

Technical Report No. 24-06

Aquatic Studies at Kensington Mine, 2023

by

Jesse W. Lindgren and Erika M. King



February 2024

Alaska Department of Fish and Game

Habitat Section



Symbols and Abbreviations

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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-fork	MEF
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	mid-eye-to-tail fork	METF
hectare	ha	at	@	standard length	SL
kilogram	kg	compass directions:		total length	TL
kilometer	km	east	E		
liter	L	north	N	Mathematics, statistics	
meter	m	south	S	<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	west	W	alternate hypothesis	H _A
millimeter	mm	copyright	©	base of natural logarithm	e
nanometer	nm	corporate suffixes:		catch per unit effort	CPUE
		Company	Co.	coefficient of variation	CV
Weights and measures (English)		Corporation	Corp.	common test statistics	(F, t, χ^2 , etc.)
cubic feet per second	ft ³ /s	Incorporated	Inc.	confidence interval	CI
foot	ft	Limited	Ltd.	correlation coefficient	
gallon	gal	District of Columbia	D.C.	(multiple)	R
inch	in	et alii (and others)	et al.	correlation coefficient	
mile	mi	et cetera (and so forth)	etc.	(simple)	r
nautical mile	nmi	exempli gratia		covariance	cov
ounce	oz	(for example)	e.g.	degree (angular)	°
pound	lb	Federal Information Code	FIC	degrees of freedom	df
quart	qt	idest (that is)	i.e.	expected value	E
yard	yd	latitude or longitude	lat. or long.	greater than	>
		monetary symbols		greater than or equal to	≥
Time and temperature		(U.S.)	\$, ¢	harvest per unit effort	HPUE
day	d	months (tables and figures): first three letters	Jan,...,Dec	less than	<
degrees Celsius	°C	registered trademark	®	less than or equal to	≤
degrees Fahrenheit	°F	trademark	™	logarithm (natural)	ln
degrees kelvin	K	United States	U.S.	logarithm (base 10)	log
hour	h	(adjective)		logarithm (specify base)	log ₂ , etc.
minute	min	United States of America (noun)	USA	minute (angular)	'
second	s	U.S.C.	United States Code	no data	ND
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	not significant	NS
Physics and chemistry				null hypothesis	H ₀
all atomic symbols				percent	%
alternating current	AC			probability	P
ampere	A			probability of a type I error (rejection of the null hypothesis when true)	α
calorie	cal			probability of a type II error (acceptance of the null hypothesis when false)	β
direct current	DC			second (angular)	"
hertz	Hz			standard deviation	SD
horsepower	hp			standard error	SE
hydrogen ion activity (negative log of)	pH			variance	
inch of mercury	inHg			population	Var
kilowatt	kW			sample	var
Kilopascal	kPa				
Nephelometric Turbidity Unit	NTU				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

TECHNICAL REPORT NO. 24-06

AQUATIC STUDIES AT KENSINGTON MINE, 2023

by

Jesse W. Lindgren

and

Erika M. King

Alaska Department of Fish and Game
Habitat Section, Southeast Region
P.O. Box 110024, Juneau, Alaska, 99811

February 2024

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Cover: Habitat Biologist Greg Albrecht collects sediment samples in Lower Johnson Creek, July 27, 2023.

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*Alaska Department of Fish and Game, Habitat Section,
P.O. Box 110024, Juneau, Alaska, 99811, USA*

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Habitat Biologists Greg Albrecht, Dylan Krull, Flynn Casey, Claire Delbecq, and Nick Jensen assisted with field data collection. Matthew Kern of Alder Grove Farm identified benthic macroinvertebrates and Greg provided benthic macroinvertebrate identification quality control. Southeast Regional Supervisor Kate Kanouse and Dylan Krull reviewed and edited the report, and Operations Manager Dr. Al Ott reviewed the report.

Thank you all for your contribution.

EXECUTIVE SUMMARY

Since 2011, 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 Coeur Alaska Inc.'s Kensington Mine operations. The aquatic studies include sampling periphyton, benthic macroinvertebrates, sediment element concentrations, pink salmon spawning substrate, and adult salmon counts in Slate, Sherman, and Johnson Creeks; reference sampling reaches include West Fork and Upper Slate Creeks, and mine-influenced sampling reaches include East Fork and Lower Slate Creeks, Upper Johnson Creek, and Lower Sherman Creek.

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 spring macroinvertebrate sampling, the Juneau area had precipitation 0.8 cm above and temperature 1.3 °F below normal with one peak streamflow event in late January. Prior to summer periphyton sampling, the Juneau area had precipitation 6.8 cm below and temperature 1.8 °F above normal with one peak streamflow event 3 weeks prior to sampling.

The 2023 mean chlorophyll a density among sites ranged 2.47–16.08 mg/m², several of which were in the upper range observed since we began sampling in 2011 and the West Fork Slate Creek mean density was the highest observed. The proportions of chlorophyll b and chlorophyll c were consistent with community composition observed in previous years. Despite environmental and stream characteristic differences (e.g., geomorphic and hydrologic) amongst sites, mean chlorophyll a densities generally follow a similar trend 2011–2023.

Benthic macroinvertebrate (BMI) mean densities ranged 955–7,086/m² across sites, several of which were in the upper range documented 2011–2022; the mean density at Upper Johnson Creek was the highest observed. The mean densities of Ephemeroptera, Plecoptera, and Trichoptera (EPT) insects among sites ranged 744–6,161 EPT/m² and composed 12–92% of the samples, consistent with previous years at each site. Mean EPT densities among sites 2011–2023, follow a similar trend with natural variation due to environmental factors and differences in site characteristics. The number of taxa identified, and the Shannon Diversity and Evenness scores, were consistent with previous years at each site.

