end of January 2016. 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 LILC3; Table 4.1; Figure 4.1).

Also in mid-to-late 2016, Teck identified challenges respecting the performance of the WLC AWTF with respect to selenium removal. 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). Monitoring results in early 2017, including greater within-area sample replication, confirmed that selenium concentrations were elevated in benthic invertebrates downstream from the AWTF compared to upstream and historical levels (Minnow 2017a).

BACI analyses completed for this report, which included data for samples collected in September 2017, confirmed that selenium concentrations in composite-taxa benthic invertebrate samples were significantly higher at mine-exposed areas in Line Creek relative to reference areas, during AWTF steady-state operation (2016 to 2017) compared to before (Figure 4.2; Appendix Tables B.7 to B.9). The spatial extent of statistically detectable change, however, was dependent on which years were included in the “before” period of the analyses. Specifically, tissue selenium concentrations were significantly elevated during AWTF operation at all mine-exposed areas in Line Creek (LILC3, LIDSL, and LI8) if data from only 2012 were used to represent the before period (Appendix Table B.7). If the “before” period included additional years, the BACI detected higher concentrations only at the areas closest to the AWTF discharge (LILC3 and LIDSL when before included 2012 and 2015; and only LILC3 if before included 2012, 2014, and 2015: Appendix Tables B.8 and B.9, respectively).

Table 4.1: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, 2006 to 2017**

Area		Biological Area Code	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)		AWTF Operation Suspended (Mar 8, 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)	2017 (December)	2018 (March)
				Sample Size	1	1	1	3	1	1	1	1	1	1	1	1	5	10	10	10	10	10
Line Creek	Reference	LI24	LC_LC1	Mean	1.4	4.4	-	-	-	-	5.1	-	-	4.0	5.3	3.8	-	-	5.2	-	-	-
Line Creek	Reference	SLINE	LC_SLC	Mean	-	-	-	-	-	-	4.8	-	-	6.0	3.9	4.1	-	4.1	4.8	-	-	5.2
Line Creek	Mine-exposed	LCUT	LC_LCUSWLC	Mean	-	-	-	-	-	-	-	-	-	-	-	6.2	5.0	6.4	5.9	6.7	6.9	6.3
Line Creek	Mine-exposed	LILC3	LC_LC3	Mean	-	-	-	-	-	-	7.0	-	-	17	13	35	27	37	24	26	27	14
Line Creek	Mine-exposed	LISP23	WL_LCUCP_SP23	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	-
Line Creek	Mine-exposed	LISP24	WL_DCP_SP24	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	14	13	7.4
Line Creek	Mine-exposed	LIDSL	LC_LCDSSLCC (Compliance Point)	Mean	-	-	-	-	-	-	8.1	-	5.6	14	8.9	16	12	10	14	12	11	6.6
Line Creek	Mine-exposed	LIDCOM	LC_LCC	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.6	7.4	9.4	7.7
Line Creek	Mine-exposed	LI8	LC_LC4	Mean	7.8	11	8.0	-	6.3	8.4	7.8	4.3	-	8.4	9.3	12	8.9	8.6	11	8.0	9.0	6.9
Fording River	Mine-exposed	FRUL	LC_LC6	Mean	-	-	-	-	-	-	7.9	-	-	-	7.5	-	-	7.0	8.1	-	-	6.9
Fording River	Mine-exposed	FO23	LC_LC5	Mean	10	5.8	9.7	5.0	5.9 [a]	8.8	7.5	11	8.8	-	6.4	6.7	-	6.6	8.9	-	-	6.4

Note: Means are presented where the number of samples > 1, all other data are individual values. FRUL=FOUL prior to 2016.

[a] Sample size n = 3.

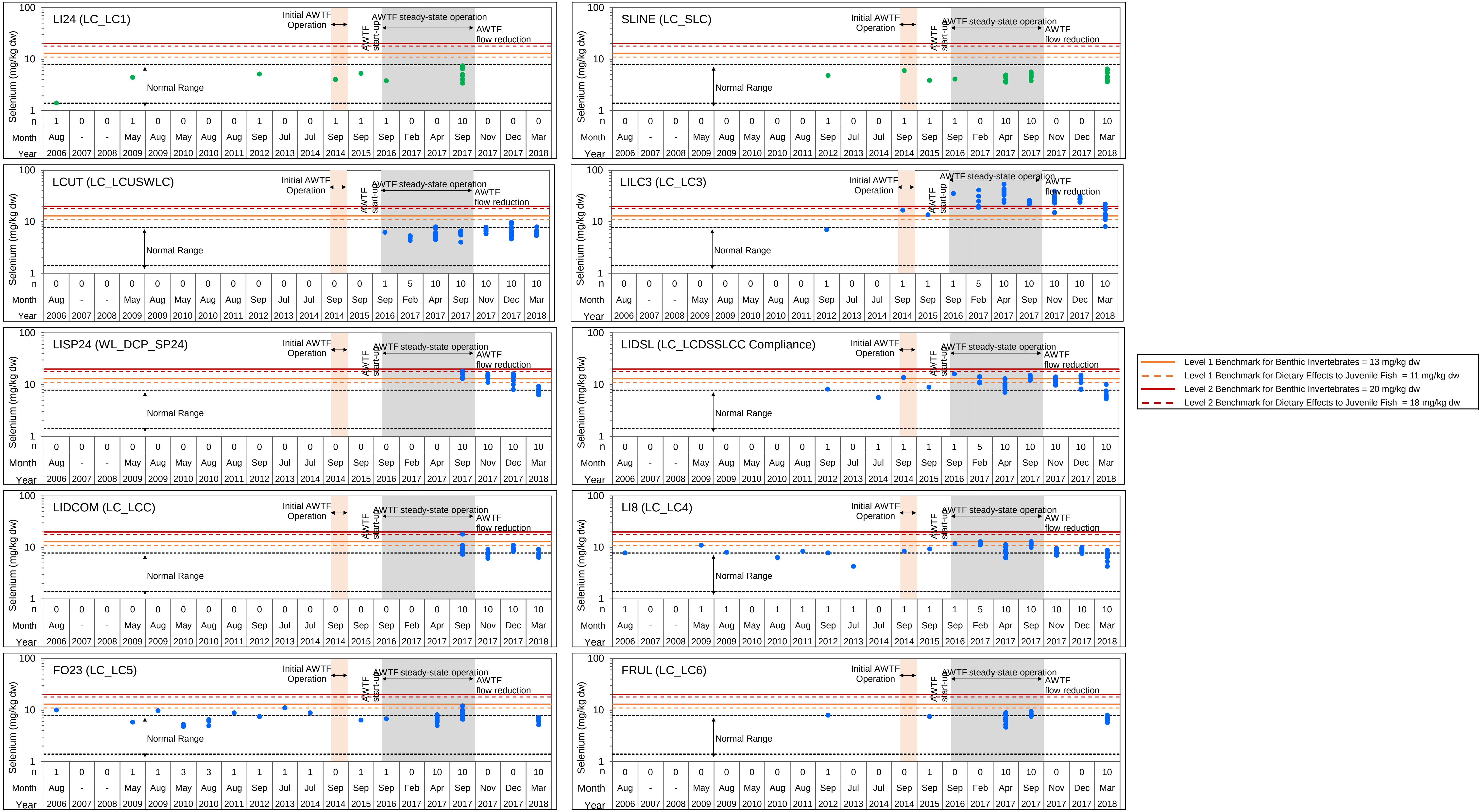


Figure 4.1: Tissue Selenium Concentrations Observed in Benthic Invertebrate (BI) Composite-Taxa Samples from Line Creek and Fording River, 2006 to 2018

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. 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).

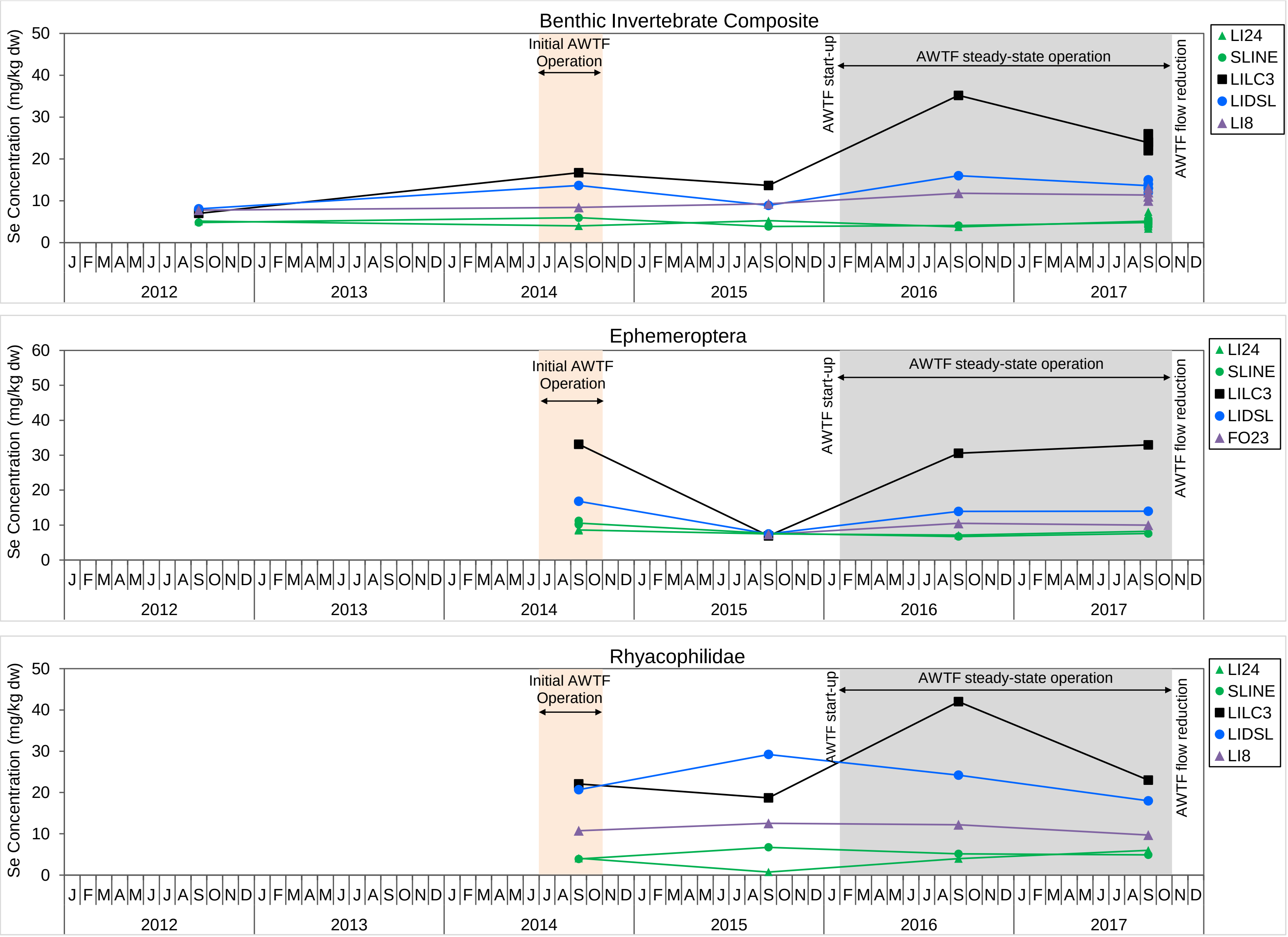


Figure 4.2: Selenium Concentrations Within Selected Groups for Stations in Line Creek Before (2015) and After (2016 and 2017) Operation of the Line Creek AWTF

Note: 2014 data was not included in BACI ANOVA due to temporary operation.

Selenium concentrations of composite benthic invertebrate tissue samples collected in September 2017 (during AWTF steady-state operation) were significantly elevated throughout the mine-exposed Line Creek locations, relative to reference areas (LI24 and SLINE) and to the area upstream of the AWTF outfall (LCUT; Figure 4.3; Appendix Table B.10a,b). However, tissue selenium concentrations in benthic invertebrates collected in the Fording River were similar downstream compared to upstream of Line Creek (Figure 4.3; Appendix Table B.10a,b). These results indicated the effect of WLC AWTF on selenium accumulation of aquatic biota was limited to Line Creek. In spite of elevated tissue selenium concentrations in Line Creek, benthic invertebrate community characteristics were similar during AWTF steady-state operation compared to before (Section 3.6; Appendix Figures A.17 to A.22).

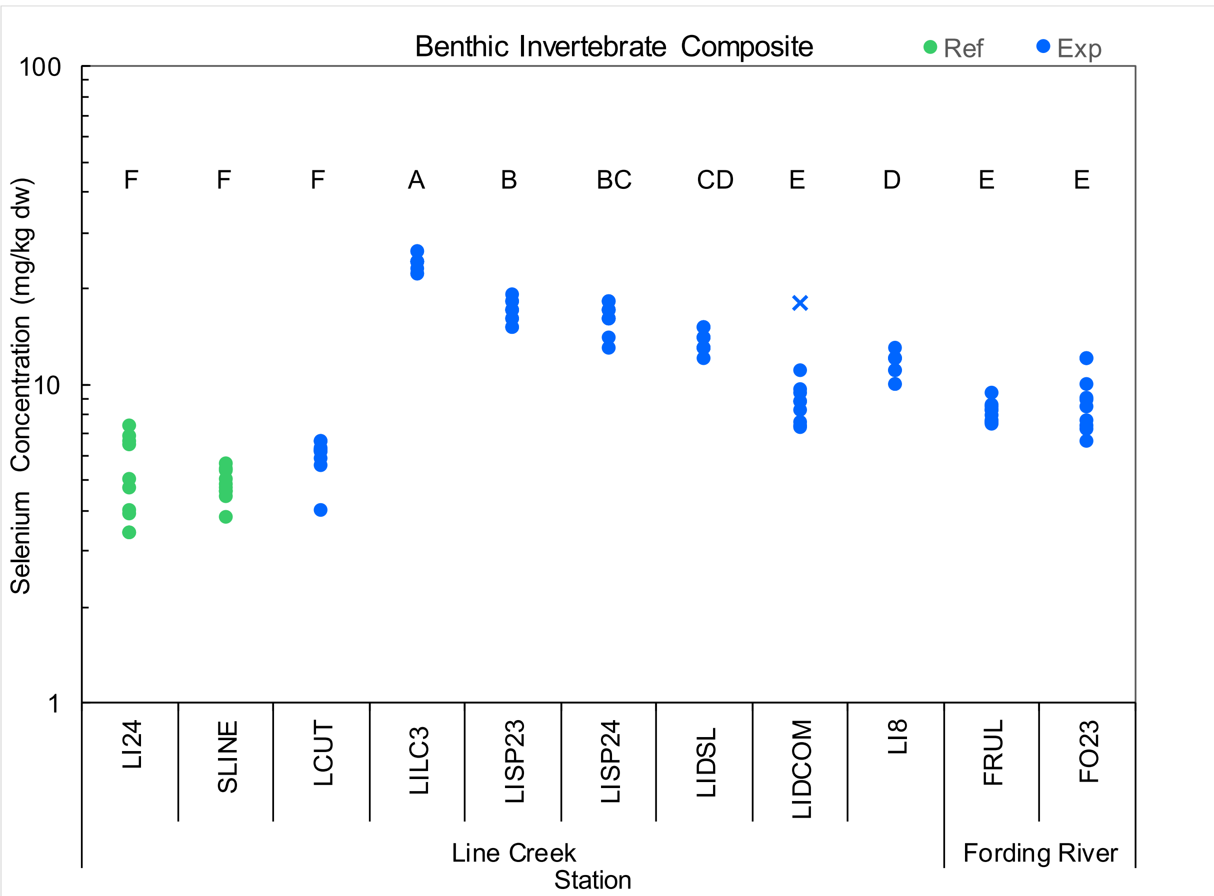


Figure 4.3: Selenium Concentrations in Composite Benthic Invertebrate Tissue Samples, September 2017

Note: Outliers are plotted as an "X"; areas with different letters were statistically different based on ANOVA followed by a Tukey's post hoc t-test.

4.3 Aqueous Selenium Speciation and Bioaccumulation

The monitoring results described above indicated selenium concentrations in benthic invertebrate tissues were significantly elevated during AWTF steady-state operation even though the AWTF was effective in reducing total selenium concentrations in Line Creek (particularly at LC_LC3; Figure 4.4). Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate (Figure 4.5), with lesser amounts (~1-2%) of chemically reduced forms such as selenite (e.g., LC_LCUSWLC in Figure 4.6[14]). However, a larger proportion of the total selenium discharged by the AWTF in 2016-2017 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). Therefore, concentrations of non-selenate forms were greater in Line Creek downstream from the AWTF than upstream (Figure 4.6) and accounted for the increase in downstream benthic invertebrate tissue selenium concentrations during AWTF operation compared to before (Table 4.1).

In the Fording River, concentrations of each selenium species and the sums of all species were usually lower downstream of input from Line Creek compared to upstream (Table 4.2). These results support the conclusion that composite benthic invertebrate tissue selenium concentrations were not elevated in the Fording River downstream of Line Creek relative to upstream (Figure 4.3).

Benthic invertebrate tissue selenium results were also plotted (Figure 4.7) relative to the regional one-step water-to-invertebrate selenium accumulation model (Golder 2018a). The model is based on observed relationships between aqueous and tissue selenium values from samples collected previously in Line Creek and in other areas of the Elk River watershed (Golder 2018a). Most values were near or less than the model line, except for samples collected nearest the AWTF in 2016 and 2017 (e.g., LILC3 in Figure 4.7[15]). These results support the conclusion that selenium accumulation in Line Creek during AWTF operation was higher than model predictions, and can be attributed to higher-than-normal concentrations of non-selenate forms of selenium.

Due to the observed increase in chemically reduced forms of aqueous selenium in effluent and downstream of the AWTF, along with the associated increase in benthic invertebrate tissue selenium concentrations in Line Creek, 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

[14] Note the differences in the y-axis scales of Figures 4.5 versus 4.6.

[15] Tissue selenium concentrations for LILC3 that were close to model predictions at very high aqueous 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.

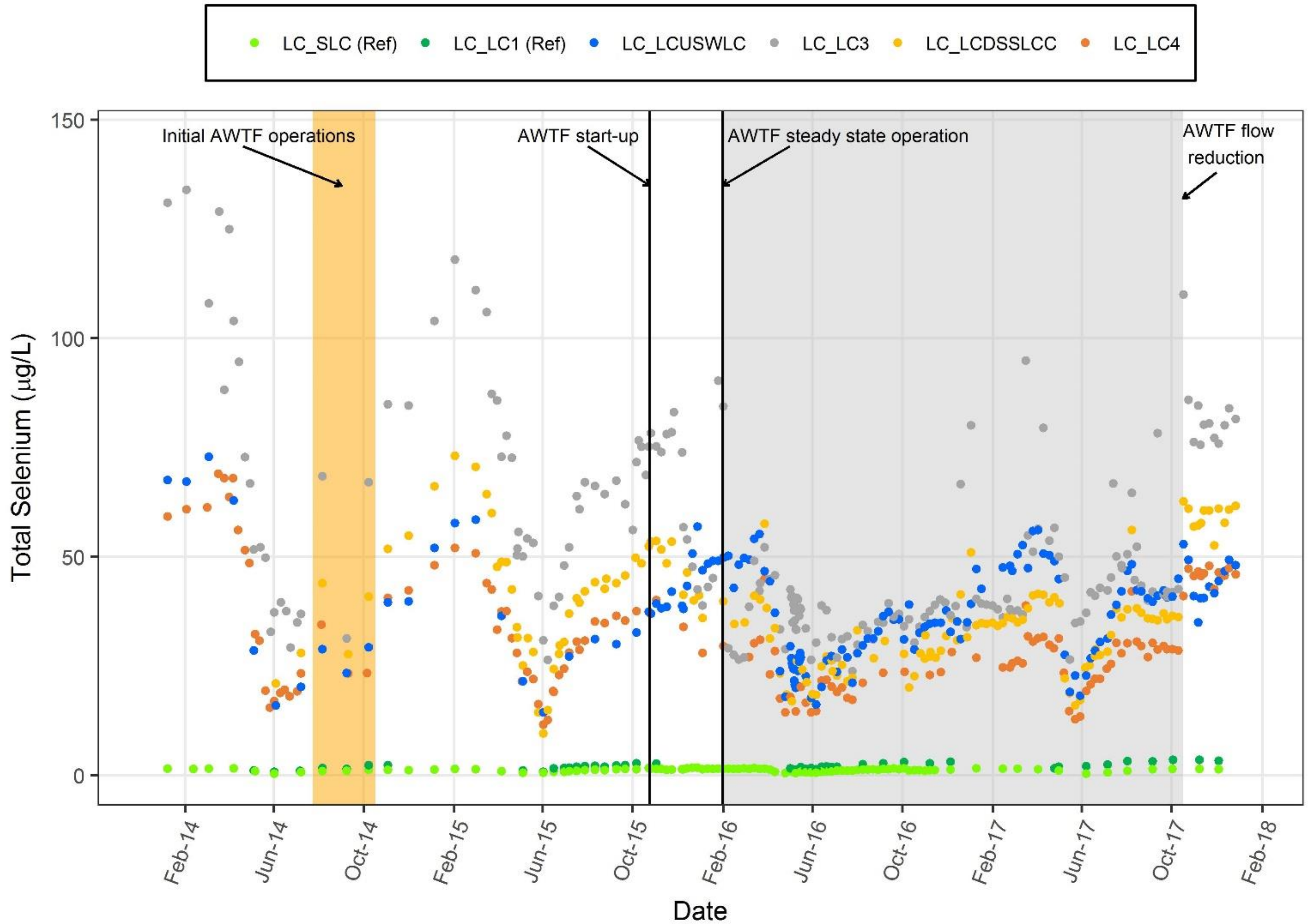


Figure 4.4: Total Selenium Concentrations in Water Samples Collected from Line Creek, 2014 to 2017

Notes: Hollow symbols indicate results less than the laboratory reporting limit (LRL). If multiple results existed for a given location and day, the first entry in the database was presented. Results for water quality sampling locations are presented only (not those associated with biological sampling locations). AWTF discharge during steady state operation (indicated by grey shading) is ~5,300 to 5,500 m^3/day, and AWTF during flow reduction is ~2,500 m^3/day.

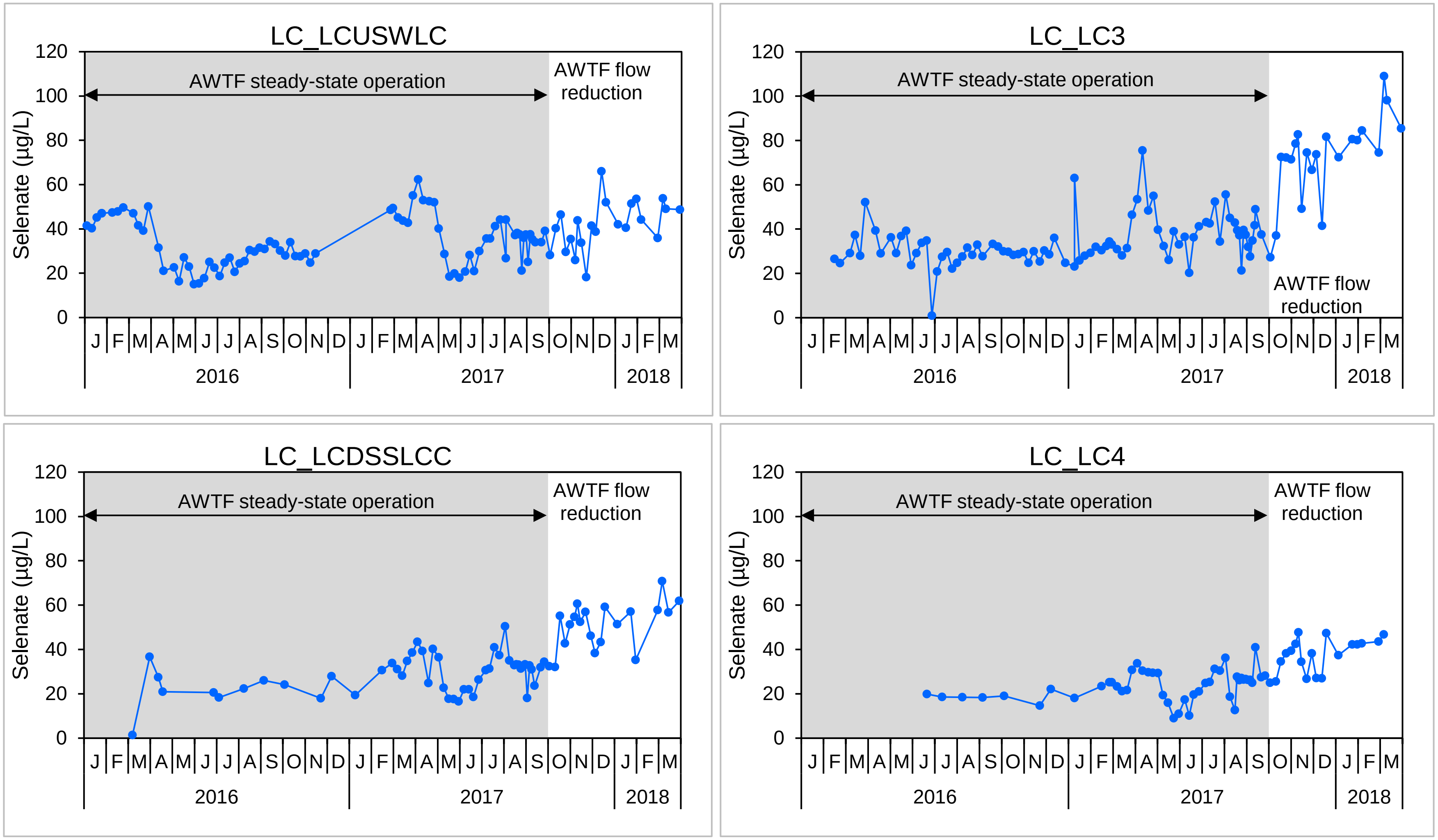


Figure 4.5: Aqueous Selenate Concentrations in Mine-exposed Stations, Line Creek, January 2016 to March 2018

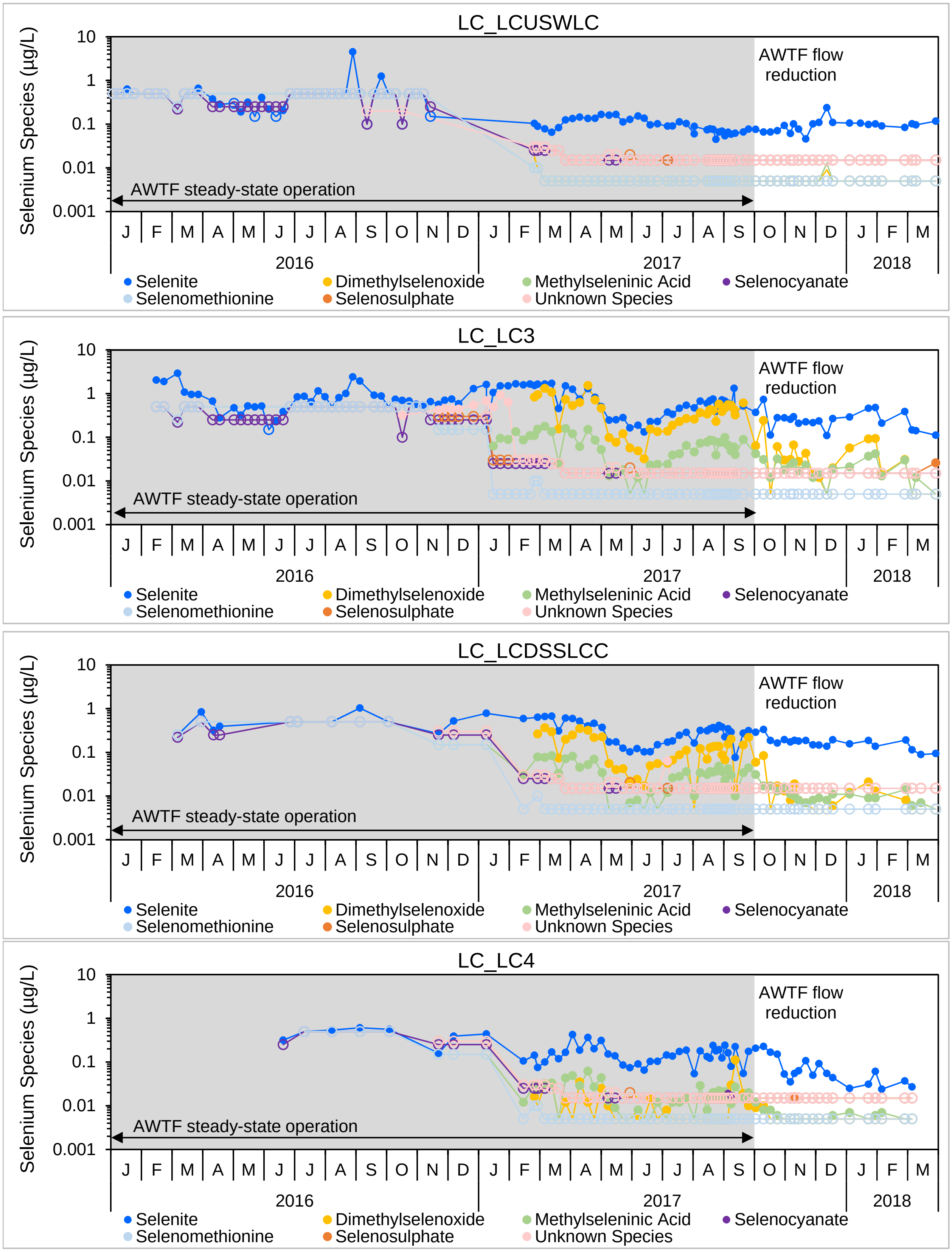


Figure 4.6: Aqueous Concentrations of Non-Selenate Selenium Species at Mine-exposed Stations in Line Creek, January 2016 to March 2018

Note: Values below the Laboratory Reporting Limit (LRL) are plotted with an open circle.

Table 4.2: Aqueous Selenium Speciation (µg/L) in Fording River Downstream from Line Creek (LC_LC5) Compared to Upstream (LC_LC6 or GH_FR1), 2017

Date	Station	Selenium Species							Sum of Species
		Selenate	Selenite	Dimethyl-seleneoxide	Methyl-seleninic acid	Seleno-cyanate	Seleno-methionine	Seleno-sulfate	
3-Aug-17	LC_LC6	41.6	0.511	0.016	0.027	< 0.015	< 0.005	< 0.015	42.2
2-Aug-17	LC_LC5	38.9	0.388	0.018	0.018	< 0.015	< 0.005	< 0.015	39.4
15-Aug-17	LC_LC6	42.1	0.434	0.016	0.02	< 0.015	< 0.005	< 0.015	42.6
	LC_LC5	37.3	0.327	0.012	0.012	< 0.015	< 0.005	< 0.015	37.7
18-Aug-17	LC_LC6	38.1	0.406	0.01	0.015	< 0.015	< 0.005	< 0.015	38.6
	LC_LC5	33.9	0.305	0.012	0.014	< 0.015	< 0.005	< 0.015	34.3
21-Aug-17	LC_LC6	37.4	0.385	0.008	0.026	< 0.015	< 0.005	< 0.015	37.9
	LC_LC5	33.4	0.28	0.006	0.014	< 0.015	< 0.005	< 0.015	33.7
24-Aug-17	LC_LC6	36.3	0.341	0.017	0.017	< 0.015	< 0.005	< 0.015	36.7
	LC_LC5	32.5	0.296	0.011	0.014	< 0.015	< 0.005	< 0.015	32.9
27-Aug-17	LC_LC6	37.6	0.393	0.008	0.023	< 0.015	< 0.005	< 0.015	38.1
	LC_LC5	32.7	0.296	0.008	< 0.005	< 0.015	< 0.005	< 0.015	33.0
30-Aug-17	LC_LC6	38.1	0.462	0.008	0.019	< 0.015	< 0.005	< 0.015	38.6
	LC_LC5	31.3	0.324	0.011	0.012	< 0.015	< 0.005	< 0.015	31.7
2-Sep-17	LC_LC6	38.3	0.449	0.007	0.016	< 0.015	< 0.005	< 0.015	38.8
	LC_LC5	25.2	0.253	< 0.005	0.011	< 0.015	< 0.005	< 0.015	25.5
5-Sep-17	LC_LC6	38.4	0.454	< 0.005	0.016	< 0.015	< 0.005	< 0.015	38.9
	LC_LC5	22.5	0.244	< 0.005	0.009	< 0.015	< 0.005	< 0.015	22.8
8-Sep-17	LC_LC6	35.5	0.373	0.019	0.019	< 0.015	< 0.005	< 0.015	35.9
	LC_LC5	30.8	0.259	0.024	0.016	< 0.015	< 0.005	< 0.015	31.1
6-Jun-17	GH_FR1	17.8	0.107	< 0.005	< 0.005	< 0.015	<0.005	< 0.020	18.0
26-Jun-17	LC_LC5	23.7	0.174	< 0.005	0.013	< 0.015	< 0.005	< 0.015	23.7
5-Sep-17	GH_FR1	47.7	0.437	< 0.005	0.016	< 0.015	<0.005	<0.015	48.2
	LC_LC5	22.5	0.244	< 0.005	0.009	< 0.015	< 0.005	< 0.015	22.5
5-Dec-17	GH_FR1	48.8	0.203	< 0.005	0.008	< 0.015	<0.005	<0.015	49.1
18-Dec-17	LC_LC5	46.8	0.157	< 0.005	0.009	< 0.015	< 0.005	< 0.015	46.8

Note: Results are presented from sampling events that were most closely matched in time.

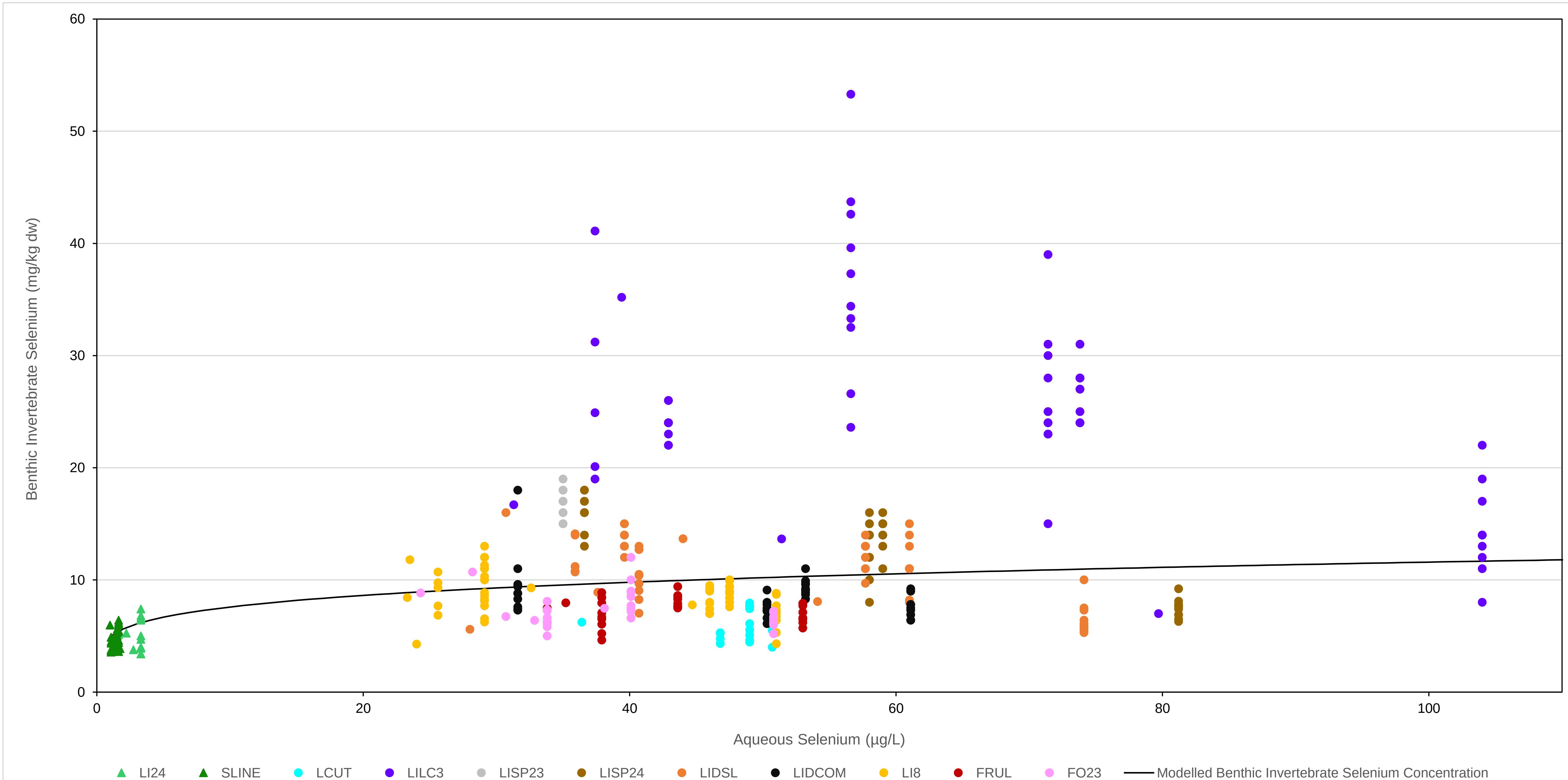


Figure 4.7: Observed and Modelled[a] Selenium Concentrations in Benthic Invertebrate Composite Samples Relative to Aqueous Selenium Concentrations At Stations Upstream and Downstream of Line Creek Operations, 2012 to 2018

[a] Benthic invertebrate selenium concentrations were estimated using a one-step water to benthic invertebrate selenium accumulation model: $\log_{10}[Se]_{benthicinvertebrate}=0.696+0.184x\log_{10}[Se]_{aq}$ (Golder 2018a)

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 exposed stations. Benthic invertebrate composite tissue results from LCUT following the commencement of AWTF (Active Water Treatment Facility) flow reduction (October 16, 2017 onwards) are not presented because LCUT was exposed to inputs from both upper Line Creek (LC_LCUSWLC) and West Line Creek (LC_WLC) after this date.

the AWTF was reduced by approximately half from October 16, 2017 until the AWTF was fully shut down on March 8, 2018 (Table 1.1).

The AWTF is scheduled to be recommissioned in August 2018 with the addition of AOP to reverse the shift in selenium species in ATWF effluent from chemically reduced species back to a selenate-dominated condition. Discharge from the AWTF to the receiving environment is currently anticipated to resume in late September 2018.

During review of preliminary results for 2017, the EMC noted a potential pattern of increasing aqueous total selenium concentrations at the LC_LC1 reference area (e.g., Figure 4.4). Trend analysis using Repeated Measures ANOVA indicated significant step increases in aqueous selenium concentrations at LC_LC1 after 2014, 2015, and 2016 (Appendix Table B.11). LC_LC1 is located on Line Creek upstream from any drainages associated with mining disturbances, therefore the potential cause of these increases is unknown. Continued monitoring at the reference location will include ongoing analysis of any further step or linear changes in total selenium (Minnow 2018b), and field verification of an absence of mine impact to this location is recommended.

4.4 Seasonal Variation and Effects of Flow Reduction

Composite benthic invertebrate samples collected through 2017 and in early 2018 showed little seasonal variation in tissue selenium concentrations, except at areas downstream from the AWTF where concentrations appear to have declined during the AWTF flow reduction period in early 2018 (Figure 4.8). Lower tissue concentrations in early 2018 likely relate to lower loads of the more bioavailable non-selenate forms of selenium in effluent discharged from the AWTF during the flow reduction period (October 16, 2017 to March 8, 2018). Tissue selenium monitoring will continue through 2018 to evaluate changes in tissue selenium concentrations associated with temporary WLC AWTF shutdown and recommissioning (Minnow 2018b).

4.5 Single-Taxon Benthic Invertebrate and Periphyton Selenium Concentrations

Selenium concentrations were also measured in single-taxon benthic invertebrate taxa samples (i.e., Ephemeroptera, Rhyacophilidae, *Parapsyche* sp., and Chironomidae), although not all taxa were sampled in all areas and years (Appendix Table B.4). Sufficient data were available to perform BACI analyses for Ephemeroptera and Rhyacophilidae tissue selenium concentrations. Ephemeroptera tissue selenium concentrations exhibited a pattern similar to that of composite-taxa benthic invertebrate tissue samples of significantly increased selenium at LILC3 and LIDSL during AWTF steady-state operation (2016 to 2017) compared to before (2015) when the AWTF was not operational (data available starting in 2014 only; Figure 4.2; Appendix Table B.8). There was no change in Rhyacophilidae tissue selenium concentrations at effluent-exposed areas

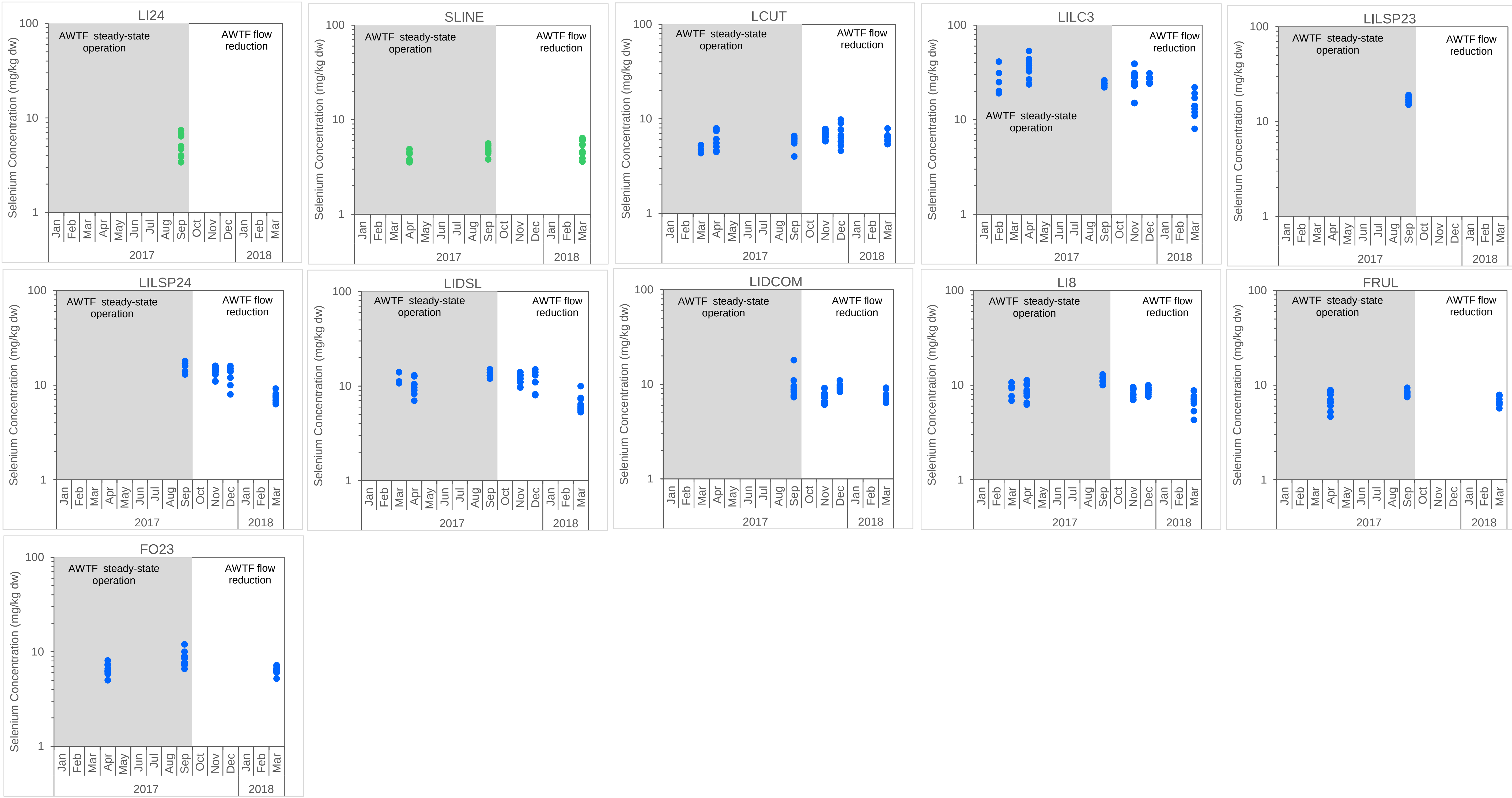


Figure 4.8: **Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples Collected at Areas Upstream and Downstream Of Mine Activities on Line Creek, 2017 to 2018**

Notes: Green symbols represent reference areas and blue represent mine-exposed areas.

relative to reference areas during AWTF operation (2016 to 2017) compared to before (2015, Figure 4.2; Appendix Table B.8).

Single-taxon benthic invertebrate samples were formerly included as part of Teck's monitoring programs to assess if they would allow for more sensitive detection of changes over time than composite-taxa samples. However, comparisons of the coefficients of variation between composite-taxa and single-taxon samples suggested that single-taxon samples do not provide an advantage in the statistical detection of temporal or spatial differences in tissue selenium (Minnow 2018c). Furthermore, single-taxon samples tissue selenium concentrations exhibit close to a 1:1 relationship with composite samples. Based on these similarities between the tissue sample types, single-taxon benthic invertebrate monitoring is not recommended for on-going monitoring in Line Creek (Minnow 2018b).

Periphyton selenium concentrations documented in 2017 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 LCUT, upstream of the AWTF; Appendix Figure B.2). Also, field technicians have reported the presence of calcite and other gritty material suspected to be sediment particles that had settled into the calcite-periphyton matrix (Minnow 2017a). Analysis of metals and total organic carbon content of samples also suggested the presence of abiotic matter that likely included selenium (Minnow 2017a). Therefore, periphyton data are considered less reliable than benthic invertebrate tissue data for interpreting selenium bioaccumulation in the aquatic food web of Line Creek. Results are summarized in Table 4.3, but were not analyzed in detail (individual 2017 results are presented in Appendix Table B.2). Periphyton sampling was continued in early 2018 to comply with the study design submitted for the Line Creek LAEMP in 2017 (Minnow 2017c) and the sampling plan for AWTF shutdown (ENV 2018), however future monitoring will focus on composite benthic invertebrate tissue selenium sampling (as described above).

4.6 Fish Tissue Selenium Concentrations

4.6.1 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 4.4).

Young male bull trout (i.e., < 31 cm fork length) captured in Line Creek in September 2017 had muscle selenium concentrations similar to those in benthic invertebrates collected in the same

Table 4.3: 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	2012 (September)	2015 (September)	2016 (September)	2017 (February/ March)	2017 (April)	2017 (September)	2017 (November)	2017 (December)	2018 (March)
Sample Size (n)				1	1	1	14	15	15	15	15	15
Line Creek	Reference	LI24	LC_LC1 (Reference)	2.1	2.9	5.5	-	-	3.8	-	-	-
		SLINE	LC_SLC (Reference)	-	1.5	4.1	-	4	3.9	-	-	3.3
	Mine-exposed	LCUT	LC_LCUSWLC	-	-	-	27	14	18	12	10	14
		LILC3	LC_LC3	18	3.8	16	45	25	13	13	12	13
		LISP24	WL_DCP_SP24	-	-	-	-	-	-	-	-	4.0
		LIDSL	LC_LCDSSLCC (Compliance Point)	-	1.4	2	5.6	4.6	4.8	4.1	3.7	2.4
		LIDCOM	LC_LCC	-	-	-	-	-	-	-	-	7.8
		LI8	LC_LC4	-	5.3	2.6	3.2	3	1.6	2.3	2.6	1.7
Fording River	Mine-exposed	FRUL	LC_LC6	-	3.7	7.1	-	5.1	-	-	-	7.6
		FO23	LC_LC5	1.6	9.1	13	-	5.5	-	-	-	7.6

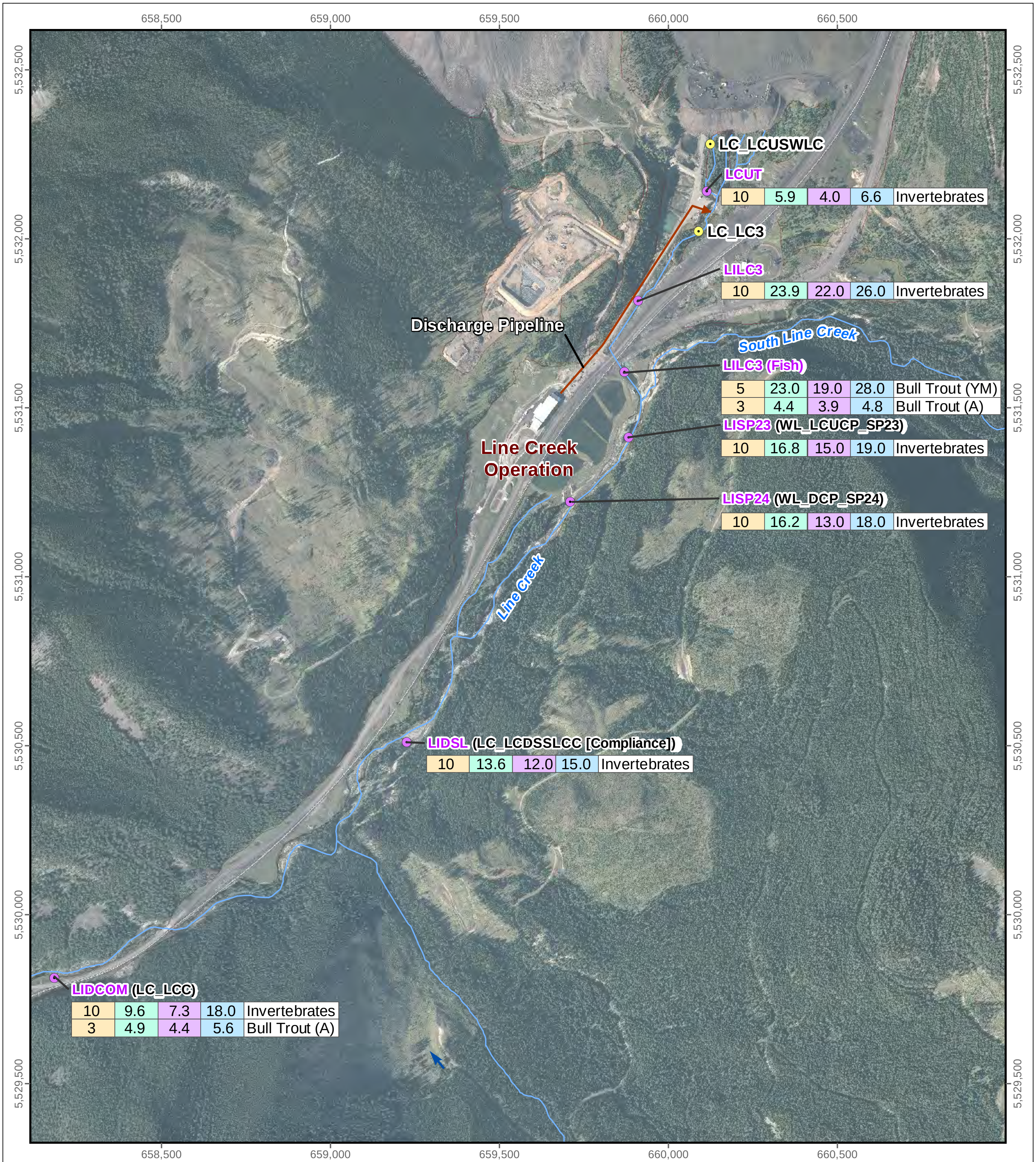
Notes: Number of samples are shown in parentheses; means are presented where the number of samples was > 1. FRUL=FOUL prior to 2016.

Table 4.4: 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*	1.06
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*	1.25
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

vicinity (Figures 4.9 and 4.10; Appendix Table B.12). This suggested that these bull trout were resident individuals feeding near the capture area. Larger adult bull trout (i.e., > 60 cm fork length) captured in upper Line Creek in 2017 had muscle selenium concentrations lower than those in benthic invertebrates collected in the sample area (Figure 4.9), suggesting non-residency. Line Creek is a regionally important stream for bull trout spawning (Minnow 2016c), therefore these larger adult bull trout were likely individuals that had recently migrated into Line Creek to spawn.

Selenium concentrations in tissues of westslope cutthroat trout have been monitored in Line Creek since 2001 (Golder 2005). In 2017, selenium concentrations in muscle from westslope cutthroat trout captured closest to the AWTF outfall (LILC3 and LIDSL) were elevated relative to previous results (2012 and 2016, respectively), whereas concentrations in muscle from fish captured further from the WLC AWTF (i.e., LI8, approximately 6.1 km from the AWTF discharge) were similar to those observed previously (Figure 4.11 top panel; Appendix Table B.12).



LEGEND

- Biological Sampling Station (Teck Water Quality Station)
- Teck Water Quality Station Only
- Teck Coal Mine Operation

Bull Trout Muscle and Benthic Invertebrate Selenium Concentrations

n	mean	min	max

(A) - Adult
(YM) - Young Male

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

0 270 540 1,080 Meters

N E S W

Projection: North American Datum 1983 UTM Zone 11

Date: May 2018
Project 177202.0023

minnow environmental inc.

Figure 4.9

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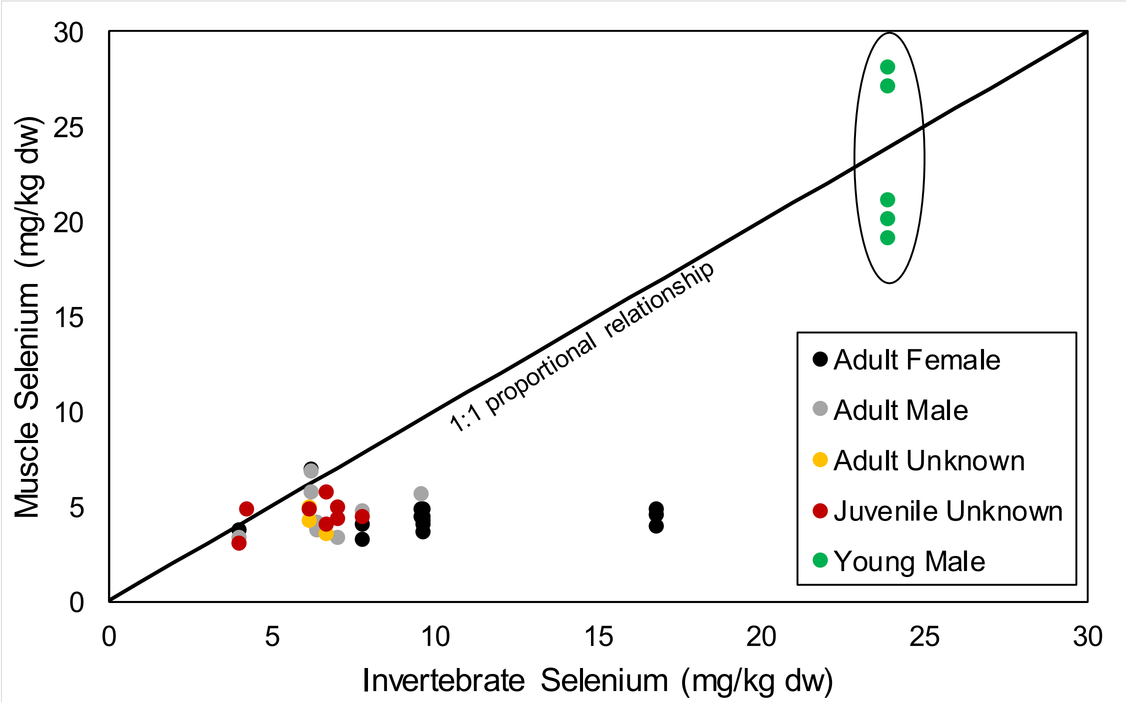

Figure 4.10: Bull Trout Muscle Selenium Concentrations Compared to Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples Collected in Same Area

Notes: Data reflect bull trout captured in Line Creek in 2017 LAEMP and in 2006 regional selenium monitoring (Minnow et al. 2007). Circled fish muscle selenium concentrations were compared to composite benthic invertebrate selenium concentrations measured at LC_LC3.

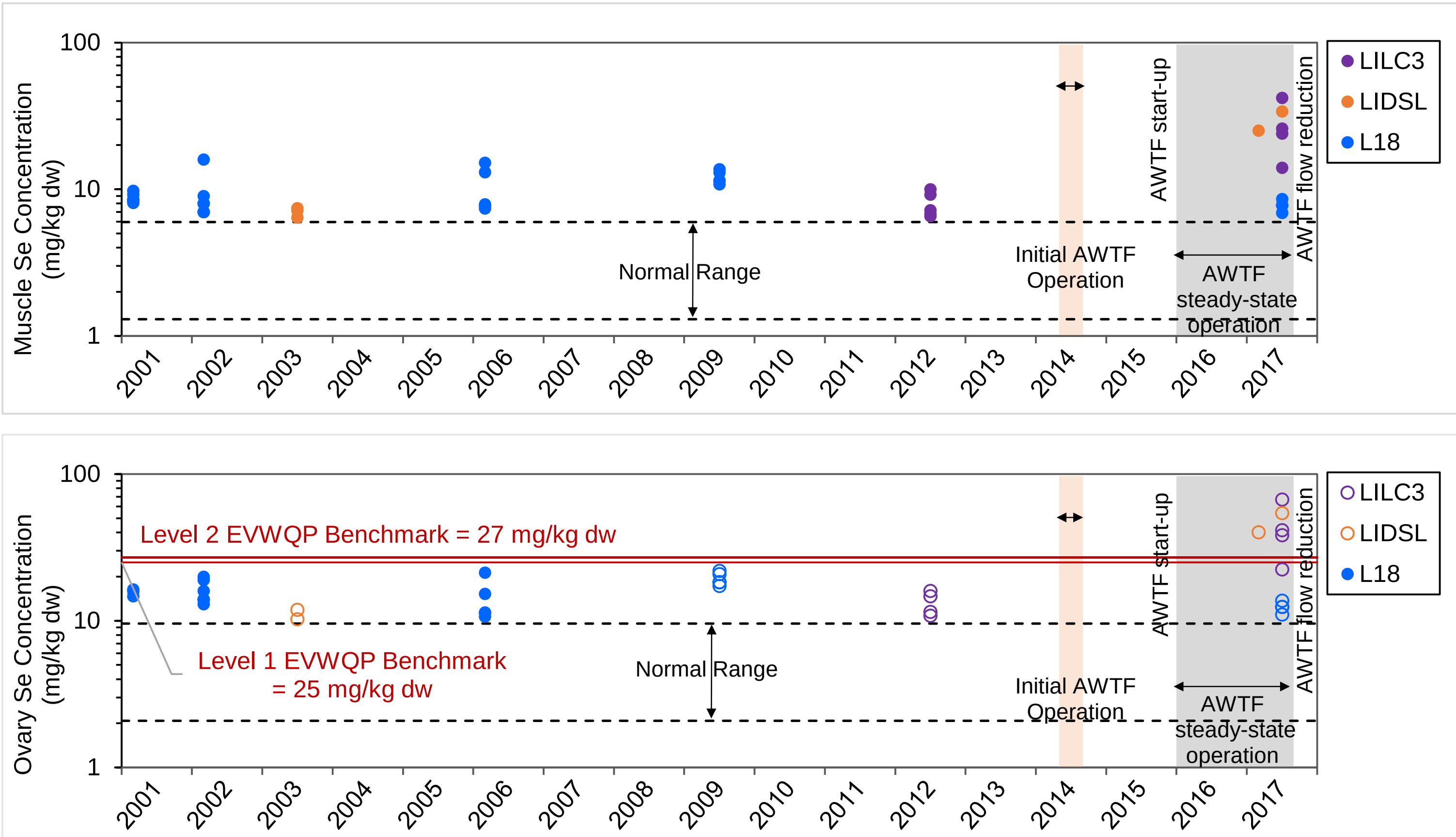

Figure 4.11: Selenium Concentrations in Muscle and Ovaries of Westslope Cutthroat Trout Sampled From Line Creek, 2001 to 2017

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.

