Technical Report No. 24-07

Aquatic Biomonitoring at Greens Creek Mine, 2023

by

Jesse W. Lindgren and Erika M. King

February 2024

Alaska Department of Fish and Game **Habitat Section**

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm
nanometer	nm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
inch of mercury	inHg
kilowatt	kW
Kilopascal	kPa
Nephelometric Turbidity Unit	NTU
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
etalii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
idest (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
no data	ND
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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February 2024

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Cover: Habitat Biologists Jesse Lindgren, Erika King, Nick Jensen, and Claire Delbecq sample juvenile fish at Greens Creek Site 54, July 12, 2023.

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EXECUTIVE SUMMARY

Since 2001, the Alaska Department of Fish and Game Habitat Section completed the aquatic biomonitoring studies required by the U.S. Forest Service and Alaska Department of Environmental Conservation for Hecla Greens Creek Mining Company's Greens Creek Mine. The aquatic studies include sampling periphyton, benthic macroinvertebrates, and juvenile fish abundance and element concentrations in Greens Creek and Tributary Creek; the reference sampling reach is Greens Creek Site 63 and mine influenced sampling reaches include Greens Creek Site 54 and Tributary Creek Sites 9 and 1847. We completed the 2023 aquatic biomonitoring studies July 10–13.

The National Weather Service (2024) reports that during 2023, the Juneau area received precipitation (197 cm) about 16% above normal (mean values 1991–2020) and snowfall (219 cm) about 2% below normal. Prior to sampling in July, the Juneau area had precipitation 6.8 cm below and air temperature 1.8 °F above normal with three peak streamflow events occurring two months prior to sampling. Mean streamflow three weeks prior to sampling was within the middle range observed 2001–2022.

The 2023 mean chlorophyll a density among all sites ranged 5.29–9.53 mg/m^2, generally within the middle range observed at Tributary Creek Site 9 and having the highest density among sites. Periphyton samples collected at all sites generally contained about 90% chlorophyll a, nearly 0% chlorophyll b, and about 10% chlorophyll c, consistent with community composition observed in previous years. Despite the environmental and stream characteristic differences (e.g., geomorphic and hydrologic) between Tributary and Greens Creeks, mean chlorophyll a densities generally follow a similar trend 2001–2023.

Benthic macroinvertebrate (BMI) mean densities ranged 1,818–6,102/m^2 across sites, the highest documented for Site 54 and Site 9 while Site 63 was in the lower range 2001–2022. The mean densities of Ephemeroptera, Plecoptera, and Trichoptera (EPT) insects among sites ranged 1,574–5,606 EPT/m^2; EPT insects at Greens Creek usually composed more than 80% of samples compared to usually less than 60% in Tributary Creek. Tributary Creek Site 9 has less variability and generally lower EPT densities than Greens Creek Sites and Tributary Creek Site 1847, except in 2023 at Site 9 where the BMI and EPT densities increased. Compared to previous years, we observed high numbers of BMI taxa at all sites, except Site 63 which has declined since 2020 though remains within the observed range.

The 2023 Dolly Varden *Salvelinus malma* captures at all sites were in the upper range observed 2001–2022, and the highest observed at Site 54. We captured juvenile coho salmon *Oncorhynchus kisutch* at Site 54 confirming adult coho salmon passage through the Greens Creek fish pass; also we captured four juvenile coho salmon at Site 63 upstream of the concrete weir—for the first time, indicating a change at the weir allowing for streamflow dependent fish passage. The number of Dolly Varden captured at Greens Creek Sites 48/63 and 54 from 2001–2023, follows a similar trend, with occasionally more captures at Site 54. We capture more juvenile coho salmon than Dolly Varden at Tributary Creek Site 9 each year. At all sites most years, we captured several age classes of Dolly Varden, and the mean fish condition ranged 1.0–1.2 for both Dolly Varden and coho salmon.

The 2023 whole body Dolly Varden samples collected at Greens Creek Site 63 and Site 54 median element concentrations were within the middle ranges previously observed, and element concentrations 2001–2023 generally followed a similar trend between sites. The 2023 Tributary

Creek Site 9 whole body Dolly Varden median element concentrations were within the middle range previously observed 2001–2022. Tributary Creek Site 9 samples had variable element concentrations of Ag, Cd, Hg, Pb, and Se 2001–2023; and the median Se concentration has decreased since 2020. At all sites, most median element concentrations were within ranges observed in whole body Dolly Varden sample sites within mining-related influence elsewhere in Alaska (Legere and Timothy 2016).

INTRODUCTION

The Greens Creek Mine is located about 29 km southwest of Juneau by air near Hawk Inlet on the west side of Admiralty Island in Southeast Alaska, within the Tongass National Forest and the Admiralty Island National Monument, both administered by the U.S. Forest Service (USFS 2013). The mine has operated since 1989, except between 1993 and 1996 when the mine temporarily closed, and produces lead and zinc concentrates that contain silver and gold. Hecla Greens Creek Mining Company (HGCMC), a subsidiary of Hecla Mining Company of Coeur d'Alene, Idaho, has owned and operated the mine since April 2008.

Most mine infrastructure is located in two drainages that support resident and anadromous fish: Tributary Creek, which contains the dry-stack tailings disposal facility (TDF) at the headwaters; and Greens Creek which contains the mill, mine facilities, and waste rock storage areas (Figure 1). To document conditions to the surrounding environment, annual monitoring requirements are included in the General Plan of Operations Integrated Monitoring Plan (IMP; HGCMC 2020) required by the U.S. Forest Service and Alaska Department of Environmental Conservation (ADEC) Waste Management Permit (WMP) 2020DB0001. Reports summarizing sampling results from previous years are in Weber Scannell and Paustian (2002), Jacobs et al. (2003), Durst and Townsend (2004), Durst et al. (2005), Durst and Jacobs (2006–2010), Kanouse (2011–2012), Kanouse and Brewster (2013–2014), Kanouse (2015), Brewster (2016), Zutz (2017–2018), Kane and Legere (2019), Kane (2020–2022), and Lindgren and King (2023).

Habitat Section staff completed the aquatic studies required annually for Greens Creek Mine in Tributary and Greens Creeks since 2001. The WMP and IMP requires sampling periphyton, benthic macroinvertebrates (BMI), and juvenile fish in Greens Creek and Tributary Creek. We document stream condition using chlorophyll density and composition, BMI density and community composition, juvenile fish abundance, and juvenile fish element concentrations.

PURPOSE

This technical report summarizes the 2023 aquatic biomonitoring study data and documents the conditions of biological communities in Greens Creek and Tributary Creek near mine development and operations, satisfying the aquatic biological monitoring requirements included in HGCMC's approved ADEC Waste Management Permit 2020DB0001 and General Plan of Operations Integrated Monitoring Plan (IMP; HGCMC 2020).

Figure 1.–Greens Creek Mine area.

STUDY AREA

Greens Creek

Greens Creek drains a 58.5 km^2 watershed with the main channel measuring 16 km from the alpine headwaters to the mouth in Hawk Inlet (USGS 2021). At sample sites grades range from 2 to 4%, cobble and gravel are the dominant substrate, and large woody debris is common; characteristic of a medium width moderate grade mixed control channel (Paustian 2010). The creek is fed by snowmelt in the spring and rain throughout the year. Snowpack influences the magnitude of peak discharge in early summer; rain events in the fall often cause peak discharge events.

The lower 10.6 km of Greens Creek (Stream No. 112-65-10230-2002) provides habitat for chum salmon *O. keta*, coho salmon, pink salmon *O. gorbuscha*, and Dolly Varden (Giefer and Graziano 2023). ADF&G Division of Commercial Fisheries staff survey returning chum and pink salmon in Greens Creek as part of their in-season assessment of salmon run strength (S. Forbes, Commercial Fisheries Area Management Biologist, ADF&G, Douglas, personal communication). Juvenile and adult Chinook salmon were documented near the portal in the early 1990s but have not been observed since; in 2017, USFS staff sampled the stream for Chinook salmon eDNA and the test result was negative (M. Johnson, Wildlife and Fisheries Biologist, U.S. Forest Service, Tongass National Forest, Juneau, personal communication).

Greens Creek discharge data are recorded at U.S. Geological Survey (USGS) Gage Site 15101490[a], downstream of sample sites 48 and 63, 1350 Creek, Cub Creek, and Hecla's water withdrawal. The gage is upstream of mining activities and represents about 40% of the watershed draining to Hawk Inlet.

Greens Creek Site 48 and Site 63

Prior to the river avulsion in fall 2017,[b] we sampled Greens Creek Site 48 which is located upstream of mining activities, except exploratory drilling, near 265 m elevation and about 0.8 km upstream of the mine portal (Figure 2). The new channel braid circumventing Site 48[c] appeared to receive little streamflow 2018–2022; however, streamflow was about evenly split between the channel braids during aquatic biomonitoring sampling in 2023 (Figures 3, 4). Due to the continued instability upstream, we completed the aquatic biomonitoring studies beginning about 3 m downstream of the channel confluences at Site 63 for a sixth consecutive year.

Site 63 is located near 265 m elevation, downstream of Big Sore Creek, and upstream of mining activities (Figure 2); unlike Site 48, 1350 Creek flows into the Site 63 sampling reach, which was unavoidable due to the limited suitable sampling areas between Big Sore Creek and the portal. The data collected at Site 48 and Site 63 are used as reference to compare the data collected downstream of mining activities at Site 54. Historically, we captured resident Dolly Varden at Sites 48 and 63, however in 2023 we captured four juvenile coho salmon at Site 63; we submitted a nomination to the anadromous waters catalog (no. 23-931; Giefer and Graziano 2023) extending Greens Creek.

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[a] Prior to February 16, 1999, the gage was located 9 m upstream and at 3 m greater elevation (USGS 2022).

[b] We also sampled Greens Creek Site 6, located upstream of Site 54 and the Bruin Creek confluence, in 2001, 2006, and 2011 (Kanouse 2012).

[c] Kate Kanouse and Johnny Zutz, Habitat Biologists, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: GCM Greens Creek sampling Sites 48 and 63; dated September 7, 2018. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

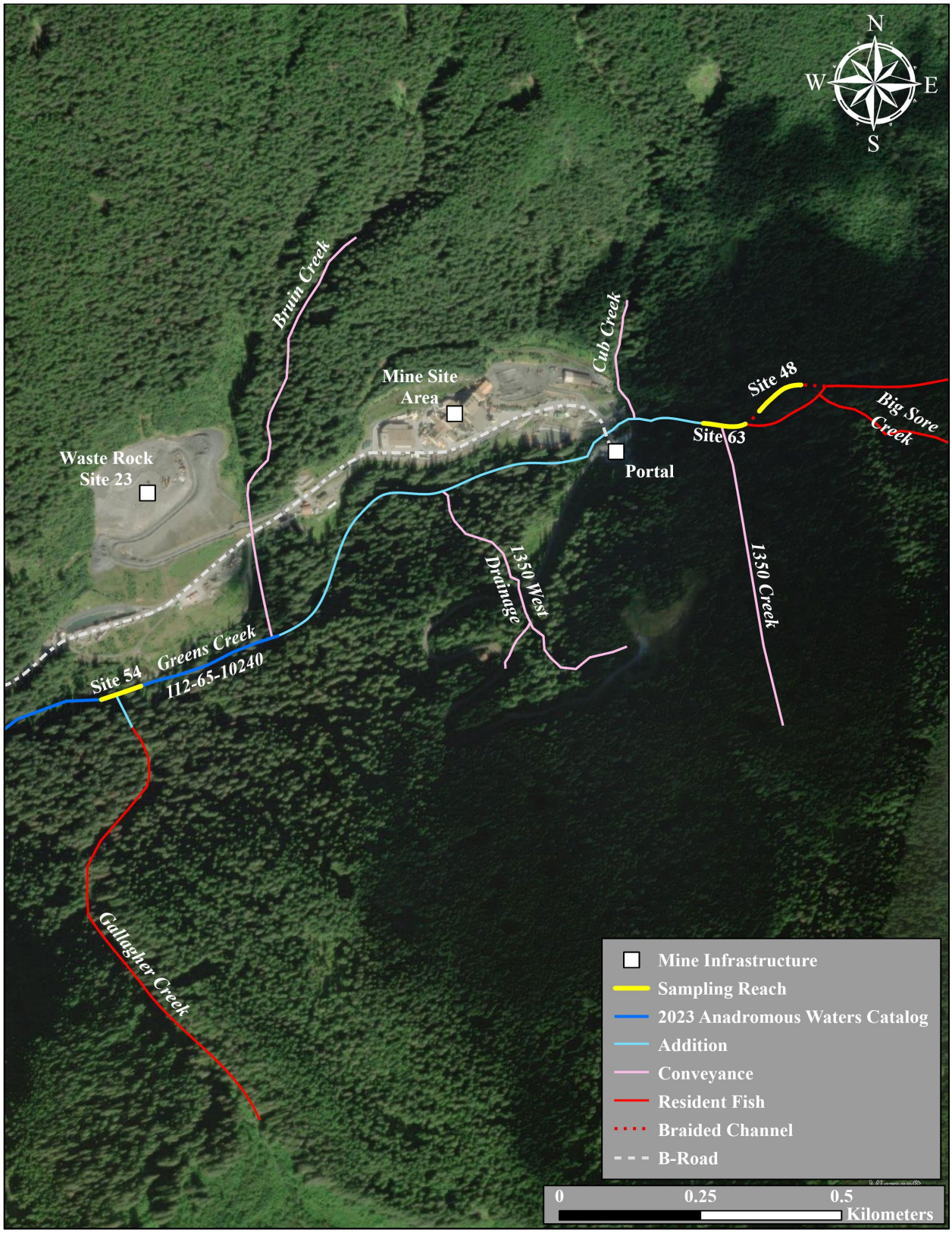

Figure 2.–Greens Creek sampling Sites 48, 63, and 54.

Figure 3.–Greens Creek Site 48 within the abandoned channel braid, July 12, 2021.

Figure 4.–Greens Creek Site 48 with streamflow, July 11, 2023.

Figure 5.–Greens Creek Site 63 periphyton and benthic macroinvertebrate sample reach, facing upstream July 11, 2023.

Greens Creek Site 54

Site 54 is located near 225 m elevation, downstream of the Bruin Creek confluence, adjacent to waste rock storage Site 23, and about 1.8 km downstream of the mine portal (Figure 2). Data collected from 2001 to 2023 at Site 54 are compared to the data at reference Sites 48 and 63 to detect potential impacts from mining activities, such as changes from waste rock storage areas, storm water ponds, and the mine site upstream. Between Sites 48/63 and 54, four tributaries drain to Greens Creek: 1350 Creek, 1350 West Drainage, Cub Creek, and Bruin Creek. Gallagher Creek enters Greens Creek at the upper extent of the Site 54 fish sample reach. Periphyton and benthic macroinvertebrate sampling occur about 30 m upstream of the fish sample reach (Figure 6).

Since 2001, we documented coho salmon, Dolly Varden, cutthroat trout *O. clarkii*, and rainbow trout *O. mykiss* at Site 54.[d] In 2023, we caught Dolly Varden and 11 juvenile coho salmon, demonstrating successful adult coho salmon passage through the Greens Creek fish pass, located about 5.6 km upriver from the stream mouth.[e]

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[d] In 2007 and 2008, two cutthroat trout were observed; one rainbow trout was observed in 2020.

[e] In 1989, Greens Creek Mining Company installed the engineered fish pass as mitigation for impacts to Tributary Creek from the TDF. Three weirs provide step pools for adult coho salmon passage through a natural bedrock chute that prevents upstream fish migration. In November 2005, flood flows caused by a heavy rainstorm damaged the fish pass, limiting upstream adult fish passage in subsequent years. Hecla repaired and fortified the fish pass in March 2016 and inspects the structure seasonally. We have observed juvenile coho salmon at Site 54 since 2017, demonstrating successful adult coho salmon passage occurred during the prior fall spawning season.

Figure 6.–Upper extent of Greens Creek Site 54, facing downstream, July 14, 2023.

Tributary Creek

Tributary Creek drains a 1.7 km^2 watershed (USFS 2013) and the main channel measures about 1.6 km between its headwaters and confluence with Zinc Creek; Figure 7). Tributary Creek (Stream No. 112-65-10230-2007) provides habitat for coho and pink salmon and Dolly Varden (Giefer and Graziano 2023).

The TDF occupies the headwaters of the watershed. Tributary Creek is a lowland stream characterized as a small flood plain channel type (Paustian 2010). Stream grade varies from 1 to 2%, organic material and sand are the dominant substrates with gravel and large and small woody debris. Discharge estimates based on field measurements and limited gage data suggest annual mean discharge is less than 3 ft^3/s (USFS 2003).

Figure 7.–Tributary Creek Site 9 and Site 1847.

Tributary Creek Site 9

Site 9 is located about 1.0 km downstream of the TDF at 25 m elevation and is sampled to detect potential changes from mining activities over time. We documented coho salmon, Dolly Varden, cutthroat and rainbow trout, and sculpin *Cottus* sp. at the site. Periphyton and benthic macroinvertebrate sampling occur within the juvenile fish sampling reach.

Greens Creek Mine TDF expansions and beaver activity have changed Tributary Creek streamflow patterns and sediment composition at Site 9 since sampling began in 2001. Tributary Creek discharge appears to be reducing over time, seemingly more so in recent years since beavers returned to the system, immediately upstream of Site 9. The current conditions (Figure 8) limit our ability to properly sample periphyton and BMI in riffles in part due to a beaver dam about 25 m upstream.

Since 2018, also we sampled periphyton and benthic macroinvertebrates at Tributary Creek Site 1847, downstream of Site 9 near the stream mouth, to investigate those communities in riffle habitats more suitable for sampling than at Site 9.[f,g] Stream discharge does not increase much between sampling sites as there are no surface inputs; the main difference between sampling sites is gradient which supports gravel substrate for sampling at Site 1847, compared to small gravel, sand, and organics at Site 9.

Figure 8.–Tributary Creek Site 9 sample reach, July 12, 2023.

[f] Kate Kanouse, Habitat Biologist, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: GCM Tributary Creek Sampling Site 1847; dated July 17, 2018. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

[g] Erika King, Habitat Biologist, to Kate Kanouse, Southeast Regional Supervisor, ADF&G Habitat Section. Memorandum: 2023 Greens Creek mine aquatic biomonitoring; dated October 16, 2023. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

Tributary Creek Site 1847

Site 1847 is located about 1.4 km downstream of the TDF at about 20 m elevation, and about 50 m upstream of the confluence with Zinc Creek (Figure 9). We sampled periphyton and BMI 2018–2023 and compare data to Site 9. We did not sample fish since Site 9 is preferred as the most upstream sampling site for Dolly Varden element concentration.

Figure 9.–Tributary Creek Site 1847 sample reach, July 12, 2023.

AQUATIC STUDIES AND LOCATIONS

July 10–13, 2023, we completed the Greens Creek Mine aquatic biomonitoring studies required in HCGMC's approved ADEC Waste Management Permit 2020DB0001 and General Plan of Operations Integrated Monitoring Plan (IMP; HGCMC 2020). Sampling locations and aquatic studies for each sample site are detailed in Table 1.

Table 1.–Aquatic biomonitoring study sample sites, 2023.

Location	Biomonitoring reach	Latitude[a]	Longitude[a]	Date Sampled
Greens Creek Site 63[b] (2018–2023)	Fish – Upper extent	58.0827	-134.6286	07/11/2023
	Fish – Lower extent	58.0832	-134.6295	
	Periphyton and benthic macroinvertebrates	58.0831	-134.6300	
Greens Creek Site 54 (2001–2023)	Fish – Upper extent	58.0785	-134.6469	07/13/2023
	Fish – Lower extent	58.0783	-134.6478	
	Periphyton and benthic macroinvertebrates	58.0783	-134.6466	
Tributary Creek Site 9 (2001–2023)	Fish – Upper extent	58.1055	-134.7450	07/12/2023
	Fish – Lower extent	58.1050	-134.7450	
Tributary Creek Site 1847 (2018–2023)	Periphyton and benthic macroinvertebrates	58.1018	-134.7458	07/12/2023

[a] WGS84 datum.

[b] Reference samples were collected at Greens Creek Site 48 2001–2017.

Periphyton Chlorophyll Density and Composition

The ADEC WMP (2.3.1.2.3) and IMP (6.3) requires annual monitoring of periphyton chlorophyll density and composition within mining influence at Greens Creek Site 54 and Tributary Creek Sites 9 and at a reference reach above mine influence at Greens Creek Site 63 to monitor changes in primary productivity compared to natural variation due to factors such as mineral seeps, climate, and stream migration and streamflow. Annual periphyton sampling occurs in July and ideally not within three weeks following peak discharge to detect changes over time.

Periphyton is composed of primary producing organisms such as algae, cyanobacteria, and heterotrophic microbes, and detritus attached to the submerged surfaces of aquatic ecosystems. Algal density and community structure are influenced by water and sediment quality through physical, chemical, and biological factors that change throughout the year (Barbour et al. 1999).

The concentration of chlorophyll a (Chl-a) pigment in periphyton samples provides an estimate of active algal biomass (density), while concentrations of chlorophyll b (Chl-b) and chlorophyll c (Chl-c) pigments estimate the composition of algal organisms present, such as green algae that produce Chl-b, and diatoms and brown algae that produce Chl-c. The chlorophyll data are used to document primary productivity.

Benthic Macroinvertebrate Density and Community Composition

The ADEC WMP (2.3.1.2.4) and IMP (6.4) requires annual monitoring of BMI density and community composition within mining influence at Greens Creek Site 54 and Tributary Creek Site 9 and at a reference reach above mine influence at Greens Creek Site 63 to detect changes in secondary productivity compared to natural variation due to factors such as mineral seeps, climate, stream migration, and streamflow. Annual BMI and periphyton sampling occur in July to detect changes over time. Sampling targets riffle habitats which support greater densities of EPT taxa

than other stream habitat types (Barbour et al. 1999) and generally are sensitive to environmental changes and have short life cycles. The BMI data are used to document secondary productivity.

Benthic macroinvertebrates (BMI) classified in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), collectively known as EPT taxa, many of which are sensitive to changes in water and sediment quality (Barbour et al. 1999). These organisms are secondary producers, feed upon periphyton and other macroinvertebrates, and are a food source for fish.

Juvenile Fish Abundance and Condition

The ADEC WMP (2.3.1.2.1) and IMP (6.5) require annual monitoring of abundance and condition of juvenile fish by species. Fish condition is affected by age, sex, season, maturation, diet, gut contents, fat reserve, and muscular development (Anderson and Neumann 1996). Length and weight data are used to assess fish condition—an index of fish condition.

Juvenile Fish Element Concentrations

The ADEC WMP (2.3.1.2.2) and IMP (6.6) requires annual monitoring of whole-body element concentrations in juvenile Dolly Varden at Greens Creek Sites 63 and 54 and Tributary Creek Site 9 to document element concentrations in aquatic communities near the mine. Element bioavailability and bioaccumulation depends on physical and chemical factors and interactions among biological communities (Tchounwou et al. 2012). Resident Dolly Varden samples are analyzed for whole body concentrations of silver (Ag), cadmium (Cd), copper (Cu), mercury (Hg), lead (Pb), selenium (Se), and zinc (Zn) to document concentrations and variability. These elements were selected based on target elements identified in the ore body. Due to the scarcity of juvenile Dolly Varden of suitable sampling size in Tributary Creek in recent years, we also collected juvenile coho salmon, following the same methods, to build a separate data set.

METHODS

We review data sets annually to ensure accuracy and consistency with modifications to the methods; corrections and updates are reported in the document and appendices. The most recent technical report presents the current data sets and should be used to analyze data from previous years.

WATER QUALITY

Basic water quality data (temperature, conductivity, and pH) were collected with a Hanna HI98194 multiparameter meter; the instrument was calibrated per the manufacturer's instructions prior to sampling. In some years, HGCMC measures water quality and we report the data.

STREAMFLOW

Sampling and Analysis

In Greens Creek, discharge was measured with a SonTek FlowTracker acoustic doppler velocimeter.[h] At least 20 measurement points were collected in equidistant subsections at a site where streamflow was confined to one channel and streambed elevation and streamflow exhibited uniformity; additional measurements were collected where changes in the streambed elevation and water velocity were observed. Depending on the selected survey site, rock and other debris were removed to obtain a channel cross section as uniform as possible. Following methods described in SonTek (2007), the survey began from either streambank along a measuring tape securely suspended across the stream—perpendicular to flow.

In Tributary Creek, discharge was measured with a collapsible 20 cm (8 in) Cutthroat flume using methods described in CDPHE (2016).[i] The flume was placed parallel to flow in a stream section confined to one channel with uniform flow, and the wing walls were spread upstream. Plastic visqueen liner was used to direct flow into the flume and the channel confined by a berm constructed using a hand shovel with stream substrate. The flume was leveled horizontally and vertically with a portable level and substrate was packed beyond the wing walls to direct all flow into the flume. Discharge was determined using charts provided by the manufacturer. Due to the channel modifications required, discharge using this method was completed after water quality, and all BMI, fish, and periphyton samples were collected.

Data Presentation

Discharge measurements are presented for each site, including the daily mean discharge data obtained from USGS Site 15101490. Also presented is a figure of Greens Creek daily mean discharges three weeks prior to the sampling event, including daily mean discharges for the period three weeks prior to sampling events 2001–2023,[j] and a figure presenting the range of Greens Creek daily mean discharges three weeks prior to sampling, 2001–2023.

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[h] From 2010–2015, discharge in Greens Creek and Tributary Creek was estimated using a Global Flow Probe Model FP101 flow meter (Kanouse 2015) and a modification of the methods described in Platts et al. (1983).

[i] From 2016 to 2018, 2020, and in 2021, Tributary Creek discharge was measured using a SonTek FlowTracker acoustic doppler velocimeter.

[j] Continuous discharge data are not available for Tributary Creek.

PERIPHYTON: CHLOROPHYLL DENSITY AND COMPOSITION

Sample Collection and Analysis

Sampling methods are adapted from Barbour et al. (1999). Ten smooth, flat, undisturbed, and perennially wetted rocks were collected from riffle habitats in less than 0.45 m water depth at each sample site and submerged in the creek near the work area in the same orientation as initially collected. To collect a sample from each rock, a 5 × 5 cm square of high-density foam was held on the sample area; the area around the foam was scrubbed with a toothbrush to remove algae and other organisms outside the sample area. The rock was rinsed by submerging it in the stream while holding the foam in place; the toothbrush also was rinsed and scrubbed in the stream to remove remnant periphyton.

A 47 mm diameter Type A/E 1 µm glass fiber filter was placed into a Nalgene® filter receptacle attached to a vacuum pump with a gauge. The foam square was removed and the underside of the foam and the sample area were gently scrubbed in a circular pattern with the toothbrush into the filter receptacle. Stream water in a wash bottle was used to rinse loosened periphyton from the foam, rock, toothbrush, and the inside of the filter receptacle onto the filter. The sample area was scrubbed a second time and the rinse cycle was repeated. With most of the water pumped through the filter, maintaining pressure less than 34 kPa, a few drops[k] of saturated magnesium carbonate solution was added to the filter[l]. The glass fiber filter was removed from the receptacle, folded in half with the sample inside, and wrapped in a white coffee filter for additional moisture absorption. The samples were placed in a sealed, labeled plastic bag with desiccant and stored in a light-proof cooler containing frozen icepacks during transportation; samples were stored in a -20°C freezer in the ADF&G Douglas laboratory until processing.

U.S. Environmental Protection Agency (EPA; 1997) protocol was followed for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.[m] Samples were removed from the freezer, cut into small pieces, and placed into individual 15 mL screw cap centrifuge tubes containing 10 mL of 90% buffered acetone. The centrifuge tubes were capped and shaken to ensure complete submersion of the sample. Secured in a vial rack covered with aluminum foil to reduce light exposure, the samples were stored in a refrigerator for 12–24 hours to allow for saturation and chlorophyll extraction.

The samples were centrifuged for 20 minutes at 500 relative centrifugal force, using a properly balanced centrifuge. Prior to sample measurement, two cuvettes containing 90% buffered acetone were placed into a Shimadzu UV-1800 spectrophotometer to calibrate absorbance of the solvent at wavelengths 664 nm, 647 nm, 630 nm, and 750 nm. Each sample supernatant was decanted into an individual cuvette and absorbance was measured at each wavelength. Each sample was treated with 80 µL of 0.1 N hydrochloric acid for 90 seconds to convert the chlorophyll to phaeophytin, and absorbance was measured at wavelengths 665 nm and 750 nm. To minimize stray light and improve resolution, sample cuvettes were cleaned with a nonabrasive wipe prior to placement in the spectrophotometer.

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[k] This measurement is not exact as the amount of water and magnesium carbonate used to create a saturated solution varies and does not affect sample integrity; supernatant solution was used to avoid magnesium carbonate solids.

[l] To prevent acidification and conversion of chlorophyll to phaeophytin.

[m] Deviations from EPA (1997) include sample storage longer than 3.5 weeks, and cutting sample filters to reduce acetone exposure for laboratory staff (as opposed to homogenization).

Trichromatic equations were used to estimate Chl-a, Chl-b, and Chl-c densities, correcting for turbidity using the 750 nm absorbance value (APHA 2012, EPA 1997). Chl-a densities were corrected when phaeophytin was detected. Each year the estimated detection limit (EDL) is determined by analyzing seven replicate spinach dilution samples; the 2023 EDL for Chl-a concentration was 0.08 mg/m^2. When Chl-a was not detected in a sample, the concentration is reported as the spectrophotometer EDL and values for Chl-b and Chl-c are not reported.

Data Presentation

For each site and by year, mean Chl-a densities (mg/m^2) ± 1 SD are presented in a figure. Greens Creek Site 63 data is presented with Site 48; Tributary Creek Site 9 data is presented with Site 1847. Annual sample data and summaries are provided in Appendix A.

BENTHIC MACROINVERTEBRATE DENSITY AND COMMUNITY COMPOSITION

Sample Collection and Analysis

Eight BMI samples[n] were collected from each site using a Hess stream bottom sampler in riffles and runs with gravel and cobble substrate and varying flow velocities—habitats that support greater BMI densities and taxonomic richness (Barbour et al. 1999). Other habitat types (e.g., pools) were excluded to reduce variability.

The Hess stream bottom sampler has a 0.086 m^2 sample area and material is captured in a 200 mL cod end—both constructed with 300 µm mesh net. After securing the frame on the streambed with the opening facing the upstream current, rocks within the sample area were scoured with a scrub brush; gravel, sand, and silt were disturbed to about 10 cm depth to dislodge macroinvertebrates into the net. The net was rinsed in the stream to ensure all organisms drifted into the cod end, and each sample was transferred from the cod end to a labeled 500 mL plastic bottle. Samples were preserved in 95% ethanol at a ratio of three parts ethanol to one part sample. Samples exceeding the capacity of the cod end were discarded in the field to minimize detritus and substrate in samples and ensure proper sample preservation.

Entire samples were processed with an elutriator system with a 0.3 mm sieve to sort macroinvertebrates from debris[o] and identified organisms to the lowest practical taxonomic level[p] using Merritt and Cummins (1996) and Stewart and Oswood (2006). Identification and enumeration were independently verified for five random samples.

BMI density was calculated for each sample by dividing the number of macroinvertebrates by 0.086 m^2—the Hess sampling area. Mean density was estimated for each site by calculating the mean density among the eight samples. Taxa richness is reported as the number of taxonomic groups identified to the lowest practical level; terrestrial[q] organisms were excluded from all calculations.

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[n] Prior to 2015, we collected 5 BMI samples each year.

[o] Gordon Willson-Naranjo and Greg Albrecht, Habitat Biologists, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: Benthic macroinvertebrate elutriation trials amendment; dated 12/17/2013. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd St, Douglas, AK.

[p] Insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera to genus, except nonbiting midges to family Chironomidae, and all others to class or order. Damaged and degraded organisms that cannot be identified are not reported.

[q] Including adult terrestrial insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera.

Data Presentation

For each site and by year, mean BMI and EPT density ± 1 SD and community composition are illustrated in figures. Greens Creek Site 63 data are presented with Site 48; Tributary Creek Site 9 data with Site 1847. Annual data summaries are provided in Appendix B.

JUVENILE FISH ABUNDANCE AND CONDITION

Sample Collection and Analysis

Following methods described in Magnus et al. (2006), two-piece 6.35 mm galvanized steel minnow traps baited with disinfected salmon roe[r] were deployed throughout 50 m sample reaches isolated by natural features, such as shallow riffles and debris jams. In areas with high streamflow, rocks were added to the bottom of each trap for weight and to provide refuge for captured fish. Bait was contained in a punctured plastic bag to prevent ingestion and reduce the possibility of sample contamination. Prior to the study, several baited minnow traps were set within 15 m of the upstream and downstream sample reach boundaries to capture potential migrants and improve sample reach isolation.[s] After the 1.5-hour trapping event, captured fish were transferred to a plastic bucket containing aerated stream water. Fish captured in the boundary traps were excluded from the abundance estimate. Ten Dolly Varden were retained for whole body element concentration analyses at each sample site, if needed, fish from the boundary traps were retained as samples.

Biologists anesthetized fish using 9 mg/L[t] AQUI-S® 20E (10% eugenol), measured and recorded FL to the nearest 1 mm, and species (Pollard et al. 1997). Fish weight was recorded to the nearest 0.1 g. During recovery, fish were retained in a perforated plastic bucket secured in the creek and released to the sample reach upon study completion.

Fulton's condition factor (K) was calculated using the equation given in Anderson and Neumann (1996), where the weight (W) of each fish is divided by the cubed length (L) of the fish, and the product multiplied by 100,000:

$$K = \frac{W}{L^3} \times 100{,}000$$

Data Presentation

Juvenile fish abundance and condition are compared by species for each site and year with data from the historical initial 1.5-hour trapping events and presented in figures.[u] Greens Creek Site 63 data are presented with Site 48. Annual data summaries and length-frequency diagrams are provided in Appendix C.

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[r] Four oz of Betadyne® was added to 3 gal of tap water to saturate roe for 15 min, stirring frequently, then drained.

[s] Greens Creek discharge is usually too high to efficiently and effectively isolate sample reaches using a 6.35 mm (0.25 in) mesh net across the stream. Though a mesh net could effectively isolate the Tributary Creek Site 9 sample reach, baited minnow traps were used all years.

[t] The dosage is equivalent to 0.30 mL anesthetic per 1 gal of stream water.

[u] Prior to an approved modification of the IMP in 2020, estimating juvenile fish populations was required—achieved with a depletion sampling method involving three sequential 1.5-hour minnow trapping events.

JUVENILE FISH ELEMENT CONCENTRATIONS

Sample Collection and Analysis

Wearing latex gloves, 10 juvenile Dolly Varden from the abundance trapping event were retained in individual clean, labeled plastic bags.[v,w] Fish retained were within the size range 85–125 mm FL;[x] an 85 mm fish provides the minimum weight (about 5 g) required for laboratory analyses, while the maximum length of 125 mm improves the probability of sampling 2–3 year old resident Dolly Varden at Greens Creek Site 54 and Tributary Creek Site 9. FL and weight were measured, correcting for bag weight, and samples were stored in a cooler with ice packs during transportation to the ADF&G Douglas laboratory, where samples were stored in a -20°C freezer.

The samples were shipped in a cooler with ice packs to ALS Environmental in Kelso, WA, maintaining written chain of custody documentation. ALS Environmental individually digested, dried, and analyzed each sample for total silver (Ag), cadmium (Cd), copper (Cu), mercury[y] (Hg), lead (Pb), selenium (Se), and zinc (Zn) on a dry weight basis following EPA (2002) method 1631E for Hg, and EPA (1998) method 6020A[z] for other elements. ALS Environmental provided Tier II quality control information, including results for matrix spikes, sample blanks, sample duplicates, and standard reference materials.

Data Presentation

For each sample site, a figure presents the minimum, median, and maximum of whole-body concentrations (mg/kg) for each analyte by year.[aa,bb] The annual raw data, presenting the mean value for duplicate sample results, and the 2023 laboratory report are provided in Appendix D.

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[v] Prior to 2015, 6 samples were collected at each site.

[w] Due to scarcity of Dolly Varden captured at Tributary Creek Site 9 2019–2022, all fish samples were collected beyond the sample reach, to achieve a sample size of 10 fish. Six fish were captured via electrofishing on August 15, 2022.

[x] To achieve a minimum sample size, when fish were scarce in some years, we retained fish samples measured less than the designated length range; when less than 85 mm, two fish were analyzed as a composite sample. We discontinued this practice.

[y] Annual analyses for Hg concentrations began in 2012; Hg data was incidentally received in 2010.

[z] EPA (1994) method 200.8 was used for analyses 2001–2010, 2012–2015, and 2018–2019.

[aa] The 2011 samples were mistakenly homogenized, resulting in one data point for each element analysis.

[bb] In 2012, laboratory contamination in several samples was suspected due to elevated sample results.

RESULTS

WEATHER AND STREAM FLOW DATA

The National Weather Service (2024) reports that during 2023, the Juneau area received precipitation (197 cm) about 16% above normal and snowfall (219 cm) about 2% below normal, compared to mean values reported 1991–2020. Prior to July aquatic biomonitoring sampling, the Juneau area received precipitation 6.8 cm below normal and the air temperature was on average 1.8 °F above normal.

Three weeks prior to July 2023 sampling, Greens Creek daily mean discharge was 76 ft^3/s, within the middle range of mean discharges observed 2001–2022 (Figure 10). There were three peak streamflow events within two months prior to sampling; discharge declined after the peak events (Figure 11). Peak events generally are defined as streamflow at or near bankfull.

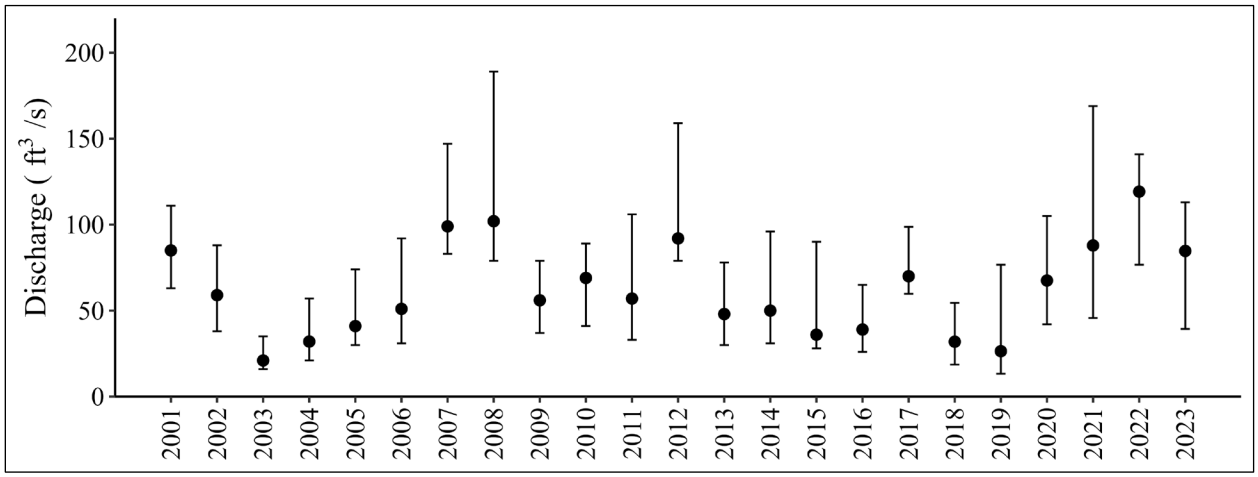

Figure 10.–Greens Creek daily mean discharge three weeks prior to sampling, 2001–2023.
Source: USGS 15101490 (USGS 2024).
Note: Minimum, median, and maximum discharges presented.

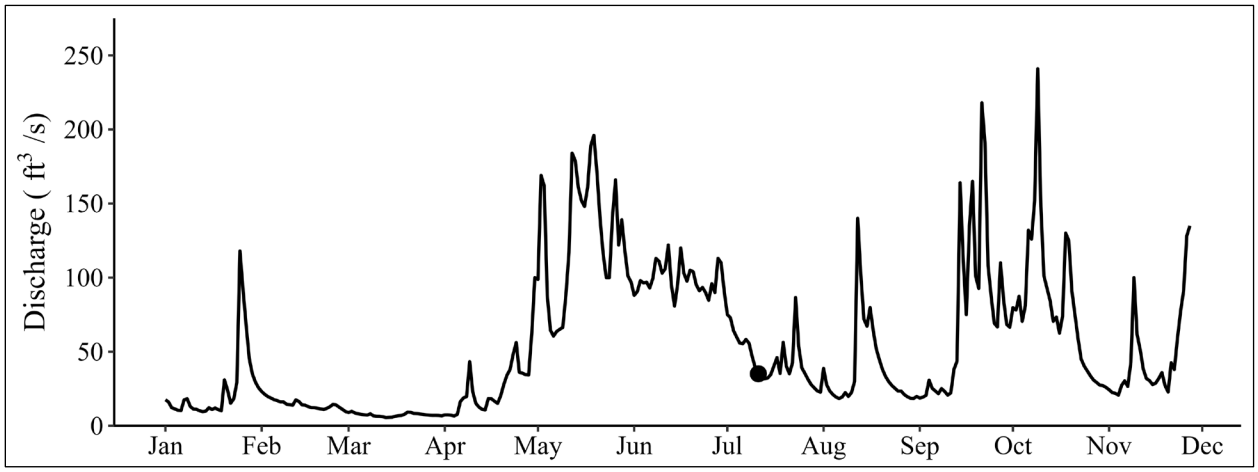

Figure 11.–Greens Creek daily mean daily discharge, 2023.
Source: USGS 15101490 (USGS 2024).
Note: Sampling dates represented by a black circle.