Sediment element concentration samples were within ranges observed in previous years at each site. At all sites, arsenic, cadmium, copper, nickel, and zinc concentrations were near or above the freshwater sediment guidelines suggested by Buchman (2008), as in previous years. Relative to the other sites, the Upper Slate Creek samples had elevated concentrations of nickel and chromium and East Fork Slate Creek samples had elevated concentrations of arsenic, cadmium, selenium, and zinc.

From August 10 to October 24, 2023, we surveyed and counted adult salmon during peak runs and observed a strong pink salmon *Oncorhynchus gorbuscha* return in Slate, Johnson, and Sherman Creeks, consistent with dominant odd-year returns observed in the Northern Southeast Inside Subregion since 2006 (Piston and Heintz 2018). Lower Slate Creek pink salmon spawning substrate samples were within the upper ranges of the particle sizes observed 2011–2022.

INTRODUCTION

The Kensington Mine is located near Berners Bay in Southeast Alaska (Figure 1), about 72 km north of Juneau and 56 km south of Haines within the City and Borough of Juneau and the Tongass National Forest (USDA 2021). The mine is owned and operated by Coeur Alaska, Inc. (Coeur), a wholly owned subsidiary of Coeur Mining, Inc.

The underground mine began producing gold concentrate for export on June 24, 2010. Tailings are disposed underground as paste backfill and in the tailings treatment facility (TTF) as slurry through a pipeline from the mill. Mine infrastructure is located in three drainages that support resident and anadromous fish: the TTF and water treatment plant in the Slate Creek drainage; the waste rock pile, camp, and mill facilities in the Johnson Creek drainage; and the waste rock pile and mine water treatment plant in the Sherman Creek drainage.

Contractors gathered aquatic data for the Kensington Mine from the late 1980s through 2005, which provided a basis for Alaska Department of Fish and Game (ADF&G) Habitat Section permit decisions, Plan of Operations monitoring requirements (Coeur 2022), the U.S. Environmental Protection Agency (USEPA) National Pollutant Elimination Discharge System Permit No. AK-005057-1, and the Alaska Department of Environmental Conservation Alaska Pollutant Discharge Elimination System (APDES) Permit No. AK0050571.^a Monitoring and research reports published during project development and operations are in Aquatic Science Inc. (2006, 2007, 2008, 2009a, 2009b, 2009c, 2009d, 2011), Timothy and Kanouse (2012–2014), Kanouse (2015), Brewster (2016), Willson-Naranjo and Kanouse (2016), Kanouse and Zutz (2017), Zutz (2018), Albrecht (2018, 2019), Kane (2020–2022), and Lindgren and King (2023).

Habitat Section staff completed the aquatic studies required annually for the Kensington Mine in Slate, Johnson, and Sherman Creeks since 2011. The APDES Permit requires sampling periphyton, benthic macroinvertebrates (BMI), and sediment. We document stream condition using chlorophyll density and composition, BMI density and community composition, pink salmon spawning substrate composition, and sediment element concentrations. Habitat Section staff also completed adult salmon counts required in the project Plan of Operations (Coeur 2022, USDA 2022).

PURPOSE

This technical report summarizes the 2023 aquatic study data and documents the condition of biological communities and sediments in Slate, Johnson, and Sherman Creeks near mine development and operations, satisfying the aquatic biological and sediment monitoring requirements summarized in the project Plan of Operations (Coeur 2022, USDA 2022) and included in the APDES Permit AK0050571.

^a Contractor reports are listed in Zutz (2018).