4.6.2 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 very difficult to time sampling so that eggs can be harvested non-lethally from females (by applying gentle abdominal pressure), and 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 4.5). 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 4.12), 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 some concentrations measured in 2017 (Figure 4.11). Estimated ovary selenium concentrations in fish captured at locations closest to the AWTF outfall in 2017 (LILC3 and LIDSL) were greater than the Level 1 benchmark of 25 mg/kg dw as well as the Level 2 benchmark of 27 mg/kg dw (Teck 2014) (Figure 4.11, bottom panel), although some of these individuals may have been juveniles (e.g., fork length of ≤ 23 cm[16]; Appendix Table B.13) or males, and thus lacking mature ovaries.

Selenium monitoring data in the Elk Valley are more limited for bull trout than for westslope cutthroat trout. However available tissue selenium concentration data indicate an ovary-to-muscle ratio of approximately 3.3 (Figure 4.13). Ovary selenium concentrations were estimated using this relationship for bull trout sampled non-lethally in 2006 (n = 3; Minnow et al. 2007). Estimated ovary selenium concentrations for 2006 and concentrations measured in ovaries collected in 2017 (n = 5; Appendix Table B.13) were all below the Level 1 Benchmark of

[16] "Mature" westslope cutthroat trout were defined by Cope et al. (2016) as individuals larger than 20 cm. Sampling was non-lethal therefore sex could not be confirmed.

Table 4.5: 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	0.040	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

[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)

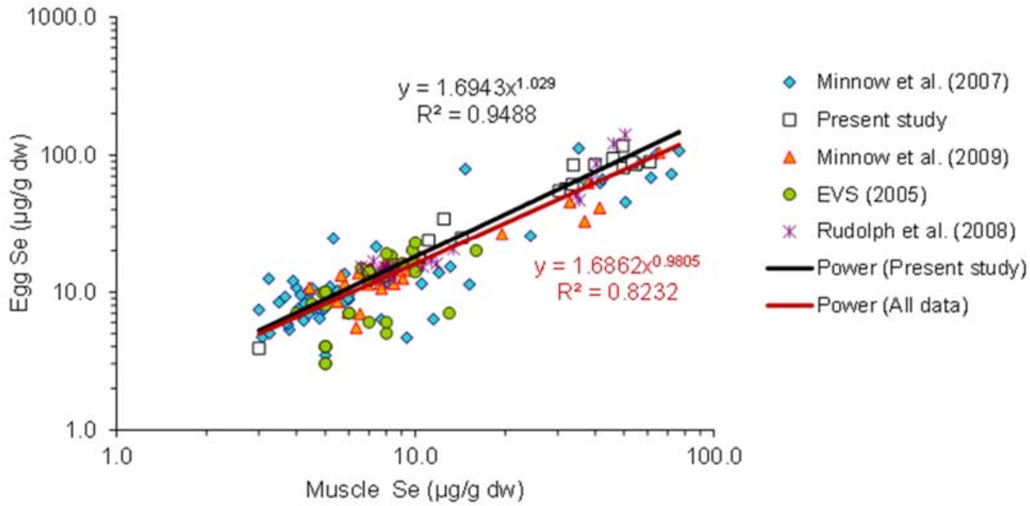

Figure 4.12: Relationship between Westslope Cutthroat Trout Muscle and Ovary Selenium Concentrations [from Nautilus and Interior Reforestation (2011)]

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

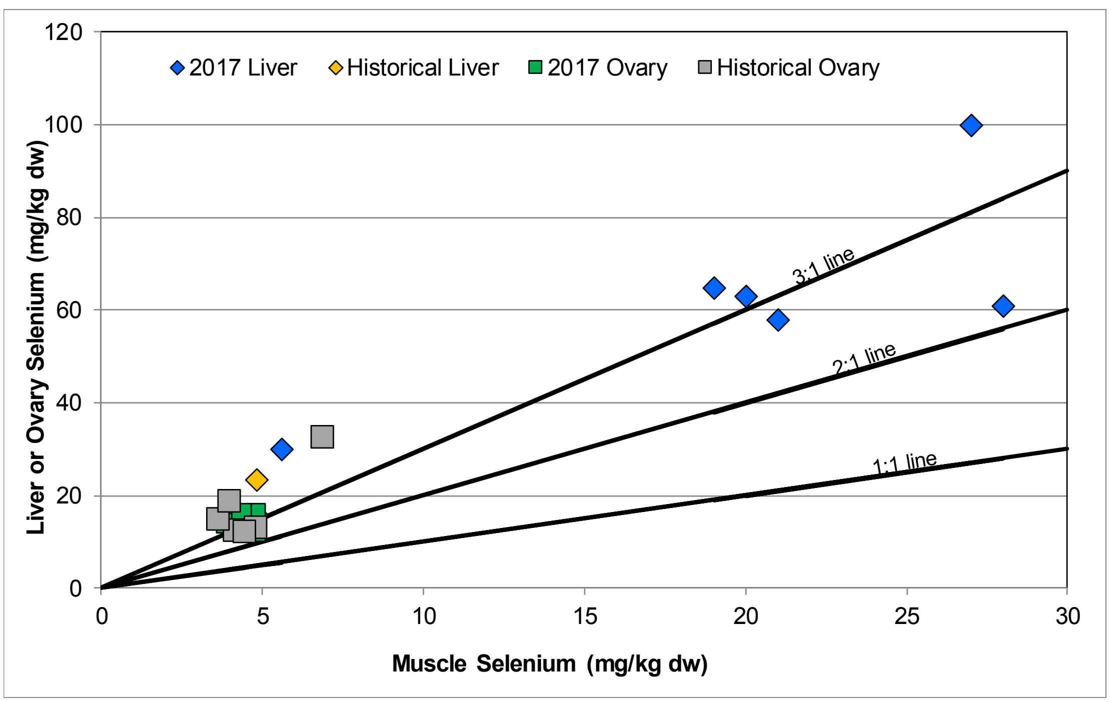

Figure 4.13: Selenium Concentrations in Liver and Ovary Tissues of Bull Trout from Elk Valley, Relative to Muscle Selenium Concentrations, 1996, 2009 and 2017

Notes: Mean ovary: muscle selenium ratios from observations was 3.3. All liver data were from young males (n=6) except for one adult female (muscle 4.8 mg/kg and liver 16 mg/kg) and one adult male (muscle 3.5 mg/kg and liver 18 mg/kg).

18 mg/kg dw[17] (Golder 2014) and the EC10 (Effect Concentration) for Dolly Varden of 56.2 mg/kg dw[18] (USEPA 2016).

4.6.3 Otoliths

Selenium concentrations measured across otolith cross-sections give an indication of life-history exposure to selenium for individual fish, thus giving evidence of similarities or differences in migration patterns for fish within and among different capture areas. Similar analyses were done previously for westslope cutthroat trout and showed high variability among individuals (Minnow 2014b). High variability in annual exposure patterns were also observed for bull trout sampled in 2017, although selenium concentrations were highest in the most recent year of growth for presumed resident bull trout (< approximately 5 years old; Appendix Figure B.4). As shown in Figure 4.9, comparison of tissue selenium concentrations to dietary exposure concentrations suggest these fish had been resident in upper Line Creek for at least a number of months (see Section 4.6.1). In addition to the differences in muscle selenium concentrations observed between young male and larger adult bull trout in 2017 (see Section 4.6.1), bull trout otolith data provide further evidence that selenium concentrations in soft tissues of mobile fish species must be interpreted with caution with respect to reflecting conditions in the area of capture.

4.7 Summary

Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate, with lesser amounts (~1-2%) of chemically reduced forms such as selenite. Although the WLC AWTF successfully reduced concentrations of total selenium in Line Creek, the effluent contained higher proportions of reduced selenium species, resulting in increased concentrations of non-selenate selenium species in Line Creek. Some of the non-selenate species of selenium are known to be more readily accumulated by aquatic biota than selenate. Benthic invertebrate tissue monitoring in Line Creek in 2016 and 2017 identified higher selenium concentrations downstream from the AWTF compared to upstream or before AWTF operation. Despite these increases in benthic invertebrate tissue concentrations, benthic invertebrate community characteristics were similar

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

[18] The 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 char (*S. malma*), later recalculated as 56.2 mg/kg dw in eggs by US EPA (2016). Holm et al. (2005) reported no effects to brook trout (*S. fontinalis*) across a wide range of egg selenium concentrations. US EPA (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.

during AWTF steady-state operation compared to before. Selenium concentrations were also elevated in the tissues of some individual bull trout and westslope cutthroat trout in 2017 compared to concentrations observed prior to AWTF operation. Benthic invertebrate tissue selenium concentrations in the Fording River were similar downstream from Line Creek, compared to upstream, indicating that the effects of AWTF on aquatic food web accumulation were limited to Line Creek.

5 OTHER POTENTIAL INFLUENCES OF THE WLC AWTF

5.1 Overview

Monitoring data are evaluated in this section to address Key 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 temperature measured by continuous loggers was highest at locations representing AWTF effluent (Buffer Pond Outlet Box [T2] and V Notch Discharge [T3]; Figure 5.1; see Figure 2.2 for logger locations). Within Line Creek, temperatures upstream (LC Intake Pond [T1]) and downstream (LC Mixing Zone Discharge [T4] and LC3 Downstream [T5]) of the AWTF were generally similar (Figure 5.1), and were also similar to discrete temperature measurements collected further upstream during routine monitoring (LC_LCUSWLC; Figure 5.1). Furthermore, temperatures recorded during routine field monitoring at LC_LC3 (downstream from the AWTF), were similar to those upstream at LC_LCUSWLC during AWTF steady state operation (Figure 5.2).

BACI analysis was performed, first with temperature data for both reference areas, which necessitated exclusion of data for December to March because winter data were not available for reference station LC_LC1. Excluding winter data, water temperatures did not differ significantly at stations downstream from the AWTF relative to reference stations, during AWTF steady-state operation (2016 to 2017) compared to before (2012, 2013, and 2015; Figure 5.2; Appendix Table C.1a). The BACI was repeated to include winter temperature data, with data for mine-exposed stations being evaluated relative to a single reference station (LC_SLC). Again, no significant effect of AWTF operation on water temperatures was indicated (Appendix Table C.1b).

BC water temperature guidelines specified for different life stages of bull trout and westslope cutthroat trout, are defined as a maximum ± 1° C change from the optimum temperature range for different life stages (BCMOE 2001b). Line Creek water temperatures throughout 2017 were within, or lower than, the optimum temperature ranges for both species (Figure 5.3).

5.3 Dissolved Oxygen

Most dissolved oxygen concentrations measured in 2017 both upstream and downstream from the AWTF were above 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 5.4). 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 all stations in some

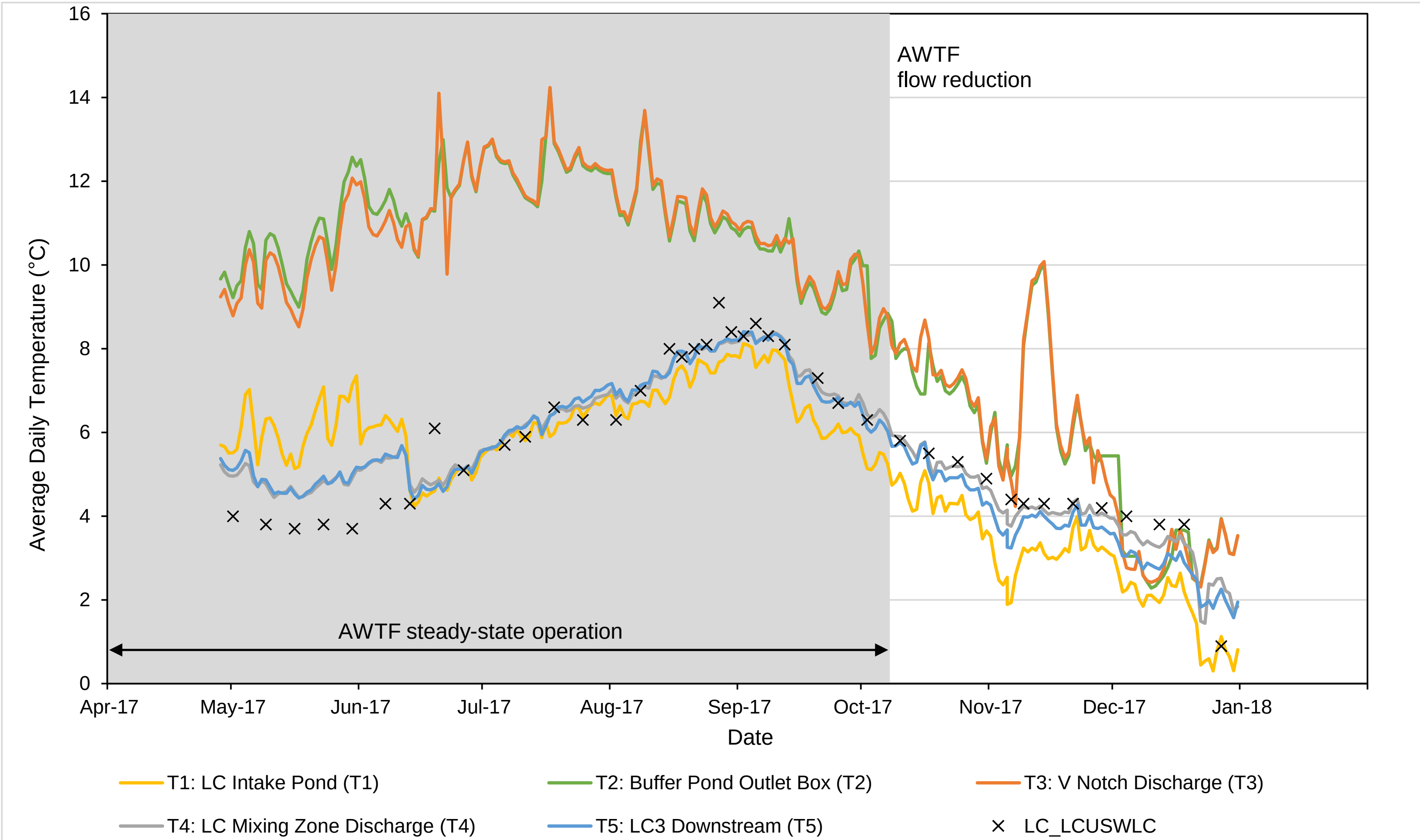

Figure 5.1: Daily Average Water Temperature (ºC) Recorded by Temperature Data Loggers, Line Creek LAEMP, 2017

Notes: Field temperatures at station LC_LCUSWLC were taken intermittently throughout 2017 and therefore do not present a continuous line.

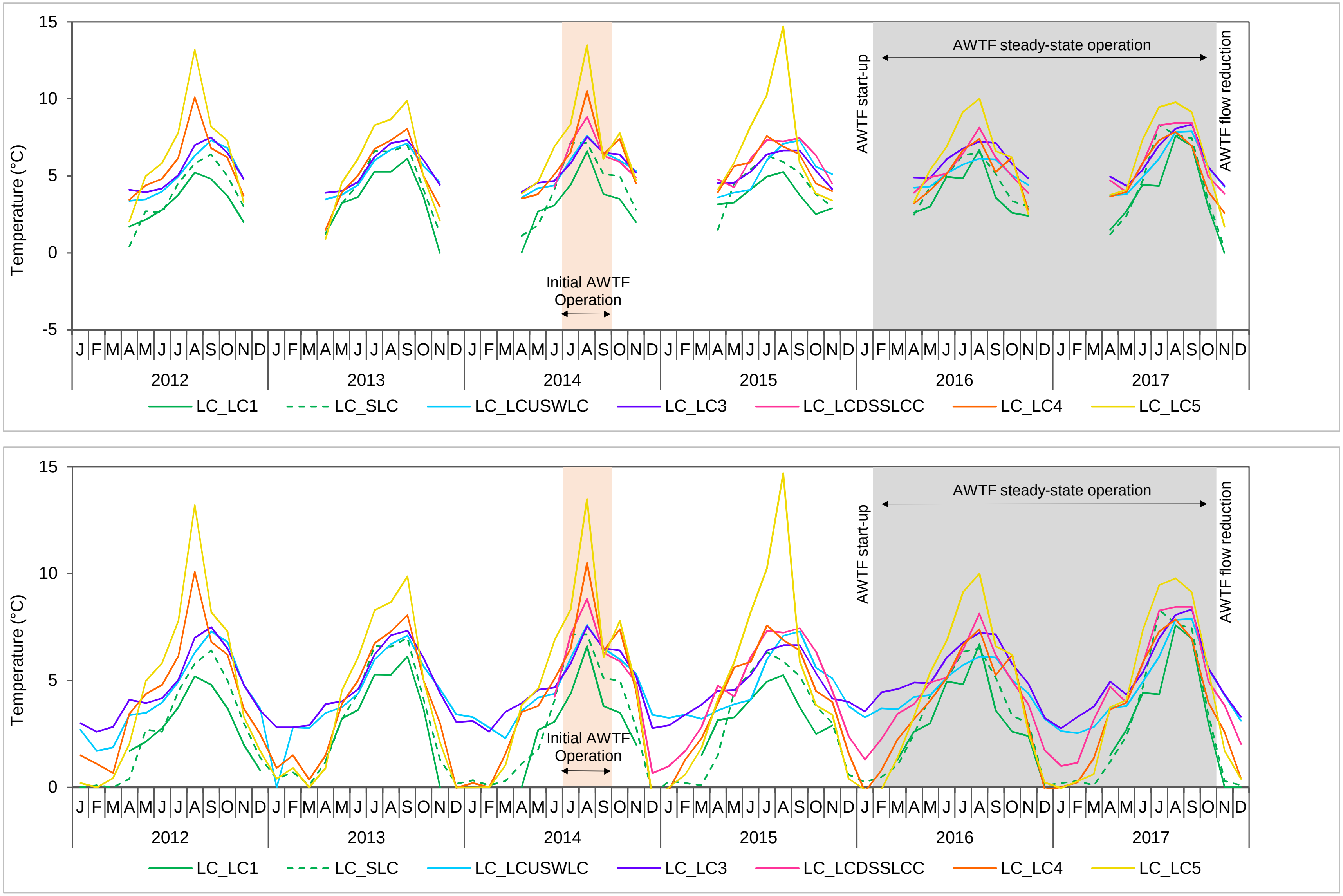

Figure 5.2: Monthly Mean Aqueous Temperature in Line Creek Before and After Operation of the Line Creek AWTF

Notes: Reference stations plotted in green. Top panel shows data for April to November as reflected in BACI ANOVA that included data for LC_LC1, where data were lacking for winter months. All available data are presented in bottom panel.

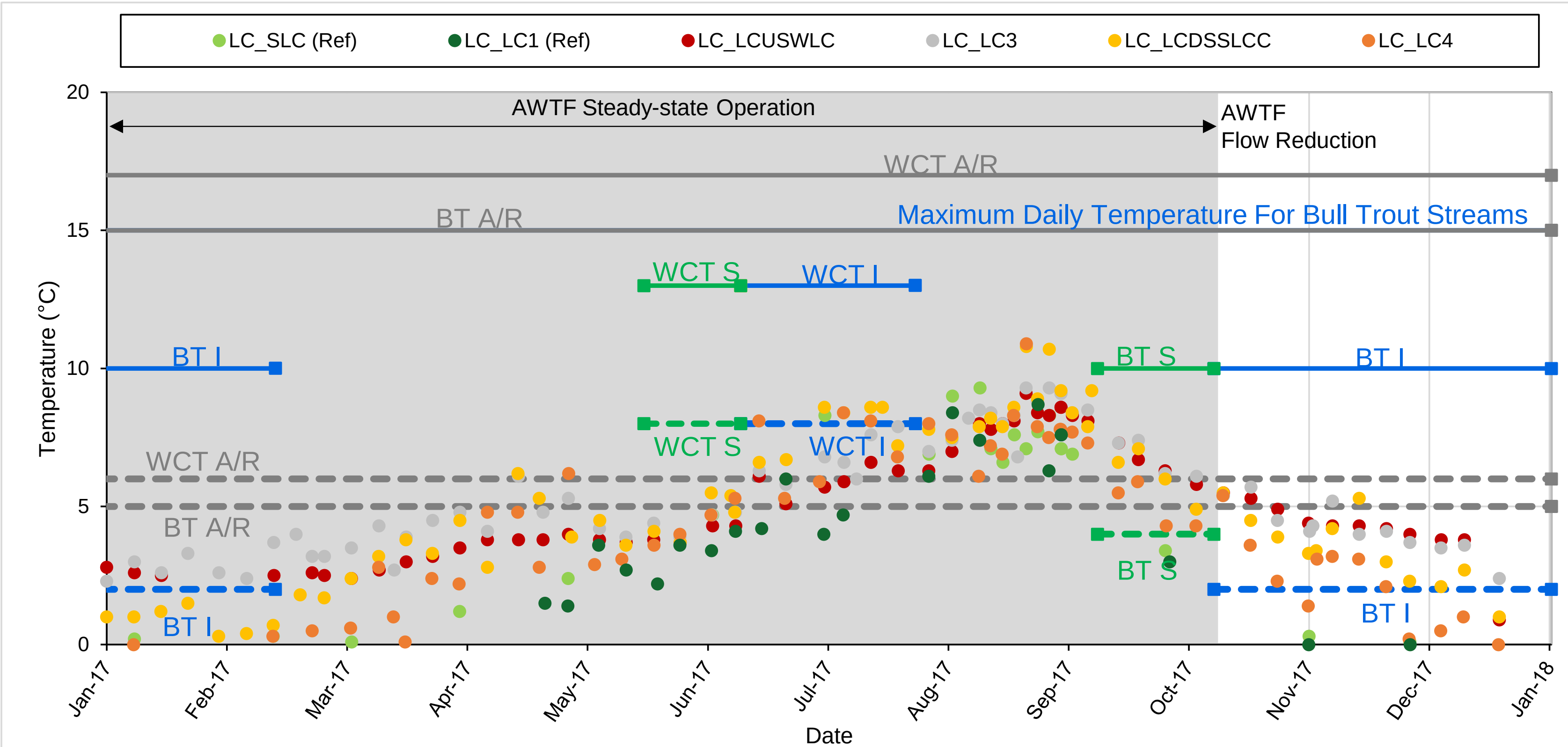

Figure 5.3: Water Temperatures at Monitoring Stations in Line Creek in 2017 Relative to BCMOE (2001b) Guidelines for Maximum (Solid Lines) and Minimum (Dotted Lines) Temperatures for Protection of Fish Species Found in Line Creek

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

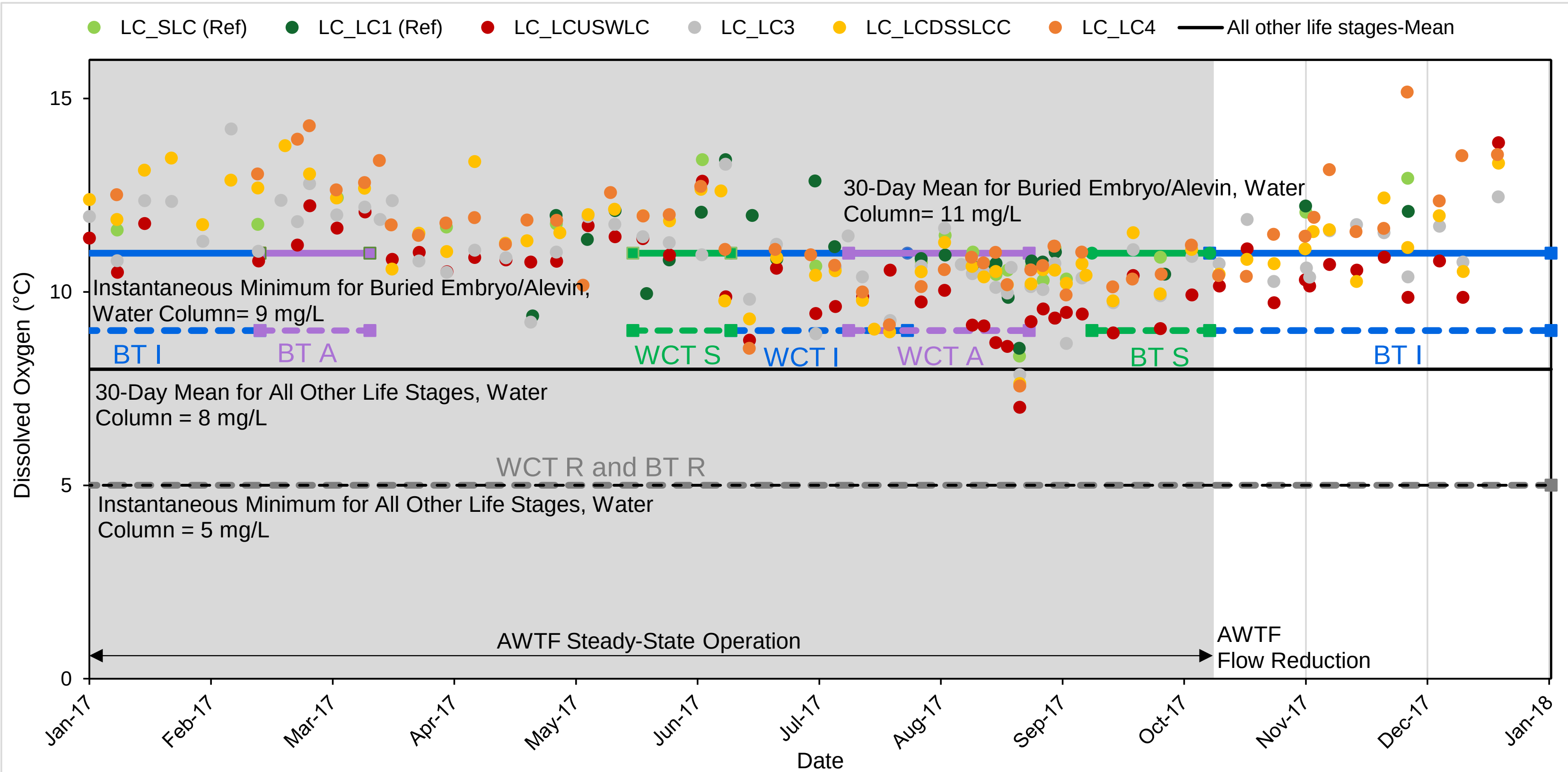

Figure 5.4: Dissolved Oxygen Concentrations at Sampling Stations in Line Creek in 2017, Relative to the BCMOE (1997) Criteria for the Protection of Fish Life Stages

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

months, especially at LC_LCUSWLC upstream from the AWTF (7 of 12 months) and also at reference stations (4 of 12 months; Table 5.1). This pattern suggests that dissolved oxygen concentrations observed below the 30-day criterion were not related to AWTF operation.

Table 5.1: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Line Creek, 2017

Month	LC_LC1	LC_SLC	LC_LCUSWLC	LC_LC3	LC_LC4
January	-	11.6	11.2	11.8	12.5
February	-	11.8	11.4	12.5	13.8
March	-	12.4	11.4	11.8	12.4
April	9.4	11.7	10.8	10.4	11.7
May	11.3	11.8	11.3	11.5	11.7
June	12.1	13.4	10.5	11.3	10.9
July	12	10.7	9.9	10.1	10.2
August	10.4	10.5	8.9	10.3	10.2
September	10.9	10.6	9.5	10.1	10.5
October	10.5	10.9	10	10.7	10.8
November	12.2	12.1	10.5	11.2	12
December	12.1	12.9	11.1	11.3	13.7

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

BACI analysis was first performed with dissolved oxygen data for both reference areas, which necessitated exclusion of data for December to March because winter data were not available for reference station LC_LC1. Excluding winter data, dissolved oxygen concentrations did not differ downstream from the AWTF, relative to reference stations, during AWTF steady-state operation (2016-2017) compared to before (2012, 2013, and 2015; Figure 5.5; Appendix Table C.2a). The BACI was repeated to include dissolved oxygen concentrations for winter months, with mine-exposed stations being evaluated relative to a single reference station (LC_SLC). Again, no significant effect of AWTF on aqueous dissolved oxygen concentrations was indicated (Appendix Table C.2b).

5.4 Toxicity Results

None of the 70 effluent and receiving water samples collected for acute laboratory toxicity testing in 2017 caused >50% mortality to rainbow trout (Table 5.2; Appendix Table C.3). Four of the 70 samples were acutely lethal to the water flea *Daphnia magna* (> 50% test mortality), including one sample from the West Line Creek influent to the AWTF (WL_WLCI_SP01), and three samples of AWTF effluent (WL_BFWB_OUT_SP21; Table 5.2; Appendix Table C.3). A total of

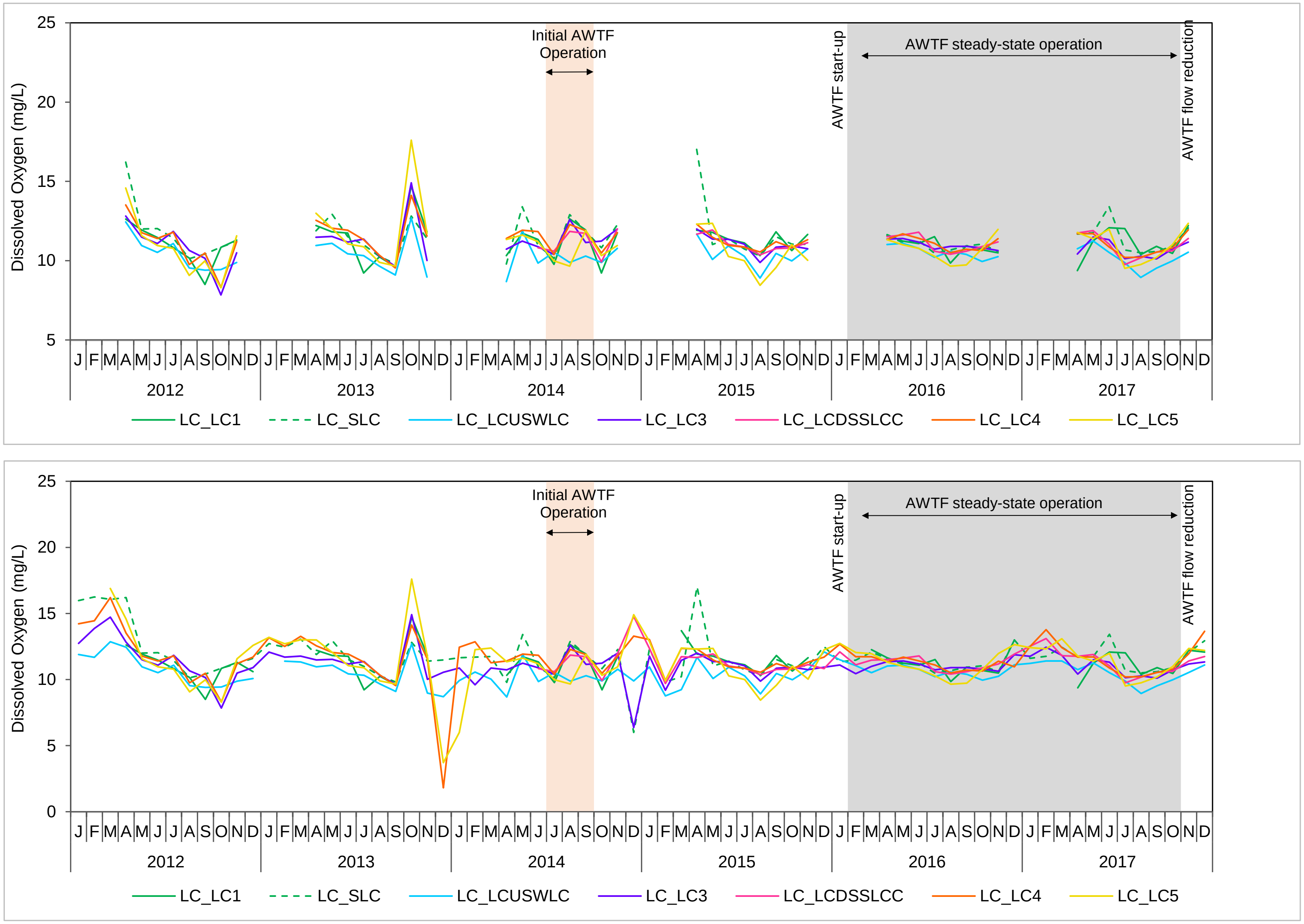

Figure 5.5: Monthly Mean Aqueous Dissolved Oxygen in Line Creek Before and After Operation of the Line Creek AWTF

Notes: Reference stations plotted in green. Top panel shows data for April to November as reflected in BACI ANOVA that included data for LC_LC1, where data were lacking for winter months. All available data are presented in bottom panel. Low dissolved oxygen values on December 9, 2013 for LC_LC4 (1.81) and LC_LC5 (3.71) were included in the plot, but may be due to probe error. Insufficient information was available to exclude these data.

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

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	1	2	0	2
WL_LCI_SP02	West Line Creek AWTF influent	0	2	0	2
WL_BFWB_OUT_SP21	West Line Creek AWTF effluent outfall	3	48	0	48
LC_LC3	Line Creek downstream of West Line Creek and AWTF outfall	0	5	0	5
LC_LCDSSLCC (Compliance)	Line Creek immediately downstream of South Line Creek confluence	0	7	0	7
LC_LC5	Fording River downstream of Line Creek	0	6	0	6

[grey shading] Acute toxicity test failure(s) (> 50% test mortality).

210 96-h rainbow trout 100% (single concentration) acute lethality toxicity tests and 235 48-h *Daphnia magna* 100% (single concentration) acute lethality toxicity tests were conducted throughout the Elk Valley in 2017 as a requirement of Permit 107517. Of the 235 *D. magna* acute toxicity tests, ten (4.3%) exhibited >50% mortality and as such were considered failed test results based on Permit 107517 criteria. There were no failures of rainbow trout toxicity tests in 2017 (i.e., mortality was ≤50% for all 2017 rainbow trout acute toxicity tests).

Teck is currently drafting a Compliance Action Plan that identifies short-term actions and Key Performance Indicators to support the goals of 1) identifying the cause(s) of *D. magna* acute toxicity failures and 2) meeting the Permit 107517 requirement that effluent must not be acutely toxic. As calcite is suspected to be responsible for adverse effects on *D. magna*, it is necessary to understand what factors may favor precipitate formation and determine if these factors are due to laboratory conditions. The draft Compliance Action Plan will identify additional laboratory tests that will help determine which factors may be contributing to observed *D. magna* toxicity and under what conditions toxicity may occur. Because differences in laboratory effluent handling procedures and testing protocols may have contributed to the observed variability in *D. magna* response, the draft Compliance Action Plan will also include an objective to develop and implement standardized laboratory testing protocols for use during acute toxicity testing. The draft Compliance Action Plan will also identify operational activities to be implemented to reduce and prevent calcite precipitation in some priority creeks.

Chronic toxicity testing is performed quarterly on samples collected at the Compliance Point (LC_LCDSSLCC). The first-quarter (Q1) test in 2017 resulted in decreased *Ceriodaphnia dubia* reproduction relative to the Fording River reference sample (Table 5.3; Golder 2018b). Mean *C. dubia* reproduction for the Q1 test was within the local normal range of responses and had an effect size (compared to mean reference response) of 30%, indicating a possible adverse response to test water, although variance in test organism performance related to background water quality could not be discounted (Golder 2018b). No effects to *C. dubia* were observed in samples collected in the remaining quarters (Q2, Q3, and Q4; 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).

P. subcapitata cell-yield was significantly reduced in Q2 of 2017 compared to one of the three reference station samples. However, due to the low effect-size relative to reference (7%) and results falling within the local and regional reference normal ranges, the difference was considered to be a false positive according to decision criteria (Golder 2018b). Testing completed in 2015 and 2016 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).

Effects to the early-life-stage survival and viability of rainbow trout were observed in one of two semi-annual tests conducted (Q4), with reductions in these endpoints relative to two of three reference area samples (Table 5.3). However, reductions in all three reference area samples relative to laboratory controls were also reported, which the laboratory concluded were consistent with effects of microbial growth. Preliminary results of investigative tests using copper-treated toxicity tests have indicated that the observed effects in both reference samples and test water may be microbial rather than a toxicological effect related to water quality (Golder 2018b). Tests conducted in 2015 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 (Table 5.3).

Overall, toxicity testing at the Compliance Point (LC_LCDSSLCC) indicated similar results in 2017 relative to prior years (2015 and 2016; Table 5.3). This suggests that greater toxicity was not observed during AWTF steady state operation compared to before. This is consistent with results of benthic invertebrate community monitoring over the same time period that also indicated no change in community characteristics during AWTF compared to before, other than a potential

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

Quarter		Water Flea (*Ceriodaphnia dubia*)		Green Alga (*Pseudokirchneriella subcapitata*)	Rainbow Trout (*Oncorhynchus mykiss*)			
		Survival (% control-normalized)	Reproduction (% control-normalized)	Cell Yield ($x10^4$ cells/ml)	Survival (% control-normalized)	Viability (% control-normalized)	Length (% control-normalized)	Wet Weight (% control-normalized)
2015	Q1	100	98 ± 14	117 ± 2.2	-	-	-	-
	Q2	100	**82 ± 12**	**69.2 ± 5.7**	102 ± 3	101 ± 6	101 ± 4	101 ± 5
	Q3	100	107 ± 20	83 ± 21	-	-	-	-
	Q4	100	80 ± 24	94 ± 18	88 ± 9	87 ± 9	98 ± 4	103 ± 4
2016	Q1	100	109 ± 16	129.5 ± 5.3	-	-	-	-
	Q2	100	**67 ± 39**	**91.0 ± 4.8**	78 ± 6	88 ± 16	104 ± 2	97 ± 12
	Q3	100	83 ± 21	119.5 ± 5.5	-	-	-	-
	Q4	100	94 ± 18	156.0 ± 4.5	**70 ± 10**	**69 ± 8**	104 ± 1	116 ± 11
2017	Q1	100	**92 ± 38**	211.8 ± 15.4	-	-	-	-
	Q2	100	124 ± 11	134.0 ± 4.2	99 ± 8	93 ± 18	107 ± 6	125 ± 10
	Q3	100	104 ± 25	146.8 ± 10.1	-	-	-	-
	Q4	100	127 ± 15	103.5 ± 4.4	**41 ± 44**	**41 ± 44**	109 ± 3	119 ± 5

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

small increase in larval chironomid (midge) proportions at sampling areas immediately downstream from the AWTF outfall (Section 3.6).

In addition to chronic toxicity testing completed under Permit 107517 (discussed above), chronic toxicity tests were also performed on samples collected in the second and fourth quarters of 2017 in accordance with Line Creek Permit 106970. The samples were collected at the AWTF outfall (WL_BRWB_OUT_SP21), the Compliance Point (LC_LCDSSLCC) and in the Fording River downstream from Line Creek (LC_LC5). No effects on the green alga *P. subcapitata*, or survival of *C. dubia* were observed, and only a single effluent test (Q4) reflected a marginal effect on rainbow trout embryo viability (Table 5.4). However, effects were indicated for *C. dubia* reproduction (samples of AWTF effluent) and duckweed growth.

5.5 Summary

AWTF operation does not appear to have significantly affected water temperature or dissolved oxygen concentrations downstream in Line Creek. Also, toxicity test data do not indicate greater toxicity during compared to before AWTF operation. In other words, there do not appear to be influences associated with WLC AWTF operation that are not already being addressed through monitoring related to Key Questions #1 (productivity) and #2 (tissue selenium accumulation), or that are being specifically addressed elsewhere (i.e., Compliance Action Plan for *D. magna* acute toxicity failures).

Table 5.4: Chronic Toxicity Results[a] for Tests Completed Under Permit 106970

Station	Quarter [b]	Water Flea (*Ceriodaphnia dubia*)		Green Alga (*Pseudokirchneriella Subcapitata*)	Duckweed (*Lemna minor*)		Rainbow Trout (*Oncorhynchus mykiss*)
		Survival LC50[c]	Reproduction IC25[d]	Growth IC25	Frond Count IC25	Dry Weight IC25	Embryo Viability EC25[e]
WL_BFWB_OUT_SP21	Q2	>100	50.3 (33.6-60.3)	>95.2	30.6 (22.2-40.2)	>97	>100
	Q4	>100	61.3 (23.2-72.0)	>95.2	21.4 (15.4-30.3)	>97	94.7 (NA-NA)
LC_LCDSSLCC	Q2	>100	64.2 (2.6-NA)	>95.2	38.8 (24.4-63.3)	70.8 (33.3-97)	>100
	Q4	>100	80.6 (39.1-100)	>95.2	65.2 (19.5-74.6)	77.7 (20.0-92.9)	>100
LC-LC5	Q2	>100	>100	>95.2	58.9 (42.8-72.2)	89.2 (70.2-97)	>100
	Q4	>100	>100	>95.2	87.1 (71.1-97.0)	>97	>100

[a] Confidence Limits are given in parentheses if reported. NA = not available.

[b] Q2 samples were collected October 2, 2017 and Q4 samples were collected April 24, 2017.

[c] LC50 - Concentration causing lethality to 50% of exposed organisms.

[d] IC25 - Concentration causing 25% inhibition relative to controls.

[e] EC25 - Concentration causing effect to 25% of exposed organisms.

6 SUMMARY

Evaluation of 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 2017 growing season, (June 15 to September 30), as they were during previous years. However, a significant increase in total phosphorus and orthophosphate concentrations ($p<0.1$) was detected in Line Creek immediately downstream from the discharge (LC_LC3) during AWTF operation (concentrations of 0.007 and 0.0028 mg/L, respectively) compared to before AWTF operation (0.004 and 0.0022 mg/L, respectively). No changes in total phosphorus and orthophosphate concentrations were detected at the Compliance Point (LC_LCDSSLCC) or stations farther downstream relative to reference station concentrations during AWTF operation compared to before. Periphyton chlorophyll-a and ash-free dry mass levels did not change significantly ($p>0.1$) in Line Creek relative to reference area levels during AWTF operation (2016 to 2017) compared to previous years when the AWTF system was not operating (2013 and 2015). Variation in these periphyton endpoints was not explained by variation in aqueous nutrient concentrations (total phosphorus, orthophosphate, or nitrate) among areas or over time (i.e., no correlation). These findings confirm results from a previous analysis (Minnow 2017b), that resulted in removal of the periphyton chlorophyll-a SPO at the Compliance Point from Permit 107517 in October 2017.

Benthic invertebrate biomass and density in Line Creek, as determined from Hess sampling, also showed no significant change ($p>0.1$) during AWTF operation (2016 to 2017) compared to before (2015). Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, indicated no change in community characteristics during AWTF operation compared to before, other than possibly a small increase in larval chironomid (midge) proportions at sampling areas immediately downstream from the AWTF outfall. Overall, the data indicate that AWTF operation is not affecting biological productivity downstream from the AWTF (summarized in Table 6.1).

Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate, with lesser amounts (~1-2%) of chemically reduced forms such as selenite. Although the WLC AWTF successfully reduced concentrations of total selenium in Line Creek, the effluent contained higher proportions of chemically reduced selenium species, resulting in increased concentrations of non-selenate selenium species in Line Creek. Some of the non-selenate species of selenium are more readily accumulated by aquatic biota than selenate. Benthic invertebrate tissue monitoring in Line Creek in 2016 and 2017 identified higher selenium concentrations downstream from the AWTF compared to upstream or before AWTF operation. Despite these increases in benthic invertebrate tissue concentrations, benthic invertebrate community characteristics were similar during AWTF steady-state operation compared to before. Selenium concentrations were also elevated in the tissues of some individual bull trout and westslope cutthroat trout in 2017 compared to concentrations observed prior to AWTF operation. Benthic invertebrate tissue selenium concentrations in the Fording River were similar downstream from Line Creek, compared to upstream, indicating that the effects of AWTF on aquatic food web accumulation were limited to Line Creek (summarized in Table 6.1).

In response to selenium concentration results in tissue, a decision was made to shut down the WLC AWTF until a technical solution could be implemented. The AWTF will remain shut down until it can be recommissioned with AOP beginning in August 2018. The AOP is designed to reverse the shift in selenium species in ATWF effluent from chemically reduced species back to a selenate-dominated condition, and discharge to the receiving environment with the AOP is currently anticipated to begin near the end of September 2018.

AWTF operation does not appear to have significantly affected water temperature or dissolved oxygen concentrations downstream in Line Creek. Also, toxicity testing does not indicate greater toxicity during AWTF operation compared to before. In general, there does not appear to be influences associated with WLC AWTF operation that are not already being addressed through monitoring related to Key Questions #1 (productivity) and #2 (tissue selenium accumulation) (see summary in Table 6.1), or that are being specifically addressed elsewhere (i.e., Compliance Action Plan for *D. magna* acute toxicity failures).

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	BACI analysis: Before = 2012, 2013, 2015; After = 2016, 2017. Stations: Ref = LC_LC1, LC_SLC; Exp = LC_LC3, LC_LC4	Significant increase at all mine-exposed stations in 2017 relative to 2015, but no difference relative to other before years (2012, 2013). Difference likely reflects lower nitrate in 2015 than increase in 2017.	Periphyton productivity	Visual Coverage Scores	Coverage scored according to CABIN guidance (Environment Canada 2012)	Coverage scored as moderate at mine-exposed and reference stations.
						Chlorophyll-a [a]	**1)** BACI analysis: Before = 2013, 2015; After = 2016, 2017 Stations: Ref = SLINE, LI24; Exp = LILC3, LIDSL, LI8 **2)** Comparison to SPO and BCWQG **3)** Relationships with nutrient concentrations	**1)** No effect associated with AWTF operation. **2)** Chlorophyll-a exceeded SPO[b]. **3)** Variation in periphyton chlorophyll-a not explained by nutrient concentrations or AWTF operation.
						AFDM	BACI analysis: Before = 2013, 2015; After = 2016, 2017 Stations: Ref = SLINE, LI24; Exp = LILC3, LIDSL, LI8	No effect associated with AWTF operation.
					Benthic invertebrate productivity	Biomass [a]	BACI analysis: Before = 2015; After = 2016, 2017. Stations: Ref = SLINE; Exp = LILC3, LIDSL	No effect associated with AWTF operation.
						Density [a]	BACI analysis: Before = 2015; After = 2016, 2017. Stations: Ref = SLINE; Exp = LILC3, LIDSL	Significant increase during AWTF operation at LILC3 and LIDSL, likely related to decrease at SLINE ref area than increase at mine-exposed areas.
		Phosphorus [a]	**1)** BACI analysis: Before = 2013 and 2015; After = 2016, 2017 (winter data included) Stations: Ref = LC_SLC; Exp = LC_LC3, LC_LC4 **2)** Comparison to SPO **3)** Comparison to baseline 97.5th percentile; LC_LC3	**1)** Significant increase during AWTF operation at LC_LC3. **2)** Phosphorus did not exceed SPO. **3)** Elevation over baseline during AWTF operation at LC_LC3, but no temporal trend.	Benthic invertebrate community structure	Abundance	Comparison to past observations and reference normal range (NR)	No evidence of effect associated with AWTF operation on secondary productivity.
						Richness	Comparison to past observations and reference normal range (NR)	All results within NR. No evidence of effect associated with AWTF operation.
		Orthophosphate [a]	**1)** BACI analysis: Before = 2012, 2013, 2015; After = 2016, 2017 (winter data excluded) Stations: Ref = LC_LC1, LC_SLC; Exp = LC_LC3, LC_LC4 **2)** Comparison to baseline 97.5th percentile; LC_LC3	**1)** Increase associated with AWTF operation at LC_LC3 and LC_LC4. **2)** Slight elevation over baseline mean at LC_LC3.		%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 AWTF operation. Slight increase in %C at exposed stations during AWTF operation compared to before.

[a] BACI analysis was performed multiple different ways to include various stations and years of data. The results primarily interpreted in the report text are presented. Results for the BACI indicate changes in an endpoint at mine-exposed areas relative to reference, during AWTF steady-state operation compared to before.
[b] In 2017, based on an evaluation of monitoring results since the AWTF came into operation, Teck submitted a request to amend Permit 107517 to remove the SPO requirement for periphyton chlorophyll-a measurements (Minnow 2017b). The permit was amended in October, 2017, to remove the periphyton chlorophyll-a SPO, therefore data from the 2017 growing season represent the final year of application of this SPO.
Ref = Reference sampling station; Exp = Mine-exposed sampling station; BACI = Before-After-Control-Impact analysis; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; AFDM = Ash-Free-Dry-Mass; Ephem = Ephemeroptera; Rhyac = Rhyacophilidae; BT = Bull trout; WCT = Westslope cutthroat trout

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

<table>
<tr><th rowspan="2">Key Questions</th><th colspan="4">Water</th><th colspan="4">Biological</th></tr>
<tr><th>Measurement Endpoint</th><th>Indicator</th><th>Analysis/Evaluation</th><th>Result</th><th>Measurement Endpoint</th><th>Indicator</th><th>Analysis/Evaluation</th><th>Result</th></tr>
<tr><td rowspan="7">Are tissue selenium concentrations reduced downstream from the AWTF?</td><td colspan="2">Total and dissolved selenium concentrations</td><td>1) Repeated measures ANOVA trend analysis: 2012-2017 for total Se at LC_LC1
2) Visual inspection of data</td><td>1) Significant increases in total Se after 2014, 2015, 2016.
2) Increase in total Se downstream of AWTF during flow reduction.</td><td rowspan="4">Tissue Selenium</td><td>Periphyton</td><td>Results confounded by the presence of abiotic particles containing inorganic selenium, no analyses completed.</td><td>No analyses completed.</td></tr>
<tr><td colspan="2" rowspan="3">Selenium speciation</td><td rowspan="3">Comparison downstream relative to upstream from the AWTF, and of Line Creek input to Fording River</td><td rowspan="3">Greater concentrations of non-selenate selenium species in Line Creek downstream relative to upstream of AWTF during AWTF operation.

Selenium species and the sums of all species in Fording River usually lower downstream of input from Line Creek compared to upstream.</td><td>Composite-taxa samples [a]</td><td>1) BACI analysis: Before = 2012; After = 2016, 2017
Stations: Ref = SLINE, LI24; Exp = LILC3, LIDSL, LI8
2) Spatial analysis using ANOVA
3) Comparison to reference normal range (NR)
4) Comparison to site-specific benchmarks</td><td>1) Significant increase in tissue [Se] during AWTF operation at all mine-exposed areas.
2) Significantly higher tissue [Se] at all mine-exposed areas relative to upstream of AWTF and reference. Concentrations in Fording River similar downstream and upstream of Line Creek input.
3) Tissue [Se] higher than NR at all mine-exposed areas and upstream of AWTF during AWTF operation.
4) Tissue [Se] of one or more samples during AWTF operation higher or equal to level 1 benchmark at all Line Creek mine-exposed stations downstream of AWTF outfall, and higher than level 2 benchmark at LILC3.</td></tr>
<tr><td>Single taxon samples [a]</td><td>BACI analysis (Ephem, Rhyac): Before = 2015; After = 2016, 2017
Stations: Ref = SLINE, LI24; Exp = LILC3, LIDSL, LI8 (Rhyac only), FO23 (Ephem only)</td><td>Significant increase in Ephem tissue Se during AWTF operation at LILC3 and LIDSL. No effect on Rhyac tissue Se associated with AWTF operation.</td></tr>
<tr><td>Fish
(WCT and BT)</td><td>Comparison to past observations and site-specific benchmarks</td><td>WCT: Fish captured near AWTF outfall in 2017 had higher muscle [Se] than previously (2012 and 2016), and estimated ovary [Se] higher than level 2 benchmark.
BT: Estimated ovary Se in 2017 below level 1 benchmark. Muscle [Se] higher in fish presumed to be resident (young males) than in larger adults presumed to be migratory spawners.</td></tr>
<tr><td colspan="2" rowspan="3">Selenium bioaccumulation model</td><td rowspan="3">Comparison of composite-taxa benthic tissue selenium results to one-step water-to-invertebrate model</td><td rowspan="3">Most tissue selenium concentration similar or less than model predictions. Samples collected nearest the AWTF in 2016 and 2017 during AWTF operation higher than model predictions.</td><td rowspan="3">Benthic invertebrate community structure</td><td>Abundance</td><td>Comparison to past observations and reference normal range (NR)</td><td>No evidence of effect associated with AWTF operation.</td></tr>
<tr><td>Richness</td><td>Comparison to past observations and reference normal range (NR)</td><td>All results within NR. No evidence of effect associated with AWTF operation.</td></tr>
<tr><td>%EPT, %E, %C</td><td>Comparison to past observations and reference normal range (NR)</td><td>%E and %EPT within range of past observations; no evidence of effect associated with AWTF operation. Slight increase in %C at exposed stations during AWTF operation compared to before.</td></tr>
</table>

[a] BACI analysis was performed multiple different ways to include various stations and years of data. The results primarily interpreted in the report text are presented. Results for the BACI indicate changes in an endpoint at mine-exposed areas relative to reference, during AWTF steady-state operation compared to before.

[b] In 2017, based on an evaluation of monitoring results since the AWTF came into operation, Teck submitted a request to amend Permit 107517 to remove the SPO requirement for periphyton chlorophyll-a measurements (Minnow 2017b). The permit was amended in October, 2017, to remove the periphyton chlorophyll-a SPO, therefore data from the 2017 growing season represent the final year of application of this SPO.

Ref = Reference sampling station; Exp = Mine-exposed sampling station; BACI = Before-After-Control-Impact analysis; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; AFDM = Ash-Free-Dry-Mass; Ephem = Ephemeroptera; Rhyac = Rhyacophilidae; BT = Bull trout; WCT = Westslope cutthroat trout

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 dowstream 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 AWTF operation.
		Routine monitoring	BACI analysis: Before = 2012, 2013, 2015; After = 2016, 2017 (winter data included). Stations: Ref = LC_SLC; Exp = LC_LC3, LC_LC4	No effect associated with AWTF operation.				
	Dissolved oxygen		**1)** BACI analysis: Before = 2012, 2013, 2015; After = 2016, 2017 (winter data included). Stations: Ref = LC_SLC; Exp = LC_LC3, LC_LC4 **2)** Comparison to BCWQG	**1)** No effect associated with AWTF operation. **2)** 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 effect associated with AWTF operation.
	Toxicity		Comparison of chronic and acute toxicity test results to reference, and past results	Results at Compliance Point similar to past years (2015, 2016), suggesting no greater toxicity during AWTF operation than before.		%EPT, %E, %C	Comparison to past observations and reference normal range (NR)	%E and %EPT within range of past observations; no evidence of effect associated with AWTF operation. Slight increase in %C at exposed stations during AWTF operation compared to before.

[a] BACI analysis was performed multiple different ways to include various stations and years of data. The results primarily interpreted in the report text are presented. Results for the BACI indicate changes in an endpoint at mine-exposed areas relative to reference, during AWTF steady-state operation compared to before.

[b] In 2017, based on an evaluation of monitoring results since the AWTF came into operation, Teck submitted a request to amend Permit 107517 to remove the SPO requirement for periphyton chlorophyll-a measurements (Minnow 2017b). The permit was amended in October, 2017, to remove the periphyton chlorophyll-a SPO, therefore data from the 2017 growing season represent the final year of application of this SPO.

Ref = Reference sampling station; Exp = Mine-exposed sampling station; BACI = Before-After-Control-Impact analysis; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; AFDM = Ash-Free-Dry-Mass; Ephem = Ephemeroptera; Rhyac = Rhyacophilidae; BT = Bull trout; WCT = Westslope cutthroat trout

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APPENDIX A
SUPPORTING DATA – PRODUCTIVITY EVALUATION

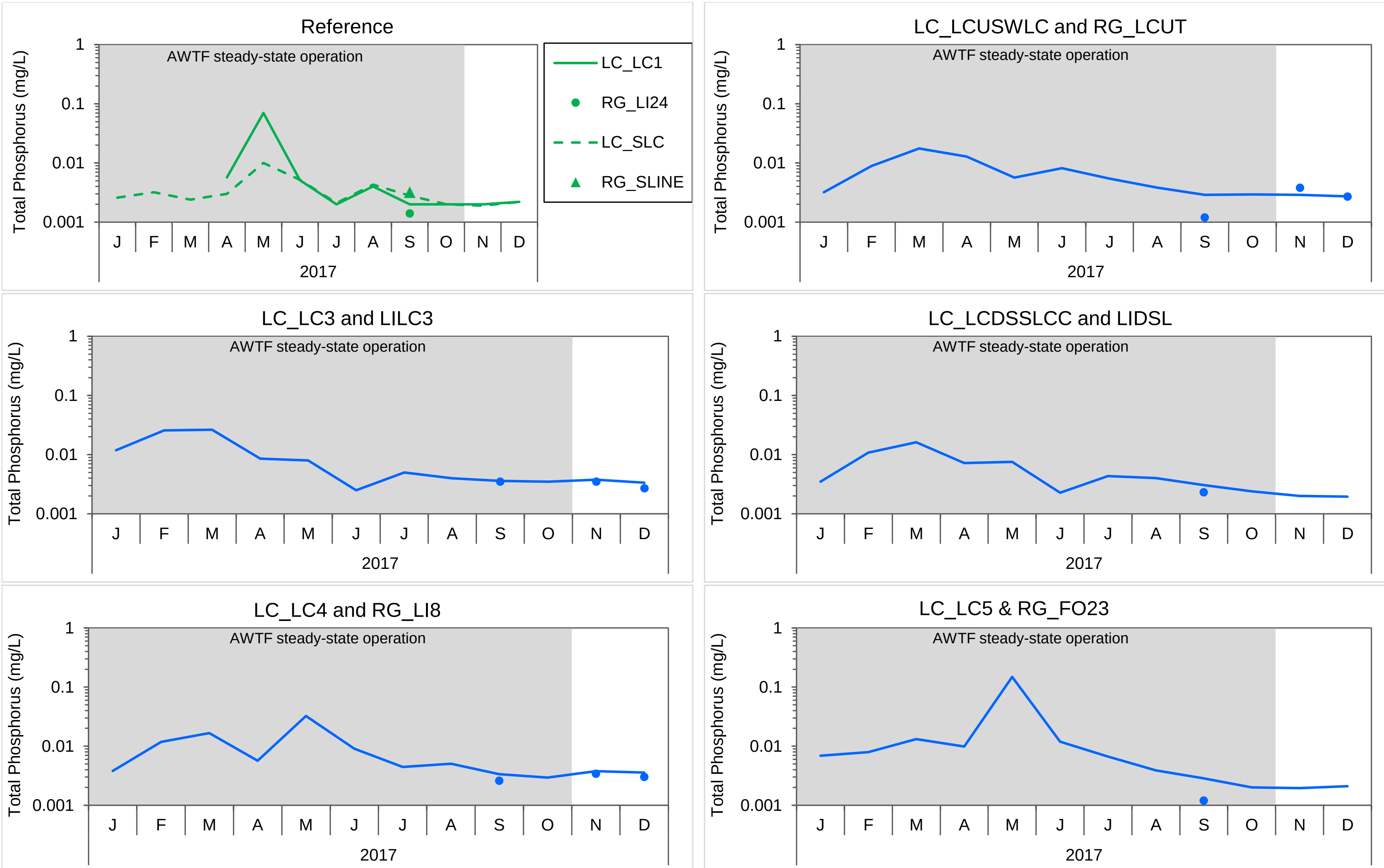


Figure A.1: Monthly Mean Total Phosphorus Concentrations at Teck Monitoring Stations (Lines) Compared to Individual Samples Collected at Biological Sampling Areas

Notes: Reference stations plotted in green and mine-exposed in blue. Monthly means at Tech water quality monitoring stations are plotted with lines and non-detect samples at the Laboratory Reporting Limit (LRL) . Biological area samples from corresponding areas are plotted with filled (> LRL) and open (< LRL) symbols.