GREENS CREEK SITE 48 AND SITE 63

On July 11, 2023, we sampled Greens Creek Site 63. Hecla environmental staff measured basic water quality at 0915 hours (Table 2). The USGS Greens Creek stream gage recorded a daily mean discharge of 35.1 ft^3/s (USGS 2024).

Table 2.–Greens Creek Site 63 water quality data, 2023.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/11/2023	7.5	105	7.99	37.09[a]

[a] As measured at the Greens Creek weir at 1400 hours. We need did not manually measure streamflow at Site 63 in 2023.

Periphyton: Chlorophyll Density and Composition

The 2023 Greens Creek Site 63 mean Chl-a density was 5.85 mg/m^2, within the middle range of mean densities 2001–2022 (Figure 12). The samples contained about 88% Chl-a, 12% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Figure 13).

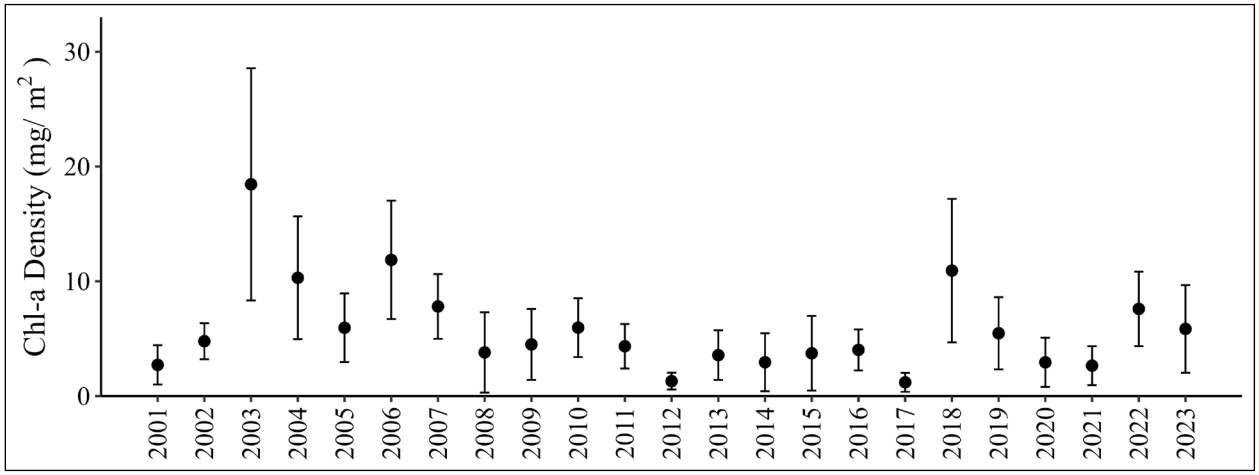

Figure 12.–Greens Creek Site 48 (2001–2017) and Site 63 (2018–2023) mean chlorophyll a densities ± 1 SD.

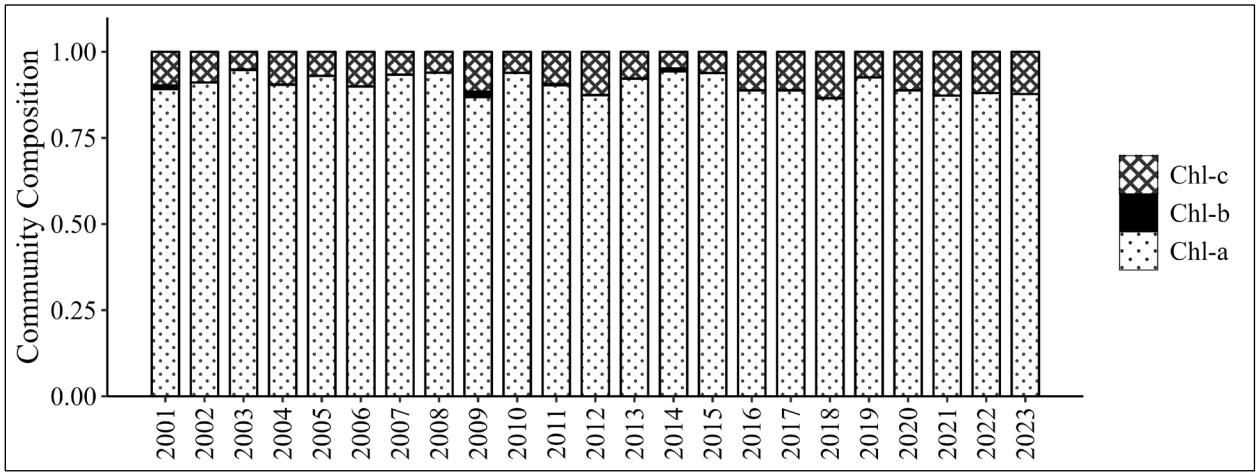

Figure 13.–Greens Creek Site 48 (2001–2017) and Site 63 (2018–2023) mean proportions of chlorophylls a, b, and c.

Benthic Macroinvertebrate Density and Community Composition

The 2023 Greens Creek Site 63 BMI mean density estimate is 1,818 BMI/m^2 and we identified 24 taxa, within the lower range of BMI densities observed 2001–2022 (Table 3; Figures 14, 15). We estimate mean EPT density was 1,574 EPT/m^2, within the lower range observed, accounting for 87% of the samples. Dominant taxa were Ephemeroptera of the families Baetidae (34%) and Ephemerellidae (14%).

Table 3.–Greens Creek Site 48 and 63 benthic macroinvertebrate data summary, 2001–2023.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mean EPT density (per m^2)	2,679	1,509	4,905	3,372	2,937	1,486	1,575	2,833	2,168	2,674	1,676	1,430	1,760
Mean BMI density (per m^2)	2,753	1,637	5,505	3,905	3,247	1,612	1,705	3,095	2,216	2,884	2,284	1,612	1,988
Number of EPT Taxa	15	19	17	17	18	12	13	11	13	14	16	16	13
Number of BMI Taxa	25	26	27	30	29	21	24	21	18	23	27	22	20
% EPT	97	92	89	86	90	92	92	92	98	93	73	89	89

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m^2)	2,223	2,430	2,534	2,111	3,490	4,084	1,956	1,076	1,535	1,574
Mean BMI density (per m^2)	2,688	2,948	3,086	2,346	3,737	4,435	2,342	1,391	1,690	1,818
Number of EPT Taxa	14	16	15	16	17	19	20	17	20	15
Number of BMI Taxa	24	27	25	25	27	28	33	29	26	24
% EPT	83	82	82	90	93	92	84	77	91	87

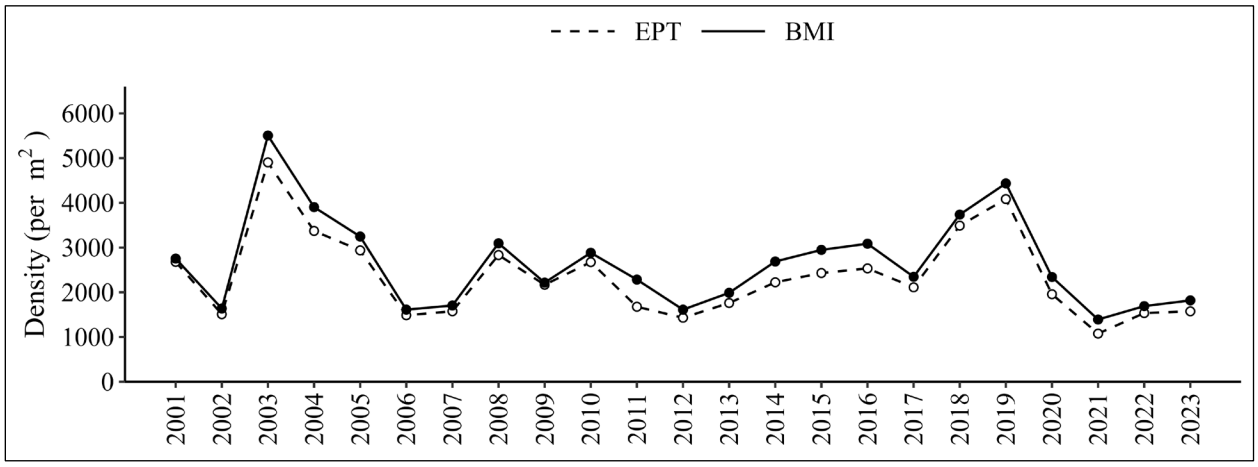

Figure 14.–Greens Creek Site 48 (2001–2017) and Site 63 (2018–2023) mean EPT and BMI densities.

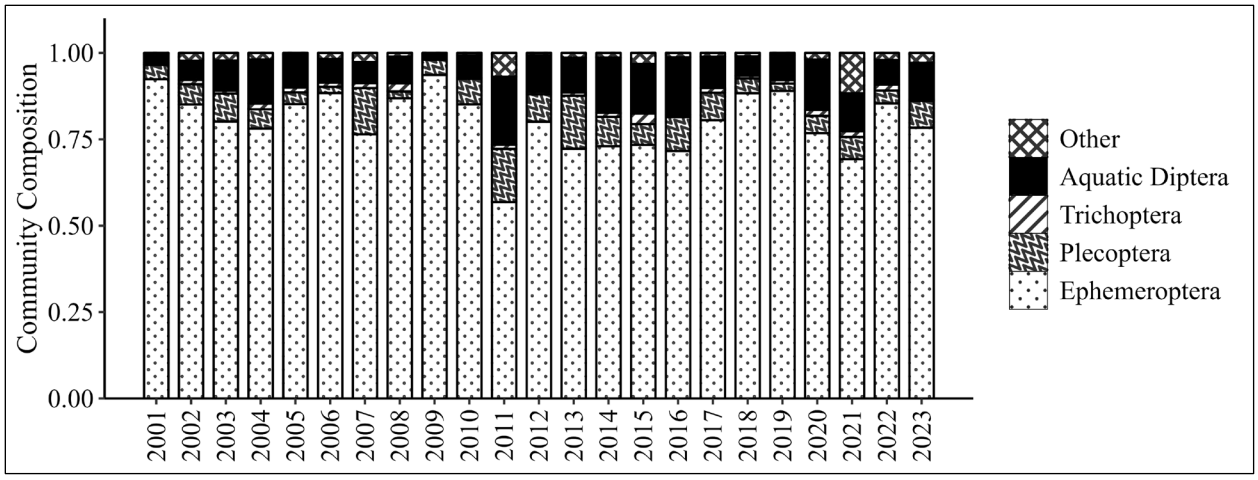

Figure 15.–Greens Creek Site 48 (2001–2017) and Site 63 (2018–2023) mean BMI community composition.

Juvenile Fish Abundance and Condition

In 2023 at Greens Creek Site 63, we captured 106 Dolly Varden (49–144 mm FL) and 4 juvenile coho salmon (76–81 mm FL), within the upper range of Dolly Varden captured during a single trapping event 2001–2022 (Figure 16). Historically, we have only captured resident Dolly Varden at Sites 48 and 63, this was the first year we captured juvenile coho salmon above the infiltration gallery concrete weir near the mine portal, which has blocked upstream fish passage since construction in the late 1980s, indicating a change in substrate or pool feature at the weir allowing stream dependent adult coho salmon passage over the weir in the previous fall.

Mean fish condition factor among the Dolly Varden captured was 1.0, about the same previously observed at Sites 48 and 63. Mean fish condition factor among the coho salmon captured was 1.2. The range of Dolly Varden length frequencies observed suggests at least two age classes were present, consistent with previous years, and one age class for coho salmon.

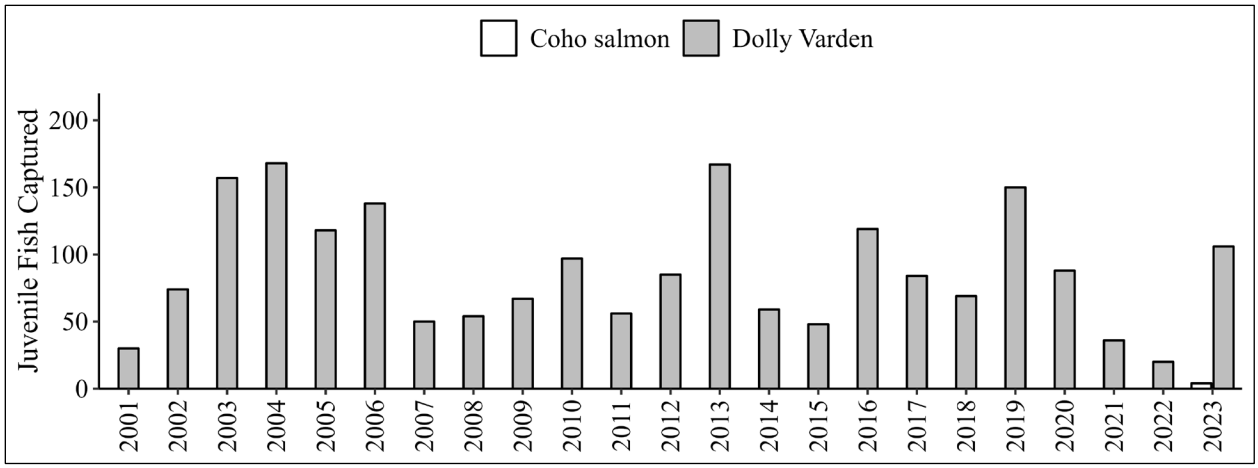

Figure 16.–Greens Creek Site 48 (2001–2017) and Site 63 (2018–2023) Dolly Varden and coho salmon captured.

Juvenile Fish Element Concentrations

In 2023 at Greens Creek Site 63, we retained 10 Dolly Varden (93–123 mm FL) for whole body element analysis. Median element concentrations were within middle ranges previously observed at Sites 48 and 63 2001–2022, and Pb concentrations in samples were lower than in 2022 (Figures 17, 18).

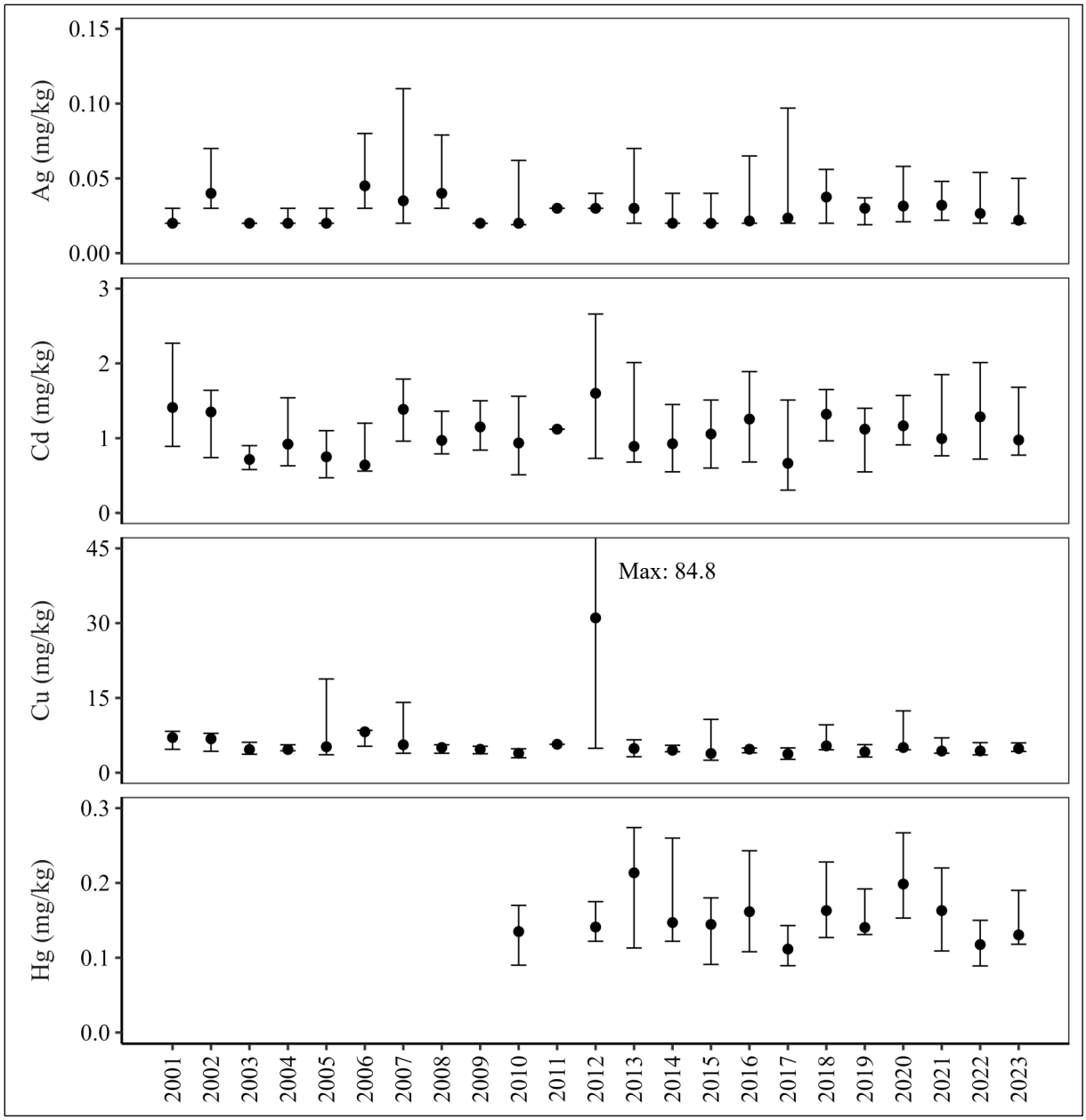

Figure 17.–Greens Creek Site 48 and Site 63 whole body Dolly Varden Ag, Cd, and Cu concentrations, 2001–2023, and Hg concentrations, 2010, 2012–2023.

Note: Minimum, median, and maximum concentrations presented.

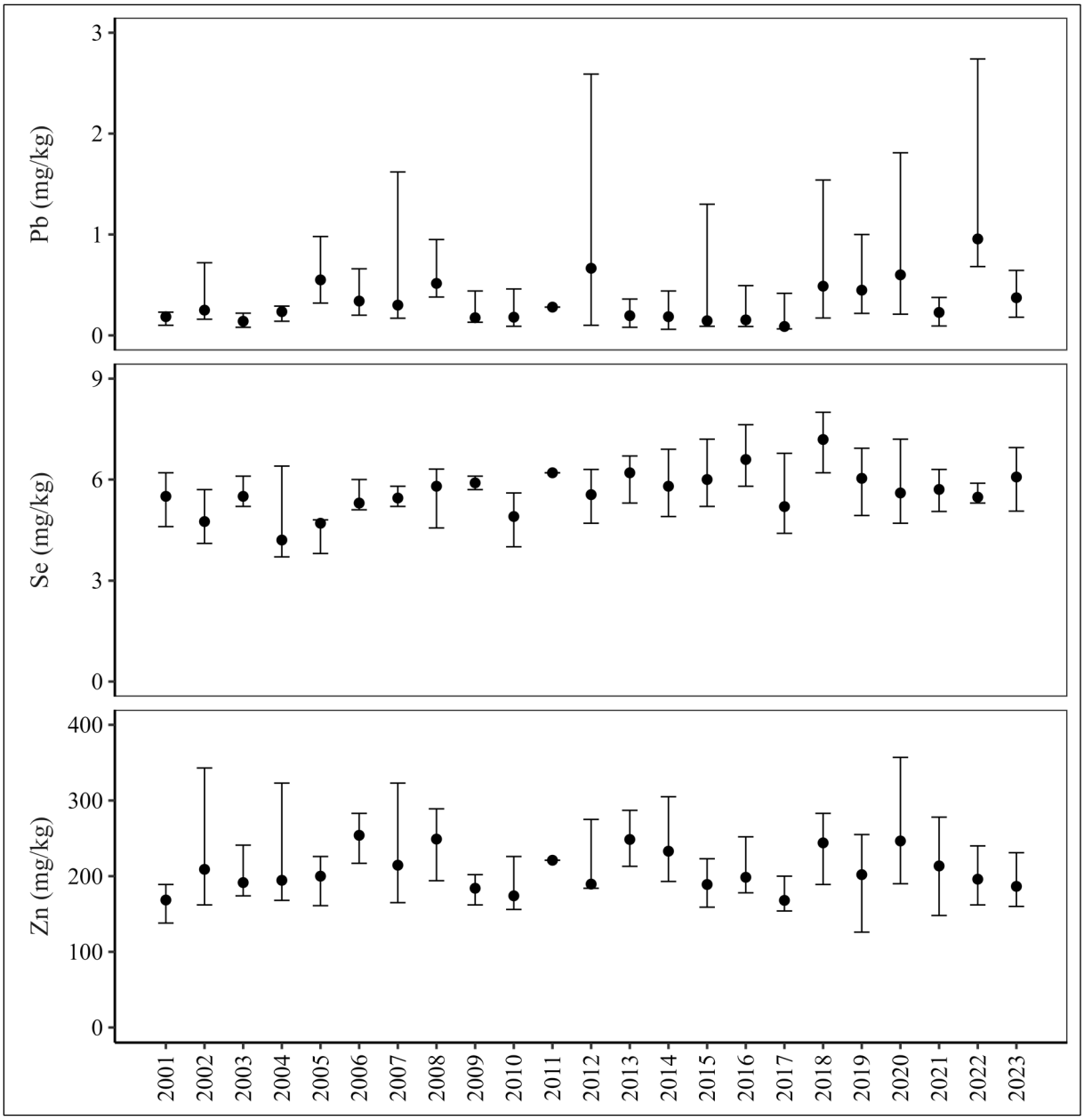

Figure 18.–Greens Creek Site 48 and Site 63 whole body Dolly Varden Pb, Se, and Zn concentrations, 2001–2023.

Note: Minimum, median, and maximum concentrations presented.

GREENS CREEK SITE 54

On July 13, 2023, we sampled Greens Creek Site 54. We measured stream discharge of 32.29 ft^3/s at 1200 hours and Hecla environmental staff measured basic water quality at 1215 hours (Table 4). The USGS stream gage recorded a daily mean discharge of 31.8 ft^3/s (USGS 2024).

Table 44.–Greens Creek Site 54 water quality data, 2023.

Sample Date	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/13/2023	9.4	96.6	7.91	32.29

Periphyton: Chlorophyll Density and Composition

The 2023 Greens Creek Site 54 mean Chl-a density was 5.94 mg/m^2, within the middle range of mean densities 2001–2022 (Figure 19). The samples contained about 89% Chl-a, 11% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Figure 20).

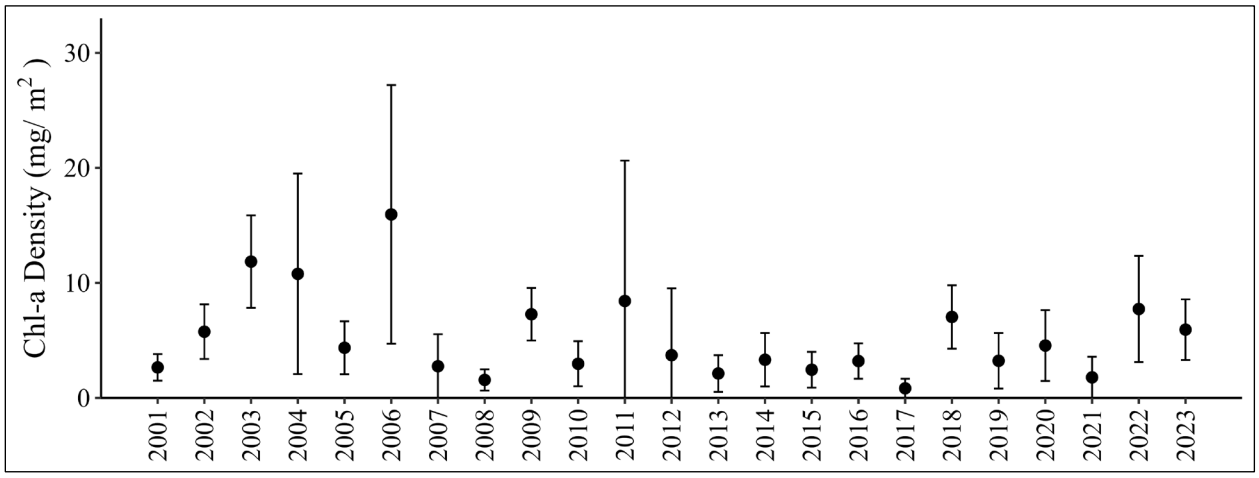

Figure 19.–Greens Creek Site 54 mean chlorophyll a densities ± 1 SD, 2001–2023.

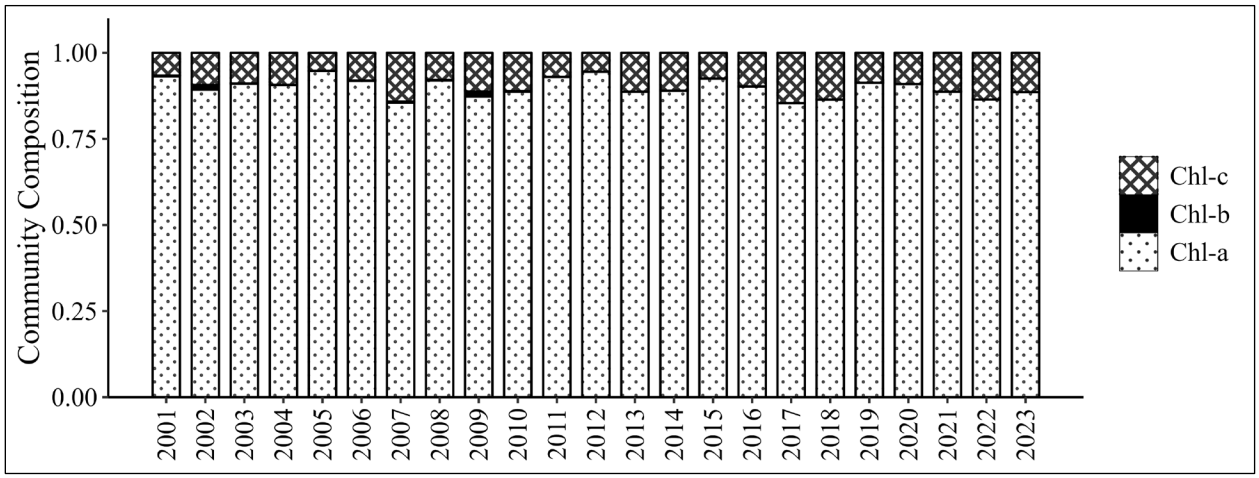

Figure 20.–Greens Creek Site 54 mean proportions of chlorophylls a, b, and c (2001–2023).

Benthic Macroinvertebrate Density and Community Composition

The 2023 Greens Creek Site 54 BMI mean density estimate is 6,102 BMI/m^2 and we identified 32 taxa, the highest observed BMI density and number of taxa observed 2001–2022 (Table 5; Figures 21, 22). We estimate mean EPT density at 5,506 EPT/m^2, the highest observed, accounting for 90% of the samples. Dominant taxa were Ephemeroptera of the families Ephemerellidae (32%) and Baetidae (20%).

Table 5.– Greens Creek Site 54 benthic macroinvertebrate data summary, 2001–2023.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mean EPT density (per m^2)	3,986	3,284	4,895	4,040	3,100	1,188	716	2,741	2,191	3,042	3,871	1,503	849
Mean BMI density (per m^2)	4,144	3,409	5,430	4,575	3,260	1,221	742	2,970	2,277	3,202	4,449	1,753	1,014
Number of EPT Taxa	16	15	15	19	18	10	10	14	16	13	20	21	12
Number of BMI Taxa	28	30	26	32	25	13	15	22	23	21	34	30	19
% EPT	96	96	90	88	95	97	97	92	96	95	87	86	84

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m^2)	3,268	1,547	3,334	1,469	3,437	3,596	3,022	888	1,308	5,506
Mean BMI density (per m^2)	3,737	1,887	3,658	1,651	3,647	4,032	3,634	1,068	1,427	6,102
Number of EPT Taxa	17	15	17	20	18	19	19	12	15	19
Number of BMI Taxa	26	28	30	31	29	29	31	24	22	32
% EPT	87	82	91	89	94	89	83	83	92	90

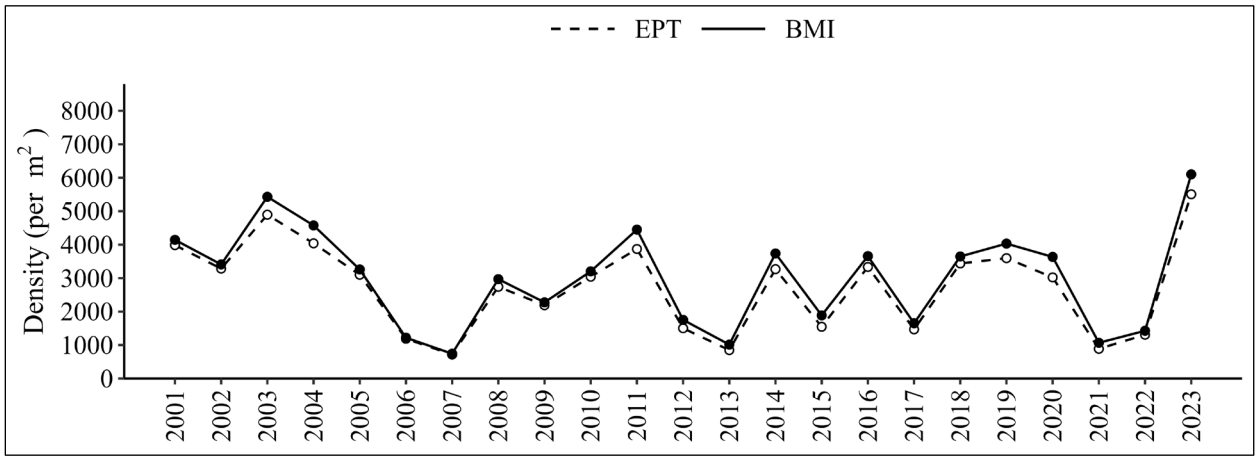

Figure 21.–Greens Creek Site 54 mean EPT and BMI densities, 2001–2023.

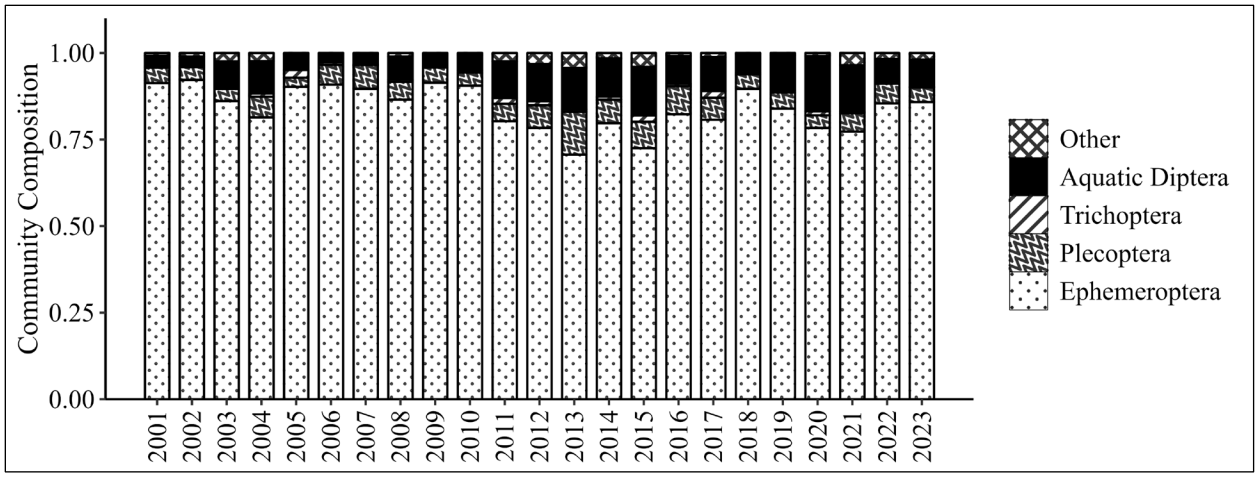

Figure 22.–Greens Creek Site 54 BMI community composition, 2001–2023.

Juvenile Fish Abundance and Condition

In 2023 at Greens Creek Site 54, we captured 204 Dolly Varden (48–143 mm FL), the highest number captured during a single trapping event 2001–2022, and 11 juvenile coho salmon (46–90 mm FL; Figure 23). Mean fish condition factor for Dolly Varden and coho salmon was 1.1, similar to previous fish captured at Site 54. The range of length frequencies observed suggests at least two age classes were present for Dolly Varden and coho salmon, consistent with previous years.

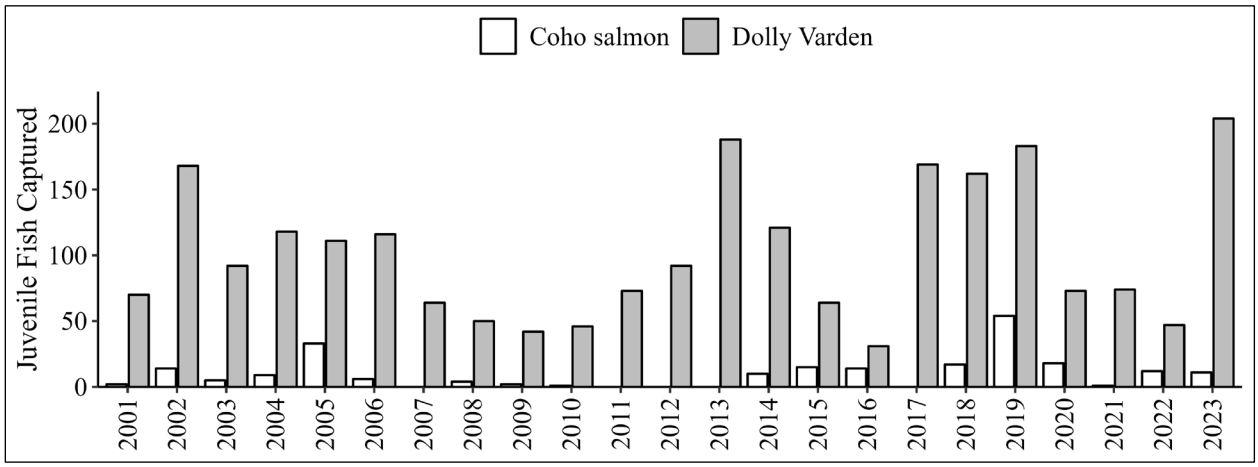

Figure 23.–Greens Creek Site 54 juvenile fish captured, 2001–2023.

Note: 2001–2010 data were from a 28 m reach, while 2011–2023 data from a 50 m reach. Other species captured are not illustrated.

Juvenile Fish Element Concentrations

In 2023 at Greens Creek Site 54, we retained 10 Dolly Varden (93–116 mm FL) for whole body element analysis. The median element concentrations were within ranges previously observed 2001–2022, and Pb concentrations in samples were lower than in 2022 (Figures 24, 25).

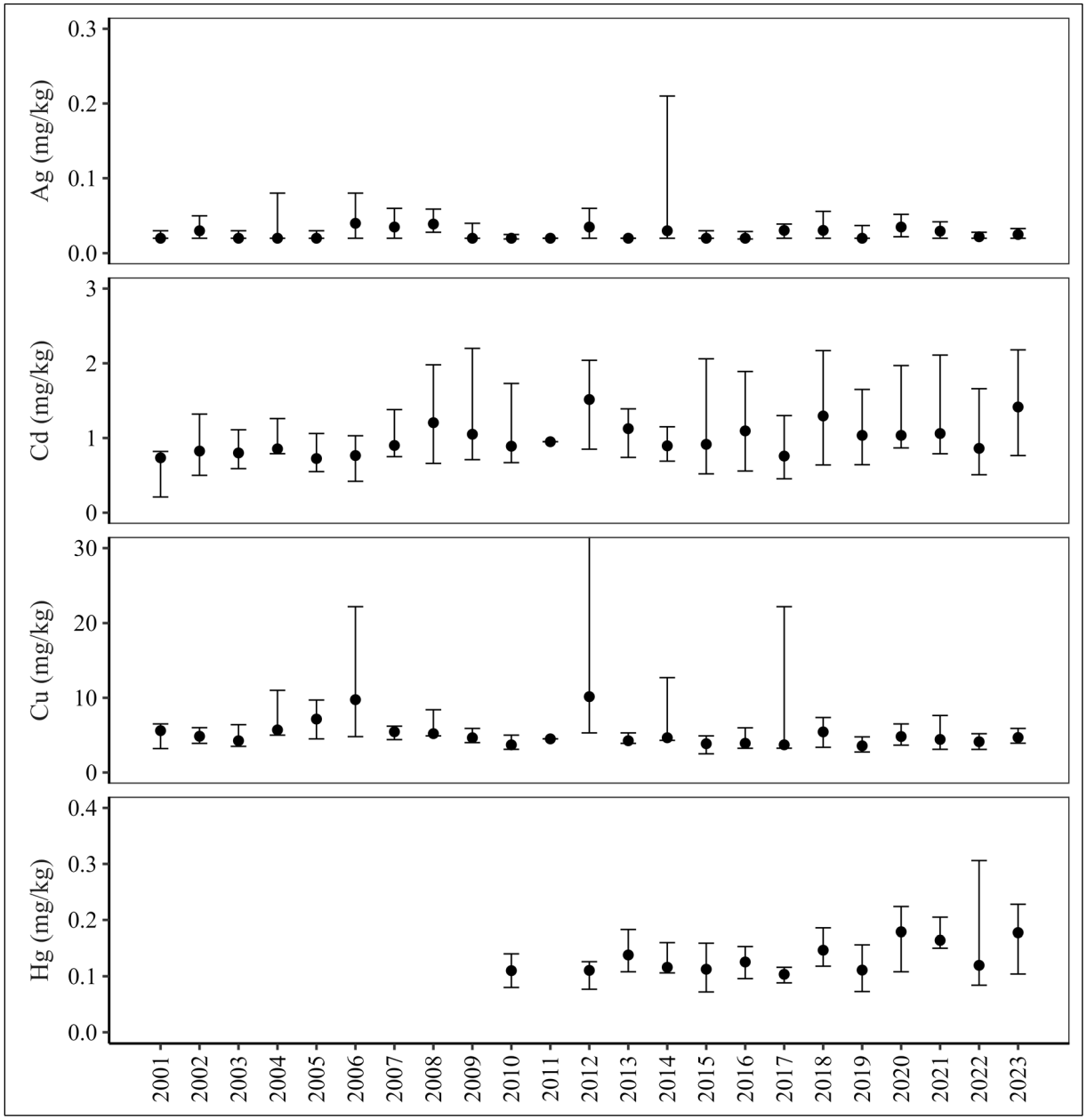

Figure 24.–Greens Creek Site 54 whole body Dolly Varden Ag, Cd, and Cu concentrations, 2001–2023, and Hg concentrations, 2010, 2012–2023.

Note: Minimum, median, and maximum concentrations presented.

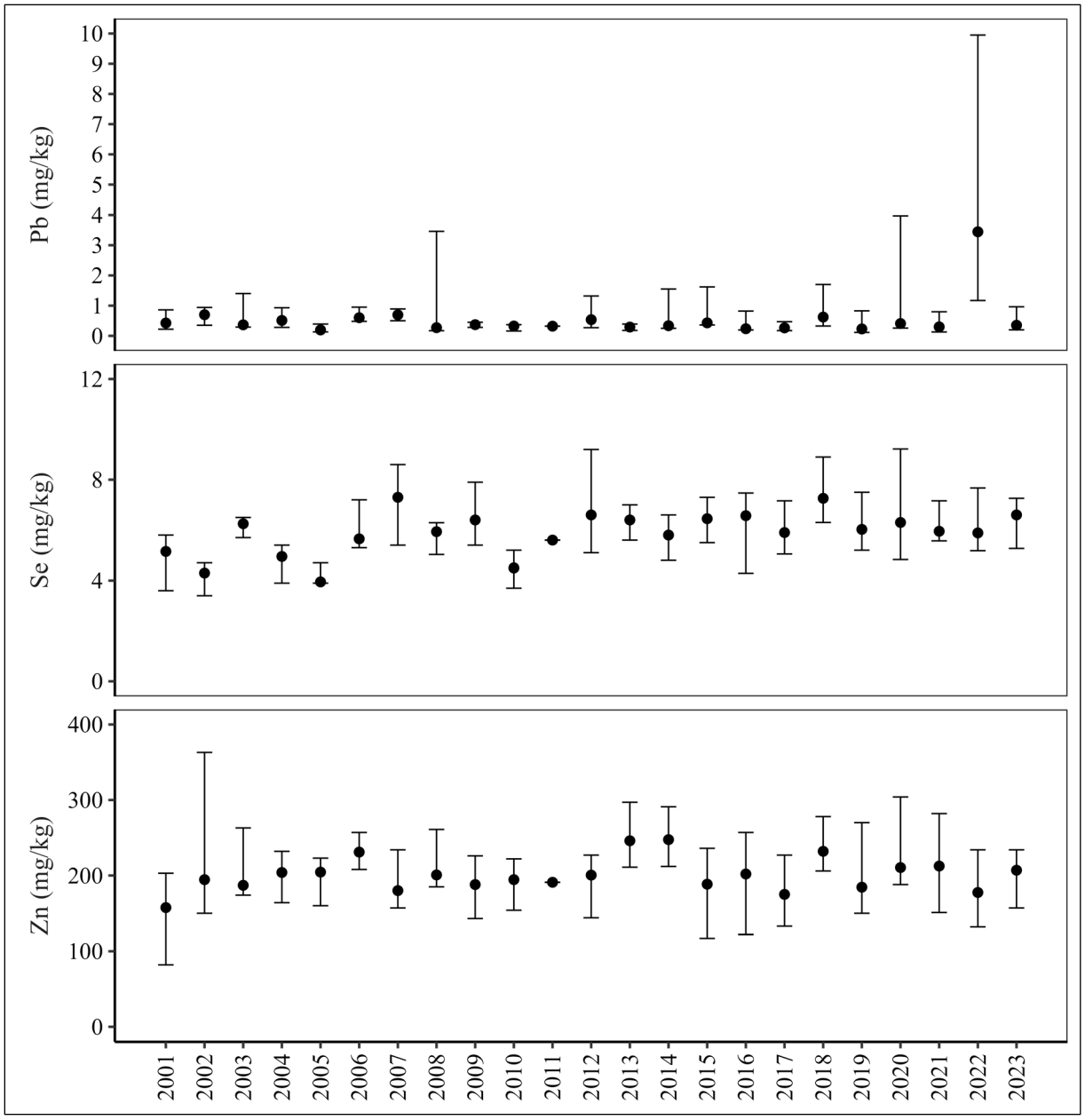

Figure 25.–Greens Creek Site 54 whole body Dolly Varden Pb, Se, and Zn concentrations, 2001–2023.