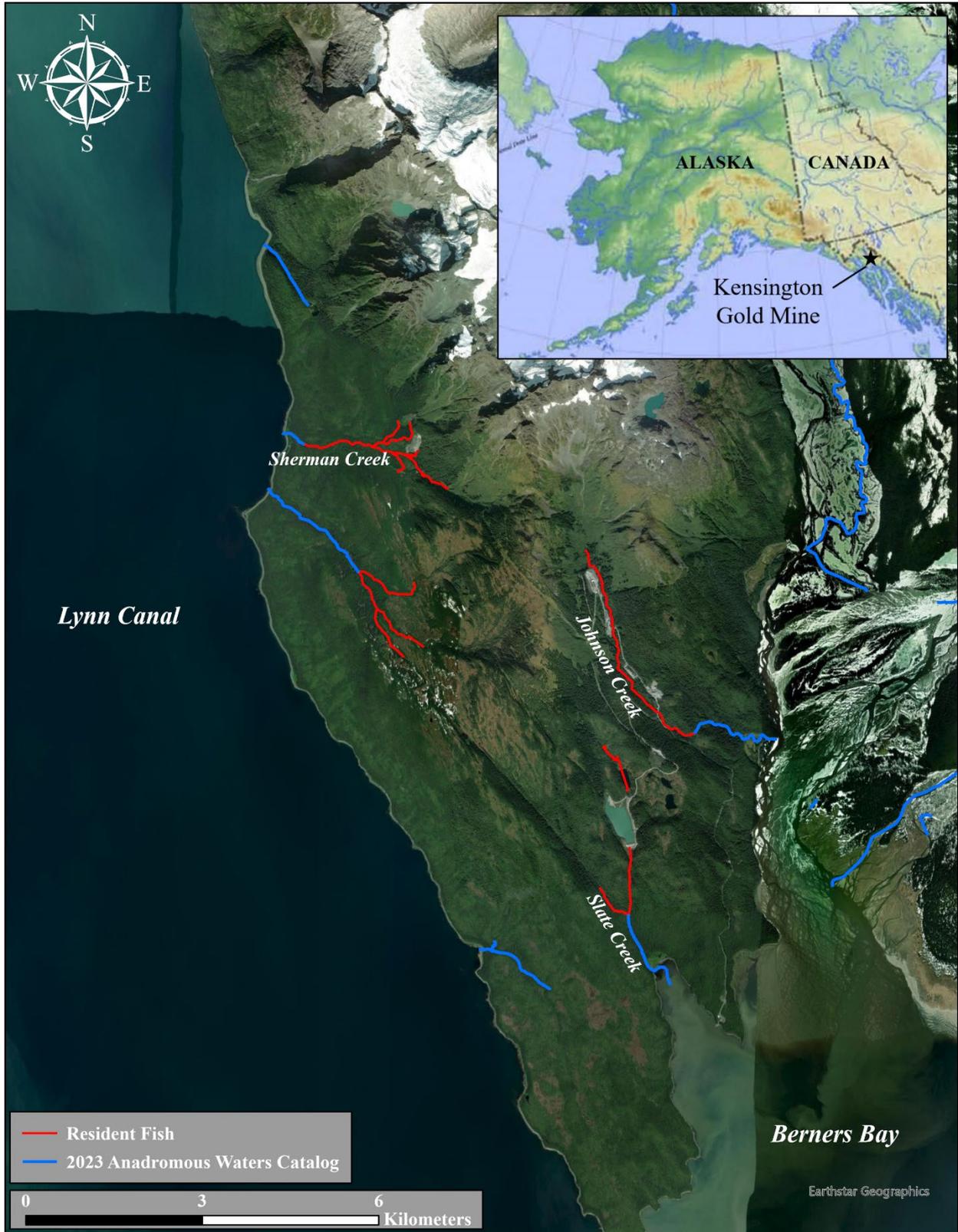


Figure 1.—Kensington Mine project area; streams adjacent to mine infrastructure and associated with aquatic studies are illustrated.

STUDY AREA

Slate Creek

Slate Creek drains a 10.5 km² watershed into Slate Cove on the northwest side of Berners Bay (Coeur 2022; Figure 2). Water from the TTF (Figure 3) and acid rock drainage seepage from the TTF spillway (Figure 4) are collected and treated at TTF water treatment plants, then discharged to East Fork Slate Creek via Outfall 002. Approximately 1 km upstream of the mouth of Lower Slate Creek, two 25 m waterfalls at the confluence of the East and West Forks preclude upstream fish migration.

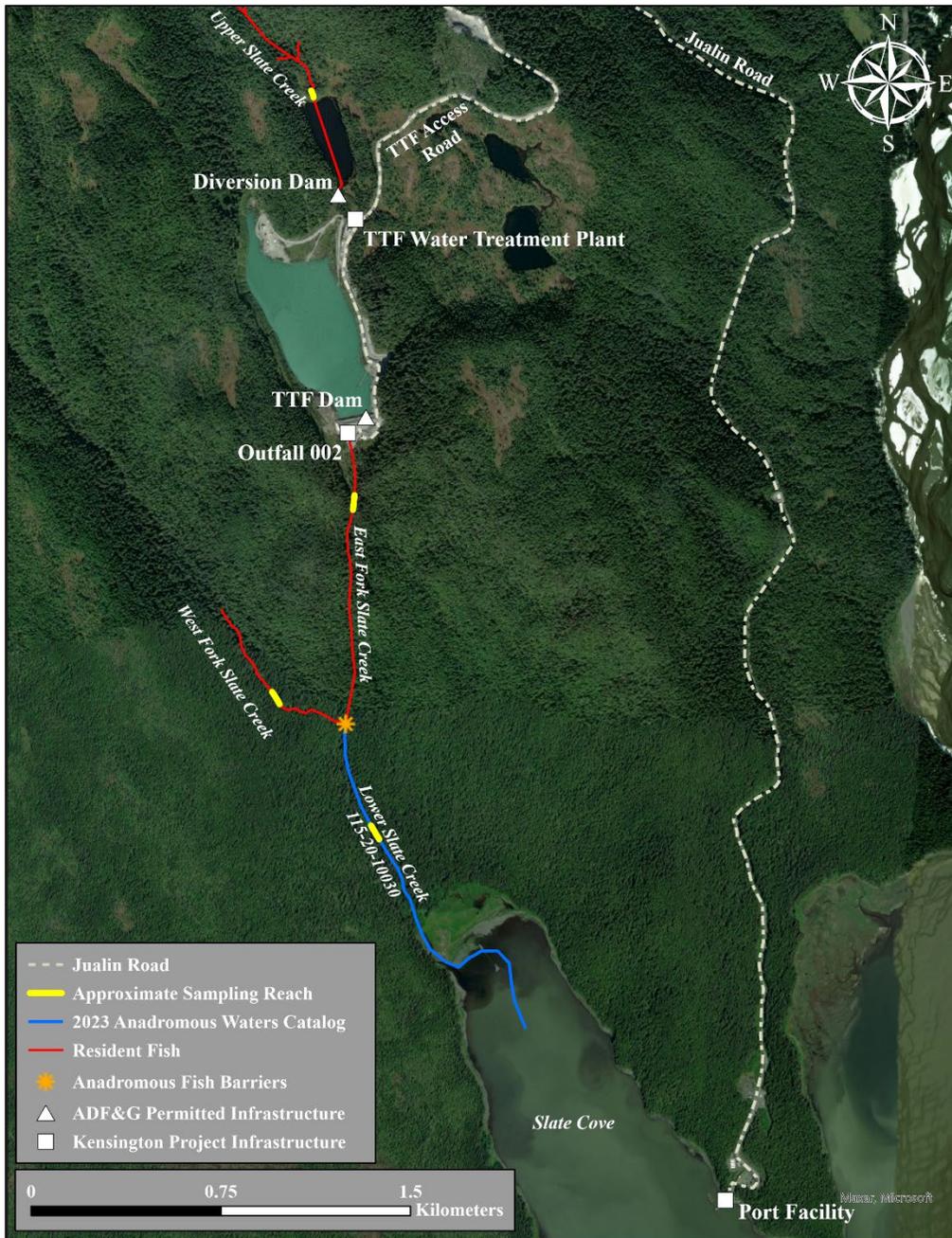


Figure 2.—Slate Creek area.