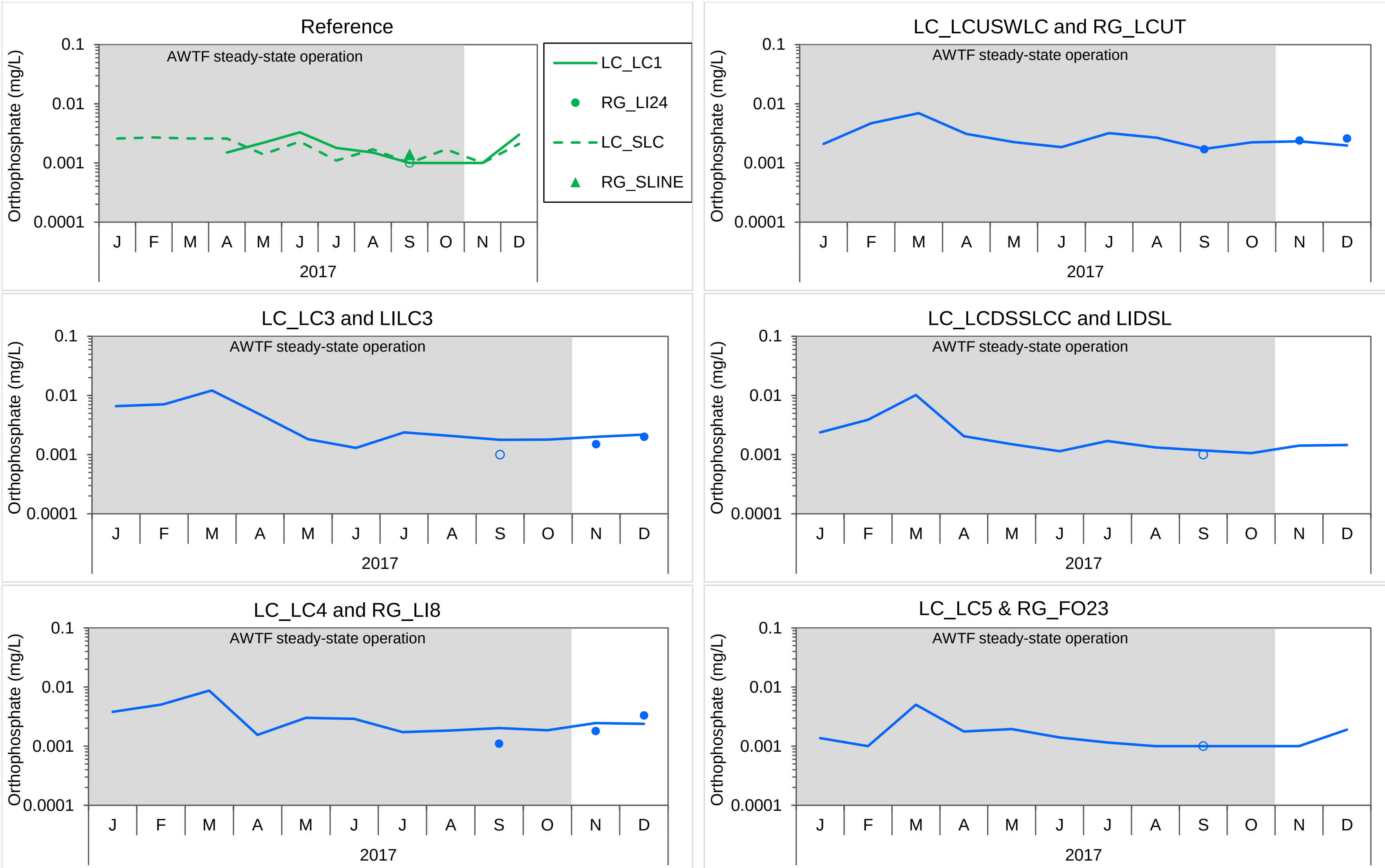


Figure A.2: Monthly Mean Orthophosphate Concentrations at Teck Monitoring Stations (Lines) Compared to Individual Samples Collected at Biological Sampling Areas

Notes: Reference stations plotted in green and mine-exposed in blue. Monthly means at Tech water quality monitoring stations are plotted with lines and non-detect samples at the Laboratory Reporting Limit (LRL) . Biological area samples from corresponding areas are plotted with filled (> LRL) and open (< LRL) symbols.

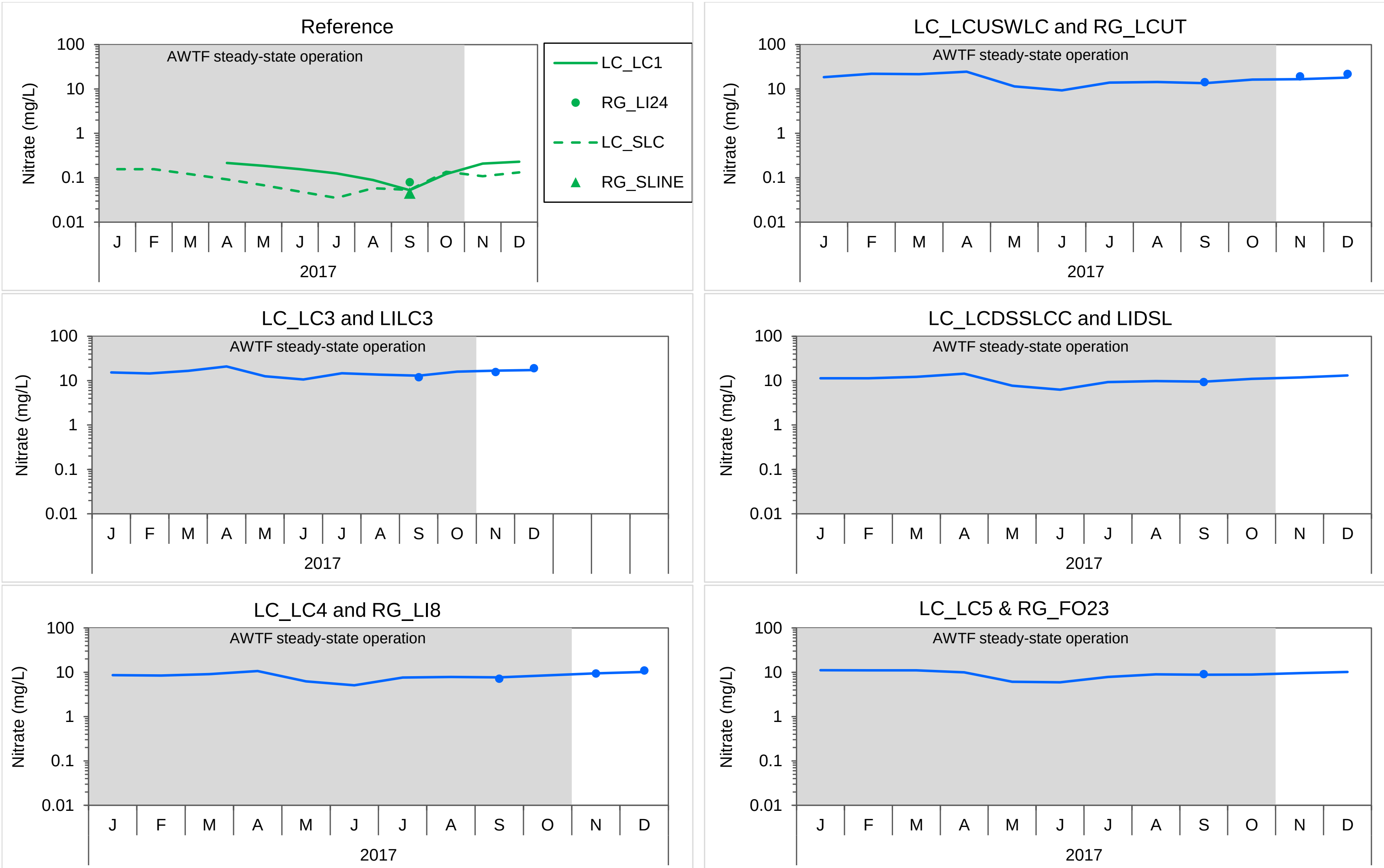


Figure A.3: Monthly Mean Nitrate Concentrations at Teck Monitoring Stations (Lines) Compared to Individual Samples Collected at Biological Sampling Areas

Notes: Reference stations plotted in green and mine-exposed in blue. Monthly means at Tech water quality monitoring stations are plotted with lines and non-detect samples at the Laboratory Reporting Limit (LRL) . Biological area samples from corresponding areas are plotted with filled (> LRL) and open (< LRL) symbols.

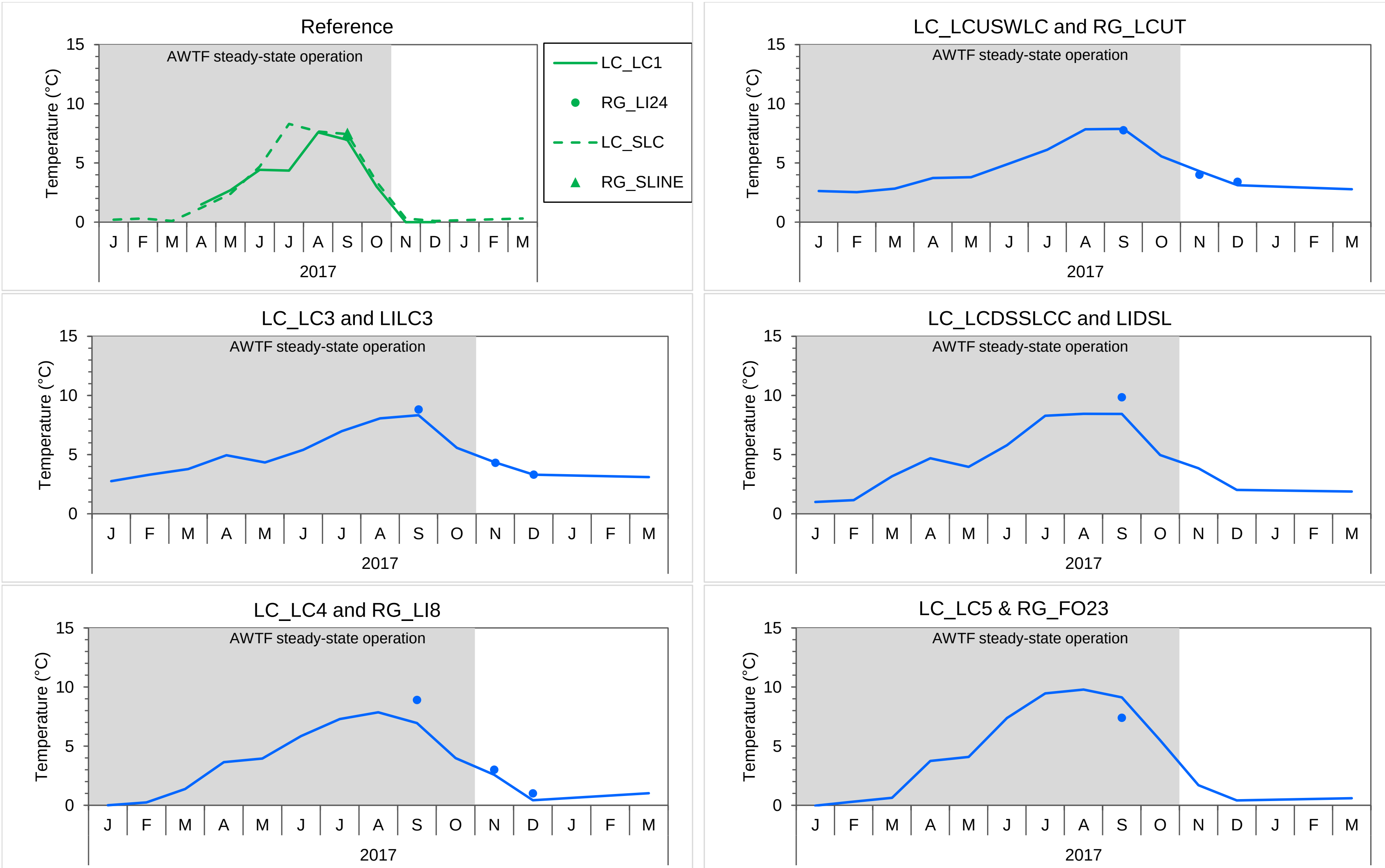


Figure A.4: Monthly Mean Temperature at Teck Monitoring Stations (Lines) Compared to Individual Samples Collected at Biological Sampling Areas

Notes: Reference stations plotted in green and mine-exposed in blue. Monthly means at Tech water quality monitoring stations are plotted with lines and non-detect samples at the Laboratory Reporting Limit (LRL) . Biological area samples from corresponding areas are plotted with filled (> LRL) and open (< LRL) symbols.

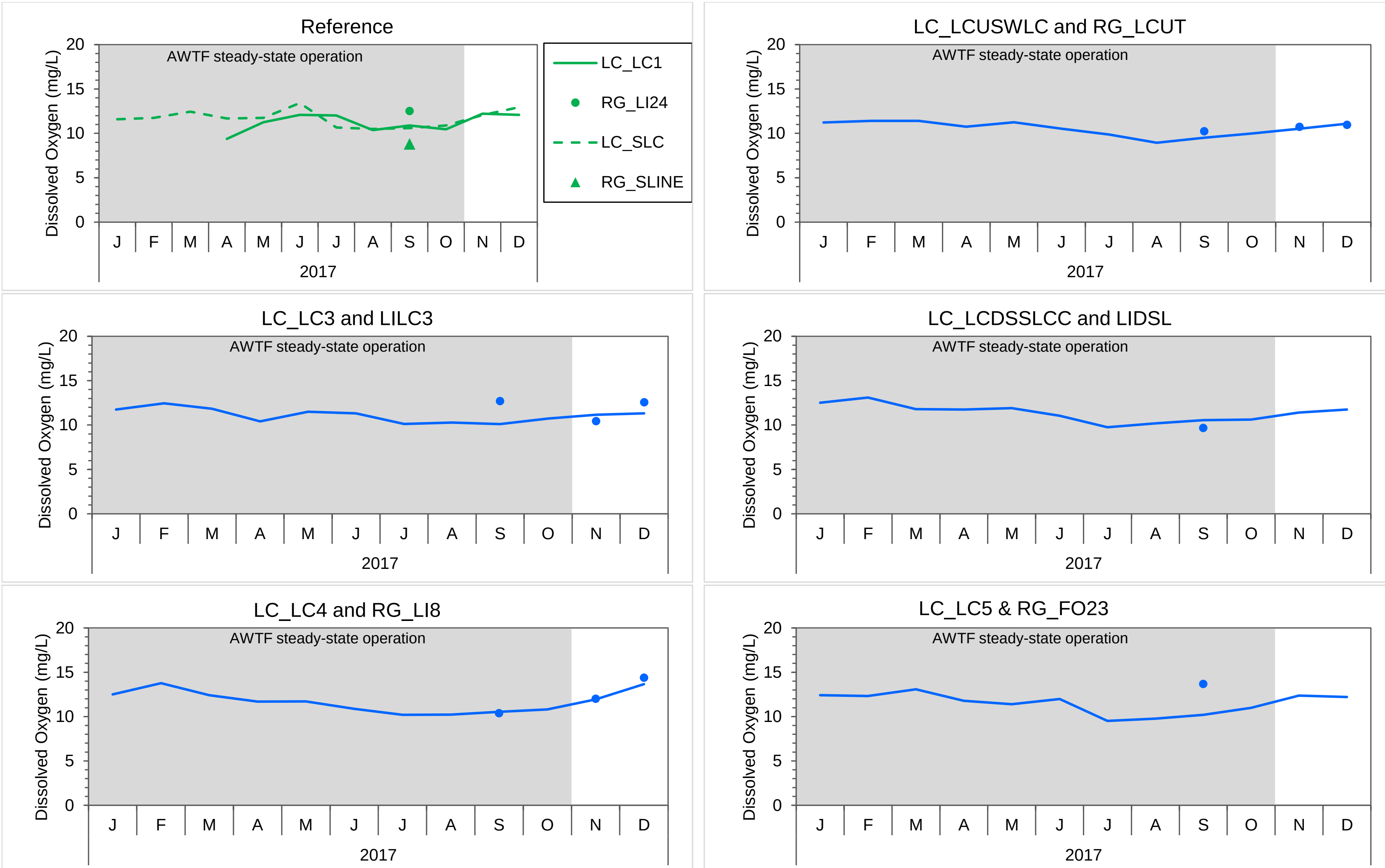


Figure A.5: Monthly Mean Dissolved Oxygen Concentrations at Teck Monitoring Stations (Lines) Compared to Individual Samples Collected at Biological Sampling Areas

Notes: Reference stations plotted in green and mine-exposed in blue. Monthly means at Tech water quality monitoring stations are plotted with lines and non-detect samples at the Laboratory Reporting Limit (LRL) . Biological area samples from corresponding areas are plotted with filled (> LRL) and open (< LRL) symbols.

Figure A.6: Periphyton at Station LI24, September 2017

Note: Top photo is of rocks selected for periphyton sampling, bottom is view downstream.

Figure A.6: Periphyton at SLINE, September 2017

Note: Top photo is of rocks selected for periphyton sampling, bottom is view across stream.

Figure A.6: **Periphyton at LCUT, September 2017**

Note: Top photo is of rocks selected for periphyton sampling, bottom is view across stream.

Figure A.6: Periphyton at LISP23 (top) and LISP24 (bottom), September 2017

Figure A.6: Periphyton at LIDSL, September 2017

Note: Top photo is of rocks selected for periphyton sampling, bottom is view downstream.

Figure A.6: Periphyton at LIDCOM, September 2017

Note: Top photo is of rocks selected for periphyton sampling, bottom is view across stream.

Figure A.6: **Periphyton at LI8, September 2017**

Note: Top photo is of rocks selected for periphyton sampling, bottom is view across stream.

Figure A.6: Periphyton at FRUL, September 2017

Note: Top photo is of rocks selected for periphyton sampling, bottom is view across stream.

Figure A.6: Periphyton Coverage at FO23, September 2017

Note: Top photo is of rocks selected for periphyton sampling, bottom is view of substrate.

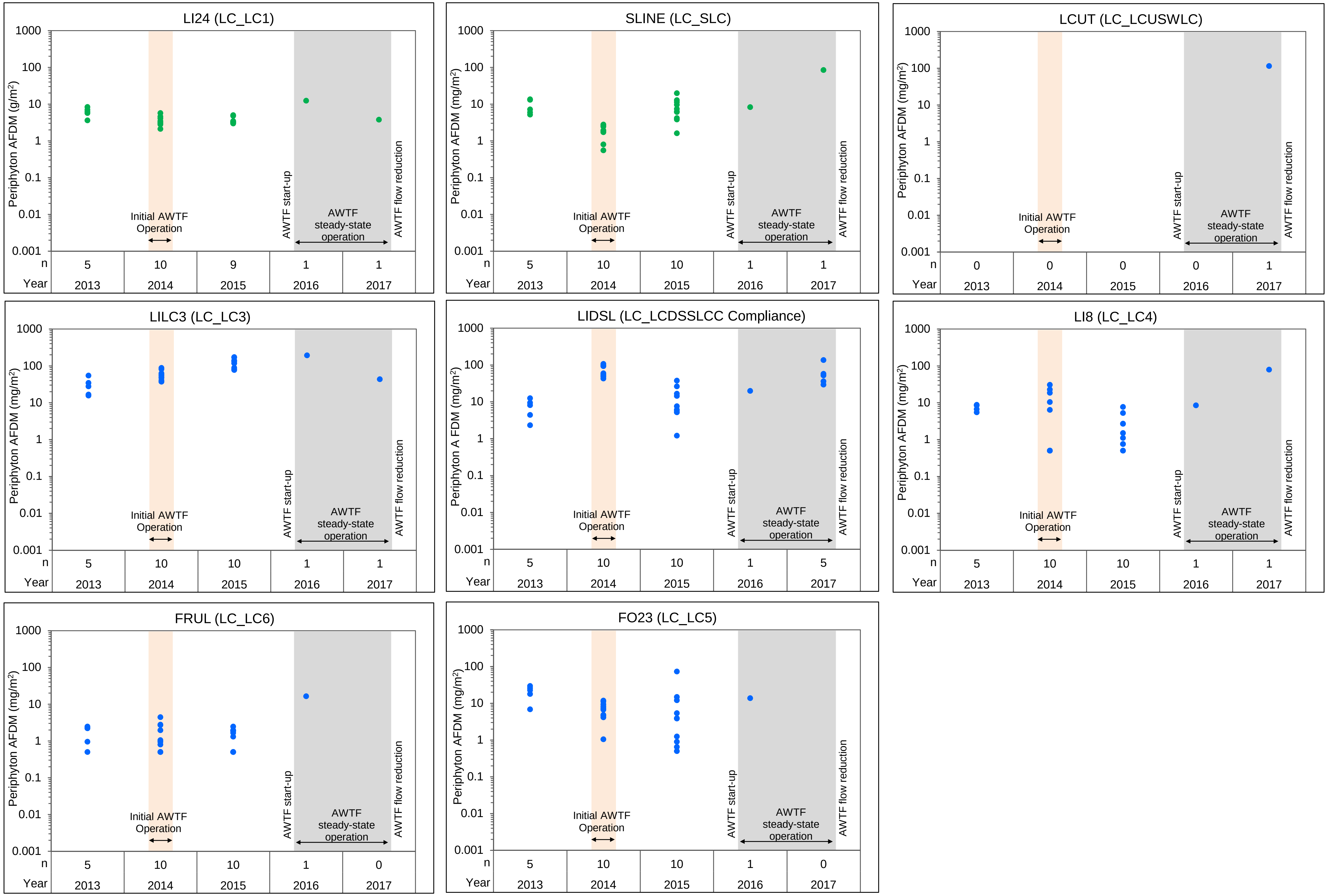


Figure A.7: Periphyton Ash-Free-Dry-Mass (AFDM) in Line Creek and Fording River, Line Creek LAEMP, 2013 to 2017

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. LI24=LC_LC1, SLINE=LC_SLC, LCUT=LC_LCUSWCC, LILC3=LC_LC3, LIDSL=LC_LCDSSLCC (Compliance), LI8=LC_LC4, FRUL=LC_LC6, and FO23=LC_LC5.

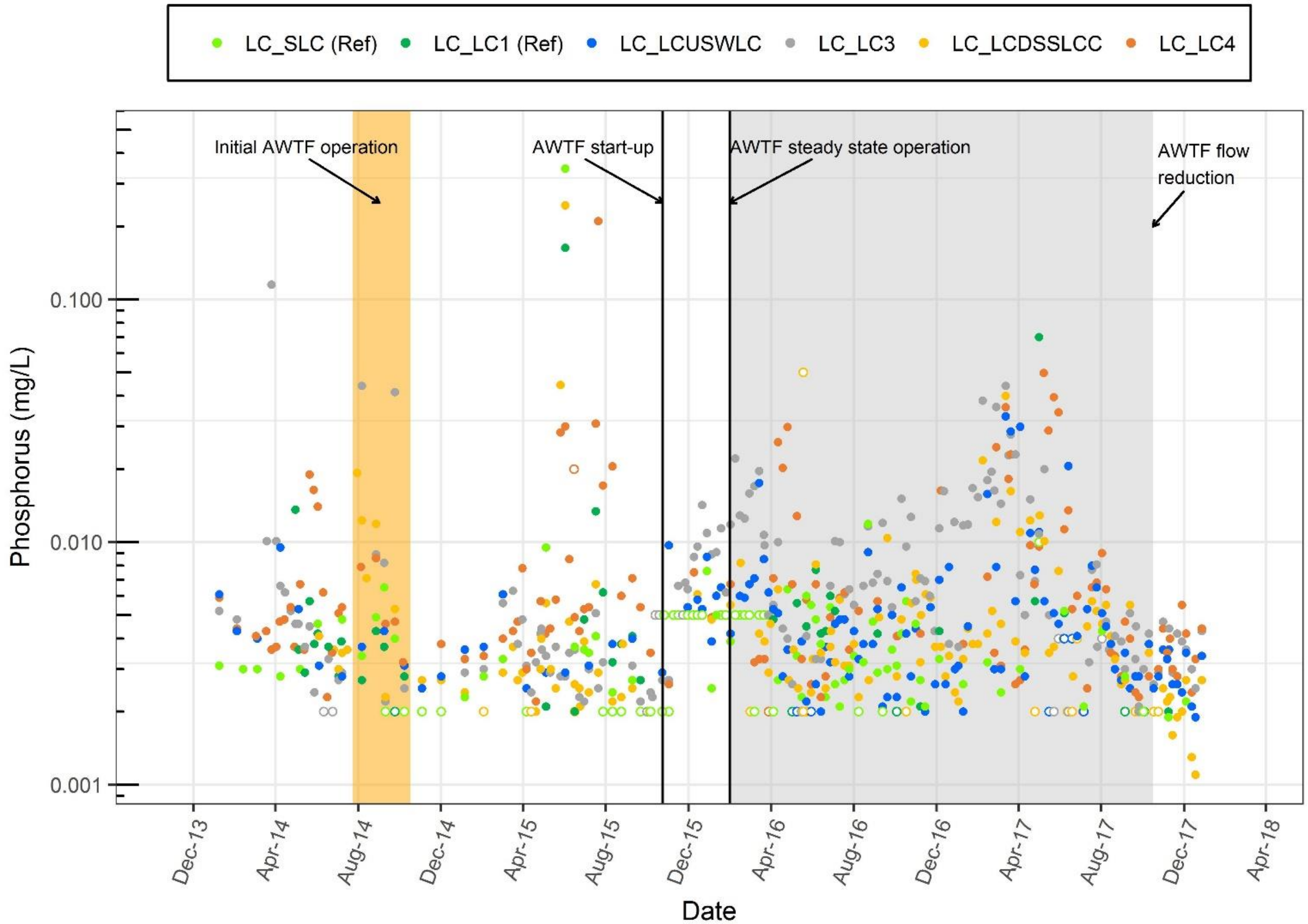


Figure A.8: Total Phosphorus Concentrations in Water Collected from Line Creek, Line Creek LAEMP, 2014 to 2017

Notes: Hollow symbols indicate results less than the laboratory reporting limit (LRL). If multiple results existed for a given location and day, the first entry in the database was presented. Results for water quality sampling locations are presented only (not those associated with biological sampling locations). AWTF discharge during steady state operation (indicated by grey shading) is ~5,300 to 5,500 m^3/day, and AWTF during flow reduction is ~2,500 m^3/day.

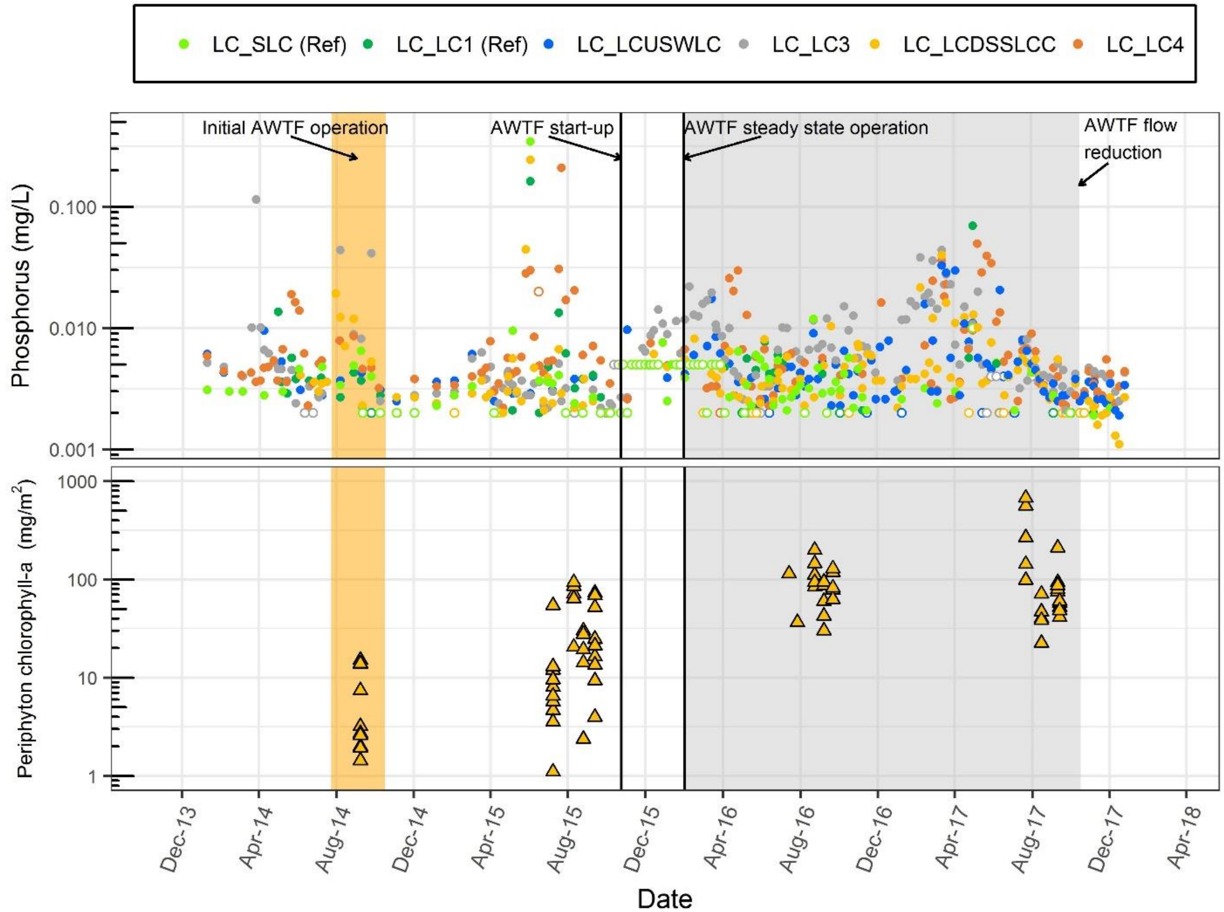


Figure A.9: **Total Phosphorus Concentrations in Water and Associated Periphyton Chlorophyll-a Concentrations from Line Creek, Line Creek LAEMP, 2014 to 2017**

Notes: Periphyton chlorophyll-a samples were collected from the biological monitoring station LIDSL, which is associated with the water quality monitoring compliance point (LC_LCDSSLCC). Hollow symbols indicate results less than the laboratory reporting limit (LRL). If multiple water quality results existed for a given location and day, the first entry in the database was presented. Total phosphorus results for water quality sampling locations are presented only (not those associated with biological sampling locations). AWTF discharge during steady state operation (indicated by grey shading) is ~5,300 to 5,500 m^3/day, and AWTF during flow reduction is ~2,500 m^3/day.

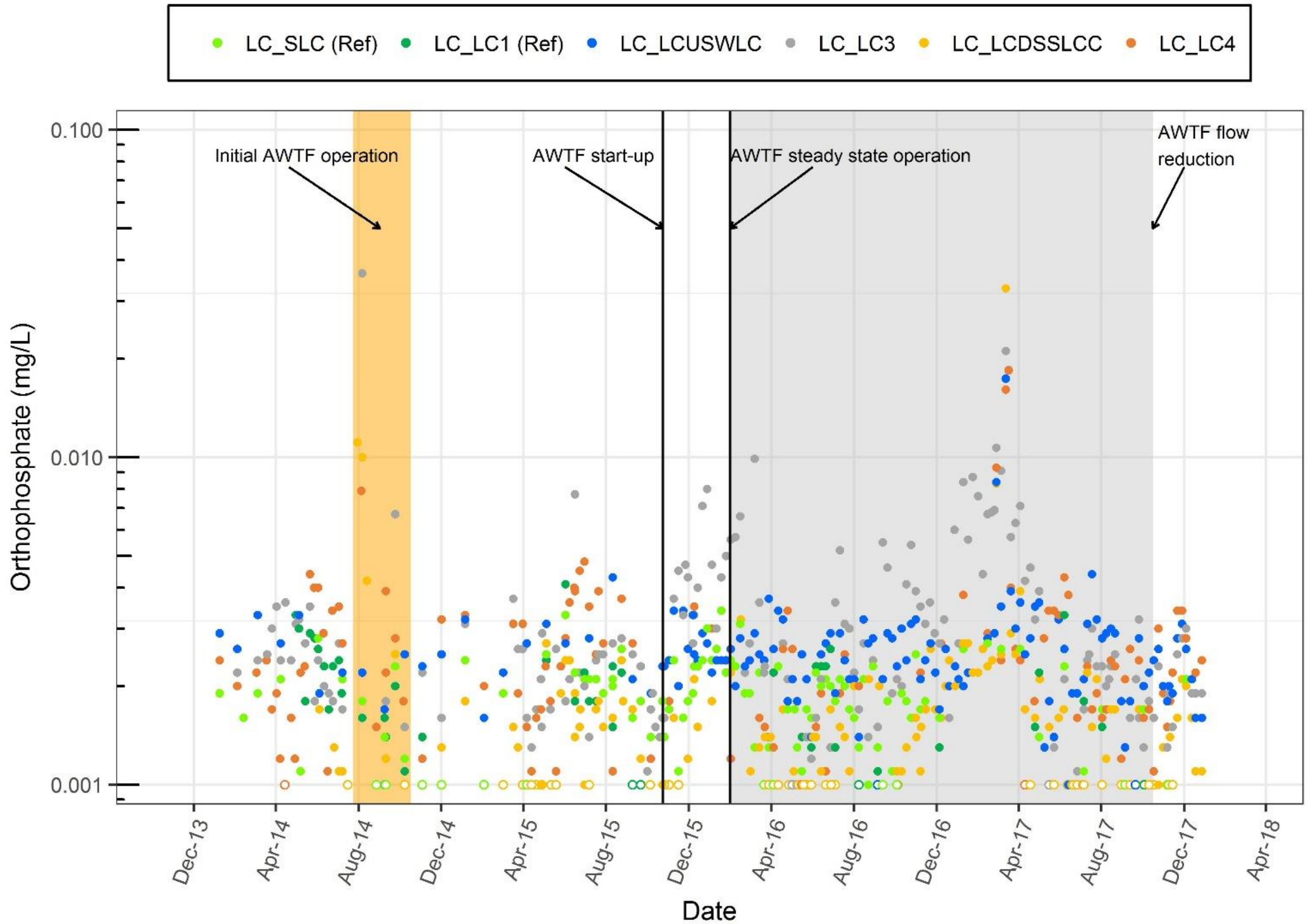


Figure A.10: Orthophosphate Concentrations in Water Collected from Line Creek, Line Creek LAEMP, 2014 to 2017

Notes: Hollow symbols indicate results less than the laboratory reporting limit (LRL). If multiple results existed for a given location and day, the first entry in the database was presented. Results for water quality sampling locations are presented only (not those associated with biological sampling locations). AWTF discharge during steady state operation (indicated by grey shading) is ~5,300 to 5,500 m^3/day, and AWTF during flow reduction is ~2,500 m^3/day.

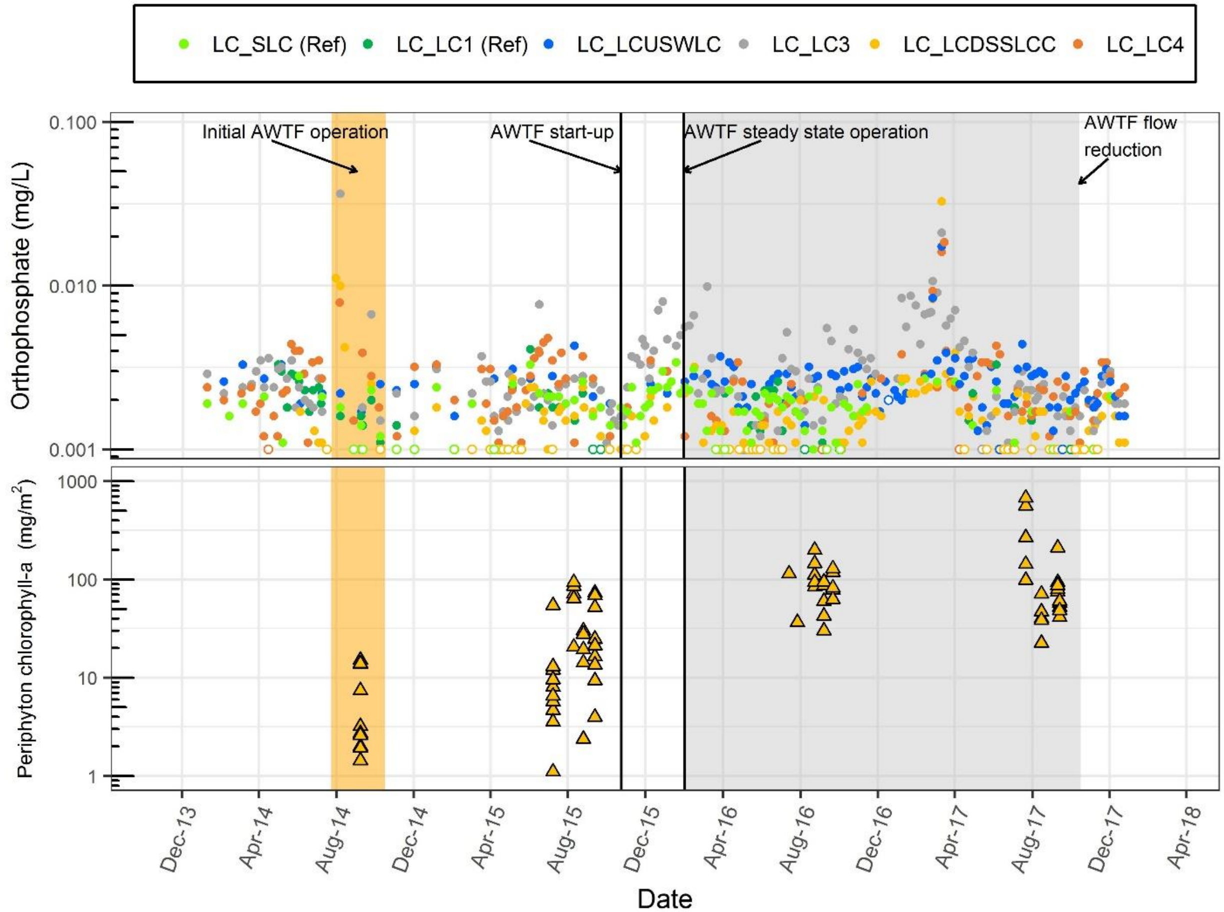
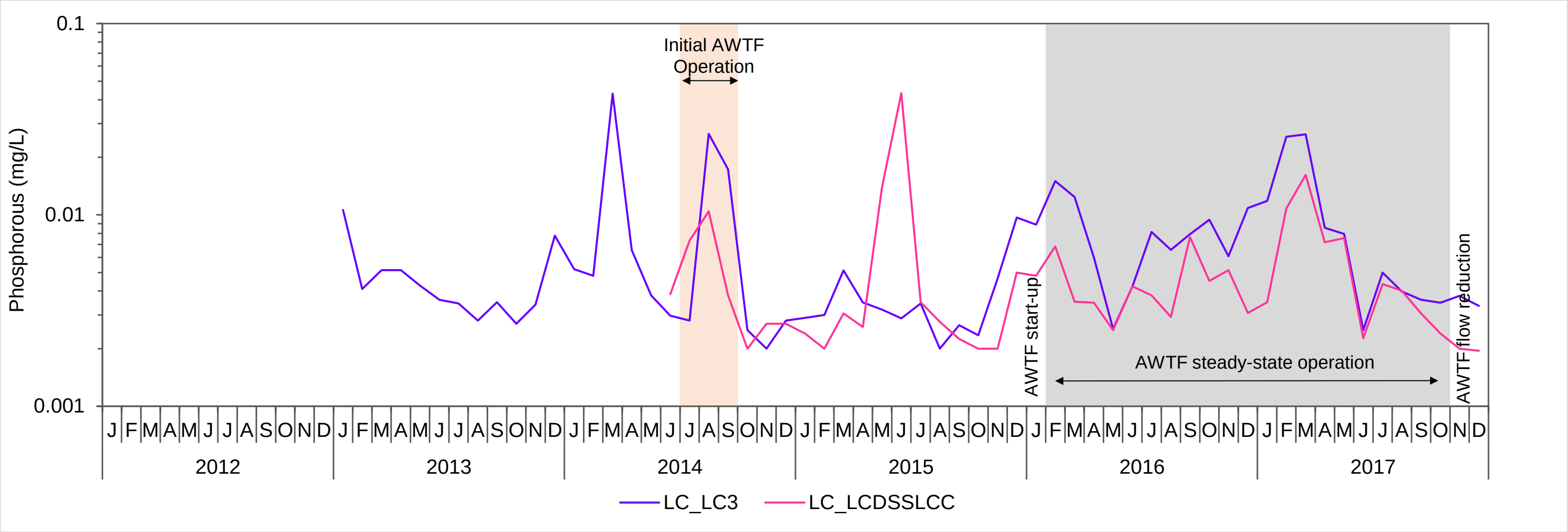


Figure A.11: Orthophosphate Concentrations in Water and Associated Periphyton Chlorophyll-a Concentrations from Line Creek, Line Creek LAEMP, 2014 to 2017

Notes: Periphyton chlorophyll-a samples were collected from the biological monitoring station LIDSL, which is associated with the water quality monitoring Compliance Point (LC_LCDSSLCC). Hollow symbols indicate results less than the laboratory reporting limit (LRL). If multiple water quality results existed for a given location and day, the first entry in the database was presented. Orthophosphate results for water quality sampling locations are presented only (not those associated with biological sampling locations). AWTF discharge during steady state operation (indicated by grey shading) is ~5,300 to 5,500 m^3/day, and AWTF during flow reduction is ~2,500 m^3/day.



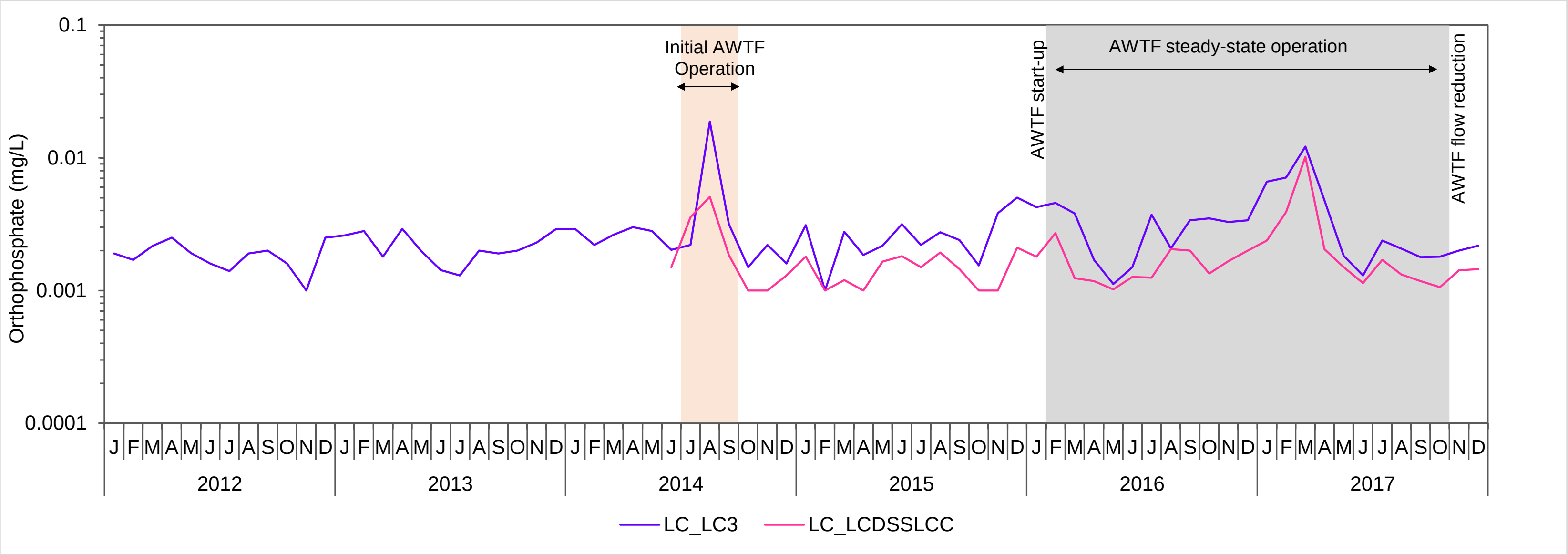


Figure A.12: Monthly Mean Aqueous Total Phosphorus and Orthophosphate Concentrations in Line Creek Before and After Operation of the Line Creek AWTF

Notes: Non-detect samples plotted at the Laboratory Reporting Limit (LRL). 2012 samples excluded for Total Phosphorus due to high LRL.

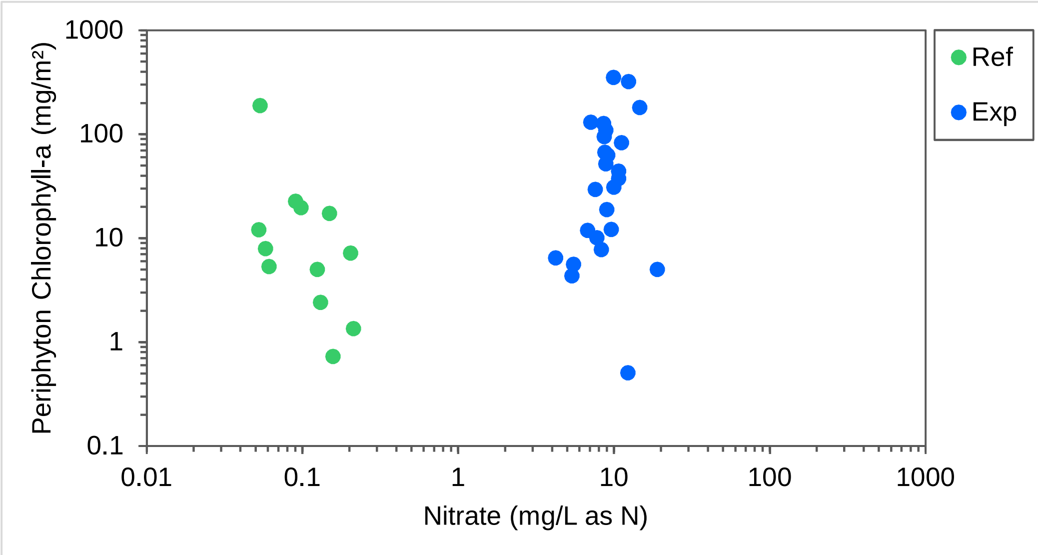


Figure A.13: Scatterplot for Significant Correlations Between Aqueous Nutrient Concentrations and Periphyton Chlorophyll-a (mg/m^2)

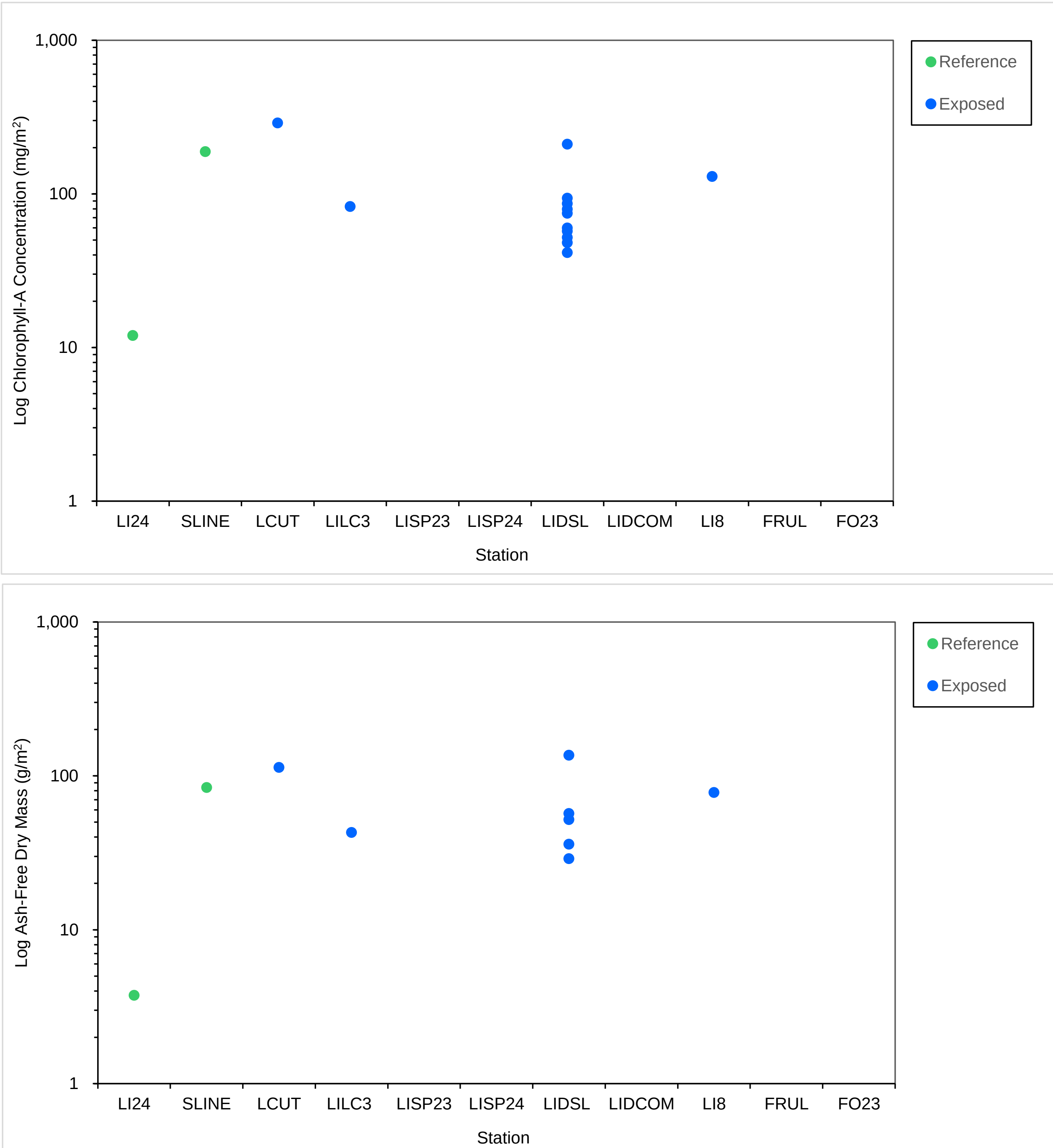


Figure A.14: Periphyton Chlorophyll-a and Ash-Free Dry Mass at Line Creek Sampling Areas Upstream and Downstream From Mine Activities, September 2017

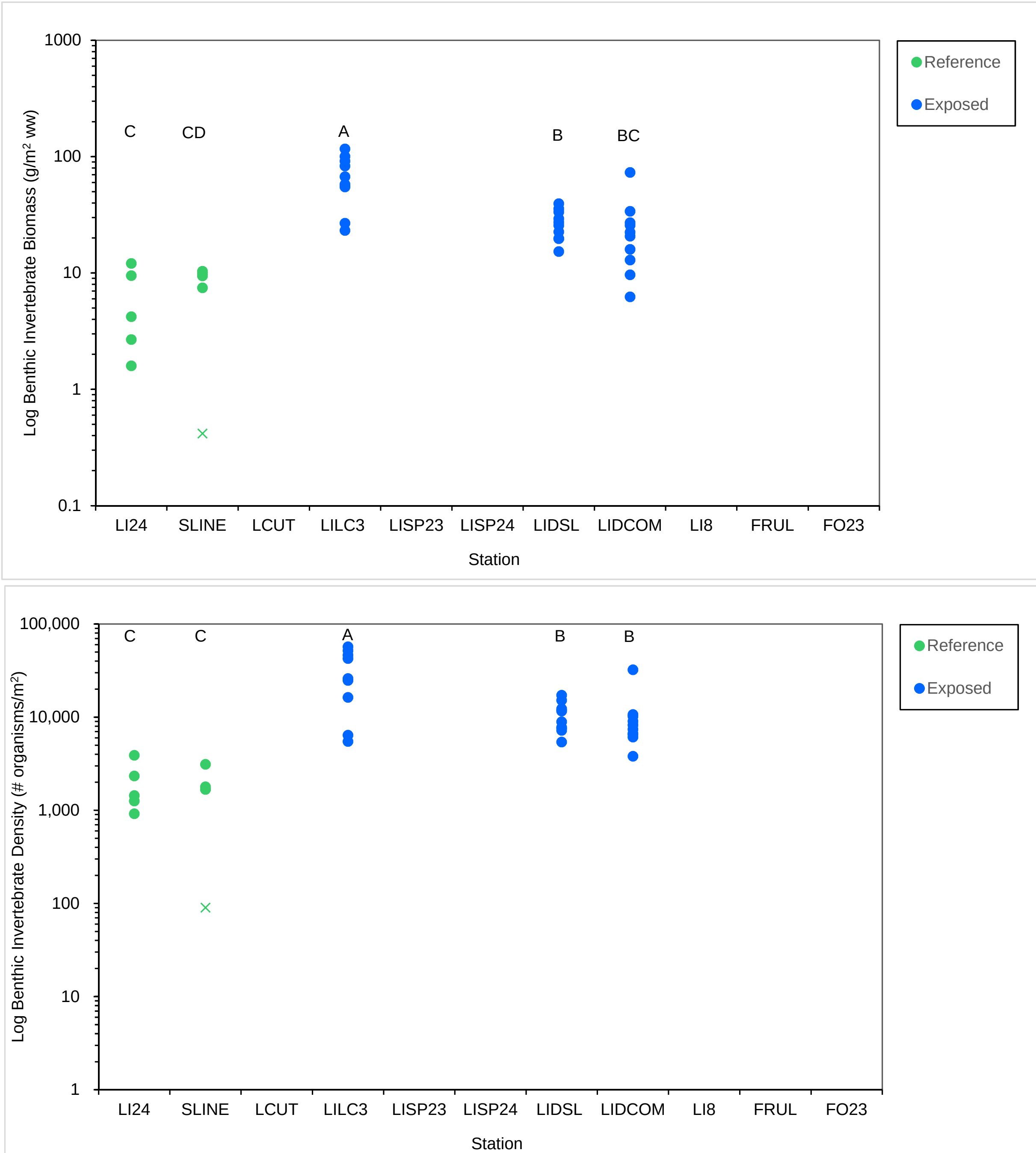


Figure A.15: Benthic Invertebrate Biomass and Density at Line Creek Sampling Areas Upstream and Downstream From Mine Activities, September, 2017

Note: Outliers are plotted with an X symbol; Stations with different symbol were statistically different in a Tukey's post-hoc t-test from an ANOVA with outlier removed.

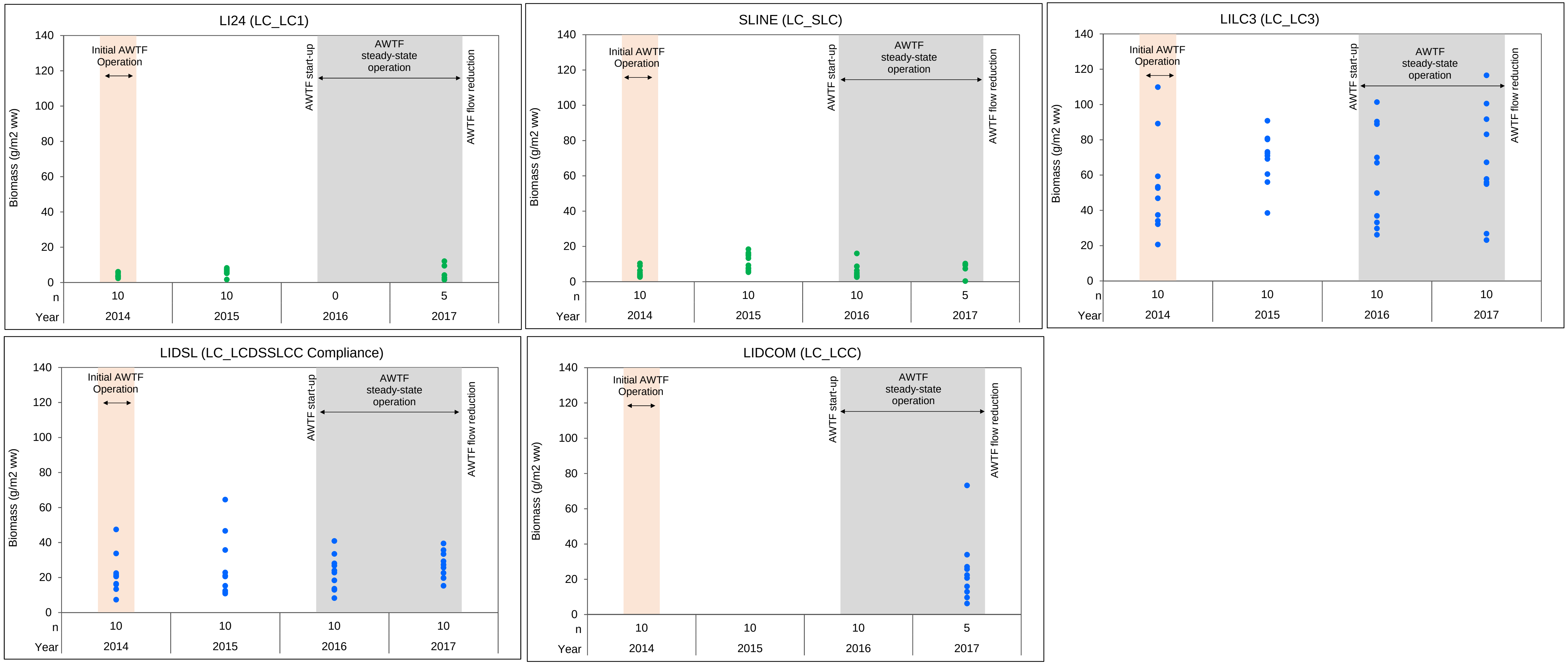


Figure A.16: **Benthic Invertebrate Biomass (Wet Weight) Based on Hess Sampling at Line Creek, 2014 to 2017**

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations.