Note: Minimum, median, and maximum concentrations presented.

TRIBUTARY CREEK SITE 9

On July 12, 2023, we sampled Tributary Creek Site 9. We measured a stream discharge of 0.07 ft^3/s (about 31 gpm) at 0945 hours and Hecla environmental staff measured basic water quality at 0830 hours (Table 6; Figures 26, 27).

Table 6.–Greens Creek Sites 9 water quality data, 2023.

Sample Date	Sample Site	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/12/2023	9	12.3	72.9	7.45	0.07

Periphyton: Chlorophyll Density and Composition

The 2023 Tributary Creek Site 9 mean Chl-a density was 9.53 mg/m^2, within the middle range of mean densities 2001–2022 (Figure). The samples contained about 94% Chl-a, 6% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Table 7).

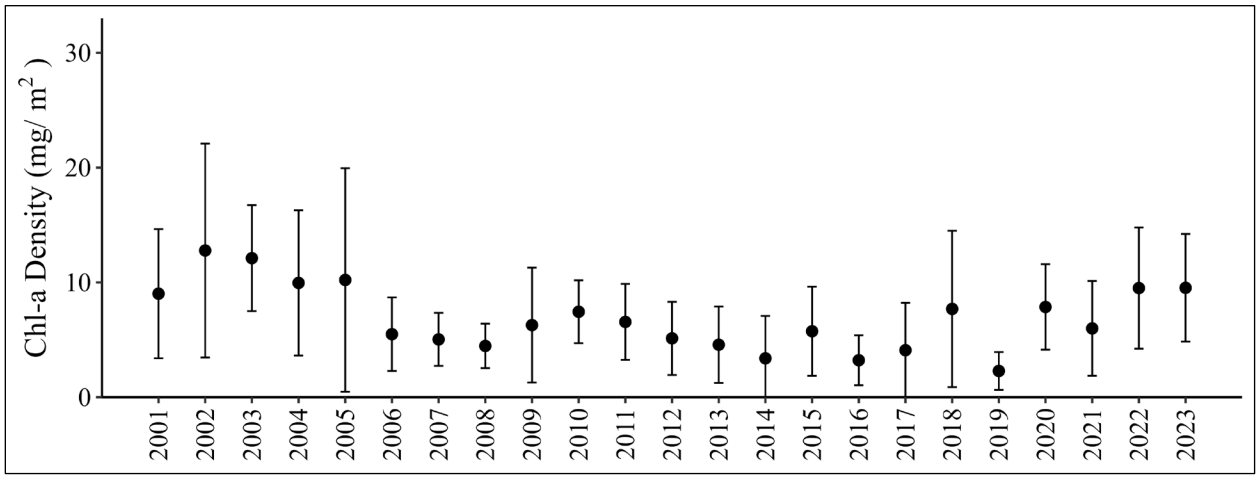

Figure 26.–Tributary Creek Site 9 mean chlorophyll a densities ± 1 SD, 2001–2023.

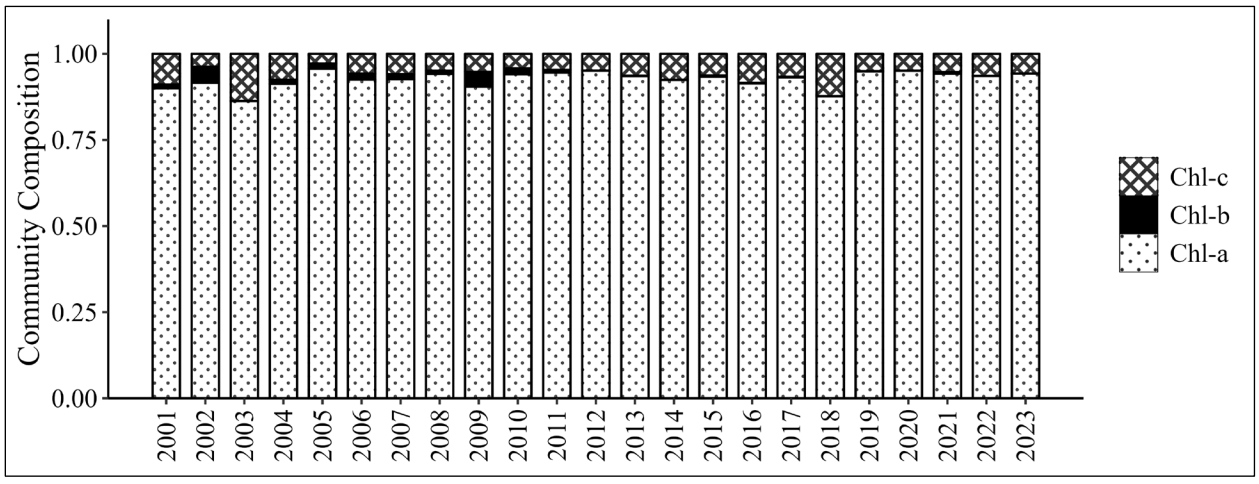

Figure 27.–Tributary Creek Site 9 mean proportions of chlorophylls a, b, and c (2001–2023).

Benthic Macroinvertebrate Density and Community Composition

The 2023 Tributary Creek Site 9 BMI mean density estimate is 5,625 BMI/m^2 and we identified 36 taxa, within the upper range of BMI densities and taxa observed 2001–2022 (Table 7; Figures 28, 29). We estimate mean EPT density at 3,251 EPT/m^2, within the upper range observed, accounting for 58% of the samples. Dominant taxa were Plecoptera of the family Nemouridae (22%) and Diptera of the family Simuliidae (17%).

Table 7.–Tributary Creek Site 9 benthic macroinvertebrate data summary, 2001–2023.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mean EPT density (per m^2)	634	1,179	3,675	1,705	1,007	1,119	337	1,144	698	246	996	753	1,991
Mean BMI density (per m^2)	1,184	1,740	5,851	2,400	1,228	1,453	507	1,751	1,114	460	1,991	1,416	2,393
Number of EPT Taxa	11	14	16	14	18	10	10	12	13	12	14	14	12
Number of BMI Taxa	21	24	36	26	30	23	21	20	26	22	26	27	20
% EPT	54	68	63	71	82	77	67	65	63	54	50	53	83

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m^2)	1,700	432	2,193	1,208	400	657	794	919	1,108	3,251
Mean BMI density (per m^2)	2,479	749	5,602	2,625	1,243	1,317	2,241	2,304	2,330	5,625
Number of EPT Taxa	12	12	16	15	13	14	15	14	14	19
Number of BMI Taxa	22	23	29	29	25	28	32	28	26	36
% EPT	69	58	39	46	32	50	35	40	48	58

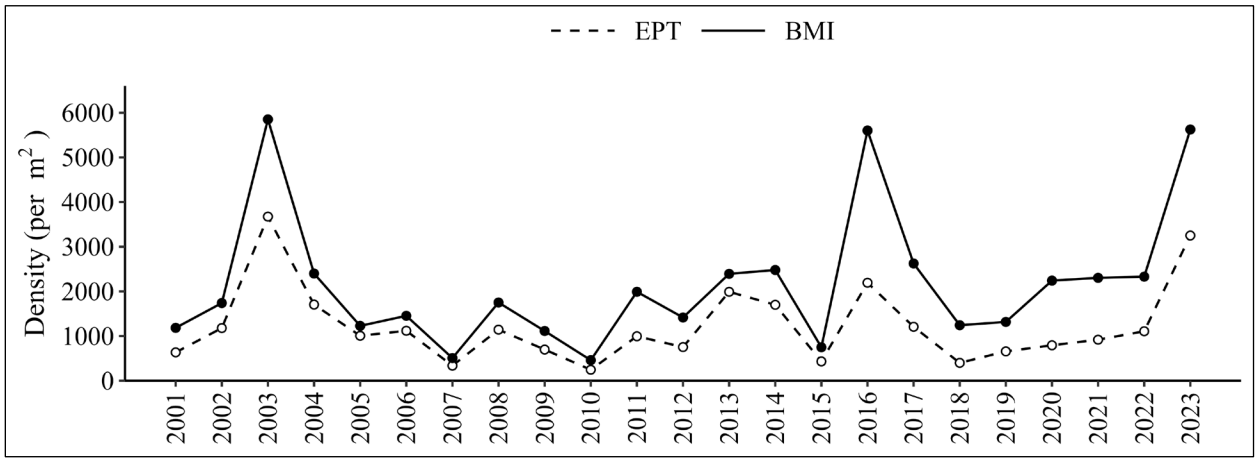

Figure 28.–Tributary Creek Site 9 mean EPT and BMI densities, 2001–2023.

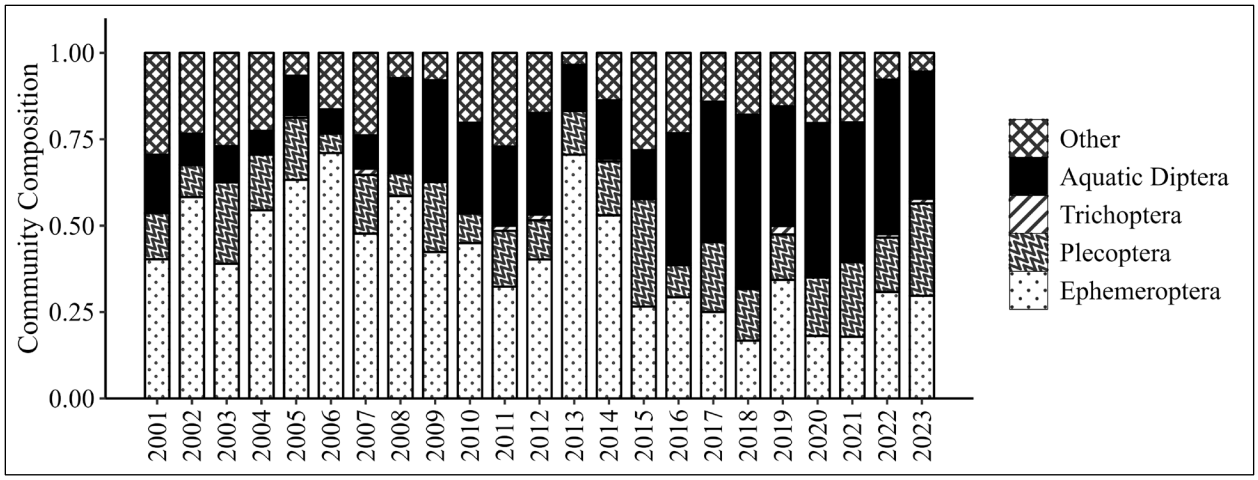

Figure 29.–Tributary Creek Site 9 mean BMI community composition, 2001–2023.

Juvenile Fish Abundance and Condition

In 2023 at Tributary Creek Site 9, we captured 16 Dolly Varden (60–95 mm FL) and 69 juvenile coho salmon (31–93 mm FL), similar to fish captures during a single trapping event 2001–2022 (Figure 30). The mean fish condition factor for Dolly Varden was 1.1 and the mean fish condition factor for juvenile coho salmon was 1.2, similar to previous fish captured at Site 9. The range of length frequencies observed suggests at least two age classes were present for Dolly Varden and coho salmon, consistent with previous years.

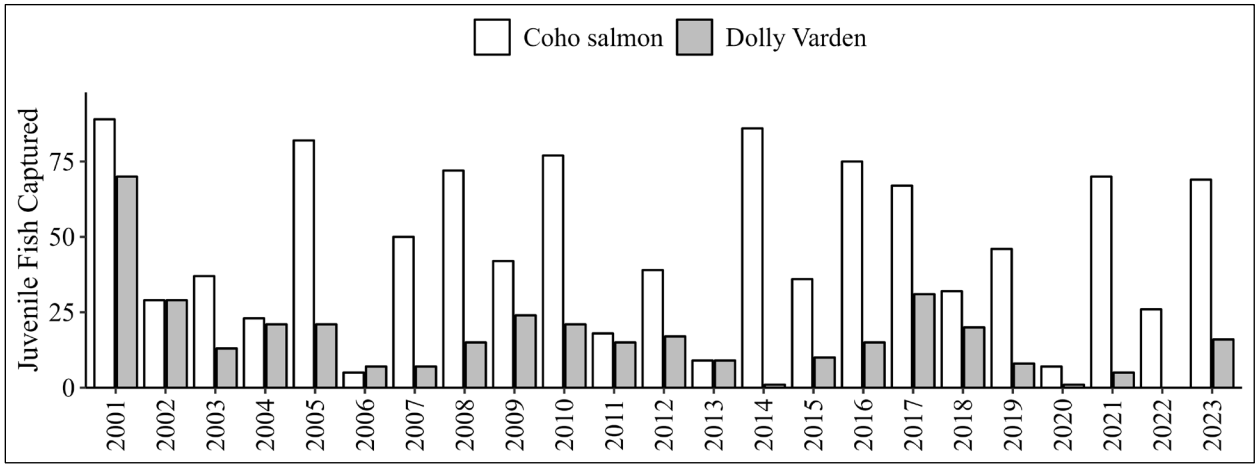

Figure 30.–Tributary Creek Site 9 juvenile fish captured, 2001–2023.

Juvenile Fish Element Concentrations

In 2023 at Tributary Creek Site 9, we retained 10 Dolly Varden[cc] (85–104 mm) for whole body element analysis. The median element concentrations were within ranges previously observed 2001–2022 and the Ag, Cd, Pb, Se, and Zn concentration medians and ranges have decreased since 2020 (Figures 31, 32).

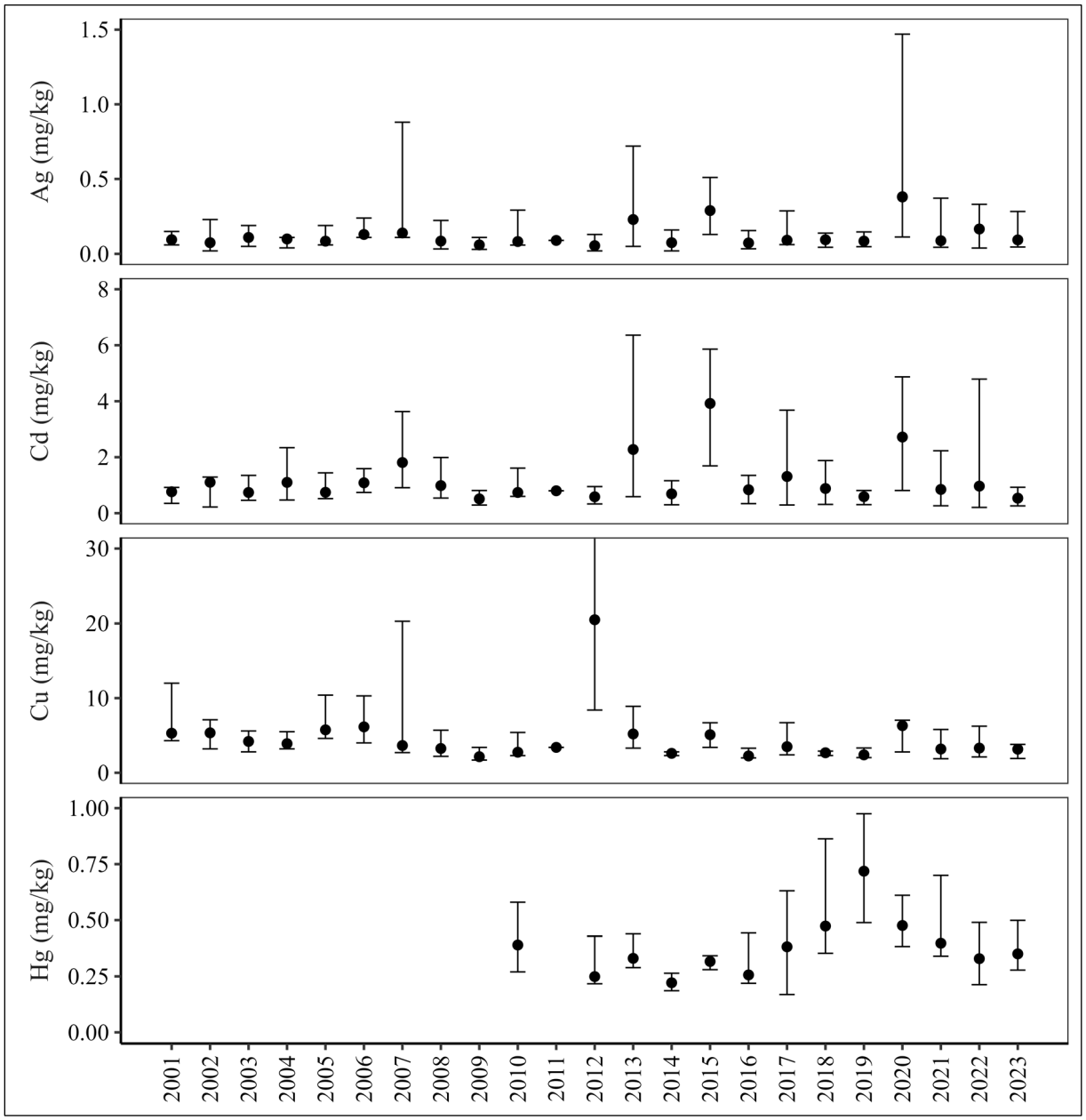

Figure 31.–Tributary Creek Site 9 whole body Dolly Varden Ag, Cd, and Cu concentrations, 2001–2023, and Hg concentrations, 2010, 2012–2023.

Note: Minimum, median, and maximum concentrations presented.

[cc] Due to scarcity of Dolly Varden captured at Tributary Creek Site 9 in 2023, four samples were collected upstream and downstream of the sample reach via a backpack electrofisher, as in previous years when necessary to achieve a minimum sample size of ten fish.

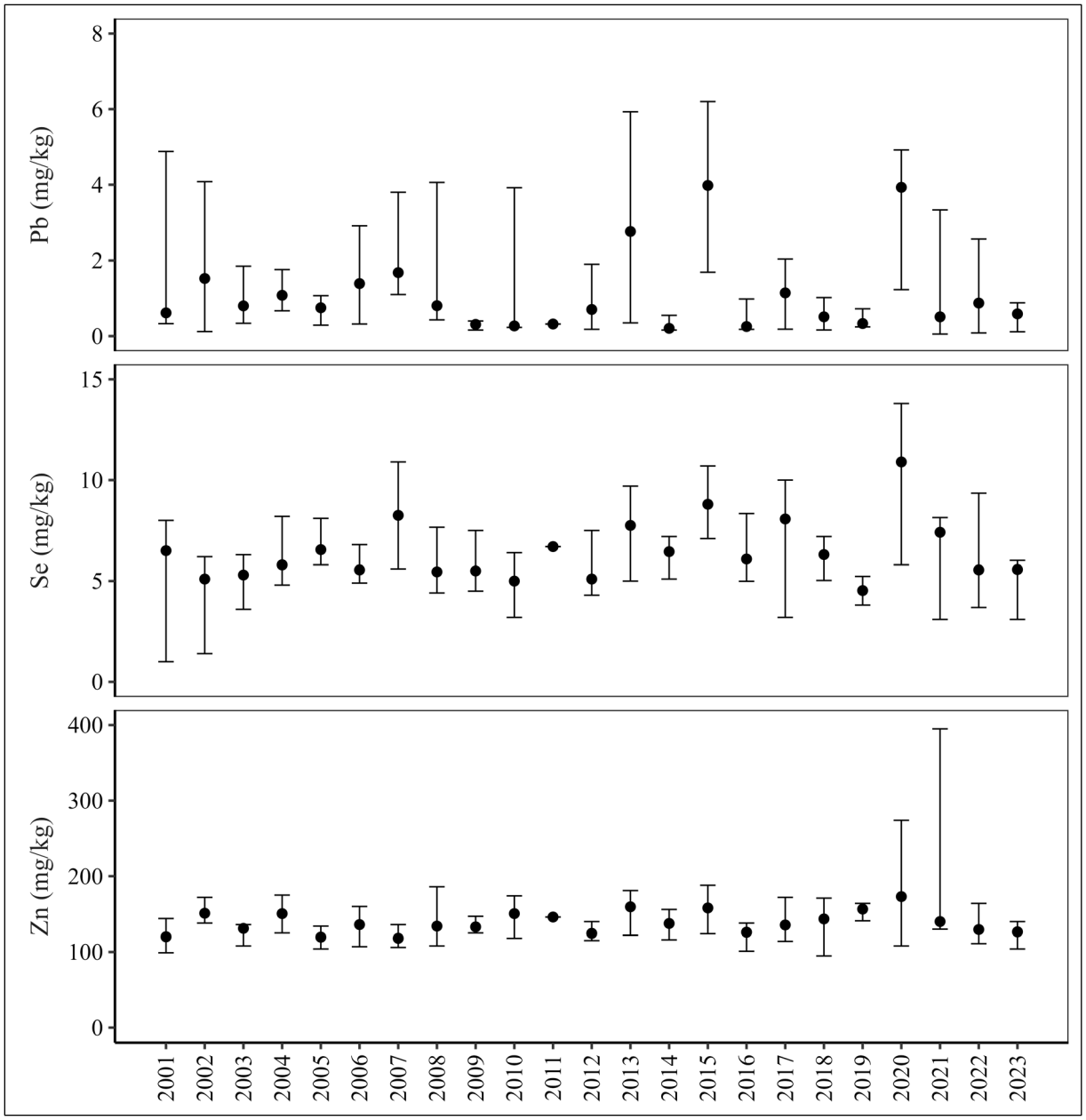

Figure 32.–Tributary Creek Site 9 whole body Dolly Varden Pb, Se, and Zn concentrations, 2001–2023.

Note: Minimum, median, and maximum concentrations presented.

TRIBUTARY CREEK SITE 1847

On July 12, 2023, we sampled Tributary Creek Sites 1847. We measured stream discharge of 0.05 ft^3/s (31 gpm) at 1300 hours and Hecla environmental staff measured basic water quality at 1200 hours (Table 8).

Table 8.–Greens Creek Site 1847 water quality data, 2023.

Sample Date	Sample Site	Temperature (°C)	Conductivity (µS/cm)	pH	Discharge (ft^3/s)
07/12/2023	1847	12.3	78.7	7.55	<0.05

Periphyton: Chlorophyll Density and Composition

The 2023 Tributary Creek Site 1847 mean Chl-a density was 5.29 mg/m^2, within the lower range of mean densities observed 2018–2022 (Figure 33). The samples contained about 95% Chl-a, 5% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Figure 34).

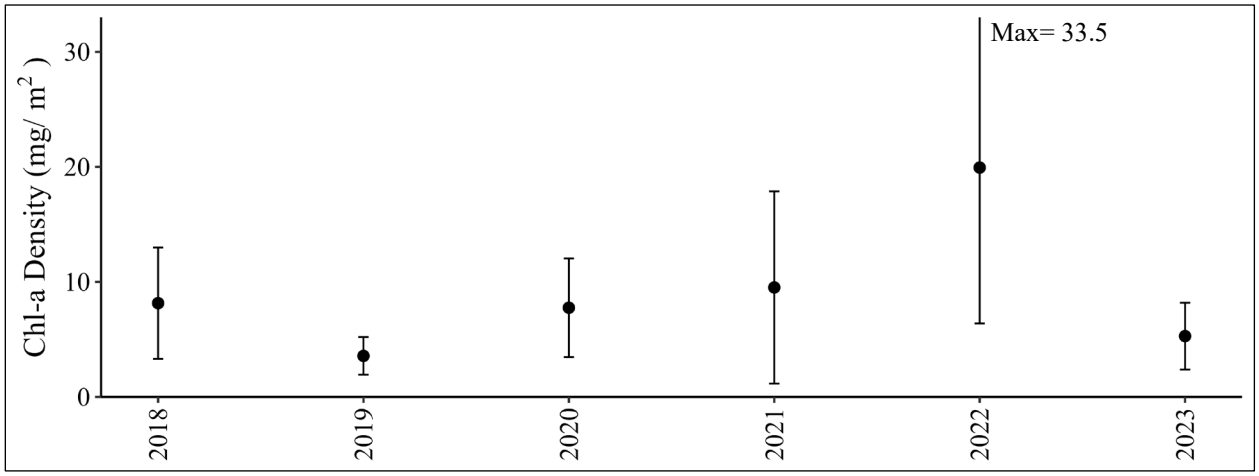

Figure 33.–Tributary Creek Site 1847 mean chlorophyll a densities ± 1 SD, 2018–2023.

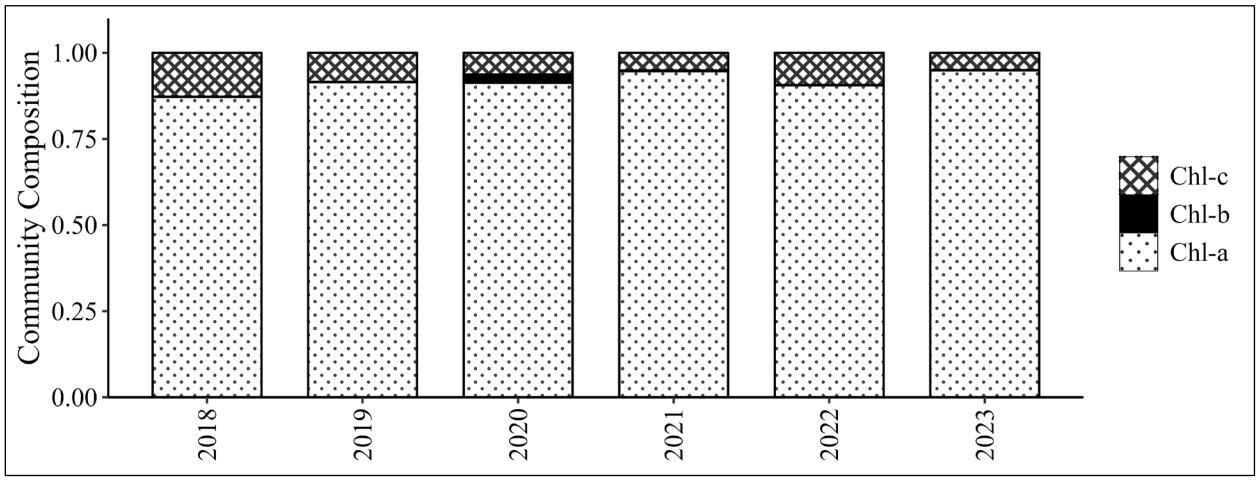

Figure 34.–Tributary Creek Site 1847 mean proportions of chlorophylls a, b, and c (2018–2023).

Benthic Macroinvertebrate Density and Community Composition

The 2023 Tributary Creek Site 1847 BMI mean density estimate is 3,962 BMI/m^2 and we identified 33 taxa, within the upper range of BMI densities and taxa observed 2018–2022 (Table 9; Figures 35, 36). We estimate mean EPT density at 2,144 EPT/m^2, within the upper range observed, accounting for 54% of the samples. Dominant taxa were Diptera of the family Chironomidae (29%) and Ephemeroptera of the family Heptageniidae (22%).

Table 9.–Tributary Creek Site 1847 benthic macroinvertebrate data summary, 2018–2023.

	2018	2019	2020	2021	2022	2023
Mean EPT density (per m^2)	1,161	2,449	1,064	1,932	2,397	2,144
Mean BMI density (per m^2)	2,192	3,555	2,517	2,860	3,653	3,962
Number of EPT Taxa	15	13	15	13	15	19
Number of BMI Taxa	29	28	29	25	26	33
% EPT	53	69	42	68	66	54

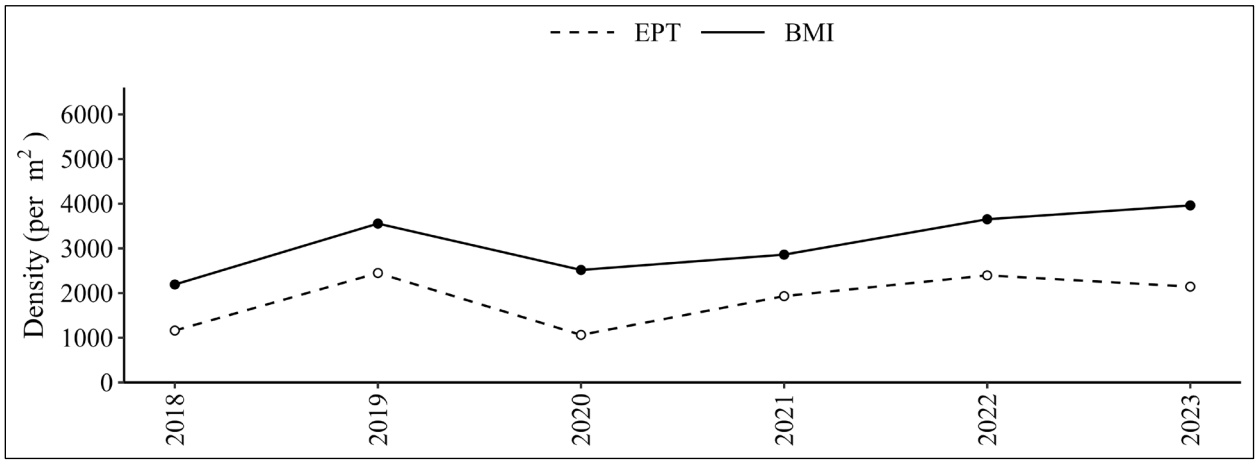

Figure 35.–Tributary Creek Site 1847 mean EPT and BMI densities 2018–2023.

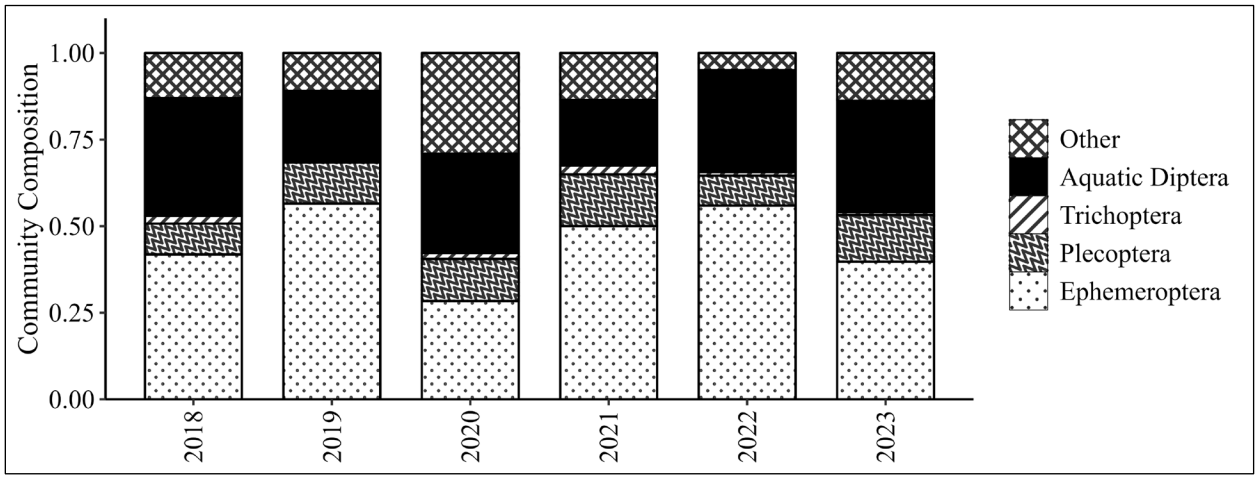

Figure 36.–Tributary Creek Site 1847 mean BMI community composition, 2018–2023.

COMPARISONS AMONG SITES

Periphyton: Chlorophyll Density and Composition

In 2023, mean Chl-a density at Site 63 (5.85 mg/m^2) was similar to Site 54 (5.94 mg/m^2). The Tributary Creek Site 9 mean Chl-a density (9.53 mg/m^2) was higher than at Site 1847 (5.29 mg/m^2), for the first time since sampling began in 2018. Periphyton samples collected at all sites generally contained about 90% Chl-a, nearly 0% Chl-b, and about 10% Chl-c each year.

Greens Creek mean Chl-a densities at Sites 48/63 and 54 followed a similar trend since 2001, except higher Chl-a concentrations were observed at Site 54 2020–2022 (Figure 37). Despite the environmental, geomorphic, hydrologic and overall stream characteristic differences between Tributary and Greens Creeks watersheds, the Tributary Creek Site 9 mean Chl-a densities generally followed the same trend as the Greens Creek data between 2001 and 2023. Tributary Creek samples had less variability than Greens Creek.

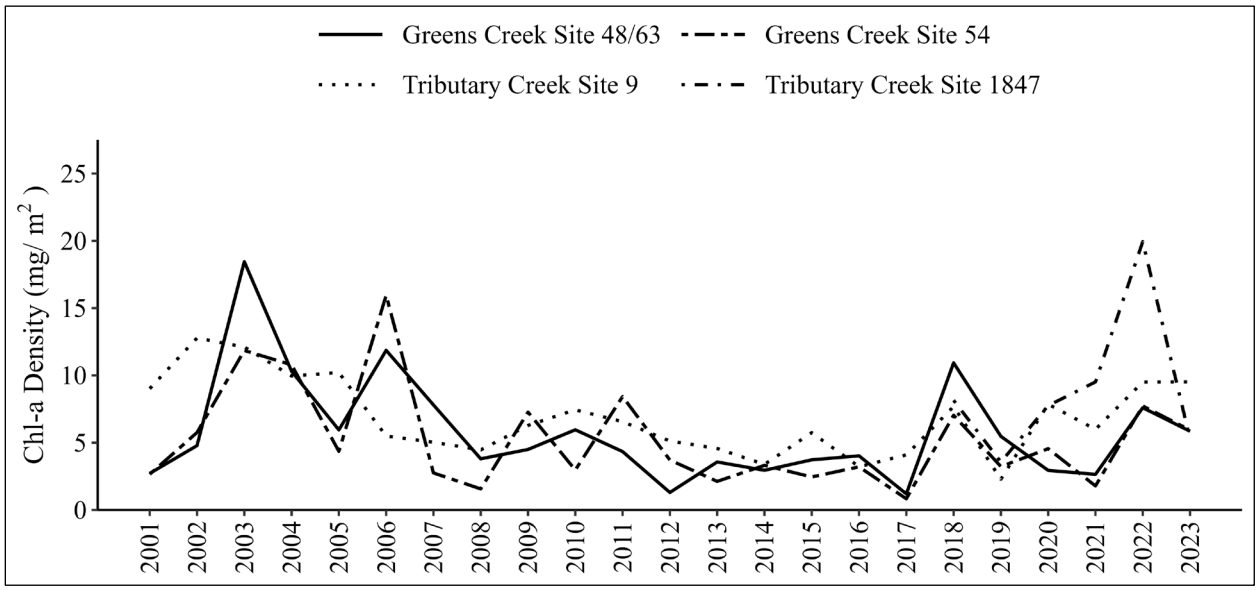

Figure 37.–Greens Creek and Tributary Creek mean chlorophyll a densities, 2001–2023.
Note: Site 48 data collected 2001–2017, and Site 63 data collected 2018–2023.

Benthic Macroinvertebrate Density and Community Composition

In 2023 at Greens Creek Sites, we observed the greatest EPT density (5,506 EPT/m^2) at Site 54 while Site 63 EPT density (1,574 EPT/m^2) was among the lowest observed (Figure 38). Tributary Creek Site 9 EPT density (3,251 EPT/m^2) was greater than Site 1847 (2,144 EPT/m^2). We observed high numbers of BMI taxa at all sites, except Site 63 which has declined since 2020 though remains within ranges previously observed 2001–2022 (Figure 39).

Despite the difference in stream conditions among Tributary and Greens Creeks, we generally observed mean EPT densities following a similar trend 2001–2023. Tributary Creek Site 9 has less variability and generally lower EPT densities than Greens Creek Sites and Tributary Creek Site 1847; except in 2023 in which Site 9 had higher EPT density than Site 1847 and Greens Creek Site 63. At Greens Creek sites, EPT insects usually composed about 90% of samples, whereas in Tributary Creek EPT insects usually composed less than 60% of samples.

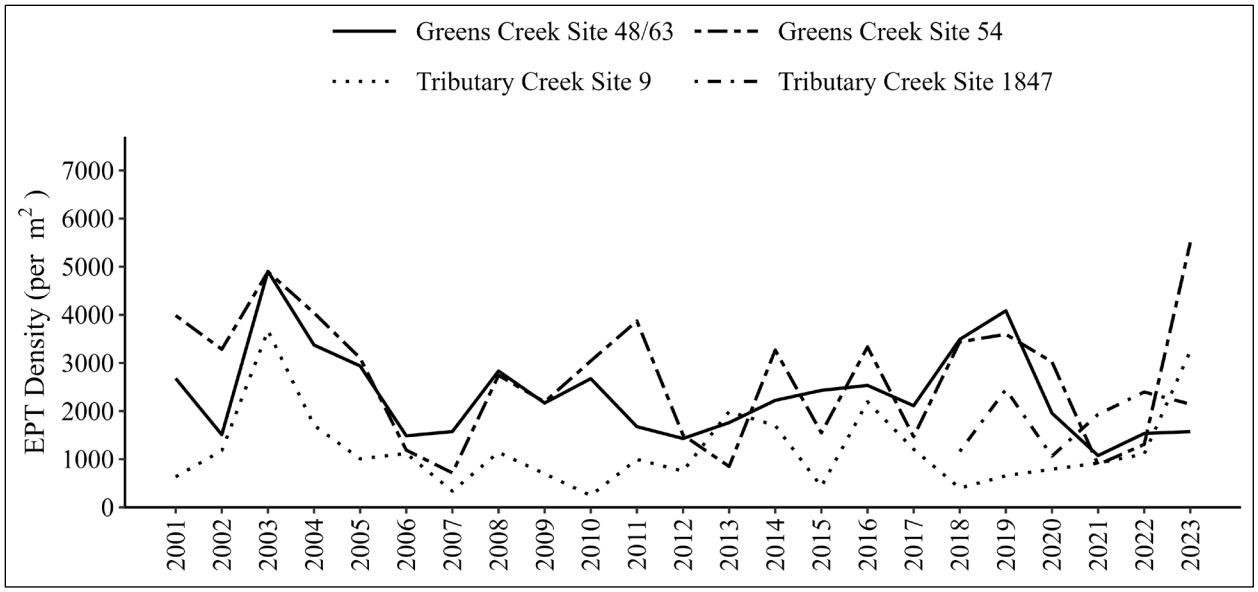

Figure 38.–Greens Creek and Tributary Creek mean EPT densities, 2001–2023.
Note: Site 48 data collected 2001–2017; Site 63 data collected 2018–2023.

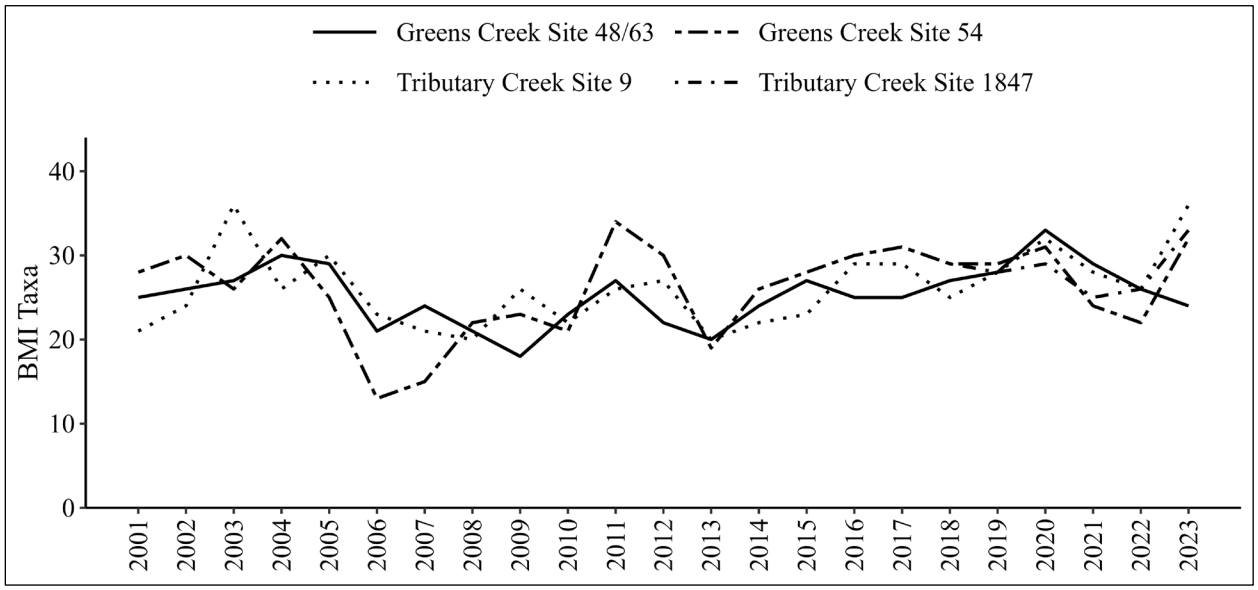

Figure 39.–Greens Creek and Tributary Creek BMI taxa richness, 2001–2023.
Note: Site 48 data collected 2001–2017; Site 63 data collected 2018–2023.