Figure 3.–Tailings treatment facility and dam (background), July 6, 2022.



Figure 4.–Tailings treatment facility dam spillway and plunge pool, April 26, 2022. The stage 3 spillway was complete in fall 2021. Drainages from the exposed graphitic phyllite on the west abutment are captured in the seepage collection sump and treated in the TTF water treatment plant.

Lower Slate Creek

Lower Slate Creek comprises a 1.6 km reach between the stream mouth in Slate Cove and the two waterfalls at the confluence of East and West Fork Slate Creek and is a mixture of water from the East and West Forks, Outfall 002, and Upper Slate Lake. Slate Creek (Stream No. 115-20-10030) provides habitat for chum *O. keta*, coho *O. kisutch*, and pink salmon, and eulachon *Thaleichthys pacificus* (Giefer and Graziano 2023). We also have documented Dolly Varden *Salvelinus malma* and cutthroat trout *O. clarkii* in the drainage (Timothy and Kanouse 2012). We sample periphyton, BMIs, pink salmon spawning substrate, and sediment at Sample Point 1 (SP1; about 9 m elevation; Figure 5) and pink salmon spawning substrate at Sample Point 2 (SP2; about 14 m elevation;

Figure 6)—both a medium moderate gradient (2–6%) mixed control channel type (Paustian 2010)—and count adult salmon throughout Lower Slate Creek.

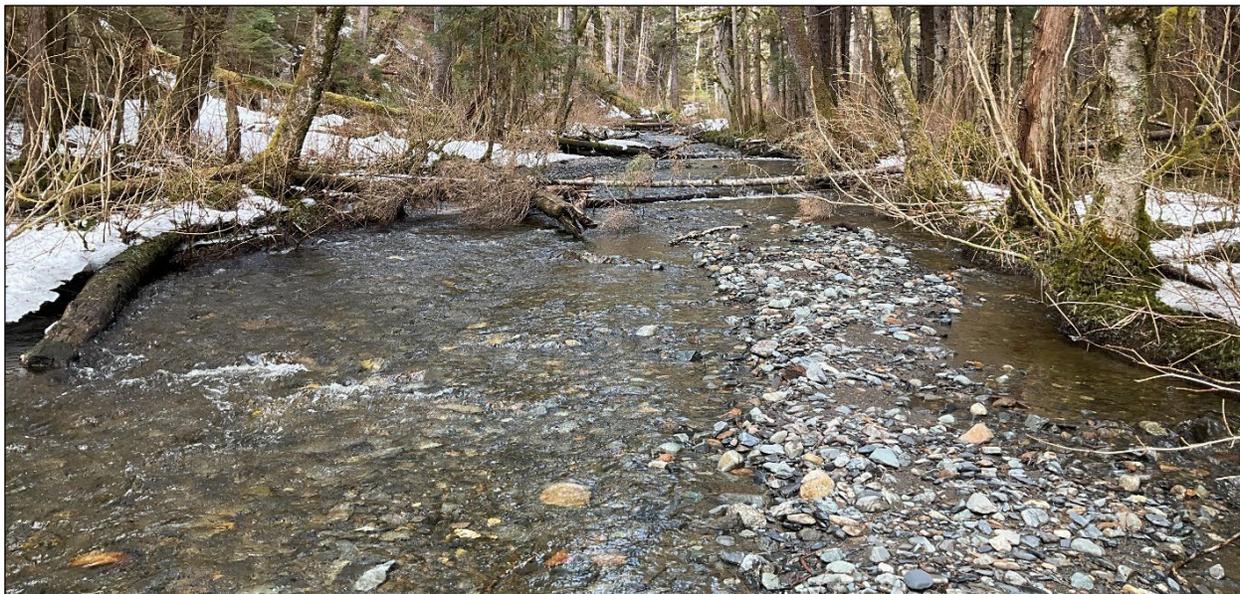


Figure 5.—Lower Slate Creek SP1 during periphyton sampling, April 19, 2023.



Figure 6.—Lower Slate Creek SP2 during spawning substrate sampling, July 6, 2023.

West Fork Slate Creek

Located in a valley approximately 800 m west of the TTF, West Fork Slate Creek (Figure 7) is not influenced by mine activities; the sample reach serves to represent natural background conditions in the area. West Fork Slate Creek is a tributary to Lower Slate Creek and provides habitat for Dolly Varden (Timothy and Kanouse 2014). We sample periphyton and BMIs about 600 m upstream of the waterfall in Lower Slate Creek, at about 85 m elevation in a cobble-dominated small moderate gradient mixed control channel (Paustian 2010).



Figure 7.—West Fork Slate Creek during benthic macroinvertebrate sampling, April 19, 2023.

East Fork Slate Creek

East Fork Slate Creek (Figure 8) comprises a 1 km reach between the confluence with West Fork Slate Creek and the TTF dam and is a tributary to Lower Slate Creek. East Fork Slate Creek discharge is dependent on Upper Slate Lake discharge—routed through a diversion pipeline bypassing the TTF—and Outfall 002^b effluent discharge from the TTF water treatment plant.^c The reach provides habitat and downstream fish passage for Dolly Varden and threespine stickleback *Gasterosteus aculeatus* (Kanouse and Zutz 2017) emigrating from Upper Slate Lake, currently via the diversion pipeline and formerly via Lower Slate Lake. We sample periphyton, BMIs, and sediment in East Fork Slate Creek 200 m downstream of the TTF at about 198 m elevation in a small moderate gradient bedrock contained channel (Paustian 2010) where angular cobble substrate is dominant.