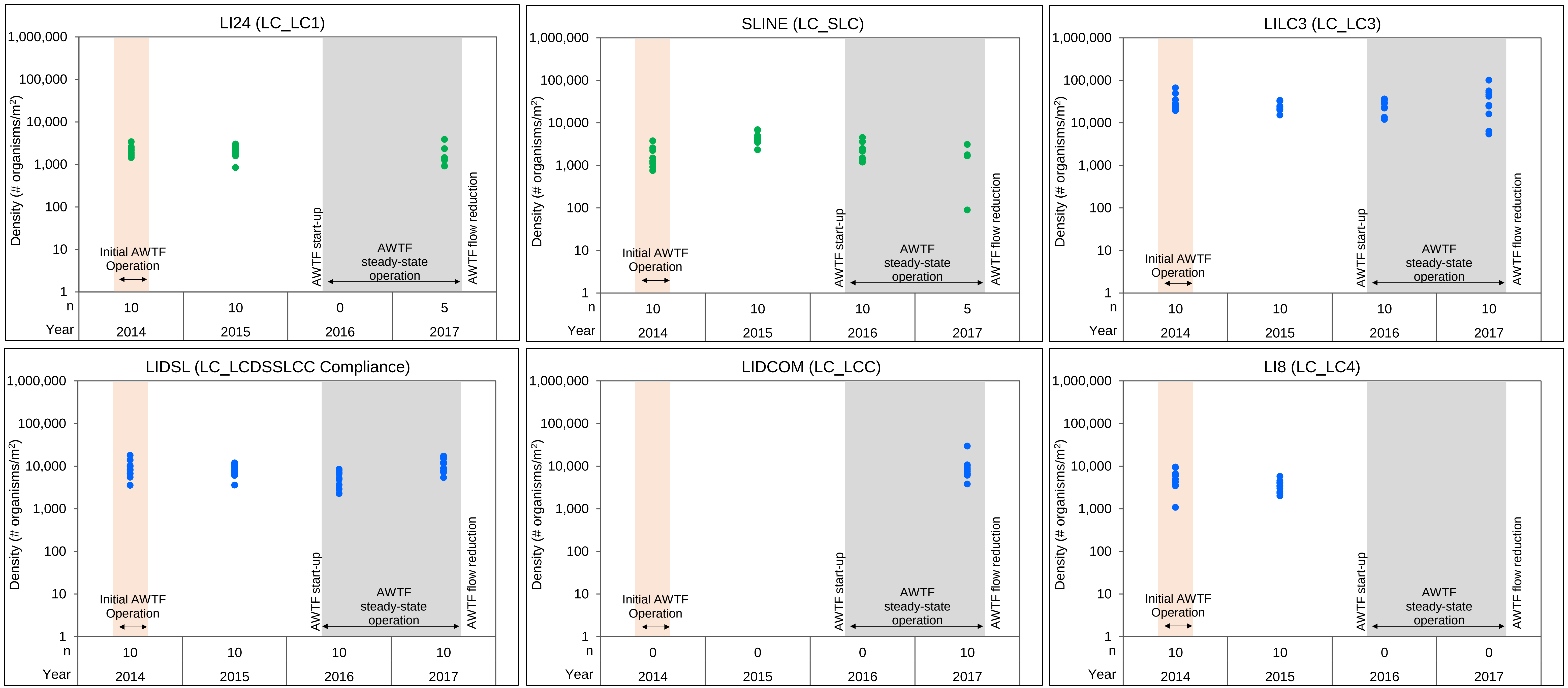


Figure A.17: Benthic Invertebrate Density Based on Hess Sampling at Line Creek, 2014 to 2017

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations.

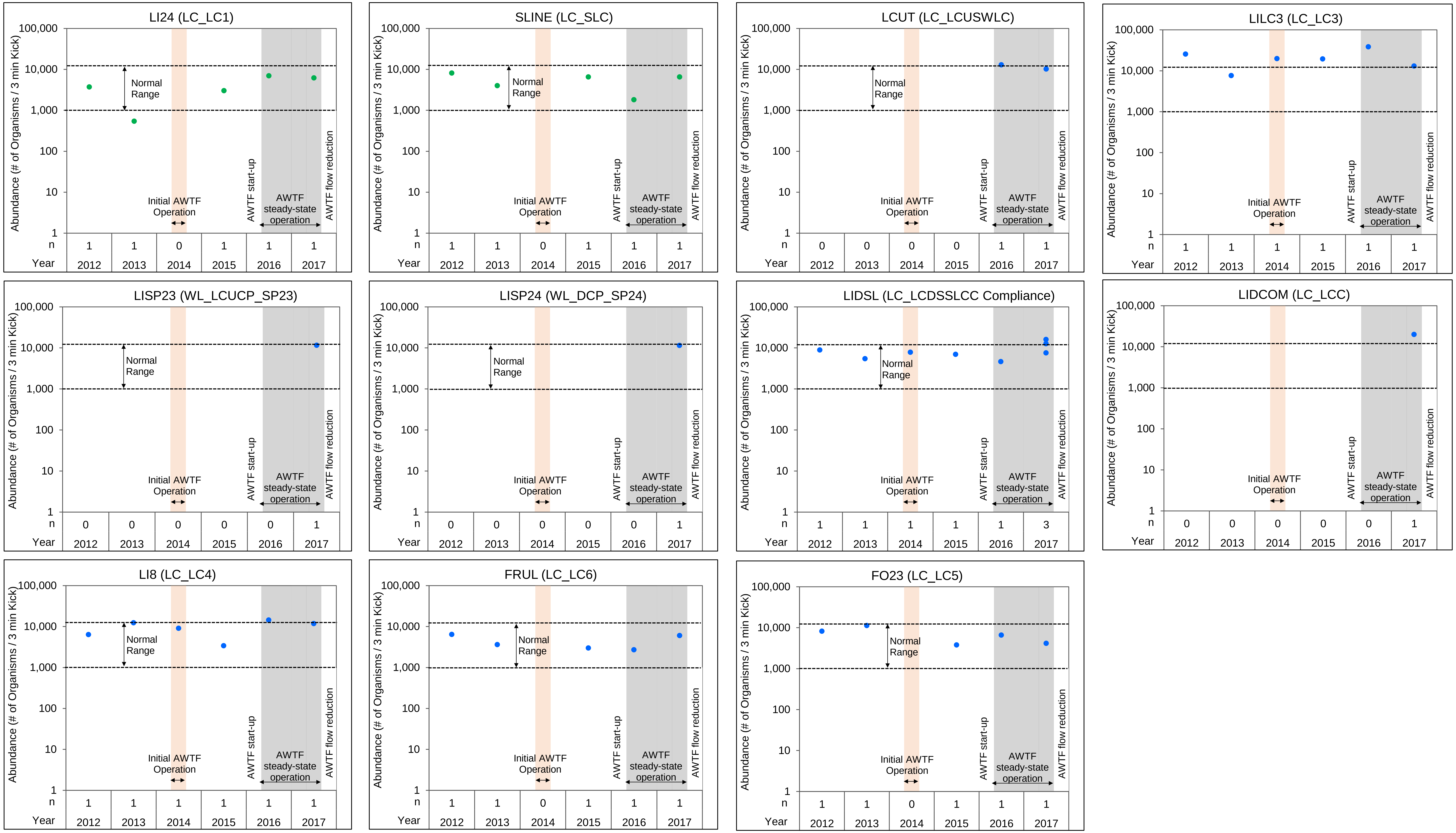


Figure A.18: Benthic Invertebrate Community Abundance (3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2017

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. Horizontal gray shading represents 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)

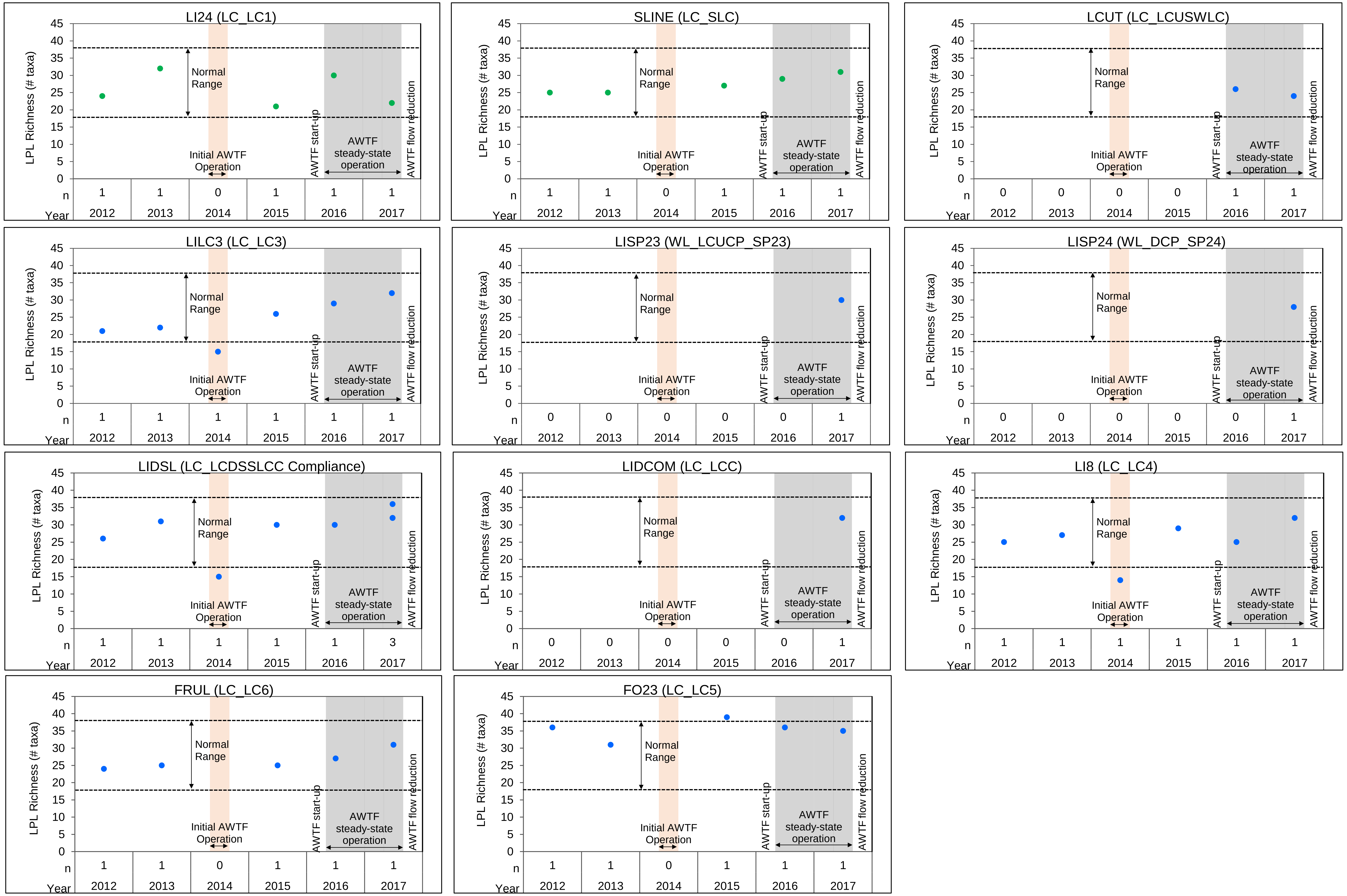


Figure A.19: Benthic Invertebrate Community Richness (Lowest Practical Level; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2017

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. Horizonal gray shading represents 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)

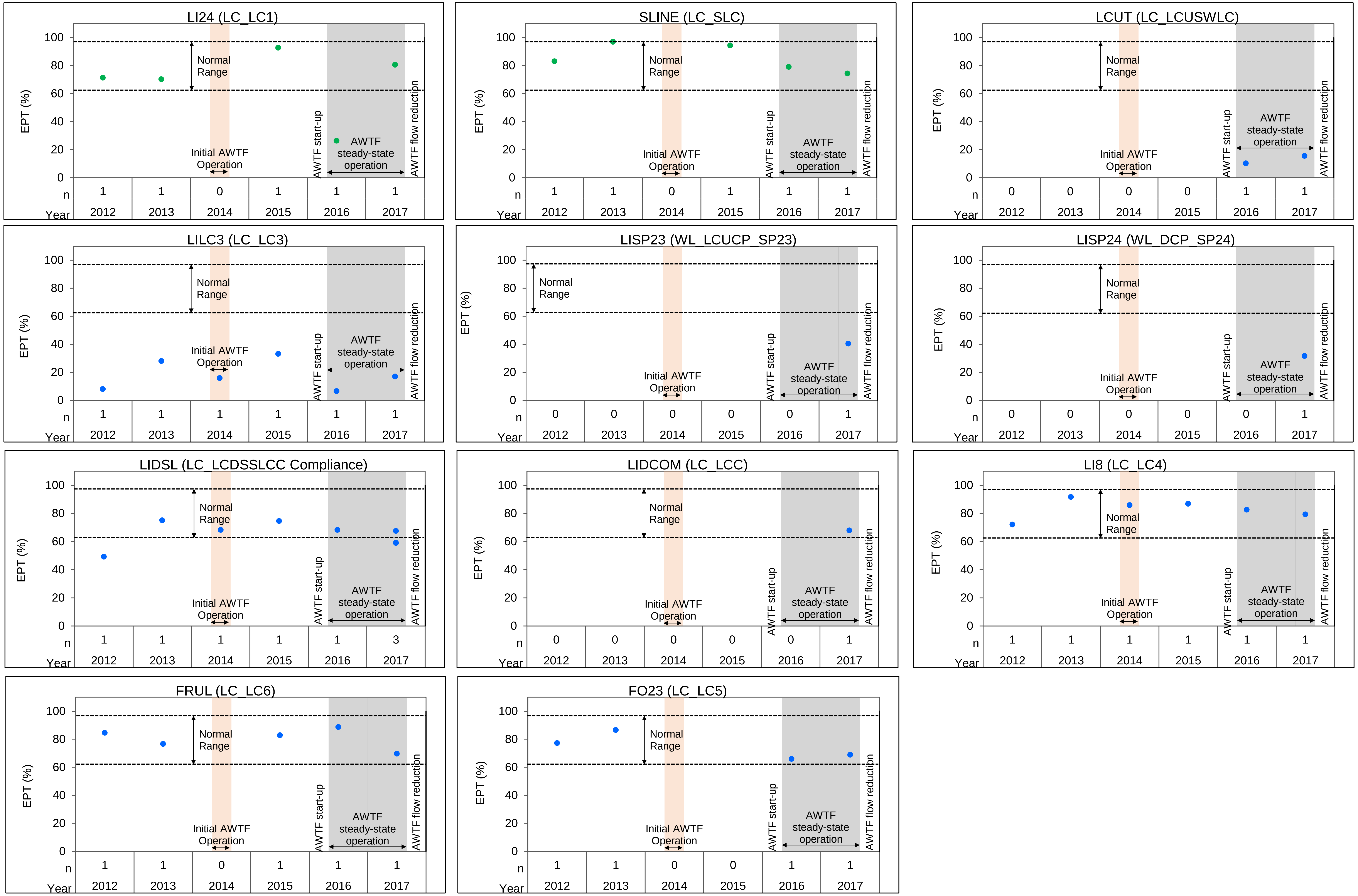


Figure A.20: Benthic Invertebrate Community Relative EPT Abundance (%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2017

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. Horizonal gray shading represents 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)

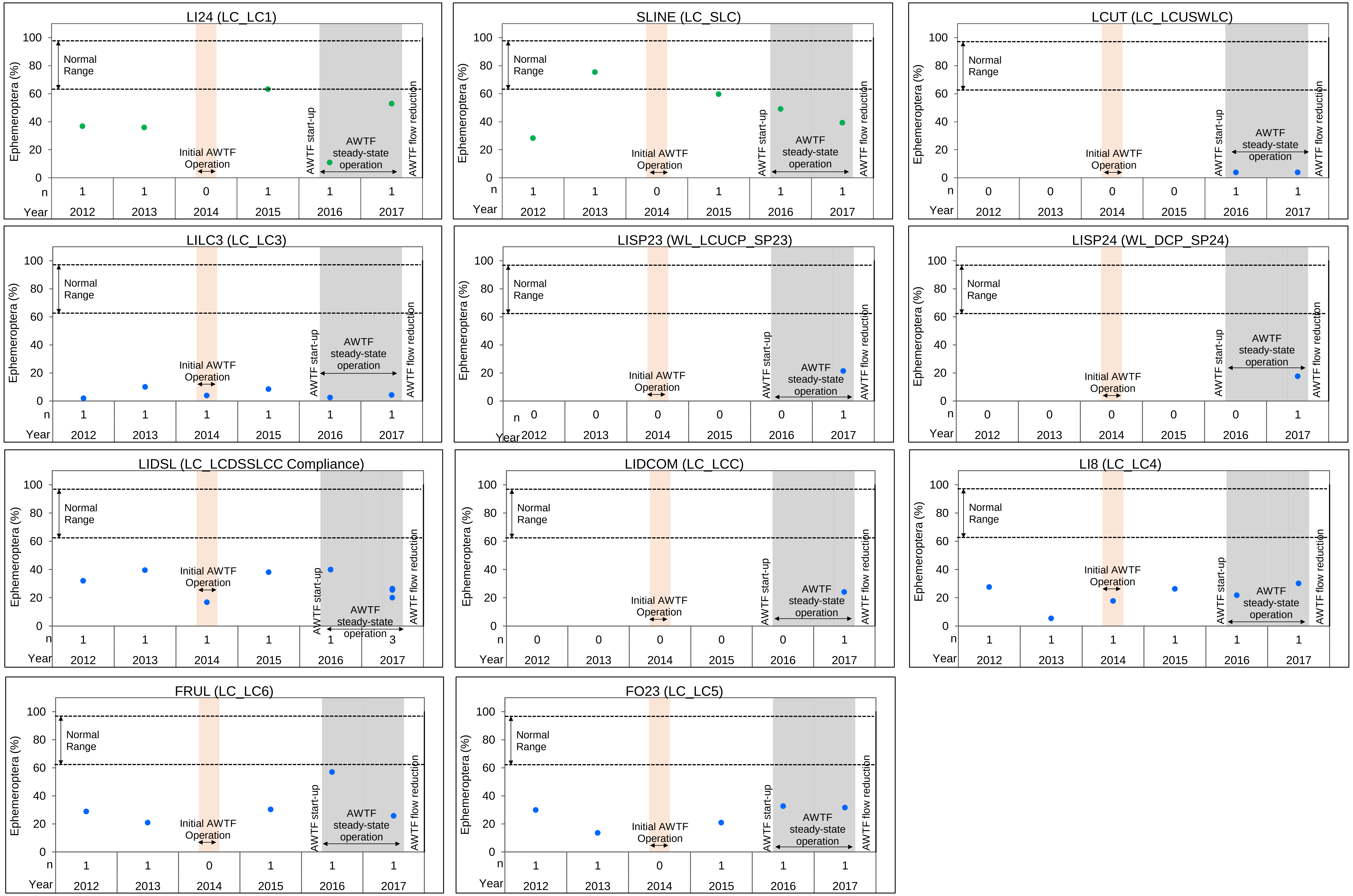


Figure A.21: Benthic Invertebrate Community Relative Ephemeroptera Abundance (%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2017

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. Horizonal gray shading represents 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)

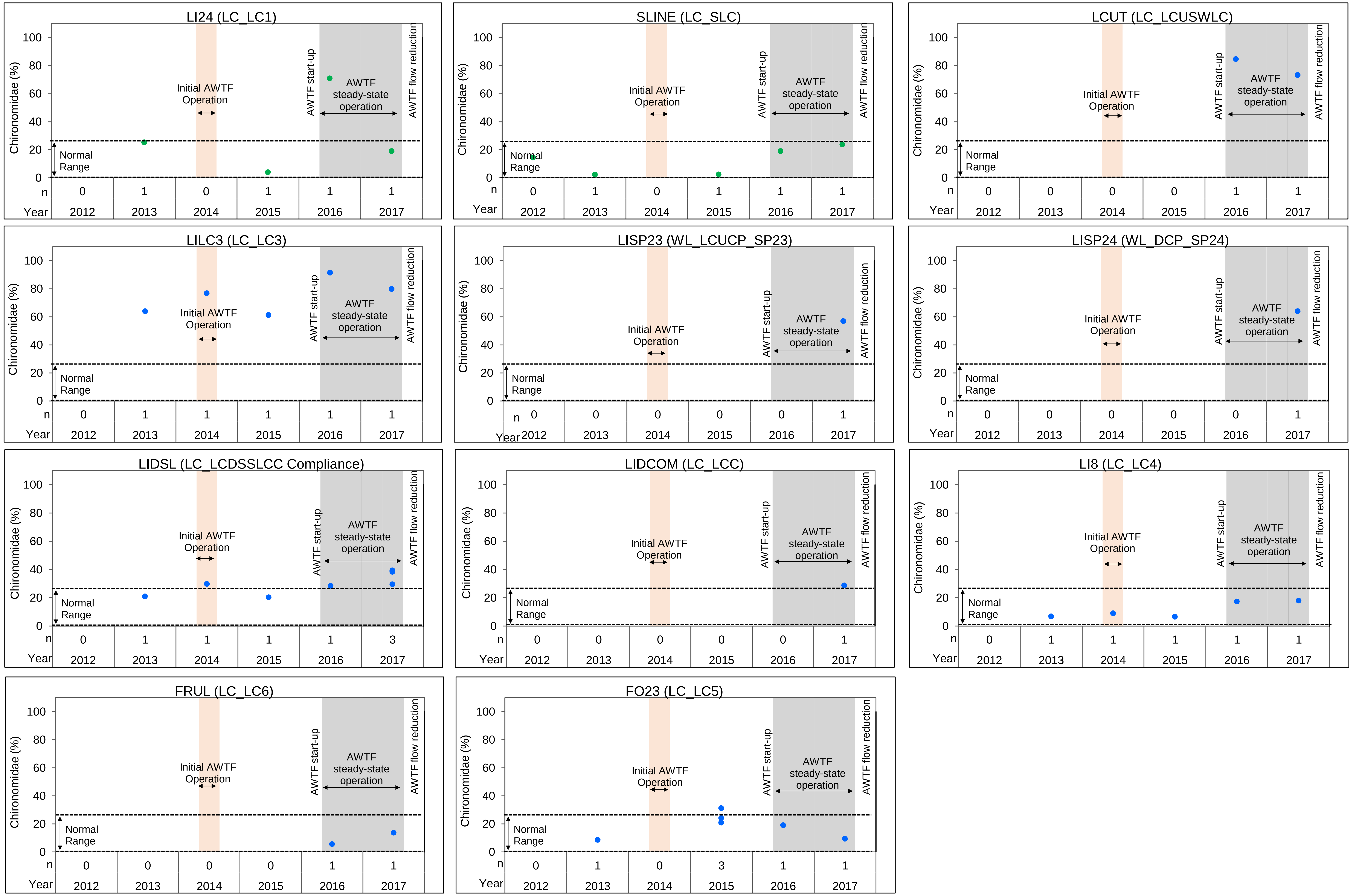


Figure A.22: Benthic Invertebrate Community Relative Chironomidae Abundance (%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2017

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. Horizonal gray shading represents 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)

Table A.1: Periphyton Chlorophyll-a Concentrations and Ash Free Dry Mass (AFDM) at Line Creek, 2017

Area	Biological Area Code	Date	Chlorophyll-a (mg/m^2)	AFDM (g/m^2)
Reference	LI24	Sep-17	12	3.8
	SLINE	Sep-17	189	84
Mine-exposed	LCUT	Sep-17	290	114
	LI8	Sep-17	130	78
	LIDSL	Jul-17	29	-
		Jul-17	36	-
		Jul-17	52	-
		Jul-17	136	-
		Jul-17	57	-
		Aug-17	40.3	-
		Aug-17	47.1	-
		Aug-17	22.5	-
		Aug-17	71.7	-
		Aug-17	38.7	-
		Sep-17	74.9	29
		Sep-17	93.9	36
		Sep-17	79.5	52
		Sep-17	211	136
		Sep-17	86.7	57
		Sep-17	52.1	-
		Sep-17	57.4	-
		Sep-17	41.5	-
		Sep-17	60	-
		Sep-17	48.3	-
	LILC3	Sep-17	83	43

Table A.2: **Visual Periphyton Coverage Scores from Line Creek and Fording River, 2017**

Area		Biological Area Code	Replicate					Mean	Standard Deviation
			A	B	C	D	E		
Line Creek	Reference	LI24	2	3	3	3	2	2.6	0.55
		SLINE	3	2	2	2	2	2.2	0.45
	Mine-exposed	LCUT	2	2	2	1	2	1.8	0.45
		LILC3	4	3	3	3	3	3.2	0.45
		LISP23	2	2	2	2	1	1.8	0.45
		LISP24	2	2	2	2	1	1.8	0.45
		LIDSL	2	2	1	1	1	1.4	0.55
		LIDCOM	2	3	3	3	2	2.6	0.55
		LI8	2	3	3	3	2	2.6	0.55
Fording River	Mine-exposed	FRUL	1	1	1	1	2	1.2	0.45
		FO23	3	3	3	2	1	2.4	0.89

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.3: ANOVA Table for BACI Models of Periphyton Chlorophyll-a and Ash-Free Dry Mass for 2013 and 2015 versus 2016 and 2017

Model					
Response	**Transform**	**Term**	**DF**	**F**	**P-Value**
Periphyton Ash-Free Dry Mass (AFDM)	-	BA	1	1.4	0.274
		CI	1	1.6	0.260
		BAxCI	1	0.10	0.761
		Year(BA)	2	0.14	0.869
		Area(CI)	3	1.6	0.294
		Year(BA)xCI	2	0.30	0.749
		Area(CI)xBA	3	0.068	0.975
		Error	6	-	-
Periphyton Chlorophyll-a concentration	-	BA	1	2.9	0.141
		CI	1	1.2	0.316
		BAxCI	1	0.11	0.756
		Year(BA)	2	0.32	0.735
		Area(CI)	3	1.4	0.333
		Year(BA)xCI	2	0.68	0.542
		Area(CI)xBA	3	0.21	0.885
		Error	6	-	-

P-value < 0.1 suggesting BAC1 effect associated with AWTF operation.

Notes: Two reference areas (SLINE and LI24) and three mine-exposed areas (LILC3, LIDSL and LI8) included in the analysis.

Table A.4: ANOVA Table for BACI Models of Periphyton Chlorophyll-a and Ash-Free Dry Mass for 2013, 2014 and 2015 versus 2016 and 2017

Model					
Response	**Transform**	**Term**	**DF**	**F**	**P-Value**
Periphyton Ash-Free Dry Mass (AFDM)	-	BA	1	2.0	0.193
		CI	1	2.9	0.121
		BAxCI	1	0.063	0.807
		Year(BA)	3	0.15	0.926
		Area(CI)	3	1.9	0.198
		Year(BA)xCI	3	0.31	0.819
		Area(CI)xBA	3	0.23	0.872
		Error	9	-	-
Periphyton Chlorophyll-a concentration	-	BA	1	6.1	0.036
		CI	1	1.4	0.261
		BAxCI	1	0.32	0.587
		Year(BA)	3	0.42	0.746
		Area(CI)	3	1.6	0.257
		Year(BA)xCI	3	0.68	0.588
		Area(CI)xBA	3	0.52	0.677
		Error	9	-	-

P-value < 0.1 suggesting BAC1 effect associated with AWTF operation.

Notes: Two reference areas (SLINE and LI24) and three mine-exposed areas (LILC3, LIDSL and LI8) included in the analysis.

Table A.5a: **ANOVA Table for BACI Models Comparing Monthly Mean Concentrations for Phosphorus Before vs After AWTF Operation**

Model					
Response	Transform	Term	DF	F	P-Value
Phosphorus	log10	BA	1	0.04	0.839
		CI	1	5.1	0.026
		BAxCI	1	0.56	0.455
		Year(BA)	2	1.15	0.321
		Area(CI)	2	2.6	0.080
		Year(BA)xCI	2	0.27	0.762
		Area(CI)xBA	2	1.9	0.157
		Area(CI)xYear(BA)	4	0.61	0.654
		Error	96	-	-

[grey box] P-value < 0.1 suggesting a BACI effect associated with AWTF operation

Notes: Analysis compares monthly means (April to November) between years before (2013 and 2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference stations LC_LC1 and LC_SLC, and mine-exposed stations LC_LC3, and LC_LC4.

Table A.5b: **ANOVA Table for BACI Models Comparing Monthly Mean Concentrations for Orthophosphate Before vs After AWTF Operation, and P-values and Magnitude of Difference**

Model						Contrasts (P-value and Magnitude of Difference[a])			
Response	Transform	Term	DF	F	P-Value	2012 LC_LC1 vs 2016 LC_SLC	2012 LC_LC1 vs 2016 LC_LC3	2012 LC_LC1 vs 2017 LC_LC3	2012 LC_LC1 vs LC_LC4 2017
Orthophosphate	log10	BA	1	1.8	0.184	-			
		CI	1	11.625	0.001				
		BAxCI	1	1.0	0.313				
		Year(BA)	3	1.9	0.139				
		Area(CI)	2	0.022	0.979				
		Year(BA)xCI	3	2.1	0.098				
		Area(CI)xBA	2	1.3	0.279				
		Area(CI)xYear(BA)	6	2.9	0.011	0.003 (2.3 SD/136 %)	<0.001 (3.1 SD/221 %)	0.016 (1.8 SD/101 %)	0.019 (1.8 SD/97 %)
		Error	120	-	-				

[grey box] P-value < 0.1 suggesting a BACI effect associated with AWTF operation

Notes: [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage. Four significant contrasts shown out of a total of 30 contrasts evaluated. Analysis compares monthly means (April to November) between years before (2012, 2013 and 2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference stations LC_LC1 and LC_SLC, and mine-exposed stations LC_LC3, and LC_LC4.

Table A.6: ANOVA Table for BACI Models Comparing Monthly Mean Concentrations for Nitrate Before vs After AWTF Operation

Model						Contrasts (P-value and Magnitude of Difference[a])					
Response	Transform	Term	DF	F	P-Value	2012 vs 2016	2012 vs 2017	2013 vs 2016	2013 vs 2017	2015 vs 2016	2015 vs 2017
Nitrate	log10	BA	1	3	0.102						
		CI	1	6510	<0.001						
		BAxCI	1	0.0361	0.850						
		Year(BA)	3	8	<0.001						
		Area(CI)	2	77	<0.001						
		Year(BA)xCI	3	2.3	0.078	0.263	0.325	0.109	0.619	0.950	0.042 1.09 SD/ 44 %
		Area(CI)xBA	2	0.76	0.470						
		Area(CI)xYear(BA)	6	0.14	0.990						
		Error	120	-	-						

[Grey shading] P-value < 0.1 suggesting a BACI effect associated with AWTF operation

Notes: Analysis compares monthly means (April to November) between years before (2012, 2013 and 2015) and after AWTF (2016 and 2017). Stations inlcuded in the analysis are reference stations LC_LC1 and LC_SLC, and mine-exposed stations LC_LC3, and LC_LC4. [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage.

Table A.7a: **ANOVA Table for BACI Models Comparing Monthly Mean Concentrations for Phosphorus Before vs After AWTF Operation**

Model						Contrasts (P-value and Magnitude of Difference[a])	
Response	Transform	Term	DF	F	P-Value	LC_SLC vs LC_LC3	LC_SLC vs LC_LC4
Phosphorus	log10	BA	1	2.6	0.110		
		CI	1	21	<0.001		
		BAxCI	1	4.1	0.044		
		Year(BA)	2	0.5	0.601		
		Area(CI)	1	1.1	0.306		
		Year(BA)xCI	2	0.3	0.765		
		Area(CI)xBA	1	3.6	0.061	0.007 1.1 SD / 104 %	0.415
		Area(CI)xYear(BA)	2	1.3	0.280		
		Error	132	-	-		

P-value < 0.1 suggesting a BACI effect associated with AWTF operation

Notes: Analysis compares monthly means (all months included in analysis) between years before (2013 and 2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference station LC_SLC and mine-exposed stations LC_LC3, and LC_LC4. a Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage.

Table A.7b: **ANOVA Table for BACI Models Comparing Monthly Mean Concentrations for Orthophosphate Before vs After AWTF Operation**

Model						Contrasts (P-value and Magnitude of Difference[a])	
Response	Transform	Term	DF	F	P-Value	LC_SLC vs LC_LC3	LC_SLC vs LC_LC4
Orthophosphate	log10	BA	1	5.8	0.017		
		CI	1	19.774	<0.001		
		BAxCI	1	0.39	0.531		
		Year(BA)	3	3.2	0.024		
		Area(CI)	1	3.2	0.075		
		Year(BA)xCI	3	0.64	0.592		
		Area(CI)xBA	1	3.4	0.069	0.147	0.711
		Area(CI)xYear(BA)	3	1.3	0.267		
		Error	165	-	-		

P-value < 0.1 suggesting a BACI effect associated with AWTF operation

Notes: Analysis compares monthly means (all months included in analysis) between years before (2012, 2013 and 2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference station LC_SLC and mine-exposed stations LC_LC3, and LC_LC4. [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage.

Table A.8a: **ANOVA Table for BACI Models Comparing Monthly Mean Concentrations for Phosphorus Before vs After AWTF Operation**

Model						Contrasts (P-value and Magnitude of Difference[a])		
Response	Transform	Term	DF	F	P-Value	LC_SLC vs LC_LC3	LC_SLC vs LC_LCDSSLCC	LC_SLC vs LC_LC4
Phosphorus	log10	BA	1	0.73	0.394			
		CI	1	11	0.001			
		BAxCI	1	3.1	0.078			
		Year(BA)	1	0.17	0.677			
		Area(CI)	2	3.7	0.028			
		Year(BA)xCI	1	0.14	0.705			
		Area(CI)xBA	2	2.8	0.065	0.006 1.39 SD / 161 %	0.303	0.597
		Area(CI)xYear(BA)	2	0.16	0.856			
		Error	132	-	-			

P-value < 0.1 suggesting a BACI effect associated with AWTF operation

Notes: Analysis compares monthly means (all months included in analysis) between years before (2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference station LC_SLC and mine-exposed stations LC_LC3, LC_LCDSSLCC, and LC_LC4. Post-hoc contrasts for area were conducted despite no significant interaction at a p-value < 0.05. [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage.

Table A.8b: **ANOVA Table for BACI Models Comparing Monthly Mean Concentrations for Orthophosphate Before vs After AWTF Operation**

Model					
Response	Transform	Term	DF	F	P-Value
Orthophosphate	log10	BA	1	1.5	0.217
		CI	1	4.6	0.035
		BAxCI	1	0.76	0.385
		Year(BA)	1	6.4	0.013
		Area(CI)	2	7.3	<0.001
		Year(BA)xCI	1	1.6	0.207
		Area(CI)xBA	2	0.58	0.564
		Area(CI)xYear(BA)	2	0.25	0.779
		Error	132	-	-

P-value < 0.1 suggesting a BACI effect associated with AWTF operation

Notes: Analysis compares monthly means (all months included in analysis) between years before (2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference station LC_SLC and mine-exposed stations LC_LC3, LC_LCDSSLCC, and LC_LC4.

Table A.9: Spearman Correlation Coefficients between Periphyton Chlorophyll-a and Aqueous Nutrient Concentrations, 2013-2017

Aqueous Nutrients	Periphyton Chlorophyll-a		
	N	r_s	P-value
Concurrent Nitrate	37	0.369	0.025
Concurrent Total Phosphorus	33	-0.080	0.656
Concurrent Orthophosphate	36	-0.057	0.742
60-d mean Nitrate	37	0.301	0.070
60-d mean Total Phosphorus	33	-0.242	0.175
60-d mean Orthophosphate	36	-0.131	0.446

r ≥ 0.6 or r ≤ -0.6

P-value < 0.05

Notes: Concurrent refers to the most recent water sample collected prior to chlorophyll-a sampling. Data included in the analysis were for areas LI24, SLINE, LCUT, LILC3, LIDSL, LI8, FO23, and FRUL.

Table A.10: ANOVA Table for BACI Models and P-values and Magnitude of Difference for Benthic Invertebrate Biomass and Density for 2015 versus 2016 and 2017

Model						Contrasts (P-value and Magnitude of Difference[a])					
						Area(CI)xYear(BA)				Year(BA)xCI	
Response	Transform	Term	DF	F	P-Value	2015 SLINE vs 2016 LILC3	2015 SLINE vs 2017 LILC3	2015 SLINE vs 2016 LIDSL	2015 SLINE vs 2017 LIDSL	2015 vs 2016	2015 vs 2017
Benthic Invertebrate Biomass	SQRT	BA	1	2.311	0.133	-				-	
		CI	1	137	<0.001						
		BAxCI	1	0.78	0.379						
		Year(BA)	1	1.4	0.247						
		Area(CI)	1	84	<0.001						
		Year(BA)xCI	1	0.14	0.714						
		Area(CI)xBA	1	0.563	0.455						
		Area(CI)xYear(BA)	1	0.01	0.936						
		Error	76	-	-						
Benthic Invertebrate Density	log10	BA	1	5.3	0.039	-				-	
		CI	1	155	<0.001						
		BAxCI	1	10	0.007						
		Year(BA)	1	0.66	0.420						
		Area(CI)	1	70	<0.001						
		Year(BA)xCI	1	8.3	0.005					0.024 (0.91 SD / 69%)	<0.001 (2.73 SD / 383%)
		Area(CI)xBA	1	0.24	0.627					-	
		Area(CI)xYear(BA)	1	3	0.116						
		Error	76	-	-	-	-	-	-	-	-
Benthic Invertebrate Density[b]	log10	BA	1	4	0.039	-				-	
		CI	1	173	<0.001						
		BAxCI	1	8	0.007						
		Year(BA)	1	5	0.032						
		Area(CI)	1	100	<0.001						
		Year(BA)xCI	1	2	0.190						
		Area(CI)xBA	1	0	0.563						
		Area(CI)xYear(BA)	1	4	0.062	0.02 (1.54 SD / 111%)	<0.001 (1.84 SD / 143%)	0.380	<0.001 (2.12 SD / 178%)		
		Error	75	-	-	-	-	-	-	-	-

[Shaded box] P-value < 0.1 suggesting BAC1 effect associated with AWTF operation.

Notes: [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area relative to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage; [b] One outlier removed from this analysis. One reference (SLINE) and two mine-exposed areas (LILC3, LIDSL) included in the analysis.

Table A.11: ANOVA Table for BACI Models and P-values and Magnitude of Difference for Benthic Invertebrate Biomass and Density for 2014 and 2015 versus 2016 and 2017

Model						Contrasts (P-value and Magnitude of Difference[a])			
						Year(BA)xCI			
Response	Transform	Term	DF	F	P-Value	2014 vs 2016	2014 vs 2017	2015 vs 2016	2015 vs 2017
Benthic Invertebrate Biomass	SQRT	BA	1	0.010	0.922	-			
		CI	1	190	<0.001				
		BAxCI	1	0.62	0.434				
		Year(BA)	2	3.9	0.023				
		Area(CI)	1	104	<0.001				
		Year(BA)xCI	2	0.16	0.853				
		Area(CI)xBA	1	0.041	0.840				
		Area(CI)xYear(BA)	2	0.52	0.593				
		Error	103	-	-				
Benthic Invertebrate Density	log10	BA	1	3.2	0.181	-			
		CI	1	289	<0.001				
		BAxCI	1	2	0.710				
		Year(BA)	2	2.00	0.140				
		Area(CI)	1	106	<0.001				
		Year(BA)xCI	2	12.6	<0.001	0.060 (-1.4 SD / -48%)	0.378	0.017 (1.1 SD / 69%)	<0.001 (2.0 SD / 383%)
		Area(CI)xBA	1	0.12	0.728	-			
		Area(CI)xYear(BA)	2	1	0.231				
		Error	103	-	-	-	-	-	-
Benthic Invertebrate Density[b]	log10	BA	1	2	0.181	-			
		CI	1	329	<0.001				
		BAxCI	1	0	0.710				
		Year(BA)	2	5	0.012				
		Area(CI)	1	140	<0.001				
		Year(BA)xCI	2	11	<0.001	0.031 (-1.4 SD / -48%)	0.378	0.006 (1.1 SD / 69%)	0.004 (2.0 SD / 160%)
		Area(CI)xBA	1	0	0.689	-			
		Area(CI)xYear(BA)	2	2	0.145				
		Error	102	-	-	-	-	-	-

(shaded) P-value < 0.1 suggesting BAC1 effect associated with AWTF operation.

Notes: [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area relative to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage; [b] One outlier removed from this analysis. One refeerence (SLINE) and two mine-exposed areas (LILC3, LIDSL) included in the analysis.

Table A.12a: ANOVA Table for Log Benthic Invertebrate Biomass in September in Line Creek 2017

Model					
Parameter	Comparison	Term	DF	F	P-Value
Biomass	Full	Area	4	16.02	<0.001
		Error	35	-	-
	Outliers removed[a]	Area	4	20.77	<0.001
		Error	34	-	-

(shaded) P-value < 0.1

[a] One outlier (SLINE Rep 2), with Studentized residuals equal to -4.97 in magnitude, was removed

Table A.12b: Grouping Information For Stations Following Tukey's Post-Hoc Comparison Of Benthic Invertebrate Biomass

Station	Area Type	N	Adjusted Mean[a]	Grouping[a]	Adjusted Mean[b]	Grouping[b]
LI24	Reference	5	4.6	C	4.6	C
SLINE	Reference	5[c]	5.0	C	9.2	CD
LCUT	Mine-exposed	-	-	-	-	-
LILC3	Mine-exposed	10	61	A	61	A
LISP23	Mine-exposed	-	-	-	-	-
LISP24	Mine-exposed	-	-	-	-	-
LIDSL	Mine-exposed	10	26	AB	26	B
LIDCOM	Mine-exposed	10	20	B	20	BC
LI8	Mine-exposed	-	-	-	-	-
FRUL	Mine-exposed	-	-	-	-	-
FO23	Mine-exposed	-	-	-	-	-

Note: Capital letters denote statistically significant differences. Means that do not share a letter are significantly different within their respective comparison, and letters earlier in the alphabet denote larger means; [a] results with outlier included; [b] results with outlier removed; [c] N of 4 when outlier removed. Stations with '-' do not have any data.

Table A.13a: ANOVA Table for Log Benthic Invertebrate Density in September in Line Creek 2017

Model					
Parameter	Comparison	Term	DF	F	P-Value
Density	Full	Area	3	19.38	<0.001
		Error	35	-	-
	Outliers removed[b]	Area	3	21.72	<0.001
		Error	34	-	-

(shaded) P-value < 0.1

[a] One outlier (SLINE Rep 2), with Studentized residuals equal to -4.97 in magnitude, was removed

Table A.13b: Grouping Information For Stations Following Tukey's Post-Hoc Comparison Of Benthic Invertebrate Density

Station	Area Type	N	Adjusted Mean[a]	Grouping[a]	Adjusted Mean[b]	Grouping[b]
LI24	Reference	5	1,723	C	1,723	C
SLINE	Reference	5[c]	1,072	C	1,993	C
LCUT	Mine-exposed	-	-	-	-	-
LILC3	Mine-exposed	10	27,162	A	27,162	A
LISP23	Mine-exposed	-	-	-	-	-
LISP24	Mine-exposed	-	-	-	-	-
LIDSL	Mine-exposed	10	9,910	B	9,910	B
LIDCOM	Mine-exposed	10	8,494	B	8,494	B
LI8	Mine-exposed	-	-	-	-	-
FRUL	Mine-exposed	-	-	-	-	-
FO23	Mine-exposed	-	-	-	-	-

Note: Capital letters denote statistically significant differences. Means that do not share a letter are significantly different within their respective comparison, and letters earlier in the alphabet denote larger means; [a] results with outlier included; [b] results with outlier removed; [c] N of 4 when outlier removed. Stations with '-' do not have any data.

Table A.14: Summary Metrics for Benthic Invertebrate Endpoints Collected by Hess Sampler at Line Creek, 2017

Area	Biological Area Code	Sample Code	Benthic Biomass (g/m^2 ww)	Density (# org/m^2)	Family Richness	EPT		Ephemeroptera		Chironomidae	
						(# org/sample)	%	(# org/sample)	%	(# org/sample)	%
Reference	LI24	LI24-01	12.1	3,890	17	2,900	0.75	1,500	0.39	840	0.22
		LI24-02	4.21	1,260	13	920	0.73	530	0.42	300	0.24
		LI24-03	1.59	1,440	11	850	0.59	610	0.42	560	0.39
		LI24-04	9.5	2,340	13	1,550	0.66	920	0.39	720	0.31
		LI24-05	2.68	920	12	670	0.73	400	0.43	210	0.23
	SLINE	SLINE-01	9.9	1,790	19	1,230	0.69	560	0.31	260	0.15
		SLINE-02	0.42	90	7	80	0.89	40	0.44	0	0.00
		SLINE-03	7.45	1,680	20	1,250	0.74	470	0.28	280	0.17
		SLINE-04	10.4	3,120	19	1,550	0.50	640	0.21	1,420	0.46
		SLINE-05	9.45	1,680	21	1,220	0.73	610	0.36	360	0.21
Mine-exposed	LILC3	LILC3-01	26.8	6,400	14	960	0.15	200	0.03	4,860	0.76
		LILC3-02	57.9	16,280	14	1,160	0.07	200	0.01	10,240	0.63
		LILC3-03	67.3	25,970	12	1,410	0.05	240	0.01	17,760	0.68
		LILC3-04	56.0	24,800	15	1,600	0.06	0	0.00	17,040	0.69
		LILC3-05	23.2	5,490	14	730	0.13	160	0.03	4,040	0.74
		LILC3-06	101	56,960	15	3,120	0.05	400	0.01	44,400	0.78
		LILC3-07	83.2	42,560	20	2,720	0.06	560	0.01	33,440	0.79
		LILC3-08	91.7	101,960	15	2,920	0.03	1,040	0.01	68,640	0.67
		LILC3-09	117	46,360	17	5,480	0.12	960	0.02	33,200	0.72
		LILC3-10	54.9	51,780	14	2,340	0.05	400	0.01	38,880	0.75
	LIDSL	LIDSL-01	35.7	15,180	22	5,940	0.39	1,600	0.11	8,400	0.55
		LIDSL-02	15.3	5,410	18	3,330	0.62	1,520	0.28	1,640	0.30
		LIDSL-03	22.6	8,930	23	5,050	0.57	2,480	0.28	3,400	0.38
		LIDSL-04	39.5	7,600	22	3,560	0.47	1,480	0.19	3,480	0.46
		LIDSL-05	33.4	11,900	20	4,180	0.35	1,240	0.10	7,080	0.59
		LIDSL-06	19.7	11,610	19	4,530	0.39	1,800	0.16	5,920	0.51
		LIDSL-07	25.6	7,210	22	3,650	0.51	1,700	0.24	2,560	0.36
		LIDSL-08	19.8	7,770	17	4,130	0.53	1,520	0.20	3,280	0.42
		LIDSL-09	29.3	12,290	26	5,930	0.48	2,300	0.19	4,900	0.40
		LIDSL-10	27.3	17,230	26	8,470	0.49	2,560	0.15	6,200	0.36
	LIDCOM	LIDCOM-01	27.1	9,030	24	5,490	0.61	2,060	0.23	2,420	0.27
		LIDCOM-02	33.9	10,690	22	6,120	0.57	2,240	0.21	3,440	0.32
		LIDCOM-03	73.2	32,240	21	13,680	0.42	3,520	0.11	15,200	0.47
		LIDCOM-04	22.4	6,660	22	4,620	0.69	1,380	0.21	1,220	0.18
		LIDCOM-05	20.7	7,420	20	3,840	0.52	1,640	0.22	2,940	0.40
		LIDCOM-06	12.9	8,220	24	5,080	0.62	1,260	0.15	1,920	0.23
		LIDCOM-07	16.0	10,200	22	4,720	0.46	1,880	0.18	4,080	0.40
		LIDCOM-08	9.7	6,530	22	3,070	0.47	940	0.14	2,360	0.36
		LIDCOM-09	6.24	3,800	21	2,000	0.53	580	0.15	1,260	0.33
		LIDCOM-10	25.7	6,110	23	3,780	0.62	1,880	0.31	1,440	0.24

Table A.15: Summary Metrics for Benthic Invertebrate Endpoints Collected in 3-Minute Kick and Sweep Sampling, at Line Creek, 2017

Area	Biological Area Code	Sample Code	Abundance (# org / 3-min kick)	LPL Richness (# taxa)	Family Richness	EPT		Ephemeroptera		Chironomidae	
						(# org/3-min)	%	(# org/3-min)	%	(# org/3-min)	%
Reference	**LI24**	LI24-01	6,200	22	14	5,000	80.6	3,280	52.9	1,180	19.0
	SLINE	SLINE-01	6,560	31	18	4,880	74.4	2,580	39.3	1,560	23.8
Mine-exposed	**LILC3**	LILC3-01	12,980	32	17	2,200	16.9	560	4.31	10,360	79.8
	LIDSL	LIDSL-01	12,760	32	20	7,540	59.1	2,560	20.1	4,900	38.4
		LIDSL-02	16,120	36	20	10,880	67.5	4,120	25.6	4,760	29.5
		LIDSL-03	7,560	32	18	4,460	59.0	2,000	26.5	2,980	39.4
	LIDCOM	LIDCOM-01	20,000	32	20	13,560	67.8	4,820	24.1	5,757	28.8
	LCUT	LCUT-01	10,240	24	16	1,600	15.6	400	3.91	7,500	73.2
	LI8	LI8-01	11,780	32	19	9,340	79.3	3,560	30.2	2,120	18.0
	LISP23	LISP23-01	11,580	30	20	4,680	40.4	2,480	21.4	6,600	57.0
	LISP24	LISP24-01	11,500	28	16	3,640	31.7	2,020	17.6	7,360	64.0
	FO23	FO23-01	4,170	35	24	2,870	68.8	1,320	31.7	390	9.4
	FRUL	FRUL-01	6,000	31	22	4,180	69.7	1,540	25.7	820	13.7

SUPPORTING DATA – PRODUCTIVITY EVALUATION

Benthic Invertebrate Community Hess Laboratory Data 2017

Benthic Macroinvertebrates Collected Through Hess Sampling (sampling area 0.1 m2) From Teck Line Creek, 2017 (Densities expressed per sampled area)

Station	LI24-BM									
Replicate	1		2		3		4		5	
ROUNDWORMS										
P. Nemata	1	0.0002	-	-	1	0.0004	1	0.0002	-	-
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
F. Planariidae	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	5	0.0197	-	-	-	-	-	-	-	-
ARTHROPODS										
MITES										
Cl. Arachnida										
Subcl. Acari	8	0.0025	3	9E-04	1	0.0007	5	0.0015	3	0.001
SEED SHRIMPS										
Cl. Ostracoda	-	-	1	2E-04	-	-	1	0.0002	-	-
INSECTS										
Cl. Insecta										
BEETLES										
O. Coleoptera										
F. Elmidae	-	-	-	-	-	-	-	-	-	-
MAYFLIES										
O. Ephemeroptera										
F. Ameletidae	7	0.0395	-	-	-	-	7	0.0731	1	0.009
F. Baetidae	-	-	-	-	2	0.0212	1	0.0059	-	-
F. Ephemerellidae	40	0.2190	29	0.157	18	0.0171	33	0.1928	13	0.024
F. Heptageniidae	103	0.1707	24	0.024	41	0.0248	51	0.1794	26	0.1
STONEFLIES										
O. Plecoptera										
F. Capniidae	-	-	-	-	1	0.0001	-	-	1	0.001
F. Chloroperlidae	31	0.0562	3	0.003	-	-	1	0.0010	-	-
F. Leuctridae	19	0.0225	2	0.001	-	-	-	-	-	-
F. Nemouridae	13	0.0382	4	0.005	10	0.0223	27	0.0606	12	0.024
F. Peltoperlidae	-	-	1	5E-04	-	-	-	-	1	0.001
F. Perlodidae	33	0.5171	12	0.199	12	0.0186	18	0.3189	6	0.091
F. Pteronarcyidae	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	40	0.0160	15	0.005	1	0.0005	15	0.0085	5	0.002
CADDISFLIES										
O. Trichoptera										
immature (?Uenoidae)	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	-	-	-	-	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	1	0.0057	1	0.004	-	-	-	-	-	-
F. Hydropsychidae	1	0.0002	1	2E-04	-	-	-	-	-	-
F. Leptoceridae	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	1	0.0001	-	-	-	-	-	-	-	-
F. Rhyacophilidae	1	0.0011	-	-	-	-	2	0.0155	2	9E-04
F. Uenoidae	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
O. Diptera										
indeterminate	-	-	1	0.001	-	-	-	-	-	-
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-
F. Chironomidae	84	0.1007	29	0.021	56	0.0530	72	0.0928	21	0.014
F. Empididae	-	-	-	-	-	-	-	-	-	-
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	1	0.0002	-	-	1	0.0005	-	-	1	4E-04
F. Simuliidae	-	-	-	-	-	-	-	-	-	-
F. Stratiomyiidae	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS	389		126		144		234		92	
TOTAL NUMBER OF TAXA [a]	17		14		11		13		12	
TOTAL BIOMASS (g)		1.2096		0.4211		0.1592		0.9504		0.2681

[a] Bold entries excluded from taxa count

Benthic Macroinvertebrates Collected Through Hess Sampling (sampling area 0.1 m2) From Teck Line Creek, 2017 (Densities expressed per sampled area)

Station	LIDCOM-BM																			
Replicate	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	14	0.0028	20	0.0108	16	0.0008	8	0.0028	8	0.0010	4	0.0004	4	0.0004	16	0.0004	4	0.0006	-	-
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	-	-	20	0.0860	40	0.1296	2	0.0036	2	0.0026	2	0.0012	40	0.0588	2	0.0004	12	0.0124	4	0.0122
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-	26	0.0062	-	-	-	-	-	-	2	0.0002
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	2	0.0040	-	-	-	-	-	-	2	0.0040	16	0.0370	8	0.0976	-	-	2	0.0204	4	0.0394
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	10	0.0036	16	0.0064	88	0.0600	4	0.0012	16	0.0060	12	0.0052	40	0.0208	22	0.0042	16	0.0054	2	0.0052
SEED SHRIMPS																				
Cl. Ostracoda	2	0.0004	16	0.0076	64	0.0536	16	0.0032	2	0.0004	2	0.0004	4	0.0008	-	-	2	0.0004	-	-
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	2	0.0052	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0044
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	-	-	4	0.0072	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Baetidae	38	0.1522	16	0.0856	64	0.3928	22	0.0858	54	0.2226	24	0.0922	76	0.3108	16	0.0426	12	0.0292	42	0.1858
F. Ephemerellidae	98	0.1058	72	0.1164	96	0.1168	22	0.0328	72	0.0856	64	0.0850	60	0.0560	54	0.0584	22	0.0264	72	0.1318
F. Heptageniidae	70	0.1034	132	0.1696	192	0.3056	94	0.1878	38	0.0742	38	0.0880	52	0.0924	24	0.0308	24	0.0428	74	0.2640
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	4	0.0030	8	0.0188	16	0.0360	12	0.0116	-	-	-	-	8	0.0064	-	-	2	0.0010	6	0.0080
F. Chloroperlidae	16	0.0238	8	0.0364	104	0.2112	40	0.0924	2	0.0014	14	0.0084	12	0.0060	16	0.0068	42	0.0514	10	0.0284
F. Leuctridae	2	0.0056	-	-	-	-	-	-	-	-	8	0.0024	20	0.0288	6	0.0018	6	0.0030	4	0.0096
F. Nemouridae	104	0.2270	132	0.3600	296	0.4408	64	0.2062	58	0.3046	56	0.1320	76	0.1192	24	0.0282	26	0.0504	41	0.0938
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Perlodidae	18	0.0506	28	0.0188	56	0.8016	30	0.2422	6	0.0470	18	0.0812	12	0.0624	4	0.0018	6	0.0506	4	0.0748
F. Pteronarcyidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	56	0.0112	56	0.0204	136	0.0512	34	0.0110	34	0.0064	30	0.0064	28	0.0048	32	0.0054	14	0.0030	48	0.0220
CADDISFLIES																				
O. Trichoptera																				
immature (?Uenoidae)	**36**	0.0020	88	0.0028	**264**	0.0208	**28**	0.0016	**50**	0.0028	**186**	0.0108	**60**	0.0060	**74**	0.0034	28	0.0016	**12**	0.0004
F. Apataniidae	2	0.0008	8	0.0100	24	0.0120	2	0.0006	-	-	-	-	32	0.0300	6	0.0036	2	0.0020	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	2	0.0042	4	0.0004	40	0.0472	6	0.0194	6	0.0010	6	0.0006	-	-	-	-	2	0.0004	2	0.0180
F. Hydropsychidae	53	0.4445	8	1.3189	32	2.5256	52	0.6420	28	0.4877	6	0.0042	4	0.0016	11	0.1417	-	-	35	0.6243
F. Leptoceridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0008	-	-	-	-
F. Rhyacophilidae	46	0.6426	48	0.3372	32	0.2136	50	0.4456	32	0.3124	56	0.3146	24	0.0308	34	0.1176	14	0.1454	26	0.3956
F. Uenoidae	4	0.0008	-	-	16	0.0080	6	0.0042	4	0.0004	2	0.0004	8	0.0008	4	0.0020	-	-	2	0.0228
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0.0042	-	-	-	-
F. Chironomidae	242	0.8052	344	0.5252	1520	1.5296	122	0.1540	294	0.4392	192	0.3432	408	0.6048	236	0.4040	126	0.1546	144	0.2732
F. Empididae	12	0.0278	8	0.0704	48	0.2616	12	0.0238	6	0.0456	22	0.0372	4	0.0072	20	0.0314	4	0.0056	20	0.0678
F. Pelecorhyncidae	-	-	-	-	-	-	2	0.0012	-	-	2	0.0028	-	-	4	0.0692	-	-	-	-
F. Psychodidae	54	0.0262	24	0.0184	56	0.0520	22	0.0098	22	0.0078	32	0.0122	32	0.0080	36	0.0062	10	0.0024	36	0.0160
F. Simuliidae	12	0.0458	8	0.0232	-	-	16	0.0548	6	0.0210	2	0.0064	-	-	4	0.0002	4	0.0154	16	0.0678
F. Stratiomyiidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	4	0.0128	1	0.1427	24	0.0496	-	-	-	-	2	0.0160	8	0.0408	-	-	-	-	3	0.2065
TOTAL NUMBER OF ORGANISMS	903		1069		3224		666		742		822		1020		653		380		611	
TOTAL NUMBER OF TAXA [a]	24		23		21		22		20		24		22		22		22		23	
TOTAL BIOMASS (g)		2.7113		3.3932		7.3200		2.2376		2.0737		1.2944		1.5952		0.9651		0.6244		2.5720