Juvenile Fish Abundance and Condition

For Greens Creek Sites 48/63 and 54 from 2001–2023, the number of Dolly Varden captured during a single trapping event followed a similar trend, with occasionally more captures at Site 54 (Figure 40). We capture more juvenile coho salmon than Dolly Varden at Tributary Creek Site 9 each year. At all sites most years, we captured several age classes of Dolly Varden, and the mean fish condition was about 1.0 for both Dolly Varden and coho salmon. 2023 was the first year we captured juvenile coho salmon (4) at Site 63, indicating adult coho salmon passed the weir near the mine portal, which has been a fish passage block since construction in the late 1980s.

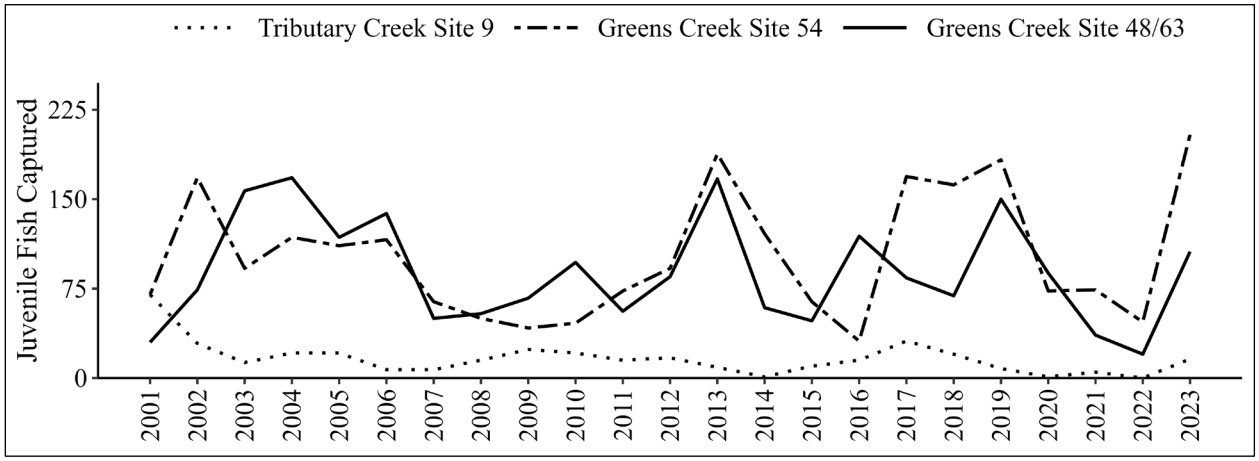

Figure 40.–Greens Creek and Tributary Creek Dolly Varden captured, 2001–2023.

Note: Site 54 2001–2010 data extrapolated to 50 m sample reach for comparison. Site 48 data collected 2001–2017, and Site 63 data collected 2018–2023.

Juvenile Fish Element Concentrations

In 2023, samples collected at Tributary Creek had a greater median Hg concentration than the Greens Creek samples, and lower median concentrations of Cd, Cu, and Zn (Figure 41). At all sites, most median element concentrations were within ranges observed in whole body Dolly Varden sample sites within mining-related influence elsewhere in Alaska (Legere and Timothy 2016).

For Greens Creek Sites 48/63 and 54 from 2001–2023, Dolly Varden element concentrations followed a similar trend, with the exception of Site 54 which had a Pb concentration spike in 2022 (the 2012 sample Cu concentrations are considered to be laboratory error). Greens Creek sites have higher Zn concentrations compared to Tributary Creek Site 9, however Site 9 Dolly Varden element concentrations 2001–2023 are higher in Ag and Hg and more variable in Cd, Pb, and Se compared to Greens Creek samples (Figures 42, 43).

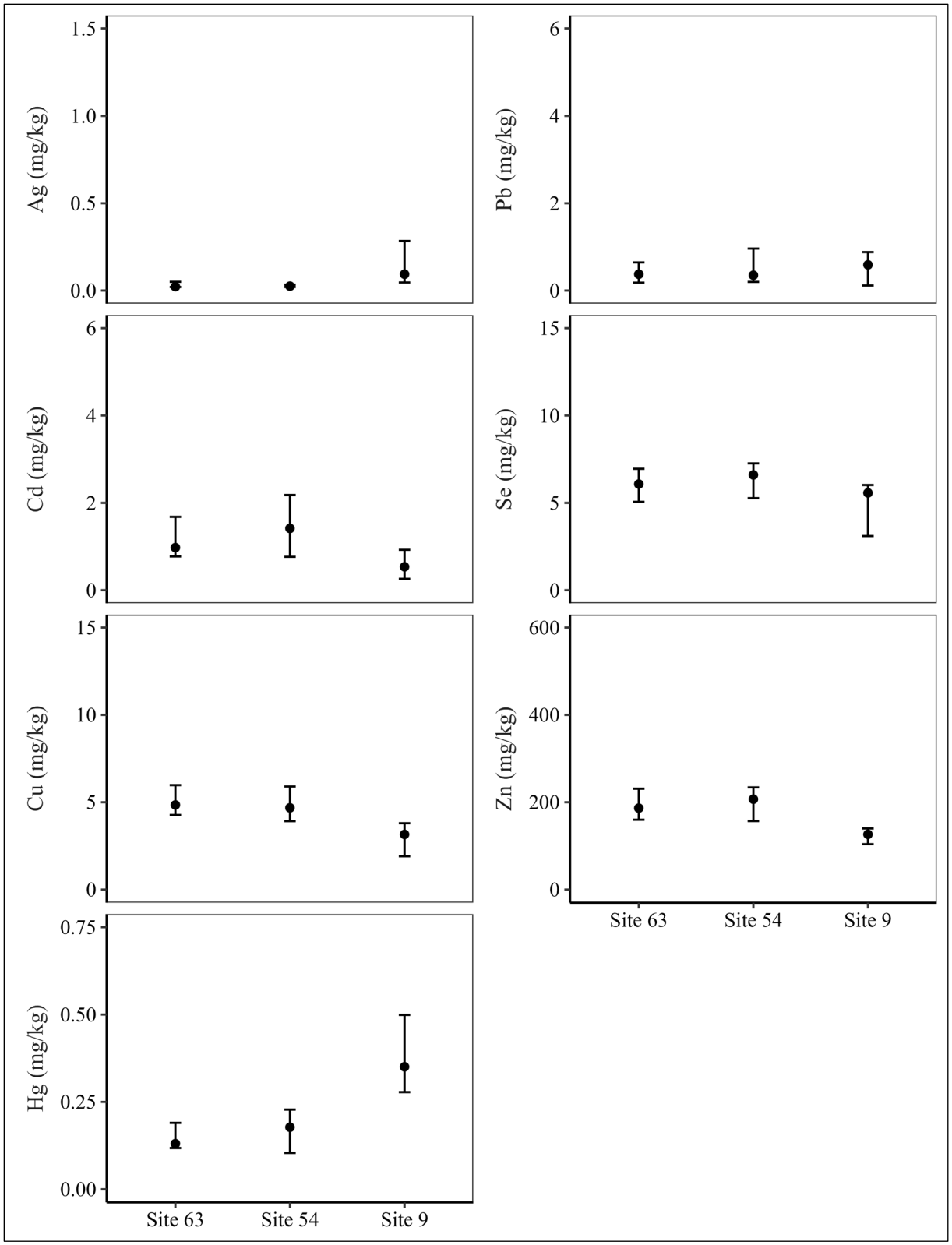

Figure 41.–Greens Creek and Tributary Creek whole body Dolly Varden element concentrations, 2023.
Note: Minimum, median, and maximum concentrations presented.

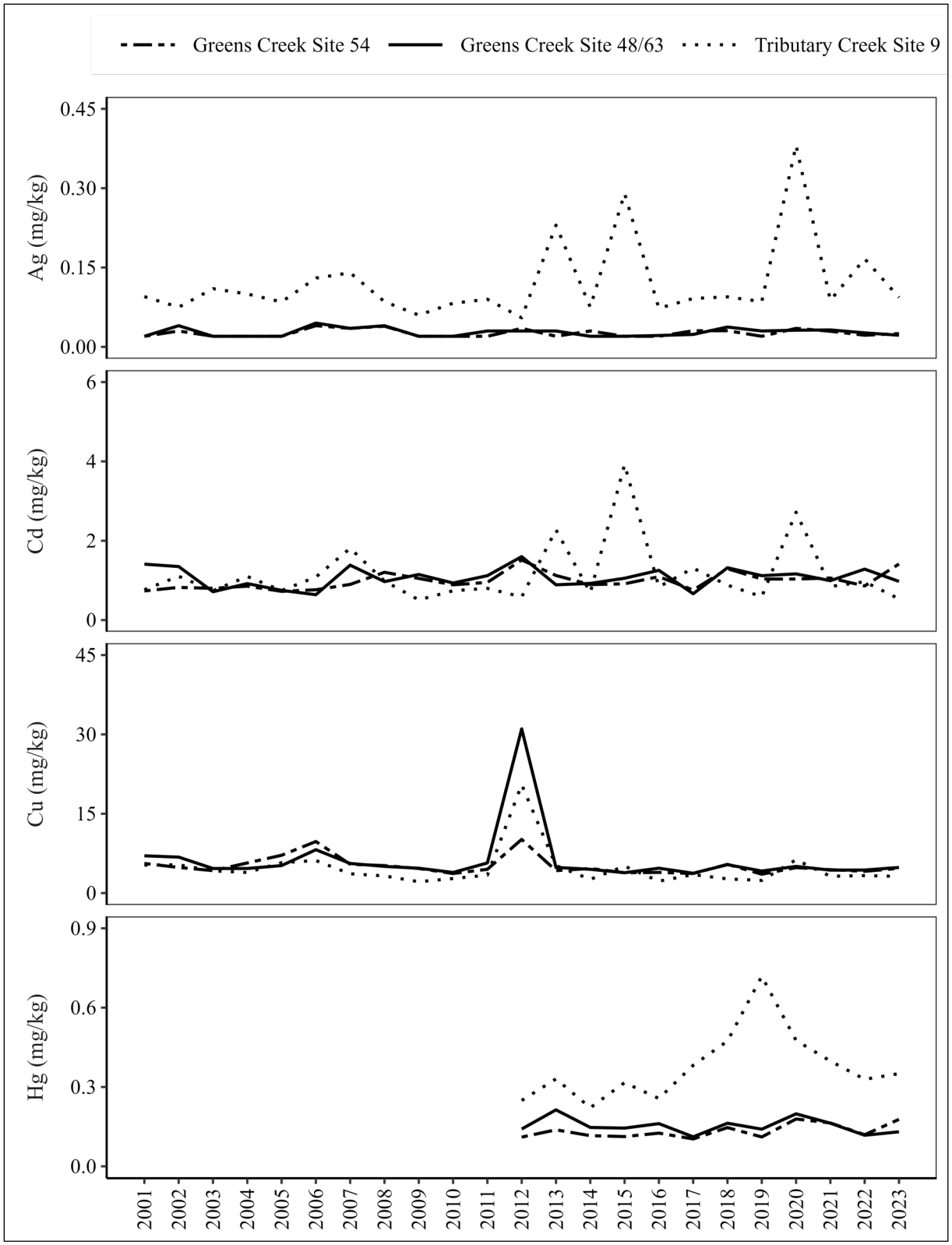

Figure 42.–Greens Creek and Tributary Creek whole body Dolly Varden median Ag, Cd, and Cu concentrations, 2001–2023, and median Hg concentrations, 2012–2023.

Note: Solid line 2001–2017 is Site 48; 2018–2023 is Site 63.

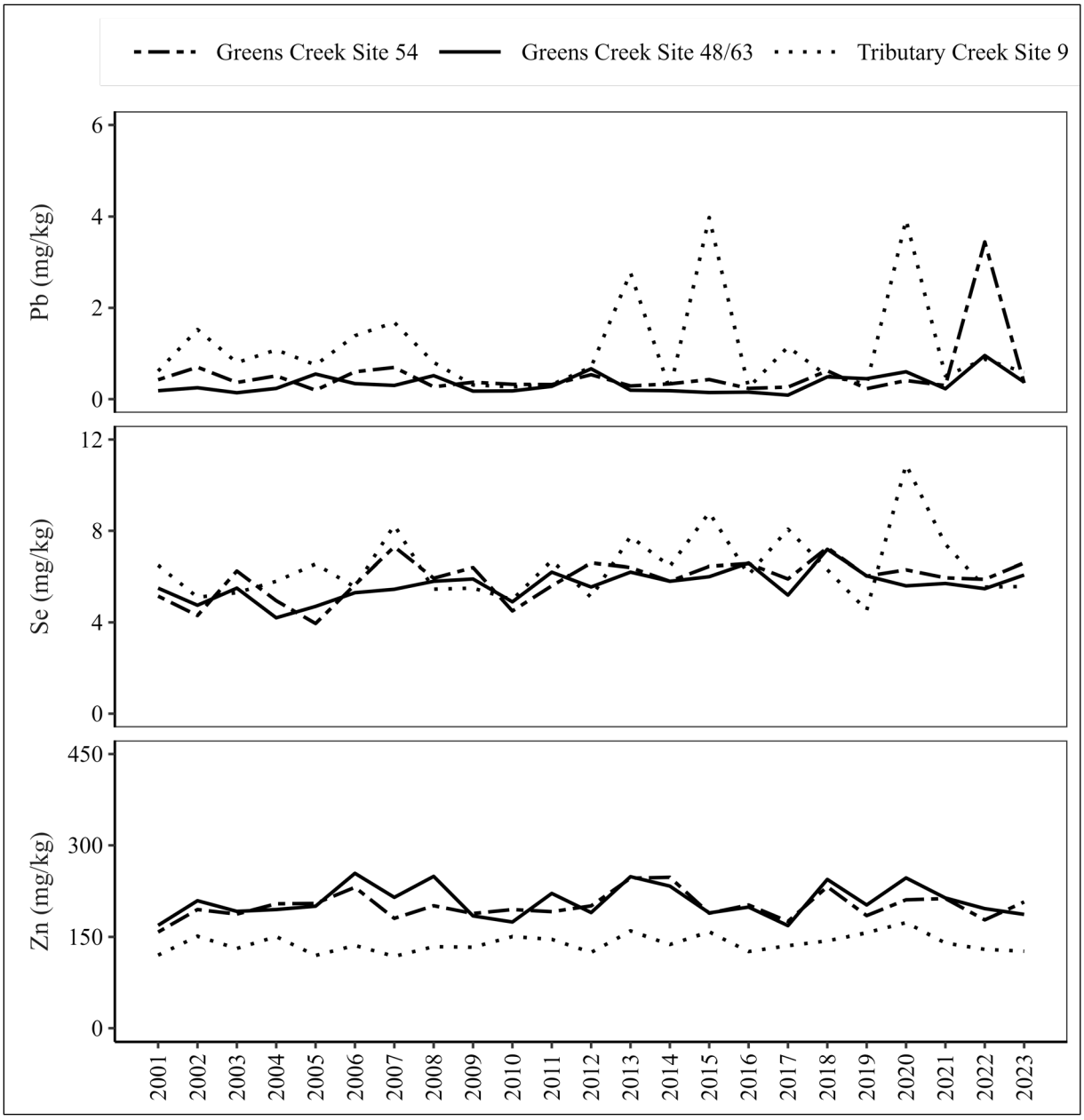

Figure 43.–Greens Creek and Tributary Creek whole body Dolly Varden median Pb, Se, and Zn concentrations, 2001–2023.

Note: Solid line 2001–2017 is Site 48; 2018–2023 is Site 63.

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APPENDIX A: CHLOROPHYLL DATA

Appendix A.1.–Greens Creek Site 48 chlorophylls a, b, and c densities, 2001–2017.

	7/23/2001			7/23/2002			7/22/2003			7/21/2004		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.91	0.01	0.14	5.34	0.00	0.29	12.92	0.00	1.26	18.05	0.00	2.03
	1.83	0.00	0.18	4.27	0.00	0.21	8.65	0.03	1.57	6.73	0.00	0.69
	5.61	0.00	0.69	6.62	0.00	0.71	3.84	0.09	0.39	8.97	0.00	0.90
	0.31	0.08	0.06	2.99	0.00	0.25	12.18	0.01	0.64	12.82	0.00	1.45
	2.96	0.04	0.36	5.34	0.00	0.75	17.19	0.00	0.72	5.45	0.00	0.62
	5.44	0.00	0.62	6.62	0.00	0.75	17.19	0.02	0.86	20.40	0.00	2.15
	3.38	0.00	0.47	6.09	0.00	0.73	33.21	0.00	2.14	6.30	0.00	0.45
	1.87	0.03	0.15	ND	ND	ND	24.24	0.13	0.99	11.64	0.00	1.38
	2.63	0.14	0.14	2.99	0.00	0.36	19.76	0.00	0.57	7.48	0.00	0.65
	1.23	0.02	0.16	2.78	0.00	0.15	35.35	0.00	0.89	5.23	0.00	0.55
mean	2.72	0.03	0.30	4.78	0.00	0.47	18.45	0.03	1.00	10.31	0.00	1.09
minimum	0.31	0.00	0.06	2.78	0.00	0.15	3.84	0.00	0.39	5.23	0.00	0.45
maximum	5.61	0.14	0.69	6.62	0.00	0.75	35.35	0.13	2.14	20.40	0.00	2.15

	7/22/2005			7/20/2006			7/20/2007			7/22/2008		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.85	0.00	0.01	8.33	0.00	0.80	6.62	0.00	0.16	1.50	0.00	0.09
	4.70	0.00	0.51	11.43	0.00	0.71	5.55	0.00	0.23	4.70	0.00	0.16
	6.62	0.00	0.27	10.68	0.00	1.25	7.48	0.00	0.33	2.67	0.00	0.24
	6.19	0.00	0.51	20.08	0.00	2.04	11.64	0.00	1.39	2.14	0.00	0.17
	11.11	0.00	0.92	10.57	0.00	0.98	6.94	0.00	0.47	0.85	0.00	0.02
	5.66	0.00	0.51	14.10	0.00	1.72	11.11	0.00	0.54	12.60	0.00	0.33
	7.69	0.00	0.53	16.98	0.00	1.76	11.75	0.01	0.60	2.78	0.00	0.19
	5.13	0.00	0.29	5.23	0.00	1.74	4.81	0.00	0.29	6.30	0.00	0.74
	2.46	0.02	0.28	16.87	0.00	1.73	8.12	0.00	1.10	1.28	0.00	0.14
	9.08	0.00	0.63	4.38	0.00	0.54	4.06	0.00	0.43	3.20	0.00	0.37
mean	5.95	0.00	0.45	11.87	0.00	1.33	7.81	0.00	0.55	3.80	0.00	0.25
minimum	0.85	0.00	0.01	4.38	0.00	0.54	4.06	0.00	0.16	0.85	0.00	0.02
maximum	11.11	0.02	0.92	20.08	0.00	2.04	11.75	0.01	1.39	12.60	0.00	0.74

	7/21/2009			7/20/2010			7/21/2011			7/21/2012		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	3.20	0.00	0.49	8.54	0.00	0.44	4.49	0.00	0.50	**0.36**	ND	ND
	1.50	0.00	0.25	4.59	0.00	0.61	6.51	0.00	0.59	0.69	0.00	0.10
	4.17	0.11	0.59	5.13	0.00	0.27	2.88	0.00	0.30	1.29	0.00	0.12
	5.66	0.07	0.73	3.10	0.00	0.26	2.59	0.17	0.05	2.56	0.00	0.39
	3.42	0.06	0.50	7.58	0.00	0.29	3.31	0.00	0.36	0.85	0.00	0.00
	8.22	0.13	0.95	5.55	0.00	0.55	5.13	0.00	0.55	1.60	0.00	0.26
	0.43	0.11	0.11	10.68	0.00	0.64	7.16	0.00	1.06	1.82	0.00	0.29
	1.39	0.18	0.29	7.69	0.00	0.41	5.66	0.00	0.49	1.92	0.00	0.28
	7.80	0.00	0.89	3.63	0.00	0.25	0.85	0.00	0.11	0.32	0.00	0.08
	9.18	0.17	1.19	3.10	0.02	0.15	4.81	0.00	0.49	1.60	0.00	0.16
mean	4.50	0.08	0.60	5.96	0.00	0.39	4.34	0.02	0.45	1.30	0.00	0.19
minimum	0.43	0.00	0.11	3.10	0.00	0.15	0.85	0.00	0.05	0.32	0.00	0.00
maximum	9.18	0.18	1.19	10.68	0.02	0.64	7.16	0.17	1.06	2.56	0.00	0.39

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll a not detected.

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	7/24/2013			7/24/2014			7/15/2015			7/12/2016		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	2.03	0.00	0.12	4.81	0.00	0.31	2.14	0.00	0.18	4.38	0.00	0.60
	1.50	0.00	0.11	0.60	0.00	0.12	11.96	0.00	0.90	3.84	0.00	0.43
	4.59	0.00	0.33	1.60	0.00	0.10	4.70	0.00	0.31	7.58	0.00	0.88
	2.03	0.00	0.19	6.62	0.00	0.00	3.31	0.00	0.24	6.51	0.00	0.75
	6.94	0.00	0.38	ND	ND	ND	5.55	0.00	0.25	2.24	0.00	0.26
	6.62	0.00	0.39	5.66	0.00	0.33	2.46	0.00	0.18	2.99	0.00	0.47
	1.60	0.00	0.26	0.55	0.00	0.02	1.38	0.00	0.08	3.20	0.00	0.45
	1.39	0.00	0.07	0.43	0.00	0.07	2.35	0.00	0.05	2.35	0.00	0.31
	3.74	0.00	0.46	1.24	0.00	0.03	2.99	0.00	0.22	2.67	0.00	0.31
	5.23	0.00	0.70	5.02	0.24	0.38	0.43	0.00	0.03	4.49	0.00	0.61
mean	3.57	0.00	0.30	2.95	0.03	0.15	3.73	0.00	0.24	4.03	0.00	0.51
minimum	1.39	0.00	0.07	0.43	0.00	0.00	0.43	0.00	0.03	2.24	0.00	0.26
maximum	6.94	0.00	0.70	6.62	0.24	0.38	11.96	0.00	0.90	7.58	0.00	0.88

	7/12/2017		
mg/m^2	Chl-a	Chl-b	Chl-c
	0.55	0.00	0.02
	0.64	0.00	0.07
	0.43	0.01	0.04
	2.99	0.00	0.39
	0.96	0.00	0.09
	0.64	0.00	0.16
	2.14	0.00	0.28
	1.70	0.00	0.26
	0.96	0.00	0.09
	0.96	0.00	0.10
mean	1.20	0.00	0.15
minimum	0.43	0.00	0.02
maximum	2.99	0.01	0.39

Appendix A.2.–Greens Creek Site 63 chlorophylls a, b, and c densities, 2018–2023.

	7/11/2018			7/9/2019			7/16/2020			7/12/2021		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	ND	ND	ND	4.17	0.00	0.33	3.10	0.00	0.38	1.82	0.00	0.25
	5.45	0.00	0.79	4.59	0.00	0.29	**0.25**	ND	ND	3.84	0.00	0.59
	9.29	0.00	1.77	2.89	0.00	0.30	2.06	0.00	0.25	6.62	0.00	1.00
	7.37	0.00	0.87	4.73	0.00	0.35	3.44	0.00	0.32	1.60	0.00	0.17
	ND	ND	ND	2.78	0.00	0.13	3.74	0.00	0.58	1.39	0.00	0.12
	23.07	0.00	4.01	5.34	0.00	0.48	0.32	0.00	0.08	3.63	0.00	0.55
	8.22	0.00	0.96	2.88	0.00	0.21	5.66	0.00	0.71	1.60	0.00	0.26
	4.38	0.00	0.64	13.03	0.00	1.09	6.94	0.00	0.52	1.17	0.00	0.13
	15.06	0.00	2.28	5.98	0.00	0.75	1.88	0.00	0.21	1.71	0.00	0.31
	14.63	0.00	2.28	8.33	0.00	0.47	2.02	0.00	0.28	3.10	0.00	0.48
mean	10.93	0.00	1.70	5.47	0.00	0.44	2.94	0.00	0.37	2.65	0.00	0.39
minimum	4.38	0.00	0.64	2.78	0.00	0.13	0.25	0.00	0.08	1.17	0.00	0.12
maximum	23.07	0.00	4.01	13.03	0.00	1.09	6.94	0.00	0.71	6.62	0.00	1.00

	7/12/2022			7/11/2023		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	2.94	0.00	0.29	11.11	0.00	1.30
	12.02	0.00	1.56	7.48	0.00	1.29
	8.01	0.00	1.04	5.32	0.00	0.73
	7.52	0.00	1.12	3.85	0.00	0.5
	4.49	0.00	0.44	13.35	0.00	1.79
	6.09	0.00	0.98	3.74	0.00	0.62
	9.61	0.00	1.23	2.44	0.00	0.26
	13.24	0.00	1.90	3.52	0.00	0.54
	6.73	0.00	0.68	6.19	0.00	0.93
	5.34	0.00	1.08	1.50	0.00	0.21
mean	7.60	0.00	1.03	5.85	0.00	0.82
minimum	2.94	0.00	0.29	1.50	0.00	0.21
maximum	13.24	0.00	1.90	13.35	0.00	1.79

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll a not detected.

Appendix A.3.–Greens Creek Site 54 chlorophylls a, b, and c densities, 2001–2023.

	7/23/2001			7/23/2002			7/22/2003			7/21/2004		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.60	0.01	0.15	2.88	0.00	0.30	13.24	0.00	1.05	17.19	0.00	2.02
	3.10	0.05	0.41	9.61	0.00	1.02	8.33	0.00	0.79	9.72	0.00	0.93
	3.61	0.00	0.21	8.12	0.00	0.24	14.20	0.00	1.45	8.76	0.00	0.67
	2.97	0.00	0.29	4.49	0.00	0.38	6.09	0.00	0.62	32.04	0.00	3.66
	1.88	0.00	0.01	5.34	0.00	0.53	15.49	0.00	1.74	5.23	0.00	0.42
	1.78	0.00	0.19	2.46	0.87	1.26	10.68	0.00	1.06	3.74	0.00	0.31
	4.95	0.00	0.22	6.51	0.00	0.64	5.55	0.00	0.39	12.82	0.00	1.35
	1.46	0.00	0.10	4.91	0.00	0.40	16.34	0.00	1.72	1.92	0.03	0.09
	1.69	0.00	0.14	4.81	0.00	0.45	12.60	0.00	1.07	10.47	0.00	1.09
	3.48	0.00	0.16	8.44	0.00	0.79	16.02	0.00	1.75	5.98	0.00	0.53
mean	2.65	0.01	0.19	5.76	0.09	0.60	11.85	0.00	1.16	10.79	0.00	1.11
minimum	1.46	0.00	0.01	2.46	0.00	0.24	5.55	0.00	0.39	1.92	0.00	0.09
maximum	4.95	0.05	0.41	9.61	0.87	1.26	16.34	0.00	1.75	32.04	0.03	3.66

	7/22/2005			7/20/2006			7/20/2007			7/22/2008		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	10.36	0.00	0.54	19.54	0.00	1.62	0.43	0.04	0.04	2.99	0.00	0.29
	2.56	0.00	0.26	5.66	0.00	0.76	**0.24**	ND	ND	1.17	0.02	0.00
	3.31	0.00	0.17	28.73	0.00	1.19	1.39	0.04	0.11	1.50	0.00	0.19
	2.88	0.00	0.12	23.28	0.00	2.63	4.27	0.00	0.48	1.71	0.00	0.13
	5.66	0.00	0.38	4.59	0.00	0.47	**0.24**	ND	ND	2.24	0.00	0.09
	2.99	0.00	0.13	27.34	0.00	2.22	3.31	0.00	0.38	2.14	0.00	0.11
	4.27	0.00	0.18	4.27	0.00	0.38	8.01	0.00	0.98	2.46	0.00	0.25
	4.38	0.00	0.31	8.86	0.00	0.94	**0.24**	ND	ND	0.96	0.00	0.01
	4.06	0.00	0.16	31.72	0.00	3.17	2.99	0.00	0.39	**0.24**	ND	ND
	3.10	0.00	0.16	5.55	0.00	0.68	6.41	0.00	0.81	**0.24**	ND	ND
mean	4.36	0.00	0.24	15.95	0.00	1.41	2.75	0.01	0.46	1.57	0.00	0.13
minimum	2.56	0.00	0.12	4.27	0.00	0.38	0.24	0.00	0.04	0.24	0.00	0.00
maximum	10.36	0.00	0.54	31.72	0.00	3.17	8.01	0.04	0.98	2.99	0.02	0.29

	7/21/2009			7/20/2010			7/21/2011			7/21/2012		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	8.01	0.11	1.06	2.67	0.00	0.29	9.61	0.00	0.64	5.54	0.00	0.24
	7.58	0.11	1.13	6.73	0.00	0.69	0.43	0.00	0.06	0.11	0.00	0.04
	6.84	0.07	0.89	4.38	0.00	0.74	3.42	0.00	0.32	2.65	0.00	0.11
	9.18	0.09	0.96	2.14	0.00	0.25	3.42	0.00	0.33	1.82	0.00	0.10
	ND	ND	ND	5.23	0.00	0.67	41.76	0.00	3.02	1.07	0.00	0.04
	8.33	0.15	1.11	1.71	0.04	0.25	5.23	0.00	0.64	1.17	0.00	0.13
	11.32	0.20	1.57	1.39	0.02	0.11	10.36	0.00	0.45	0.75	0.00	0.06
	5.34	0.17	0.66	3.20	0.00	0.46	7.16	0.00	0.53	19.54	0.00	1.10
	4.49	0.10	0.63	2.04	0.00	0.21	0.64	0.00	0.07	4.06	0.00	0.30
	4.38	0.10	0.43	0.21	0.01	0.05	2.24	0.00	0.29	0.43	0.01	0.04
mean	7.27	0.12	0.94	2.97	0.01	0.37	8.43	0.00	0.64	3.71	0.00	0.22
minimum	4.38	0.07	0.43	0.21	0.00	0.05	0.43	0.00	0.06	0.11	0.00	0.04
maximum	11.32	0.20	1.57	6.73	0.04	0.74	41.76	0.00	3.02	19.54	0.01	1.10

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	7/24/2013			7/24/2014			7/15/2015			7/12/2016		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	2.56	0.00	0.26	6.51	0.00	0.60	1.07	0.00	0.13	2.46	0.00	0.19
	2.14	0.00	0.23	4.91	0.00	0.92	1.60	0.00	0.23	3.42	0.00	0.36
	1.28	0.00	0.24	4.59	0.00	0.42	1.82	0.00	0.21	5.66	0.00	0.87
	2.14	0.00	0.37	1.82	0.00	0.11	4.27	0.00	0.34	1.17	0.00	0.11
	0.53	0.00	0.02	7.05	0.00	0.56	6.09	0.00	0.43	1.92	0.00	0.17
	0.43	0.00	0.07	2.67	0.00	0.45	2.46	0.00	0.15	5.77	0.00	0.57
	ND	ND	ND	1.50	0.00	0.17	2.24	0.00	0.16	2.24	0.00	0.27
	2.03	0.00	0.28	2.46	0.00	0.20	1.92	0.00	0.10	2.14	0.00	0.12
	5.87	0.00	0.76	**0.05**	ND	ND	1.33	0.00	0.08	3.52	0.00	0.45
	2.14	0.00	0.21	1.60	0.00	0.26	1.71	0.00	0.15	3.74	0.00	0.36
mean	2.12	0.00	0.27	3.32	0.00	0.41	2.45	0.00	0.20	3.20	0.00	0.35
minimum	0.43	0.00	0.02	0.05	0.00	0.11	1.07	0.00	0.08	1.17	0.00	0.11
maximum	5.87	0.00	0.76	7.05	0.00	0.92	6.09	0.00	0.43	5.77	0.00	0.87

	7/12/2017			7/10/2018			7/10/2019			7/16/2020		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.17	0.00	0.08	10.57	0.00	2.03	2.56	0.00	0.19	8.44	0.00	0.61
	0.19	ND	ND	7.05	0.00	1.13	0.75	0.00	0.05	6.93	0.00	0.58
	0.64	0.00	0.11	9.93	0.00	1.57	3.72	0.00	0.28	8.26	0.00	1.05
	2.99	0.00	0.38	8.12	0.00	1.55	8.22	0.00	0.80	2.24	0.00	0.27
	0.43	0.00	0.07	6.84	0.00	0.84	4.62	0.00	0.50	4.78	0.00	0.47
	0.96	0.00	0.09	1.51	0.00	0.29	5.98	0.00	0.90	3.74	0.00	0.50
	0.85	0.00	0.11	8.54	0.00	1.03	0.96	0.00	0.09	7.62	0.00	0.78
	0.19	ND	ND	6.09	0.00	0.98	1.82	0.00	0.13	2.02	0.00	0.19
	0.37	0.00	0.18	3.63	0.00	0.50	1.82	0.00	0.05	0.55	0.00	0.02
	0.55	0.00	0.12	8.12	0.00	1.16	1.82	0.00	0.09	0.96	0.00	0.09
mean	0.83	0.00	0.14	7.04	0.00	1.11	3.23	0.00	0.31	4.55	0.00	0.46
minimum	0.19	0.00	0.07	1.51	0.00	0.29	0.75	0.00	0.05	0.55	0.00	0.02
maximum	2.99	0.00	0.38	10.57	0.00	2.03	8.22	0.00	0.90	8.44	0.00	1.05

	7/12/2021			7/12/2022			7/13/2023		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.85	0.00	0.03	2.88	0.00	0.33	11.64	0.00	1.63
	0.56	0.00	0.06	14.74	0.00	1.77	6.41	0.00	0.84
	0.97	0.00	0.13	2.88	0.00	0.67	7.90	0.00	0.99
	2.65	0.00	0.43	14.20	0.00	2.12	5.79	0.00	0.73
	1.07	0.00	0.04	9.40	0.00	1.48	4.96	0.00	0.51
	1.39	0.00	0.13	12.07	0.00	1.68	5.55	0.00	0.89
	1.50	0.00	0.20	6.94	0.00	1.85	2.25	0.00	0.32
	0.75	0.00	0.05	5.98	0.00	0.66	7.05	0.00	0.95
	1.51	0.00	0.22	5.23	0.00	1.04	4.81	0.00	0.52
	6.62	0.00	0.99	2.99	0.00	0.55	2.99	0.00	0.26
mean	1.79	0.00	0.23	7.73	0.00	1.22	5.94	0.00	0.76
minimum	0.56	0.00	0.03	2.88	0.00	0.33	2.25	0.00	0.26
maximum	6.62	0.00	0.99	14.74	0.00	2.12	11.64	0.00	1.63

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll a not detected.

Appendix A.4.–Tributary Creek Site 9 chlorophylls a, b, and c densities, 2001–2023.

	7/23/2001			7/23/2002			7/23/2003			7/21/2004		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	6.62	0.00	0.79	8.91	0.00	0.52	9.61	0.00	1.26	9.40	0.22	0.80
	11.15	0.00	1.20	16.43	0.95	1.28	17.19	0.00	0.79	5.77	0.00	0.42
	15.05	0.00	1.47	12.65	0.17	0.00	7.69	0.00	0.29	5.45	0.00	0.48
	16.58	0.23	1.51	5.44	0.45	0.07	8.76	0.00	1.11	6.09	0.03	0.38
	3.15	0.00	0.33	23.72	1.21	0.84	10.47	0.00	1.92	14.52	0.02	1.40
	2.59	0.06	0.28	12.75	0.40	0.22	10.79	0.00	1.88	6.51	0.17	0.40
	1.61	0.00	0.01	32.53	0.00	1.89	22.64	0.00	3.98	10.36	0.13	0.80
	6.66	0.00	0.43	4.40	1.50	0.00	12.39	0.00	2.43	6.84	0.04	0.36
	15.21	0.81	1.44	2.94	0.30	0.17	8.54	0.00	1.69	26.17	0.51	2.61
	11.55	0.00	1.51	8.01	1.47	0.27	13.03	0.00	3.86	8.44	0.22	0.53
mean	9.02	0.11	0.90	12.78	0.65	0.53	12.11	0.00	1.92	9.96	0.13	0.82
minimum	1.61	0.00	0.01	2.94	0.00	0.00	7.69	0.00	0.29	5.45	0.00	0.36
maximum	16.58	0.81	1.51	32.53	1.50	1.89	22.64	0.00	3.98	26.17	0.51	2.61

	7/23/2005			7/21/2006			7/20/2007			7/23/2008		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	6.09	0.00	0.25	3.42	0.25	0.19	ND	ND	ND	2.35	0.00	0.12
	8.01	1.28	0.18	4.08	0.40	0.20	5.45	0.08	0.23	6.94	0.00	0.27
	1.82	0.13	0.07	6.94	0.00	0.40	7.26	0.00	0.54	6.30	0.24	0.34
	9.08	0.06	0.29	4.11	0.01	0.32	ND	ND	ND	6.41	0.00	0.25
	4.70	0.00	0.10	4.17	0.00	0.39	ND	ND	ND	2.46	0.12	0.19
	4.70	0.00	0.12	4.78	0.00	0.29	0.85	0.16	0.11	6.19	0.05	0.39
	7.80	0.00	0.20	14.16	0.00	0.57	6.41	0.06	0.24	4.06	0.00	0.13
	14.85	0.00	0.46	4.34	0.01	0.21	7.05	0.24	0.65	4.59	0.00	0.37
	36.10	0.10	1.12	5.23	0.00	0.56	5.02	0.00	0.26	1.60	0.00	0.00
	8.97	0.00	0.26	3.66	0.37	0.26	3.20	0.00	0.23	3.74	0.00	0.28
mean	10.21	0.16	0.31	5.49	0.10	0.34	5.03	0.08	0.32	4.46	0.04	0.23
minimum	1.82	0.00	0.07	3.42	0.00	0.19	0.85	0.00	0.11	1.60	0.00	0.00
maximum	36.10	1.28	1.12	14.16	0.40	0.57	7.26	0.24	0.65	6.94	0.24	0.39

	7/22/2009			7/20/2010			7/20/2011			7/26/2012		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	2.03	0.10	0.16	12.82	0.00	0.39	4.81	0.47	0.08	3.63	0.00	0.25
	5.45	0.17	0.38	6.62	0.00	0.39	3.84	0.00	0.12	8.97	0.00	0.33
	4.38	0.24	0.30	7.69	0.00	0.43	4.91	0.00	0.34	10.68	0.00	0.48
	7.05	0.58	0.33	5.66	0.12	0.32	10.47	0.03	0.50	3.74	0.00	0.25
	9.08	0.36	0.49	9.72	0.88	0.40	5.13	0.00	0.37	1.28	0.00	0.04
	8.76	0.41	0.62	5.98	0.00	0.20	1.71	0.00	0.01	1.71	0.00	0.12
	2.14	0.08	0.09	5.55	0.00	0.40	6.30	0.00	0.44	5.66	0.00	0.29
	18.37	0.66	0.78	10.57	0.28	0.34	9.61	0.00	0.35	6.09	0.00	0.26
	2.35	0.18	0.16	4.06	0.05	0.16	12.50	0.00	0.87	2.14	0.00	0.21
	3.20	0.20	0.33	5.77	0.00	0.32	6.30	0.00	0.17	7.37	0.00	0.40
mean	6.28	0.30	0.36	7.44	0.13	0.34	6.56	0.05	0.33	5.13	0.00	0.26
minimum	2.03	0.08	0.09	4.06	0.00	0.16	1.71	0.00	0.01	1.28	0.00	0.04
maximum	18.37	0.66	0.78	12.82	0.88	0.43	12.50	0.47	0.87	10.68	0.00	0.48

-continued-

	7/23/2013			7/23/2014			7/14/2015			7/11/2016		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	11.00	0.00	0.64	ND	ND	ND	5.13	0.00	0.33	5.66	0.00	0.35
	2.88	0.00	0.19	11.21	0.00	0.63	15.06	0.00	0.94	2.24	0.00	0.13
	5.45	0.00	0.40	1.60	0.00	0.17	2.67	0.00	0.14	1.88	0.00	0.21
	5.02	0.00	0.40	5.87	0.00	0.37	3.63	0.00	0.09	1.82	0.00	0.22
	2.24	0.00	0.15	5.98	0.00	0.60	5.55	0.00	0.47	7.80	0.00	0.90
	2.99	0.00	0.17	0.75	0.00	0.06	2.56	0.00	0.11	1.92	0.00	0.26
	9.51	0.00	0.66	1.71	0.00	0.15	2.88	0.21	0.10	1.33	0.00	0.08
	0.32	0.05	0.15	**0.05**	ND	ND	9.29	0.00	0.87	1.55	0.03	0.16
	3.52	0.00	0.19	0.11	0.00	0.00	6.62	0.00	0.52	3.10	0.00	0.21
	2.78	0.00	0.17	3.20	0.00	0.23	4.06	0.00	0.30	4.91	0.00	0.46
mean	4.57	0.01	0.31	3.39	0.00	0.28	5.75	0.02	0.39	3.22	0.00	0.30
minimum	0.32	0.00	0.15	0.05	0.00	0.00	2.56	0.00	0.09	1.33	0.00	0.08
maximum	11.00	0.05	0.66	11.21	0.00	0.63	15.06	0.21	0.94	7.80	0.03	0.90

	7/11/2017			7/12/2018			7/11/2019			7/15/2020		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	12.82	0.00	1.07	15.59	0.00	1.74	ND	ND	ND	4.91	0.00	0.23
	1.39	0.00	0.02	4.49	0.00	0.51	1.32	0.00	0.15	11.96	0.00	0.51
	1.50	0.00	0.07	20.40	0.00	2.90	0.21	0.00	0.03	5.98	0.00	0.55
	8.44	0.00	0.56	0.21	0.00	0.00	2.75	0.00	0.06	4.38	0.00	0.22
	3.31	0.07	0.15	5.13	0.00	0.61	ND	ND	ND	14.63	0.00	0.77
	1.39	0.00	0.03	10.25	0.00	1.80	4.59	0.00	0.25	6.19	0.00	0.25
	0.43	0.00	0.00	11.64	0.00	1.82	2.56	0.00	0.12	7.80	0.00	0.36
	0.96	0.00	0.06	7.80	0.00	1.31	ND	ND	ND	3.52	0.00	0.11
	3.10	0.00	0.28	0.43	0.01	0.04	ND	ND	ND	7.37	0.00	0.48
	7.58	0.00	0.69	0.96	0.00	0.05	ND	ND	ND	11.85	0.00	0.57
mean	4.09	0.01	0.29	7.69	0.00	1.08	2.29	0.00	0.12	7.86	0.00	0.41
minimum	0.43	0.00	0.00	0.21	0.00	0.00	0.21	0.00	0.03	3.52	0.00	0.11
maximum	12.82	0.07	1.07	20.40	0.01	2.90	4.59	0.00	0.25	14.63	0.00	0.77

	7/13/2021			7/11/2022			7/12/2023		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	14.31	0.00	0.73	4.91	0.00	0.41	15.06	0.00	0.75
	2.46	0.30	0.40	4.06	0.00	0.37	6.51	0.00	0.58
	11.96	0.00	0.73	17.84	0.00	1.04	10.47	0.00	0.58
	2.99	0.00	0.18	7.69	0.00	0.55	12.39	0.00	0.79
	3.74	0.00	0.21	6.41	0.00	0.60	3.84	0.00	0.23
	5.55	0.00	0.20	4.81	0.00	0.27	5.45	0.00	0.42
	3.20	0.00	0.16	11.32	0.00	0.76	17.19	0.00	0.77
	2.78	0.00	0.14	13.24	0.00	1.12	12.60	0.00	0.83
	5.23	0.00	0.23	17.94	0.00	1.03	7.48	0.00	0.57
	7.69	0.00	0.38	6.84	0.00	0.37	4.27	0.00	0.26
mean	5.99	0.03	0.34	9.51	0.00	0.65	9.53	0.00	0.58
minimum	2.46	0.00	0.14	4.06	0.00	0.27	3.84	0.00	0.23
maximum	14.31	0.30	0.73	17.94	0.00	1.12	17.19	0.00	0.83

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll a not detected.