^b Outfall 002 began discharging to East Fork Slate Creek in December 2010.

^c Daily mean discharge data combining the diversion pipeline and Outfall 002 data for July was presented 2011–2018 (Albrecht 2019).



Figure 8.—East Fork Slate Creek during macroinvertebrate sampling, April 18, 2023.

Upper Slate Creek

Upper Slate Creek (Figure 9) is a tributary to Upper Slate Lake, upstream of mine influence, and the sample reach serves to represent natural background conditions in the area. The stream provides habitat for Dolly Varden (Albrecht 2018). We sample periphyton, BMIs, and sediment in Upper Slate Creek within 75 m of Upper Slate Lake at about 229 m elevation in a micro moderate gradient mixed control channel (Paustian 2010).



Figure 9.—Upper Slate Creek during sediment sampling, July 5, 2023.

Johnson Creek

Johnson Creek drains a 14.6 km² watershed to the Lace River on the northwest shore of Berners Bay (Coeur 2022; Figure 10). Adjacent to the mill facilities, a water supply infiltration gallery installed in Upper Johnson Creek provides the primary source of fresh water for processing.^d Upper and Middle Johnson Creek are immediately adjacent to supporting infrastructure and the Jualin Road crosses the stream at two locations (Bridge #1 and #2).

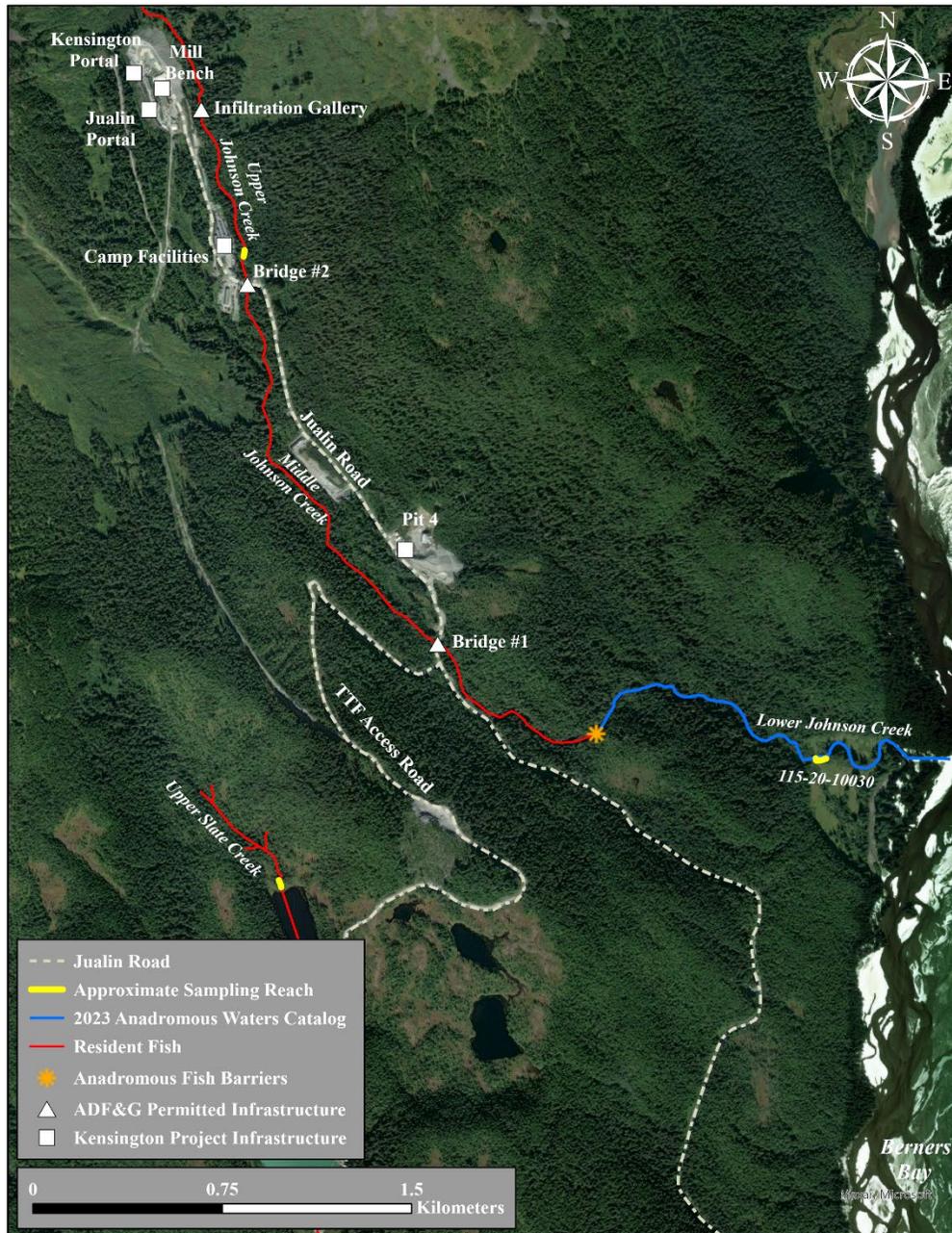


Figure 10.–Johnson Creek area.

^d Authorized under Fish Habitat Permit FH11-I-0130.

Lower Johnson Creek

Lower Johnson Creek comprises a 1.5 km reach between the Lace River and a 30 m waterfall precluding upstream fish migration; the reach is a mixture of drainages near mine infrastructure in Middle^c and Upper Johnson Creeks. Johnson Creek (Stream No. 115-20-10070) provides habitat for chum, coho, and pink salmon (Giefer and Graziano 2023). We also documented Dolly Varden and cutthroat trout in the drainage (Timothy and Kanouse 2012). We sample sediment about 600 m upstream from the mouth at about 9 m elevation in a low gradient moderate width floodplain channel (Figure 11; Paustian 2010) and count adult salmon throughout Lower Johnson Creek.