[a] Bold entries excluded from taxa count

Benthic Macroinvertebrates Collected Through Hess Sampling (sampling area 0.1 m2) From Teck Line Creek, 2017 (Densities expressed per sampled area)

Station	LIDSL-BM																			
Replicate	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	4	0.0008	-	-	4	0.0002	-	-	4	0.0004	-	-	-	-	-	-	-	-	4	0.0008
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	4	0.0004	6	0.0068	8	0.0152	4	0.0084	8	0.0116	8	0.0620	10	0.0302	4	0.0050	28	0.0390	16	0.0300
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0040
F. Lumbricidae	-	-	-	-	-	-	4	0.0040	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	8	0.0072	10	0.0242	-	-	12	0.0532	12	0.0788	24	0.1200	10	0.0356	8	0.0188	8	0.0168	20	0.0932
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	12	0.0048	2	0.0008	8	0.0024	4	0.0016	4	0.0012	12	0.0064	6	0.0054	-	-	8	0.0026	68	0.0292
SEED SHRIMPS																				
Cl. Ostracoda	32	0.0080	4	0.0006	6	0.0018	12	0.0028	4	0.0004	44	0.0148	14	0.0060	16	0.0022	52	0.0128	100	0.0248
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0024
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	-	-	2	0.0058	2	0.0002	12	0.0048	-	-	4	0.0048	-	-	8	0.0038	24	0.0062	20	0.0072
F. Baetidae	40	0.0812	12	0.0386	28	0.0684	60	0.1916	52	0.1396	8	0.0484	22	0.0822	16	0.0402	52	0.1370	32	0.1524
F. Ephemerellidae	8	0.0076	10	0.0124	34	0.0206	12	0.0124	24	0.0300	20	0.0444	26	0.0302	20	0.0174	20	0.0078	44	0.0264
F. Heptageniidae	112	0.2296	128	0.4826	184	0.1856	64	0.2576	48	0.1636	148	0.2688	122	0.2716	108	0.2696	134	0.2626	160	0.3076
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	4	0.0032	2	0.0036	6	0.0038	8	0.0040	12	0.0112	8	0.0112	8	0.0126	4	0.0012	4	0.0030	8	0.0096
F. Chloroperlidae	32	0.0884	18	0.0782	38	0.0524	48	0.1084	76	0.2540	60	0.1820	42	0.0818	28	0.0592	68	0.1546	40	0.0352
F. Leuctridae	4	0.0016	-	-	2	0.0034	4	0.0040	8	0.0104	-	-	2	0.0076	-	-	14	0.0124	-	-
F. Nemouridae	64	0.1396	34	0.1764	74	0.3248	36	0.1248	48	0.0744	80	0.2732	36	0.0702	84	0.2186	64	0.0842	116	0.4632
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Perlodidae	8	0.0776	-	-	12	0.1562	-	-	12	0.1064	-	-	4	0.3164	12	0.0574	4	0.0026	17	0.1372
F. Pteronarcyidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	44	0.0112	16	0.0068	42	0.0090	8	0.0028	44	0.0116	36	0.0216	24	0.0146	12	0.0012	42	0.0076	20	0.0052
CADDISFLIES																				
O. Trichoptera																				
immature (?Uenoidae)	36	0.0032	34	0.0020	20	0.0022	40	0.0012	-	-	56	0.0028	16	0.0012	60	0.0026	**70**	0.0036	**248**	0.0104
F. Apataniidae	4	0.0048	2	0.0018	2	0.0008	-	-	-	-	-	-	2	0.0020	-	-	4	0.0022	4	0.0060
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0002	-	-
F. Glossosomatidae	4	0.0152	18	0.0694	22	0.0770	12	0.0576	-	-	16	0.0752	20	0.0694	8	0.0110	2	0.0114	88	0.0528
F. Hydropsychidae	210	1.7651	55	0.3290	25	0.6272	48	2.3920	74	0.9765	5	0.0918	29	0.4851	17	0.8095	65	0.9144	9	0.5162
F. Leptoceridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0004	-	-
F. Rhyacophilidae	24	0.0864	2	0.0020	14	0.2636	4	0.0036	20	0.2360	12	0.2076	12	0.2152	36	0.3098	18	0.2310	33	0.1597
F. Uenoidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0004	8	0.0056
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Chironomidae	840	1.0100	164	0.2074	340	0.3936	348	0.4788	708	1.1476	592	0.4860	256	0.3776	328	0.1440	490	0.4906	620	0.6088
F. Empididae	12	0.0212	22	0.0812	6	0.0180	8	0.0208	8	0.0260	12	0.0440	18	0.0672	8	0.0090	6	0.0076	16	0.0260
F. Pelecorhyncidae	-	-	-	-	2	0.0220	4	0.0072	-	-	-	-	2	0.0022	-	-	2	0.0014	4	0.0076
F. Psychodidae	8	0.0016	-	-	12	0.0038	4	0.0008	8	0.0044	12	0.0044	20	0.0136	-	-	26	0.0062	16	0.0052
F. Simuliidae	4	0.0008	-	-	2	0.0086	-	-	16	0.0576	-	-	-	-	-	-	-	-	-	-
F. Stratiomyiidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	-	-	-	-	-	-	4	0.2056	-	-	4	0.0008	20	0.3670	-	-	16	0.5120	4	0.0040
TOTAL NUMBER OF ORGANISMS	1518		541		893		760		1190		1161		721		777		1229		1723	
TOTAL NUMBER OF TAXA [a]	23		19		24		23		20		20		23		18		26		26	
TOTAL BIOMASS (g)		3.5695		1.5296		2.2608		3.9480		3.3417		1.9702		2.5649		1.9805		2.9306		2.7307

[a] Bold entries excluded from taxa count

Benthic Macroinvertebrates Collected Through Hess Sampling (sampling area 0.1 m2) From Teck Line Creek, 2017 (Densities expressed per sampled area)

Station	LILC3-BM																			
Replicate	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	20	0.0014	40	0.0048	32	0.0032	48	0.0104	10	0.0016	64	0.0064	48	0.0088	136	0.0208	40	0.0032	56	0.0040
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	4	0.0022	68	0.1488	56	0.1928	104	0.2112	14	0.0236	168	0.8824	176	0.4344	168	0.3352	352	0.5256	88	0.3056
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	0.0008	-	-	-	-
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	-	-	-	-	-	-	8	0.0128	-	-	40	0.1728	40	0.1576	120	0.4528	72	0.2280	40	0.2160
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	10	0.0030	44	0.0204	72	0.0376	40	0.0152	30	0.0132	72	0.0328	144	0.0448	80	0.0272	80	0.0368	88	0.0392
SEED SHRIMPS																				
Cl. Ostracoda	20	0.0052	320	0.0856	520	0.1528	400	0.0968	14	0.0028	592	0.1280	208	0.0480	2472	0.7152	208	0.0464	784	0.1952
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0016	-	-	-	-	-	-
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Baetidae	16	0.0220	8	0.0124	24	0.0456	-	-	12	0.0262	40	0.1240	40	0.0936	64	0.2128	88	0.1344	40	0.0968
F. Ephemerellidae	-	-	-	-	-	-	-	-	2	0.0022	-	-	8	0.0088	-	-	-	-	-	-
F. Heptageniidae	4	0.0294	12	0.0052	-	-	-	-	2	0.0004	-	-	8	0.0016	40	0.0112	8	0.0008	-	-
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	-	-	4	0.0032	16	0.0384	8	0.0192	-	-	-	-	16	0.0472	-	-	8	0.0272	8	0.0152
F. Chloroperlidae	10	0.0216	20	0.0724	24	0.0496	16	0.0304	-	-	160	0.4456	32	0.1008	48	0.2024	88	0.1200	96	0.2864
F. Leuctridae	-	-	-	-	-	-	-	-	-	-	8	0.0072	-	-	-	-	-	-	-	-
F. Nemouridae	14	0.0894	12	0.0696	32	0.2344	56	0.1632	10	0.0412	48	0.2712	64	0.2384	12	0.0624	136	0.7880	24	0.0448
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Perlodidae	8	0.0432	-	-	8	0.1888	16	0.0872	-	-	8	0.2128	24	0.6680	48	0.1232	16	0.0096	-	-
F. Pteronarcyidae	-	-	-	-	-	-	8	0.0320	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0008	8	0.0008
CADDISFLIES																				
O. Trichoptera																				
immature (?Uenoidae)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	-	-	8	0.1456	-	-	-	-	8	0.0048	-	-	-	-	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0016	-	-	-	-	-	-
F. Hydropsychidae	30	1.0725	7	0.7347	5	0.7363	32	1.8016	38	1.4452	32	2.4272	24	1.3960	-	-	124	3.7909	26	0.8804
F. Leptoceridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	-	-	12	0.0048	-	-	-	-	2	0.0004	8	0.0088	-	-	80	0.0344	-	-	8	0.0024
F. Rhyacophilidae	14	0.6852	41	2.9517	32	2.5408	16	0.7232	7	0.1468	8	0.0232	40	1.1800	-	-	72	2.4720	24	0.0472
F. Uenoidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0064	-	-
F. Chironomidae	486	0.6802	1024	1.6296	1776	2.5064	1704	2.2168	404	0.6126	4440	5.2976	3344	3.7064	6864	6.6952	3320	3.4432	3888	3.3600
F. Empididae	-	-	16	0.0424	-	-	16	0.0320	2	0.0042	8	0.0152	8	0.0184	40	0.2768	8	0.0208	-	-
F. Pelecorhyncidae	2	0.0158	-	-	-	-	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0016	-	-	-	-
F. Simuliidae	2	0.0096	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Stratiomyiidae	-	-	-	-	-	-	-	-	-	-	-	-	8	0.1544	-	-	-	-	-	-
F. Tipulidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS	640		1628		2597		2480		549		5696		4256		10196		4636		5178	
TOTAL NUMBER OF TAXA [a]	14		14		12		15		14		15		20		15		17		14	
TOTAL BIOMASS (g)		2.6807		5.7856		6.7267		5.5976		2.3206		######		8.3152		9.1720		11.6541		5.4940

[a] Bold entries excluded from taxa count

Benthic Macroinvertebrates Collected Through Hess Sampling (sampling area 0.1 m2) From Teck Line Creek, 2017 (Densities expressed per sampled area)

Station	SLINE-BM									
Replicate	1		2		3		4		5	
ROUNDWORMS										
P. Nemata	-	-	1	0.0013	1	0.0007	1	0.0011	-	-
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
F. Planariidae	-	-	-	-	-	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	1	0.0001
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	1	0.0051	-	-	1	0.0010	3	0.0046	1	0.0036
ARTHROPODS										
MITES										
Cl. Arachnida										
Subcl. Acari	2	0.0009	-	-	1	0.0006	-	-	3	0.0013
SEED SHRIMPS										
Cl. Ostracoda	19	0.0051	-	-	9	0.0036	5	0.0011	2	0.0005
INSECTS										
Cl. Insecta										
BEETLES										
O. Coleoptera										
F. Elmidae	-	-	-	-	-	-	-	-	-	-
MAYFLIES										
O. Ephemeroptera										
F. Ameletidae	-	-	-	-	3	0.0151	-	-	-	-
F. Baetidae	4	0.0122	1	0.0027	2	0.0062	2	0.0081	1	0.0047
F. Ephemerellidae	13	0.0066	-	-	9	0.0074	16	0.0327	18	0.1378
F. Heptageniidae	39	0.1387	3	0.0340	33	0.0753	46	0.2933	42	0.1697
STONEFLIES										
O. Plecoptera										
F. Capniidae	-	-	-	-	-	-	3	0.0047	-	-
F. Chloroperlidae	15	0.0452	1	0.0003	8	0.0108	3	0.0067	3	0.0036
F. Leuctridae	10	0.0124	1	0.0006	2	0.0030	-	-	1	0.0002
F. Nemouridae	14	0.0259	1	0.0025	10	0.0251	30	0.0533	12	0.0301
F. Peltoperlidae	1	0.0016	-	-	1	0.0002	2	0.0101	1	0.0007
F. Perlodidae	-	-	-	-	8	0.1866	9	0.1684	9	0.2031
F. Pteronarcyidae	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	-	-	-	-	4	0.0023	1	0.0003	3	0.0001
CADDISFLIES										
O. Trichoptera										
immature (?Uenoidae)	**14**	0.0007	-	-	**20**	0.0010	**5**	0.0003	**2**	0.0001
F. Apataniidae	-	-	-	-	-	-	-	-	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	1	0.0063	-	-	3	0.0170	2	0.0100	4	0.0267
F. Hydropsychidae	6	0.0623	1	0.0002	8	0.2633	6	0.2062	6	0.0605
F. Leptoceridae	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	2	0.1120	-	-	-	-	-	-	-	-
F. Rhyacophilidae	3	0.0245	-	-	9	0.0912	20	0.1436	18	0.2742
F. Uenoidae	1	0.0010	-	-	5	0.0023	10	0.0051	2	0.0024
TRUE FLIES										
O. Diptera										
indeterminate	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	1	0.0006	-	-	-	-	-	-	-	-
F. Chironomidae	26	0.0156	-	-	28	0.0195	142	0.0721	36	0.0244
F. Empididae	5	0.0201	-	-	3	0.0132	4	0.0127	1	0.0009
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	-	-	-	-	-	-	2	0.0011	1	0.0002
F. Simuliidae	-	-	-	-	-	-	-	-	1	0.0001
F. Stratiomyiidae	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	2	0.4909	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS	179		9		168		312		168	
TOTAL NUMBER OF TAXA [a]	19		7		20		19		21	
TOTAL BIOMASS (g)		0.9877		0.0416		0.7454		1.0355		0.9450

[a] Bold entries excluded from taxa count

SUPPORTING DATA – PRODUCTIVITY EVALUATION

Benthic Invertebrate Community Kick and Sweep Laboratory Data, Methods, and QC Report 2017

Cordillera Consulting

Project: Teck Line Creek LAEMP 2017 (177202-0023)

Minnow Environmental (Ontario), Kevin Martens, Michael White, Patti Orr Shari Weech, Deb McMillan

Taxonomist: Sue Salter 250-494-7553
suesalter@cordilleraconsulting.ca

Site:	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017
Sample:	LI8-BIC	LISP24-BIC	LIDCOM-BIC	FO23-BIC	SLINE-BIC	LIDSL-BIC-01	LIDSL-BIC-02	LIDSL-BIC-03	LISP23-BIC	LILC3-BIC	LI24-BIC	LCUT-BIC	FRUL-BIC
Sample Collection Date:	08-Sep-17	11-Sep-17	10-Sep-17	13-Sep-17	09-Sep-17	10-Sep-17	10-Sep-17	10-Sep-17	11-Sep-17	09-Sep-17	11-Sep-17	10-Sep-17	13-Sep-17
CC#:	CC181023	CC181024	CC181025	CC181026	CC181027	CC181028	CC181029	CC181030	CC181031	CC181032	CC181033	CC181034	CC181035
Phylum: Arthropoda	0		0		0		0		0		0		0
Subphylum: Hexapoda	0		0		0		0		0		0		0
Class: Insecta	0		0		0		0		0		0		0
Order: Ephemeroptera	0		0		0		0		0		0		0
Family: Ameletidae	0		0		0		0		0		0		0
Ameletus	60	200	20	30	120	100	40	100	180		80		20
Family: Baetidae	0	20	80		20	60	0	20	0		0		140
Baetis	880	280	960	470	120	340	440	480	480	280	20	160	700
Baetis bicaudatus	0		0		20		20		0		0		0
Baetis rhodani group	680	420	580	260	20	300	20	40	260	200	20	140	80
Family: Ephemerellidae	0	200	1080	70	60	220	780	240	120		420		80
Drunella	20		0		780		0		0		300		0
Drunella doddsii	340	40	500	70	360	180	100	80	60		120		20
Family: Heptageniidae	1560	860	1540	410	740	1200	2700	1000	1340	80	2280	100	500
Cinygmula	20		0		0		0		0		0		0
Epeorus	0		60	10	280	160	20	40	0		0		0
Rhithrogena	0		0		60		0		40		40		0
Order: Plecoptera	0		0		0		20	60	0		20		60
Family: Capniidae	300		80	20	20		60	40	40	40	60		60
Utacapnia	0		0		0		0		0	40	0		0
Family: Chloroperlidae	0		140	40	60	60	20	20	0	100	340		20
Sweltsa	60	120	280	100	60	80	140	140	100	320	100	140	40
Family: Leuctridae	40		0		40		0		0		20		40
Family: Nemouridae	0		800		0	540	0		0		0	20	100
Visoka cataractae	0		0		0		0		0		40		0
Zapada	580	280	1880	80	100	620	1240	200	180	120	120	60	80
Zapada oregonensis group	220	160	240	10	180	120	200	300	140	200	60	120	20
Zapada cinctipes	600		160	580	20	180	500	120	0	80	0		1240
Zapada columbiana	140	60	60		260	160	400	40	0	40	300	100	0
Family: Peltoperlidae	0		0		0		0		0		0		0
Yoraperla	0		0		20		0		0		0		0
Family: Perlidae	0		0	40	0		0		0		0		140
Hesperoperla	0		0	30	0		0		0		0		220
Family: Perlodidae	20		0		20		60		0		80	40	0
Kogotus	20		360	80	20	160	160	60	20	40	0	60	40
Megarcys	20		0		260	60	100		20	100	120	80	0
Family: Taeniopterygidae	80	40	540	120	100		440	20	0		20		40
Taenionema	1620	100	1140	190	0	900	600	180	180	40	320		200
Order: Trichoptera	60	500	2180	40	580	700	340	760	1000	40	80	120	80
Family: Apataniidae	0		0		0		0		0		0		0
Apatania	1720		180		0		0		0		0	20	0
Family: Brachycentridae	0		0	50	0		0		0		0		0
Brachycentrus americanus	0		0		0		0		0		0		40
Family: Glossosomatidae	0	20	60		0	20	120		80		0		0
Glossosoma	0		0	80	40		20		40		0		0
Family: Hydropsychidae	60	280	380		260	1240	1940	360	160	320	0	360	0
Parapsyche	0	20	20		100	80	100	20	60	80	0	60	0
Family: Limnephilidae	0		0		0		0		0		20		0
Ecclisomyia	0		0		0		0		80	20	0		0
Family: Rhyacophilidae	0		0		0		0		0		0		0
Rhyacophila	140	20	160	30	40	40	120		60	40	20		200
Rhyacophila betteni group	40		0		0		60	40	0		0		20
Rhyacophila brunnea/vemna grou	60		40	50	0	20	20	20	0		0		0
Rhyacophila hyalinata group	0	20	20	10	100		60	40	20	20	0	20	0
Rhyacophila vofixa group	0		0		20		40		20		0		0
Rhyacophila narvae	0		0		0		0	20	0		0		0
Family: Uenoidae	0		0		0		0		0		0		0
Neothremma	0		20		0		0		0		0		0
Oligophlebodes	0		0		0		0	20	0		0		0
Order: Coleoptera	0		0		0		0		0		0		0
Family: Elmidae	0		0	10	0		0		0		0		0
Heterlimnius	0		0		0		0		20		0		0
Order: Diptera	0		40		0		0		0		0		0
Family: Athericidae	0		0		0		0		0		0		0
Atherix	0		0	60	0		0		0		0		40
Family: Ceratopogonidae	0		0		0	20	0		0		0		20
Family: Chironomidae	480	1900	880	60	280	1240	1380	540	1220	1800	60	1140	160
Subfamily: Chironominae	0		0		0		0		0		0		0
Tribe: Tanytarsini	20	160	100	20	0	220	60	60	180		0		20
Micropsectra	160	240	160	20	0	120	80	40	80	460	0	120	180
Subfamily: Diamesinae	0		0		0		0		0		0		0
Tribe: Diamesini	0		0		0		0		0		0		0
Diamesa	0	160	40		180	40	60		60	360	0	200	0
Pagastia	360	520	540	10	20	300	520	360	580	800	40	760	60
Pseudodiamesa	0	20	20		0		0		0	20	20		0
Subfamily: Orthocladiinae	0		0		0	200	0		500		0		40
Corynoneura	0	40	80		0	20	0		0		0		0
Diplocladius cultriger	0		0		0		0		0	40	0		0
Eukiefferiella	120	600	560	70	380	260	180	20	360	400	120	480	20
Hydrobaenus	400	380	600	50	0	220	320	320	40	240	0		60
Limnophyes	0		0		0		0	20	0		0		0
Orthocladius complex	360	2600	1900	100	540	1360	1020	1320	2840	4100	760	4280	60
Parorthocladius	0	20	0		20		20		0	20	40		0
Psectrocladius	20		0		0		0		0		0		0
Rheocricotopus	140	660	80		40	500	840	240	500	1820	20	420	20
Thienemanniella	0		0		0		0	20	0		0		0
Tvetenia	40	40	760	40	100	420	280	40	240	300	120	100	160
Zalutschia	20		0		0		0		0		0		0
Subfamily: Tanypodinae	0		0		0		0		0		0		40
Tribe: Pentaneurini	0		0		0		0		0		0		0
Thienemannimyia group	0		0	20	0		0		0		0		0

Cordillera Consulting

Project: Teck Line Creek LAEMP 2017 (177202-0023)

Minnow Environmental (Ontario), Kevin Martens, Michael White, Patti Orr Shari Weech, Deb McMillan

Taxonomist: Sue Salter 250-494-7553
suesalter@cordilleraconsulting.ca

Site:	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017
Sample:	LI8-BIC	LISP24-BIC	LIDCOM-BIC	FO23-BIC	SLINE-BIC	LIDSL-BIC-01	LIDSL-BIC-02	LIDSL-BIC-03	LISP23-BIC	LILC3-BIC	LI24-BIC	LCUT-BIC	FRUL-BIC
Sample Collection Date:	08-Sep-17	11-Sep-17	10-Sep-17	13-Sep-17	09-Sep-17	10-Sep-17	10-Sep-17	10-Sep-17	11-Sep-17	09-Sep-17	11-Sep-17	10-Sep-17	13-Sep-17
CC#:	CC181023	CC181024	CC181025	CC181026	CC181027	CC181028	CC181029	CC181030	CC181031	CC181032	CC181033	CC181034	CC181035
| Tribe: Procladiini													
Procladius		20											
| Family: Empididae	80	160	100						20	20		20	
Clinocerinae Unknown Genus A				10									
Hemerodromia				30									240
Neoplasta				90		20							20
| Family: Muscidae													
Limnophora										20		20	
| Family: Psychodidae													
Pericoma/Telmatoscopus	40		260	230		100	80	40					280
| Family: Simuliidae						20	20						
Simulium						20	20		20				
| Family: Tipulidae					20								
Antocha				10		20							
Dicranota				20	20	20							
Hexatoma		20	40				40						20
Pedicia								20			20		
Subphylum: Chelicerata													
| Class: Arachnida													
| Order: Trombidiformes							20		60				
| Family: Aturidae													
Aturus	20												
| Family: Feltriidae													
Feltria						40	20		80	60		140	
| Family: Lebertiidae													
Lebertia	60	40	160	170	20	20	80	20	40	100		280	20
| Family: Sperchontidae													
Sperchon	120	120	120	20	40	40	180	20	60	200		620	
Sperchonopsis					20								
| Family: Torrenticolidae													
Testudacarus				30									20
Phylum: Annelida													
Subphylum: Clitellata													
| Class: Oligochaeta													
| Order: Lumbriculida													
| Family: Lumbriculidae								20					
Rhynchelmis												20	
| Order: Tubificida													
| Family: Enchytraeidae													
Enchytraeus				80			20			20		40	
| Family: Naididae													
Nais				150									340
| Subfamily: Tubificinae withou		160											
Totals:	**11780**	**11500**	**20000**	**4170**	**6560**	**12760**	**16120**	**7560**	**11580**	**12980**	**6200**	**10240**	**6000**

Taxa present but not included:													
Phylum: Arthropoda													
Subphylum: Crustacea													
| Class: Ostracoda	20	20	20		20	20	20	20	20	20	20	20	
| Class: Branchiopoda													
| Order: Cladocera													20
Phylum: Nemata			20	10	20	20	20	20	20	20		20	
Phylum: Platyhelminthes													
| Class: Turbellaria				10	20	20	20	20		20			
Totals:	**20**	**20**	**40**	**20**	**60**	**60**	**60**	**60**	**40**	**60**	**20**	**40**	**20**

APPENDIX B
SUPPORTING DATA – SELENIUM MONITORING

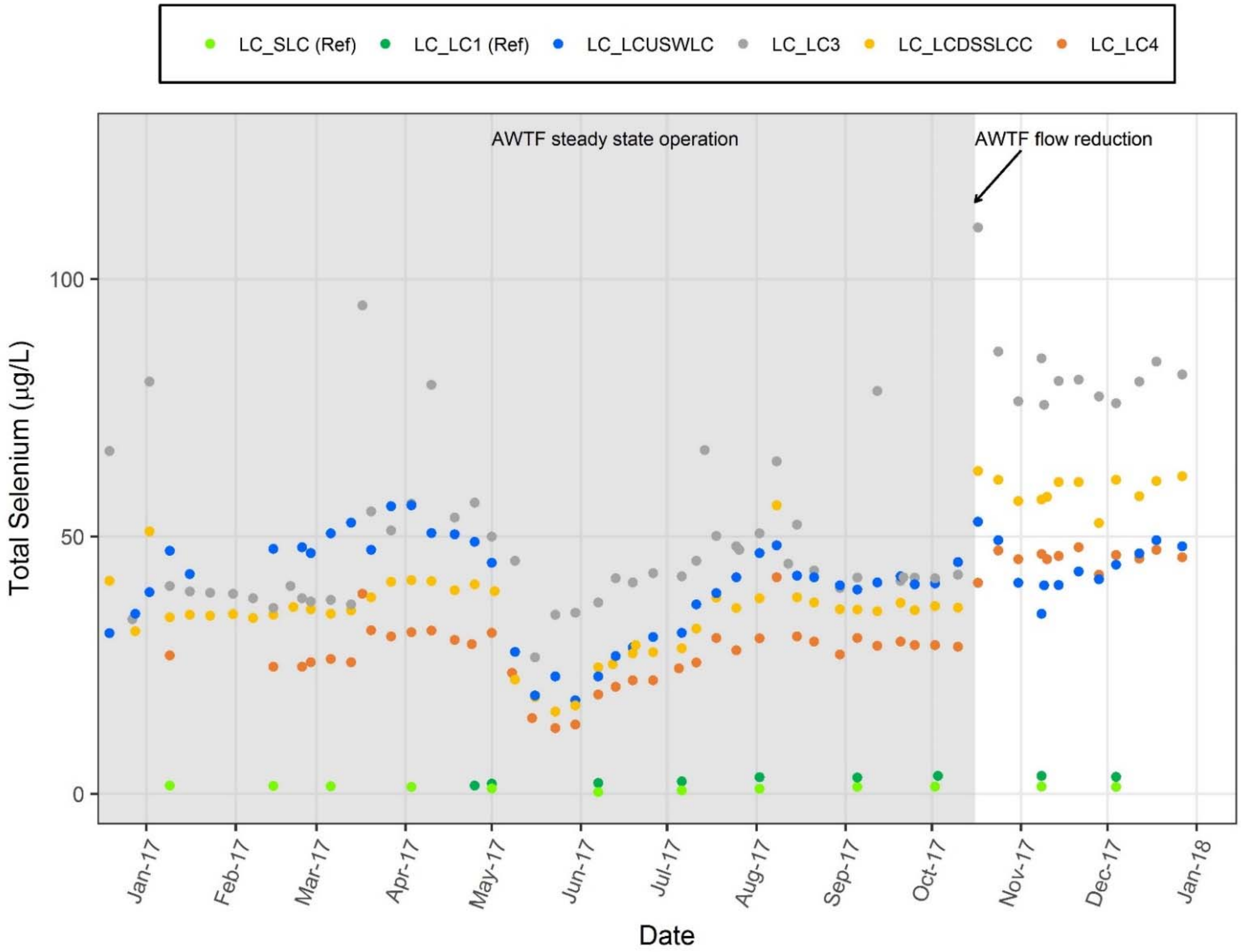


Figure B.1: Total Selenium Concentrations in Water Collected from Line Creek and Fording River, Line Creek LAEMP, 2017

Notes: Hollow symbols indicate results less than the laboratory reporting limit (LRL). If multiple results existed for a given location and day, the first entry in the database was presented. Results for water quality sampling locations are presented only (not those associated with biological sampling locations). Active water treatment facility (AWTF) discharge during steady state operation (indicated by grey shading) is ~5,300 to 5,500 m^3/day, and AWTF during flow reduction is ~2,500 m^3/day.

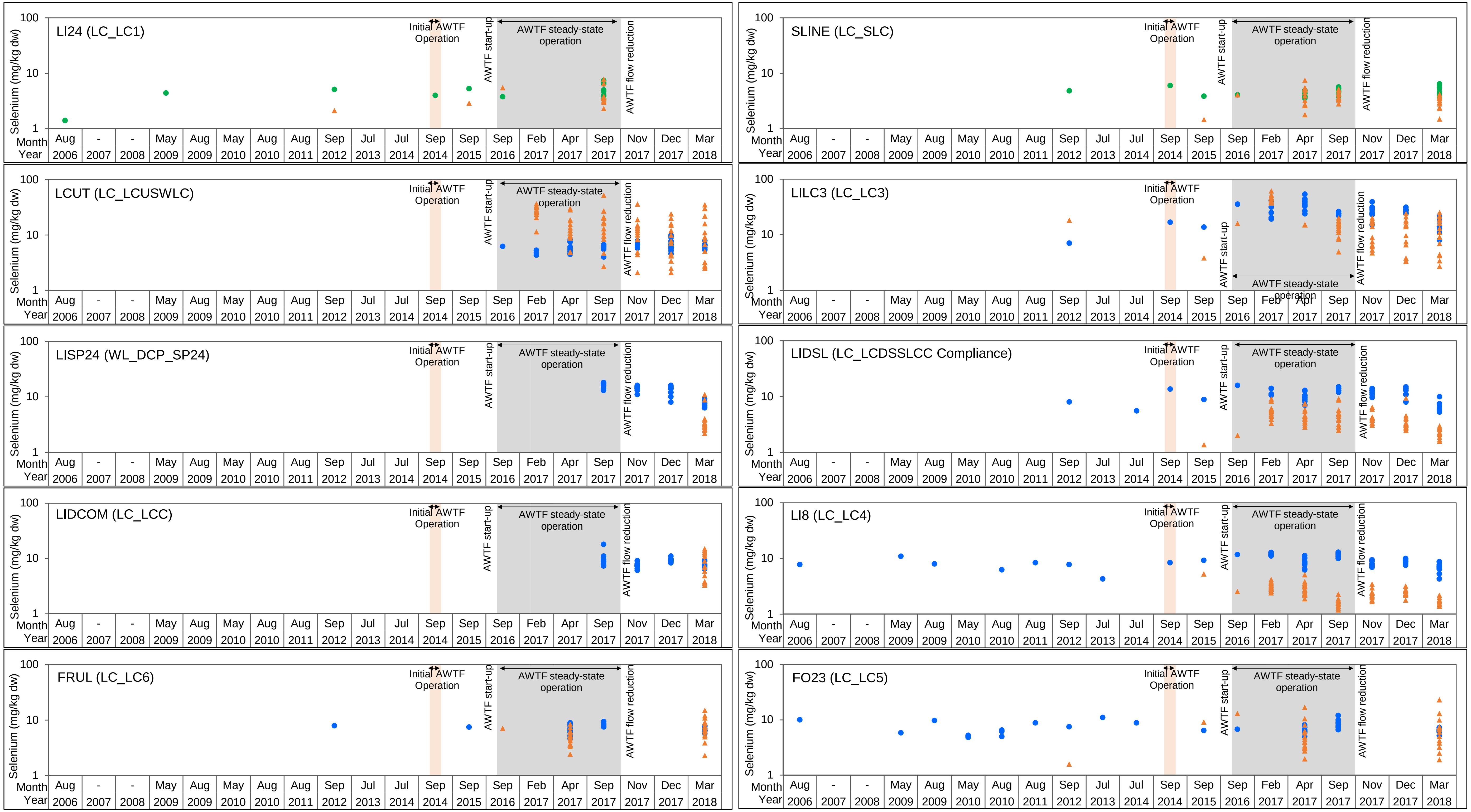


Figure B.2: Tissue Selenium Concentrations Observed in Benthic Invertebrate (BI) Composite-Taxa Samples (Green and Blue Circles) and in Periphyton Samples (Orange Triangles) from Line Creek and Fording River, Line Creek LAEMP, 2006 to 2018

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations.

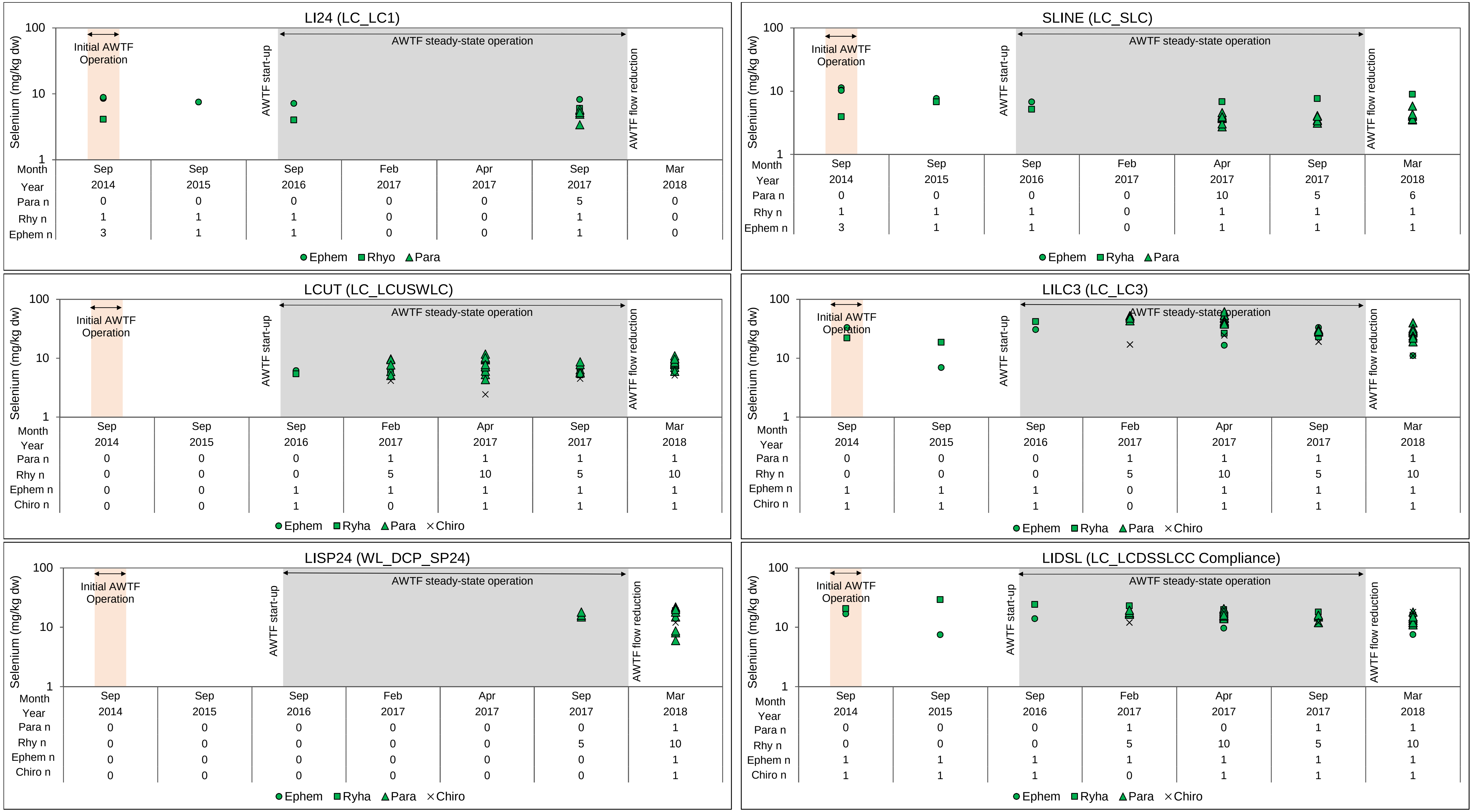


Figure B.3: Tissue Selenium Concentrations of Benthic Invertebrate (Ephemeroptera, Rhyacophilidae, and Parasyche) from Line Creek and Fording River, Line Creek LAEMP, 2014 to 2018

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations.

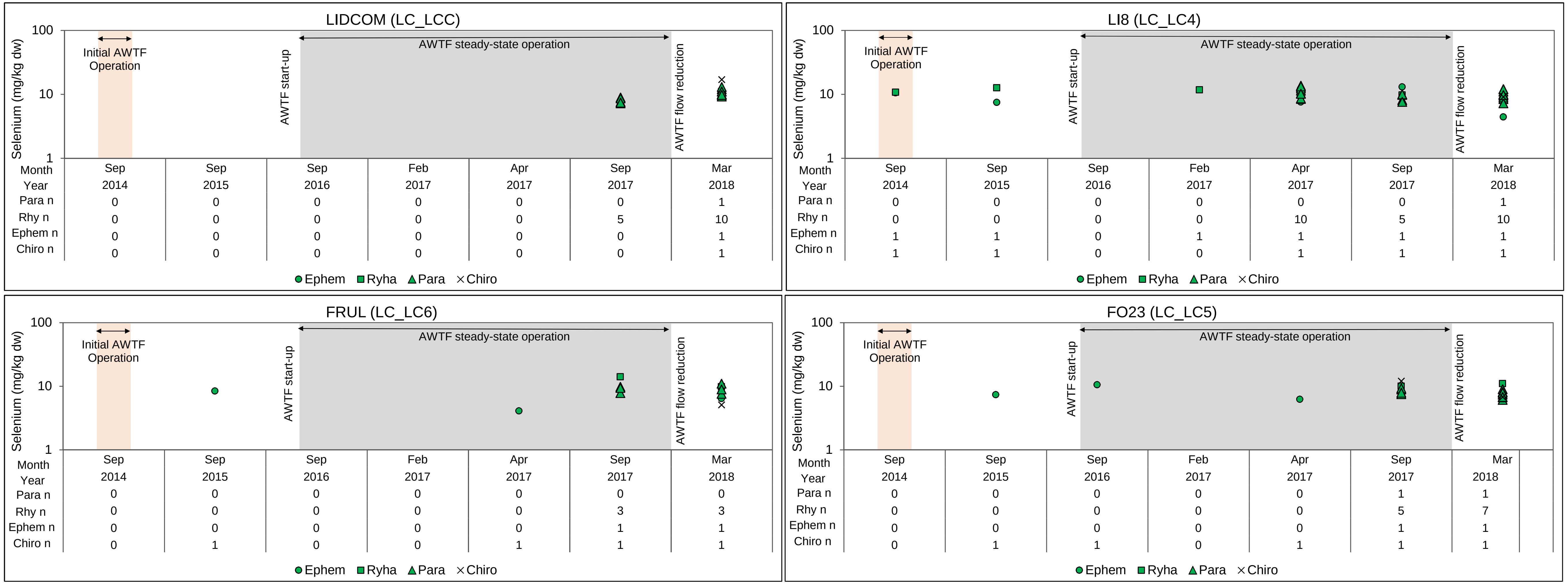


Figure B.3: **Tissue Selenium Concentrations of Benthic Invertebrate (Ephemeroptera, Rhyacophilidae, and Parasyche) from Line Creek and Fording River, Line Creek LAEMP, 2014 to 2018**

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations.

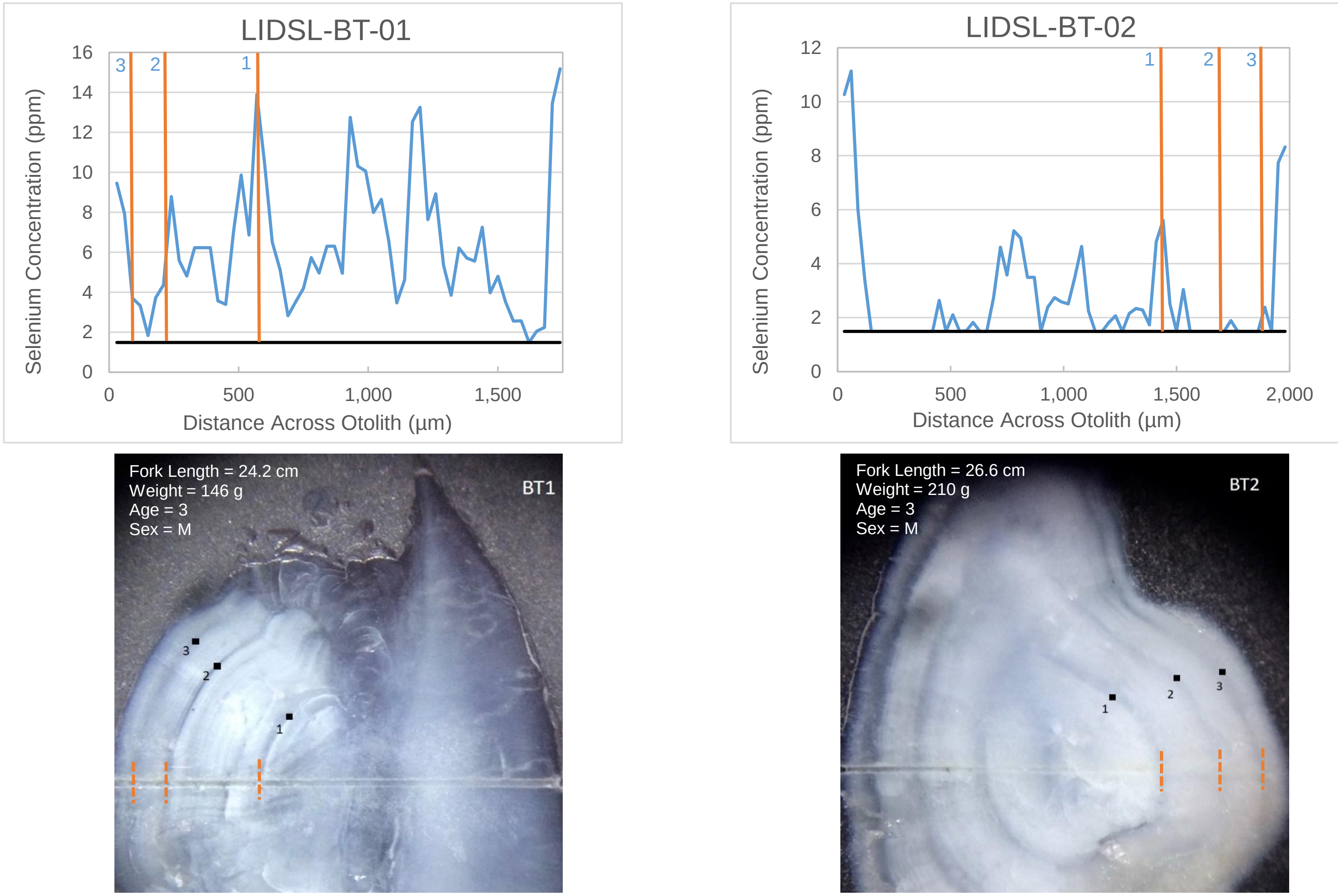
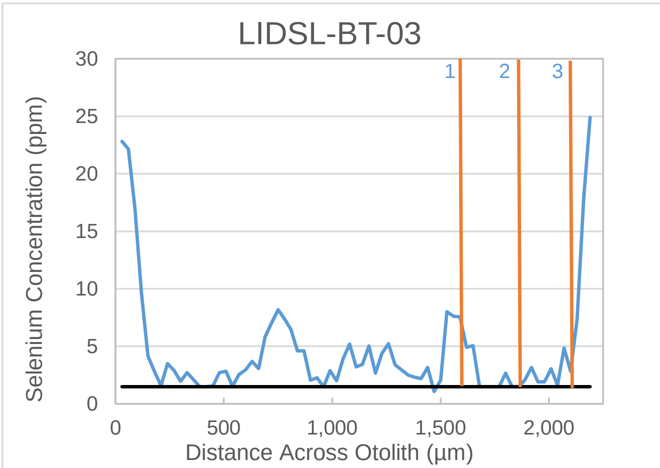
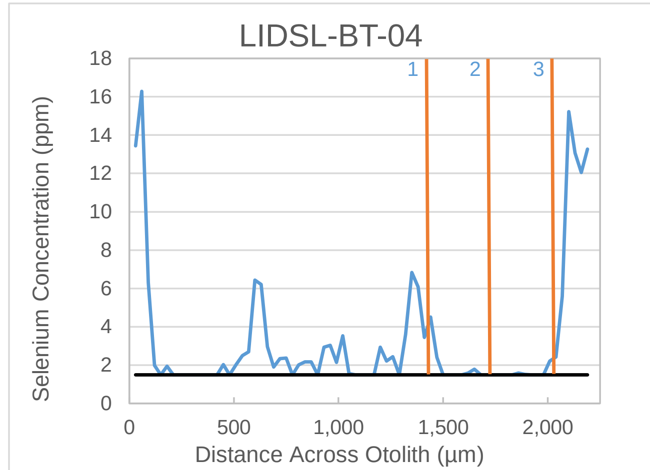


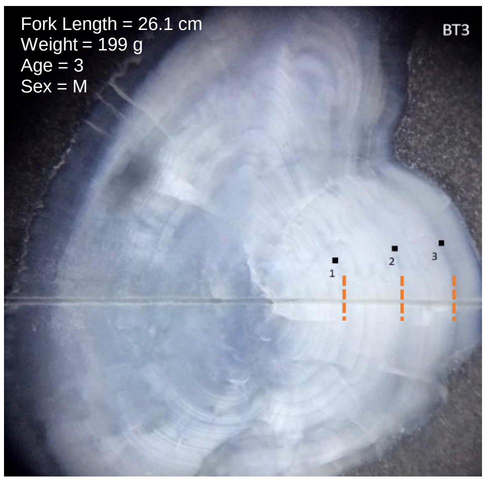
Figure B.4: Selenium Concentrations (ppm) Measured Across Bull Trout Otoliths using Laser Ablation ICP-MS Analysis, Line Creek LAEMP, 2017

Detection Limit

Notes: Fish age associated with distance across otolith (µm) is denoted on the selenium concentration plots in blue numbering.







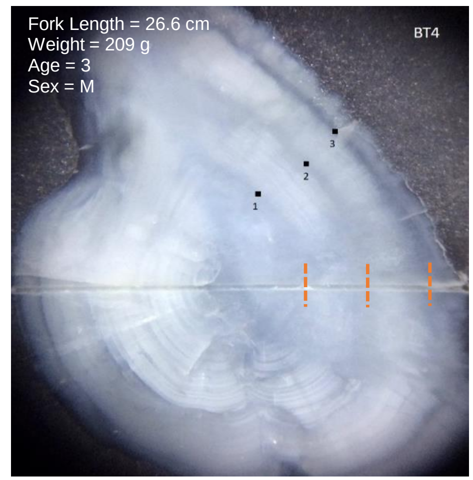


Figure B.4: Selenium Concentrations (ppm) Measured Across Bull Trout Otoliths using Laser Ablation ICP-MS Analysis, Line Creek LAEMP, 2017

——— Detection Limit

Notes: Fish age associated with distance across otolith (µm) is denoted on the selenium concentration plots in blue numbering.

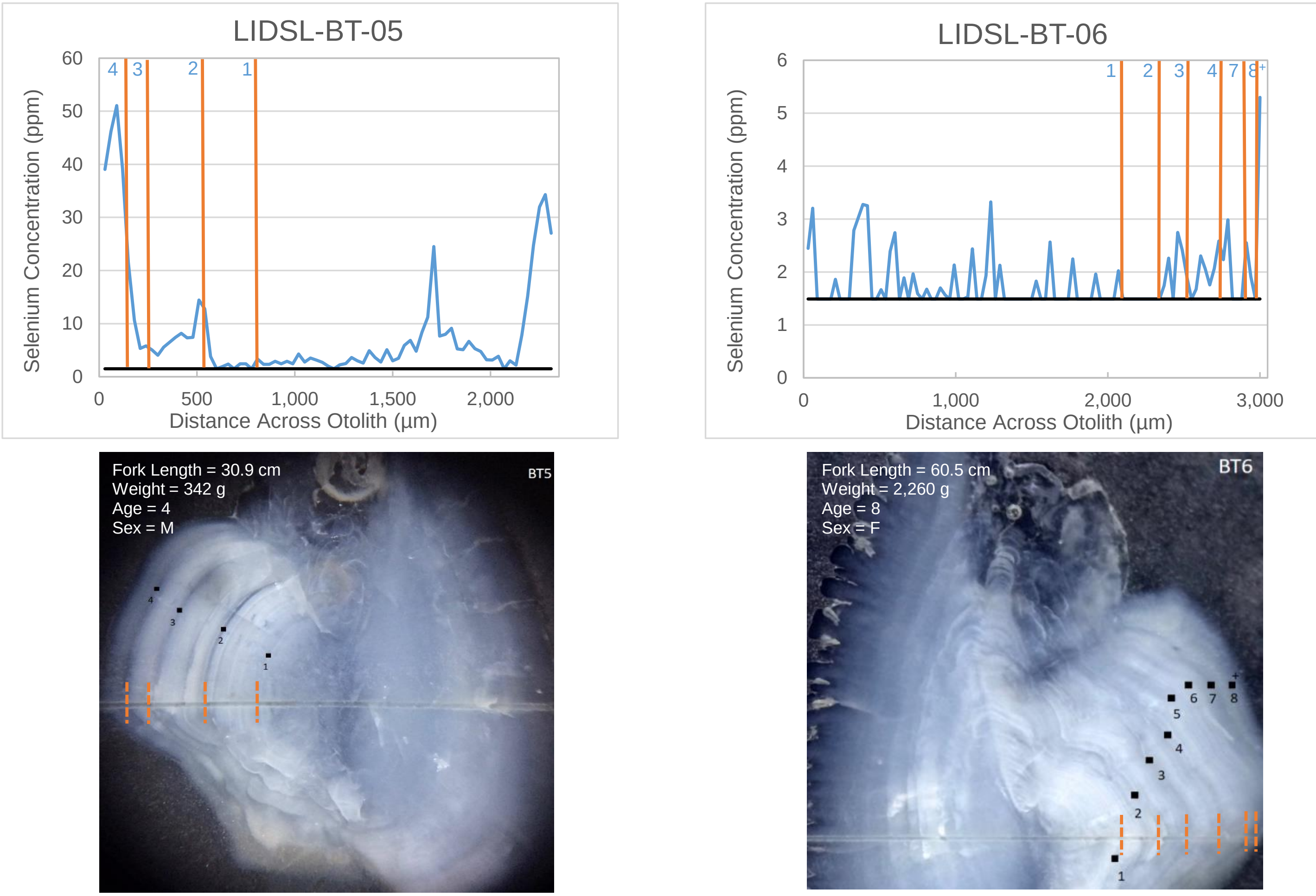


Figure B.4: Selenium Concentrations (ppm) Measured Across Bull Trout Otoliths using Laser Ablation ICP-MS Analysis, Line Creek LAEMP, 2017

—— Detection Limit

Notes: Fish age associated with distance across otolith (µm) is denoted on the selenium concentration plots in blue numbering.

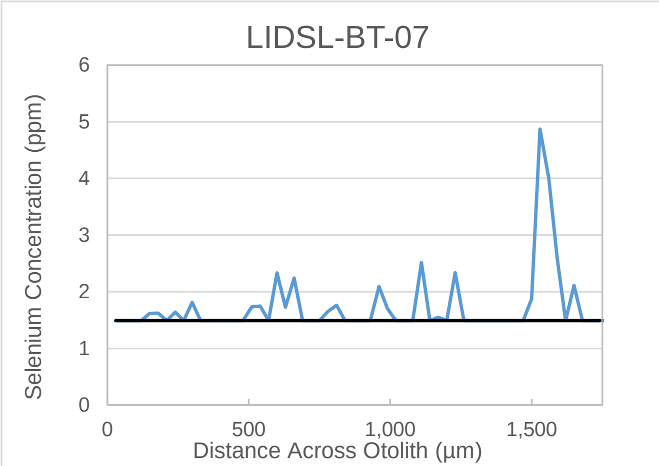


Figure B.4: Selenium Concentrations (ppm) Measured Across Bull Trout Otoliths using Laser Ablation ICP-MS Analysis, Line Creek LAEMP, 2017

Detection Limit

Notes: Fish age associated with distance across otolith (µm) is denoted on the selenium concentration plots in blue numbering. Age could not be determined for the otolith pictured for LIDSL-BT-07 due to deformation, however was successfully determined for an alternate otolith collected from the same individual (age = 10 years; Table 13). Age associated with distance across the otolith was therefore not displayed for this particular sample (LIDSL-BT-07).

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, April 2017 to March 2018 [a]

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)	7-Jun-17	2.03	< 0.015	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	2.11
			2-Aug-17	3.22	0.027	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	3.31
			15-Aug-17	3.16	0.034	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	3.25
			18-Aug-17	2.84	0.029	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	2.93
			21-Aug-17	2.75	0.030	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	2.84
			27-Aug-17	2.81	0.030	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	2.90
			30-Aug-17	1.74	0.022	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.82
			2-Sep-17	2.78	0.032	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	2.87
			5-Sep-17	1.54	0.027	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.63
			3-Oct-17	2.95	< 0.015	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	3.03
		LC_SLC (SLINE)	7-Jun-17	0.365	< 0.015	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	0.440
			2-Aug-17	1.15	0.022	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.23
			15-Aug-17	1.24	0.025	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.33
			18-Aug-17	1.11	0.022	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.19
			21-Aug-17	1.10	0.018	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.18
			24-Aug-17	1.10	0.019	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.18
			27-Aug-17	1.13	0.025	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.22
			30-Aug-17	1.13	0.020	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.21
			2-Sep-17	0.476	< 0.015	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	0.551
			5-Sep-17	1.22	0.025	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.31
			8-Sep-17	1.11	0.018	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.19
			11-Sep-17	1.56	0.240	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.86
			2-Oct-17	1.23	0.021	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.31
			9-Mar-18	1.36	< 0.015	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	1.44
	Mine-exposed	LC_LCUSWLC (LCUT)	3-Apr-17	62.4	0.134	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	62.6
			10-Apr-17	53.0	0.145	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	53.2
			18-Apr-17	52.5	0.135	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	52.7
			25-Apr-17	52.1	0.136	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	52.3
			1-May-17	40.2	0.167	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	40.4
			9-May-17	28.7	0.160	< 0.005	< 0.005	< 0.015	< 0.005	< 0.020	< 0.020	28.9
			16-May-17	18.5	0.166	< 0.005	< 0.005	< 0.015	< 0.005	< 0.020	< 0.020	18.7
			23-May-17	19.9	0.112	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	20.1
			30-May-17	18.0	0.128	< 0.005	< 0.005	< 0.015	< 0.005	< 0.020	< 0.015	18.2
			7-Jun-17	20.8	0.153	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	21.0
			13-Jun-17	28.2	0.137	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	28.4
			19-Jun-17	21.0	0.096	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	21.2
			26-Jun-17	30.0	0.102	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	30.2
			6-Jul-17	35.7	0.090	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	0.021	35.9
			11-Jul-17	35.7	0.091	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	35.9
			18-Jul-17	41.3	0.113	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	41.5
			25-Jul-17	44.2	0.103	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	44.4
			2-Aug-17	44.3	0.089	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	44.4
			2-Aug-17	26.8	0.060	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	26.9
			15-Aug-17	37.3	0.074	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	37.4
			18-Aug-17	38.2	0.078	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	38.3
			21-Aug-17	37.6	0.076	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	37.7
			24-Aug-17	21.3	0.045	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	21.4
			27-Aug-17	36.1	0.066	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	36.2
			30-Aug-17	37.5	0.069	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	37.6
			2-Sep-17	25.2	0.054	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	25.3
			5-Sep-17	37.6	0.065	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	37.7
			8-Sep-17	35.3	0.059	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	35.4
			12-Sep-17	34.1	0.062	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	34.2
			20-Sep-17	34.1	0.066	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	34.2
			25-Sep-17	39.1	0.077	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	39.2
			2-Oct-17	28.2	0.076	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	28.3
			10-Oct-17	40.3	0.066	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	40.4
			17-Oct-17	46.5	0.066	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	46.6
			24-Oct-17	29.7	0.071	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	29.8
			31-Oct-17	35.5	0.093	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	35.7
			8-Nov-17	26.0	0.061	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	26.1
			9-Nov-17	43.9	0.101	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	44.1
			14-Nov-17	33.8	0.077	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	33.9
			21-Nov-17	18.3	0.046	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	18.4
			28-Nov-17	41.5	0.101	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	41.7
			4-Dec-17	38.8	0.109	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	39.0
			12-Dec-17	66.1	0.238	0.009	0.013	< 0.015	< 0.005	< 0.015	< 0.015	66.4
			18-Dec-17	52.1	0.109	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	52.3
			4-Jan-18	42.1	0.106	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	42.3
			15-Jan-18	40.6	0.105	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	40.8
			23-Jan-18	51.5	0.098	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	51.7
			30-Jan-18	53.6	0.101	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	53.8
			5-Feb-18	44.2	0.091	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	44.4
			26-Feb-18	35.9	0.084	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	36.0
			5-Mar-18	53.8	0.102	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	54.0
			9-Mar-18	49.1	0.096	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	49.3

[a] Results for samples collected from January to March, 2017, were presented in the 2016 Line Creek LAEMP report (Minnow 2017a).