Appendix A.5.–Tributary Creek Site 1847 chlorophylls a, b, and c densities, 2018–2023.

	7/12/2018			7/11/2019			7/15/2020			7/13/2021		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	16.98	0.00	3.10	3.95	0.00	0.40	15.38	1.55	1.02	16.34	0.00	0.74
	9.29	0.00	1.66	2.78	0.00	0.25	5.23	0.00	0.26	8.04	0.00	0.36
	6.09	0.00	0.70	0.75	0.00	0.05	12.50	0.00	1.28	27.55	0.00	1.40
	3.63	0.00	0.28	4.70	0.00	0.52	2.46	0.51	0.13	6.51	0.00	0.47
	12.82	0.00	2.14	5.77	0.00	0.58	8.12	0.00	0.54	1.07	0.04	0.17
	3.63	0.02	0.57	4.49	0.00	0.43	6.41	0.00	0.30	6.11	0.00	0.46
	2.24	0.00	0.33	1.92	0.00	0.09	8.44	0.00	0.61	1.13	0.16	0.05
	ND	ND	ND	4.17	0.00	0.32	6.41	0.00	0.52	15.17	0.00	0.87
	8.01	0.00	0.66	ND	ND	ND	1.71	0.00	0.11	1.92	0.00	0.08
	10.68	0.00	1.29	ND	ND	ND	10.89	0.00	0.58	11.32	0.00	0.55
mean	8.15	0.00	1.19	3.57	0.00	0.33	7.76	0.21	0.54	9.52	0.02	0.52
minimum	2.24	0.00	0.28	0.75	0.00	0.05	1.71	0.00	0.11	1.07	0.00	0.05
maximum	16.98	0.02	3.10	5.77	0.00	0.58	15.38	1.55	1.28	27.55	0.16	1.40

	7/13/2022			7/12/2023		
mg/m^2	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	34.07	0.00	4.74	4.81	0.00	0.26
	23.39	0.00	1.83	5.87	0.00	0.44
	6.51	0.00	1.01	5.24	0.00	0.24
	15.59	0.00	1.21	8.76	0.00	0.42
	29.48	0.00	3.20	5.43	0.00	0.28
	34.50	0.00	2.97	2.24	0.00	0.10
	2.46	0.00	0.25	3.10	0.00	0.15
	11.43	0.00	1.00	2.25	0.00	0.12
	37.70	0.00	4.14	3.74	0.00	0.15
	4.27	0.00	0.29	11.43	0.00	0.63
mean	19.94	0.00	2.06	5.29	0.00	0.28
minimum	2.46	0.00	0.25	2.24	0.00	0.10
maximum	37.70	0.00	4.74	11.43	0.00	0.63

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll a not detected.

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–Greens Creek Site 48 (2001–2017) and 63 (2018–2023) BMI data summary.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total BMI Taxa	25	26	27	30	29	21	24	21	18	23	27	22	20	24	27	25	25	27	28	33	29	26	24
Mean BMI Taxa / Sample	12	13	18	19	16	11	13	13	10	15	17	13	12	13	17	13	15	14	16	14	16	13	11
Total Ephemeroptera Taxa	6	6	7	6	6	6	7	6	7	7	7	7	7	7	8	8	7	8	8	9	8	9	8
Total Plecoptera Taxa	7	11	6	9	8	4	5	3	5	6	7	7	5	6	6	5	6	7	6	8	6	7	6
Total Trichoptera Taxa	2	2	4	2	4	2	1	2	1	1	2	2	1	1	2	2	3	2	5	3	3	4	1
Ephemeroptera	1,094	599	1,897	1,034	902	495	428	887	852	937	558	555	618	844	1,488	1,520	1,300	2,271	2,715	1,237	663	993	980
Plecoptera	49	41	191	74	36	10	75	20	40	81	151	55	131	98	122	209	128	110	65	80	61	43	98
Trichoptera	7	9	20	22	15	7	8	24	1	4	12	5	8	14	62	14	22	20	30	29	16	20	5
Aquatic Diptera	31	39	206	169	101	38	34	79	15	71	193	73	86	184	291	352	146	144	220	234	105	83	132
Other	3	16	53	25	5	10	15	11	2	8	68	5	12	16	65	28	18	26	21	31	112	24	36
% Ephemeroptera	92.4	85.1	80.1	78.8	85.5	88.3	79.7	87	93.1	85.6	56.8	80.1	72.3	73.1	73.4	72	81	88.3	89	76.8	69.3	85.4	78.3
% Plecoptera	4.1	5.8	8.1	5.7	3.4	2.6	11.2	2.5	4.5	6.8	15.4	7.9	15.3	8.5	6	10.1	8	4.3	2.1	5	6.4	3.7	7.8
% Trichoptera	0.6	1.3	0.8	1.8	1.6	1.3	1.5	2	0.2	0.3	1.2	0.7	0.9	1.2	3.1	0.7	1.4	0.8	1	1.8	1.7	1.7	0.4
% Aquatic Diptera	2.6	5.5	8.7	11.9	9	6.3	5.6	7.7	1.8	6.2	19.7	10.5	10.1	15.9	14.3	16.6	9	5.6	7.2	14.5	11	7.1	10.6
% Other	0.3	2.3	2.2	1.8	0.5	1.4	2	0.8	0.4	1.1	6.9	0.7	1.4	1.2	3.2	1.3	1.1	1	0.7	1.9	11.7	2.1	2.9
% EPT	97	92	89	86	90	92	92	92	98	93	73	89	89	83	82	82	90	93	92	84	77	91	87
% Chironomidae	1	4	7	11	8	3	4	6	1	5	17	9	9	15	9	14	9	5	7	12	6	5	10
% Dominant Taxon	41	35	30	28	30	37	36	58	46	31	21	37	25	31	28	27	24	39	38	39	32	43	36
Total BMI	1,184	704	2,367	1,679	1,396	693	733	1,331	953	1,240	982	693	855	1,156	2,028	2,123	1,614	2,571	3,051	1,611	957	1,163	1,251
Total Terrestrial Invertebrates	0	4	5	1	24	5	2	8	2	11	4	0	14	32	6	4	27	4	6	10	0	2	7
Total Invertebrates	1,184	708	2,372	1,680	1,420	698	735	1,339	955	1,251	986	693	869	1,188	2,034	2,127	1,641	2,575	3,057	1,621	957	1,165	1,258
% Sample BMI	100	99	99	99	98	99	99	99	99	99	99	100	98	97	99	99	98	100	100	99	100	100	99
% Sample Terrestrial	0	1	1	1	2	1	1	1	1	1	1	0	2	3	1	1	2	0	0	1	0	0	1
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Total Invertebrates /m^2	2,753	1,647	5,516	3,907	3,302	1,623	1,709	3,114	2,221	2,909	2,293	1,612	2,021	2,763	2,956	3,092	2,385	3,743	4,443	2,356	1,391	1,693	1,828
Total BMI/m^2	2,753	1,637	5,505	3,905	3,247	1,612	1,705	3,095	2,216	2,884	2,284	1,612	1,988	2,688	2,948	3,086	2,346	3,737	4,435	2,342	1,391	1,690	1,818
±1 SD	1,435	434	1,579	677	1,441	807	648	980	1,939	1,530	630	872	526	1,043	892	1,219	1,034	1,240	1,708	1,899	768	808	494

Appendix B.2.–Greens Creek Site 54 BMI data summary, 2001–2023.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total BMI Taxa	28	30	26	32	25	13	15	22	23	21	34	30	19	26	28	30	31	29	29	31	24	22	32
Mean BMI Taxa / Sample	15	14	16	19	15	9	8	14	13	13	18	14	9	11	14	15	14	14	15	15	12	11	14
Total Ephemeroptera Taxa	7	6	7	6	8	5	6	8	7	6	8	7	5	7	7	8	8	8	9	8	7	7	8
Total Plecoptera Taxa	7	7	7	10	7	3	4	4	7	5	7	10	6	7	6	6	8	7	7	9	4	6	8
Total Trichoptera Taxa	2	2	1	3	3	2	0	2	2	2	5	4	1	3	2	3	4	3	3	2	1	2	3
Ephemeroptera	1,627	1,352	2,011	1,601	1,265	477	286	1,105	895	1,247	1,536	591	308	1,277	941	2,072	917	2,249	2,328	1,959	568	839	3,603
Plecoptera	80	54	82	117	37	30	22	65	43	53	96	49	54	109	99	204	72	105	129	91	39	56	177
Trichoptera	7	6	12	19	31	4	0	9	4	8	32	9	3	15	24	18	22	11	17	29	4	5	8
Aquatic Diptera	53	39	173	184	65	13	10	85	32	61	203	81	52	177	182	201	111	134	282	399	98	65	330
Other	15	15	57	46	4	1	1	13	5	8	46	24	19	24	52	22	14	10	18	22	26	17	80
% Ephemeroptera	91.3	92.2	86.1	81.4	90.2	90.9	89.7	86.5	91.4	90.6	80.3	78.1	70.6	79.7	72.5	82.1	81.2	89.6	83.9	78.4	77.3	85.4	85.8
% Plecoptera	4.5	3.7	3.5	5.9	2.6	5.7	6.9	5.1	4.4	3.8	5.1	6.4	12.4	6.8	7.6	8.1	5.8	4.2	4.7	3.6	5.3	5.7	4.2
% Trichoptera	0.4	0.4	0.5	1	2.2	0.8	0	0.7	0.4	0.6	1.7	1.2	0.7	0.9	1.8	1	1.9	0.4	0.6	1.2	0.5	0.5	0.2
% Aquatic Diptera	3	2.7	7.4	9.4	4.6	2.5	3.1	6.7	3.3	4.4	10.6	10.7	11.9	11	14	8	9.8	5.3	10.2	16	13.3	6.6	7.9
% Other	0.8	1	2.4	2.3	0.3	0.2	0.3	1	0.5	0.6	2.4	3.5	4.4	1.5	4	0.9	1.2	0.4	0.6	0.9	3.5	1.7	1.9
% EPT	96	96	90	88	95	97	97	92	96	95	87	86	84	87	82	91	89	94	89	83	83	92	90
% Chironomidae	2	2	6	8	4	2	2	5	2	3	8	9	10	10	11	6	8	5	9	15	4	4	7
% Dominant Taxon	52	43	40	38	40	31	34	52	40	35	43	30	30	35	32	25	23	37	43	39	45	53	33
Total BMI	1,782	1,466	2,335	1,967	1,402	525	319	1,277	979	1,377	1,913	754	436	1,607	1,298	2,517	1,136	2,509	2,774	2,500	735	982	4,198
Total Terrestrial Invertebrates	0	4	7	1	3	1	6	1	8	9	14	5	8	12	6	3	24	4	1	3	0	2	10
Total Invertebrates	1,782	1,470	2,342	1,968	1,405	526	325	1,278	987	1,386	1,927	759	444	1,619	1,304	2,520	1,160	2,513	2,775	2,503	735	984	4,208
% Sample BMI	100	99	99	99	99	99	98	100	99	99	99	99	98	99	99	99	98	100	100	100	100	100	100
% Sample Terrestrial	0	1	1	1	1	1	2	0	1	1	1	1	2	1	1	1	2	0	0	0	0	0	0
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Total Invertebrates /m^2	4,144	3,419	5,447	4,577	3,267	1,223	756	2,972	2,295	3,223	4,481	1,765	1,033	3,765	1,895	3,663	1,686	3,653	4,033	3,638	1,068	1,430	6,116
Total BMI/m^2	4,144	3,409	5,430	4,575	3,260	1,221	742	2,970	2,277	3,202	4,449	1,753	1,014	3,737	1,887	3,658	1,651	3,647	4,032	3,634	1,068	1,427	6,102
±1 SD	1,464	1,148	1,422	1,540	1,016	345	293	1,855	297	772	2,668	738	642	1,253	1,065	1,139	809	973	978	2,454	553	1,029	2,947

Appendix B.3.–Tributary Creek Site 9 BMI data summary, 2001–2023.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total BMI Taxa	21	24	36	26	30	23	21	20	26	22	26	27	20	22	23	29	29	25	28	32	28	26	36
Mean BMI Taxa / Sample	14	15	21	14	14	11	10	14	13	10	12	15	11	12	11	18	16	14	15	14	15	16	19
Total Ephemeroptera Taxa	6	7	8	5	9	7	5	7	8	7	6	5	7	6	6	7	7	8	7	8	7	6	9
Total Plecoptera Taxa	5	5	5	6	5	2	3	4	5	5	6	6	4	3	6	4	5	3	4	3	3	4	4
Total Trichoptera Taxa	0	2	3	3	4	1	2	1	0	0	2	3	1	3	0	5	3	2	3	4	4	4	6
Ephemeroptera	205	436	981	562	334	444	104	441	203	89	277	245	726	565	137	1,128	452	143	311	279	283	494	1,150
Plecoptera	68	69	593	166	95	35	37	50	97	17	138	69	130	166	160	359	365	128	119	261	342	252	1,033
Trichoptera	0	2	7	5	4	2	4	1	0	0	13	10	2	8	0	22	7	4	22	6	7	16	54
Aquatic Diptera	86	66	256	66	60	42	21	206	141	52	196	179	135	181	73	1,449	727	427	314	683	634	716	1,424
Other	150	175	679	233	35	102	52	55	38	40	232	106	36	146	145	896	255	153	140	313	319	125	209
% Ephemeroptera	40.3	58.3	39	54.5	63.3	71	47.7	58.6	42.4	44.9	32.4	40.2	70.6	53	26.6	29.3	25.1	16.7	34.3	18.1	17.9	30.8	29.7
% Plecoptera	13.4	9.2	23.6	16.1	18	5.6	17	6.6	20.3	8.6	16.1	11.3	12.6	15.6	31.1	9.3	20.2	15	13.1	16.9	21.6	15.7	26.7
% Trichoptera	0	0.3	0.3	0.5	0.8	0.3	1.8	0.1	0	0	1.5	1.6	0.2	0.8	0	0.6	0.4	0.5	2.4	0.4	0.4	1	1.4
% Aquatic Diptera	16.9	8.8	10.2	6.4	11.4	6.7	9.6	27.4	29.4	26.3	22.9	29.4	13.1	17	14.2	37.6	40.2	49.9	34.7	44.3	40	44.7	36.8
% Other	29.5	23.4	26.9	22.6	6.6	16.3	23.9	7.3	7.9	20.2	27.1	17.4	3.5	13.7	28.2	23.2	14.1	17.9	15.5	20.3	20.1	7.8	5.4
% EPT	54	68	63	71	82	77	67	65	63	54	50	53	83	69	58	39	46	32	50	35	40	48	58
% Chironomidae	7	5	5	5	8	4	1	1	22	23	21	26	11	14	11	29	24	35	15	40	36	16	15
% Dominant Taxon	26	29	26	44	37	40	26	33	32	32	24	30	38	30	28	29	24	45	31	43	37	35	28
Total BMI	509	748	2,516	1,032	528	625	218	753	479	198	856	609	1,029	1,066	515	3,854	1,806	855	906	1,542	1,585	1,603	3,870
Total Terrestrial Invertebrates	0	5	15	3	12	33	1	5	50	22	2	9	13	13	6	18	3	8	2	4	2	0	15
Total Invertebrates	509	753	2,531	1,035	540	658	219	758	529	220	858	618	1,042	1,079	521	3,872	1,809	863	908	1,546	1,587	1,603	3,885
% Sample BMI	100	99	99	99	98	95	99	99	91	90	99	99	99	99	99	99	99	99	100	100	100	100	100
% Sample Terrestrial	0	1	1	1	2	5	1	1	10	11	1	1	1	1	1	1	1	1	0	0	0	0	0
Total Sample Area (m^2)	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Total Invertebrates /m^2	1,184	1,751	5,886	2,407	1,256	1,530	509	1,763	1,230	512	1,995	1,437	2,423	2,509	757	5,628	2,629	1,254	1,320	2,247	2,307	2,330	5,647
Total BMI/m^2	1,184	1,740	5,851	2,400	1,228	1,453	507	1,751	1,114	460	1,991	1,416	2,393	2,479	749	5,602	2,625	1,243	1,317	2,241	2,304	2,330	5,625
±1 SD	1,148	620	1,579	851	357	878	268	631	636	463	447	615	1,897	727	348	3,133	1,059	464	855	1,409	879	1,296	2,583

Appendix B.4.–Tributary Creek Site 1847 BMI data summary, 2018–2023.

	2018	2019	2020	2021	2022	2023
Total BMI Taxa	29	28	29	25	26	33
Mean BMI Taxa / Sample	18	18	16	15	17	16
Total Ephemeroptera Taxa	7	7	8	5	8	8
Total Plecoptera Taxa	4	3	4	3	4	6
Total Trichoptera Taxa	4	3	3	5	3	5
Ephemeroptera	631	1,382	492	985	1,406	1,084
Plecoptera	134	291	210	294	217	368
Trichoptera	34	12	30	50	26	23
Aquatic Diptera	512	493	496	372	740	875
Other	197	268	504	267	124	376
% Ephemeroptera	41.8	56.5	28.4	50.1	55.9	39.8
% Plecoptera	8.9	11.9	12.1	14.9	8.6	13.5
% Trichoptera	2.3	0.5	1.7	2.5	1	0.8
% Aquatic Diptera	34	20.2	28.6	18.9	29.4	32.1
% Other	13.1	11	29.1	13.6	4.9	13.8
% EPT	53	69	42	68	66	54
% Chironomidae	29	14	25	16	23	29
% Dominant Taxon	38	35	36	37	34	36
Total BMI	1,508	2,446	1,732	1,968	2,513	2,726
Total Terrestrial Invertebrates	5	1	2	5	3	2
Total Invertebrates	1,513	2,447	1,734	1,973	2,516	2,728
% Sample BMI	100	100	100	100	100	100
% Sample Terrestrial	0	0	0	0	0	0
Total Sample Area (m^2)	0.69	0.69	0.69	0.69	0.69	0.69
Total Invertebrates /m^2	2,199	3,557	2,520	2,868	3,657	3,965
Total BMI/m^2	2,192	3,555	2,517	2,860	3,653	3,962
±1 SD	1,248	2,417	762	1,209	1,581	1,703

APPENDIX C: JUVENILE FISH DATA

Appendix C.1.–Greens Creek Site 48 (2001-2017) and 63 (2018-2023) Dolly Varden capture data, 2001–2017.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	48–139	30	ND
2002	DV	45–160	74	ND
2003	DV	54–153	157	ND
2004	DV	58–156	168	ND
2005	DV	53–149	118	ND
2006	DV	49–150	138	ND
2007	DV	60–154	50	ND
2008	DV	80–137	54	ND
2009	DV	54–142	67	ND
2010	DV	62–163	97	ND
2011	DV	57–155	56	ND
2012	DV	68–156	85	1.00
2013	DV	38–149	167	1.00
2014	DV	52–146	59	1.10
2015	DV	58–146	48	1.00
2016	DV	50–148	119	1.20
2017	DV	52–156	84	1.10
2018	DV	59–144	69	1.03
2019	DV	63–176	150	1.03
2020	DV	59–149	88	0.94
2021	DV	70–136	36	0.98
2022	DV	52–124	20	1.10
2023	DV	49-144	106	0.99

Appendix C.2.–Greens Creek Site 54 resident fish capture data, 2001–2023.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	27–138	70	ND
2002	DV	43–160	168	ND
2003	DV	54–184	92	ND
2004	DV	55–161	118	ND
2005	DV	56–134	111	ND
2006	DV	50–138	116	ND
2007	DV	58–125	64	ND
	CT	102–104	2	ND
2008	DV	45–131	50	ND
	CT	101–106	2	ND
2009	DV	48–141	42	ND
2010	DV	60–151	46	ND
2011	DV	57–150	73	ND
2012	DV	53–143	92	1.00
2013	DV	50–150	188	1.10
2014	DV	58–158	121	1.00
2015	DV	54–150	64	1.00
2016	DV	59–140	31	1.10
2017	DV	48–150	169	1.10
2018	DV	52–133	162	0.98
2019	DV	61–154	183	1.02
2020	DV	63–158	73	0.97
	RT	135	1	1.03
2021	DV	47–169	74	1.00
2022	DV	58–150	47	1.00
2023	DV	48-143	204	1.07

Appendix C.3.–Greens Creek Site 54 coho salmon capture data, 2001–2023.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	CO	44–95	2	ND
2002	CO	59–85	14	ND
2003	CO	44–51	5	ND
2004	CO	74–95	9	ND
2005	CO	68–91	33	ND
2006	CO	66–88	6	ND
2007	CO	ND	0	ND
2008	CO	53–69	4	ND
2009	CO	67–71	2	ND
2010	CO	77	1	ND
2011	CO	ND	0	ND
2012	CO	ND	0	ND
2013	CO	ND	0	ND
2014	CO	70–85	10	1.20
2015	CO	45–100	15	1.10
2016	CO	69–88	14	1.20
2017	CO	ND	0	ND
2018	CO	38–90	17	1.17
2019	CO	44–95	54	1.20
2020	CO	64–94	18	1.12
2021	CO	63	1	1.48
2022	CO	61–86	12	1.20
2023	CO	46-90	11	1.13

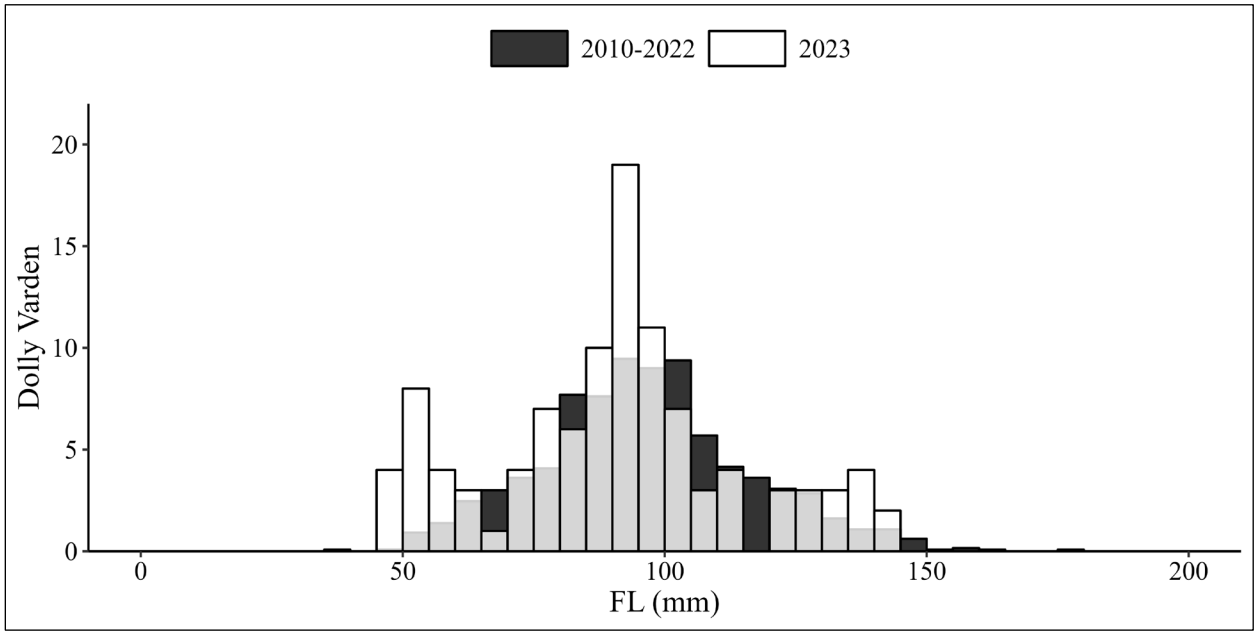
Appendix C.4.–Tributary Creek Site 9 resident fish capture data, 2001–2023.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	DV	61–110	70	ND
	CT	124	1	ND
2002	DV	70–147	29	ND
2003	DV	68–114	13	ND
	CT	122	1	ND
2004	DV	68–109	21	ND
	CT	122	1	ND
	RT	86–106	3	ND
2005	DV	59–131	21	ND
	CT	103	1	ND
2006	DV	85–117	7	ND
2007	DV	81–158	7	ND
2008	DV	60–92	15	ND
	CT	109	1	ND
2009	DV	48–91	24	ND
	CT	97	1	ND
2010	DV	58–108	21	ND
	CT	64–89	4	ND
2011	DV	50–115	15	ND
	CT	115	1	ND
2012	DV	74–122	17	1.00
	CT	63–93	4	1.00
2013	DV	52–92	9	1.20
2014	DV	105	1	1.10
	RT	110	1	0.40
2015	DV	55–80	10	1.20
2016	DV	76–114	15	1.00
2017	DV	55–117	31	1.20
2018	DV	58–106	20	1.04
2019	DV	59–102	8	1.12
2020	DV	112	1	0.97
2021	DV	64–77	5	1.10
2022	DV	ND	0	ND
2023	DV	60-95	16	1.10

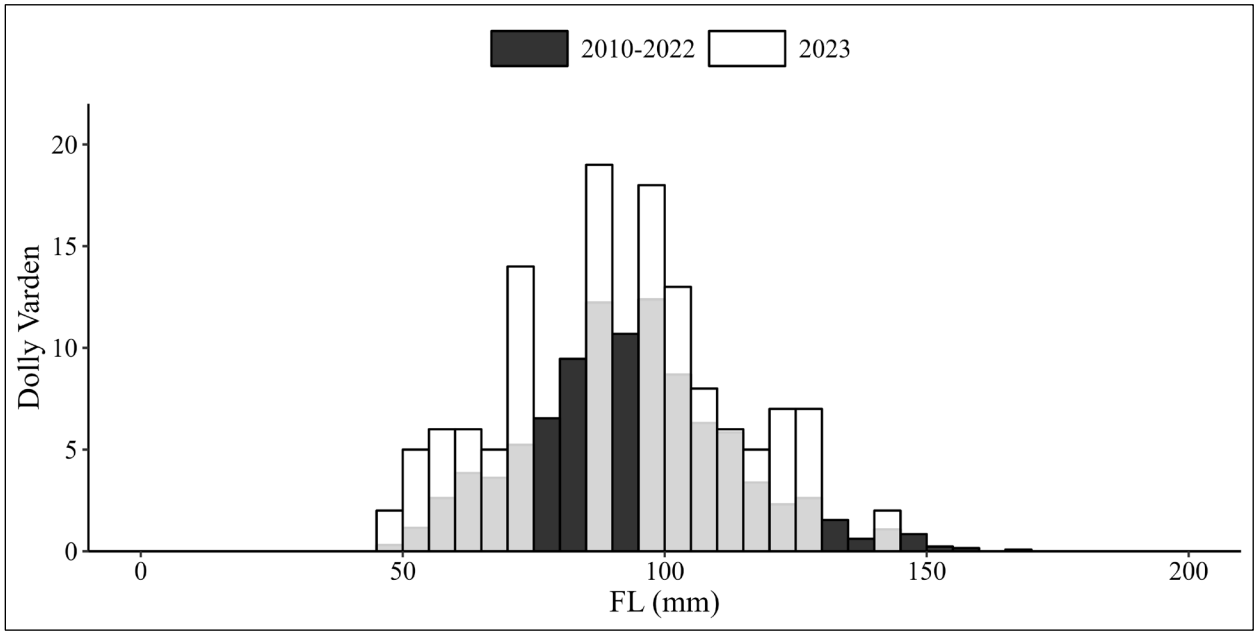
Appendix C.5.–Tributary Creek Site 9 coho salmon capture data, 2001–2023.

Year	Species	FL (mm)	Fish Captured (n)	Condition Factor
2001	CO	40–101	89	ND
2002	CO	34–85	29	ND
2003	CO	46–88	37	ND
2004	CO	42–94	23	ND
2005	CO	39–98	82	ND
2006	CO	82–92	5	ND
2007	CO	39–107	50	ND
2008	CO	48–100	72	ND
2009	CO	38–116	42	ND
2010	CO	41–85	77	ND
2011	CO	42–95	18	ND
2012	CO	46–105	39	1.10
2013	CO	50–90	9	1.40
2014	CO	39–91	86	1.20
2015	CO	38–90	36	1.30
2016	CO	45–95	75	1.30
2017	CO	35–94	67	1.30
2018	CO	39–92	32	1.11
2019	CO	45–85	46	1.19
2020	CO	51–83	7	1.28
2021	CO	40–94	70	1.24
2022	CO	41–95	26	1.24
2023	CO	31-93	69	1.22

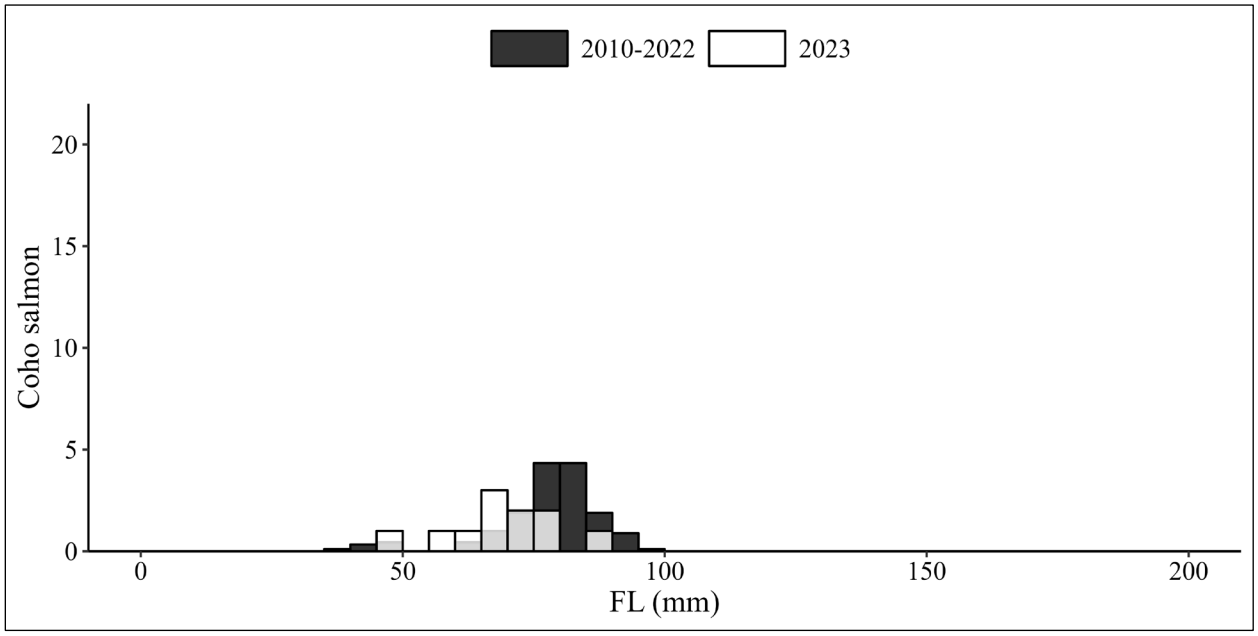
Appendix C.6.–Greens Creek Site 48 and Site 63 Dolly Varden length frequency distributions, 2010–2022 and 2023.



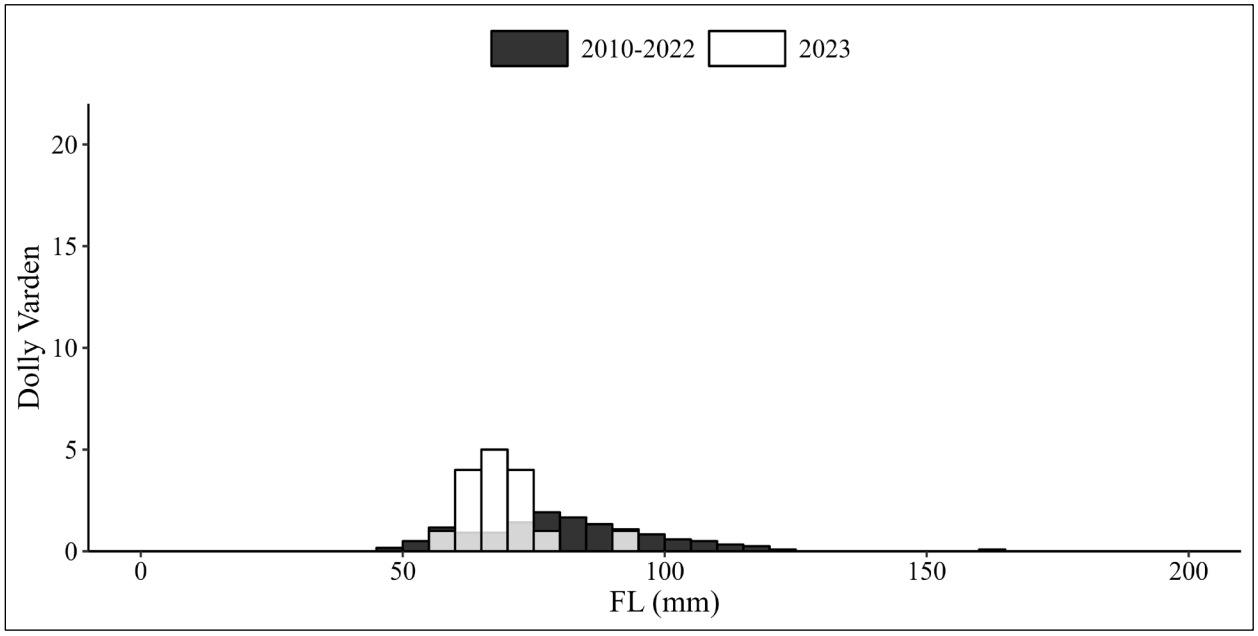
Appendix C.7.–Greens Creek Site 54 Dolly Varden length frequency distributions, 2010–2022 and 2023.



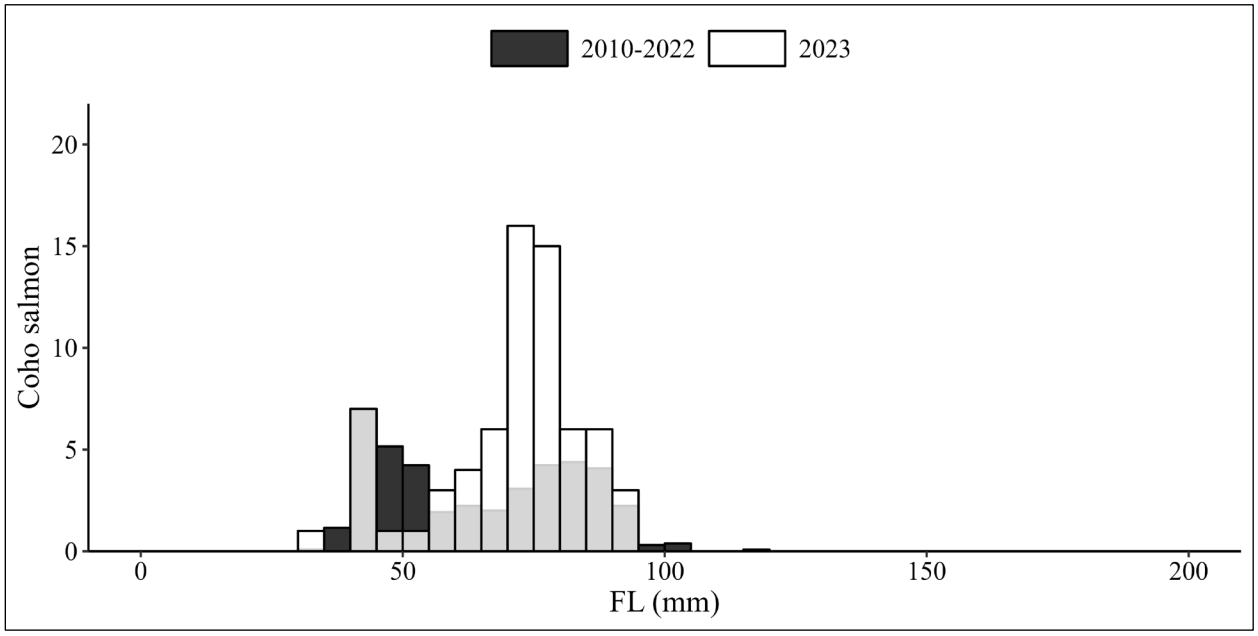
Appendix C.8.–Greens Creek Site 54 coho salmon length frequency distributions, 2010–2022 and 2023.



Appendix C.9.–Tributary Creek Site 9 Dolly Varden length frequency distributions, 2010–2022 and 2023.



Appendix C.10.–Tributary Creek Site 9 coho salmon length frequency distributions, 2010–2022 and 2023.



APPENDIX D: JUVENILE FISH ELEMENT CONCENTRATIONS DATA AND LAB REPORT

Appendix D.1.–Greens Creek Site 48 (2001-2017) and Site 63 (2018-2023) Dolly Varden element concentrations.

Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/23/2001	131	26	0.020	1.76	8.30	ND	0.200	6.10	180
	137	28.8	0.030	0.89	7.20	ND	0.170	4.60	146
	119	18.8	0.020	2.27	5.70	ND	0.200	6.20	189
	121	21.1	0.020	1.56	6.90	ND	0.170	5.20	182
	111	13.7	0.030	0.89	4.70	ND	0.230	5.40	138
	121	21.1	<0.020	1.26	7.40	ND	0.100	5.60	157
7/24/2002	133	23.2	0.030	1.64	6.80	ND	0.720	4.80	239
	120	15	0.070	0.85	7.00	ND	0.280	4.10	210
	122	17.5	0.030	0.74	4.30	ND	0.170	4.90	162
	127	20.8	0.040	1.40	6.10	ND	0.160	4.70	185
	134	24.8	0.050	1.30	7.90	ND	0.460	4.30	208
	128	21.7	0.040	1.56	6.80	ND	0.220	5.70	343
7/22/2003	90	8.9	<0.020	0.65	4.20	ND	0.140	5.60	191
	98	9.9	<0.020	0.90	5.10	ND	0.220	5.50	180
	103	12.1	<0.020	0.82	5.60	ND	0.160	5.40	241
	112	12.5	<0.020	0.78	6.10	ND	0.110	6.10	192
	108	11.9	<0.020	0.63	3.90	ND	0.140	5.20	174
	100	10.5	<0.020	0.58	3.70	ND	0.080	5.50	218
7/22/2004	96	8.6	<0.020	0.63	4.70	ND	0.150	4.30	206
	88	6.8	<0.020	0.83	5.60	ND	0.260	4.00	175
	101	11.5	<0.020	1.54	4.60	ND	0.210	4.10	183
	98	9.3	<0.020	0.80	5.20	ND	0.280	3.70	168
	93	7.6	<0.020	1.25	4.40	ND	0.140	6.40	220
	91	7.5	0.030	1.01	4.50	ND	0.290	5.60	323
7/22/2005	103	19.7	0.020	0.66	4.40	ND	0.440	4.20	183
	96	13.1	<0.020	0.84	14.50	ND	0.980	4.80	220
	119	15.6	0.020	0.89	4.40	ND	0.660	4.80	226
	114	17.1	0.020	0.59	6.00	ND	0.320	4.80	178
	111	15.3	0.030	1.10	18.80	ND	0.790	4.60	217
	125	16.9	0.030	0.47	3.60	ND	0.360	3.80	161
7/20/2006	110	15.8	0.040	0.56	8.50	ND	0.370	5.40	244
	110	15.4	0.050	1.20	8.30	ND	0.310	6.00	217
	113	16.1	0.040	0.65	6.30	ND	0.240	5.40	264
	132	25	0.060	0.63	8.10	ND	0.660	5.20	232
	104	12.8	0.080	0.96	8.50	ND	0.370	5.10	283
	114	16.7	0.030	0.63	5.30	ND	0.200	5.10	270

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/21/2007	122	17.9	0.030	1.16	5.50	ND	0.170	5.50	221
	95	10.4	0.020	1.42	3.90	ND	0.290	5.80	165
	135	22.8	0.090	1.35	14.10	ND	1.370	5.30	166
	98	9.9	0.030	0.96	5.70	ND	0.270	5.20	269
	105	13.2	0.110	1.79	11.40	ND	1.620	5.40	323
	99	10	0.040	1.43	5.20	ND	0.310	5.70	208
7/22/2008	112	16.4	0.069	1.23	5.20	ND	0.950	5.72	289
	123	21.3	0.039	0.79	3.90	ND	0.570	4.56	194
	105	14	0.079	0.82	4.60	ND	0.520	5.88	199.5
	124	20.6	0.041	0.87	4.90	ND	0.420	6.31	244
	115	16.9	0.030	1.36	5.30	ND	0.510	5.36	254
	122	19.8	0.037	1.07	5.60	ND	0.380	6.11	260
7/21/2009	120	20.1	<0.020	1.05	5.20	ND	0.220	5.90	186
	121	20.7	<0.020	1.40	5.30	ND	0.440	5.70	173
	119	17.9	0.020	1.10	4.50	ND	0.130	5.90	182
	108	13.6	<0.020	1.20	4.10	ND	0.150	5.70	162
	109	14.6	<0.020	1.50	4.90	ND	0.170	5.90	186
	110	15.2	<0.020	0.84	3.80	ND	0.180	6.10	202
7/21/2010	103	11.9	0.020	1.56	4.80	0.090	0.160	5.00	226
	109	16.1	<0.019	0.51	3.00	0.150	0.200	5.60	168
	108	13.9	0.040	0.91	4.20	0.170	0.300	5.00	180
	105	13.8	<0.020	0.98	3.40	0.130	0.090	4.60	163
	98	10.8	0.062	0.90	4.80	0.140	0.460	4.80	213
	93	9.1	<0.020	0.96	3.60	0.100	0.090	4.00	156
7/22/2011	NA	NA	0.030	1.12	5.70	ND	0.280	6.20	221
7/24/2012	109	11.3	0.030	2.26	27.00	0.134	0.160	5.50	186
	123	18.3	0.030	1.37	4.90	0.122	0.100	5.70	184
	110	9.8	0.030	1.83	25.60	0.159	2.590	5.60	275
	103	10.6	0.030	0.99	76.80	0.175	0.300	5.10	189
	104	10.7	0.030	2.66	84.80	0.122	1.050	6.30	242
	116	15.8	0.040	0.73	35.10	0.148	1.030	4.70	190
7/25/2013	145	20.6	<0.020	0.68	3.70	0.214	0.170	5.30	237
	115	17.9	0.070	0.97	6.10	0.238	0.240	5.80	239
	115	14.3	<0.020	0.81	4.00	0.180	0.080	6.70	258
	105	11.4	<0.020	0.68	3.20	0.213	0.140	6.40	213
	109	13	0.040	2.01	6.60	0.113	0.360	6.20	271
	105	12.4	0.040	1.75	5.70	0.274	0.220	6.20	287

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/25/2014	110	13	0.040	0.55	4.50	0.146	0.110	5.30	234
	100	10.5	<0.020	0.93	4.20	0.148	0.190	6.90	213
	106	10.7	<0.020	1.22	4.80	0.199	0.380	5.70	232
	105	11.3	<0.020	1.45	4.20	0.122	0.440	6.10	193
	100	10.4	<0.020	0.92	4.50	0.134	0.060	4.90	237
	120	14.8	0.040	0.75	5.50	0.260	0.180	5.90	305
7/16/2015	105	12.4	<0.020	0.60	2.50	0.114	0.130	6.20	159
	104	11.7	0.040	1.11	10.70	0.100	1.300	5.80	205
	100	11.7	0.030	1.05	3.80	0.152	0.140	6.10	187
	105	11.3	0.030	1.39	4.20	0.154	0.360	6.10	198
	105	12.7	<0.020	1.06	4.00	0.128	0.120	5.70	169
	100	10.4	0.020	1.49	3.90	0.165	0.370	5.40	191
	104	9.6	<0.020	0.85	3.10	0.091	0.090	5.20	175
	85	8.6	0.030	0.90	3.60	0.139	0.270	5.90	172
	102	10.3	<0.020	1.51	3.70	0.180	0.150	7.20	192
	120	16.3	<0.020	0.86	4.00	0.150	0.140	6.40	223
7/14/2016	84	7.3	<0.020	1.28	4.72	0.180	0.157	7.63	252
	82	6.1	0.023	0.92	4.82	0.160	0.147	5.83	222
	98	10.1	0.021	1.09	3.99	0.108	0.150	6.30	189
	93	7.9	<0.020	1.44	4.49	0.163	0.205	6.77	197
	88	6.9	0.035	1.50	4.65	0.243	0.493	7.63	185
	84	7.3	0.023	0.68	4.12	0.150	0.088	6.42	200
	94	8.8	0.065	1.21	4.69	0.172	0.143	7.19	194
	86	7.6	0.022	1.89	4.96	0.210	0.295	7.27	251
	93	9.4	<0.020	1.23	4.85	0.127	0.193	5.80	205
	101	9.8	<0.020	1.32	4.72	0.114	0.134	6.28	178
7/13/2017	95	8.7	0.054	0.65	3.74	0.115	0.189	5.79	172
	91	8	0.097	1.51	3.86	0.118	0.417	5.98	169
	102	10	0.024	0.75	3.92	0.092	0.089	5.37	168
	105	13.1	0.022	1.00	4.98	0.143	0.237	6.78	194
	94	8.6	<0.020	0.46	2.81	0.106	0.064	4.50	166
	99	9.9	0.023	1.03	3.93	0.111	0.087	5.39	200
	98	10.8	0.022	0.46	2.68	0.101	0.064	4.40	168
	124	18.8	0.034	0.66	3.77	0.123	0.087	5.02	154
	99	10.7	<0.020	0.67	3.48	0.089	0.067	4.69	165
	95	9.8	0.044	0.30	3.18	0.112	0.126	4.73	159

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Appendix D.1.–Page 4 of 5.

Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/13/2018	92	7	0.038	1.55	6.52	0.175	0.635	7.50	283
	95	8	0.056	1.13	5.15	0.169	0.906	6.56	236
	105	11.5	0.045	1.63	7.10	0.181	1.290	7.50	250
	87	6.5	0.021	1.65	4.65	0.127	0.263	7.40	244
	97	8.2	0.044	1.44	5.42	0.157	1.540	7.38	244
	90	6.8	0.026	1.18	4.60	0.149	0.324	7.00	195
	105	10.6	0.025	1.10	5.33	0.178	0.172	6.20	247
	95	8.1	<0.020	1.43	4.89	0.134	0.187	8.00	189
	110	13	0.037	0.96	9.61	0.146	0.340	6.60	190
	104	10.1	0.043	1.21	5.57	0.228	1.300	6.40	250
7/9/2019	105	10.3	<0.019	1.22	5.43	0.132	0.594	6.31	255
	121	16.5	0.029	0.89	4.24	0.192	0.537	5.75	209
	95	8.7	0.020	1.02	3.78	0.138	0.382	5.99	203
	110	16.5	0.031	0.55	3.15	0.163	0.327	6.93	126
	101	10.8	0.022	0.80	3.34	0.134	0.266	6.08	169
	99	12.8	0.037	1.40	5.05	0.135	1.000	6.10	207
	100	12	<0.019	1.40	4.64	0.131	0.218	5.44	201
	120	16.8	0.032	1.32	5.63	0.143	0.329	6.27	182
	95	10.1	0.034	1.34	4.10	0.162	0.514	5.46	229
	107	14.2	0.032	0.71	3.94	0.174	0.570	4.93	180
7/16/2020	125	20.6	0.027	1.31	4.70	0.267	0.590	5.90	271
	125	18.1	0.034	0.91	4.90	0.244	0.210	5.40	224
	100	10.5	0.029	1.18	5.20	0.153	0.210	5.20	219
	124	17.4	0.058	1.15	12.40	0.174	1.810	4.70	204
	129	18.8	0.039	1.04	4.90	0.190	0.610	5.20	204
	109	11.4	0.053	1.33	4.70	0.195	1.280	6.30	290
	119	14.3	0.040	1.09	6.40	0.240	0.770	5.80	269
	95	7.8	0.023	1.03	4.60	0.203	0.500	7.20	190
	97	7.5	0.027	1.57	6.00	0.176	0.620	5.30	357
	105	12.7	0.021	1.35	5.80	0.202	0.330	6.20	311
7/12/2021	119	12.6	0.027	0.78	4.41	0.163	0.291	6.30	212
	94	7.5	0.048	1.45	6.35	0.116	0.264	5.20	188
	93	7.6	0.025	1.44	5.07	0.163	0.207	6.04	228
	114	12.7	0.034	0.83	4.12	0.193	0.341	5.79	215
	113	9.9	0.022	0.85	3.91	0.114	0.093	5.05	148
	95	7.3	0.038	1.14	4.10	0.192	0.150	6.16	222
	105	12.1	0.040	0.76	6.99	0.109	0.376	5.28	180
	102	8.2	0.030	1.85	4.86	0.220	0.226	5.47	278
	113	13.8	0.035	0.81	4.04	0.179	0.210	5.97	194
	92	6.5	0.025	1.79	4.28	0.146	0.229	5.62	228

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/12/2022	94	13	0.035	0.78	4.37	0.115	1.330	5.35	209
	94	9	0.034	1.72	4.41	0.117	1.060	5.44	223
	93	9.3	0.028	1.13	4.35	0.144	1.030	5.57	193
	117	15.9	0.036	1.65	6.03	0.150	0.736	5.61	240
	97	9.7	0.020	1.44	4.95	0.099	1.140	5.44	199
	98	10	0.020	0.92	3.57	0.089	0.868	5.89	162
	99	10	0.054	1.76	5.13	0.143	2.740	5.43	235
	98	8.4	0.025	0.76	4.21	0.121	0.682	5.30	163
	95	8.9	0.024	0.72	3.93	0.094	0.781	5.51	168
	124	22.1	0.025	2.01	4.01	0.118	0.882	5.53	180
7/11/2023	115	16.3	0.020	1.27	4.32	0.144	0.435	5.55	206
	112	10.1	0.020	1.29	5.12	0.167	0.472	5.98	231
	123	16.3	0.050	1.57	5.98	0.118	0.644	6.08	212
	105	11	0.026	0.89	4.27	0.119	0.289	5.06	160
	110	13.3	0.031	0.96	5.57	0.190	0.311	5.90	218
	98	9.3	0.021	1.68	5.89	0.119	0.444	6.95	179
	114	14.8	0.023	0.91	4.57	0.133	0.180	6.07	175
	100	9.1	0.031	0.99	5.18	0.133	0.540	6.24	180
	95	9.6	0.020	0.85	4.36	0.126	0.262	6.54	168
	93	8.7	0.021	0.77	4.34	0.128	0.264	6.60	193

Appendix D.2.–Greens Creek Site 54 Dolly Varden element concentrations, 2001–2023.

Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/23/2001	121	21.5	0.030	0.46	4.30	ND	0.330	5.70	126
	119	19.3	0.020	0.21	3.20	ND	0.220	3.60	82
	107	15.7	0.030	0.73	6.30	ND	0.590	4.70	144
	109	13.6	0.020	0.82	5.40	ND	0.860	4.90	172
	105	13.5	<0.020	0.79	6.50	ND	0.450	5.80	203
	138	27.5	<0.020	0.74	5.80	ND	0.400	5.40	171
7/24/2002	118	18	0.030	0.50	4.40	ND	0.940	3.40	363
	128	22.3	0.030	0.52	4.50	ND	0.350	4.70	150
	115	17.7	0.050	0.95	6.00	ND	0.660	4.40	161
	115	18.9	0.030	1.03	5.20	ND	0.660	4.20	216
	124	21.1	0.050	1.32	5.20	ND	0.740	3.90	194
	123	20.9	0.020	0.70	3.90	ND	0.780	4.40	195
7/22/2003	123	21.1	0.030	0.85	6.40	ND	1.400	6.10	188
	101	10.6	<0.020	0.67	4.20	ND	0.320	6.40	174
	88	9.2	<0.020	0.75	4.30	ND	0.350	6.50	186
	109	14.8	<0.020	1.11	5.80	ND	0.380	5.70	188
	95	10.6	<0.020	0.59	3.50	ND	0.290	5.70	174
	92	9.7	<0.020	0.91	4.10	ND	0.430	6.50	263
7/21/2004	103	9.9	0.020	0.79	11.00	ND	0.570	4.60	232
	104	10	<0.020	0.88	5.50	ND	0.540	5.00	206
	86	6.6	<0.020	1.26	5.10	ND	0.360	5.30	164
	96	9.3	0.030	0.79	5.90	ND	0.280	5.40	191
	93	9.9	<0.020	0.83	5.00	ND	0.480	3.90	202
	104	12.9	0.080	1.12	7.00	ND	0.930	4.90	217
7/22/2005	120	12.3	0.030	0.72	5.00	ND	0.270	4.00	160
	106	12.1	0.020	0.63	4.50	ND	0.130	3.90	200
	113	20.8	<0.020	0.73	8.80	ND	0.170	4.70	223
	114	17.9	<0.020	0.82	9.70	ND	0.170	3.90	222
	112	16.1	0.030	1.06	8.80	ND	0.220	4.40	209
	118	22.3	0.020	0.55	5.50	ND	0.390	3.90	185
7/20/2006	137	27.3	0.060	0.42	4.80	ND	0.510	5.70	208
	112	14.9	0.040	0.75	16.00	ND	0.950	7.20	223
	102	12	0.020	0.93	22.20	ND	0.520	6.30	239
	114	19.6	0.040	1.03	7.60	ND	0.850	5.30	252
	98	12.3	0.080	0.54	10.90	ND	0.480	5.40	223
	115	16.9	0.040	0.78	8.60	ND	0.680	5.60	257

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/20/2007	102	11.8	0.040	0.88	5.30	ND	0.540	5.60	157
	125	21.1	0.030	0.97	5.20	ND	0.830	7.50	234
	97	10.7	0.060	0.81	5.70	ND	0.890	8.60	185
	123	19.7	0.020	0.75	4.40	ND	0.500	7.10	175
	104	12.5	0.030	0.92	5.60	ND	0.570	7.80	174
	110	15.1	0.040	1.38	6.20	ND	0.820	5.40	191
7/22/2008	123	21.9	0.039	0.66	5.30	ND	0.260	5.53	185
	94	10.8	0.039	1.04	5.10	ND	0.280	6.07	203
	123	21.5	0.028	1.53	4.90	ND	3.460	6.29	261
	97	11.2	0.029	1.34	5.00	ND	0.170	5.90	198.5
	108	16	0.045	1.98	6.30	ND	0.230	5.97	220
	108	14.2	0.059	1.07	8.40	ND	1.310	5.03	195
7/21/2009	132	26.9	0.040	1.10	4.80	ND	0.330	5.40	213
	141	32.3	0.020	0.71	4.50	ND	0.450	7.90	143
	116	17.9	<0.020	0.99	4.20	ND	0.400	6.30	153
	117	17.7	0.030	1.00	5.90	ND	0.390	6.80	200
	119	22.1	<0.020	1.20	4.00	ND	0.280	6.50	176
	103	13	0.020	2.20	5.30	ND	0.350	5.90	226
7/20/2010	115	16	<0.019	0.80	3.40	0.080	0.370	4.60	159
	112	12.8	0.022	0.67	3.10	0.090	0.340	3.70	154
	118	12.6	<0.020	0.98	3.60	0.120	0.250	5.20	190
	108	10.6	<0.019	1.31	3.80	0.100	0.160	4.10	212
	115	12.3	<0.020	1.73	5.00	0.120	0.360	4.40	222
	94	9	0.025	0.77	4.00	0.140	0.310	4.80	199
7/21/2011	NA	NA	<0.020	0.95	4.50	ND	0.320	5.60	191
7/23/2012	132	24.2	0.020	0.85	7.70	0.077	0.410	9.20	144
	118	17.3	0.040	1.03	7.70	0.109	0.570	6.30	199
	109	13.1	0.060	2.04	19.20	0.112	1.320	7.40	215
	97	9.1	0.030	2.04	65.60	0.126	0.500	6.20	227
	115	15.4	0.040	1.22	12.60	0.123	1.100	6.90	202
	119	18.3	0.030	1.81	5.30	0.080	0.270	5.10	191
7/24/2013	117	16.9	<0.020	1.39	4.20	0.131	0.300	5.60	247
	117	17.6	0.020	0.74	3.90	0.183	0.390	7.00	297
	94	11.3	<0.020	1.27	4.30	0.172	0.280	6.60	262
	118	18.9	<0.020	0.89	3.90	0.145	0.330	6.00	211
	105	10.3	0.020	1.18	5.30	0.108	0.270	6.40	245
	116	15.3	0.020	1.07	4.50	0.126	0.180	6.40	225

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/24/2014	125	21.2	0.080	0.93	12.70	0.121	1.550	5.70	212
7/25/2014	104	10.8	0.040	1.15	4.50	0.111	0.370	4.80	247
	110	11.5	0.210	0.85	4.30	0.119	0.300	6.20	291
	110	14.9	<0.020	0.69	4.80	0.113	0.250	5.90	248
	104	10.5	<0.020	1.03	5.00	0.106	0.280	5.70	250
	135	24.1	0.020	0.86	4.40	0.160	0.490	6.60	243
7/15/2015	110	11.3	0.020	0.92	4.70	0.121	0.590	6.30	236
	105	11.5	<0.020	0.52	2.50	0.116	0.360	7.00	117
	110	11.7	<0.020	0.67	3.00	0.106	0.360	6.40	171
	105	12	0.030	1.16	3.80	0.109	1.620	7.30	221
	100	10.7	<0.020	2.06	4.90	0.106	0.370	6.60	198
	95	8.4	<0.020	0.91	3.40	0.096	0.380	5.50	176
	100	8.2	<0.020	0.60	3.60	0.119	0.490	5.80	219
	92	9.9	0.020	0.84	4.70	0.072	0.470	6.50	153
	90	7.1	0.030	1.32	3.90	0.159	1.080	7.20	204
	88	6.2	0.020	1.13	4.00	0.119	0.390	6.40	179
7/12/2016	127	21.5	<0.020	0.91	3.24	0.096	0.194	4.29	122
	113	16.2	0.024	1.01	3.49	0.130	0.295	6.23	154
	117	15.8	<0.020	1.44	4.22	0.146	0.232	7.03	210
	104	12.1	<0.019	0.63	3.39	0.153	0.220	6.18	173
	101	9	<0.020	1.49	4.57	0.129	0.305	6.66	257
	95	8.7	<0.020	0.56	3.26	0.101	0.226	6.01	194
	99	11.1	0.029	1.89	5.98	0.110	0.820	7.47	210
	86	8.8	0.022	1.52	5.21	0.101	0.359	6.48	226
	107	10	<0.020	0.98	3.60	0.127	0.239	7.10	182
	97	8.9	<0.019	1.18	4.60	0.124	0.215	6.93	244
7/12/2017	103	11.5	0.028	0.74	3.39	0.100	0.189	6.36	173
	96	8.8	0.030	0.77	3.69	0.103	0.327	5.90	160
	93	8.1	0.039	0.49	3.25	0.116	0.468	5.10	133
	96	10.4	0.020	0.67	3.30	0.107	0.173	5.70	177
	84	6.5	0.028	0.72	3.72	0.110	0.403	5.18	192
	109	14.1	0.033	0.45	3.29	0.088	0.212	5.05	150
	90	9	0.035	1.30	5.34	0.093	0.281	7.16	227
	97	9.9	0.029	0.89	3.79	0.090	0.246	6.30	178
	101	10.6	0.031	0.87	4.27	0.104	0.222	6.40	167
	115	14.1	0.039	1.20	22.20	0.109	0.444	5.90	191

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/12/2018	125	18.7	0.024	1.11	5.65	0.171	0.325	6.30	230
	90	6.3	<0.020	2.17	6.05	0.154	1.150	7.86	260
	90	7.5	0.032	1.75	5.47	0.139	1.080	8.00	225
	95	8.1	0.037	0.73	3.37	0.183	1.700	6.46	278
	110	14.1	0.040	0.64	3.82	0.156	0.568	6.40	208
	95	9.7	0.026	1.28	7.36	0.119	0.769	7.32	258
	95	7.1	0.023	1.31	4.78	0.130	0.452	7.20	234
	85	6.9	0.029	0.73	4.22	0.118	0.675	6.84	206
	100	10.1	0.056	1.35	5.40	0.186	0.421	7.99	241
	105	12.9	0.036	1.45	6.08	0.136	0.538	8.90	217
7/10/2019	100	10.4	0.037	1.28	4.77	0.149	0.828	5.91	201
	90	7.2	<0.020	1.65	4.55	0.142	0.318	6.25	270
	95	8.7	<0.020	1.06	3.53	0.081	0.231	6.05	188
	111	13.4	<0.020	0.98	3.75	0.073	0.274	5.53	150
	89	7.7	<0.020	1.07	3.61	0.116	0.340	6.00	181
	87	4.2	<0.020	1.01	3.62	0.078	0.178	6.40	178
	101	10.3	<0.020	0.64	3.42	0.117	0.114	7.50	168
	103	9.9	<0.020	0.66	2.74	0.156	0.227	5.60	168
	96	9.5	<0.020	1.58	3.09	0.105	0.157	6.28	194
	94	8.5	<0.020	0.86	3.05	0.106	0.114	5.20	216
7/16/2020	92	7.1	0.027	1.97	4.95	0.192	0.279	5.83	304
	98	9.6	0.035	1.88	6.50	0.193	0.322	4.83	241
	100	10.7	0.022	0.87	3.66	0.132	0.330	9.22	198
	126	17.7	0.022	1.05	4.13	0.148	0.729	7.39	211
	116	14.2	0.035	1.61	4.43	0.224	0.581	6.76	193
	92	7.6	0.033	0.88	4.50	0.153	3.970	5.50	207
	112	14.2	0.037	0.96	5.10	0.197	0.352	6.08	212
	110	11.8	0.035	0.90	5.23	0.183	0.257	6.27	251
	104	11.9	0.052	1.23	5.85	0.175	0.721	6.33	210
	102	9.8	0.037	1.02	4.68	0.108	0.463	7.13	188
7/12/2021	88	7.5	0.042	1.26	5.96	0.184	0.418	5.91	227
	93	9.9	0.025	1.08	4.28	0.150	0.291	7.01	183
	83	5.3	0.035	1.04	4.00	0.161	0.797	5.75	222
	105	11.6	0.038	1.43	4.96	0.182	0.334	6.12	230
	90	6.8	0.027	0.79	3.43	0.205	0.272	5.60	157
	99	8	0.020	0.81	3.44	0.175	0.203	5.78	189
	92	7.9	0.028	2.11	7.63	0.163	0.265	7.16	282
	96	8.2	0.020	0.86	3.10	0.161	0.304	5.57	151
	91	6.8	0.031	0.93	4.57	0.165	0.409	5.99	203
	92	7.2	0.035	1.74	4.89	0.161	0.128	6.92	261

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/12/2022	100	10	0.021	1.66	5.19	0.306	2.010	6.07	234
	110	14.6	0.023	1.14	4.28	0.084	3.570	7.67	184
	118	19.4	0.020	0.65	3.22	0.188	1.550	5.33	171
	124	24.2	0.024	0.75	4.56	0.106	1.170	5.70	132
	108	11.6	0.028	0.51	4.35	0.120	3.320	5.18	151
	103	10.9	0.021	0.84	3.67	0.140	6.760	5.48	139
	116	17.9	0.025	0.89	3.71	0.119	3.870	6.19	182
	113	14.5	0.020	0.82	3.96	0.121	1.650	6.15	173
	101	11.6	0.027	1.03	4.82	0.104	9.950	6.31	186
	93	8.8	0.020	0.88	3.09	0.110	6.290	5.40	185
7/13/2023	112	15	0.033	2.18	5.90	0.183	0.324	6.73	234
	109	13	0.029	1.16	4.67	0.217	0.400	6.13	222
	94	8.7	0.024	1.14	4.25	0.104	0.377	6.07	157
	94	8.8	0.020	1.39	5.10	0.131	0.198	6.83	231
	111	13.2	0.020	1.48	3.92	0.181	0.257	6.88	211
	93	9.1	0.025	1.91	4.93	0.147	0.410	5.48	179
	98	9.1	0.025	2.04	5.64	0.182	0.277	6.47	203
	115	14.9	0.027	1.05	4.69	0.228	0.520	7.21	195
	116	14.8	0.020	1.44	4.64	0.154	0.962	5.27	234
	103	10.5	0.027	0.76	4.32	0.174	0.222	7.26	165

Appendix D.3.–Tributary Creek Site 9 Dolly Varden element concentrations, 2001–2023.

Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/21/2001	97	9.1	0.090	0.35	4.30	ND	0.560	6.80	127
	97	9.7	0.100	0.77	5.20	ND	0.670	8.00	118
	97	9.5	0.150	0.92	5.40	ND	4.880	5.30	144
	98	10.4	0.150	0.86	6.70	ND	2.190	1.00	99
	86	6.4	0.080	0.76	4.90	ND	0.330	6.20	106
	93	7.8	0.060	0.37	12.00	ND	0.380	6.80	122
7/24/2002	103	10.8	0.020	0.22	3.70	ND	0.120	1.40	144
	97	10.4	0.070	1.20	5.50	ND	1.660	3.30	172
	100	11.2	0.130	1.06	6.10	ND	3.400	5.00	138
	90	7.9	0.230	1.29	7.10	ND	4.080	5.20	168
	90	9.2	0.080	1.15	5.20	ND	1.390	6.20	150
	100	9.3	0.040	0.84	3.20	ND	0.330	5.40	152
7/23/2003	106	10.7	0.060	0.46	2.80	ND	0.340	6.30	134
	89	6.8	0.100	1.01	4.00	ND	0.820	6.00	131
	112	17.4	0.160	1.35	4.40	ND	1.850	5.70	108
	95	11.6	0.190	0.69	5.60	ND	1.300	3.60	136
	91	9.5	0.050	0.72	4.40	ND	0.560	4.90	131
	84	8.4	0.120	0.76	3.90	ND	0.780	4.70	125
7/21/2004	84	5.5	0.100	0.96	3.20	ND	1.190	5.40	169
	96	8.5	0.100	1.24	3.80	ND	0.670	5.90	138
	105	14.1	0.100	2.02	4.00	ND	1.760	5.80	125
	85	5.8	0.040	0.47	3.70	ND	0.930	4.80	175
	81	6.4	0.090	2.34	4.30	ND	1.440	8.20	140
	86	10.4	0.110	0.83	5.50	ND	0.970	5.80	161
7/23/2005	97	11.1	0.060	0.70	10.40	ND	0.290	6.40	104
	113	16.8	0.100	0.63	4.70	ND	0.970	6.10	122
	115	18.8	0.070	0.52	6.30	ND	0.530	5.80	109
	117	20.5	0.190	0.79	9.90	ND	1.070	6.70	117
	101	11.7	0.070	1.44	5.20	ND	1.000	8.10	130
	107	13.7	0.100	1.29	4.60	ND	0.460	8.00	134
7/21/2006	99	12.9	0.120	0.74	4.00	ND	0.320	6.30	120
	96	11.6	0.120	0.76	7.70	ND	1.320	6.80	157
	94	10.9	0.180	1.59	10.30	ND	2.480	4.90	160
	100	10.9	0.110	1.34	8.50	ND	1.460	5.20	142
	97	11.7	0.140	0.88	4.60	ND	0.960	5.20	107
	117	20.8	0.240	1.29	4.30	ND	2.920	5.90	130

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/20/2007	98	12.4	0.110	0.91	2.70	ND	1.100	7.80	106
	89	8.9	0.120	1.72	3.30	ND	1.800	5.60	136
	114	14.1	0.150	2.76	3.40	ND	1.280	8.70	122
	81	7.1	0.140	1.90	4.20	ND	2.030	7.00	114
	114	14.6	0.880	3.63	3.90	ND	1.560	10.90	131
	93	10.6	0.140	1.50	20.30	ND	3.800	9.40	107
7/23/2008	103	12.9	0.224	1.99	4.20	ND	3.470	7.66	169
	108	14.8	0.095	0.96	3.20	ND	0.860	5.82	143
	88	8.9	0.076	0.93	3.30	ND	0.750	4.41	186
	86	9.3	0.220	1.91	5.70	ND	4.060	5.71	119
	92	9.6	0.073	1.01	2.70	ND	0.610	5.20	125
	90	8.7	0.033	0.54	2.20	ND	0.430	4.80	108
7/22/2009	83	6.9	0.040	0.29	1.70	ND	0.240	5.40	127
	91	8.6	0.060	0.55	2.10	ND	0.160	5.10	137
	91	8.5	0.110	0.36	2.00	ND	0.230	7.50	138
	98	10.3	0.090	0.81	3.40	ND	0.380	5.80	147
	91	8.6	0.030	0.47	2.20	ND	0.400	4.50	125
	90	7.8	0.060	0.60	2.20	ND	0.380	5.60	129
7/20/2010	87	7.4	0.293	1.61	5.40	0.430	3.920	6.40	151
	94	10.9	0.124	0.82	2.50	0.580	0.240	5.70	174
	90	8.5	0.084	0.73	2.90	0.350	0.290	5.30	125
	90	8.2	0.059	0.60	2.30	0.270	0.330	4.70	151
	108	13.5	0.081	0.66	2.60	0.540	0.250	3.20	118
	105	11.6	0.076	0.75	3.10	0.270	0.230	3.90	150
7/21/2011	NA	NA	0.090	0.80	3.40	ND	0.320	6.70	146
7/26/2012	89	7.3	<0.020	0.33	18.40	0.429	0.180	4.30	123
	122	16.5	0.030	0.60	8.40	0.257	0.540	4.80	126
	NA	8.1	0.050	0.76	42.40	0.217	1.650	4.90	140
	105	11.7	0.130	0.57	22.60	0.241	0.740	7.50	128
	98	9.9	0.070	0.95	203.00	0.235	1.900	5.50	115
	NA	20.2	0.060	0.53	8.50	0.278	0.670	5.30	116
7/23/2013	90	10.1	0.720	6.36	7.50	0.418	5.930	9.70	179
	92	10.4	0.270	1.57	3.80	0.329	1.600	6.90	122
	85	7.8	0.190	2.41	5.80	0.297	3.900	8.60	153
	NA	8	0.050	0.59	3.30	0.439	0.350	5.00	152
	82	6.6	0.480	4.67	8.90	0.332	4.870	9.60	181
	81	5.5	0.130	2.14	4.60	0.289	1.640	5.60	166

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/23/2014	105	13.1	0.160	0.82	2.70	0.186	0.160	7.10	145
	105	11.5	0.020	0.69	2.30	0.188	0.180	5.10	140
	104	9.1	0.090	0.69	2.60	0.247	0.220	7.20	116
	94	8.4	0.060	1.16	2.40	0.264	0.330	6.70	156
	95	8.3	0.120	0.54	2.80	0.215	0.550	6.20	135
	105	11.4	0.040	0.30	2.60	0.228	0.190	5.30	117
7/14/2015	NA	12.4	0.220	3.92	3.80	0.285	3.300	7.10	188
	77	5.7	0.330	4.40	5.20	0.321	4.930	9.10	157
	84	7.2	0.220	2.54	5.30	0.338	2.840	7.90	134
	NA	81	0.480	4.73	6.70	0.338	6.200	10.60	173
	82	6.9	0.360	3.76	4.60	0.342	4.800	8.50	153
	NA	7.7	0.250	4.03	5.30	0.280	3.420	7.80	165
	90	9.3	0.280	1.81	3.40	0.304	1.690	9.20	124
	80	6.8	0.300	3.92	5.10	0.312	4.870	9.70	159
	NA	8.9	0.130	1.69	4.20	0.322	1.860	7.20	142
	NA	12.8	0.510	5.86	5.10	0.293	4.540	10.70	175
7/11/2016	97	8.1	0.057	0.34	1.99	0.250	0.222	6.34	136
	90	6.3	0.068	0.90	2.68	0.219	0.493	5.61	115
	105	11.5	0.139	0.44	2.23	0.315	0.333	7.48	124
	94	9.4	0.134	1.30	2.76	0.234	0.982	7.12	134
	94	10.3	0.078	0.78	2.35	0.334	0.189	6.62	125
	114	16.4	0.109	1.03	2.19	0.232	0.285	5.83	131
	87	6.5	0.051	0.49	2.09	0.363	0.190	4.99	101
	89	6.5	0.034	0.58	2.17	0.249	0.198	5.61	138
	102	11.1	0.156	0.89	3.29	0.443	0.368	5.40	127
	87	6.1	0.059	1.35	2.27	0.263	0.179	8.34	125
7/11/2017	109	12.9	0.080	1.15	2.76	0.269	0.484	10.00	114
	78	5.4	0.191	2.78	3.60	0.408	2.040	8.80	145
	78	5.7	0.089	2.34	6.71	0.310	1.570	7.89	160
	109	12.4	0.094	1.29	2.40	0.631	0.413	6.15	122
	84	6.2	0.079	1.16	2.62	0.400	0.412	7.39	121
	117	17.8	0.288	3.68	3.21	0.439	1.720	9.25	148
	87	7.4	0.191	2.02	4.01	0.261	1.300	8.60	126
	94	9.2	0.068	0.29	3.55	0.169	0.183	3.20	163
	73	4.1	0.062	0.82	3.85	0.364	0.988	5.50	172
	83	6.7	0.096	1.33	3.44	0.457	1.800	8.25	118

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Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/12/2018	105	12.4	0.096	0.70	2.31	0.490	0.385	6.30	154
	81	6.7	0.115	1.09	2.80	0.577	0.963	7.20	160
	92	9.4	0.070	0.31	2.90	0.406	0.196	5.03	109
	106	11.9	0.044	0.51	2.32	0.457	0.353	5.40	137
	85	7.5	0.085	1.30	2.80	0.353	1.020	6.00	171
	92	8.3	0.108	0.97	2.84	0.863	0.381	6.70	94.8
	85	6.4	0.093	1.36	2.73	0.364	0.871	6.31	144
	108	11.6	0.084	0.79	2.53	0.435	0.162	6.20	143
	86	5.8	0.096	1.88	2.63	0.771	0.636	6.40	128
	109	12.5	0.139	0.71	2.37	0.664	0.945	6.40	154
7/11/2019	84	12.4	0.048	0.58	2.45	0.710	0.280	4.15	147
	102	6.7	0.078	0.62	2.04	0.727	0.385	4.91	161
	97	9.4	0.114	0.81	3.32	0.489	0.695	3.81	164
	91	11.9	0.093	0.60	2.35	0.775	0.245	5.23	152
	124	7.5	0.147	0.30	2.57	0.550	0.723	4.09	141
	NA	8.3	0.058	0.55	2.03	0.975	0.244	4.92	162
7/15/2020	112	13.6	0.113	0.81	2.79	0.611	1.230	7.19	108
	161	41.7	0.262	1.81	3.89	0.476	1.970	5.80	176
	120	16.9	0.616	4.52	6.35	0.383	4.920	10.90	222
	98	10.2	0.381	2.72	5.99	0.462	3.190	11.20	130
	119	19.2	0.517	2.78	7.04	0.489	4.780	13.80	173
	93	7.7	1.470	4.87	6.31	0.487	4.040	11.40	274
	87	6.6	0.357	1.68	6.68	0.425	3.930	9.31	163
7/13/2021	104	11.4	0.239	1.01	3.57	0.348	1.090	6.99	138
	99	10.2	0.373	2.23	3.70	0.442	0.757	8.09	132
	123	13.5	0.056	0.97	4.47	0.358	2.390	3.10	395
	110	13.6	0.084	0.26	1.88	0.438	0.079	7.85	132
	85	7.1	0.321	1.29	5.80	0.457	3.340	7.83	142
7/20/2021	102	10.2	0.059	0.50	2.23	0.340	0.166	6.03	130
	115	11.7	0.044	0.28	2.79	0.700	0.054	3.17	192
	103	10.2	0.092	0.72	2.75	0.357	0.263	8.14	168

-continued-

Date	FL (mm)	Weight (g)	Ag (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
7/12/2022	94	8.4	0.039	0.21	2.12	0.213	0.084	3.69	111
	97	8.2	0.147	1.30	3.38	0.287	0.749	6.59	154
	77	4.8	0.041	0.40	3.23	0.346	0.185	4.02	128
	77	4.3	0.218	0.48	2.83	0.364	0.679	3.94	143
8/15/2022	98	15.1	0.332	4.79	5.83	0.490	1.340	9.35	164
	100	10.6	0.186	2.26	2.69	0.297	1.000	6.21	111
	104	13.8	0.103	0.95	3.48	0.325	1.040	5.11	130
	104	13.4	0.101	0.52	3.00	0.328	0.428	4.64	123
	122	23.3	0.221	0.98	6.24	0.330	2.570	7.45	129
	87	9.3	0.260	2.55	3.64	0.452	1.450	5.99	154
7/12/2023	95	7.7	0.057	0.52	2.88	0.299	0.502	5.87	128
	104	10.7	0.063	0.26	1.91	0.368	0.114	6.02	104
	94	9.2	0.092	0.55	2.34	0.499	0.881	4.68	119
	86	6.9	0.098	0.56	3.54	0.286	0.797	5.69	131
	92	7.9	0.049	0.47	3.04	0.317	0.299	5.21	118
	100	11.4	0.115	0.71	3.80	0.443	0.445	5.51	140
	90	7.6	0.128	0.92	3.34	0.354	0.857	5.98	128
	85	6.4	0.046	0.51	3.43	0.278	0.724	5.20	125
	86	6	0.284	0.56	3.15	0.357	0.675	5.63	131
	99	8.7	0.095	0.33	3.17	0.347	0.312	3.10	105

ALS Environmental
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September 26, 2023 **Analytical Report for Service Request No:** K2309806

Kate Kanouse
Alaska Department of Fish and Game
Division of Habitat
802 3rd Street
P.O. Box 110024
Douglas, AK 99811-0024

RE: 2023 Greens Creek Biomonitoring

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory August 31, 2023
For your reference, these analyses have been assigned our service request number **K2309806.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

ALS Environmental
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Table of Contents

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

ALS Environmental—Kelso Laboratory
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Phone (360)577-7222 Fax (360)636-1068
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ALS Environmental

Client: Alaska Department of Fish and Game
Project: 2023 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2309806
Date Received: 08/31/2023

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier level IV requested by the client.

Sample Receipt:

Forty animal tissue samples were received for analysis at ALS Environmental on 08/31/2023. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 6020A, 09/26/2023:The Relative Percent Difference (RPD) for the replicate analysis of Zinc in sample Tributary Creek Site 9 DV Metals Fish #1 was outside the normal ALS control limits. The samples were homogenized, freeze dried, then ground prior to digestion, however this was not sufficient to achieve a completely uniform distribution of Zinc in the tissue.

Method 6020A, 09/26/2023: The matrix spike recovery of Zinc for sample Tributary Creek Site 9 DV Metals Fish #1 was outside the ALS control criteria as a result of the nonhomogeneous distribution of Zinc in the sample. The Relative Percent Difference (RPD) for the replicate analysis supported this (see note above). Since the unspiked sample contained high analyte concentration relative to the amount spiked, the variability between replicates was sufficient to bias the percent recovery outside normal ALS control criteria. The associated QA/QC results (e.g. control sample, calibration standards, etc.) indicated the analysis was in control. No further corrective action was appropriate.