Figure 11.—Greg Albrecht and Flynn Casey collecting sediment at Lower Johnson Creek, July 5, 2023.

Upper Johnson Creek

Upper Johnson Creek comprises the reach between Bridge #2 and the headwaters and flows adjacent to the camp facilities, mill bench, and the Kensington waste rock stockpile. Water is collected through an infiltration gallery in Upper Johnson Creek near the mill bench to support the camp. Upper Johnson Creek provides habitat for Dolly Varden (Timothy and Kanouse 2012). We sample BMIs about 50 m upstream of the Jualin Road Bridge #2 at about 207 m elevation in a medium width moderate grade mixed control channel (Paustian 2010) with boulder and cobble substrate (Figure 12).

^c Mine facilities include the domestic wastewater treatment plant, warehouse, storage of reclamation material and acid-generating rock stockpiles, bridges, and Pit 4; drainages include Snowslide Gulch, the domestic wastewater outfall, and storm water discharges.



Figure 12.—Upper Johnson Creek during macroinvertebrate sampling, April 19, 2023.

Sherman Creek

Sherman Creek drains a 10.84 km² watershed to the east shore of Lynn Canal (Coeur 2022; Figure 13). A 15 m waterfall approximately 460 m upstream from the Lower Sherman Creek mouth precludes upstream fish migration. Middle Sherman Creek comprises the 2 km reach between the waterfall and the Comet Beach Road bridge; Upper Sherman Creek comprises the reach upstream of the bridge to the headwaters. Water from the underground workings is collected and treated at the Comet Water Treatment Plants, then discharged to Middle Sherman Creek via Outfall 001.

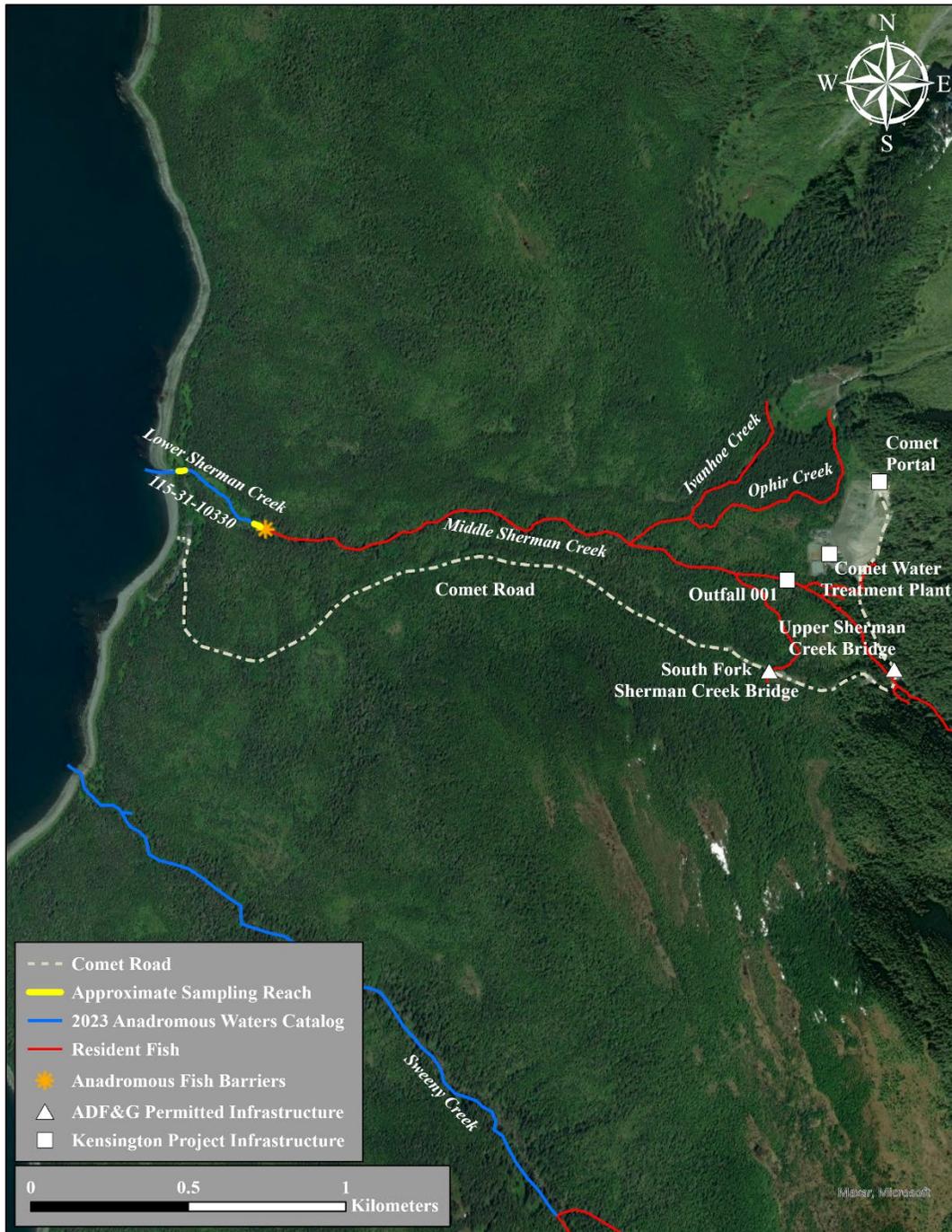


Figure 13.—Sherman Creek area.