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, April 2017 to March 2018 [a]

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 (Continued)	Mine-exposed (Continued)	LC_LC3 (LILC3)	3-Apr-17	53.5	1.26	0.532	0.120	< 0.015	< 0.005	< 0.015	< 0.015	55.5
			10-Apr-17	75.5	0.753	0.629	0.061	< 0.015	< 0.005	< 0.015	< 0.015	77.0
			18-Apr-17	48.3	1.30	1.54	0.151	< 0.015	< 0.005	< 0.015	< 0.015	51.3
			25-Apr-17	55.0	0.821	0.716	0.086	< 0.015	< 0.005	< 0.015	< 0.015	56.7
			1-May-17	39.7	0.507	0.463	0.052	< 0.015	< 0.005	< 0.015	< 0.015	40.8
			9-May-17	32.3	0.248	0.098	0.013	< 0.015	< 0.005	< 0.020	< 0.020	32.7
			16-May-17	26.0	0.252	0.077	0.016	< 0.015	< 0.005	< 0.020	< 0.020	26.4
			23-May-17	39.0	0.283	0.121	0.018	< 0.015	< 0.005	< 0.015	< 0.015	39.5
			30-May-17	33.1	0.164	0.057	< 0.005	< 0.015	< 0.005	< 0.020	< 0.015	33.4
			7-Jun-17	36.5	0.189	0.049	0.012	< 0.015	< 0.005	< 0.015	< 0.015	36.8
			13-Jun-17	20.2	0.132	0.032	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	20.4
			19-Jun-17	36.3	0.229	0.154	0.023	< 0.015	< 0.005	< 0.015	< 0.015	36.8
			26-Jun-17	41.2	0.231	0.135	0.024	< 0.015	< 0.005	< 0.015	< 0.015	41.6
			6-Jul-17	43.1	0.376	0.138	0.024	< 0.015	< 0.005	< 0.015	< 0.015	43.7
			11-Jul-17	42.5	0.337	0.188	0.039	< 0.015	< 0.005	< 0.015	< 0.015	43.1
			18-Jul-17	52.4	0.462	0.229	0.042	< 0.015	< 0.005	< 0.015	< 0.015	53.2
			25-Jul-17	34.4	0.543	0.268	0.065	< 0.015	< 0.005	< 0.015	< 0.015	35.3
			2-Aug-17	55.6	0.471	0.260	0.046	< 0.015	< 0.005	< 0.015	< 0.015	56.4
			8-Aug-17	45.0	0.673	0.365	0.073	< 0.015	< 0.005	< 0.015	< 0.015	46.2
			15-Aug-17	42.9	0.598	0.340	0.078	< 0.015	< 0.005	< 0.015	< 0.015	44.0
			18-Aug-17	39.5	0.693	0.428	0.086	< 0.015	< 0.005	< 0.015	< 0.015	40.8
			21-Aug-17	37.2	0.753	0.414	0.084	< 0.015	< 0.005	< 0.015	< 0.015	38.5
			24-Aug-17	21.3	0.396	0.230	0.039	< 0.015	< 0.005	< 0.015	< 0.015	22.0
			27-Aug-17	39.6	0.577	0.575	0.077	< 0.015	< 0.005	< 0.015	< 0.015	40.9
			30-Aug-17	37.4	0.717	0.390	0.077	< 0.015	< 0.005	< 0.015	< 0.015	38.6
			2-Sep-17	32.0	0.672	0.468	0.099	< 0.015	< 0.005	< 0.015	< 0.015	33.3
			5-Sep-17	27.6	0.604	0.555	0.066	< 0.015	< 0.005	< 0.015	< 0.015	28.9
			8-Sep-17	34.8	0.504	0.540	0.049	< 0.015	< 0.005	< 0.015	< 0.015	35.9
			11-Sep-17	41.7	1.33	0.432	0.060	< 0.015	< 0.005	< 0.015	< 0.015	43.6
			12-Sep-17	48.9	0.365	0.323	0.040	< 0.015	< 0.005	< 0.015	< 0.015	49.7
			20-Sep-17	37.5	0.521	0.611	0.089	< 0.015	< 0.005	< 0.015	< 0.015	38.8
			2-Oct-17	27.3	0.373	0.064	0.042	< 0.015	< 0.005	< 0.015	< 0.015	27.8
			10-Oct-17	37.1	0.738	0.242	0.031	< 0.015	< 0.005	< 0.015	< 0.015	38.2
			17-Oct-17	72.5	0.113	< 0.005	0.012	< 0.015	< 0.005	< 0.015	< 0.015	72.7
			24-Oct-17	72.3	0.281	0.061	0.032	< 0.015	< 0.005	< 0.015	< 0.015	72.7
			31-Oct-17	71.5	0.280	0.030	0.018	< 0.015	< 0.005	< 0.015	< 0.015	71.9
			8-Nov-17	78.6	0.259	0.031	0.022	< 0.015	< 0.005	< 0.015	< 0.015	79.0
			9-Nov-17	82.7	0.295	0.067	0.026	< 0.015	< 0.005	< 0.015	< 0.015	83.1
			14-Nov-17	49.2	0.209	0.028	0.017	< 0.015	< 0.005	< 0.015	< 0.015	49.5
			21-Nov-17	74.6	0.226	0.043	0.023	< 0.015	< 0.005	< 0.015	< 0.015	74.9
			28-Nov-17	66.7	0.216	0.014	0.012	< 0.015	< 0.005	< 0.015	< 0.015	67.0
			4-Dec-17	73.7	0.237	0.012	0.014	< 0.015	< 0.005	< 0.015	< 0.015	74.0
			12-Dec-17	41.5	0.110	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	41.7
			18-Dec-17	81.7	0.269	0.020	0.019	< 0.015	< 0.005	< 0.015	< 0.015	82.1
			4-Jan-18	72.4	0.292	0.057	0.021	< 0.015	< 0.005	< 0.015	< 0.015	72.8
			23-Jan-18	80.6	0.463	0.092	0.037	< 0.015	< 0.005	< 0.015	< 0.015	81.2
			30-Jan-18	80.1	0.479	0.094	0.042	< 0.015	< 0.005	< 0.015	< 0.015	80.8
			5-Feb-18	84.5	0.211	0.014	0.013	< 0.015	< 0.005	< 0.015	< 0.015	84.8
			26-Feb-18	74.6	0.39	0.031	0.03	< 0.015	< 0.005	< 0.015	< 0.015	75.1
			5-Mar-18	109	0.147	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	109.2
			9-Mar-18	98.1	0.142	< 0.005	0.012	< 0.015	< 0.005	< 0.015	< 0.015	98.3
		WL_LCUCP_SP23 (LISP23)	3-Apr-17	43.6	0.816	0.322	0.092	< 0.015	< 0.005	< 0.015	< 0.015	44.9
			11-Aug-17	40.2	0.550	0.331	0.057	< 0.015	< 0.005	< 0.015	< 0.015	41.2
			15-Aug-17	38.0	0.547	0.395	0.061	< 0.015	< 0.005	< 0.015	< 0.015	39.1
			18-Aug-17	30.8	0.446	0.231	0.058	< 0.015	< 0.005	< 0.015	< 0.015	31.6
			21-Aug-17	35.0	0.556	0.277	0.065	< 0.015	< 0.005	< 0.015	< 0.015	35.9
			24-Aug-17	36.4	0.534	0.113	0.061	< 0.015	< 0.005	< 0.015	< 0.015	37.2
			24-Aug-17	33.7	0.561	0.121	0.050	< 0.015	< 0.005	< 0.015	< 0.015	34.5
			30-Aug-17	36.6	0.559	0.333	0.057	< 0.015	< 0.005	< 0.015	< 0.015	37.6
			2-Sep-17	36.3	0.556	0.244	0.084	< 0.015	< 0.005	< 0.015	< 0.015	37.2
			5-Sep-17	35.6	0.534	0.243	0.071	< 0.015	< 0.005	< 0.015	< 0.015	36.5
			8-Sep-17	34.1	0.462	0.194	0.045	< 0.015	< 0.005	< 0.015	< 0.015	34.9
			31-Oct-17	57.4	0.266	0.039	0.019	< 0.015	< 0.005	< 0.015	< 0.015	57.8
			21-Nov-17	54.1	0.231	0.019	0.012	< 0.015	< 0.005	< 0.015	< 0.015	54.4
			24-Jan-18	57.6	0.292	0.026	0.017	< 0.015	< 0.005	< 0.015	< 0.015	58.0
			28-Feb-18	68.9	0.236	0.011	0.013	< 0.015	< 0.005	< 0.015	< 0.015	69.2
			14-Mar-18	70.1	0.131	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	70.3
		WL_DCP_SP24 (LISP24)	11-Aug-17	34.1	0.462	0.299	0.044	< 0.015	< 0.005	< 0.015	< 0.015	35.0
			15-Aug-17	32.8	0.460	0.326	0.052	< 0.015	< 0.005	< 0.015	< 0.015	33.7
			18-Aug-17	28.8	0.397	0.319	0.047	< 0.015	< 0.005	< 0.015	< 0.015	29.6
			21-Aug-17	30.4	0.458	0.221	0.052	< 0.015	< 0.005	< 0.015	< 0.015	31.2
			24-Aug-17	28.9	0.443	0.079	0.047	< 0.015	< 0.005	< 0.015	< 0.015	29.5
			24-Aug-17	28.4	0.427	0.071	0.059	< 0.015	< 0.005	< 0.015	< 0.015	29.0
			30-Aug-17	19.6	0.357	0.117	0.045	< 0.015	< 0.005	< 0.015	< 0.015	20.2
			2-Sep-17	30.1	0.461	0.152	0.071	< 0.015	< 0.005	< 0.015	< 0.015	30.8
			5-Sep-17	29.2	0.440	0.189	0.040	< 0.015	< 0.005	< 0.015	< 0.015	29.9
			8-Sep-17	26.0	0.348	0.231	0.034	< 0.015	< 0.005	< 0.015	< 0.015	26.7
			9-Nov-17	63.0	0.254	0.024	0.018	< 0.015	< 0.005	< 0.015	< 0.015	63.3
			4-Dec-17	54.9	0.257	< 0.005	0.011	< 0.015	< 0.005	< 0.015	< 0.015	55.2

[a] Results for samples collected from January to March, 2017, were presented in the 2016 Line Creek LAEMP report (Minnow 2017a).

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, April 2017 to March 2018 [a]

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 (Continued)	Mine-exposed (Continued)	LC_LCDSSLCC (Compliance) (LIDSL)	3-Apr-17	43.4	0.591	0.248	0.081	< 0.015	< 0.005	< 0.015	< 0.015	44.4
			10-Apr-17	39.3	0.513	0.348	0.045	< 0.015	< 0.005	< 0.015	< 0.015	40.3
			18-Apr-17	24.8	0.400	0.318	0.052	< 0.015	< 0.005	< 0.015	< 0.015	25.6
			24-Apr-17	40.2	0.462	0.217	0.069	< 0.015	< 0.005	< 0.015	< 0.015	41.0
			2-May-17	36.5	0.370	0.225	0.034	< 0.015	< 0.005	< 0.015	< 0.015	37.2
			9-May-17	22.7	0.171	0.055	< 0.005	< 0.015	< 0.005	< 0.020	< 0.020	23.0
			16-May-17	17.7	0.172	0.040	< 0.005	< 0.015	< 0.005	< 0.020	< 0.020	18.0
			23-May-17	17.6	0.124	0.042	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	17.8
			30-May-17	16.5	0.102	0.022	0.007	< 0.015	< 0.005	< 0.020	< 0.015	16.7
			7-Jun-17	22.0	0.121	0.024	0.008	< 0.015	< 0.005	< 0.015	< 0.015	22.2
			13-Jun-17	22.0	0.102	0.017	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	22.2
			19-Jun-17	18.6	0.103	0.049	0.012	< 0.015	< 0.005	< 0.015	< 0.015	18.8
			26-Jun-17	26.4	0.149	0.055	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	26.7
			6-Jul-17	30.6	0.170	0.056	0.012	< 0.015	< 0.005	< 0.015	0.063	30.9
			11-Jul-17	31.3	0.182	0.066	0.026	< 0.015	< 0.005	< 0.015	< 0.015	31.6
			18-Jul-17	40.9	0.245	0.087	0.028	< 0.015	< 0.005	< 0.015	< 0.015	41.3
			25-Jul-17	37.4	0.285	0.111	0.036	< 0.015	< 0.005	< 0.015	< 0.015	37.9
			2-Aug-17	50.4	0.163	< 0.005	0.010	< 0.015	< 0.005	< 0.015	< 0.015	50.6
			8-Aug-17	35.0	0.317	0.121	0.034	< 0.015	< 0.005	< 0.015	< 0.015	35.5
			15-Aug-17	32.9	0.310	0.069	0.031	< 0.015	< 0.005	< 0.015	< 0.015	33.4
			18-Aug-17	33.3	0.344	0.126	0.036	< 0.015	< 0.005	< 0.015	< 0.015	33.9
			21-Aug-17	33.1	0.366	0.134	0.035	< 0.015	< 0.005	< 0.015	< 0.015	33.7
			24-Aug-17	31.4	0.336	0.137	0.037	< 0.015	< 0.005	< 0.015	< 0.015	32.0
			27-Aug-17	32.2	0.411	0.137	0.048	< 0.015	< 0.005	< 0.015	< 0.015	32.8
			30-Aug-17	33.3	0.377	0.087	0.036	< 0.015	< 0.005	< 0.015	< 0.015	33.9
			2-Sep-17	18.1	0.225	0.067	0.023	< 0.015	< 0.005	< 0.015	< 0.015	18.5
			5-Sep-17	32.8	0.343	0.154	0.042	< 0.015	< 0.005	< 0.015	< 0.015	33.4
			8-Sep-17	31.0	0.291	0.200	0.030	< 0.015	< 0.005	< 0.015	< 0.015	31.6
			12-Sep-17	23.6	0.076	0.014	0.010	< 0.015	< 0.005	< 0.015	< 0.015	23.8
			20-Sep-17	31.9	0.273	0.147	0.034	< 0.015	< 0.005	< 0.015	< 0.015	32.4
			25-Sep-17	34.4	0.312	0.219	0.044	< 0.015	< 0.005	< 0.015	< 0.015	35.0
			2-Oct-17	32.4	0.287	0.059	0.031	< 0.015	< 0.005	< 0.015	< 0.015	32.8
			10-Oct-17	32.1	0.333	0.084	0.017	< 0.015	< 0.005	< 0.015	< 0.015	32.6
			17-Oct-17	55.2	0.186	< 0.005	0.017	< 0.015	< 0.005	< 0.015	< 0.015	55.5
			24-Oct-17	42.7	0.163	0.017	0.013	< 0.015	< 0.005	< 0.015	< 0.015	42.9
			31-Oct-17	51.2	0.195	0.013	0.016	< 0.015	< 0.005	< 0.015	< 0.015	51.5
			8-Nov-17	54.7	0.172	0.008	0.011	< 0.015	< 0.005	< 0.015	< 0.015	54.9
			10-Nov-17	60.6	0.187	0.019	0.010	< 0.015	< 0.005	< 0.015	< 0.015	60.9
			14-Nov-17	52.4	0.180	0.008	0.008	< 0.015	< 0.005	< 0.015	< 0.015	52.6
			21-Nov-17	57.0	0.186	0.007	0.007	< 0.015	< 0.005	< 0.015	< 0.015	57.3
			28-Nov-17	46.2	0.148	< 0.005	0.008	< 0.015	< 0.005	< 0.015	< 0.015	46.4
			4-Dec-17	38.4	0.146	< 0.005	0.009	< 0.015	< 0.005	< 0.015	< 0.015	38.6
			12-Dec-17	43.3	0.137	< 0.005	0.008	< 0.015	< 0.005	< 0.015	< 0.015	43.5
			18-Dec-17	59.2	0.193	0.006	0.011	< 0.015	< 0.005	< 0.015	< 0.015	59.5
			4-Jan-18	51.4	0.156	0.012	0.011	< 0.015	< 0.005	< 0.015	< 0.015	51.6
			23-Jan-18	57.1	0.186	0.021	0.009	< 0.015	< 0.005	< 0.015	< 0.015	57.4
			30-Jan-18	35.3	0.137	0.013	0.009	< 0.015	< 0.005	< 0.015	< 0.015	35.5
			27-Feb-18	57.8	0.191	0.008	0.014	< 0.015	< 0.005	< 0.015	< 0.015	58.1
			5-Mar-18	70.8	0.114	< 0.005	0.006	< 0.015	< 0.005	< 0.015	< 0.015	71.0
			14-Mar-18	56.7	0.089	< 0.005	0.007	< 0.015	< 0.005	< 0.015	< 0.015	56.9
		LC_LCC (LIDCOM)	8-Aug-17	38.1	0.266	0.074	0.026	< 0.015	< 0.005	< 0.015	< 0.015	38.5
			15-Aug-17	32.4	0.314	0.115	0.028	< 0.015	< 0.005	< 0.015	< 0.015	32.9
			18-Aug-17	29.9	0.278	0.093	0.032	< 0.015	< 0.005	< 0.015	< 0.015	30.4
			21-Aug-17	28.3	0.267	0.069	0.030	< 0.015	< 0.005	< 0.015	< 0.015	28.7
			24-Aug-17	18.6	0.201	0.045	0.015	< 0.015	< 0.005	< 0.015	< 0.015	18.9
			27-Aug-17	27.7	0.291	0.079	0.036	< 0.015	< 0.005	< 0.015	< 0.015	28.2
			30-Aug-17	28.9	0.272	0.042	0.022	< 0.015	< 0.005	< 0.015	< 0.015	29.3
			2-Sep-17	19.8	0.222	0.029	0.022	< 0.015	< 0.005	< 0.015	< 0.015	20.1
			5-Sep-17	29.1	0.283	0.064	0.027	< 0.015	< 0.005	< 0.015	< 0.015	29.5
			8-Sep-17	26.5	0.221	0.104	0.018	< 0.015	< 0.005	< 0.015	< 0.015	26.9
			8-Sep-17	2.53	0.027	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	2.6
			10-Nov-17	53.4	0.159	0.012	0.012	< 0.015	< 0.005	< 0.015	< 0.015	53.6
			5-Dec-17	47.9	0.134	< 0.005	0.008	< 0.015	< 0.005	< 0.015	< 0.015	48.1
		LC_LC4 (LI8)	3-Apr-17	33.7	0.426	< 0.005	0.049	< 0.015	< 0.005	< 0.015	< 0.015	34.2
			10-Apr-17	30.4	0.187	0.035	0.029	< 0.015	< 0.005	< 0.015	< 0.015	30.7
			18-Apr-17	29.7	0.364	0.012	0.062	< 0.015	< 0.005	< 0.015	< 0.015	30.2
			24-Apr-17	29.5	0.202	< 0.005	0.027	< 0.015	< 0.005	< 0.015	< 0.015	29.8
			1-May-17	29.3	0.311	0.025	0.044	< 0.015	< 0.005	< 0.015	< 0.015	29.7
			8-May-17	19.4	0.152	0.01	0.013	< 0.015	< 0.005	< 0.020	< 0.020	19.6
			15-May-17	15.9	0.138	< 0.005	0.009	< 0.015	< 0.005	< 0.020	< 0.020	16.1
			23-May-17	9.00	0.085	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	9.1
			30-May-17	11.00	0.074	< 0.005	< 0.005	< 0.015	< 0.005	< 0.020	< 0.015	11.1
			7-Jun-17	17.4	0.09	0.006	0.008	< 0.015	< 0.005	< 0.015	< 0.015	17.6
			13-Jun-17	10.2	0.065	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	10.3
			19-Jun-17	19.6	0.103	0.014	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	19.8
			26-Jun-17	21.1	0.104	< 0.005	0.012	< 0.015	< 0.005	< 0.015	< 0.015	21.3
			5-Jul-17	24.8	0.145	0.008	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	25.0
			11-Jul-17	25.3	0.137	< 0.005	0.012	< 0.015	< 0.005	< 0.015	< 0.015	25.5

[a] Results for samples collected from January to March, 2017, were presented in the 2016 Line Creek LAEMP report (Minnow 2017a).

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, April 2017 to March 2018 [a]

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 (Continued)	Mine-exposed (Continued)	LC_LC4 (LI8) (Continued)	18-Jul-17	31.2	0.174	< 0.005	0.012	< 0.015	< 0.005	< 0.015	< 0.015	31.4
			25-Jul-17	30.4	0.187	< 0.005	0.015	< 0.015	< 0.005	< 0.015	< 0.015	30.7
			2-Aug-17	36.2	0.054	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	36.3
			8-Aug-17	18.7	0.180	< 0.005	0.029	< 0.015	< 0.005	< 0.015	< 0.015	19.0
			15-Aug-17	12.6	0.133	< 0.005	0.008	< 0.015	< 0.005	< 0.015	< 0.015	12.8
			18-Aug-17	27.7	0.122	< 0.005	0.015	< 0.015	< 0.005	< 0.015	< 0.015	27.9
			21-Aug-17	26.1	0.239	< 0.005	0.020	< 0.015	< 0.005	< 0.015	< 0.015	26.4
			24-Aug-17	27.1	0.180	< 0.005	0.016	< 0.015	< 0.005	< 0.015	< 0.015	27.4
			27-Aug-17	26.4	0.192	< 0.005	0.022	< 0.015	< 0.005	< 0.015	< 0.015	26.7
			30-Aug-17	26.6	0.124	< 0.005	0.014	< 0.015	< 0.005	< 0.015	< 0.015	26.8
			2-Sep-17	26.3	0.242	< 0.005	0.021	< 0.015	< 0.005	< 0.015	< 0.015	26.6
			5-Sep-17	26.3	0.162	< 0.005	0.017	0.019	< 0.005	< 0.015	< 0.015	26.5
			8-Sep-17	25.0	0.080	0.030	0.011	0.017	< 0.005	< 0.015	< 0.015	25.2
			12-Sep-17	40.9	0.225	0.112	0.027	< 0.015	< 0.005	< 0.015	< 0.015	41.3
			20-Sep-17	27.4	0.055	0.019	0.016	< 0.015	< 0.005	< 0.015	< 0.015	27.5
			25-Sep-17	28.1	0.175	0.010	0.020	< 0.015	< 0.005	< 0.015	< 0.015	28.4
			2-Oct-17	24.9	0.207	0.009	0.012	< 0.015	< 0.005	< 0.015	< 0.015	25.2
			10-Oct-17	25.5	0.227	0.010	0.008	< 0.015	< 0.005	< 0.015	< 0.015	25.8
			17-Oct-17	34.6	0.168	< 0.005	0.008	< 0.015	< 0.005	< 0.015	< 0.015	34.8
			24-Oct-17	38.2	0.151	< 0.005	0.006	< 0.015	< 0.005	< 0.015	< 0.015	38.4
			31-Oct-17	39.4	0.053	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	39.5
			8-Nov-17	42.5	0.035	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	42.6
			10-Nov-17	47.7	0.055	< 0.005	< 0.005	< 0.015	< 0.005	0.016	< 0.015	47.8
			14-Nov-17	34.4	0.063	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	34.5
			21-Nov-17	26.7	0.107	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	26.9
			28-Nov-17	38.2	0.050	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	38.3
			4-Dec-17	27.1	0.092	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	27.3
			12-Dec-17	27.0	0.055	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	27.1
			18-Dec-17	47.3	0.044	< 0.005	0.006	< 0.015	< 0.005	< 0.015	< 0.015	47.4
			4-Jan-18	37.4	0.025	< 0.005	0.007	< 0.015	< 0.005	< 0.015	< 0.015	37.5
			23-Jan-18	42.3	0.031	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	42.4
			30-Jan-18	42.2	0.061	< 0.005	0.006	< 0.015	< 0.005	< 0.015	< 0.015	42.3
			5-Feb-18	42.7	0.024	< 0.005	0.007	< 0.015	< 0.005	< 0.015	< 0.015	42.8
			26-Feb-18	43.5	0.037	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	43.6
			5-Mar-18	46.7	0.027	< 0.005	< 0.005	< 0.015	< 0.005	< 0.015	< 0.015	46.8
Fording River	Mine-exposed (Continued)	LC_LC6 (FRUL)	3-Aug-17	41.6	0.511	0.016	0.027	< 0.015	< 0.005	< 0.015	< 0.015	42.2
			15-Aug-17	42.1	0.434	0.016	0.020	< 0.015	< 0.005	< 0.015	< 0.015	42.6
			18-Aug-17	38.1	0.406	0.010	0.015	< 0.015	< 0.005	< 0.015	< 0.015	38.6
			21-Aug-17	37.4	0.385	0.008	0.026	< 0.015	< 0.005	< 0.015	< 0.015	37.9
			24-Aug-17	36.3	0.341	0.017	0.017	< 0.015	< 0.005	< 0.015	< 0.015	36.7
			27-Aug-17	37.6	0.393	0.008	0.023	< 0.015	< 0.005	< 0.015	< 0.015	38.1
			30-Aug-17	38.1	0.462	0.008	0.019	< 0.015	< 0.005	< 0.015	< 0.015	38.6
			2-Sep-17	38.3	0.449	0.007	0.016	< 0.015	< 0.005	< 0.015	< 0.015	38.8
			5-Sep-17	38.4	0.454	< 0.005	0.016	< 0.015	< 0.005	< 0.015	< 0.015	38.9
			8-Sep-17	35.5	0.373	0.019	0.019	< 0.015	< 0.005	< 0.015	< 0.015	36.0
		LC_LC5 (FO23)	26-Jun-17	23.7	0.174	< 0.005	0.013	< 0.015	< 0.005	< 0.015	< 0.015	23.9
			2-Aug-17	38.9	0.388	0.018	0.018	< 0.015	< 0.005	< 0.015	< 0.015	39.4
			15-Aug-17	37.3	0.327	0.012	0.012	< 0.015	< 0.005	< 0.015	< 0.015	37.7
			18-Aug-17	33.9	0.305	0.012	0.014	< 0.015	< 0.005	< 0.015	< 0.015	34.3
			21-Aug-17	33.4	0.280	0.006	0.014	< 0.015	< 0.005	< 0.015	< 0.015	33.8
			24-Aug-17	32.5	0.296	0.011	0.014	< 0.015	< 0.005	< 0.015	< 0.015	32.9
			27-Aug-17	32.7	0.296	0.008	< 0.005	< 0.015	< 0.005	< 0.015	0.019	33.1
			30-Aug-17	31.3	0.324	0.011	0.012	< 0.015	< 0.005	< 0.015	< 0.015	31.7
			2-Sep-17	25.2	0.253	< 0.005	0.011	< 0.015	< 0.005	< 0.015	< 0.015	25.5
			5-Sep-17	22.5	0.244	< 0.005	0.009	< 0.015	< 0.005	< 0.015	< 0.015	22.8
			8-Sep-17	30.8	0.259	0.024	0.016	< 0.015	< 0.005	< 0.015	< 0.015	31.1
			18-Dec-17	46.8	0.157	< 0.005	0.009	< 0.015	< 0.005	< 0.015	< 0.015	47.0
			14-Feb-18	43.6	0.143	< 0.005	0.006	< 0.015	< 0.005	< 0.015	< 0.015	43.8

[a] Results for samples collected from January to March, 2017, were presented in the 2016 Line Creek LAEMP report (Minnow 2017a).

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LI24 (LC_LC1)	LI24-PERT-01	11-Sep-17	3.1	3.2	2.3	7.8	3.8	1.4	3.1	4.5
	LI24-PERT-02	11-Sep-17	3.2							
	LI24-PERT-03	11-Sep-17	3.0							
	LI24-PERT-04	11-Sep-17	3.2							
	LI24-PERT-05	11-Sep-17	2.3							
	LI24-PERT-06	11-Sep-17	6.5							
	LI24-PERT-07	11-Sep-17	7.8							
	LI24-PERT-08	11-Sep-17	3.8							
	LI24-PERT-09	11-Sep-17	3.2							
	LI24-PERT-10	11-Sep-17	3.5							
	LI24-PERT-11	11-Sep-17	3.6							
	LI24-PERT-12	11-Sep-17	3.7							
	LI24-PERT-13	11-Sep-17	3.1							
	LI24-PERT-14	11-Sep-17	3.8							
	LI24-PERT-15	11-Sep-17	3.1							
SLINE (LC_SLC)	SLINE-PERT-01	26-Apr-17	5.0	3.9	1.8	7.5	4.0	1.6	3.2	4.8
	SLINE-PERT-02	26-Apr-17	2.7							
	SLINE-PERT-03	26-Apr-17	5.5							
	SLINE-PERT-04	26-Apr-17	5.2							
	SLINE-PERT-05	26-Apr-17	2.6							
	SLINE-PERT-06	26-Apr-17	7.5							
	SLINE-PERT-07	26-Apr-17	5.2							
	SLINE-PERT-08	26-Apr-17	4.5							
	SLINE-PERT-09	26-Apr-17	5.4							
	SLINE-PERT-10	26-Apr-17	3.2							
	SLINE-PERT-11	26-Apr-17	3.9							
	SLINE-PERT-12	26-Apr-17	2.6							
	SLINE-PERT-13	26-Apr-17	2.7							
	SLINE-PERT-14	26-Apr-17	1.8							
	SLINE-PERT-15	26-Apr-17	2.7							
	SLINE-PERT-01	09-Sep-17	4.8	3.6	2.8	5.2	3.9	0.72	3.5	4.3
	SLINE-PERT-02	09-Sep-17	3.5							
	SLINE-PERT-03	09-Sep-17	5.2							
	SLINE-PERT-04	09-Sep-17	3.4							
	SLINE-PERT-05	09-Sep-17	4.1							
	SLINE-PERT-06	09-Sep-17	4.3							
	SLINE-PERT-07	09-Sep-17	5.1							
	SLINE-PERT-08	09-Sep-17	3.7							
	SLINE-PERT-09	09-Sep-17	3.6							
	SLINE-PERT-10	09-Sep-17	3.6							
	SLINE-PERT-11	09-Sep-17	2.8							
	SLINE-PERT-12	09-Sep-17	3.3							
	SLINE-PERT-13	09-Sep-17	3.3							
	SLINE-PERT-14	09-Sep-17	4.4							
	SLINE-PERT-15	09-Sep-17	3.4							
	SLINE-PERT-01	08-Mar-18	2.4	3.5	1.5	4.2	3.3	0.74	2.9	3.6
	SLINE-PERT-02	08-Mar-18	3.6							
	SLINE-PERT-03	08-Mar-18	3.6							
	SLINE-PERT-04	08-Mar-18	3.7							
	SLINE-PERT-05	08-Mar-18	3.2							
	SLINE-PERT-06	08-Mar-18	1.5							
	SLINE-PERT-07	08-Mar-18	3.0							
	SLINE-PERT-08	08-Mar-18	3.5							
	SLINE-PERT-09	08-Mar-18	3.8							
	SLINE-PERT-10	08-Mar-18	3.5							
	SLINE-PERT-11	08-Mar-18	2.3							
	SLINE-PERT-12	08-Mar-18	2.8							
	SLINE-PERT-13	08-Mar-18	3.9							
	SLINE-PERT-14	08-Mar-18	3.9							
	SLINE-PERT-15	08-Mar-18	4.2							
LCUT (LC_LCUSWLC)	LCUT-PERT-01	25-Apr-17	11	11	4.8	30	14	7.4	10	17
	LCUT-PERT-02	25-Apr-17	30							
	LCUT-PERT-03	25-Apr-17	29							
	LCUT-PERT-04	25-Apr-17	4.8							
	LCUT-PERT-05	25-Apr-17	14							
	LCUT-PERT-06	25-Apr-17	9.6							
	LCUT-PERT-07	25-Apr-17	18							
	LCUT-PERT-08	25-Apr-17	9.7							
	LCUT-PERT-09	25-Apr-17	5.0							
	LCUT-PERT-10	25-Apr-17	15							
	LCUT-PERT-11	25-Apr-17	19							
	LCUT-PERT-12	25-Apr-17	8.8							
	LCUT-PERT-13	25-Apr-17	11							
	LCUT-PERT-14	25-Apr-17	9.8							
	LCUT-PERT-15	25-Apr-17	12							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.2: **Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018**

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LCUT (LC_LCUSWLC; Continued)	LCUT-PERT-01	07-Sep-17	4.7	17	2.7	52	18	12	12	24
	LCUT-PERT-02	07-Sep-17	20							
	LCUT-PERT-03	07-Sep-17	27							
	LCUT-PERT-04	07-Sep-17	20							
	LCUT-PERT-05	07-Sep-17	9.6							
	LCUT-PERT-06	08-Sep-17	11							
	LCUT-PERT-07	08-Sep-17	21							
	LCUT-PERT-08	08-Sep-17	17							
	LCUT-PERT-09	08-Sep-17	52							
	LCUT-PERT-10	08-Sep-17	27							
	LCUT-PERT-11	08-Sep-17	8.4							
	LCUT-PERT-12	08-Sep-17	13							
	LCUT-PERT-13	08-Sep-17	16							
	LCUT-PERT-14	08-Sep-17	2.7							
LCUT (LC_LCUSWLC)	LCUT-PERT-01	09-Nov-17	15	11	2.1	36	12	7.9	8.1	16
	LCUT-PERT-02	09-Nov-17	11							
	LCUT-PERT-03	09-Nov-17	2.1							
	LCUT-PERT-04	09-Nov-17	13							
	LCUT-PERT-05	09-Nov-17	8.5							
	LCUT-PERT-06	09-Nov-17	13							
	LCUT-PERT-07	09-Nov-17	8.3							
	LCUT-PERT-08	09-Nov-17	10							
	LCUT-PERT-09	09-Nov-17	11							
	LCUT-PERT-10	09-Nov-17	12							
	LCUT-PERT-11	09-Nov-17	14							
	LCUT-PERT-12	09-Nov-17	4.9							
	LCUT-PERT-13	09-Nov-17	36							
	LCUT-PERT-14	09-Nov-17	19							
	LCUT-PERT-15	09-Nov-17	4.4							
	LCUT-PERT-01	04-Dec-17	7.8	7.8	2.1	24	9.7	6.7	6.3	13
	LCUT-PERT-02	04-Dec-17	2.1							
	LCUT-PERT-03	04-Dec-17	20							
	LCUT-PERT-04	04-Dec-17	2.5							
	LCUT-PERT-05	04-Dec-17	24							
	LCUT-PERT-06	04-Dec-17	15							
	LCUT-PERT-07	04-Dec-17	4.6							
	LCUT-PERT-08	04-Dec-17	9.9							
	LCUT-PERT-09	04-Dec-17	4.3							
	LCUT-PERT-10	04-Dec-17	3.4							
	LCUT-PERT-11	04-Dec-17	12							
	LCUT-PERT-12	04-Dec-17	7.1							
	LCUT-PERT-13	04-Dec-17	4.2							
	LCUT-PERT-14	04-Dec-17	16							
	LCUT-PERT-15	04-Dec-17	12							
	LCUT-PERT-01	09-Mar-18	8.2	9.1	2.5	35	14	11	8.0	19
	LCUT-PERT-02	09-Mar-18	9.1							
	LCUT-PERT-03	09-Mar-18	16							
	LCUT-PERT-04	09-Mar-18	30							
	LCUT-PERT-05	09-Mar-18	2.7							
	LCUT-PERT-06	09-Mar-18	3.2							
	LCUT-PERT-07	09-Mar-18	2.8							
	LCUT-PERT-08	09-Mar-18	6.7							
	LCUT-PERT-09	09-Mar-18	2.5							
	LCUT-PERT-10	09-Mar-18	11							
	LCUT-PERT-11	09-Mar-18	35							
	LCUT-PERT-12	09-Mar-18	30							
	LCUT-PERT-13	09-Mar-18	22							
	LCUT-PERT-14	09-Mar-18	22							
	LCUT-PERT-15	09-Mar-18	5.1							
LILC3 (LC_LC3)	LILC3-PERT-01	25-Apr-17	27	26	15	32	25	4.9	23	28
	LILC3-PERT-02	25-Apr-17	30							
	LILC3-PERT-03	25-Apr-17	23							
	LILC3-PERT-04	25-Apr-17	22							
	LILC3-PERT-05	25-Apr-17	32							
	LILC3-PERT-06	25-Apr-17	28							
	LILC3-PERT-07	25-Apr-17	25							
	LILC3-PERT-08	25-Apr-17	29							
	LILC3-PERT-09	25-Apr-17	31							
	LILC3-PERT-10	25-Apr-17	25							
	LILC3-PERT-11	25-Apr-17	25							
	LILC3-PERT-12	25-Apr-17	26							
	LILC3-PERT-13	25-Apr-17	15							
	LILC3-PERT-14	25-Apr-17	28							
	LILC3-PERT-15	25-Apr-17	16							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LILC3 (LC_LC3; Continued)	LILC3-PERT-01	09-Sep-17	18	12	4.9	20	13	4.0	11	15
	LILC3-PERT-02	09-Sep-17	11							
	LILC3-PERT-03	09-Sep-17	4.9							
	LILC3-PERT-04	09-Sep-17	14							
	LILC3-PERT-05	09-Sep-17	8.8							
	LILC3-PERT-06	09-Sep-17	20							
	LILC3-PERT-07	09-Sep-17	11							
	LILC3-PERT-08	09-Sep-17	16							
	LILC3-PERT-09	09-Sep-17	13							
	LILC3-PERT-10	09-Sep-17	17							
	LILC3-PERT-11	09-Sep-17	12							
	LILC3-PERT-12	09-Sep-17	8.3							
	LILC3-PERT-13	09-Sep-17	12							
	LILC3-PERT-14	09-Sep-17	15							
	LILC3-PERT-15	09-Sep-17	12							
	LILC3-PERT-01	09-Nov-17	16	16	4.7	20	13	5.6	10	16
	LILC3-PERT-02	09-Nov-17	6.1							
	LILC3-PERT-03	09-Nov-17	16							
	LILC3-PERT-04	09-Nov-17	18							
	LILC3-PERT-05	09-Nov-17	5.3							
	LILC3-PERT-06	09-Nov-17	6.5							
	LILC3-PERT-07	09-Nov-17	8.9							
	LILC3-PERT-08	09-Nov-17	7.5							
	LILC3-PERT-09	09-Nov-17	20							
	LILC3-PERT-10	09-Nov-17	18							
	LILC3-PERT-11	09-Nov-17	4.7							
	LILC3-PERT-12	09-Nov-17	18							
	LILC3-PERT-13	09-Nov-17	16							
	LILC3-PERT-14	09-Nov-17	14							
	LILC3-PERT-15	09-Nov-17	17							
	LILC3-PERT-01	04-Dec-17	14	14	3.3	24	12	6.5	9.1	16
	LILC3-PERT-02	04-Dec-17	15							
	LILC3-PERT-03	04-Dec-17	18							
	LILC3-PERT-04	04-Dec-17	24							
	LILC3-PERT-05	04-Dec-17	3.4							
	LILC3-PERT-06	04-Dec-17	17							
	LILC3-PERT-07	04-Dec-17	6.6							
	LILC3-PERT-08	04-Dec-17	9.6							
	LILC3-PERT-09	04-Dec-17	7.5							
	LILC3-PERT-10	04-Dec-17	14							
	LILC3-PERT-11	04-Dec-17	21							
	LILC3-PERT-12	04-Dec-17	3.8							
	LILC3-PERT-13	04-Dec-17	15							
	LILC3-PERT-14	04-Dec-17	3.3							
	LILC3-PERT-15	04-Dec-17	14							
	LILC3-PERT-1	09-Mar-18	22	13	2.7	25	13	7.5	9.1	17
	LILC3-PERT-2	09-Mar-18	18							
	LILC3-PERT-3	09-Mar-18	18							
	LILC3-PERT-4	09-Mar-18	9.1							
	LILC3-PERT-5	09-Mar-18	19							
	LILC3-PERT-6	09-Mar-18	25							
	LILC3-PERT-7	09-Mar-18	16							
	LILC3-PERT-8	09-Mar-18	21							
	LILC3-PERT-9	09-Mar-18	4.4							
	LILC3-PERT-10	09-Mar-18	13							
	LILC3-PERT-11	09-Mar-18	4.2							
	LILC3-PERT-12	09-Mar-18	3.4							
	LILC3-PERT-13	09-Mar-18	2.7							
	LILC3-PERT-14	09-Mar-18	11							
	LILC3-PERT-15	09-Mar-18	6.9							
LISP24 (WL_DCP_SP24)	LISP24-PERT-01	10-Mar-18	11	3.2	2.2	11	4.0	2.5	2.7	5.3
	LISP24-PERT-02	10-Mar-18	4.0							
	LISP24-PERT-03	10-Mar-18	3.2							
	LISP24-PERT-04	10-Mar-18	8.8							
	LISP24-PERT-05	10-Mar-18	2.2							
	LISP24-PERT-06	10-Mar-18	2.8							
	LISP24-PERT-07	10-Mar-18	3.3							
	LISP24-PERT-08	10-Mar-18	3.4							
	LISP24-PERT-09	10-Mar-18	3.0							
	LISP24-PERT-10	10-Mar-18	3.8							
	LISP24-PERT-11	10-Mar-18	2.6							
	LISP24-PERT-12	10-Mar-18	2.5							
	LISP24-PERT-13	10-Mar-18	4.0							
	LISP24-PERT-14	10-Mar-18	2.6							
	LISP24-PERT-15	10-Mar-18	2.9							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.2: **Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018**

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LIDSL (LC_LCDSSLCC) Compliance	LIDSL-PERT-01	26-Apr-17	4.5	4.4	2.9	7.7	4.6	1.4	3.9	5.4
	LIDSL-PERT-02	26-Apr-17	4.4							
	LIDSL-PERT-03	26-Apr-17	4.1							
	LIDSL-PERT-04	26-Apr-17	7.4							
	LIDSL-PERT-05	26-Apr-17	2.9							
	LIDSL-PERT-06	26-Apr-17	4.5							
	LIDSL-PERT-07	26-Apr-17	3.6							
	LIDSL-PERT-08	26-Apr-17	7.7							
	LIDSL-PERT-09	26-Apr-17	4.7							
	LIDSL-PERT-10	26-Apr-17	3.1							
	LIDSL-PERT-11	26-Apr-17	4.0							
	LIDSL-PERT-12	26-Apr-17	3.4							
	LIDSL-PERT-13	26-Apr-17	5.5							
	LIDSL-PERT-14	26-Apr-17	5.9							
	LIDSL-PERT-15	26-Apr-17	4.0							
	LIDSL-PERT-01	10-Sep-17	3.8	4.5	2.5	9.2	4.8	2.0	3.8	5.8
	LIDSL-PERT-02	10-Sep-17	5.0							
	LIDSL-PERT-03	10-Sep-17	5.1							
	LIDSL-PERT-04	10-Sep-17	8.8							
	LIDSL-PERT-05	10-Sep-17	4.9							
	LIDSL-PERT-06	10-Sep-17	5.7							
	LIDSL-PERT-07	10-Sep-17	3.8							
	LIDSL-PERT-08	10-Sep-17	2.9							
	LIDSL-PERT-09	10-Sep-17	5.8							
	LIDSL-PERT-10	10-Sep-17	4.0							
	LIDSL-PERT-11	10-Sep-17	2.5							
	LIDSL-PERT-12	10-Sep-17	4.5							
	LIDSL-PERT-13	10-Sep-17	2.8							
	LIDSL-PERT-14	10-Sep-17	9.2							
	LIDSL-PERT-15	10-Sep-17	3.2							
	LIDSL-PERT-01	10-Nov-17	3.4	3.9	3.1	6.5	4.1	0.93	3.7	4.6
	LIDSL-PERT-02	10-Nov-17	4.1							
	LIDSL-PERT-03	10-Nov-17	3.8							
	LIDSL-PERT-04	10-Nov-17	6.5							
	LIDSL-PERT-05	10-Nov-17	4.3							
	LIDSL-PERT-06	10-Nov-17	3.4							
	LIDSL-PERT-07	10-Nov-17	6.0							
	LIDSL-PERT-08	10-Nov-17	4.1							
	LIDSL-PERT-09	10-Nov-17	3.9							
	LIDSL-PERT-10	10-Nov-17	4.3							
	LIDSL-PERT-11	10-Nov-17	3.4							
	LIDSL-PERT-12	10-Nov-17	3.1							
	LIDSL-PERT-13	10-Nov-17	4.2							
	LIDSL-PERT-14	10-Nov-17	3.8							
	LIDSL-PERT-15	10-Nov-17	3.9							
	LIDSL-PERT-01	05-Dec-17	2.8	3.2	2.5	9.5	3.7	1.7	2.9	4.6
	LIDSL-PERT-02	05-Dec-17	2.7							
	LIDSL-PERT-03	05-Dec-17	3.2							
	LIDSL-PERT-04	05-Dec-17	9.5							
	LIDSL-PERT-05	05-Dec-17	3.3							
	LIDSL-PERT-06	05-Dec-17	3.9							
	LIDSL-PERT-07	05-Dec-17	3.1							
	LIDSL-PERT-08	05-Dec-17	4.6							
	LIDSL-PERT-09	05-Dec-17	3.3							
	LIDSL-PERT-10	05-Dec-17	3.4							
	LIDSL-PERT-11	05-Dec-17	2.9							
	LIDSL-PERT-12	05-Dec-17	3.1							
	LIDSL-PERT-13	05-Dec-17	2.5							
	LIDSL-PERT-14	05-Dec-17	3.2							
	LIDSL-PERT-15	05-Dec-17	4.2							
	LIDSL-PERT-01	10-Mar-18	2.6	2.6	1.6	3.0	2.4	0.4	2.2	2.6
	LIDSL-PERT-02	10-Mar-18	1.7							
	LIDSL-PERT-03	10-Mar-18	1.6							
	LIDSL-PERT-04	10-Mar-18	2.6							
	LIDSL-PERT-05	10-Mar-18	2.6							
	LIDSL-PERT-06	10-Mar-18	2.1							
	LIDSL-PERT-07	10-Mar-18	2.6							
	LIDSL-PERT-08	10-Mar-18	2.3							
	LIDSL-PERT-09	10-Mar-18	2.7							
	LIDSL-PERT-10	10-Mar-18	2.8							
	LIDSL-PERT-11	10-Mar-18	2.6							
	LIDSL-PERT-12	10-Mar-18	2.6							
	LIDSL-PERT-13	10-Mar-18	3.0							
	LIDSL-PERT-14	10-Mar-18	1.9							
	LIDSL-PERT-15	10-Mar-18	2.2							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LIDCOM (LC_LCC)	LIDCOM-PERT-01	10-Mar-18	13	7.0	3.3	15	7.8	4.2	5.7	9.9
	LIDCOM-PERT-02	10-Mar-18	3.8							
	LIDCOM-PERT-03	10-Mar-18	3.8							
	LIDCOM-PERT-04	10-Mar-18	7.0							
	LIDCOM-PERT-05	10-Mar-18	15							
	LIDCOM-PERT-06	10-Mar-18	3.3							
	LIDCOM-PERT-07	10-Mar-18	9.0							
	LIDCOM-PERT-08	10-Mar-18	4.9							
	LIDCOM-PERT-09	10-Mar-18	3.6							
	LIDCOM-PERT-10	10-Mar-18	12							
	LIDCOM-PERT-11	10-Mar-18	5.9							
	LIDCOM-PERT-12	10-Mar-18	11							
	LIDCOM-PERT-13	10-Mar-18	7.2							
	LIDCOM-PERT-14	10-Mar-18	3.6							
	LIDCOM-PERT-15	10-Mar-18	14							
LI8 (LC_LC4)	LI8-PERT-01	26-Apr-17	2.4	2.8	1.9	5.1	3.0	0.82	2.6	3.4
	LI8-PERT-02	26-Apr-17	2.2							
	LI8-PERT-03	26-Apr-17	2.3							
	LI8-PERT-04	26-Apr-17	2.7							
	LI8-PERT-05	26-Apr-17	1.9							
	LI8-PERT-06	26-Apr-17	2.8							
	LI8-PERT-07	26-Apr-17	2.6							
	LI8-PERT-08	26-Apr-17	3.9							
	LI8-PERT-09	26-Apr-17	3.2							
	LI8-PERT-10	26-Apr-17	3.6							
	LI8-PERT-11	26-Apr-17	3.1							
	LI8-PERT-12	26-Apr-17	5.1							
	LI8-PERT-13	26-Apr-17	3.3							
	LI8-PERT-14	26-Apr-17	2.3							
	LI8-PERT-15	26-Apr-17	3.4							
	LI8-PERT-01	08-Sep-17	1.3	1.6	1.2	2.3	1.6	0.27	1.5	1.8
	LI8-PERT-02	08-Sep-17	1.4							
	LI8-PERT-03	08-Sep-17	1.8							
	LI8-PERT-04	08-Sep-17	1.5							
	LI8-PERT-05	08-Sep-17	1.6							
	LI8-PERT-06	08-Sep-17	1.8							
	LI8-PERT-07	08-Sep-17	1.5							
	LI8-PERT-08	08-Sep-17	1.2							
	LI8-PERT-09	08-Sep-17	1.6							
	LI8-PERT-10	08-Sep-17	1.7							
	LI8-PERT-11	08-Sep-17	1.4							
	LI8-PERT-12	08-Sep-17	1.9							
	LI8-PERT-13	08-Sep-17	2.3							
	LI8-PERT-14	08-Sep-17	1.5							
	LI8-PERT-15	08-Sep-17	1.7							
	LI8-PERT-01	10-Nov-17	1.7	2.4	1.7	3.5	2.3	0.46	2.1	2.6
	LI8-PERT-02	10-Nov-17	1.8							
	LI8-PERT-03	10-Nov-17	2.4							
	LI8-PERT-04	10-Nov-17	3.5							
	LI8-PERT-05	10-Nov-17	3.0							
	LI8-PERT-06	10-Nov-17	2.4							
	LI8-PERT-07	10-Nov-17	2.2							
	LI8-PERT-08	10-Nov-17	2.4							
	LI8-PERT-09	10-Nov-17	2.1							
	LI8-PERT-10	10-Nov-17	2.0							
	LI8-PERT-11	10-Nov-17	2.5							
	LI8-PERT-12	10-Nov-17	2.0							
	LI8-PERT-13	10-Nov-17	2.1							
	LI8-PERT-14	10-Nov-17	2.5							
	LI8-PERT-15	10-Nov-17	2.4							
	LI8-PERT-01	05-Dec-17	1.8	2.7	1.8	3.2	2.6	0.40	2.4	2.8
	LI8-PERT-02	05-Dec-17	2.3							
	LI8-PERT-03	05-Dec-17	2.3							
	LI8-PERT-04	05-Dec-17	2.2							
	LI8-PERT-05	05-Dec-17	2.4							
	LI8-PERT-06	05-Dec-17	3.2							
	LI8-PERT-07	05-Dec-17	3.2							
	LI8-PERT-08	05-Dec-17	2.8							
	LI8-PERT-09	05-Dec-17	2.7							
	LI8-PERT-10	05-Dec-17	2.6							
	LI8-PERT-11	05-Dec-17	2.7							
	LI8-PERT-12	05-Dec-17	2.7							
	LI8-PERT-13	05-Dec-17	2.8							
	LI8-PERT-14	05-Dec-17	2.4							
	LI8-PERT-15	05-Dec-17	3.2							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.2: Periphyton Selenium Concentrations and Summary Statistics for Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LI8 (LC_LC4; Continued)	LI8-PERT-01	10-Mar-18	2.0	1.8	1.4	2.2	1.7	0.22	1.6	1.9
	LI8-PERT-02	10-Mar-18	2.2							
	LI8-PERT-03	10-Mar-18	2.0							
	LI8-PERT-04	10-Mar-18	1.6							
	LI8-PERT-05	10-Mar-18	1.8							
	LI8-PERT-06	10-Mar-18	1.5							
	LI8-PERT-07	10-Mar-18	1.5							
	LI8-PERT-08	10-Mar-18	1.8							
	LI8-PERT-09	10-Mar-18	1.8							
	LI8-PERT-10	10-Mar-18	1.8							
	LI8-PERT-11	10-Mar-18	1.4							
	LI8-PERT-12	10-Mar-18	1.8							
	LI8-PERT-13	10-Mar-18	1.5							
	LI8-PERT-14	10-Mar-18	1.8							
	LI8-PERT-15	10-Mar-18	1.7							
FRUL (LC_LC6)	FRUL-PERT-01	27-Apr-17	8.5	5.0	2.4	8.5	5.1	1.7	4.2	6.0
	FRUL-PERT-02	27-Apr-17	5.4							
	FRUL-PERT-03	27-Apr-17	4.3							
	FRUL-PERT-04	27-Apr-17	5.9							
	FRUL-PERT-05	27-Apr-17	7.3							
	FRUL-PERT-06	27-Apr-17	6.4							
	FRUL-PERT-07	27-Apr-17	5.0							
	FRUL-PERT-08	27-Apr-17	3.5							
	FRUL-PERT-09	27-Apr-17	7.4							
	FRUL-PERT-10	27-Apr-17	3.7							
	FRUL-PERT-11	27-Apr-17	5.2							
	FRUL-PERT-12	27-Apr-17	3.6							
	FRUL-PERT-13	27-Apr-17	4.6							
	FRUL-PERT-14	27-Apr-17	3.3							
	FRUL-PERT-15	27-Apr-17	2.4							
	FRUL-PERT-01	11-Mar-18	5.0	7.0	2.3	15	7.6	3.2	6.0	9.3
	FRUL-PERT-02	11-Mar-18	7.6							
	FRUL-PERT-03	11-Mar-18	7.9							
	FRUL-PERT-04	11-Mar-18	12							
	FRUL-PERT-05	11-Mar-18	9.2							
	FRUL-PERT-06	11-Mar-18	3.9							
	FRUL-PERT-07	11-Mar-18	8.7							
	FRUL-PERT-08	11-Mar-18	5.4							
	FRUL-PERT-09	11-Mar-18	2.3							
	FRUL-PERT-10	11-Mar-18	11							
	FRUL-PERT-11	11-Mar-18	7.0							
	FRUL-PERT-12	11-Mar-18	15							
	FRUL-PERT-13	11-Mar-18	6.5							
	FRUL-PERT-14	11-Mar-18	6.7							
	FRUL-PERT-15	11-Mar-18	6.1							
FO23 (LC_LC5)	FO23-PERT-01	27-Apr-17	3.4	4.0	2.0	17	5.5	3.9	3.5	7.4
	FO23-PERT-02	27-Apr-17	17							
	FO23-PERT-03	27-Apr-17	4.0							
	FO23-PERT-04	27-Apr-17	2.0							
	FO23-PERT-05	27-Apr-17	3.9							
	FO23-PERT-06	27-Apr-17	4.5							
	FO23-PERT-07	27-Apr-17	4.9							
	FO23-PERT-08	27-Apr-17	2.7							
	FO23-PERT-09	27-Apr-17	6.3							
	FO23-PERT-10	27-Apr-17	3.0							
	FO23-PERT-11	27-Apr-17	5.8							
	FO23-PERT-12	27-Apr-17	11							
	FO23-PERT-13	27-Apr-17	3.2							
	FO23-PERT-14	27-Apr-17	8.1							
	FO23-PERT-15	27-Apr-17	3.1							
	FO23-PERT-01	11-Mar-18	4.2	6.7	1.9	23	7.6	5.5	4.8	10
	FO23-PERT-02	11-Mar-18	5.0							
	FO23-PERT-03	11-Mar-18	6.9							
	FO23-PERT-04	11-Mar-18	3.8							
	FO23-PERT-05	11-Mar-18	6.7							
	FO23-PERT-06	11-Mar-18	3.2							
	FO23-PERT-07	11-Mar-18	2.5							
	FO23-PERT-08	11-Mar-18	7.2							
	FO23-PERT-09	11-Mar-18	7.5							
	FO23-PERT-10	11-Mar-18	13							
	FO23-PERT-11	11-Mar-18	1.9							
	FO23-PERT-12	11-Mar-18	6.0							
	FO23-PERT-13	11-Mar-18	23							
	FO23-PERT-14	11-Mar-18	10							
	FO23-PERT-15	11-Mar-18	13							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.3: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018**