Approved by Noe D. Davis Date 09/26/2023

Chain of Custody

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CHAIN OF CUSTODY

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see 2 attachments SR# K2309806

PAGE 1 OF 1 COC#

PROJECT NAME: 2023 Greens Creek Biomonitoring
PROJECT NUMBER:
PROJECT MANAGER: Kate Kanouse
COMPANY NAME: AK Department of Fish & Game
ADDRESS: 802 3rd Street
CITY/STATE/ZIP: Douglas, AK, 99824
E-MAIL ADDRESS: kate.kanouse@alaska.gov
PHONE #: (907) 465-4290 FAX #:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐ SIM PAH☐	Volatile Organics 624☐ 8260☐ 8270LL☐	Hydrocarbons Gas☐ Diesel☐ 8021☐ BTEX☐ (*see below) Oil☐	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	PCBs Aroclors☐ Congeners☐	Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	Metals, Total or Dissolved (See List below)	Cyanide☐ Hex-Chrom☐	(circle) pH, Cond., Cl, SO_4, PO4, F, NO_2, NO_3, BOD, TSS, TDS, Turb.	(circle) NH_3-N, COD, TKN, TOC, DOC, NO_2+NO_3, T-Phos	TOX 9020☐ AOX 1650☐ 506☐	Alkalinity☐ CO_3☐ HCO_3☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ CO_2☐ Methane☐ Ethane☐ Ethene☐			REMARKS
See attachments (2) for													X								X	Hg-1631E			
whole body	juvenile fish																							
individual	samples																							

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
✓ II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

INVOICE INFORMATION

P.O. # Hecla Greens Creek
Bill To: David Landes
dlandes@hecla-mining.com

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 day
✓ Standard (15 working days)
___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca (Cd) Co Cr (Cu) Fe (Pb) Mg Mn Mo Ni K (Ag) Na (Se) Sr Tl Sn V (Zn) (Hg)

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: ____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

Please send report to Kate Kanouse and Jesse Lindgren (jesse.lindgren@alaska.gov)

Please send invoice to David Landes at dlandes@hecla-mining.com

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature: [signature]	Signature:	Signature:
Date/Time: 8/29/23 0930	Date/Time: 8/31/23 1000	Date/Time:	Date/Time:
Printed Name: Emma King	Printed Name: Daniel S	Printed Name:	Printed Name:
Firm: ADFG	Firm: ALS	Firm:	Firm:

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VR23098O6

Project Name:	2023 Greens Creek Mine Biomonitoring		**Attachment 1 of 2**
Project Manager:	Erika King	Sample Type:	Whole body juvenile Dolly Varden char
Company Name:	Alaska Department of Fish and Game	Analysis:	Total metals, dry weight basis, report percent solids
Contact Information:	erika.king@alaska.gov / 907-465-6979		

Matrix	Sample Date	Sample Name	Sample ID	Total Metals	Fork Length (mm)	Weight (g)
Whole Body		Greens Creek Site 54 DV Metals Fish #1	2023GC54DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	112	15.0
Whole Body		Greens Creek Site 54 DV Metals Fish #2	2023GC54DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	109	13.0
Whole Body		Greens Creek Site 54 DV Metals Fish #3	2023GC54DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	8.7
Whole Body		Greens Creek Site 54 DV Metals Fish #4	2023GC54DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	8.8
Whole Body		Greens Creek Site 54 DV Metals Fish #5	2023GC54DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	111	13.2
Whole Body		Greens Creek Site 54 DV Metals Fish #6	2023GC54DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	9.1
Whole Body		Greens Creek Site 54 DV Metals Fish #7	2023GC54DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	9.1
Whole Body		Greens Creek Site 54 DV Metals Fish #8	2023GC54DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	115	14.9
Whole Body		Greens Creek Site 54 DV Metals Fish #9	2023GC54DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	116	14.8
Whole Body		Greens Creek Site 54 DV Metals Fish #10	2023GC54DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	103	10.5
Whole Body		Greens Creek Site 63 DV Metals Fish #1	2023GC63DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	115	16.3
Whole Body		Greens Creek Site 63 DV Metals Fish #2	2023GC63DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	112	10.1
Whole Body		Greens Creek Site 63 DV Metals Fish #3	2023GC63DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	123	16.3
Whole Body		Greens Creek Site 63 DV Metals Fish #4	2023GC63DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	105	11.0
Whole Body		Greens Creek Site 63 DV Metals Fish #5	2023GC63DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	110	13.3
Whole Body		Greens Creek Site 63 DV Metals Fish #6	2023GC63DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	98	9.3
Whole Body		Greens Creek Site 63 DV Metals Fish #7	2023GC63DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	114	14.8
Whole Body		Greens Creek Site 63 DV Metals Fish #8	2023GC63DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	9.1
Whole Body		Greens Creek Site 63 DV Metals Fish #9	2023GC63DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	9.6
Whole Body		Greens Creek Site 63 DV Metals Fish #10	2023GC63DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	8.7

VN23098806

Project Name:	2023 Greens Creek Mine Biomonitoring		**Attachment 2 of 2**
Project Manager:	Erika King	Sample Type:	Whole body juvenile Dolly Varden char and Coho Salmon
Company Name:	Alaska Department of Fish and Game	Analysis:	Total metals, dry weight basis, report percent solids
Contact Information:	erika.king@alaska.gov / 907-465-6979		

Matrix	Sample Date	Sample Name	Sample ID	Total Metals	Fork Length (mm)	Weight (g)
Whole Body		Tributary Creek Site 9 DV Metals Fish #1	2023TC9DV1	Ag, Cd, Cu, Hg, Pb, Se, Zn	95	7.7
Whole Body		Tributary Creek Site 9 DV Metals Fish #2	2023TC9DV2	Ag, Cd, Cu, Hg, Pb, Se, Zn	104	10.7
Whole Body		Tributary Creek Site 9 DV Metals Fish #3	2023TC9DV3	Ag, Cd, Cu, Hg, Pb, Se, Zn	94	9.2
Whole Body		Tributary Creek Site 9 DV Metals Fish #4	2023TC9DV4	Ag, Cd, Cu, Hg, Pb, Se, Zn	86	6.9
Whole Body		Tributary Creek Site 9 DV Metals Fish #5	2023TC9DV5	Ag, Cd, Cu, Hg, Pb, Se, Zn	92	7.9
Whole Body		Tributary Creek Site 9 DV Metals Fish #6	2023TC9DV6	Ag, Cd, Cu, Hg, Pb, Se, Zn	100	11.4
Whole Body		Tributary Creek Site 9 DV Metals Fish #7	2023TC9DV7	Ag, Cd, Cu, Hg, Pb, Se, Zn	90	7.6
Whole Body		Tributary Creek Site 9 DV Metals Fish #8	2023TC9DV8	Ag, Cd, Cu, Hg, Pb, Se, Zn	85	6.4
Whole Body		Tributary Creek Site 9 DV Metals Fish #9	2023TC9DV9	Ag, Cd, Cu, Hg, Pb, Se, Zn	86	6.0
Whole Body		Tributary Creek Site 9 DV Metals Fish #10	2023TC9DV10	Ag, Cd, Cu, Hg, Pb, Se, Zn	99	8.7
Whole Body		Tributary Creek Site 9 CO Metals Fish #1	2023TC9CO1	Ag, Cd, Cu, Hg, Pb, Se, Zn	93	10.1
Whole Body		Tributary Creek Site 9 CO Metals Fish #2	2023TC9CO2	Ag, Cd, Cu, Hg, Pb, Se, Zn	92	8.1
Whole Body		Tributary Creek Site 9 CO Metals Fish #3	2023TC9CO3	Ag, Cd, Cu, Hg, Pb, Se, Zn	85	6.8
Whole Body		Tributary Creek Site 9 CO Metals Fish #4	2023TC9CO4	Ag, Cd, Cu, Hg, Pb, Se, Zn	92	7.3
Whole Body		Tributary Creek Site 9 CO Metals Fish #5	2023TC9CO5	Ag, Cd, Cu, Hg, Pb, Se, Zn	90	9.4
Whole Body		Tributary Creek Site 9 CO Metals Fish #6	2023TC9CO6	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	7.3
Whole Body		Tributary Creek Site 9 CO Metals Fish #7	2023TC9CO7	Ag, Cd, Cu, Hg, Pb, Se, Zn	89	7.6
Whole Body		Tributary Creek Site 9 CO Metals Fish #8	2023TC9CO8	Ag, Cd, Cu, Hg, Pb, Se, Zn	86	7.3
Whole Body		Tributary Creek Site 9 CO Metals Fish #9	2023TC9CO9	Ag, Cd, Cu, Hg, Pb, Se, Zn	88	8.0
Whole Body		Tributary Creek Site 9 CO Metals Fish #10	2023TC9CO10	Ag, Cd, Cu, Hg, Pb, Se, Zn	87	8.3

PM MH

Cooler Receipt and Preservation Form

Client AK Dept. of Fish & Game Service Request K23 09806

Received: 8-31-23 Opened: 8-31-23 By: DS Unloaded: 8-31-23 By: DS

1. Samples were received via? *USPS* (*Fed Ex*) *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) (*Cooler*) *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? _____
   If present, were custody seals intact? Y (N) If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
	2.8	IR01				783082284020	

4. Was a Temperature Blank present in cooler? NA Y (N) If yes, notate the temperature in the appropriate column above:
   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":
5. Were samples received within the method specified temperature ranges? NA (Y) N
   If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. (NA) Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

6. Packing material: *Inserts* *Baggies* (*Bubble Wrap*) (*Gel Packs*) *Wet Ice* *Dry Ice* *Sleeves* _____
7. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
8. Were samples received in good condition (unbroken) NA (Y) N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA (Y) N
10. Did all sample labels and tags agree with custody papers? NA (Y) N
11. Were appropriate bottles/containers and volumes received for the tests indicated? (NA) Y N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
13. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
14. Was C12/Res negative? (NA) Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM (NA) Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? (NA) Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: _____

Total Solids

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
Greens Creek Site 54 DV Metals Fish #1	K2309806-001	**22.4**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #2	K2309806-002	**21.6**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #3	K2309806-003	**24.0**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #4	K2309806-004	**21.8**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #5	K2309806-005	**21.1**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #6	K2309806-006	**21.3**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #7	K2309806-007	**21.6**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #8	K2309806-008	**20.9**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #9	K2309806-009	**20.8**	-	-	1	09/14/23	
Greens Creek Site 54 DV Metals Fish #10	K2309806-010	**22.7**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #1	K2309806-011	**21.4**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #2	K2309806-012	**20.4**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #3	K2309806-013	**22.0**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #4	K2309806-014	**21.1**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #5	K2309806-015	**21.1**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #6	K2309806-016	**20.5**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #7	K2309806-017	**22.2**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #8	K2309806-018	**21.6**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #9	K2309806-019	**21.6**	-	-	1	09/14/23	
Greens Creek Site 63 DV Metals Fish #10	K2309806-020	**21.6**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #1	K2309806-021	**22.1**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #2	K2309806-022	**23.8**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #3	K2309806-023	**23.0**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #4	K2309806-024	**21.0**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #5	K2309806-025	**22.6**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #6	K2309806-026	**22.4**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #7	K2309806-027	**21.0**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #8	K2309806-028	**21.8**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #9	K2309806-029	**21.8**	-	-	1	09/14/23	
Tributary Creek Site 9 DV Metals Fish #10	K2309806-030	**23.3**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #1	K2309806-031	**20.6**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #2	K2309806-032	**22.1**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #3	K2309806-033	**21.1**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #4	K2309806-034	**21.1**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #5	K2309806-035	**22.1**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #6	K2309806-036	**21.7**	-	-	1	09/14/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23
Analysis Method:	Freeze Dry	**Units:**	Percent
Prep Method:	None	**Basis:**	Wet

Total Solids

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
Tributary Creek Site 9 CO Metals Fish #7	K2309806-037	**20.9**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #8	K2309806-038	**22.4**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #9	K2309806-039	**21.3**	-	-	1	09/14/23	
Tributary Creek Site 9 CO Metals Fish #10	K2309806-040	**21.5**	-	-	1	09/14/23	

Metals

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ALS Group USA, Corp.
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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	08/31/23

Mercury, Total

Prep Method:	METHOD	Units:	ng/g
Analysis Method:	1631E	Basis:	Dry
Test Notes:			

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Greens Creek Site 54 DV Metals Fish #1	K2309806-001	10	2.0	10	09/25/23	09/26/23	183	
Greens Creek Site 54 DV Metals Fish #2	K2309806-002	9.8	2.0	10	09/25/23	09/26/23	217	
Greens Creek Site 54 DV Metals Fish #3	K2309806-003	9.6	1.9	10	09/25/23	09/26/23	104	
Greens Creek Site 54 DV Metals Fish #4	K2309806-004	9.6	1.6	10	09/25/23	09/26/23	131	
Greens Creek Site 54 DV Metals Fish #5	K2309806-005	10	2.0	10	09/25/23	09/26/23	181	
Greens Creek Site 54 DV Metals Fish #6	K2309806-006	10	2.0	10	09/25/23	09/26/23	147	
Greens Creek Site 54 DV Metals Fish #7	K2309806-007	10	2.0	10	09/25/23	09/26/23	182	
Greens Creek Site 54 DV Metals Fish #8	K2309806-008	9.7	1.9	10	09/25/23	09/26/23	228	
Greens Creek Site 54 DV Metals Fish #9	K2309806-009	9.9	2.0	10	09/25/23	09/26/23	154	
Greens Creek Site 54 DV Metals Fish #10	K2309806-010	9.8	2.0	10	09/25/23	09/26/23	174	
Greens Creek Site 63 DV Metals Fish #1	K2309806-011	9.6	1.9	10	09/25/23	09/26/23	144	
Greens Creek Site 63 DV Metals Fish #2	K2309806-012	10	2.0	10	09/25/23	09/26/23	167	
Greens Creek Site 63 DV Metals Fish #3	K2309806-013	9.9	2.0	10	09/25/23	09/26/23	118	
Greens Creek Site 63 DV Metals Fish #4	K2309806-014	9.6	1.9	10	09/25/23	09/26/23	119	
Greens Creek Site 63 DV Metals Fish #5	K2309806-015	99	2.0	10	09/25/23	09/26/23	190	
Greens Creek Site 63 DV Metals Fish #6	K2309806-016	9.9	2.0	10	09/25/23	09/26/23	119	
Greens Creek Site 63 DV Metals Fish #7	K2309806-017	9.9	2.0	10	09/25/23	09/26/23	133	
Greens Creek Site 63 DV Metals Fish #8	K2309806-018	9.9	2.0	10	09/25/23	09/26/23	133	
Greens Creek Site 63 DV Metals Fish #9	K2309806-019	9.9	2.0	10	09/25/23	09/26/23	126	
Greens Creek Site 63 DV Metals Fish #10	K2309806-020	9.7	2.0	10	09/25/23	09/26/23	128	
Method Blank 1	K2309806-MB1	1.0	0.2	1	NA	09/26/23	ND	
Method Blank 2	K2309806-MB2	1.0	0.2	1	NA	09/26/23	ND	
Method Blank 3	K2309806-MB3	1.0	0.2	1	NA	09/26/23	ND	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	08/31/23
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 54 DV Metals Fish #1	Units:	ng/g
Lab Code:	K2309806-001MS, K2309806-001DMS	Basis:	Dry
Test Notes:			

				Spike Level		Sample	Spike Result		Percent Recovery		ALS Acceptance	Relative Percent	
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Result Notes**
Mercury	METHOD	1631E	9.8	246	244	183	425	416	98	95	70-130	2	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	08/31/23
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 63 DV Metals Fish #3	Units:	ng/g
Lab Code:	K2309806-013MS, K2309806-013DMS	Basis:	Dry
Test Notes:			

				Spike Level		Sample	Spike Result		Percent Recovery		ALS	Relative	
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Acceptance Limits**	**Percent Difference**	**Result Notes**
Mercury	METHOD	1631E	10	249	250	118	358	362	96	98	70-130	1	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name: Ongoing Precision and Recovery (Initial)

Units: ng/g
Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	5.32	106	70-130	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name: Ongoing Precision and Recovery (Final)

Units: ng/g
Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	5.00	100	70-130	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Quality Control Sample (QCS) Summary
Total Metals

Sample Name:	Quality Control Sample	Units:	ng/g
Lab Code:		Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	292	272	93	70-130	

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	08/31/23

Mercury, Total

Prep Method:	METHOD	Units:	ng/g
Analysis Method:	1631E	Basis:	Dry
Test Notes:			

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tributary Creek Site 9 DV Metals Fish #1	K2309806-021	9.9	2.0	20	09/25/23	09/26/23	299	
Tributary Creek Site 9 DV Metals Fish #2	K2309806-022	9.9	2.0	1	09/25/23	09/26/23	368	
Tributary Creek Site 9 DV Metals Fish #3	K2309806-023	9.8	2.0	1	09/25/23	09/26/23	499	
Tributary Creek Site 9 DV Metals Fish #4	K2309806-024	10	2.0	1	09/25/23	09/26/23	286	
Tributary Creek Site 9 DV Metals Fish #5	K2309806-025	9.9	2.0	1	09/25/23	09/26/23	317	
Tributary Creek Site 9 DV Metals Fish #6	K2309806-026	10	2.0	1	09/25/23	09/26/23	443	
Tributary Creek Site 9 DV Metals Fish #7	K2309806-027	9.7	1.9	1	09/25/23	09/26/23	354	
Tributary Creek Site 9 DV Metals Fish #8	K2309806-028	9.9	2.0	1	09/25/23	09/26/23	278	
Tributary Creek Site 9 DV Metals Fish #9	K2309806-029	9.7	1.9	1	09/25/23	09/26/23	357	
Tributary Creek Site 9 DV Metals Fish #10	K2309806-030	9.9	2.0	1	09/25/23	09/26/23	347	
Tributary Creek Site 9 CO Metals Fish #1	K2309806-031	10	2.0	1	09/25/23	09/26/23	208	
Tributary Creek Site 9 CO Metals Fish #2	K2309806-032	10	2.0	1	09/25/23	09/26/23	276	
Tributary Creek Site 9 CO Metals Fish #3	K2309806-033	10	2.0	1	09/25/23	09/26/23	226	
Tributary Creek Site 9 CO Metals Fish #4	K2309806-034	9.6	1.9	1	09/25/23	09/26/23	240	
Tributary Creek Site 9 CO Metals Fish #5	K2309806-035	9.9	2.0	1	09/25/23	09/26/23	342	
Tributary Creek Site 9 CO Metals Fish #6	K2309806-036	9.8	2.0	1	09/25/23	09/26/23	281	
Tributary Creek Site 9 CO Metals Fish #7	K2309806-037	10	2.0	1	09/25/23	09/26/23	261	
Tributary Creek Site 9 CO Metals Fish #8	K2309806-038	10	2.0	1	09/25/23	09/26/23	265	
Tributary Creek Site 9 CO Metals Fish #9	K2309806-039	9.8	2.0	1	09/25/23	09/26/23	254	
Tributary Creek Site 9 CO Metals Fish #10	K2309806-040	9.6	1.9	1	09/25/23	09/26/23	284	
Method Blank 1	K2309806-MB1	1.0	0.2	1	09/25/23	09/26/23	ND	
Method Blank 2	K2309806-MB2	1.0	0.2	1	09/25/23	09/26/23	ND	
Method Blank 3	K2309806-MB3	1.0	0.2	1	09/25/23	09/26/23	ND	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	08/31/23
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #6	Units:	ng/g
Lab Code:	K2309806-026MS, K2309806-026DMS	Basis:	Dry
Test Notes:			

				Spike Level		Sample	Spike Result		Percent Recovery		ALS Acceptance	Relative Percent	Result
Analyte	**Prep Method**	**Analysis Method**	**MRL**	**MS**	**DMS**	**Result**	**MS**	**DMS**	**MS**	**DMS**	**Limits**	**Difference**	**Notes**
Mercury	METHOD	1631E	9.8	250	244	443	657	665	86	91	70-130	1	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal tissue	**Date Received:**	08/31/23
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #6	Units:	ng/g
Lab Code:	K2309806-026MS, K2309806-026DMS	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	ALS Acceptance Limits	Relative Percent Difference	Result Notes
Mercury	METHOD	1631E	9.8	249	244	347	575	573	92	93	70-130	<1	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name: Ongoing Precision and Recovery (Initial)

Units: ng/g
Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	5.03	101	70-130	

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Ongoing Precision and Recovery (OPR) Sample Summary
Total Metals

Sample Name: Ongoing Precision and Recovery (Final)

Units: ng/g
Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	5.00	4.81	96	70-130	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Animal tissue	**Date Received:**	NA
		Date Extracted:	09/25/23
		Date Analyzed:	09/26/23

Quality Control Sample (QCS) Summary
Total Metals

Sample Name:	Quality Control Sample	Units:	ng/g
Lab Code:		Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS Percent Recovery Acceptance Limits	Result Notes
Mercury	METHOD	1631E	292	265	91	70-130	

ALS Group USA, Corp.
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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2309806-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.18**	mg/Kg	0.020	0.004	5	09/26/23 12:11	09/22/23	
Copper	6020A	**5.90**	mg/Kg	0.099	0.030	5	09/26/23 12:11	09/22/23	
Lead	6020A	**0.324**	mg/Kg	0.020	0.003	5	09/26/23 12:11	09/22/23	
Selenium	6020A	**6.73**	mg/Kg	0.99	0.20	5	09/26/23 12:11	09/22/23	
Silver	6020A	**0.033**	mg/Kg	0.020	0.008	5	09/26/23 12:11	09/22/23	
Zinc	6020A	**234**	mg/Kg	0.49	0.08	5	09/26/23 12:11	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2309806-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.16**	mg/Kg	0.020	0.004	5	09/26/23 12:22	09/22/23	
Copper	6020A	**4.67**	mg/Kg	0.099	0.030	5	09/26/23 12:22	09/22/23	
Lead	6020A	**0.400**	mg/Kg	0.020	0.003	5	09/26/23 12:22	09/22/23	
Selenium	6020A	**6.13**	mg/Kg	0.99	0.20	5	09/26/23 12:22	09/22/23	
Silver	6020A	**0.029**	mg/Kg	0.020	0.008	5	09/26/23 12:22	09/22/23	
Zinc	6020A	**222**	mg/Kg	0.50	0.08	5	09/26/23 12:22	09/22/23	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2309806-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.14**	mg/Kg	0.020	0.004	5	09/26/23 12:28	09/22/23	
Copper	6020A	**4.25**	mg/Kg	0.099	0.030	5	09/26/23 12:28	09/22/23	
Lead	6020A	**0.377**	mg/Kg	0.020	0.003	5	09/26/23 12:28	09/22/23	
Selenium	6020A	**6.07**	mg/Kg	0.99	0.20	5	09/26/23 12:28	09/22/23	
Silver	6020A	**0.024**	mg/Kg	0.020	0.008	5	09/26/23 12:28	09/22/23	
Zinc	6020A	**157**	mg/Kg	0.50	0.08	5	09/26/23 12:28	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2309806-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.39**	mg/Kg	0.020	0.004	5	09/26/23 12:30	09/22/23	
Copper	6020A	**5.10**	mg/Kg	0.098	0.030	5	09/26/23 12:30	09/22/23	
Lead	6020A	**0.198**	mg/Kg	0.020	0.003	5	09/26/23 12:30	09/22/23	
Selenium	6020A	**6.83**	mg/Kg	0.98	0.20	5	09/26/23 12:30	09/22/23	
Silver	6020A	**0.019**	mg/Kg	0.020	0.008	5	09/26/23 12:30	09/22/23	**J**
Zinc	6020A	**231**	mg/Kg	0.49	0.08	5	09/26/23 12:30	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2309806-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.48**	mg/Kg	0.020	0.004	5	09/26/23 12:32	09/22/23	
Copper	6020A	**3.92**	mg/Kg	0.098	0.030	5	09/26/23 12:32	09/22/23	
Lead	6020A	**0.257**	mg/Kg	0.020	0.003	5	09/26/23 12:32	09/22/23	
Selenium	6020A	**6.88**	mg/Kg	0.98	0.20	5	09/26/23 12:32	09/22/23	
Silver	6020A	**0.014**	mg/Kg	0.020	0.008	5	09/26/23 12:32	09/22/23	**J**
Zinc	6020A	**211**	mg/Kg	0.49	0.08	5	09/26/23 12:32	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2309806-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.91**	mg/Kg	0.020	0.004	5	09/26/23 12:34	09/22/23	
Copper	6020A	**4.93**	mg/Kg	0.098	0.030	5	09/26/23 12:34	09/22/23	
Lead	6020A	**0.410**	mg/Kg	0.020	0.003	5	09/26/23 12:34	09/22/23	
Selenium	6020A	**5.48**	mg/Kg	0.98	0.20	5	09/26/23 12:34	09/22/23	
Silver	6020A	**0.025**	mg/Kg	0.020	0.008	5	09/26/23 12:34	09/22/23	
Zinc	6020A	**179**	mg/Kg	0.49	0.08	5	09/26/23 12:34	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2309806-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.04**	mg/Kg	0.020	0.004	5	09/26/23 12:36	09/22/23	
Copper	6020A	**5.64**	mg/Kg	0.099	0.030	5	09/26/23 12:36	09/22/23	
Lead	6020A	**0.277**	mg/Kg	0.020	0.003	5	09/26/23 12:36	09/22/23	
Selenium	6020A	**6.47**	mg/Kg	0.99	0.20	5	09/26/23 12:36	09/22/23	
Silver	6020A	**0.025**	mg/Kg	0.020	0.008	5	09/26/23 12:36	09/22/23	
Zinc	6020A	**203**	mg/Kg	0.49	0.08	5	09/26/23 12:36	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2309806-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.05**	mg/Kg	0.020	0.004	5	09/26/23 12:38	09/22/23	
Copper	6020A	**4.69**	mg/Kg	0.099	0.030	5	09/26/23 12:38	09/22/23	
Lead	6020A	**0.520**	mg/Kg	0.020	0.003	5	09/26/23 12:38	09/22/23	
Selenium	6020A	**7.21**	mg/Kg	0.99	0.20	5	09/26/23 12:38	09/22/23	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	09/26/23 12:38	09/22/23	
Zinc	6020A	**195**	mg/Kg	0.50	0.08	5	09/26/23 12:38	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2309806-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.44**	mg/Kg	0.020	0.004	5	09/26/23 12:40	09/22/23	
Copper	6020A	**4.64**	mg/Kg	0.099	0.030	5	09/26/23 12:40	09/22/23	
Lead	6020A	**0.962**	mg/Kg	0.020	0.003	5	09/26/23 12:40	09/22/23	
Selenium	6020A	**5.27**	mg/Kg	0.99	0.20	5	09/26/23 12:40	09/22/23	
Silver	6020A	**0.019**	mg/Kg	0.020	0.008	5	09/26/23 12:40	09/22/23	**J**
Zinc	6020A	**234**	mg/Kg	0.50	0.08	5	09/26/23 12:40	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 54 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2309806-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.765**	mg/Kg	0.020	0.004	5	09/26/23 12:43	09/22/23	
Copper	6020A	**4.32**	mg/Kg	0.099	0.030	5	09/26/23 12:43	09/22/23	
Lead	6020A	**0.222**	mg/Kg	0.020	0.003	5	09/26/23 12:43	09/22/23	
Selenium	6020A	**7.26**	mg/Kg	0.99	0.20	5	09/26/23 12:43	09/22/23	
Silver	6020A	**0.027**	mg/Kg	0.020	0.008	5	09/26/23 12:43	09/22/23	
Zinc	6020A	**165**	mg/Kg	0.49	0.08	5	09/26/23 12:43	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2309806-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.27**	mg/Kg	0.020	0.004	5	09/26/23 12:45	09/22/23	
Copper	6020A	**4.32**	mg/Kg	0.099	0.030	5	09/26/23 12:45	09/22/23	
Lead	6020A	**0.435**	mg/Kg	0.020	0.003	5	09/26/23 12:45	09/22/23	
Selenium	6020A	**5.55**	mg/Kg	0.99	0.20	5	09/26/23 12:45	09/22/23	
Silver	6020A	**0.014**	mg/Kg	0.020	0.008	5	09/26/23 12:45	09/22/23	**J**
Zinc	6020A	**206**	mg/Kg	0.50	0.08	5	09/26/23 12:45	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2309806-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.29**	mg/Kg	0.020	0.004	5	09/26/23 12:47	09/22/23	
Copper	6020A	**5.12**	mg/Kg	0.099	0.030	5	09/26/23 12:47	09/22/23	
Lead	6020A	**0.472**	mg/Kg	0.020	0.003	5	09/26/23 12:47	09/22/23	
Selenium	6020A	**5.98**	mg/Kg	0.99	0.20	5	09/26/23 12:47	09/22/23	
Silver	6020A	**0.018**	mg/Kg	0.020	0.008	5	09/26/23 12:47	09/22/23	**J**
Zinc	6020A	**231**	mg/Kg	0.50	0.08	5	09/26/23 12:47	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2309806-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.57**	mg/Kg	0.020	0.004	5	09/26/23 12:53	09/22/23	
Copper	6020A	**5.98**	mg/Kg	0.099	0.030	5	09/26/23 12:53	09/22/23	
Lead	6020A	**0.644**	mg/Kg	0.020	0.003	5	09/26/23 12:53	09/22/23	
Selenium	6020A	**6.08**	mg/Kg	0.99	0.20	5	09/26/23 12:53	09/22/23	
Silver	6020A	**0.050**	mg/Kg	0.020	0.008	5	09/26/23 12:53	09/22/23	
Zinc	6020A	**212**	mg/Kg	0.50	0.08	5	09/26/23 12:53	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2309806-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.894**	mg/Kg	0.020	0.004	5	09/26/23 12:55	09/22/23	
Copper	6020A	**4.27**	mg/Kg	0.098	0.030	5	09/26/23 12:55	09/22/23	
Lead	6020A	**0.289**	mg/Kg	0.020	0.003	5	09/26/23 12:55	09/22/23	
Selenium	6020A	**5.06**	mg/Kg	0.98	0.20	5	09/26/23 12:55	09/22/23	
Silver	6020A	**0.026**	mg/Kg	0.020	0.008	5	09/26/23 12:55	09/22/23	
Zinc	6020A	**160**	mg/Kg	0.49	0.08	5	09/26/23 12:55	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2309806-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.963**	mg/Kg	0.020	0.004	5	09/26/23 12:57	09/22/23	
Copper	6020A	**5.57**	mg/Kg	0.10	0.03	5	09/26/23 12:57	09/22/23	
Lead	6020A	**0.311**	mg/Kg	0.020	0.003	5	09/26/23 12:57	09/22/23	
Selenium	6020A	**5.90**	mg/Kg	1.0	0.2	5	09/26/23 12:57	09/22/23	
Silver	6020A	**0.031**	mg/Kg	0.020	0.008	5	09/26/23 12:57	09/22/23	
Zinc	6020A	**218**	mg/Kg	0.50	0.08	5	09/26/23 12:57	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2309806-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.68**	mg/Kg	0.020	0.004	5	09/26/23 12:59	09/22/23	
Copper	6020A	**5.89**	mg/Kg	0.099	0.030	5	09/26/23 12:59	09/22/23	
Lead	6020A	**0.444**	mg/Kg	0.020	0.003	5	09/26/23 12:59	09/22/23	
Selenium	6020A	**6.95**	mg/Kg	0.99	0.20	5	09/26/23 12:59	09/22/23	
Silver	6020A	**0.021**	mg/Kg	0.020	0.008	5	09/26/23 12:59	09/22/23	
Zinc	6020A	**179**	mg/Kg	0.50	0.08	5	09/26/23 12:59	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2309806-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.906**	mg/Kg	0.020	0.004	5	09/26/23 13:01	09/22/23	
Copper	6020A	**4.57**	mg/Kg	0.099	0.030	5	09/26/23 13:01	09/22/23	
Lead	6020A	**0.180**	mg/Kg	0.020	0.003	5	09/26/23 13:01	09/22/23	
Selenium	6020A	**6.07**	mg/Kg	0.99	0.20	5	09/26/23 13:01	09/22/23	
Silver	6020A	**0.023**	mg/Kg	0.020	0.008	5	09/26/23 13:01	09/22/23	
Zinc	6020A	**175**	mg/Kg	0.49	0.08	5	09/26/23 13:01	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2309806-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.987**	mg/Kg	0.020	0.004	5	09/26/23 13:03	09/22/23	
Copper	6020A	**5.18**	mg/Kg	0.099	0.030	5	09/26/23 13:03	09/22/23	
Lead	6020A	**0.540**	mg/Kg	0.020	0.003	5	09/26/23 13:03	09/22/23	
Selenium	6020A	**6.24**	mg/Kg	0.99	0.20	5	09/26/23 13:03	09/22/23	
Silver	6020A	**0.031**	mg/Kg	0.020	0.008	5	09/26/23 13:03	09/22/23	
Zinc	6020A	**180**	mg/Kg	0.50	0.08	5	09/26/23 13:03	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2309806-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.854**	mg/Kg	0.020	0.004	5	09/26/23 13:05	09/22/23	
Copper	6020A	**4.36**	mg/Kg	0.099	0.030	5	09/26/23 13:05	09/22/23	
Lead	6020A	**0.262**	mg/Kg	0.020	0.003	5	09/26/23 13:05	09/22/23	
Selenium	6020A	**6.54**	mg/Kg	0.99	0.20	5	09/26/23 13:05	09/22/23	
Silver	6020A	**0.018**	mg/Kg	0.020	0.008	5	09/26/23 13:05	09/22/23	**J**
Zinc	6020A	**168**	mg/Kg	0.50	0.08	5	09/26/23 13:05	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Greens Creek Site 63 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2309806-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.773**	mg/Kg	0.020	0.004	5	09/26/23 13:07	09/22/23	
Copper	6020A	**4.34**	mg/Kg	0.10	0.03	5	09/26/23 13:07	09/22/23	
Lead	6020A	**0.264**	mg/Kg	0.020	0.003	5	09/26/23 13:07	09/22/23	
Selenium	6020A	**6.6**	mg/Kg	1.0	0.2	5	09/26/23 13:07	09/22/23	
Silver	6020A	**0.021**	mg/Kg	0.020	0.008	5	09/26/23 13:07	09/22/23	
Zinc	6020A	**193**	mg/Kg	0.50	0.08	5	09/26/23 13:07	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #1	**Basis:**	Dry
Lab Code:	K2309806-021		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.525**	mg/Kg	0.020	0.004	5	09/26/23 13:24	09/22/23	
Copper	6020A	**2.88**	mg/Kg	0.10	0.03	5	09/26/23 13:24	09/22/23	
Lead	6020A	**0.502**	mg/Kg	0.020	0.003	5	09/26/23 13:24	09/22/23	
Selenium	6020A	**5.87**	mg/Kg	1.0	0.2	5	09/26/23 13:24	09/22/23	
Silver	6020A	**0.057**	mg/Kg	0.020	0.008	5	09/26/23 13:24	09/22/23	
Zinc	6020A	**128**	mg/Kg	0.50	0.08	5	09/26/23 13:24	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #2	**Basis:**	Dry
Lab Code:	K2309806-022		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.260**	mg/Kg	0.020	0.004	5	09/26/23 13:34	09/22/23	
Copper	6020A	**1.91**	mg/Kg	0.099	0.030	5	09/26/23 13:34	09/22/23	
Lead	6020A	**0.114**	mg/Kg	0.020	0.003	5	09/26/23 13:34	09/22/23	
Selenium	6020A	**6.02**	mg/Kg	0.99	0.20	5	09/26/23 13:34	09/22/23	
Silver	6020A	**0.063**	mg/Kg	0.020	0.008	5	09/26/23 13:34	09/22/23	
Zinc	6020A	**104**	mg/Kg	0.50	0.08	5	09/26/23 13:34	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #3	**Basis:**	Dry
Lab Code:	K2309806-023		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.547**	mg/Kg	0.020	0.004	5	09/26/23 13:40	09/22/23	
Copper	6020A	**2.34**	mg/Kg	0.099	0.030	5	09/26/23 13:40	09/22/23	
Lead	6020A	**0.881**	mg/Kg	0.020	0.003	5	09/26/23 13:40	09/22/23	
Selenium	6020A	**4.68**	mg/Kg	0.99	0.20	5	09/26/23 13:40	09/22/23	
Silver	6020A	**0.092**	mg/Kg	0.020	0.008	5	09/26/23 13:40	09/22/23	
Zinc	6020A	**119**	mg/Kg	0.50	0.08	5	09/26/23 13:40	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #4	**Basis:**	Dry
Lab Code:	K2309806-024		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.556**	mg/Kg	0.020	0.004	5	09/26/23 13:43	09/22/23	
Copper	6020A	**3.54**	mg/Kg	0.098	0.029	5	09/26/23 13:43	09/22/23	
Lead	6020A	**0.797**	mg/Kg	0.020	0.003	5	09/26/23 13:43	09/22/23	
Selenium	6020A	**5.69**	mg/Kg	0.98	0.20	5	09/26/23 13:43	09/22/23	
Silver	6020A	**0.098**	mg/Kg	0.020	0.008	5	09/26/23 13:43	09/22/23	
Zinc	6020A	**131**	mg/Kg	0.49	0.08	5	09/26/23 13:43	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #5	**Basis:**	Dry
Lab Code:	K2309806-025		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.471**	mg/Kg	0.020	0.004	5	09/26/23 13:45	09/22/23	
Copper	6020A	**3.04**	mg/Kg	0.099	0.030	5	09/26/23 13:45	09/22/23	
Lead	6020A	**0.299**	mg/Kg	0.020	0.003	5	09/26/23 13:45	09/22/23	
Selenium	6020A	**5.21**	mg/Kg	0.99	0.20	5	09/26/23 13:45	09/22/23	
Silver	6020A	**0.049**	mg/Kg	0.020	0.008	5	09/26/23 13:45	09/22/23	
Zinc	6020A	**118**	mg/Kg	0.49	0.08	5	09/26/23 13:45	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #6	**Basis:**	Dry
Lab Code:	K2309806-026		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.714**	mg/Kg	0.020	0.004	5	09/26/23 13:47	09/22/23	
Copper	6020A	**3.80**	mg/Kg	0.099	0.030	5	09/26/23 13:47	09/22/23	
Lead	6020A	**0.445**	mg/Kg	0.020	0.003	5	09/26/23 13:47	09/22/23	
Selenium	6020A	**5.51**	mg/Kg	0.99	0.20	5	09/26/23 13:47	09/22/23	
Silver	6020A	**0.115**	mg/Kg	0.020	0.008	5	09/26/23 13:47	09/22/23	
Zinc	6020A	**140**	mg/Kg	0.50	0.08	5	09/26/23 13:47	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #7	**Basis:**	Dry
Lab Code:	K2309806-027		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.925**	mg/Kg	0.020	0.004	5	09/26/23 13:49	09/22/23	
Copper	6020A	**3.34**	mg/Kg	0.098	0.029	5	09/26/23 13:49	09/22/23	
Lead	6020A	**0.857**	mg/Kg	0.020	0.003	5	09/26/23 13:49	09/22/23	
Selenium	6020A	**5.98**	mg/Kg	0.98	0.20	5	09/26/23 13:49	09/22/23	
Silver	6020A	**0.128**	mg/Kg	0.020	0.008	5	09/26/23 13:49	09/22/23	
Zinc	6020A	**128**	mg/Kg	0.49	0.08	5	09/26/23 13:49	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #8	**Basis:**	Dry
Lab Code:	K2309806-028		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.506**	mg/Kg	0.020	0.004	5	09/26/23 13:51	09/22/23	
Copper	6020A	**3.43**	mg/Kg	0.099	0.030	5	09/26/23 13:51	09/22/23	
Lead	6020A	**0.724**	mg/Kg	0.020	0.003	5	09/26/23 13:51	09/22/23	
Selenium	6020A	**5.20**	mg/Kg	0.99	0.20	5	09/26/23 13:51	09/22/23	
Silver	6020A	**0.046**	mg/Kg	0.020	0.008	5	09/26/23 13:51	09/22/23	
Zinc	6020A	**125**	mg/Kg	0.50	0.08	5	09/26/23 13:51	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #9	**Basis:**	Dry
Lab Code:	K2309806-029		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.558**	mg/Kg	0.020	0.004	5	09/26/23 13:53	09/22/23	
Copper	6020A	**3.15**	mg/Kg	0.098	0.030	5	09/26/23 13:53	09/22/23	
Lead	6020A	**0.675**	mg/Kg	0.020	0.003	5	09/26/23 13:53	09/22/23	
Selenium	6020A	**5.63**	mg/Kg	0.98	0.20	5	09/26/23 13:53	09/22/23	
Silver	6020A	**0.284**	mg/Kg	0.020	0.008	5	09/26/23 13:53	09/22/23	
Zinc	6020A	**131**	mg/Kg	0.49	0.08	5	09/26/23 13:53	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 DV Metals Fish #10	**Basis:**	Dry
Lab Code:	K2309806-030		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.327**	mg/Kg	0.020	0.004	5	09/26/23 13:55	09/22/23	
Copper	6020A	**3.17**	mg/Kg	0.10	0.03	5	09/26/23 13:55	09/22/23	
Lead	6020A	**0.312**	mg/Kg	0.020	0.003	5	09/26/23 13:55	09/22/23	
Selenium	6020A	**3.1**	mg/Kg	1.0	0.2	5	09/26/23 13:55	09/22/23	
Silver	6020A	**0.095**	mg/Kg	0.020	0.008	5	09/26/23 13:55	09/22/23	
Zinc	6020A	**105**	mg/Kg	0.50	0.08	5	09/26/23 13:55	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #1	**Basis:**	Dry
Lab Code:	K2309806-031		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.383**	mg/Kg	0.020	0.004	5	09/26/23 13:57	09/22/23	
Copper	6020A	**3.56**	mg/Kg	0.099	0.030	5	09/26/23 13:57	09/22/23	
Lead	6020A	**0.787**	mg/Kg	0.020	0.003	5	09/26/23 13:57	09/22/23	
Selenium	6020A	**3.16**	mg/Kg	0.99	0.20	5	09/26/23 13:57	09/22/23	
Silver	6020A	**0.095**	mg/Kg	0.020	0.008	5	09/26/23 13:57	09/22/23	
Zinc	6020A	**143**	mg/Kg	0.50	0.08	5	09/26/23 13:57	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #2	**Basis:**	Dry
Lab Code:	K2309806-032		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.750**	mg/Kg	0.020	0.004	5	09/26/23 13:59	09/22/23	
Copper	6020A	**3.42**	mg/Kg	0.099	0.030	5	09/26/23 13:59	09/22/23	
Lead	6020A	**0.449**	mg/Kg	0.020	0.003	5	09/26/23 13:59	09/22/23	
Selenium	6020A	**5.11**	mg/Kg	0.99	0.20	5	09/26/23 13:59	09/22/23	
Silver	6020A	**0.173**	mg/Kg	0.020	0.008	5	09/26/23 13:59	09/22/23	
Zinc	6020A	**140**	mg/Kg	0.50	0.08	5	09/26/23 13:59	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #3	**Basis:**	Dry
Lab Code:	K2309806-033		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.188**	mg/Kg	0.020	0.004	5	09/26/23 14:05	09/22/23	
Copper	6020A	**8.30**	mg/Kg	0.10	0.03	5	09/26/23 14:05	09/22/23	
Lead	6020A	**0.325**	mg/Kg	0.020	0.003	5	09/26/23 14:05	09/22/23	
Selenium	6020A	**4.70**	mg/Kg	1.0	0.2	5	09/26/23 14:05	09/22/23	
Silver	6020A	**0.132**	mg/Kg	0.020	0.008	5	09/26/23 14:05	09/22/23	
Zinc	6020A	**149**	mg/Kg	0.50	0.08	5	09/26/23 14:05	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #4	**Basis:**	Dry
Lab Code:	K2309806-034		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.344**	mg/Kg	0.020	0.004	5	09/26/23 14:07	09/22/23	
Copper	6020A	**2.65**	mg/Kg	0.099	0.030	5	09/26/23 14:07	09/22/23	
Lead	6020A	**0.324**	mg/Kg	0.020	0.003	5	09/26/23 14:07	09/22/23	
Selenium	6020A	**5.39**	mg/Kg	0.99	0.20	5	09/26/23 14:07	09/22/23	
Silver	6020A	**0.092**	mg/Kg	0.020	0.008	5	09/26/23 14:07	09/22/23	
Zinc	6020A	**154**	mg/Kg	0.50	0.08	5	09/26/23 14:07	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #5	**Basis:**	Dry
Lab Code:	K2309806-035		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.282**	mg/Kg	0.020	0.004	5	09/26/23 14:09	09/22/23	
Copper	6020A	**2.53**	mg/Kg	0.099	0.030	5	09/26/23 14:09	09/22/23	
Lead	6020A	**0.382**	mg/Kg	0.020	0.003	5	09/26/23 14:09	09/22/23	
Selenium	6020A	**3.63**	mg/Kg	0.99	0.20	5	09/26/23 14:09	09/22/23	
Silver	6020A	**0.085**	mg/Kg	0.020	0.008	5	09/26/23 14:09	09/22/23	
Zinc	6020A	**130**	mg/Kg	0.50	0.08	5	09/26/23 14:09	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #6	**Basis:**	Dry
Lab Code:	K2309806-036		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**1.16**	mg/Kg	0.020	0.004	5	09/26/23 14:12	09/22/23	
Copper	6020A	**3.43**	mg/Kg	0.10	0.03	5	09/26/23 14:12	09/22/23	
Lead	6020A	**0.357**	mg/Kg	0.020	0.003	5	09/26/23 14:12	09/22/23	
Selenium	6020A	**5.3**	mg/Kg	1.0	0.2	5	09/26/23 14:12	09/22/23	
Silver	6020A	**0.166**	mg/Kg	0.020	0.008	5	09/26/23 14:12	09/22/23	
Zinc	6020A	**134**	mg/Kg	0.50	0.08	5	09/26/23 14:12	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #7	**Basis:**	Dry
Lab Code:	K2309806-037		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**2.41**	mg/Kg	0.020	0.004	5	09/26/23 14:14	09/22/23	
Copper	6020A	**3.83**	mg/Kg	0.099	0.030	5	09/26/23 14:14	09/22/23	
Lead	6020A	**0.492**	mg/Kg	0.020	0.003	5	09/26/23 14:14	09/22/23	
Selenium	6020A	**6.50**	mg/Kg	0.99	0.20	5	09/26/23 14:14	09/22/23	
Silver	6020A	**0.163**	mg/Kg	0.020	0.008	5	09/26/23 14:14	09/22/23	
Zinc	6020A	**151**	mg/Kg	0.49	0.08	5	09/26/23 14:14	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #8	**Basis:**	Dry
Lab Code:	K2309806-038		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.250**	mg/Kg	0.020	0.004	5	09/26/23 14:16	09/22/23	
Copper	6020A	**3.25**	mg/Kg	0.099	0.030	5	09/26/23 14:16	09/22/23	
Lead	6020A	**0.436**	mg/Kg	0.020	0.003	5	09/26/23 14:16	09/22/23	
Selenium	6020A	**3.85**	mg/Kg	0.99	0.20	5	09/26/23 14:16	09/22/23	
Silver	6020A	**0.050**	mg/Kg	0.020	0.008	5	09/26/23 14:16	09/22/23	
Zinc	6020A	**117**	mg/Kg	0.50	0.08	5	09/26/23 14:16	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #9	**Basis:**	Dry
Lab Code:	K2309806-039		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.683**	mg/Kg	0.020	0.004	5	09/26/23 14:18	09/22/23	
Copper	6020A	**3.97**	mg/Kg	0.098	0.029	5	09/26/23 14:18	09/22/23	
Lead	6020A	**3.13**	mg/Kg	0.020	0.003	5	09/26/23 14:18	09/22/23	
Selenium	6020A	**3.60**	mg/Kg	0.98	0.20	5	09/26/23 14:18	09/22/23	
Silver	6020A	**0.151**	mg/Kg	0.020	0.008	5	09/26/23 14:18	09/22/23	
Zinc	6020A	**165**	mg/Kg	0.49	0.08	5	09/26/23 14:18	09/22/23	

Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23 10:00
Sample Name:	Tributary Creek Site 9 CO Metals Fish #10	**Basis:**	Dry
Lab Code:	K2309806-040		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	**0.541**	mg/Kg	0.020	0.004	5	09/26/23 14:20	09/22/23	
Copper	6020A	**4.24**	mg/Kg	0.098	0.029	5	09/26/23 14:20	09/22/23	
Lead	6020A	**0.232**	mg/Kg	0.020	0.003	5	09/26/23 14:20	09/22/23	
Selenium	6020A	**4.41**	mg/Kg	0.98	0.20	5	09/26/23 14:20	09/22/23	
Silver	6020A	**0.181**	mg/Kg	0.020	0.008	5	09/26/23 14:20	09/22/23	
Zinc	6020A	**113**	mg/Kg	0.49	0.08	5	09/26/23 14:20	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2316597-01		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	ND	U	mg/Kg	0.020	0.004	5	09/26/23 12:03	09/22/23	
Copper	6020A	ND	U	mg/Kg	0.10	0.03	5	09/26/23 12:03	09/22/23	
Lead	6020A	ND	U	mg/Kg	0.020	0.003	5	09/26/23 12:03	09/22/23	
Selenium	6020A	ND	U	mg/Kg	1.0	0.2	5	09/26/23 12:03	09/22/23	
Silver	6020A	ND	U	mg/Kg	0.020	0.008	5	09/26/23 12:03	09/22/23	
Zinc	6020A	ND	U	mg/Kg	0.5	0.08	5	09/26/23 12:03	09/22/23	

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Analytical Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2316598-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Cadmium	6020A	ND U	mg/Kg	0.020	0.004	5	09/26/23 13:16	09/22/23	
Copper	6020A	**0.04 J**	mg/Kg	0.10	0.03	5	09/26/23 13:16	09/22/23	
Lead	6020A	ND U	mg/Kg	0.020	0.003	5	09/26/23 13:16	09/22/23	
Selenium	6020A	ND U	mg/Kg	1.0	0.2	5	09/26/23 13:16	09/22/23	
Silver	6020A	ND U	mg/Kg	0.020	0.008	5	09/26/23 13:16	09/22/23	
Zinc	6020A	ND U	mg/Kg	0.5	0.08	5	09/26/23 13:16	09/22/23	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23
		Date Analyzed:	09/26/23

Replicate Sample Summary
Total Metals

Sample Name:	Greens Creek Site 54 DV Metals Fish #1	**Units:**	mg/Kg
Lab Code:	K2309806-001	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2316597-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.020	0.004	2.18	1.91	2.05	13	20
Copper	6020A	0.10	0.03	5.90	5.60	5.75	5	20
Lead	6020A	0.020	0.003	0.324	0.303	0.314	7	20
Selenium	6020A	1.0	0.2	6.7	6.6	6.7	2	20
Silver	6020A	0.020	0.008	0.033	0.025	0.029	28 #	20
Zinc	6020A	0.5	0.08	234	226	230	3	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23
		Date Analyzed:	09/26/23

Replicate Sample Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #1	**Units:**	mg/Kg
Lab Code:	K2309806-021	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2316598-05 Result	Average	RPD	RPD Limit
Cadmium	6020A	0.020	0.004	0.525	0.505	0.515	4	20
Copper	6020A	0.10	0.03	2.88	2.75	2.82	5	20
Lead	6020A	0.020	0.003	0.502	0.535	0.519	6	20
Selenium	6020A	1.0	0.2	5.87	5.55	5.71	6	20
Silver	6020A	0.020	0.008	0.057	0.086	0.072	41 #	20
Zinc	6020A	0.5	0.08	128	101	115	24 *	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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Superset Reference:

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	N/A
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23
		Date Analyzed:	09/26/23
		Date Extracted:	09/22/23

Matrix Spike Summary
Total Metals

Sample Name:	Greens Creek Site 54 DV Metals Fish #1	**Units:**	mg/Kg
Lab Code:	K2309806-001	**Basis:**	Dry
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ2316597-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	2.18	6.56	4.93	89	75-125
Copper	5.90	28.6	24.7	92	75-125
Lead	0.324	45.0	49.3	91	75-125
Selenium	6.73	23.8	16.4	104	75-125
Silver	0.033	4.42	4.93	89	75-125
Zinc	234	264	49.3	62 #	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	N/A
Sample Matrix:	Animal Tissue	**Date Received:**	08/31/23
		Date Analyzed:	09/26/23
		Date Extracted:	09/22/23

Matrix Spike Summary
Total Metals

Sample Name:	Tributary Creek Site 9 DV Metals Fish #1	**Units:**	mg/Kg
Lab Code:	K2309806-021	**Basis:**	Dry
Analysis Method:	6020A		
Prep Method:	PSEP Metals		

Matrix Spike
KQ2316598-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	0.525	5.30	4.97	96	75-125
Copper	2.88	26.2	24.8	94	75-125
Lead	0.502	45.2	49.7	90	75-125
Selenium	5.87	23.6	16.6	107	75-125
Silver	0.057	4.52	4.97	90	75-125
Zinc	128	156	49.7	57 N	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2023 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2309806
Date Analyzed: 09/26/23

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2316597-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	6020A	4.72	5.00	94	80-120
Copper	6020A	23.7	25.0	95	80-120
Lead	6020A	47.3	50.0	95	80-120
Selenium	6020A	16.7	16.7	100	80-120
Silver	6020A	4.66	5.00	93	80-120
Zinc	6020A	46.9	50.0	94	80-120

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2023 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Service Request: K2309806
Date Analyzed: 09/26/23

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2316598-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Cadmium	6020A	4.68	5.00	94	80-120
Copper	6020A	23.7	25.0	95	80-120
Lead	6020A	45.6	50.0	91	80-120
Selenium	6020A	16.7	16.7	100	80-120
Silver	6020A	4.52	5.00	90	80-120
Zinc	6020A	46.4	50.0	93	80-120

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/22/23
		Date Analyzed:	09/26/23

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K2309806-SRM1	Basis:	Dry
Test Notes:	Dorm-5 Solids = 95.8%		

Source: N.R.C.C. Dorm-5

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	6020A	0.148	0.146	99	0.113 - 0.186	
Copper	PSEP Tissue	6020A	3.30	3.24	98	2.58 - 4.04	
Lead	PSEP Tissue	6020A	0.058	0.063	109	0.042 - 0.077	
Selenium	PSEP Tissue	6020A	2.40	2.44	102	1.83 - 3.01	
Silver	PSEP Tissue	6020A	0.135	0.129	96	0.097 - 0.179	
Zinc	PSEP Tissue	6020A	28.7	24.6	86	22.2 - 35.6	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/22/23
		Date Analyzed:	09/26/23

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K2309806-SRM2	Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	6020A	42.3	38.2	90	32.4-52.9	
Copper	PSEP Tissue	6020A	497	447	90	380-623	
Lead	PSEP Tissue	6020A	0.225	0.185	82	0.166-0.292	
Selenium	PSEP Tissue	6020A	10.9	10.6	97	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	141	104	104-170	

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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/22/23
		Date Analyzed:	09/26/23

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K2309806-SRM3	Basis:	Dry
Test Notes:	Dorm-5 Solids = 95.8%		

Source: N.R.C.C. Dorm-5

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	6020A	0.148	0.142	96	0.113 - 0.186	
Copper	PSEP Tissue	6020A	3.30	3.16	96	2.58 - 4.04	
Lead	PSEP Tissue	6020A	0.058	0.059	102	0.042 - 0.077	
Selenium	PSEP Tissue	6020A	2.40	2.46	103	1.83 - 3.01	
Silver	PSEP Tissue	6020A	0.135	0.117	87	0.097 - 0.179	
Zinc	PSEP Tissue	6020A	28.7	27.6	96	22.2 - 35.6	

ALS Group USA, Corp.
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QA/QC Report

Client:	Alaska Department of Fish and Game	**Service Request:**	K2309806
Project:	2023 Greens Creek Biomonitoring	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	09/22/23
		Date Analyzed:	09/26/23

Standard Reference Material Summary
Total Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	K2309806-SRM4	Basis:	Dry
Test Notes:	Tort-3 Solids = 97.4%		

Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Cadmium	PSEP Tissue	6020A	42.3	37.2	88	32.4-52.9	
Copper	PSEP Tissue	6020A	497	440	89	380-623	
Lead	PSEP Tissue	6020A	0.225	0.183	81	0.166-0.292	
Selenium	PSEP Tissue	6020A	10.9	10.2	94	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	122	90	104-170	

ALS Group USA, Corp.
dba ALS Environmental

Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 426923
Analytical Method: 6020A **Extraction Date:** 09/22/23 11:05

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
Greens Creek Site 54 DV Metals Fish #1	K2309806-001	NA	8/31/23	0.3040 g	30 mL	
Greens Creek Site 54 DV Metals Fish #2	K2309806-002	NA	8/31/23	0.3030 g	30 mL	
Greens Creek Site 54 DV Metals Fish #3	K2309806-003	NA	8/31/23	0.3020 g	30 mL	
Greens Creek Site 54 DV Metals Fish #4	K2309806-004	NA	8/31/23	0.3050 g	30 mL	
Greens Creek Site 54 DV Metals Fish #5	K2309806-005	NA	8/31/23	0.3050 g	30 mL	
Greens Creek Site 54 DV Metals Fish #6	K2309806-006	NA	8/31/23	0.3050 g	30 mL	
Greens Creek Site 54 DV Metals Fish #7	K2309806-007	NA	8/31/23	0.3040 g	30 mL	
Greens Creek Site 54 DV Metals Fish #8	K2309806-008	NA	8/31/23	0.3020 g	30 mL	
Greens Creek Site 54 DV Metals Fish #9	K2309806-009	NA	8/31/23	0.3030 g	30 mL	
Greens Creek Site 54 DV Metals Fish #10	K2309806-010	NA	8/31/23	0.3040 g	30 mL	
Greens Creek Site 63 DV Metals Fish #1	K2309806-011	NA	8/31/23	0.3020 g	30 mL	
Greens Creek Site 63 DV Metals Fish #2	K2309806-012	NA	8/31/23	0.3030 g	30 mL	
Greens Creek Site 63 DV Metals Fish #3	K2309806-013	NA	8/31/23	0.3020 g	30 mL	
Greens Creek Site 63 DV Metals Fish #4	K2309806-014	NA	8/31/23	0.3050 g	30 mL	
Greens Creek Site 63 DV Metals Fish #5	K2309806-015	NA	8/31/23	0.3010 g	30 mL	
Greens Creek Site 63 DV Metals Fish #6	K2309806-016	NA	8/31/23	0.3020 g	30 mL	
Greens Creek Site 63 DV Metals Fish #7	K2309806-017	NA	8/31/23	0.3040 g	30 mL	
Greens Creek Site 63 DV Metals Fish #8	K2309806-018	NA	8/31/23	0.3030 g	30 mL	
Greens Creek Site 63 DV Metals Fish #9	K2309806-019	NA	8/31/23	0.3030 g	30 mL	
Greens Creek Site 63 DV Metals Fish #10	K2309806-020	NA	8/31/23	0.3000 g	30 mL	
Method Blank	KQ2316597-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ2316597-02LCS	NA	NA	0.3000 g	30 mL	
Standard Reference Material	KQ2316597-03SRM	NA	8/31/23	0.3010 g	30 mL	
Standard Reference Material	KQ2316597-04SRM	NA	8/31/23	0.3010 g	30 mL	
Duplicate	KQ2316597-05DUP	NA	8/31/23	0.3000 g	30 mL	
Matrix Spike	KQ2316597-06MS	NA	8/31/23	0.3040 g	30 mL	

Prep Summary Report

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring
Sample Matrix: Animal Tissue

Metals

Prep Method: PSEP Metals **Extraction Lot:** 426924
Analytical Method: 6020A **Extraction Date:** 09/22/23 11:05

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
Tributary Creek Site 9 DV Metals Fish #1	K2309806-021	NA	8/31/23	0.3010 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #2	K2309806-022	NA	8/31/23	0.3020 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #3	K2309806-023	NA	8/31/23	0.3030 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #4	K2309806-024	NA	8/31/23	0.3060 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #5	K2309806-025	NA	8/31/23	0.3040 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #6	K2309806-026	NA	8/31/23	0.3030 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #7	K2309806-027	NA	8/31/23	0.3070 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #8	K2309806-028	NA	8/31/23	0.3020 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #9	K2309806-029	NA	8/31/23	0.3050 g	30 mL	
Tributary Creek Site 9 DV Metals Fish #10	K2309806-030	NA	8/31/23	0.3000 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #1	K2309806-031	NA	8/31/23	0.3030 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #2	K2309806-032	NA	8/31/23	0.3030 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #3	K2309806-033	NA	8/31/23	0.3010 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #4	K2309806-034	NA	8/31/23	0.3030 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #5	K2309806-035	NA	8/31/23	0.3030 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #6	K2309806-036	NA	8/31/23	0.3000 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #7	K2309806-037	NA	8/31/23	0.3040 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #8	K2309806-038	NA	8/31/23	0.3030 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #9	K2309806-039	NA	8/31/23	0.3060 g	30 mL	
Tributary Creek Site 9 CO Metals Fish #10	K2309806-040	NA	8/31/23	0.3060 g	30 mL	
Method Blank	KQ2316598-01MB	NA	NA	0.3000 g	30 mL	
Lab Control Sample	KQ2316598-02LCS	NA	NA	0.3000 g	30 mL	
Standard Reference Material	KQ2316598-03SRM	NA	8/31/23	0.3050 g	30 mL	
Standard Reference Material	KQ2316598-04SRM	NA	8/31/23	0.3010 g	30 mL	
Duplicate	KQ2316598-05DUP	NA	8/31/23	0.3020 g	30 mL	
Matrix Spike	KQ2316598-06MS	NA	8/31/23	0.3020 g	30 mL	

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
ICV 09/26/23 11:44						
Cadmium	6020A	818453	12.5	12.5	100	90-110
Copper	6020A	818453	12.5	12.5	100	90-110
Lead	6020A	818453	25.0	25.0	100	90-110
Selenium	6020A	818453	25.9	25.0	104	90-110
Silver	6020A	818453	12.3	12.5	99	90-110
Zinc	6020A	818453	24.8	25.0	99	90-110
CCV 09/26/23 11:46						
Cadmium	6020A	818453	24.9	25.0	100	90-110
Copper	6020A	818453	25.1	25.0	101	90-110
Lead	6020A	818453	24.7	25.0	99	90-110
Selenium	6020A	818453	25.4	25.0	102	90-110
Silver	6020A	818453	12.4	12.5	99	90-110
Zinc	6020A	818453	24.9	25.0	100	90-110
CCV 09/26/23 12:24						
Cadmium	6020A	818453	25.1	25.0	100	90-110
Copper	6020A	818453	25.4	25.0	102	90-110
Lead	6020A	818453	24.9	25.0	100	90-110
Selenium	6020A	818453	25.4	25.0	101	90-110
Silver	6020A	818453	12.3	12.5	99	90-110
Zinc	6020A	818453	25.2	25.0	101	90-110
CCV 09/26/23 12:49						
Cadmium	6020A	818453	24.9	25.0	100	90-110
Copper	6020A	818453	25.6	25.0	102	90-110
Lead	6020A	818453	24.7	25.0	99	90-110
Selenium	6020A	818453	25.5	25.0	102	90-110
Silver	6020A	818453	12.2	12.5	98	90-110
Zinc	6020A	818453	25.5	25.0	102	90-110
CCV 09/26/23 13:09						
Cadmium	6020A	818453	24.8	25.0	99	90-110
Copper	6020A	818453	25.5	25.0	102	90-110
Lead	6020A	818453	24.5	25.0	98	90-110
Selenium	6020A	818453	25.2	25.0	101	90-110
Silver	6020A	818453	12.2	12.5	98	90-110
Zinc	6020A	818453	25.4	25.0	101	90-110
CCV 09/26/23 13:36						
Cadmium	6020A	818453	24.9	25.0	100	90-110

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
CCV 09/26/23 13:36						
Copper	6020A	818453	25.3	25.0	101	90-110
Lead	6020A	818453	24.3	25.0	97	90-110
Selenium	6020A	818453	25.7	25.0	103	90-110
Silver	6020A	818453	12.2	12.5	98	90-110
Zinc	6020A	818453	24.6	25.0	99	90-110
CCV 09/26/23 14:01						
Cadmium	6020A	818453	25.2	25.0	101	90-110
Copper	6020A	818453	25.5	25.0	102	90-110
Lead	6020A	818453	24.6	25.0	98	90-110
Selenium	6020A	818453	25.4	25.0	102	90-110
Silver	6020A	818453	12.3	12.5	99	90-110
Zinc	6020A	818453	25.5	25.0	102	90-110
CCV 09/26/23 14:22						
Cadmium	6020A	818453	24.9	25.0	100	90-110
Copper	6020A	818453	25.2	25.0	101	90-110
Lead	6020A	818453	24.3	25.0	97	90-110
Selenium	6020A	818453	26.0	25.0	104	90-110
Silver	6020A	818453	12.2	12.5	97	90-110
Zinc	6020A	818453	25.2	25.0	101	90-110

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	C
ICB 09/26/23 11:48				
Cadmium	6020A	818453	0.008	U
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U
CCB 09/26/23 11:50				
Cadmium	6020A	818453	0.008	U
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U
CCB 09/26/23 12:26				
Cadmium	6020A	818453	0.008	U
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U
CCB 09/26/23 12:51				
Cadmium	6020A	818453	0.008	U
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U
CCB 09/26/23 13:12				
Cadmium	6020A	818453	0.008	U
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U
CCB 09/26/23 13:38				
Cadmium	6020A	818453	0.008	U

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	C
CCB 09/26/23 13:38				
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U
CCB 09/26/23 14:03				
Cadmium	6020A	818453	0.008	U
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U
CCB 09/26/23 14:24				
Cadmium	6020A	818453	0.008	U
Copper	6020A	818453	0.06	U
Lead	6020A	818453	0.006	U
Selenium	6020A	818453	0.4	U
Silver	6020A	818453	0.016	U
Zinc	6020A	818453	0.2	U

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

LOW LEVEL INITIAL AND LOW LEVEL CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
LLICVT							
Cadmium	6020A	818453	0.042	0.04	105	70-130	09/26/23 11:52
Copper	6020A	818453	0.19	0.2	94	70-130	09/26/23 11:52
Lead	6020A	818453	0.038	0.04	95	70-130	09/26/23 11:52
Selenium	6020A	818453	2.0	2.0	101	70-130	09/26/23 11:52
Silver	6020A	818453	0.040	0.04	100	70-130	09/26/23 11:52
Zinc	6020A	818453	0.84	1.0	84	70-130	09/26/23 11:52
LLCCVT							
Cadmium	6020A	818453	0.039	0.04	97	70-130	09/26/23 13:14
Copper	6020A	818453	0.21	0.2	106	70-130	09/26/23 13:14
Lead	6020A	818453	0.033	0.04	83	70-130	09/26/23 13:14
Selenium	6020A	818453	2.0	2.0	100	70-130	09/26/23 13:14
Silver	6020A	818453	0.036	0.04	91	70-130	09/26/23 13:14
Zinc	6020A	818453	1.0	1.0	101	70-130	09/26/23 13:14
LLCCVT							
Cadmium	6020A	818453	0.035	0.04	88	70-130	09/26/23 14:26
Copper	6020A	818453	0.20	0.2	101	70-130	09/26/23 14:26
Lead	6020A	818453	0.039	0.04	97	70-130	09/26/23 14:26
Selenium	6020A	818453	2.1	2.0	103	70-130	09/26/23 14:26
Silver	6020A	818453	0.039	0.04	98	70-130	09/26/23 14:26
Zinc	6020A	818453	1.1	1.0	109	70-130	09/26/23 14:26

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSA **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	818453	0.011	-	-	-	09/26/23 11:54
Copper	6020A	818453	0.12	-	-	-	09/26/23 11:54
Lead	6020A	818453	0.109	-	-	-	09/26/23 11:54
Selenium	6020A	818453	0.4	-	-	-	09/26/23 11:54
Silver	6020A	818453	0.007	-	-	-	09/26/23 11:54
Zinc	6020A	818453	0.6	-	-	-	09/26/23 11:54

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

ICP INTERFERENCE CHECK SAMPLE

Sample ID ICSAB **Concentration Units:** ug/L

Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits	Analysis Date
Cadmium	6020A	818453	24.1	25.0	96	80-120	09/26/23 11:56
Copper	6020A	818453	47.5	50.0	95	80-120	09/26/23 11:56
Lead	6020A	818453	0.110	-	-	-	09/26/23 11:56
Selenium	6020A	818453	25.1	25.0	101	80-120	09/26/23 11:56
Silver	6020A	818453	11.9	12.5	95	80-120	09/26/23 11:56
Zinc	6020A	818453	23.6	25.0	94	80-120	09/26/23 11:56

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

POST SPIKE SAMPLE RECOVERY

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Initial Sample Result	Post Spike Result	True Value	% Rec	% Rec. Limits	Analysis Date
K2309806-001A								
Cadmium	6020A	818453	4.42	53.0	50.0	97	80-120	09/26/23 12:18
Copper	6020A	818453	12.0	59.9	50.0	96	80-120	09/26/23 12:18
Lead	6020A	818453	0.66	47.6	50.0	94	80-120	09/26/23 12:18
Selenium	6020A	818453	14	65	50	103	80-120	09/26/23 12:18
Silver	6020A	818453	0.07	4.84	5.00	95	80-120	09/26/23 12:18
Zinc	6020A	818453	473	521	50.0	94 #	80-120	09/26/23 12:18
K2309806-021A								
Cadmium	6020A	818453	1.05	50.0	50.0	98	80-120	09/26/23 13:30
Copper	6020A	818453	5.8	54.5	50.0	98	80-120	09/26/23 13:30
Lead	6020A	818453	1.01	47.3	50.0	92	80-120	09/26/23 13:30
Selenium	6020A	818453	12	64	50	105	80-120	09/26/23 13:30
Silver	6020A	818453	0.11	4.85	5.00	95	80-120	09/26/23 13:30
Zinc	6020A	818453	256	292	50.0	71 #	80-120	09/26/23 13:30

Results flagged with a pound (#) indicate the control criteria is not applicable.

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring

ICP SERIAL DILUTIONS

Concentration Units: ug/L

Sample ID / Analyte	Method	Analysis Batch:	Initial Sample Result	Serial Dillution Result	% Diff	% Diff. Limit	Analysis Date
K2309806-001SDL							
Cadmium	6020A	818453	22.1	22.3	1	10	09/26/23 12:16
Copper	6020A	818453	59.8	61.2	2	10	09/26/23 12:16
Lead	6020A	818453	3.3	3.2	1	10	09/26/23 12:16
Selenium	6020A	818453	68	65	5	10	09/26/23 12:16
Silver	6020A	818453	0.3	0.3 U	6	10	09/26/23 12:16
Zinc	6020A	818453	2370	2370	0	10	09/26/23 12:16
K2309806-021SDL							
Cadmium	6020A	818453	5.3	5.2	2	10	09/26/23 13:28
Copper	6020A	818453	28.8	29.6	3	10	09/26/23 13:28
Lead	6020A	818453	5.0	4.9	2	10	09/26/23 13:28
Selenium	6020A	818453	59	58	2	10	09/26/23 13:28
Silver	6020A	818453	0.6	0.6 J	5	10	09/26/23 13:28
Zinc	6020A	818453	1280	1230	4	10	09/26/23 13:28

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

Detection Limits

Instrument: K-ICP-MS-06 **Matrix:** Animal Tissue

Analyte	Mass	Units	MRL	MDL	Method
Cadmium	111	ug/L	0.04	0.008	6020A
Copper	65	ug/L	0.2	0.06	6020A
Lead	208	ug/L	0.04	0.006	6020A
Selenium	78	ug/L	2	0.4	6020A
Silver	107	ug/L	0.04	0.016	6020A
Zinc	66	ug/L	1	0.16	6020A

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

ICP Linear Range (Quarterly)

Instrument: K-ICP-MS-06

Analyte	Concentration (ug/L)	Method
Cadmium 111	9000	6020A
Copper 65	4500	6020A
Lead 208	4500	6020A
Selenium 78	9000	6020A
Silver 107	450	6020A
Zinc 66	9000	6020A

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

Analysis Run Log

Instrument ID: **K-ICP-MS-06** **Analytical BatchID:** **818453**

Sample	Dilution Factor	Date/Time	Cd	Cu	Pb	Se	Ag	Zn
ZZZZZZ	1	09/26/23 11:39						
ZZZZZZ	1	09/26/23 11:41						
ICV	1	09/26/23 11:44	X	X	X	X	X	X
CCV	1	09/26/23 11:46	X	X	X	X	X	X
ICB	1	09/26/23 11:48	X	X	X	X	X	X
CCB	1	09/26/23 11:50	X	X	X	X	X	X
LLICVT	1	09/26/23 11:52	X	X	X	X	X	X
ICSA	1	09/26/23 11:54	X	X	X	X	X	X
ICSAB	1	09/26/23 11:56	X	X	X	X	X	X
ZZZZZZ	1	09/26/23 11:58						
KQ2316597-01MB	5	09/26/23 12:03	X	X	X	X	X	X
KQ2316597-02LCS	5	09/26/23 12:05	X	X	X	X	X	X
KQ2316597-03SRM	5	09/26/23 12:07	X	X	X	X	X	X
KQ2316597-04SRM	5	09/26/23 12:09	X	X	X	X	X	X
K2309806-001	5	09/26/23 12:11	X	X	X	X	X	X
K2309806-001DUP	5	09/26/23 12:14	X	X	X	X	X	X
K2309806-001SDL	25	09/26/23 12:16	X	X	X	X	X	X
K2309806-001PS	5	09/26/23 12:18	X	X	X	X	X	X
K2309806-001MS	5	09/26/23 12:20	X	X	X	X	X	X
K2309806-002	5	09/26/23 12:22	X	X	X	X	X	X
CCV	1	09/26/23 12:24	X	X	X	X	X	X
CCB	1	09/26/23 12:26	X	X	X	X	X	X
K2309806-003	5	09/26/23 12:28	X	X	X	X	X	X
K2309806-004	5	09/26/23 12:30	X	X	X	X	X	X
K2309806-005	5	09/26/23 12:32	X	X	X	X	X	X
K2309806-006	5	09/26/23 12:34	X	X	X	X	X	X
K2309806-007	5	09/26/23 12:36	X	X	X	X	X	X
K2309806-008	5	09/26/23 12:38	X	X	X	X	X	X
K2309806-009	5	09/26/23 12:40	X	X	X	X	X	X
K2309806-010	5	09/26/23 12:43	X	X	X	X	X	X
K2309806-011	5	09/26/23 12:45	X	X	X	X	X	X
K2309806-012	5	09/26/23 12:47	X	X	X	X	X	X
CCV	1	09/26/23 12:49	X	X	X	X	X	X
CCB	1	09/26/23 12:51	X	X	X	X	X	X
K2309806-013	5	09/26/23 12:53	X	X	X	X	X	X
K2309806-014	5	09/26/23 12:55	X	X	X	X	X	X
K2309806-015	5	09/26/23 12:57	X	X	X	X	X	X

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

Analysis Run Log

Instrument ID: **K-ICP-MS-06** **Analytical BatchID:** **818453**

Sample	Dilution Factor	Date/Time	Cd	Cu	Pb	Se	Ag	Zn
K2309806-016	5	09/26/23 12:59	X	X	X	X	X	X
K2309806-017	5	09/26/23 13:01	X	X	X	X	X	X
K2309806-018	5	09/26/23 13:03	X	X	X	X	X	X
K2309806-019	5	09/26/23 13:05	X	X	X	X	X	X
K2309806-020	5	09/26/23 13:07	X	X	X	X	X	X
CCV	1	09/26/23 13:09	X	X	X	X	X	X
CCB	1	09/26/23 13:12	X	X	X	X	X	X
LLCCVT	1	09/26/23 13:14	X	X	X	X	X	X
KQ2316598-01MB	5	09/26/23 13:16	X	X	X	X	X	X
KQ2316598-02LCS	5	09/26/23 13:18	X	X	X	X	X	X
KQ2316598-03SRM	5	09/26/23 13:20	X	X	X	X	X	X
KQ2316598-04SRM	5	09/26/23 13:22	X	X	X	X	X	X
K2309806-021	5	09/26/23 13:24	X	X	X	X	X	X
K2309806-021DUP	5	09/26/23 13:26	X	X	X	X	X	X
K2309806-021SDL	25	09/26/23 13:28	X	X	X	X	X	X
K2309806-021PS	5	09/26/23 13:30	X	X	X	X	X	X
K2309806-021MS	5	09/26/23 13:32	X	X	X	X	X	X
K2309806-022	5	09/26/23 13:34	X	X	X	X	X	X
CCV	1	09/26/23 13:36	X	X	X	X	X	X
CCB	1	09/26/23 13:38	X	X	X	X	X	X
K2309806-023	5	09/26/23 13:40	X	X	X	X	X	X
K2309806-024	5	09/26/23 13:43	X	X	X	X	X	X
K2309806-025	5	09/26/23 13:45	X	X	X	X	X	X
K2309806-026	5	09/26/23 13:47	X	X	X	X	X	X
K2309806-027	5	09/26/23 13:49	X	X	X	X	X	X
K2309806-028	5	09/26/23 13:51	X	X	X	X	X	X
K2309806-029	5	09/26/23 13:53	X	X	X	X	X	X
K2309806-030	5	09/26/23 13:55	X	X	X	X	X	X
K2309806-031	5	09/26/23 13:57	X	X	X	X	X	X
K2309806-032	5	09/26/23 13:59	X	X	X	X	X	X
CCV	1	09/26/23 14:01	X	X	X	X	X	X
CCB	1	09/26/23 14:03	X	X	X	X	X	X
K2309806-033	5	09/26/23 14:05	X	X	X	X	X	X
K2309806-034	5	09/26/23 14:07	X	X	X	X	X	X
K2309806-035	5	09/26/23 14:09	X	X	X	X	X	X
K2309806-036	5	09/26/23 14:12	X	X	X	X	X	X
K2309806-037	5	09/26/23 14:14	X	X	X	X	X	X

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

Analysis Run Log

Instrument ID: **K-ICP-MS-06** **Analytical BatchID:** **818453**

Sample	Dilution Factor	Date/Time	Cd	Cu	Pb	Se	Ag	Zn
K2309806-038	5	09/26/23 14:16	X	X	X	X	X	X
K2309806-039	5	09/26/23 14:18	X	X	X	X	X	X
K2309806-040	5	09/26/23 14:20	X	X	X	X	X	X
CCV	1	09/26/23 14:22	X	X	X	X	X	X
CCB	1	09/26/23 14:24	X	X	X	X	X	X
LLCCVT	1	09/26/23 14:26	X	X	X	X	X	X

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Instrument ID: **K-ICP-MS-06** **Analytical BatchID:** **818453**

Sample	Date/Time	Ge72H2	Ge72He	In115He	Lu175He
ZZZZZZ	09/26/23 11:39				
ZZZZZZ	09/26/23 11:41				
ICV	09/26/23 11:44	97	103	102	102
CCV	09/26/23 11:46	98	102	101	103
ICB	09/26/23 11:48	97	101	102	101
CCB	09/26/23 11:50	97	100	102	101
LLICVT	09/26/23 11:52	97	102	102	103
ICSA	09/26/23 11:54	92	96	96	100
ICSAB	09/26/23 11:56	92	96	95	100
ZZZZZZ	09/26/23 11:58				
KQ2316597-01MB	09/26/23 12:03	97	100	103	103
KQ2316597-02LCS	09/26/23 12:05	99	103	103	103
KQ2316597-03SRM	09/26/23 12:07	98	99	101	103
KQ2316597-04SRM	09/26/23 12:09	98	103	101	104
K2309806-001	09/26/23 12:11	99	102	102	104
K2309806-001DUP	09/26/23 12:14	101	101	103	105
K2309806-001SDL	09/26/23 12:16	104	106	106	107
K2309806-001PS	09/26/23 12:18	99	103	103	105
K2309806-001MS	09/26/23 12:20	102	101	103	104
K2309806-002	09/26/23 12:22	101	102	104	107
CCV	09/26/23 12:24	107	107	107	107
CCB	09/26/23 12:26	107	108	109	110
K2309806-003	09/26/23 12:28	99	104	103	106
K2309806-004	09/26/23 12:30	103	103	105	105
K2309806-005	09/26/23 12:32	105	104	107	108
K2309806-006	09/26/23 12:34	104	105	106	108
K2309806-007	09/26/23 12:36	106	107	107	111
K2309806-008	09/26/23 12:38	106	108	108	109
K2309806-009	09/26/23 12:40	106	108	109	109
K2309806-010	09/26/23 12:43	106	109	110	111
K2309806-011	09/26/23 12:45	105	109	110	110
K2309806-012	09/26/23 12:47	109	110	111	112
CCV	09/26/23 12:49	114	113	116	114
CCB	09/26/23 12:51	111	113	115	114
K2309806-013	09/26/23 12:53	106	106	108	110
K2309806-014	09/26/23 12:55	106	107	109	111
K2309806-015	09/26/23 12:57	106	107	109	112

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Instrument ID: **K-ICP-MS-06** **Analytical BatchID:** **818453**

Sample	Date/Time	Ge72H2	Ge72He	In115He	Lu175He
K2309806-016	09/26/23 12:59	109	109	111	114
K2309806-017	09/26/23 13:01	109	111	113	115
K2309806-018	09/26/23 13:03	111	111	112	114
K2309806-019	09/26/23 13:05	110	112	114	115
K2309806-020	09/26/23 13:07	110	112	114	117
CCV	09/26/23 13:09	117	115	118	117
CCB	09/26/23 13:12	112	116	118	117
LLCCVT	09/26/23 13:14	113	114	117	116
KQ2316598-01MB	09/26/23 13:16	113	114	118	117
KQ2316598-02LCS	09/26/23 13:18	112	112	115	116
KQ2316598-03SRM	09/26/23 13:20	107	107	111	114
KQ2316598-04SRM	09/26/23 13:22	107	109	111	114
K2309806-021	09/26/23 13:24	108	110	115	116
K2309806-021DUP	09/26/23 13:26	110	113	116	119
K2309806-021SDL	09/26/23 13:28	116	116	120	120
K2309806-021PS	09/26/23 13:30	112	112	116	119
K2309806-021MS	09/26/23 13:32	113	113	116	119
K2309806-022	09/26/23 13:34	114	116	120	122
CCV	09/26/23 13:36	116	116	119	119
CCB	09/26/23 13:38	113	115	120	118
K2309806-023	09/26/23 13:40	110	112	115	117
K2309806-024	09/26/23 13:43	108	111	113	117
K2309806-025	09/26/23 13:45	112	113	115	118
K2309806-026	09/26/23 13:47	113	112	115	119
K2309806-027	09/26/23 13:49	113	111	116	118
K2309806-028	09/26/23 13:51	111	111	116	119
K2309806-029	09/26/23 13:53	110	110	116	118
K2309806-030	09/26/23 13:55	113	114	117	120
K2309806-031	09/26/23 13:57	111	112	115	120
K2309806-032	09/26/23 13:59	112	114	118	122
CCV	09/26/23 14:01	119	120	123	123
CCB	09/26/23 14:03	117	117	123	123
K2309806-033	09/26/23 14:05	110	114	117	121
K2309806-034	09/26/23 14:07	112	114	117	121
K2309806-035	09/26/23 14:09	114	115	119	121
K2309806-036	09/26/23 14:12	112	116	118	121
K2309806-037	09/26/23 14:14	114	114	119	122

Client: Alaska Department of Fish and Game **Service Request:** K2309806
Project: 2023 Greens Creek Biomonitoring/

ICP-MS INTERNAL STANDARDS RELATIVE INTENSITY SUMMARY

Instrument ID: **K-ICP-MS-06** **Analytical BatchID:** **818453**

Sample	Date/Time	Ge72H2	Ge72He	In115He	Lu175He
K2309806-038	09/26/23 14:16	115	116	120	122
K2309806-039	09/26/23 14:18	113	117	120	122
K2309806-040	09/26/23 14:20	114	117	120	122
CCV	09/26/23 14:22	116	120	125	124
CCB	09/26/23 14:24	119	119	123	124
LLCCVT	09/26/23 14:26	118	118	124	124