Lower Sherman Creek

Lower Sherman Creek comprises the reach between the stream mouth and the 15 m barrier waterfall; the reach is a mixture of drainages near and from mine infrastructure in Middle Sherman Creek and its tributaries.^f Sherman Creek (115-31-10330) provides habitat for chum and pink salmon (Gieffer and Graziano 2023). We also documented Dolly Varden throughout the system (Timothy and Kanouse 2012). We sample periphyton, BMIs, and sediment in a medium width moderate gradient mixed control channel (Paustian 2010) at Sample Point 1 (SP1; about 12 m elevation; Figure 14), and periphyton and BMIs at Sample Point 2 (SP2; about 26 m elevation; Figure 15), a similar channel type. We count adult salmon throughout Lower Sherman Creek.



Figure 14.–Lower Sherman Creek SP1 during macroinvertebrate sampling, April 18, 2023.



Figure 15.–Lower Sherman Creek SP2 during macroinvertebrate sampling, April 18, 2023.

^f Mine facilities and infrastructure include the Comet water treatment plant, waste rock pile, bridges and culverts; drainages include Ivanhoe Creek, Ophir Creek, South Fork Sherman Creek, and Comet water treatment plant Outfall 001.

AQUATIC STUDIES AND LOCATIONS

Between April 18 and October 24, 2023, we completed the Kensington Mine aquatic studies required in the project Plan of Operations (Coeur 2022) and APDES Permit AK0050571. Sampling locations of the required aquatic studies for each sample site are detailed in Table 1.

Table 1.–Aquatic studies sampling sites and schedule, 2023.

Location	Sample Site	Latitude	Longitude	Date Sampled
Lower Slate Creek	Periphyton	58.7905	-135.0345	7/26
	Benthic macroinvertebrates	58.7905	-135.0345	4/19
	Spawning substrate			
	Sample Point 1	58.7905	-135.0345	7/6
	Sample Point 2	58.7920	-135.0360	7/6
	Sediment composition and element concentrations	58.7905	-135.0345	7/6
	Adult pink, chum, and coho salmon surveys	58.7880	-135.0315	8/10-10/24
		58.7964	-135.0389	
West Fork Slate Creek	Periphyton	58.7993	-135.0457	7/26
	Benthic macroinvertebrates	58.7993	-135.0457	4/19
East Fork Slate Creek	Periphyton	58.8045	-135.0381	7/27
	Benthic macroinvertebrates	58.8045	-135.0381	4/18
	Sediment composition and element concentrations	58.8053	-135.0383	7/6
Upper Slate Creek	Periphyton	58.8189	-135.0415	7/26
	Benthic macroinvertebrates	58.8189	-135.0415	4/19
	Sediment composition and element concentrations	58.8189	-135.0416	7/5
Johnson Creek	Sediment composition and element concentrations	58.8235	-135.0024	7/5
	Benthic macroinvertebrates	58.8407	-135.0450	4/19
	Adult pink, chum, and coho salmon surveys	58.8241	-134.9999	8/10-10/24
		58.8243	-135.0201	
Lower Sherman Creek	Periphyton	58.8687	-135.1415	7/27
	Benthic macroinvertebrates			
	Sample Point 1	58.8687	-135.1415	4/18
	Sample Point 2	58.8674	-135.1381	4/18
	Sediment composition and element concentrations	58.8687	-135.1413	7/5
	Adult pink and chum salmon surveys	58.8689	-135.1422	8/10-8/30
		58.8671	-135.1367	

Note: WGS84 datum.

Periphyton Chlorophyll Density and Composition

The APDES permit (Section 1.5.3.5.3) requires annual monitoring of periphyton chlorophyll density and composition within mining influence at Lower Slate, East Fork Slate, and Lower Sherman Creeks and at reference reaches above mine influence at West Fork Slate and Upper Slate Creeks to detect changes in baseline primary productivity compared to natural variation due to factors such as mineral seeps, climate, stream migration and stream flow. Annual periphyton sampling occurs between June and August and 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 APDES permit (Section 1.5.3.2) requires annual monitoring of BMI density and community composition within mining influence at Lower Slate, East Fork Slate, Upper Johnson, and Lower Sherman Creeks and at reference reaches above mine influence at West Fork Slate and Upper Slate Creeks to detect changes in baseline secondary productivity compared to natural variation due to factors such as mineral seeps, climate, stream migration and stream flow. Annual BMI sampling occurs between March and May after spring breakup and before peak snowmelt 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.

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

Adult Salmon Counts

The Plan of Operations (Coeur 2022, USDA 2022) requires annual counts of adult chum, coho, and pink salmon in Lower Slate, Lower Johnson, and Lower Sherman Creeks throughout the peak run period for each species.^g Annual peak run sampling occurs between August and November depending on natural variation in adult salmon spawning. The data are used to document adult salmon presence.

Spawning Substrate Composition

The APDES permit (Section 1.5.3.5.1) requires annual sampling of pink salmon spawning substrate during early July at Lower Slate Creek SP1 and SP2 to detect change in composition over time. Geometric mean particle size (GMPS), an index of substrate textural composition, is calculated for each sample, and among samples collected at each site. Data are used to document changes in spawning substrate composition.

Sediment Composition and Element Concentrations

The APDES permit (Section 1.5.2) requires annual analysis of one^h fine sediment sample within mining influence at Lower Slate, East Fork Slate, Lower Johnson, and Lower Sherman Creeks and at the reference reach above mine influence at Upper Slate Creek to detect changes in sediment

^g Per the USFS (2022) Record of Decision. During the years 2011–2021, we counted fish throughout the entire spawning seasons.