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LI24 (LC_LC1)	LI24-BIC-01	11-Sep-17	3.4	4.9	3.4	7.4	5.2	1.5	4.2	6.1
	LI24-BIC-02	11-Sep-17	6.8							
	LI24-BIC-03	11-Sep-17	5.0							
	LI24-BIC-04	11-Sep-17	4.7							
	LI24-BIC-05	11-Sep-17	7.4							
	LI24-BIC-06	11-Sep-17	6.4							
	LI24-BIC-07	11-Sep-17	6.6							
	LI24-BIC-08	11-Sep-17	4.0							
	LI24-BIC-09	11-Sep-17	3.4							
	LI24-BIC-10	11-Sep-17	3.9							
SLINE (LC_SLC)	SLINE-BIC-01	26-Apr-17	4.4	3.8	3.6	4.9	4.1	0.53	3.7	4.4
	SLINE-BIC-02	26-Apr-17	3.7							
	SLINE-BIC-03	26-Apr-17	4.9							
	SLINE-BIC-04	26-Apr-17	4.5							
	SLINE-BIC-05	26-Apr-17	3.6							
	SLINE-BIC-06	26-Apr-17	3.6							
	SLINE-BIC-07	26-Apr-17	3.8							
	SLINE-BIC-08	26-Apr-17	3.8							
	SLINE-BIC-09	26-Apr-17	3.8							
	SLINE-BIC-10	26-Apr-17	4.9							
	SLINE-BIC-01	9-Sep-17	3.8	4.8	3.8	5.6	4.8	0.53	4.5	5.1
	SLINE-BIC-02	9-Sep-17	4.6							
	SLINE-BIC-03	9-Sep-17	4.6							
	SLINE-BIC-04	9-Sep-17	4.7							
	SLINE-BIC-05	9-Sep-17	4.4							
	SLINE-BIC-06	9-Sep-17	5.6							
	SLINE-BIC-07	9-Sep-17	5.4							
	SLINE-BIC-08	9-Sep-17	5.0							
	SLINE-BIC-09	9-Sep-17	5.3							
	SLINE-BIC-10	9-Sep-17	4.8							
	SLINE-BIC-01	8-Mar-18	4.6	5.5	3.6	6.4	5.2	1.0	4.6	5.8
	SLINE-BIC-02	8-Mar-18	5.4							
	SLINE-BIC-03	8-Mar-18	6.4							
	SLINE-BIC-04	8-Mar-18	6.2							
	SLINE-BIC-05	8-Mar-18	4.4							
	SLINE-BIC-06	8-Mar-18	6.1							
	SLINE-BIC-07	8-Mar-18	5.5							
	SLINE-BIC-08	8-Mar-18	6.0							
	SLINE-BIC-09	8-Mar-18	3.6							
	SLINE-BIC-10	8-Mar-18	3.9							
LCUT (LC_LCUSWLC)	LCUT-BIC-01	25-Apr-17	7.6	6.8	4.5	7.9	6.4	1.4	5.5	7.3
	LCUT-BIC-02	25-Apr-17	5.5							
	LCUT-BIC-03	25-Apr-17	7.7							
	LCUT-BIC-04	25-Apr-17	4.6							
	LCUT-BIC-05	25-Apr-17	7.6							
	LCUT-BIC-06	25-Apr-17	6.1							
	LCUT-BIC-07	25-Apr-17	5.1							
	LCUT-BIC-08	25-Apr-17	4.5							
	LCUT-BIC-09	25-Apr-17	7.4							
	LCUT-BIC-10	25-Apr-17	7.9							
	LCUT-BIC-01	8-Sep-17	5.8	6.2	4.0	6.6	5.9	0.76	5.5	6.4
	LCUT-BIC-02	8-Sep-17	6.6							
	LCUT-BIC-03	8-Sep-17	6.6							
	LCUT-BIC-04	8-Sep-17	6.3							
	LCUT-BIC-05	8-Sep-17	6.2							
	LCUT-BIC-06	8-Sep-17	6.1							
	LCUT-BIC-07	8-Sep-17	6.1							
	LCUT-BIC-08	8-Sep-17	5.5							
	LCUT-BIC-09	8-Sep-17	4.0							
	LCUT-BIC-10	8-Sep-17	6.2							
	LCUT-BIC-01	9-Nov-17	7.2	6.7	5.8	7.8	6.7	0.70	6.2	7.1
	LCUT-BIC-02	9-Nov-17	7.8							
	LCUT-BIC-03	9-Nov-17	6.8							
	LCUT-BIC-04	9-Nov-17	6.5							
	LCUT-BIC-05	9-Nov-17	6.4							
	LCUT-BIC-06	9-Nov-17	5.9							
	LCUT-BIC-07	9-Nov-17	7.5							
	LCUT-BIC-08	9-Nov-17	5.8							
	LCUT-BIC-09	9-Nov-17	7.0							
	LCUT-BIC-10	9-Nov-17	5.9							
	LCUT-BIC-01	4-Dec-17	7.6	6.6	4.6	9.8	6.9	1.7	5.8	7.9
	LCUT-BIC-02	4-Dec-17	4.6							
	LCUT-BIC-03	4-Dec-17	5.8							
	LCUT-BIC-04	4-Dec-17	6.4							
	LCUT-BIC-05	4-Dec-17	5.2							
	LCUT-BIC-06	4-Dec-17	9.8							
	LCUT-BIC-07	4-Dec-17	6.7							
	LCUT-BIC-08	4-Dec-17	7.7							
	LCUT-BIC-09	4-Dec-17	9.0							
	LCUT-BIC-10	4-Dec-17	5.7							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.3: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LCUT (LC_LCUSWLC; Continued)	LCUT-BIC-01	9-Mar-18	5.4	6.4	5.4	7.9	6.3	0.73	5.9	6.8
	LCUT-BIC-02	9-Mar-18	7.9							
	LCUT-BIC-03	9-Mar-18	5.4							
	LCUT-BIC-04	9-Mar-18	5.8							
	LCUT-BIC-05	9-Mar-18	6.7							
	LCUT-BIC-06	9-Mar-18	6.5							
	LCUT-BIC-07	9-Mar-18	6.4							
	LCUT-BIC-08	9-Mar-18	6.6							
	LCUT-BIC-09	9-Mar-18	6.0							
	LCUT-BIC-10	9-Mar-18	6.4							
LILC3 (LC_LC3)	LILC3-BIC-01	25-Apr-17	27	36	24	53	37	8.7	31	42
	LILC3-BIC-02	25-Apr-17	24							
	LILC3-BIC-03	25-Apr-17	37							
	LILC3-BIC-04	25-Apr-17	33							
	LILC3-BIC-05	25-Apr-17	40							
	LILC3-BIC-06	25-Apr-17	43							
	LILC3-BIC-07	25-Apr-17	34							
	LILC3-BIC-08	25-Apr-17	44							
	LILC3-BIC-09	25-Apr-17	33							
	LILC3-BIC-10	25-Apr-17	53							
	LILC3-BIC-01	9-Sep-17	22	24	22	26	24	1.4	23	25
	LILC3-BIC-02	9-Sep-17	26							
	LILC3-BIC-03	9-Sep-17	24							
	LILC3-BIC-04	9-Sep-17	24							
	LILC3-BIC-05	9-Sep-17	22							
	LILC3-BIC-06	9-Sep-17	24							
	LILC3-BIC-07	9-Sep-17	23							
	LILC3-BIC-08	9-Sep-17	26							
	LILC3-BIC-09	9-Sep-17	24							
	LILC3-BIC-10	9-Sep-17	24							
	LILC3-BIC-01	9-Nov-17	15	25	15	39	26	6.3	22	30
	LILC3-BIC-02	9-Nov-17	28							
	LILC3-BIC-03	9-Nov-17	24							
	LILC3-BIC-04	9-Nov-17	39							
	LILC3-BIC-05	9-Nov-17	23							
	LILC3-BIC-06	9-Nov-17	30							
	LILC3-BIC-07	9-Nov-17	25							
	LILC3-BIC-08	9-Nov-17	23							
	LILC3-BIC-09	9-Nov-17	31							
	LILC3-BIC-10	9-Nov-17	24							
	LILC3-BIC-01	4-Dec-17	25	28	24	31	27	2.2	26	28
	LILC3-BIC-02	4-Dec-17	27							
	LILC3-BIC-03	4-Dec-17	24							
	LILC3-BIC-04	4-Dec-17	31							
	LILC3-BIC-05	4-Dec-17	28							
	LILC3-BIC-06	4-Dec-17	24							
	LILC3-BIC-07	4-Dec-17	28							
	LILC3-BIC-08	4-Dec-17	27							
	LILC3-BIC-09	4-Dec-17	28							
	LILC3-BIC-10	4-Dec-17	28							
	LILC3-BIC-01	9-Mar-18	8.0	14	8.0	22	14	4.0	12	17
	LILC3-BIC-02	9-Mar-18	19							
	LILC3-BIC-03	9-Mar-18	12							
	LILC3-BIC-04	9-Mar-18	11							
	LILC3-BIC-05	9-Mar-18	14							
	LILC3-BIC-06	9-Mar-18	14							
	LILC3-BIC-07	9-Mar-18	13							
	LILC3-BIC-08	9-Mar-18	22							
	LILC3-BIC-09	9-Mar-18	14							
	LILC3-BIC-10	9-Mar-18	17							
LISP23 (WL_LCUCP_SP23)	LISP23-BIC-01	11-Sep-17	17	17	15	19	17	1.3	16	18
	LISP23-BIC-02	11-Sep-17	15							
	LISP23-BIC-03	11-Sep-17	18							
	LISP23-BIC-04	11-Sep-17	16							
	LISP23-BIC-05	11-Sep-17	15							
	LISP23-BIC-06	11-Sep-17	19							
	LISP23-BIC-07	11-Sep-17	18							
	LISP23-BIC-08	11-Sep-17	17							
	LISP23-BIC-09	11-Sep-17	17							
	LISP23-BIC-10	11-Sep-17	16							
LISP24 (WL_DCP_SP24)	LISP24-BIC-01	11-Sep-17	16	17	13	18	16	1.6	15	17
	LISP24-BIC-02	11-Sep-17	16							
	LISP24-BIC-03	11-Sep-17	17							
	LISP24-BIC-04	11-Sep-17	17							
	LISP24-BIC-05	11-Sep-17	18							
	LISP24-BIC-06	11-Sep-17	16							
	LISP24-BIC-07	11-Sep-17	14							
	LISP24-BIC-08	11-Sep-17	13							
	LISP24-BIC-09	11-Sep-17	18							
	LISP24-BIC-10	11-Sep-17	17							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.3: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018**

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LISP24 (WL_DCP_SP24; Continued)	LISP24-BIC-01	9-Nov-17	14	15	11	16	14	1.4	13	15
	LISP24-BIC-02	9-Nov-17	13							
	LISP24-BIC-03	9-Nov-17	15							
	LISP24-BIC-04	9-Nov-17	11							
	LISP24-BIC-05	9-Nov-17	15							
	LISP24-BIC-06	9-Nov-17	15							
	LISP24-BIC-07	9-Nov-17	15							
	LISP24-BIC-08	9-Nov-17	16							
	LISP24-BIC-09	9-Nov-17	14							
	LISP24-BIC-10	9-Nov-17	14							
	LISP24-BIC-01	4-Dec-17	8.0	14	8.0	16	13	2.5	11	15
	LISP24-BIC-02	4-Dec-17	14							
	LISP24-BIC-03	4-Dec-17	12							
	LISP24-BIC-04	4-Dec-17	10							
	LISP24-BIC-05	4-Dec-17	15							
	LISP24-BIC-06	4-Dec-17	16							
	LISP24-BIC-07	4-Dec-17	14							
	LISP24-BIC-08	4-Dec-17	14							
	LISP24-BIC-09	4-Dec-17	15							
	LISP24-BIC-10	4-Dec-17	12							
	LISP24-BIC-01	10-Mar-18	7.8	7.5	6.3	9.2	7.4	0.85	6.9	8.0
	LISP24-BIC-02	10-Mar-18	7.4							
	LISP24-BIC-03	10-Mar-18	7.6							
	LISP24-BIC-04	10-Mar-18	6.9							
	LISP24-BIC-05	10-Mar-18	6.9							
	LISP24-BIC-06	10-Mar-18	6.5							
	LISP24-BIC-07	10-Mar-18	8.1							
	LISP24-BIC-08	10-Mar-18	7.7							
	LISP24-BIC-09	10-Mar-18	9.2							
	LISP24-BIC-10	10-Mar-18	6.3							
LIDSL (LC_LCDSSLCC) Compliance	LIDSL-BIC-01	26-Apr-17	9.7	10	7.0	13	10	2.0	9.1	12
	LIDSL-BIC-02	26-Apr-17	10.5							
	LIDSL-BIC-03	26-Apr-17	9.0							
	LIDSL-BIC-04	26-Apr-17	12.7							
	LIDSL-BIC-05	26-Apr-17	10.4							
	LIDSL-BIC-06	26-Apr-17	12.7							
	LIDSL-BIC-07	26-Apr-17	13.0							
	LIDSL-BIC-08	26-Apr-17	7.0							
	LIDSL-BIC-09	26-Apr-17	10.4							
	LIDSL-BIC-10	26-Apr-17	8.3							
	LIDSL-BIC-01	10-Sep-17	15	14	12	15	14	0.97	13	14
	LIDSL-BIC-02	10-Sep-17	15							
	LIDSL-BIC-03	10-Sep-17	13							
	LIDSL-BIC-04	10-Sep-17	14							
	LIDSL-BIC-05	10-Sep-17	14							
	LIDSL-BIC-06	10-Sep-17	13							
	LIDSL-BIC-07	10-Sep-17	13							
	LIDSL-BIC-08	10-Sep-17	13							
	LIDSL-BIC-09	10-Sep-17	12							
	LIDSL-BIC-10	10-Sep-17	14							
	LIDSL-BIC-01	10-Nov-17	13	13	9.7	14	12	1.3	11	13
	LIDSL-BIC-02	10-Nov-17	13							
	LIDSL-BIC-03	10-Nov-17	14							
	LIDSL-BIC-04	10-Nov-17	9.7							
	LIDSL-BIC-05	10-Nov-17	11							
	LIDSL-BIC-06	10-Nov-17	11							
	LIDSL-BIC-07	10-Nov-17	13							
	LIDSL-BIC-08	10-Nov-17	13							
	LIDSL-BIC-09	10-Nov-17	12							
	LIDSL-BIC-10	10-Nov-17	12							
	LIDSL-BIC-01	5-Dec-17	14	11	8.0	15	11	2.2	9.9	13
	LIDSL-BIC-02	5-Dec-17	11							
	LIDSL-BIC-03	5-Dec-17	15							
	LIDSL-BIC-04	5-Dec-17	13							
	LIDSL-BIC-05	5-Dec-17	11							
	LIDSL-BIC-06	5-Dec-17	11							
	LIDSL-BIC-07	5-Dec-17	8.2							
	LIDSL-BIC-08	5-Dec-17	11							
	LIDSL-BIC-09	5-Dec-17	11							
	LIDSL-BIC-10	5-Dec-17	8.0							
	LIDSL-BIC-01	10-Mar-18	5.7	6.0	5.3	10	6.6	1.4	5.7	7.4
	LIDSL-BIC-02	10-Mar-18	5.8							
	LIDSL-BIC-03	10-Mar-18	5.3							
	LIDSL-BIC-04	10-Mar-18	7.3							
	LIDSL-BIC-05	10-Mar-18	10							
	LIDSL-BIC-06	10-Mar-18	7.5							
	LIDSL-BIC-07	10-Mar-18	5.5							
	LIDSL-BIC-08	10-Mar-18	6.1							
	LIDSL-BIC-09	10-Mar-18	6.4							
	LIDSL-BIC-10	10-Mar-18	5.9							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.3: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LIDCOM (LC_LCC)	LIDCOM-BIC-01	10-Sep-17	11	8.8	7.3	18	9.6	3.2	7.7	12
	LIDCOM-BIC-02	10-Sep-17	18							
	LIDCOM-BIC-03	10-Sep-17	7.3							
	LIDCOM-BIC-04	10-Sep-17	8.3							
	LIDCOM-BIC-05	10-Sep-17	8.8							
	LIDCOM-BIC-06	10-Sep-17	9.6							
	LIDCOM-BIC-07	10-Sep-17	8.8							
	LIDCOM-BIC-08	10-Sep-17	7.6							
	LIDCOM-BIC-09	10-Sep-17	7.4							
	LIDCOM-BIC-10	10-Sep-17	9.4							
	LIDCOM-BIC-01	10-Nov-17	9.1	7.3	6.1	9.1	7.4	0.80	6.9	7.9
	LIDCOM-BIC-02	10-Nov-17	7.2							
	LIDCOM-BIC-03	10-Nov-17	7.3							
	LIDCOM-BIC-04	10-Nov-17	7.5							
	LIDCOM-BIC-05	10-Nov-17	7.3							
	LIDCOM-BIC-06	10-Nov-17	7.3							
	LIDCOM-BIC-07	10-Nov-17	8.0							
	LIDCOM-BIC-08	10-Nov-17	6.1							
	LIDCOM-BIC-09	10-Nov-17	7.8							
	LIDCOM-BIC-10	10-Nov-17	6.6							
	LIDCOM-BIC-01	5-Dec-17	9.2	9.2	8.3	11	9.4	0.75	8.9	9.8
	LIDCOM-BIC-02	5-Dec-17	9.9							
	LIDCOM-BIC-03	5-Dec-17	9.1							
	LIDCOM-BIC-04	5-Dec-17	8.9							
	LIDCOM-BIC-05	5-Dec-17	9.7							
	LIDCOM-BIC-06	5-Dec-17	9.6							
	LIDCOM-BIC-07	5-Dec-17	9.1							
	LIDCOM-BIC-08	5-Dec-17	11							
	LIDCOM-BIC-09	5-Dec-17	8.3							
	LIDCOM-BIC-10	5-Dec-17	8.7							
	LIDCOM-BIC-01	10-Mar-18	9.0	7.7	6.4	9.2	7.7	1.0	7.1	8.4
	LIDCOM-BIC-02	10-Mar-18	9.0							
	LIDCOM-BIC-03	10-Mar-18	7.8							
	LIDCOM-BIC-04	10-Mar-18	7.8							
	LIDCOM-BIC-05	10-Mar-18	7.5							
	LIDCOM-BIC-06	10-Mar-18	6.9							
	LIDCOM-BIC-07	10-Mar-18	9.2							
	LIDCOM-BIC-08	10-Mar-18	6.4							
	LIDCOM-BIC-09	10-Mar-18	6.4							
	LIDCOM-BIC-10	10-Mar-18	7.3							
LI8 (LC_LC4)	LI8-BIC-01	26-Apr-17	8.3	8.4	6.2	11	8.6	1.6	7.6	9.6
	LI8-BIC-02	26-Apr-17	10							
	LI8-BIC-03	26-Apr-17	10							
	LI8-BIC-04	26-Apr-17	8.1							
	LI8-BIC-05	26-Apr-17	8.6							
	LI8-BIC-06	26-Apr-17	8.9							
	LI8-BIC-07	26-Apr-17	6.5							
	LI8-BIC-08	26-Apr-17	6.2							
	LI8-BIC-09	26-Apr-17	7.7							
	LI8-BIC-10	26-Apr-17	11							
	LI8-BIC-01	8-Sep-17	11	12	10	13	11	0.97	11	12
	LI8-BIC-02	8-Sep-17	10							
	LI8-BIC-03	8-Sep-17	12							
	LI8-BIC-04	8-Sep-17	12							
	LI8-BIC-05	8-Sep-17	13							
	LI8-BIC-06	8-Sep-17	11							
	LI8-BIC-07	8-Sep-17	10							
	LI8-BIC-08	8-Sep-17	12							
	LI8-BIC-09	8-Sep-17	11							
	LI8-BIC-10	8-Sep-17	12							
	LI8-BIC-01	10-Nov-17	7.9	8.5	7.0	9.5	8.3	0.98	7.7	8.9
	LI8-BIC-02	10-Nov-17	9.2							
	LI8-BIC-03	10-Nov-17	9.0							
	LI8-BIC-04	10-Nov-17	9.2							
	LI8-BIC-05	10-Nov-17	7.0							
	LI8-BIC-06	10-Nov-17	9.1							
	LI8-BIC-07	10-Nov-17	9.5							
	LI8-BIC-08	10-Nov-17	8.0							
	LI8-BIC-09	10-Nov-17	7.0							
	LI8-BIC-10	10-Nov-17	7.4							
	LI8-BIC-01	5-Dec-17	9.4	9.0	7.6	10	8.9	0.78	8.5	9.4
	LI8-BIC-02	5-Dec-17	10							
	LI8-BIC-03	5-Dec-17	9.0							
	LI8-BIC-04	5-Dec-17	7.6							
	LI8-BIC-05	5-Dec-17	9.4							
	LI8-BIC-06	5-Dec-17	9.9							
	LI8-BIC-07	5-Dec-17	8.0							
	LI8-BIC-08	5-Dec-17	8.9							
	LI8-BIC-09	5-Dec-17	8.4							
	LI8-BIC-10	5-Dec-17	8.8							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.3: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018**

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation	Lower	Upper
LI8 (LC_LC4; Continued)	LI8-BIC-01	10-Mar-18	6.4	7.1	4.3	8.8	6.9	1.4	6.1	7.8
	LI8-BIC-02	10-Mar-18	7.7							
	LI8-BIC-03	10-Mar-18	5.3							
	LI8-BIC-04	10-Mar-18	7.3							
	LI8-BIC-05	10-Mar-18	6.7							
	LI8-BIC-06	10-Mar-18	7.1							
	LI8-BIC-07	10-Mar-18	7.0							
	LI8-BIC-08	10-Mar-18	4.3							
	LI8-BIC-09	10-Mar-18	8.8							
	LI8-BIC-10	10-Mar-18	8.7							
FRUL (LC_LC6)	FRUL-BIC-01	27-Apr-17	6.5	6.9	4.6	8.9	7.0	1.4	6.1	7.9
	FRUL-BIC-02	27-Apr-17	7.1							
	FRUL-BIC-03	27-Apr-17	8.9							
	FRUL-BIC-04	27-Apr-17	6.7							
	FRUL-BIC-05	27-Apr-17	4.6							
	FRUL-BIC-06	27-Apr-17	8.4							
	FRUL-BIC-07	27-Apr-17	6.1							
	FRUL-BIC-08	27-Apr-17	5.2							
	FRUL-BIC-09	27-Apr-17	8.4							
	FRUL-BIC-10	27-Apr-17	7.9							
	FRUL-BIC-01	13-Sep-17	7.7	8.1	7.5	9.4	8.1	0.60	7.8	8.5
	FRUL-BIC-02	13-Sep-17	7.6							
	FRUL-BIC-03	13-Sep-17	8.5							
	FRUL-BIC-04	13-Sep-17	8.3							
	FRUL-BIC-05	13-Sep-17	7.6							
	FRUL-BIC-06	13-Sep-17	8.3							
	FRUL-BIC-07	13-Sep-17	7.9							
	FRUL-BIC-08	13-Sep-17	9.4							
	FRUL-BIC-09	13-Sep-17	7.5							
	FRUL-BIC-10	13-Sep-17	8.6							
	FRUL-BIC-01	11-Mar-18	6.5	6.6	5.7	7.9	6.9	0.75	6.4	7.3
	FRUL-BIC-02	11-Mar-18	7.9							
	FRUL-BIC-03	11-Mar-18	6.5							
	FRUL-BIC-04	11-Mar-18	6.6							
	FRUL-BIC-05	11-Mar-18	6.6							
	FRUL-BIC-06	11-Mar-18	7.7							
	FRUL-BIC-07	11-Mar-18	7.9							
	FRUL-BIC-08	11-Mar-18	5.7							
	FRUL-BIC-09	11-Mar-18	7.1							
	FRUL-BIC-10	11-Mar-18	6.2							
FO23 (LC_LC5)	F023-BIC-01	27-Apr-17	6.3	6.4	5.0	8.1	6.6	0.90	6.0	7.2
	F023-BIC-02	27-Apr-17	6.6							
	F023-BIC-03	27-Apr-17	6.2							
	F023-BIC-04	27-Apr-17	6.1							
	F023-BIC-05	27-Apr-17	5.8							
	F023-BIC-06	27-Apr-17	8.1							
	F023-BIC-07	27-Apr-17	5.0							
	F023-BIC-08	27-Apr-17	7.3							
	F023-BIC-09	27-Apr-17	7.3							
	F023-BIC-10	27-Apr-17	7.3							
	F023-BIC-01	13-Sep-17	9.0	8.7	6.6	12	8.9	1.9	7.8	10
	F023-BIC-02	13-Sep-17	7.4							
	F023-BIC-03	13-Sep-17	7.2							
	F023-BIC-04	13-Sep-17	8.9							
	F023-BIC-05	13-Sep-17	12							
	F023-BIC-06	13-Sep-17	6.6							
	F023-BIC-07	13-Sep-17	8.5							
	F023-BIC-08	13-Sep-17	12							
	F023-BIC-09	13-Sep-17	10							
	F023-BIC-10	13-Sep-17	7.7							
	F023-BIC-01	11-Mar-18	6.3	6.3	5.2	7.2	6.4	0.58	6.0	6.7
	F023-BIC-02	11-Mar-18	5.2							
	F023-BIC-03	11-Mar-18	6.3							
	F023-BIC-04	11-Mar-18	6.0							
	F023-BIC-05	11-Mar-18	6.1							
	F023-BIC-06	11-Mar-18	6.1							
	F023-BIC-07	11-Mar-18	6.5							
	F023-BIC-08	11-Mar-18	6.7							
	F023-BIC-09	11-Mar-18	7.1							
	F023-BIC-10	11-Mar-18	7.2							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.4: Selenium Concentrations Measured in Benthic Invertebrate *Parapsyche* sp. Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximium	Area Mean	Area Standard Deviation	Lower	Upper
LI24 (LC_LC1)	LI24-PAR-01	11-Sep-17	5.6	5.2	3.4	5.8	5.0	0.95	4.1	5.8
	LI24-PAR-02	11-Sep-17	5.8							
	LI24-PAR-03	11-Sep-17	4.9							
	LI24-PAR-04	11-Sep-17	3.4							
	LI24-PAR-05	11-Sep-17	5.2							
SLINE (LC_SLC)	SLINE-PAR-01	26-Apr-17	2.7	3.8	2.7	4.6	3.7	0.52	3.4	4.1
	SLINE-PAR-02	26-Apr-17	3.7							
	SLINE-PAR-03	26-Apr-17	3.8							
	SLINE-PAR-04	26-Apr-17	4.2							
	SLINE-PAR-05	26-Apr-17	3.8							
	SLINE-PAR-06	26-Apr-17	3.9							
	SLINE-PAR-07	26-Apr-17	3.0							
	SLINE-PAR-08	26-Apr-17	3.9							
	SLINE-PAR-09	26-Apr-17	4.6							
	SLINE-PAR-10	26-Apr-17	3.9							
	SLINE-PAR-01	09-Sep-17	3.5	3.5	3.1	4.1	3.6	0.42	3.3	4.0
	SLINE-PAR-02	09-Sep-17	3.1							
	SLINE-PAR-03	09-Sep-17	3.4							
	SLINE-PAR-04	09-Sep-17	4.1							
	SLINE-PAR-05	09-Sep-17	4.0							
	SLINE-PAR-01	08-Mar-18	4.0	4.1	3.5	5.8	4.2	0.83	3.5	4.9
	SLINE-PAR-02	08-Mar-18	4.1							
	SLINE-PAR-03	08-Mar-18	3.5							
	SLINE-PAR-04	08-Mar-18	3.6							
	SLINE-PAR-05	08-Mar-18	5.8							
	SLINE-PAR-06	08-Mar-18	4.3							
LCUT (LC_LCUSWLC)	LCUT-PAR-01	25-Apr-17	5.3	7.6	4.3	12	7.9	2.4	6.5	9.4
	LCUT-PAR-02	25-Apr-17	12							
	LCUT-PAR-03	25-Apr-17	9.4							
	LCUT-PAR-04	25-Apr-17	4.3							
	LCUT-PAR-05	25-Apr-17	7.3							
	LCUT-PAR-06	25-Apr-17	9.8							
	LCUT-PAR-07	25-Apr-17	6.1							
	LCUT-PAR-08	25-Apr-17	7.2							
	LCUT-PAR-09	25-Apr-17	10							
	LCUT-PAR-10	25-Apr-17	7.8							
	LCUT-PAR-01	08-Sep-17	6.4	6.4	5.6	8.7	6.9	1.3	5.7	8.0
	LCUT-PAR-02	08-Sep-17	5.8							
	LCUT-PAR-03	08-Sep-17	5.6							
	LCUT-PAR-04	08-Sep-17	7.8							
	LCUT-PAR-05	08-Sep-17	8.7							
	LCUT-PAR-01	09-Mar-18	7.0	8.4	6.0	11	8.5	1.5	7.6	9.4
	LCUT-PAR-02	09-Mar-18	8.0							
	LCUT-PAR-03	09-Mar-18	7.8							
	LCUT-PAR-04	09-Mar-18	8.2							
	LCUT-PAR-05	09-Mar-18	9.0							
	LCUT-PAR-06	09-Mar-18	6.0							
	LCUT-PAR-07	09-Mar-18	10							
	LCUT-PAR-08	09-Mar-18	8.6							
	LCUT-PAR-09	09-Mar-18	11							
	LCUT-PAR-10	09-Mar-18	9.7							
LILC3 (LC_LC3)	LILC3-PAR-01	25-Apr-17	54	45	38	62	47	7.9	42	52
	LILC3-PAR-02	25-Apr-17	48							
	LILC3-PAR-03	25-Apr-17	49							
	LILC3-PAR-04	25-Apr-17	53							
	LILC3-PAR-05	25-Apr-17	40							
	LILC3-PAR-06	25-Apr-17	43							
	LILC3-PAR-07	25-Apr-17	39							
	LILC3-PAR-08	25-Apr-17	41							
	LILC3-PAR-09	25-Apr-17	38							
	LILC3-PAR-10	25-Apr-17	62							
	LILC3-PAR-01	09-Sep-17	30	29	28	31	29	1.1	28	30
	LILC3-PAR-02	09-Sep-17	29							
	LILC3-PAR-03	09-Sep-17	28							
	LILC3-PAR-04	09-Sep-17	31							
	LILC3-PAR-05	09-Sep-17	29							
	LILC3-PAR-01	09-Mar-18	28	29	19	40	28	5.8	25	32
	LILC3-PAR-02	09-Mar-18	30							
	LILC3-PAR-03	09-Mar-18	40							
	LILC3-PAR-04	09-Mar-18	30							
	LILC3-PAR-05	09-Mar-18	19							
	LILC3-PAR-06	09-Mar-18	32							
	LILC3-PAR-07	09-Mar-18	27							
	LILC3-PAR-08	09-Mar-18	29							
	LILC3-PAR-09	09-Mar-18	24							
	LILC3-PAR-10	09-Mar-18	22							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.4: **Selenium Concentrations Measured in Benthic Invertebrate *Parapsyche* sp. Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April to March 2018**

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximium	Area Mean	Area Standard Deviation	Lower	Upper
LISP23 (WL_LCUCP_SP23)	LISP23-PAR-01	11-Sep-17	13	16	13	19	16	2.4	14	18
	LISP23-PAR-02	11-Sep-17	18							
	LISP23-PAR-03	11-Sep-17	19							
	LISP23-PAR-04	11-Sep-17	15							
	LISP23-PAR-05	11-Sep-17	16							
LISP24 (WL_DCP_SP24)	LISP24-PAR-01	11-Sep-17	15	16	15	18	17	1.3	15	18
	LISP24-PAR-02	11-Sep-17	18							
	LISP24-PAR-03	11-Sep-17	16							
	LISP24-PAR-04	11-Sep-17	16							
	LISP24-PAR-05	11-Sep-17	18							
	LISP24-PAR-01	10-Mar-18	22	8.7	6.0	22	12	6.5	6.2	18
	LISP24-PAR-02	10-Mar-18	15							
	LISP24-PAR-03	10-Mar-18	8.1							
	LISP24-PAR-04	10-Mar-18	8.7							
	LISP24-PAR-05	10-Mar-18	6.0							
	LISP24-PAR-06	10-Mar-18	15							
	LISP24-PAR-07	10-Mar-18	21							
	LISP24-PAR-08	10-Mar-18	18							
	LISP24-PAR-09	10-Mar-18	18							
	LISP24-PAR-10	10-Mar-18	20							
LIDSL (LC_LCDSSLCC) Compliance	LIDSL-PAR-01	26-Apr-17	20	16	14	21	17	2.2	15	18
	LIDSL-PAR-02	26-Apr-17	15							
	LIDSL-PAR-03	26-Apr-17	16							
	LIDSL-PAR-04	26-Apr-17	14							
	LIDSL-PAR-05	26-Apr-17	16							
	LIDSL-PAR-06	26-Apr-17	17							
	LIDSL-PAR-07	26-Apr-17	16							
	LIDSL-PAR-08	26-Apr-17	21							
	LIDSL-PAR-09	26-Apr-17	18							
	LIDSL-PAR-10	26-Apr-17	16							
	LIDSL-PAR-01	10-Sep-17	16	16	12	16	15	1.7	13	17
	LIDSL-PAR-02	10-Sep-17	15							
	LIDSL-PAR-03	10-Sep-17	16							
	LIDSL-PAR-04	10-Sep-17	16							
	LIDSL-PAR-05	10-Sep-17	12							
	LIDSL-PAR-01	10-Mar-18	13	14	11	18	14	2.1	12	15
	LIDSL-PAR-02	10-Mar-18	15							
	LIDSL-PAR-03	10-Mar-18	12							
	LIDSL-PAR-04	10-Mar-18	15							
	LIDSL-PAR-05	10-Mar-18	11							
	LIDSL-PAR-06	10-Mar-18	18							
	LIDSL-PAR-07	10-Mar-18	14							
	LIDSL-PAR-08	10-Mar-18	12							
	LIDSL-PAR-09	10-Mar-18	12							
	LIDSL-PAR-10	10-Mar-18	15							
LIDCOM (LC_LCC)	LIDCOM-PAR-01	10-Sep-17	7.2	7.6	7.2	8.9	7.9	0.76	7.3	8.6
	LIDCOM-PAR-02	10-Sep-17	7.6							
	LIDCOM-PAR-03	10-Sep-17	8.9							
	LIDCOM-PAR-04	10-Sep-17	8.6							
	LIDCOM-PAR-05	10-Sep-17	7.4							
	LIDCOM-PAR-01	10-Mar-18	12	10	10	13	11	1.4	9.8	12
	LIDCOM-PAR-02	10-Mar-18	10							
	LIDCOM-PAR-03	10-Mar-18	13							
	LIDCOM-PAR-04	10-Mar-18	10							
	LIDCOM-PAR-05	10-Mar-18	10							
	LIDCOM-PAR-06	10-Mar-18	11							
	LIDCOM-PAR-07	10-Mar-18	11							
	LIDCOM-PAR-08	10-Mar-18	9.2							
	LIDCOM-PAR-09	10-Mar-18	9.7							
	LIDCOM-PAR-10	10-Mar-18	9.8							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.4: Selenium Concentrations Measured in Benthic Invertebrate *Parapsyche* sp. Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)						95% Confidence Interval	
			Sample	Area Median	Area Minimum	Area Maximium	Area Mean	Area Standard Deviation	Lower	Upper
LI8 (LC_LC4)	LI8-PAR-01	26-Apr-17	10	11	8.5	14	11	1.9	10	12
	LI8-PAR-02	26-Apr-17	13							
	LI8-PAR-03	26-Apr-17	8.5							
	LI8-PAR-04	26-Apr-17	10							
	LI8-PAR-05	26-Apr-17	11							
	LI8-PAR-06	26-Apr-17	14							
	LI8-PAR-07	26-Apr-17	12							
	LI8-PAR-08	26-Apr-17	8.6							
	LI8-PAR-09	26-Apr-17	13							
	LI8-PAR-10	26-Apr-17	10							
	LI8-PAR-01	08-Sep-17	8.1	9.8	7.6	10	9.1	1.2	8.1	10
	LI8-PAR-02	08-Sep-17	10							
	LI8-PAR-03	08-Sep-17	9.8							
	LI8-PAR-04	08-Sep-17	10							
	LI8-PAR-05	08-Sep-17	7.6							
	LI8-PAR-01	10-Mar-18	9.5	10	7.2	12	10	1.5	8.9	11
	LI8-PAR-02	10-Mar-18	8.4							
	LI8-PAR-03	10-Mar-18	10							
	LI8-PAR-04	10-Mar-18	10							
	LI8-PAR-05	10-Mar-18	12							
	LI8-PAR-06	10-Mar-18	8.9							
	LI8-PAR-07	10-Mar-18	7.2							
	LI8-PAR-08	10-Mar-18	11							
	LI8-PAR-09	10-Mar-18	12							
	LI8-PAR-10	10-Mar-18	10							
FRUL (LC_LC6)	FRUL-PAR-01	13-Sep-17	7.8	9.4	7.8	9.8	9.0	1.1	7.8	10
	FRUL-PAR-02	13-Sep-17	9.8							
	FRUL-PAR-03	13-Sep-17	9.4							
	FRUL-PAR-01	11-Mar-18	7.6	8.9	7.6	11	9.2	1.7	7.2	11
	FRUL-PAR-02	11-Mar-18	11							
	FRUL-PAR-03	11-Mar-18	8.9							
FO23 (LC_LC5)	F023-PAR-01	13-Sep-17	8.9	8.9	7.5	9.3	8.5	0.76	7.8	9.2
	F023-PAR-02	13-Sep-17	8.9							
	F023-PAR-03	13-Sep-17	9.3							
	F023-PAR-04	13-Sep-17	7.5							
	F023-PAR-05	13-Sep-17	7.9							
	F023-PAR-01	11-Mar-18	7.4	7.4	6.1	9.0	7.4	0.99	6.6	8.3
	F023-PAR-02	11-Mar-18	9.0							
	F023-PAR-03	11-Mar-18	6.1							
	F023-PAR-04	11-Mar-18	6.7							
	F023-PAR-05	11-Mar-18	8.1							
	F023-PAR-06	11-Mar-18	7.9							
	F023-PAR-07	11-Mar-18	6.8							

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to March were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.5a: Selenium Concentrations Measured in Composite Chironomidae Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)
LCUT (LC_LCUSWLC)	LCUT-CHI	25-Apr-17	2.4
	LCUT-CHI	08-Sep-17	4.5
	LCUT-CHI	09-Mar-18	5.1
LILC3 (LC_LC3)	LILC3-CHI	25-Apr-17	25
	LILC3-CHI	09-Sep-17	19
	LILC3-CHI	09-Mar-18	11
LISP24 (WL_DCP_SP24)	LISP24-CHI	10-Mar-18	12
LIDSL (LC_LCDSSLCC) Compliance	LIDSL-CHI	10-Sep-17	12
LIDCOM (LC_LCC)	LIDCOM-CHI	10-Mar-18	17
LI8 (LC_LC4)	L18-CHI	10-Mar-18	9.1
FRUL (LC_LC6)	FRUL-CHI	11-Mar-18	5.1
FO23 (LC_LC5)	FO23-CHI	13-Sep-17	12
	FO23-CHI	11-Mar-18	6.8

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to April were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.5b: Selenium Concentrations Measured in Composite Ephemeroptera Samples Collected from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)
LI24 (LC_LC1)	LI24-MAY	11-Sep-17	8.2
SLINE (LC_SLC)	SLINE-MAY	26-Apr-17	6.8
	SLINE-MAY	09-Sep-17	7.6
	SLINE-MAY	08-Mar-18	8.9
LCUT (LC_LCUSWLC)	LCUT-MAY	25-Apr-17	5.7
	LCUT-MAY	08-Sep-17	6.3
	LCUT-MAY	09-Mar-18	8.4
LILC3 (LC_LC3)	LILC3-MAY	25-Apr-17	17
	LILC3-MAY	09-Sep-17	33
	LILC3-MAY	09-Mar-18	11
LISP24 (WL_DCP_SP24)	LISP24-MAY	10-Mar-18	7.7
LIDSL (LC_LCDSSLCC) Compliance	LIDSL-MAY	26-Apr-17	9.7
	LIDSL-MAY	10-Sep-17	14
	LIDSL-MAY	10-Mar-18	7.5
LIDCOM (LC_LCC)	LI24-MAY	10-Mar-18	9.9
LI8 (LC_LC4)	LI8-MAY	26-Apr-17	7.6
	LI8-MAY	08-Sep-17	13
	LI8-MAY	10-Mar-18	4.4
FRUL (LC_LC6)	FRUL-MAY	27-Apr-17	4.1
	FRUL-MAY	13-Sep-17	8.8
	FRUL-MAY	11-Mar-18	6.4
FO23 (LC_LC5)	FO23-MAY	27-Apr-17	6.2
	FO23-MAY	13-Sep-17	10
	FO23-MAY	11-Mar-18	7.4

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to April were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.5c: Selenium Concentrations Measured in Composite Rhyacophilidae Samples Collected April from Line Creek and Fording River, Line Creek LAEMP, April 2017 to March 2018

Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)
LI24 (LC_LC1)	LI24-RHY	11-Sep-17	6.0
SLINE (LC_SLC)	SLINE-RHY	26-Apr-17	3.9
	SLINE-RHY	09-Sep-17	4.9
	SLINE-RHY	08-Mar-18	5.6
LCUT (LC_LCUSWLC)	LCUT-RHY	25-Apr-17	6.1
	LCUT-RHY	08-Sep-17	5.2
	LCUT-RHY	09-Mar-18	5.7
LILC3 (LC_LC3)	LILC3-RHY	25-Apr-17	26
	LILC3-RHY	09-Sep-17	23
	LILC3-RHY	09-Mar-18	20
LISP24 (WL_DCP_SP24)	LISP24-RHY	10-Mar-18	19
LIDSL (LC_LCDSSLCC) Compliance	LIDSL-RHY	26-Apr-17	20
	LIDSL-RHY	10-Sep-17	18
	LIDSL-RHY	10-Mar-18	16
LIDCOM (LC_LCC)	LIDCOM-RHY	10-Mar-18	11
LI8 (LC_LC4)	LI8-RHY	26-Apr-17	12
	LI8-RHY	08-Sep-17	9.7
	LI8-RHY	10-Mar-18	9.4
FRUL (LC_LC6)	FRUL-RHY	13-Sep-17	14
	FRUL-RHY	11-Mar-18	9.8
FO23 (LC_LC5)	F023-RHY	13-Sep-17	10
	F023-RHY	11-Mar-18	11

Note: Tissue selenium concentrations are displayed starting in March 2017. Results from 2017 prior to April were presented in the 2016 Line Creek LAEMP (Minnow 2017a).

Table B.6: **Selenium Tissue Concentrations (mg/kg dw) of Specific Benthic Invertebrate Taxa Collected in the Vicinity of Line Creek, 2009 to March 2018**

Water-body		Biological Area Code	Year	Month	Ephemeroptera		Trichoptera				Diptera	
							Parapsyche sp.		Rhyacophilidae		Chironomidae	
					Mean	Sample Size	Mean	Sample Size	Mean	Sample Size	Mean	Sample Size
Line Creek	Reference	LI24	2014	September	8.6	3	-	-	4.1	1	-	-
			2015	September	7.5	1	-	-	0.70	1	-	-
			2016	September	7.1	1	-	-	4.0	1	-	-
			2017	September	8.2	1	5.0	5	6.0	1	-	-
		SLINE	2014	September	11	3	-	-	3.9	1	-	-
			2015	September	7.7	1	-	-	6.7	1	-	-
			2016	September	6.7	1	-	-	5.2	1	-	-
			2017	April	6.8	1	3.7	10	3.9	1	-	-
				September	7.6	1	3.6	5	4.9	1	-	-
			2018	March	8.9	1	3.7	10	5.6	1	-	-
	Mine-exposed	LCUT	2016	September	6.1	1	-	-	5.4	1	-	-
			2017	February/March	-	-	7.6	5	6.3	1	4.1	1
				April	5.7	1	7.9	10	6.1	1	2.4	1
				September	6.3	1	6.9	5	5.2	1	4.5	1
			2018	March	8.4	1	-	-	5.7	1	5.1	1
		LILC3	2014	September	33	1	-	-	22	1	-	-
			2015	September	6.9	1	-	-	19	1	-	-
			2016	September	31	1	-	-	42	1	-	-
			2017	February/March	-	-	50	5	-	-	17	1
				April	17	1	47	10	26	1	25	1
				September	33	1	29	5	23	1	19	1
			2018	March	11	1	-	-	20	1	11	11
		LISP23	2017	September	-	-	16	5	-	-	-	-
		LISP24	2017	September	-	-	17	5	-	-	-	-
			2018	March	7.7	1	17	5	19	1	12	1
		LIDSL	2014	September	17	1	-	-	21	1	-	-
			2015	September	7.5	1	-	-	29	1	-	-
			2016	September	14	1	-	-	24	1	-	-
			2017	February/March	-	-	18	5	23	1	12	1
				April	9.7	1	17	10	20	1	-	-
				September	14	1	15	5	18	1	12	1
			2018	March	7.5	1	-	-	16	1	-	-
		LIDCOM	2017	September	-	-	7.9	5	-	-	-	-
			2018	March	9.9	1	-	-	11	1	17	1
		LI8	2009	September	-	-	-	-	14	1	-	-
			2014	September	11	1	-	-	11	1	-	-
			2015	September	7.4	1	-	-	13	1	-	-
			2016	September	-	-	-	-	12	1	-	-
			2017	February/March	-	-	12	5	12	1	-	-
				April	7.6	1	11	10	12	1	-	-
				September	13	1	9.1	5	9.7	1	-	-
			2018	March	4.4	1	-	-	9.4	1	9.1	1
Fording River		FRUL	2015	September	8.4	1	-	-	-	-	-	-
			2017	April	4.1	1	-	-	-	-	-	-
				September	8.8	1	9.0	3	14	1	-	-
			2018	March	6.4	1	9.2	3	9.8	1	5.1	1
		FO23	2015	September	7.4	1	-	-	-	-	-	-
			2016	September	11	1	-	-	-	-	-	-
			2017	April	6.2	1	-	-	-	-	-	-
				September	10	1	8.5	5	10	1	12	1
			2018	March	6.4	1	7.4	7	11	1	6.8	1

Notes: Means are presented where the number of samples > 1, all other data are individual values. FRUL=FOUL prior to 2016.

Table B.7: ANOVA Table for BACI Models, and P-values and Magnitude of Difference for Contrasts of Tissue Selenium Concentrations During AWTF Operation (2016, 2017) Compared to Before (2012 only)

Model						Magnitude of Difference[a]
Response	**Years**	**Term**	**DF**	**F**	**P-Value**	**BAxCI**
Benthic Composite Tissue Selenium Concentration	2012 vs 2016 & 2017	BA	1	12	0.040	-
		CI	1	34	0.010	
		BAxCI	1	9.5	0.054	3.44 SD / 163%
		Year(BA)	1	1.3	0.341	-
		Area(CI)	3	6.9	0.074	
		Year(BA)xCI	1	1.8	0.275	
		Area(CI)xBA	3	4.0	0.142	
		Error	3	-	-	- - - - -

(Grey shading) P-value < 0.1 suggesting BAC1 effect associated with AWTF operation.

Notes: [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area relative to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage. Analysis included data for reference areas LI24 and SLINE, and mine-exposed areas LILC3, LIDSL and LI8.

Table B.8: **ANOVA Table for BACI Models, and P-values and Magnitude of Difference for Contrasts of Tissue Selenium Concentrations During AWTF Operation (2016, 2017) Compared to Before (2012, 2015)**

Model						Contrasts (P-value and Magnitude of Difference[a])				
						Area(CI)×BA				
Response	Years	Term	DF	F	P-Value	LI24 vs SLINE	LILC3 vs Pooled Ref	LIDSL vs Pooled Ref	LI8 vs Pooled Ref	FO23 vs Pooled Ref
Benthic Composite Tissue Selenium Concentration[b]	2012 & 2015 vs 2016 & 2017	BA	1	21.23	0.004	-				
		CI	1	55.84	<0.001					
		BAxCI	1	15.79	0.007					
		Year(BA)	2	1.42	0.313					
		Area(CI)	3	10.18	0.009					
		Year(BA)xCI	2	1.83	0.240					
		Area(CI)xBA	3	6.61	0.025	0.83	0.001 (7.1 SD/195 %)	0.093 (2.4 SD/81 %)	0.35	NA
		Error	6	-	-	-	-	-	-	
Ephemeroptera Tissue Selenium Concentration[c]	2015 vs 2016 & 2017	BA	1	194.55	0.001	-				
		CI	1	250.24	0.001					
		BAxCI	1	135.74	0.001					
		Year(BA)	1	1.96	0.256					
		Area(CI)	3	146.34	0.001					
		Year(BA)xCI	1	0.07	0.806					
		Area(CI)xBA	3	78.54	0.002	0.69	<0.001 (28 SD/369 %)	0.016 (7.4S D/90%)	NA	0.11
		Error	3	-	-	-	-	-	-	-
Rhyacophilidae Tissue Selenium Concentration[b]	2015 vs 2016 & 2017	BA	1	0.23	0.663	-				
		CI	1	38.47	0.008					
		BAxCI	1	0.00	0.990					
		Year(BA)	1	2.65	0.202					
		Area(CI)	3	5.83	0.091					
		Year(BA)xCI	1	2.41	0.218					
		Area(CI)xBA	3	2.37	0.249					
		Error	3	-	-	-	-	-	-	-

[shaded] P-value < 0.1 suggesting BAC1 effect associated with AWTF operation.

Notes: [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area relative to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage. NAs represent contrasts not applicable to corresponding ANOVA. [b] Analysis included data for reference areas LI24 and SLINE, and mine-exposed areas LILC3, LIDSL and LI8.
[c] Analysis included data for reference areas LI24 and SLINE, and mine-exposed areas LILC3, LIDSL and FO23.

Table B.9: ANOVA Table for BACI Models, and P-values and Magnitude of Difference for Contrasts of Tissue Selenium Concentrations During AWTF Operation (2016, 2017) Compared to Before (2012, 2014, 2015)

Model							Contrasts (P-value and Magnitude of Difference[a])							
							Area(CI)×BA				Year(BA)×CI			
Response	Transform	Years	Term	DF	F	P-Value	LI24 vs SLINE	LILC3 vs Pooled Ref	LIDSL vs Pooled Ref	LI8 vs Pooled Ref	2014 vs 2016	2014 vs 2017	2015 vs 2016	2015 vs 2017
Benthic Composite Tissue Selenium Concentration [b]	-	2012, 2014 & 2015 vs 2016 & 2017	BA	1	19.87	0.002	-				-			
			CI	1	69.69	<0.001								
			BAxCI	1	15.44	0.003								
			Year(BA)	3	1.90	0.200								
			Area(CI)	3	11.86	0.002								
			Year(BA)xCI	3	1.79	0.220								
			Area(CI)xBA	3	6.78	0.011	0.98	<0.001 (6.6 SD/145%)	0.13	0.27				
			Error	9	-	-	-	-	-	-	-	-	-	-
Rhyacophilidae Tissue Selenium Concentration [b]	-	2014 & 2015 vs 2016 & 2017	BA	1	0.96	0.364	-				-			
			CI	1	59.39	<0.001								
			BAxCI	1	0.11	0.749								
			Year(BA)	2	1.77	0.249								
			Area(CI)	3	8.39	0.014								
			Year(BA)xCI	2	1.62	0.274								
			Area(CI)xBA	3	2.42	0.164								
			Error	6	-	-	-	-	-	-	-	-	-	-
Ephemeroptera Tissue Selenium Concentration [c]	log10	2014 & 2015 vs 2016 & 2017	BA	1	3.03	0.157	-				-			
			CI	1	57.12	0.002								
			BAxCI	1	10.02	0.034								
			Year(BA)	2	13.39	0.017								
			Area(CI)	2	8.31	0.038								
			Year(BA)xCI	2	6.05	0.062					0.541	0.748	0.014 (5.9 SD / 239%)	0.019 (5.4 SD / 212%)
			Area(CI)xBA	2	2.01	0.249								
			Error	4	-	-	-	-	-	-	-	-	-	-

(grey shading) P-value < 0.1 suggesting BAC1 effect associated with AWTF operation.

Notes: [a] Magnitude of difference reported as 1) the change in the relative difference in means between mine-exposed and reference in the after period relative to the before period, expressed in terms of the number of pooled within-area/year standard deviations and 2) the difference between the observed mean in the after period for the impact area relative to the predicted mean (assuming no BACI effect) in the after period for the impact area, expressed as a percentage. NAs represent contrasts not applicable to corresponding ANOVA. [b] Analysis included data for reference areas LI24 and SLINE, and mine-exposed areas LILC3, LIDSL and LI8.
[c] Analysis included data for reference areas LI24 and SLINE, and mine-exposed areas LILC3, and LIDSL.

Table B.10a: ANOVA Table for September Log Selenium Concentration in Benthic Invertebrate Composite Samples

Model				
Comparison	Term	DF	F	P-Value
Full	Area	10	110	<0.001
	Error	99	-	-
Outliers removed[a]	Area	10	136	<0.001
	Error	98	-	-

(shaded) P-value < 0.1

[a] One outlier (LIDCOM-BIC 2 Sep), with Studentized residuals equal to 4.92 in magnitude, was removed.

Table B.10b: Grouping Information For Stations Following Tukey's *Post Hoc* Comparison Of September Selenium Concentration In Benthic Invertebrate Composite Samples

Biological Area Code	Area Type	N	Adjusted Mean[a]	Grouping[a]	Adjusted Mean[b]	Grouping[b]
LI24	Reference	10	4.96	F	4.96	F
SLINE	Reference	10	4.79	F	4.79	F
LCUT	Mine-exposed	10	5.89	F	5.89	F
LILC3	Mine-exposed	10	23.9	A	23.9	A
LISP23	Mine-exposed	10	16.8	B	16.8	B
LISP24	Mine-exposed	10	16.1	B	16.1	BC
LIDSL	Mine-exposed	10	13.6	BC	13.6	CD
LIDCOM	Mine-exposed	10[c]	9.28	DE	8.62	E
LI8	Mine-exposed	10	11.4	CD	11.4	D
FRUL	Mine-exposed	10	8.12	E	8.12	E
FO23	Mine-exposed	10	8.76	E	8.76	E

Note: Capital letters denote statistically significant differences. Means that do not share a letter are significantly different within their respective comparison, and letters earlier in the alphabet denote larger means.

[a] results with outlier included.

[b] results with outlier removed.

[c] N of 9 when outlier removed.

Table B.11: Results of Temporal Analysis of Monthly Mean Total Selenium Concentrations in LC_LC1, 2012 to 2017 (not relative to reference means)

Model				Linear		Step after 2012		Step after 2013		Step after 2014		Step after 2015		Step after 2016	
Term	DF	F	P-Value	P-value	Magnitude Change [a]	P-value	Magnitude Change [a]	P-value	Magnitude Change [a]	P-value	Magnitude Change [a]	P-value	Magnitude Change [a]	P-value	Magnitude Change [a]
Year	5	1.66	0.168	0.0247	63	0.8299	7.7	0.0912	42	0.0159	61	0.0170	63	0.0015	66
Error	41	-	-												

(shaded) P-value < 0.1

[a] For linear change: percent change in the most recent year relative to the first year of the comparison. For step change: percent chance after the step change relative to before the step change. P-value for full model becomes highly significant (P-value < 0.001) with the removal of May samples where one high outlier occurred in May of 2012.

Table B.12: **Meristics and Tissue Selenium Concentrations for Westslope Cutthroat Trout Sampled from Line Creek, 2001 to 2017**

AWTF Operation Phase	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Sex[a]	Age	Fulton's Condition Factor	Abnormalities	Tissue Selenium (mg/kg dw)			
			Easting	Northing				(cm)	(cm)	(g)			(K)		Muscle	Gonad	Ovary	Estimated Ovary [b]
Prior to AWTF Operation	LI8	2001	654480	5529034	Golder 2005	Apr-2001	L1-1	-	34.0	530	M	5			9.2	-		-
	LI8	2001	654480	5529034		Apr-2001	L1-2	-	32.0	475	M	3			8.1	-		-
	LI8	2001	654480	5529034		Apr-2001	L1-4	-	34.6	680	M	4			8.5	-		-
	LI8	2001	654480	5529034		Apr-2001	L1-3	-	36.1	725	F	4			8.4	15	15	-
	LI8	2001	654480	5529034		Apr-2001	L1-5	-	32.9	550	F	4			9.8	16	16	-
	LI8	2001	654480	5529034		Apr-2001	L1-6	-	32.5	500	F	5			8.5	16	16	-
	LI8	2002	654480	5529034		Apr-2002	LN-1	-	38.5	780	M	7			8.0	5.0		-
	LI8	2002	654480	5529034		Apr-2002	LN-2	-	39.0	750	F	7			16	20	20	-
	LI8	2002	654480	5529034		Apr-2002	LN-3	-	34.7	615	F	5			7.0	14	14	-
	LI8	2002	654480	5529034		Apr-2002	LN-4	-	32.5	480	F	6			8.0	19	19	-
	LI8	2002	654480	5529034		Apr-2002	LN-5	-	34.5	550	F	7			7.0	14	14	-
	LI8	2002	654480	5529034		Apr-2002	LN-6	-	37.8	785	F	6			7.0	14	14	-
	LI8	2002	654480	5529034		Apr-2002	LN-7	-	38.5	850	F	7			9.0	16	16	-
	LI8	2002	654480	5529034		Apr-2002	LN-8	-	33.6	525	F	6			7.0	13	13	-
	LI8	2002	654480	5529034		Apr-2002	LN-9	-	30.1	400	F	5			7.0	14	14	-
	LI8	2002	654480	5529034		Apr-2002	LN-10	-	37.8	675	F	6			8.0	14	14	-
	LIDSL	2003	659281	5530548	Minnow 2004	Jul-2003	LC-CT1	-	39.1	800	M	6			7.2	-		-
	LIDSL	2003	659281	5530548		Jul-2003	LC-CT2	-	34.8	700	F	4			6.4	-		10
	LIDSL	2003	659281	5530548		Jul-2003	LC-CT3	-	31.5	470	F	4			7.4	-		12
	LI8	2006	657406	5529218	Minnow et al. 2007	Apr-2006	LI8001	-	30.6	435	F	5			7.9	11	11	-
	LI8	2006	657406	5529218		Apr-2006	LI8002	-	31.7	427	F	5			7.7	11	11	-
	LI8	2006	657406	5529218		Apr-2006	LI8003	-	27.4	288	F	5			7.4	21	21	-
	LI8	2006	657406	5529218		Apr-2006	LI8004	-	21.4	132	F	6			15	11	11	-
	LI8	2006	657406	5529218		Apr-2006	LI8005	-	20.5	117	F	5			13	15	15	-
	LI8	2009	657406	5529218	Minnow et al. 2011	Sep-2009	LI8a	-	30.5	435	F	5			12	-		18
	LI8	2009	657406	5529218		Sep-2009	LI8b	-	28.8	327	F	6			11	-		17
	LI8	2009	657406	5529218		Sep-2009	LI8c	-	22.1	184	F	6			11	-		18
	LI8	2009	657406	5529218		Sep-2009	LI8d	-	21.2	112	F	4			14	-		22
	LI8	2009	657406	5529218		Sep-2009	LI8e	-	21.3	132	F	4			13	-		21
	LILC3	2012	660085	5532021	Minnow 2014b	24-May-12	LILC3-WCT1	-	21.1	135	F	-			10	-		16
	LILC3	2012	660085	5532021		24-May-12	LILC3-WCT2	-	18.2	63	U	-			7.2	-		12
	LILC3	2012	660085	5532021		24-May-12	LILC3-WCT3	-	18.0	58	U	-			9.2	-		15
	LILC3	2012	660085	5532021		24-May-12	LILC3-WCT4	-	17.7	57	U	-			6.8	-		11
	LILC3	2012	660085	5532021		1-Jun-12	LILC3-WCT5	-	20.0	79	M	-			6.6	-		-

(blue box) Ovary selenium concentration exceeding the site-specific benchmark for WCT of 25 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

(orange box) Ovary selenium concentration exceeding the site-specific benchmark for WCT of 27 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 sifficiently mature or samples were collected non-lethally.

[a] 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.12: Meristics and Tissue Selenium Concentrations for Westslope Cutthroat Trout Sampled from Line Creek, 2001 to 2017

AWTF Operation Phase	Area	Year	Capture Location UTM (NAD83, 11U) Easting	Capture Location UTM (NAD83, 11U) Northing	Study	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Sex[a]	Age	Fulton's Condition Factor (K)	Abnormalities	Tissue Selenium (mg/kg dw) Muscle	Tissue Selenium (mg/kg dw) Gonad	Tissue Selenium (mg/kg dw) Ovary	Tissue Selenium (mg/kg dw) Estimated Ovary [b]
AWTF Steady State Operation	LI8	2017	655320	5529059	2017 LC LAEMP	7-Sep-17	LI8-WCT-01	36.7	35.1	645	U	-	1	-	6.9	-		11
	LI8	2017	655320	5529059		7-Sep-17	LI8-WCT-02	44.6	42.8	1,005	U	-	1	slight jaw malformation	7.8	-		12
	LI8	2017	655320	5529059		7-Sep-17	LI8-WCT-03	32.1	30.4	382	U	-	1	-	7.8	-		12
	LI8	2017	655320	5529059		8-Sep-17	LI8-WCT-04	40.1	38.7	750	U	-	1	bite on belly	7.8	-		12
	LI8	2017	655320	5529059		8-Sep-17	LI8-WCT-05	31.7	30.5	355	U	-	1	-	8.6	-		14
	LIDCOM	2017	658185	5529820		28-Apr-17	LIDCOM-WCT-01	36.5	35.5	570	U	-	1	-	12	-		20
	LIDSL	2017	659293	5530590		26-Apr-17	LIDSL-WCT-01	27.0	26.5	220	U	-	1	-	25	-		40
	LIDSL	2017	659293	5530590		8-Sep-17	LIDSL-WCT-01	41.4	39.8	885	U	-	1	-	34	-		54
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-02	30.7	29.4	345	U	-	1	bite on right side	26	-		42
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-03	26.2	25.3	230	U	-	1	-	14	-		22
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-04	27.4	26.2	230	U	-	1	-	24	-		38
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-05	23.4	22.2	122	U	-	1	-	42	-		67

(blue) Ovary selenium concentration exceeding the site-specific benchmark for WCT of 25 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

(orange) Ovary selenium concentration exceeding the site-specific benchmark for WCT of 27 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 sifficiently mature or samples were collected non-lethally.

[a] 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.13: Meristics and Tissue Selenium Concentrations for Bull Trout Sampled from Line Creek, 2006 to 2017

AWTF Operation Phase	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Fulton's Condition Factor	Gonad Weight[2]	Liver Weight	Abnormal-ities	Sex[a]	Life Stage	Age	Tissue Selenium Concentration (mg/kg dw)			
			Easting	Northing				(cm)	(cm)	(g)	(K)	(g)	(g)					Muscle	Ovary	Ovary (Estimated[a])	Liver
Prior to AWTF Operation	LI8	2006	656892	5529139	Minnow et al. 2007	23-Aug-06	LI8101	-	74.0	4,309					M	A	-	4.7	-	-	-
	LI8	2006	656892	5529139		23-Aug-06	LI8102	-	63.3	2,948					F	A	-	4.0	-	13	-
	LI8	2006	656892	5529139		23-Aug-06	LI8103	-	63.5	2,722					F	A	-	3.1	-	10	-
	LI8	2006	656892	5529139		23-Aug-06	LI8104	-	23.3	162					U	J	-	4.4	-	14	-
AWTF Steady State Operation	LILC3	2017	659887	5531590	2017 LC LAEMP	27-Apr-17	LILC3-ST-01	40.0	38.5	550	0.96	-	-	-	-	J	-	26	-	-	-
	LIDCOM	2017	658185	5529820		10-Sep-17	LIDCOM-BT-07	77.6	75.2	4,220	0.99	49	37	-	M	A	10	5.6	-	-	30
	LIDCOM	2017	658185	5529820		11-Sep-17	LIDCOM-BT-11	65.9	63.2	2,660	1.02	356	23	-	F	A	-	4.8	16	-	-
	LIDCOM	2017	658185	5529820		11-Sep-17	LIDCOM-BT-12	73.6	68.5	3,160	0.98	-	-	cut on caudal	F	A	-	4.4	16	-	-
	LILC3	2017	659892	5531560		10-Sep-17	LILC3-BT-06	63.1	60.5	2,260	1.02	356	23	-	F	A	8	4.8	12	-	16
	LILC3	2017	659892	5531560		11-Sep-17	LILC3-BT-08	61.8	60.0	2,080	0.96	-	-	-	F	A	-	3.9	14	-	-
	LILC3	2017	659892	5531560		11-Sep-17	LILC3-BT-10	63.2	61.9	1,840	0.78	-	-	-	F	A	-	4.5	15	-	-
	LILC3	2017	659892	5531560		11-Sep-17	LILC3-BT-09	35.0	33.2	370	1.01	-	-	-	U	J	-	-	-	-	-
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-01	25.5	24.2	146	1.03	0.8	1.7	-	M	YM	3	21	-	-	58
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-02	27.9	26.6	210	1.12	1.1	2.8	-	M	YM	3	19	-	-	65
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-03	27.8	26.1	199	1.12	1.0	3.0	bite on dorsal	M	YM	3	28	-	-	61
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-04	28.0	26.6	209	1.11	0.9	2.5	-	M	YM	3	20	-	-	63
	LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-05	32.3	30.9	342	1.16	0.9	4.9	-	M	YM	4	27	-	-	100

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).

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

[a] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 3.3:1 presented in Figure 4.13. 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

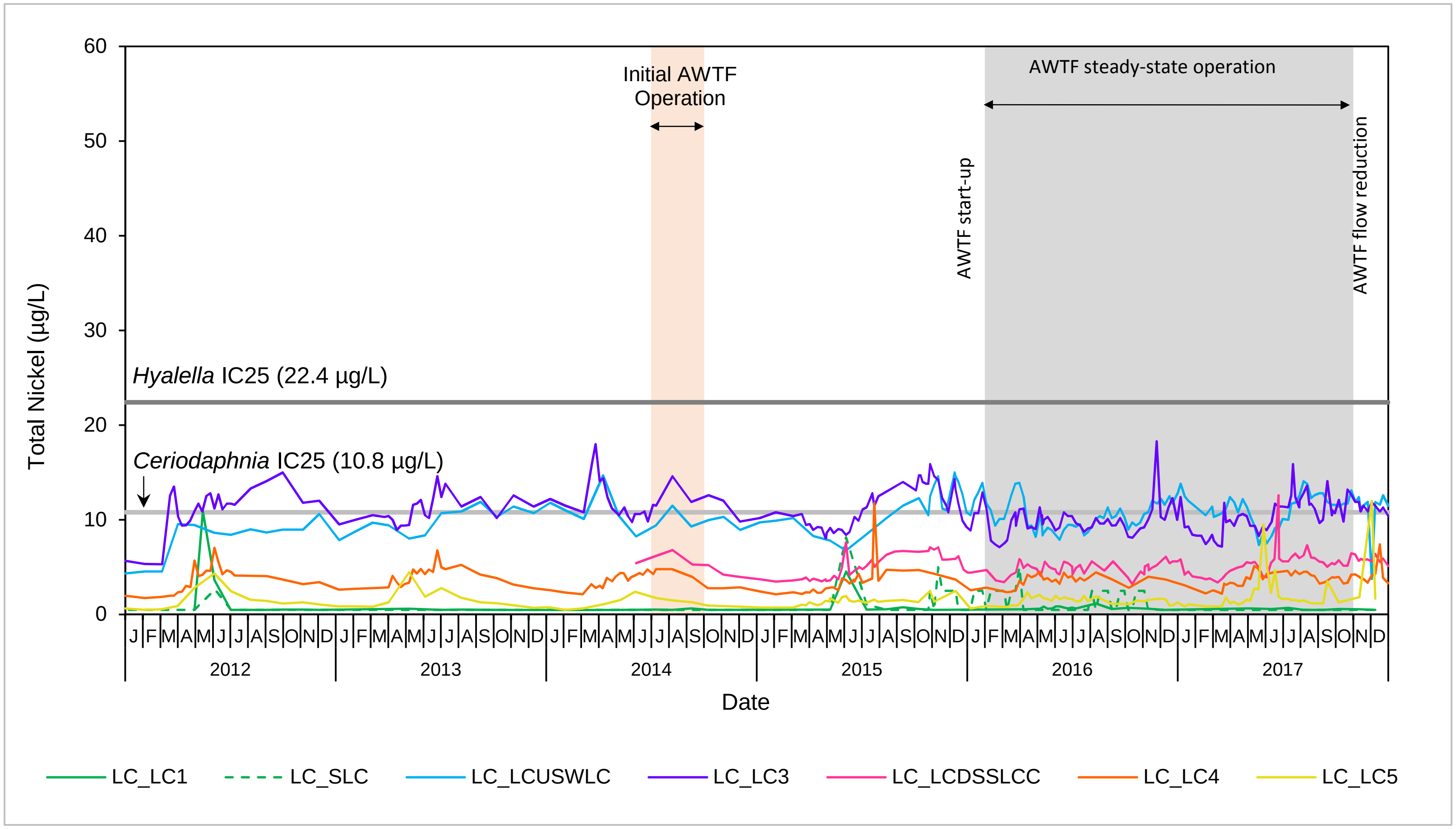


Figure C.1: Aqueous Concentrations of Nickel in Line Creek, Relative to Site-specific IC25 Values for *Ceriodaphnia* and *Hyalella*, 2012 to 2017

Notes: IC25 benchmark for nickel as defined by Nautilus (2018): *Ceriodaphnia* = 10.8 µg/L, *Hyalella* = 22.4 µg/L.

Table C.1a: ANOVA Table for BACI Models Comparing Temperature Before vs After AWTF Operation (no winter data)

Model					
Response	Transform	Term	DF	F	P-Value
Temperature	-	BA	1	0.41	0.521
		CI	1	24.7	<0.001
		BAxCI	1	0.17	0.678
		Year(BA)	3	0.051	0.985
		Area(CI)	2	2.0	0.144
		Year(BA)xCI	3	0.15	0.931
		Area(CI)xBA	2	0.57	0.567
		Area(CI)xYear(BA)	6	0.032	1.00
		Error	120	-	-

P-value < 0.1 suggesting a BACI effect associated with AWTF operation.

Notes: Analysis compares monthly means (April to November) between years before (2012, 2013 and 2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference stations LC_LC1 and LC_SLC, and mine-exposed stations LC_LC3, and LC_LC4.

Table C.1b: ANOVA Table for BACI Models Comparing Temperature Before vs After AWTF Operation (with winter data, without LC_LC1)

Model					
Response	Transform	Term	DF	F	P-Value
Temperature	-	BA	1	0.13	0.719
		CI	1	14.5	<0.001
		BAxCI	1	0.036	0.850
		Year(BA)	3	0.075	0.973
		Area(CI)	1	5.5	0.020
		Year(BA)xCI	3	0.11	0.955
		Area(CI)xBA	1	1.0	0.312
		Area(CI)xYear(BA)	3	0.09	0.963
		Error	165	-	-

P-value < 0.1 suggesting a BACI effect associated with AWTF operation.

Notes: Analysis compares monthly means (all months) between years before (2012, 2013 and 2015) and after AWTF operation (2016 and 2017). No data for LC_LC5 in February 2012. Stations included in the analysis are reference station LC_SLC, and mine-exposed stations LC_LC3, and LC_LC4.

Table C.2a: ANOVA Table for BACI Models Comparing Concentrations for Dissolved Oxygen Before vs After AWTF Operation (no winter data)

Model					
Response	**Transform**	**Term**	**DF**	**F**	**P-Value**
Dissolved Oxygen	log10	BA	1	0.018	0.894
		CI	1	1.32	0.253
		BAxCI	1	0.000019	0.996
		Year(BA)	3	1.8	0.144
		Area(CI)	2	0.46	0.631
		Year(BA)xCI	3	0.82	0.484
		Area(CI)xBA	2	0.044	0.957
		Area(CI)xYear(BA)	6	0.10	0.996
		Error	120	-	-

P-value < 0.1 suggesting a BACI effect associated with AWTF operation.

Notes: Analysis compares monthly means (April to November) between years before (2012, 2013 and 2015) and after AWTF operation (2016 and 2017). Stations included in the analysis are reference stations LC_LC1 and LC_SLC, and mine-exposed stations LC_LC3, and LC_LC4.

Table C.2b: ANOVA Table for BACI Models Comparing Concentrations for Dissolved Oxygen Before vs After AWTF Operation (with winter data, without LC_LC1)

Model					
Response	**Transform**	**Term**	**DF**	**F**	**P-Value**
Dissolved Oxygen	none	BA	1	1.449	0.230
		CI	1	3.86	0.051
		BAxCI	1	0.807	0.370
		Year(BA)	3	2.2	0.090
		Area(CI)	1	1.33	0.250
		Year(BA)xCI	3	0.26	0.857
		Area(CI)xBA	1	0.13	0.721
		Area(CI)xYear(BA)	3	0.29	0.835
		Error	165	-	-

P-value < 0.1 suggesting a BACI effect associated with AWTF operation.

Notes: Analysis compares monthly means (all months) between years before (2012, 2013 and 2015) and after AWTF operation (2016 and 2017). No data for LC_LC5 in February 2012. Stations included in the analysis are reference stations LC_SLC, and mine-exposed stations LC_LC3, and LC_LC4. Low dissolved oxygen value on December 9, 2013 for LC_LC4 (1.81) was included in the analysis, but may be due to probe error. Insufficient information was available to exclude these data.

Table C.3: **Acute Toxicity Results for Line Creek Operations, 2017**

Water Station		*Daphnia magna*		*Oncorhynchus mykiss*	
Teck Code	Description	Date	Percent Mortality	Date	Percent Mortality
WL_WLCI_SP01	West Line Creek AWTF influent	14-Jul-17	83	14-Jul-17	0
		12-Aug-17	13	12-Aug-17	0
WL_LCI_SP02	West Line Creek AWTF influent	14-Jul-17	0	14-Jul-17	0
		21-Sep-17	0	21-Sep-17	0
WL_BFWB_OUT_SP21	West Line Creek AWTF effluent outfall	3-Jan-17	0	3-Jan-17	0
		9-Jan-17	0	9-Jan-17	0
		16-Jan-17	0	16-Jan-17	0
		23-Jan-17	0	23-Jan-17	10
		31-Jan-17	0	31-Jan-17	0
		7-Feb-17	0	7-Feb-17	0
		14-Feb-17	0	14-Feb-17	0
		21-Feb-17	0	21-Feb-17	0
		27-Feb-17	0	27-Feb-17	0
		6-Mar-17	0	6-Mar-17	0
		13-Mar-17	0	13-Mar-17	0
		21-Mar-17	0	21-Mar-17	0
		27-Mar-17	0	27-Mar-17	0
		3-Apr-17	0	3-Apr-17	0
		10-Apr-17	0	10-Apr-17	0
		17-Apr-17	0	17-Apr-17	0
		24-Apr-17	0	24-Apr-17	0
		1-May-17	0	1-May-17	0
		5-Jun-17	0	5-Jun-17	0
		12-Jun-17	0	12-Jun-17	0
		10-Jul-17	100	10-Jul-17	0
		14-Jul-17	0	14-Jul-17	0
		17-Jul-17	47	17-Jul-17	0
		24-Jul-17	13	24-Jul-17	0
		31-Jul-17	3	31-Jul-17	0
		8-Aug-17	87	8-Aug-17	0
		12-Aug-17	7	12-Aug-17	0
		14-Aug-17	0	14-Aug-17	0
		21-Aug-17	0	21-Aug-17	0
		28-Aug-17	0	28-Aug-17	0
		5-Sep-17	0	5-Sep-17	0
		12-Sep-17	0	12-Sep-17	0
		18-Sep-17	100	18-Sep-17	0
		21-Sep-17	37	21-Sep-17	10
		25-Sep-17	7	25-Sep-17	20
		2-Oct-17	43	2-Oct-17	0
		10-Oct-17	7	10-Oct-17	0
		16-Oct-17	0	16-Oct-17	0
		23-Oct-17	0	23-Oct-17	0
		30-Oct-17	0	30-Oct-17	0
		6-Nov-17	0	6-Nov-17	0
		14-Nov-17	3	14-Nov-17	0
		20-Nov-17	0	20-Nov-17	0
		28-Nov-17	0	28-Nov-17	0
		4-Dec-17	3	4-Dec-17	0
		11-Dec-17	0	11-Dec-17	0
		18-Dec-17	0	18-Dec-17	0
		27-Dec-17	0	27-Dec-17	0
LC_LC3	Line Creek downstream of West Line Creek and AWTF outfall	14-Jul-17	0	14-Jul-17	0
		26-Jul-17	0	26-Jul-17	0
		12-Aug-17	0	12-Aug-17	0
		21-Sep-17	0	21-Sep-17	0
		25-Sep-17	3	25-Sep-17	0
LC_LCDSSLCC (Compliance)	Line Creek immediately downstream of South Line Creek confluence	16-Jan-17	0	16-Jan-17	0
		20-Mar-17	0	20-Mar-17	0
		15-Aug-17	0	15-Aug-17	0
		5-Sep-17	3	5-Sep-17	0
		2-Oct-17	0	2-Oct-17	0
		28-Nov-17	0	28-Nov-17	0
		4-Dec-17	0	4-Dec-17	0
LC_LC5	Fording River downstream of Line Creek	16-Jan-17	0	16-Jan-17	0
		15-Aug-17	0	15-Aug-17	0
		5-Sep-17	0	5-Sep-17	0
		2-Oct-17	0	2-Oct-17	10
		28-Nov-17	0	28-Nov-17	0
		4-Dec-17	0	4-Dec-17	0

APPENDIX D
OTHER SUPPORTING INFORMATION

Table D.1: ***In Situ*** **Water Quality Measures Collected for the Line Creek LAEMP, September, November, December 2017 and March 2018**

Characteristics	September 2017										
	Reference		Mine-exposed Line Creek							Mine-exposed Fording River	
	LI24	SLINE	LCUT	LILC3	LISP23	LISP24	LIDSL	LIDCOM	LI8	FRUL	FO23
Easting	662214	661106	660121	659931	659883	659710	659256	658185	655426	654547	652965
Northing	5538393	5531373	5532132	5531848	5531412	5531221	5530529	5529820	5528959	5530171	5528974
Sampling Date	11-Sep-17	9-Sep-17	7-Sep-17	9-Sep-17	11-Sep-17	11-Sep-17	10-Sep-17	10-Sep-17	8-Sep-17	13-Sep-17	13-Sep-17
Temperature (°C)	7.19	7.49	7.76	8.81	8.09	10.09	9.85	8.67	8.91	11.83	7.40
Dissolved Oxygen (mg/L)	12.51	8.81	10.24	12.69	10.61	10.38	9.67	12.37	10.38	10.77	13.69
Dissolved Oxygen (%)	104.2	73.7	86.2	109.7	90.1	92.5	85.6	106.4	89.9	99.8	114.1
Specific Conductivity (µS/cm)	303	364	918	856	846	882	867	674	750	716	725
Conductivity (µS/cm)	200	243	616	591	573	630	616	464	519	535	481
pH	8.27	8.25	8.33	7.80	7.94	7.96	7.99	8.26	9.15	8.09	7.94

Notes: *In situ* data was not recorded in April 2017.

Table D.1: *In Situ* Water Quality Measures Collected for the Line Creek LAEMP, September, November, December 2017 and March 2018

Characteristics	November 2017										
	Reference		Mine-exposed Line Creek							Mine-exposed Fording River	
	LI24	SLINE	LCUT	LILC3	LISP23	LISP24	LIDSL	LIDCOM	LI8	FRUL	FO23
Easting	-	-	660114	659947	-	659680	659320	658185	659264	-	-
Northing	-	-	5532140	5531859	-	5531192	5530619	5529820	5530542	-	-
Sampling Date	-	-	9-Nov-17	9-Nov-17	-	9-Nov-17	10-Nov-17	10-Nov-17	10-Nov-17	-	-
Temperature (°C)	-	-	4.00	4.30	-	3.50	3.40	3.1	3.00	-	-
Dissolved Oxygen (mg/L)	-	-	10.74	10.43	-	10.68	11.56	12.04	12.00	-	-
Dissolved Oxygen (%)	-	-	-	-	-	-	-	-	-	-	-
Specific Conductivity (µS/cm)	-	-	1,301	1,097	-	960	938	868	805	-	-
Conductivity (µS/cm)	-	-	-	-	-	-	-	-	-	-	-
pH	-	-	8.05	8.10	-	8.21	8.16	8.26	8.38	-	-

Notes: *In situ* data was not recorded in April 2017.

Table D.1: ***In Situ*** **Water Quality Measures Collected for the Line Creek LAEMP, September, November, December 2017 and March 2018**

Characteristics	December 2017										
	Reference		Mine-exposed Line Creek							Mine-exposed Fording River	
	LI24	SLINE	LCUT	LILC3	LISP23	LISP24	LIDSL	LIDCOM	LI8	FRUL	FO23
Easting	-	-	660114	659947	-	659680	659320	658185	659264	-	-
Northing	-	-	5532140	5531859	-	5531192	5530619	5529820	5530542	-	-
Sampling Date	-	-	4-Dec-17	4-Dec-17	-	4-Dec-17	4-Dec-17	5-Dec-17	5-Dec-17	-	-
Temperature (°C)	-	-	3.40	3.30	-	2.7	2.3	1.5	1.00	-	-
Dissolved Oxygen (mg/L)	-	-	10.96	12.57	-	13.31	11.15	13.94	14.39	-	-
Dissolved Oxygen (%)	-	-	-	-	-	-		-	-	-	-
Specific Conductivity (µS/cm)	-	-	736	1,105	-	964	698	479.7	816	-	-
Conductivity (µS/cm)	-	-	-	-	-	-		-	-	-	-
pH	-	-	7.94	8.30	-	8.47	8.36	8.52	8.62	-	-

Notes: *In situ* data was not recorded in April 2017.

Table D.1: ***In Situ*** **Water Quality Measures Collected for the Line Creek LAEMP, September, November, December 2017 and March 2018**

Characteristics	March 2018								
	Reference	Mine-exposed Line Creek						Mine-exposed Fording River	
	SLINE	LCUT	LILC3	LISP24	LIDSL	LIDCOM	LI8	FO23	FRUL
Easting	661106	660121	659931	659902	659218	658184	655426	652965	654530
Northing	5531373	5532132	5531848	5531445	5530522	5529814	5528959	5528974	5530162
Sampling Date	8-Mar-18	8-Mar-18	8-Mar-18	10-Mar-18	10-Mar-18	10-Mar-18	43169	11-Mar-18	11-Mar-18
Temperature (°C)	0.500	2.90	3.40	1.70	1.90	2.00	2.20	-0.100	0.300
Dissolved Oxygen (mg/L)	13.3	13.6	13.1	14.8	14.6	14.1	14.6	15.0	14.3
Dissolved Oxygen (%)	92.3	101	98.6	106	106	105	106	103	98.5
Specific Conductivity (µS/cm)	362	209	1,193	1,049	985	867	796	844	847
Conductivity (µS/cm)	192	121	700	582	551	485	448	440	447
pH	8.19	8.17	8.19	8.16	8.27	8.38	8.49	8.12	8.12

Notes: *In situ* data was not recorded in April 2017.

Table D.2: Calcite Count for Line Creek and Fording River, September 2017

Reference									
SLINE					LI24				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	5.5	-	1	0	0	1.8	-
2	0	0	6.5	-	2	0	0	4.2	-
3	0	0	41	-	3	0	0	5.3	-
4	0	0	8	-	4	0	1	19.5	-
5	0	0	4.5	-	5	0	0	11.4	-
6	0	0	25	-	6	0	0	3.5	-
7	0	0	1.5	-	7	0	0	2.6	-
8	0	0	5.5	-	8	0	0	5.7	-
9	0	0	10.5	-	9	0	0	6.9	-
10	0	0	5	0	10	0	0	7.2	0
11	0	0	26.5	-	11	0	0	5.3	-
12	0	0	6.5	-	12	0	0	3.7	-
13	0	0	8	-	13	0	0	15.1	-
14	0	0	13	-	14	0	0	6.4	-
15	0	0	23	-	15	0	1	9.8	-
16	0	0	4.5	-	16	0	0	6.1	-
17	0	0	15	-	17	0	0	5.2	-
18	0	0	7	-	18	0	0	7.0	-
19	0	0	24	-	19	0	0	4.9	-
20	0	0	21	0	20	0	0	6.5	0
21	0	0	9	-	21	0	0	14.7	-
22	0	0	7.5	-	22	0	0	17.6	-
23	0	0	13	-	23	0	0	9.4	-
24	0	0	10.5	-	24	0	0	18.1	-
25	0	0	17	-	25	0	0	2.3	-
26	0	0	29	-	26	0	0	8.4	-
27	0	0	12.5	-	27	0	0	3.1	-
28	0	0	7.5	-	28	0	1	20.7	-
29	0	0	17.5	-	29	0	0	6.2	-
30	0	0	16	0.9	30	0	0	3.1	0.25
31	0	0	46	-	31	0	0	5.2	-
32	0	0	19	-	32	0	0	5.1	-
33	0	0	4.5	-	33	0	0	5.9	-
34	0	0	9	-	34	0	0	8.4	-
35	0	0	7	-	35	0	1	31.2	-
36	0	0	24	-	36	0	0	9.5	-
37	0	0	6.5	-	37	0	0	20.4	-
38	0	0	3	-	38	0	0	5.0	-
39	0	0	5	-	39	0	0	13.3	-
40	0	0	8	0	40	0	0	4.6	0
41	0	0	10.5	-	41	0	0	3.9	-
42	0	0	8	-	42	0	0	10.5	-
43	0	0	39	-	43	0	1	17.8	-
44	0	0	13.5	-	44	0	0	5.4	-
45	0	0	12.5	-	45	0	0	14.0	-
46	0	0	8	-	46	0	0	3.9	-
47	0	0	9.5	-	47	0	0	5.2	-
48	0	0	7.5	-	48	0	0	3.4	-
49	0	0	7.5	-	49	0	0	2.6	-
50	0	0	21	0.1	50	0	0	3.3	0
51	0	0	7	-	51	0	0	3.2	-
52	0	0	8	-	52	0	0	5.9	-
53	0	0	7.5	-	53	0	0	12.1	-
54	0	0	26	-	54	0	0	10.7	-
55	0	0	8.5	-	55	0	0	18.2	-
56	0	0	10.5	-	56	0	0	9.4	-
57	0	0	9	-	57	0	0	6.1	-
58	0	0	10	-	58	0	0	2.5	-
59	0	0	16	-	59	0	0	11.3	-
60	0	0	6	0.25	60	0	0	4.1	0
61	0	0	28	-	61	0	0	17.2	-
62	0	0	9	-	62	0	1	34.7	-
63	0	0	15	-	63	0	0	16.3	-
64	0	0	24	-	64	0	0	3.9	-
65	0	0	14	-	65	0	0	4.8	-
66	0	0	6	-	66	0	0	3.7	-
67	0	0	5	-	67	0	0	8.1	-
68	0	0	10	-	68	0	0	6.6	-
69	0	0	5.5	-	69	0	0	4.2	-
70	0	0	8.5	0.25	70	0	0	3.5	0.25
71	0	0	5.5	-	71	0	0	2.8	-
72	0	0	7	-	72	0	0	9.2	-
73	0	0	14	-	73	0	0	19.4	-
74	0	0	51.5	-	74	0	0	5.5	-
75	0	0	14	-	75	0	0	10.4	-
76	0	0	5.5	-	76	0	0	3.9	-
77	0	0	2.5	-	77	0	0	3.3	-
78	0	0	9	-	78	0	0	6.2	-
79	0	0	7	-	79	0	1	22.8	-
80	0	0	12.5	0	80	0	1	11.2	0.25
81	0	0	7	-	81	0	0	4.3	-
82	0	0	18	-	82	0	1	19.8	-
83	0	0	6.5	-	83	0	0	9.8	-
84	0	0	16	-	84	0	0	7.3	-
85	0	0	5	-	85	0	1	11.4	-
86	0	0	7.5	-	86	0	0	14.6	-
87	0	0	20	-	87	0	1	38.4	-
88	0	0	21	-	88	0	0	6.5	-
89	0	0	9	-	89	0	0	4.7	-
90	0	0	8	0	90	0	1	32.4	-
91	0	0	27	-	91	0	0	6.3	0.25
92	0	0	8.5	-	92	0	0	8.3	-
93	0	0	13	-	93	0	0	4.9	-
94	0	0	5	-	94	0	0	4.0	-
95	0	0	11	-	95	0	0	12.4	-
96	0	0	4	-	96	0	0	8.3	-
97	0	0	3	-	97	0	0	4.8	-
98	0	0	17	-	98	0	0	5.7	-
99	0	0	10	-	99	0	0	5.6	-
100	0	0	15.5	0.1	100	0	0	10.3	0
TOTAL	**0**	**0**	**-**	**-**	**TOTAL**	**0**	**0.12**	**-**	**-**
Calcite Index		**0.00**			**Calcite Index**		**0.12**		

Table D.2: Calcite Count for Line Creek and Fording River, September 2017

Mine-exposed Line Creek									
LCUT					LILC3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	7.5	-	1	0	1	2.5	-
2	0	1	14	-	2	0	1	5.0	-
3	0	1	10	-	3	0	1	6.5	-
4	0	1	11	-	4	0	1	6.2	-
5	0	1	11	-	5	0	1	5.7	-
6	0	1	10	-	6	0	1	3.6	-
7	0	1	13	-	7	0	1	9.4	-
8	0	1	7	-	8	0	1	6.1	-
9	0	1	23	-	9	0	1	6.9	-
10	0	1	20	0.5	10	0	1	6.0	0.25
11	0	1	6.5	-	11	0	1	3.6	-
12	0	1	8	-	12	0	1	3.1	-
13	0	1	8	-	13	0	1	3.7	-
14	0	1	18	-	14	0	1	8.2	-
15	0	1	8	-	15	0	1	7.4	-
16	0	1	12	-	16	0	1	4.9	-
17	0	1	4.5	-	17	0	1	4.6	-
18	0	1	9.5	-	18	0	1	3.7	-
19	0	1	9	-	19	0	1	3.8	-
20	0	1	11	0	20	0	1	1.9	0.25
21	0	1	12	-	21	0	1	6.9	-
22	0	1	3.4	-	22	0	1	3.8	-
23	0	1	38	-	23	0	1	5.4	-
24	0	1	4	-	24	0	1	6.3	-
25	0	1	25	-	25	0	1	11.0	-
26	2	1	10	-	26	0	1	12.5	-
27	0	1	6	-	27	0	1	9.9	-
28	0	1	8	-	28	0	1	8.4	-
29	0	1	15	-	29	0	1	5.5	-
30	0	1	13	0	30	0	1	12.7	0
31	0	1	13	-	31	0	1	21.4	-
32	0	1	9	-	32	0	1	8.4	-
33	0	1	10	-	33	0	1	13.5	-
34	0	1	10	-	34	0	1	39.7	-
35	0	1	8	-	35	0	1	17.8	-
36	2	1	23	-	36	0	1	14.6	-
37	0	1	6	-	37	0	1	13.7	-
38	0	1	4	-	38	0	1	13.0	-
39	0	1	26	-	39	0	1	10.8	-
40	2	1	10	0.25	40	0	1	3.1	0
41	0	1	5	-	41	0	1	16.3	-
42	0	1	6	-	42	0	1	11.9	-
43	0	1	11	-	43	0	1	13.7	-
44	0	1	7	-	44	0	1	14.1	-
45	0	1	3.5	-	45	0	1	15.5	-
46	0	1	9	-	46	0	1	4.6	-
47	0	1	6	-	47	0	1	12.9	-
48	0	1	14	-	48	0	1	4.8	-
49	0	1	15	-	49	0	1	5.7	-
50	0	1	8	0	50	0	1	2.1	0
51	0	1	53	-	51	0	1	3.1	-
52	0	1	2	-	52	0	1	13.3	-
53	0	1	4.5	-	53	0	1	6.8	-
54	0	1	13	-	54	0	1	9.5	-
55	0	1	10	-	55	0	1	10.1	-
56	0	1	7	-	56	0	1	8.3	-
57	0	1	9	-	57	0	1	11.4	-
58	0	1	5	-	58	0	1	7.3	-
59	0	1	15	-	59	0	1	14.2	-
60	0	1	4	0	60	0	1	9.9	0.25
61	0	1	20	-	61	0	1	6.7	-
62	0	1	11	-	62	0	1	3.2	-
63	0	1	9	-	63	0	1	6.9	-
64	2	1	10	-	64	0	1	6.7	-
65	0	1	6	-	65	0	1	5.4	-
66	1	1	3	-	66	0	1	8.2	-
67	0	1	10	-	67	0	1	5.3	-
68	0	1	4	-	68	0	1	3.2	-
69	0	1	5	-	69	0	1	3.0	-
70	0	1	12	0	70	0	1	7.6	0.5
71	0	1	7.5	-	71	0	1	4.2	-
72	0	1	8.5	-	72	0	1	8.3	-
73	0	1	3.5	-	73	0	1	9.2	-
74	0	1	30	-	74	0	1	8.5	-
75	0	1	7	-	75	0	1	5.9	-
76	0	1	11.5	-	76	0	1	2.8	-
77	0	1	8	-	77	0	1	14.7	-
78	0	1	4	-	78	0	1	51.0	-
79	0	1	8	-	79	0	1	8.0	-
80	0	1	8	0	80	0	1	7.2	0.25
81	0	1	14.5	-	81	0	1	3.1	-
82	0	1	22	-	82	0	1	5.2	-
83	0	1	2	-	83	0	1	3.3	-
84	0	1	12	-	84	0	1	5.4	-
85	0	1	5	-	85	0	1	9.0	-
86	0	1	5	-	86	0	1	6.1	-
87	0	1	11	-	87	0	1	2.5	-
88	0	1	10	-	88	0	1	6.2	-
89	0	1	18	-	89	0	1	9.0	-
90	0	1	4	0	90	0	1	4.4	0
91	0	1	26	-	91	0	1	10.5	-
92	0	1	5	-	92	0	1	5.8	-
93	0	1	11.5	-	93	0	1	4.9	-
94	0	1	9	-	94	0	1	4.2	-
95	0	1	11	-	95	0	1	7.7	-
96	0	1	4	-	96	0	1	10.9	-
97	0	1	4.5	-	97	0	1	6.6	-
98	0	1	9.5	-	98	0	1	10.5	-
99	0	1	23	-	99	0	1	5.8	-
100	0	1	8	0	100	0	1	6.3	0.25
TOTAL	**0**	**1**	**-**	**-**	**TOTAL**	**0**	**1**	**-**	**-**
Calcite Index			**1.09**		**Calcite Index**			**1.00**	

Table D.2: **Calcite Count for Line Creek and Fording River, September 2017**

Mine-exposed Line Creek									
LISP23					LISP24				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	5	-	1	0	1	10	-
2	0	1	10	-	2	0	1	8	-
3	0	1	5	-	3	0	1	6	-
4	0	1	12	-	4	0	1	32	-
5	0	1	28	-	5	0	1	10.5	-
6	0	1	9	-	6	0	1	9.5	-
7	0	0	8	-	7	0	1	10	-
8	0	1	14	-	8	0	0	4	-
9	0	1	22	-	9	0	0	5.5	-
10	0	1	12	0	10	0	1	11	0
11	0	1	8	-	11	0	1	9.5	-
12	0	1	45	-	12	0	1	8.5	-
13	0	1	10.5	-	13	0	1	7.5	-
14	0	1	16	-	14	0	1	32	-
15	0	1	4	-	15	0	0	6.5	-
16	0	1	9.5	-	16	0	1	60	-
17	0	1	13.5	-	17	0	1	7.5	-
18	0	0	6	-	18	0	1	13.5	-
19	0	0	5	-	19	0	1	18	-
20	0	1	7	0.75	20	0	1	9.5	0
21	0	1	11	-	21	0	1	11.5	-
22	0	1	14	-	22	0	1	3.5	-
23	0	1	11.5	-	23	0	1	9.5	-
24	0	1	10	-	24	0	1	10	-
25	0	1	30	-	25	0	1	9	-
26	0	1	10	-	26	0	1	7	-
27	0	1	15	-	27	0	1	13.5	-
28	0	1	6.5	-	28	0	1	8.5	-
29	0	1	10.5	-	29	0	1	3.5	-
30	0	1	7.5	0	30	0	1	7	0
31	0	1	7	-	31	0	1	8.5	-
32	0	1	6.5	-	32	0	1	10.5	-
33	0	1	11	-	33	0	1	9.5	-
34	0	1	28	-	34	0	1	7.5	-
35	0	1	8	-	35	0	1	23	-
36	0	1	9	-	36	0	1	10	-
37	0	1	18	-	37	0	1	32	-
38	0	1	14	-	38	0	1	3.5	-
39	0	1	29	-	39	0	1	5	-
40	0	1	6.5	0.25	40	0	1	9.5	0
41	0	1	7	-	41	0	1	25.5	-
42	0	1	10	-	42	0	1	15	-
43	0	1	5.5	-	43	0	1	11	-
44	0	1	9	-	44	0	1	14	-
45	0	1	9.5	-	45	0	0	9	-
46	0	1	6	-	46	0	0	9	-
47	0	1	9	-	47	0	1	8	-
48	0	1	13	-	48	0	0	3.5	-
49	0	1	8	-	49	0	0	17	-
50	0	1	8.5	0	50	0	0	10.5	0.25
51	0	1	28	-	51	0	1	33	-
52	0	1	7	-	52	0	1	10	-
53	0	1	24	-	53	0	1	7	-
54	0	1	6.5	-	54	0	1	7.5	-
55	0	1	7	-	55	0	1	12	-
56	0	1	47	-	56	0	1	5.5	-
57	0	1	26.5	-	57	0	1	8.5	-
58	0	1	9	-	58	0	1	18	-
59	0	1	8.5	-	59	0	1	9.5	-
60	0	1	10	0	60	0	1	10	0.75
61	0	1	10	-	61	0	1	10	-
62	0	1	8.5	-	62	0	1	18	-
63	0	1	6	-	63	0	1	36	-
64	0	1	5.5	-	64	0	1	11	-
65	0	1	4.5	-	65	0	1	14	-
66	0	1	5	-	66	0	1	6.5	-
67	0	1	7.5	-	67	0	1	8.5	-
68	0	1	7.5	-	68	0	1	8.5	-
69	0	1	8	-	69	0	1	4	-
70	0	1	4.5	0.25	70	0	1	12	0
71	0	1	10.5	-	71	0	1	10	-
72	0	1	7	-	72	0	1	7	-
73	0	1	13.5	-	73	0	1	8	-
74	0	1	9.5	-	74	0	1	6	-
75	0	1	13.5	-	75	0	1	17	-
76	0	1	6	-	76	0	1	6	-
77	0	1	11	-	77	0	0	4	-
78	0	1	21	-	78	0	0	9	-
79	0	1	21	-	79	0	1	10.5	-
80	0	1	8	0	80	0	1	6.5	0.25
81	0	1	11	-	81	0	1	11	-
82	0	1	8.5	-	82	0	1	8	-
83	0	1	9	-	83	0	1	22	-
84	0	1	5.5	-	84	0	0	4	-
85	0	1	8.5	-	85	0	1	9	-
86	0	1	12	-	86	0	1	15	-
87	0	1	9	-	87	0	0	4.5	-
88	0	1	9.5	-	88	0	1	9.5	-
89	0	1	9.5	-	89	0	1	10.5	-
90	0	1	19	0.1	90	0	1	6.5	0.5
91	0	1	5.5	-	91	0	0	6	-
92	0	1	10	-	92	0	0	5	-
93	0	1	6	-	93	0	0	35	-
94	0	1	6	-	94	0	1	7	-
95	0	1	17	-	95	0	0	4	-
96	0	1	6	-	96	0	1	6	-
97	0	1	20	-	97	0	1	8.5	-
98	0	1	12	-	98	0	1	6.5	-
99	0	1	2.5	-	99	0	1	9	-
100	0	1	8	0	100	0	1	10	0
TOTAL	**0**	**0.97**	**-**	**-**	**TOTAL**	**0**	**0.84**	**-**	**-**
Calcite Index		**0.97**			**Calcite Index**		**0.84**		

Table D.2: **Calcite Count for Line Creek and Fording River, September 2017**

Mine-exposed Line Creek									
LIDSL					LIDCOM				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	9.5	-	1	0	1	15.5	-
2	0	1	10.5	-	2	0	1	6.1	-
3	0	1	19	-	3	0	1	15.5	-
4	0	0	11.5	-	4	0	1	7.7	-
5	0	1	8	-	5	0	0	9.1	-
6	0	1	22	-	6	0	0	9.8	-
7	0	1	13	-	7	0	1	8.8	-
8	0	1	9	-	8	0	1	7.2	-
9	0	1	17	-	9	0	1	7.6	-
10	0	1	15	0	10	0	1	8.2	0.25
11	0	0	6	-	11	0	1	9.0	-
12	0	1	10	-	12	0	1	12.2	-
13	0	1	8	-	13	0	1	4.3	-
14	0	1	8	-	14	0	1	10.6	-
15	0	1	19	-	15	0	1	11.0	-
16	0	1	11	-	16	0	1	9.6	-
17	0	1	30	-	17	0	1	6.4	-
18	0	1	14	-	18	0	1	7.3	-
19	0	1	12	-	19	0	1	11.9	-
20	0	0	6.5	0	20	0	1	7.0	0.5
21	0	1	39	-	21	0	1	6.3	-
22	0	0	11	-	22	0	1	8.5	-
23	0	0	7	-	23	0	1	10.5	-
24	0	1	12	-	24	0	1	11.4	-
25	0	0	7	-	25	0	1	12.7	-
26	0	0	3.5	-	26	0	1	8.0	-
27	0	1	15	-	27	0	1	6.3	-
28	0	1	11.5	-	28	0	1	4.6	-
29	0	0	6.5	-	29	0	1	5.2	-
30	0	1	14.5	0	30	0	1	6.9	0.5
31	0	0	9	-	31	0	1	5.5	-
32	0	1	9	-	32	0	1	3.8	-
33	0	0	10	-	33	0	0	6.1	-
34	0	1	19	-	34	0	1	4.8	-
35	0	1	13	-	35	0	1	6.8	-
36	0	1	8	-	36	0	1	5.1	-
37	0	0	10	-	37	0	1	15.7	-
38	0	1	15.5	-	38	0	1	7.3	-
39	0	0	1	-	39	0	1	14.1	-
40	0	0	5	0	40	0	1	12.8	0.5
41	0	0	13	-	41	0	1	7.2	-
42	0	1	10	-	42	0	1	8.6	-
43	0	1	8	-	43	0	0	9.1	-
44	0	0	4	-	44	0	1	8.8	-
45	0	1	14	-	45	0	1	7.0	-
46	0	1	8	-	46	0	1	10.9	-
47	0	1	7	-	47	0	1	8.1	-
48	0	1	10	-	48	0	1	8.6	-
49	0	1	30	-	49	0	1	12.5	-
50	0	1	9	0	50	0	1	8.0	0.25
51	0	1	8.5	-	51	0	1	6.0	-
52	0	1	19	-	52	0	1	8.3	-
53	0	1	15.5	-	53	0	1	6.0	-
54	0	1	14.5	-	54	0	1	7.2	-
55	0	1	12	-	55	0	1	8.4	-
56	0	0	6.5	-	56	0	1	7.2	-
57	0	1	10.5	-	57	0	1	6.1	-
58	0	1	18	-	58	0	1	7.5	-
59	0	1	8	-	59	0	1	9.6	-
60	0	0	4	0.5	60	0	1	6.0	0.25
61	0	0	6	-	61	0	1	7.6	-
62	0	1	12	-	62	0	1	9.2	-
63	0	0	9	-	63	0	1	7.4	-
64	0	1	18	-	64	0	1	7.2	-
65	0	1	7	-	65	0	1	6.9	-
66	0	1	13	-	66	0	1	10.0	-
67	0	1	13	-	67	0	1	22.0	-
68	0	1	9	-	68	0	1	3.3	-
69	0	0	4	-	69	0	1	14.4	-
70	0	1	26	0.25	70	0	1	8.0	0.25
71	0	1	14	-	71	0	1	11.8	-
72	0	0	7	-	72	0	1	17.7	-
73	0	0	11	-	73	0	1	13.0	-
74	0	1	8	-	74	0	1	8.6	-
75	0	1	9.5	-	75	0	1	5.7	-
76	0	1	6	-	76	0	1	6.2	-
77	0	0	11	-	77	0	1	8.3	-
78	0	0	6.5	-	78	0	1	8.8	-
79	0	0	6.5	-	79	0	1	7.0	-
80	0	0	10.5	0	80	0	1	9.2	0.5
81	0	1	7	-	81	0	1	10.1	-
82	0	0	10	-	82	0	1	5.1	-
83	0	0	7.5	-	83	0	1	6.2	-
84	0	1	36	-	84	0	1	5.4	-
85	0	0	4.5	-	85	0	1	9.8	-
86	0	0	12.5	-	86	0	1	9.2	-
87	0	1	14	-	87	0	1	6.5	-
88	0	1	6	-	88	0	1	5.0	-
89	0	1	7	-	89	0	1	3.6	-
90	0	1	18	0	90	0	1	3.8	0.25
91	0	0	6	-	91	0	1	5.5	-
92	0	0	7	-	92	0	1	5.9	-
93	0	0	8.5	-	93	0	1	8.9	-
94	0	0	4.5	-	94	0	1	8.4	-
95	0	1	9.5	-	95	0	1	9.7	-
96	0	1	6	-	96	0	1	6.5	-
97	0	1	13	-	97	0	1	3.3	-
98	0	1	28	-	98	0	1	9.7	-
99	0	1	13.5	-	99	0	1	10.2	-
100	0	1	14	0	100	0	1	7.6	0.25
TOTAL	**0**	**0.65**	**-**	**-**	**TOTAL**	**0**	**0.96**	**-**	**-**
Calcite Index		**0.65**			**Calcite Index**		**0.96**		

Table D.2: Calcite Count for Line Creek and Fording River, September 2017

Mine-exposed Line Creek LI8					Mine-exposed Fording River FRUL				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	8.5	-	1	0	1	6	-
2	0	1	10	-	2	0	1	22	-
3	0	1	9	-	3	0	1	8.5	-
4	0	1	13	-	4	0	0	7.5	-
5	0	1	11	-	5	0	0	7.5	-
6	0	1	6	-	6	0	1	8.5	-
7	0	1	24.5	-	7	0	0	10	-
8	0	1	5.5	-	8	0	1	5	-
9	0	1	14	-	9	0	1	4	-
10	0	1	15	0.5	10	0	1	1.5	0
11	0	1	10.5	-	11	0	1	2.8	-
12	0	1	12.5	-	12	0	1	11	-
13	0	1	15	-	13	0	1	3	-
14	0	1	6.5	-	14	0	1	13	-
15	0	1	9.5	-	15	0	1	4	-
16	0	1	7	-	16	0	1	8	-
17	0	1	30	-	17	0	1	5	-
18	0	1	6	-	18	0	0	7	-
19	0	1	11	-	19	0	1	7.5	-
20	0	1	12.5	0	20	0	0	6.5	0
21	0	1	18	-	21	0	1	10	-
22	0	1	6	-	22	0	0	6	-
23	0	1	11	-	23	0	0	11	-
24	0	1	3	-	24	0	0	7	-
25	0	1	26	-	25	0	0	10	-
26	0	1	12.5	-	26	0	0	28	-
27	0	1	9.5	-	27	0	0	8	-
28	0	1	7	-	28	0	1	6.5	-
29	0	1	10	-	29	0	0	6	-
30	0	1	20	0.25	30	0	0	13	0.75
31	0	1	8	-	31	0	1	2.5	-
32	0	1	15	-	32	0	0	7	-
33	0	1	4	-	33	0	1	4	-
34	0	1	5	-	34	0	0	6	-
35	0	1	11	-	35	0	0	14	-
36	0	1	5	-	36	0	0	4.5	-
37	0	1	5.5	-	37	0	1	12.5	-
38	0	1	1.5	-	38	0	0	7	-
39	0	1	9	-	39	0	0	17.5	-
40	0	1	9.5	0.25	40	0	0	10	0
41	0	1	6.5	-	41	0	1	10	-
42	0	1	9	-	42	0	0	14	-
43	0	1	14	-	43	0	0	13	-
44	0	1	16	-	44	0	0	7	-
45	0	1	7.5	-	45	0	0	16	-
46	0	1	4.5	-	46	0	0	12	-
47	0	1	5	-	47	0	0	10	-
48	0	1	15.5	-	48	0	0	3.2	-
49	0	1	9	-	49	0	1	12	-
50	0	1	8	0	50	0	1	11	0.25
51	0	1	5.5	-	51	0	0	13	-
52	0	1	6.5	-	52	0	0	15	-
53	0	1	9	-	53	0	0	12	-
54	0	0	3.5	-	54	0	0	6	-
55	0	1	10.5	-	55	0	0	43	-
56	0	1	7.5	-	56	0	0	4	-
57	0	1	2	-	57	0	0	15	-
58	0	1	20	-	58	0	0	17.5	-
59	0	1	9.5	-	59	0	0	7	-
60	0	1	6	0	60	0	0	9	0
61	0	1	8.5	-	61	0	0	7.5	-
62	0	1	10.5	-	62	0	0	13	-
63	0	1	8	-	63	0	0	8	-
64	0	1	9	-	64	0	0	11	-
65	0	0	4	-	65	0	0	6	-
66	0	0	7	-	66	0	0	10	-
67	0	1	11	-	67	0	0	10	-
68	0	0	9	-	68	0	0	9	-
69	0	1	11	-	69	0	0	5.5	-
70	0	1	14	0.5	70	0	0	12	0
71	0	1	9.5	-	71	0	0	5	-
72	0	1	9.5	-	72	0	0	11	-
73	0	1	12	-	73	0	0	8.5	-
74	0	1	12	-	74	0	0	5	-
75	0	1	6.5	-	75	0	0	4.5	-
76	0	1	6.5	-	76	0	0	4	-
77	0	1	6.5	-	77	0	0	10.5	-
78	0	1	7.5	-	78	0	0	7	-
79	0	1	6	-	79	0	0	4.5	-
80	0	1	7.5	0	80	0	0	5	0.75
81	0	1	11	-	81	0	0	9	-
82	0	0	4	-	82	0	0	10	-
83	0	1	6	-	83	0	0	9	-
84	0	1	28	-	84	0	0	13	-
85	0	1	11	-	85	0	0	3	-
86	0	1	27	-	86	0	0	4	-
87	0	1	12	-	87	0	0	13	-
88	0	1	5	-	88	0	0	8	-
89	0	1	11.5	-	89	0	0	5.5	-
90	0	1	14	0.5	90	0	0	5	0
91	0	1	7	-	91	0	0	8	-
92	0	0	6.5	-	92	0	0	8.5	-
93	0	1	8	-	93	0	0	4.5	-
94	0	1	8	-	94	0	0	3.5	-
95	0	1	6	-	95	0	0	6	-
96	0	1	7	-	96	0	0	14	-
97	0	1	7	-	97	0	0	5	-
98	0	1	6	-	98	0	0	2.5	-
99	0	1	10.5	-	99	0	0	15	-
100	0	1	7	0.25	100	0	0	10	0.25
TOTAL	**0**	**0.94**	**-**	**-**	**TOTAL**	**0**	**0.23**	**-**	**-**
Calcite Index		**0.94**			**Calcite Index**		**0.23**		

Table D.3: Channel Depth and Velocity Data Associated with Mine-exposed Sampling Areas, September 2017

Interval		1	2	3	4	5	6	7	mean
Reference	**LI24**								
	Depth (cm)	11	14	14	22	10			14
	Velocity (m/s)	0.020	0.12	0.25	0.47	0.13			0.20
	SLINE								
	Depth (cm)	30	10	25	27	24			23.2
	Velocity (m/s)	0.36	0.81	0.20	0.27	0.067			0.34
Mine-exposed Line Creek	**LCUT**								
	Depth (cm)	-	-	-	-	-			-
	Velocity (m/s)	-	-	-	-	-			-
	LILC3								
	Depth (cm)	21	24	22	16.5	10			19
	Velocity (m/s)	0.54	0.79	0.68	0.18	0.39			0.52
	LISP23								
	Depth (cm)	17	25	39	24	13			23.6
	Velocity (m/s)	0.50	1.1	0.53	0.66	0.11			0.57
	LISP24								
	Depth (cm)	18	26	27	30	18			23.8
	Velocity (m/s)	0.15	0.65	0.72	0.47	0.13			0.43
	LIDSL								
	Depth (cm)	19	32	37	23	12			24.6
	Velocity (m/s)	0.28	0.38	0.36	0.28	0.44			0.35
	LIDCOM								
	Depth (cm)	22	30	34	34	24	12	8	23
	Velocity (m/s)	0.29	0.46	0.58	0.62	0.41	0.36	0.21	0.42
	LI8								
	Depth (cm)	9	22	27	34	32			24.8
	Velocity (m/s)	0.0060	0.31	0.26	0.70	0.76			0.41
Mine-exposed Fording River	**FRUL**								
	Depth (cm)	19	31	21	46	16			26.6
	Velocity (m/s)	0.40	0.26	0.89	0.56	0.18			0.46
	FO23								
	Depth (cm)	0.12	0.15	0.26	0.35	0.28			0.23
	Velocity (m/s)	0.33	0.50	0.40	0.61	0.50			0.47

Notes: Velocity measurements were taken at five randomly chosen locations throughout the kick sample area. Velocity was measured at the bottom of the water column.

Table D.4: Stream Habitat Samples Collected in September 2017

	Station ID	Reference		Mine-exposed Line Creek							Mine-exposed Fording River	
		LI24	SLINE	LCUT	LILC3	LISP23	LISP24	LIDSL	LIDCOM	LI8	FRUL	FO23
	Waterbody	Line Creek	South Line Creek	Line Creek	Line Creek	Line Creek	Line Creek	Line Creek	Line Creek	Line Creek	Fording River	Fording River
	Date Sampled	11-Sep-17	9-Sep-17	7-Sep-17	9-Sep-17	11-Sep-17	11-Sep-17	10-Sep-17	10-Sep-17	8-Sep-17	13-Sep-17	13-Sep-17
	Zone 11 UTMs - E	662214	661106	660121	659931	659883	659710	659256	658185	655426	654547	652965
	Zone 11 UTMs - N	5538393	5531373	5532132	5531848	5531412	5531221	5530529	5529820	5528959	5530171	5528974
	Elevation	5,427	1,513	1,445	4,680	1,420	1,415	1,394	4,450	1,281	1,262	1,223
	Samplers' Initials	JW MW	TN TW	TN TW	JW MW	TN TW	TN TW	TN TW	JW MW	TN TW	TN TW	JT SW
	Habitat Characteristics											
	Surrounding Land Use	Mining	Forest	Mining	Mining	Forest, Mining	Forest, Mining	Forest, Mining	Mining	Forest, Mining	Forest, Livestock	Mining, Forest
	Anthropogenic Influences	Mining around, but not influenced u/s	-	downstream rock drain	Water has been treated	Mine, ~500m d/s of effluent discharge	-	-	Mine located u/s	-	-	-
	Length of Reach Assessed (m)	50	50	50	50	50	100	100	50	50	100	100
Habitat	% Riffle	-	-	-	-	50	-	-	100	-	-	-
Habitat	% Run	-	-	-	-	40	-	-	-	-	-	-
Habitat	% Rapids	-	-	-	-	10	-	-	-	-	-	-
Habitat	% Pool/Back Eddy	-	-	-	-	0	-	-	-	-	-	-
Substrate	% Bedrock	-	-	-	-	0	-	-	5	-	-	-
Substrate	% Boulder	-	-	-	-	10	-	-	10	-	-	-
Substrate	% Cobble	-	-	-	-	50	-	-	85	-	-	-
Substrate	% Pebble	-	-	-	-	15	-	-	-	-	-	-
Substrate	% Gravel	-	-	-	-	20	-	-	-	-	-	-
Substrate	% Sand/Finer	-	-	-	-	5	-	-	-	-	-	-
Substrate	% Organic	-	-	-	-	0	-	-	-	-	-	-
	Canopy Coverage (%)	-	-	-	-	26-50	-	-	-	-	-	-
	Streamside Vegetation (most dominant first)	-	-	-	-	coniferous trees, ferns/grass, shrubs	-	-	coniferous trees, ferns/grass, shrubs, deciduous	-	-	-
	Macrophyte Coverage (%)	-	-	-	-	0	-	-	0	-	-	-
	Periphyton Coverage	-	-	-	-	2	-	-	3	-	-	-
	Bank Stability	stable, no erosion	unstable, substantial erosion	stable, no erosion	moderate	unstable, substantial erosion	moderate	moderate	moderate	moderate	moderate	stable, no erosion
	Water Colour & Clarity	no colour, clear	colourless, clear	colourless, clear	no colour, clear	colourless, clear	colourless, clear	colourless, clear	no colour, clear	colourless, clear	colourless, clear	no colour, clear
	Channel Measurements											
	Bankfull Width (m)	-	-	-	-	24	-	-	16	-	-	-
	Wetted Width (m)	-	-	-	-	11	-	-	9.4	-	-	-
	Bankfull-Wetted Depth (cm)	-	-	-	-	-	-	-	0.76	-	-	-
	Gradient (%)	-	-	-	-	-	-	-	1.5	-	-	-
	CABIN											
	Samplers' Initials	MW	TW	-	JW	TW	TW	TW	MW	TW	TW	JT SW
	Sampling Time (min)	3	3	-	3	3	3	3	3	3	3	3
	Total Kick Distance (m)	5.5	20	-	12	30	30	60	18.8	30	40	12
	Number of Replicates		1	-		1	1	3		1	1	
	Number of Jars	1	1	-	1	1	1	3	1	1	1	0.25
	Number of transects	16.5	4	-	2	3	3	6	2	3	4	12
	Distance from shore (m)	-	-	-	-	-	-	-	-	-	-	-

Table D.5: Summary of Catches and Catch-per-unit-effort (CPUE) for the LAEMP, April and September 2017

Station ID	Area	UTM		Sampling Date	Time		Number of Poles	Effort (Angler Days)	Depth Range (m)		Bull Trout			Westslope Cutthroat Trout		
		Easting	Northing		Start	End			Shallowest	Deepest	Catch	Mortality	CPUE	Catch	Mortality	CPUE
-	LIDCOM	658185	5529820	28-Apr-17	-	-	-		-	-	-	-	-	1	1	-
-	LIDSL	659293	5530590	26-Apr-17	-	-	-		-	-	-	-	-	1	1	-
-	LILC3	659887	5531590	27-Apr-17	-	-	-		-	-	1	1	-	-	-	-
LI8-AN-01	LI8	655320	5529059	7-Sep-17	14:45	16:40	2	0.32	0.8	1.0	-	-	-	3	0	9.4
LI8-AN-02	LILC3	659892	5531560	8-Sep-17	9:00	13:45	2	0.79	0.8	1.5	5	5	6.3	5	0	6.3
LI8-AN-03	LI8	655320	5529059	8-Sep-17	14:05	16:25	2	0.39	0.8	1.0	-	-	-	2	0	5.1
LI8-AN-04	LILC3	659892	5531560	9-Sep-17	8:00	9:30	2	0.25	1.0	-	1	1	4.0	-	-	-
LI8-AN-05	LIDCOM	658185	5529820	10-Sep-17	9:45	10:15	2	0.08	1.0	1.8	1	1	12	-	-	-
LI8-AN-06	LILC3	659892	5531560	11-Sep-17	9:30	10:20	2	0.14	1.0	2.0	3	0	22	-	-	-
LI8-AN-07	LIDCOM	658185	5529820	11-Sep-17	10:45	11:30	2	0.13	0.8	1.9	2	0	16	-	-	-

CPUE = # of fish / angler day (12 hrs)