^h Beginning in 2020, Coeur agreed and we voluntarily collected two additional annual samples at each site to document element concentration variability.

element concentrations over time. Annual sediment sampling occurs in July and samples are analyzed for particle size, total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of silver (Ag), aluminum (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se), and zinc (Zn).

Sediment element concentrations are influenced by a variety of factors, such as geochemical composition and weathering within the watershed, sediment grain size, organic content, and development (Tchounwou et al. 2012). Subsequently, sediment element concentrations influence benthic aquatic productivity, and heavy metals in sediments can decrease BMI taxa richness and alter the composition of BMI communities (Qu et al. 2010).

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.

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 submerged cobble in riffle habitats in less than 0.45 m water depth at each sample site and submerged in the creek in the same orientation they were 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 dropsⁱ of saturated magnesium carbonate solution were added to the filter^j. After all the water was pumped through the glass fiber filter, it 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.

USEPA (1997) protocol was followed for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.^k 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 the potential for 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 min at 500 relative centrifugal force, using a properly balanced centrifuge. Prior to sample measurement, two cuvettes containing 90% buffered acetone

ⁱ 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 solids.

^j To prevent acidification and conversion of chlorophyll to phaeophytin.

^k Deviations from USEPA (1997) include samples storage longer than 3.5 weeks and cutting sample filters to reduce acetone exposure for laboratory staff (as opposed to homogenization).

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. Supernatant from each sample was decanted into an individual cuvette and absorbance was measured at each wavelength. Each sample was treated with 80 μ L 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.

Trichromatic equations were used to estimate Chl-a, Chl-b, and Chl-c concentrations, correcting for turbidity using the 750 nm absorbance value (APHA 2012, USEPA 1997). Chl-a concentrations were corrected when phaeophytin was detected. When Chl-a was not detected in a sample, the concentration is reported as the spectrophotometer estimated detection limit and the values for Chl-b or Chl-c were excluded. The 2023 estimated detection limit for Chl-a concentration was 0.08 mg/m².

Data Presentation

For each site and by year, mean densities of Chl-a, Chl-b, and Chl-c are presented in a table, Chl-a densities in a figure, and mean proportions of Chl-a, Chl-b, and Chl-c in a figure. Annual data from 2011 through 2022 are provided in Appendix A.

BENTHIC MACROINVERTEBRATE DENSITY AND COMMUNITY COMPOSITION

Sample Collection and Analysis

Six BMI samples were collected from each site using a Surber 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 Surber stream bottom sampler has a 0.093 m² sample area and material is captured in a 200 mL cod end, both constructed with 300 μ m mesh net. After securing the frame on the streambed with the opening facing upstream, 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.

Contractor Matt Kern of Alder Grove Farm used an elutriator system and 0.5 mm and 0.3 mm sieves to sort macroinvertebrates from debris,¹ and identified organisms to the lowest practical taxonomic level^m using Merritt and Cummins (1996) and Stewart and Oswood (2006). Habitat biologists provided quality control by verifying macroinvertebrate identification of eight samples.

¹ 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 Division of Habitat, 802 3rd Street, Douglas, AK.

^m Insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera to genus, except nonbiting midges to family Chironomidae, and all others to class or order.

BMI density (per m²) for each sample was calculated by dividing the number of macroinvertebrates by 0.093 m²—the Surber sampling area. Mean density was estimated for each site by calculating the mean density among the six samples. Taxa richness is reported as the number of taxonomic groups identified to the lowest practical level; terrestrialⁿ organisms were excluded from all calculations.

Shannon Diversity (*H*) and Evenness (*E*) Indices provide measures of taxonomic diversity and abundance equality. These indices are calculated using the following equations from Magurran (1988):

$$H = - \sum_{i=1}^S (P_i \log_{10} P_i) \quad \text{and} \quad E = \frac{H}{\log_{10} S}$$

where P_i is the number of macroinvertebrates per taxonomic group divided by the total number of macroinvertebrates in the sample, and S is the number of taxonomic groups in the sample.^o A single taxa macroinvertebrate community has an H value of 0, which increases with the number of taxa (richness) and abundance equality (evenness). The Evenness calculation normalizes the H value to a number between 0 and 1, with an E value of 1 indicating all taxa are equally abundant.

Data Presentation

For each site and by year, a table is presented summarizing mean BMI and EPT density, total taxa, total EPT taxa, percent EPT, and mean Shannon Diversity and Evenness scores. Mean densities and community composition are presented in a figure. Annual data from 2011 through 2023 are provided in Appendix B.

ADULT SALMON COUNTS

Sample Collection

We counted adult salmon downstream of fish migration barriers once per week during peak runs, August through early September for pink and chum salmon and late September through mid-October for coho salmon. Stream surveys for pink and chum salmon and carcasses were conducted by foot on Slate and Sherman Creeks and by aerial count via helicopter on Johnson Creek^p. Foot surveys for coho salmon and carcasses were conducted on Slate and Johnson Creeks. To improve coho salmon observations, biologists conducted snorkel surveys and recorded underwater videos with a GoPro in large pools and around large woody debris—habitats where adult coho salmon tend to concentrate.

Each survey began at the stream mouth, proceeded upstream by established reach identifiers and concluded at the fish migration barrier. One biologist enumerated and recorded while the other biologist verified counts and provided bear protection. Approximate weather and streamflow conditions were recorded for each survey.

ⁿ Including adult terrestrial insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera.

^o Assuming all taxonomic groups are represented.

^p Aerial surveys are conducted on Lower Johnson Creek throughout the pink and chum salmon run due to the observed brown bear density in the area; this method of enumeration is inherently imprecise.

Data Presentation

For each site, figures are presented of the peak weekly adult pink salmon count; the 2011–2023 peak counts by species are presented in a table. Compiled 2011–2023 pink salmon counts by statistical week are provided in Appendix C.

SPAWNING SUBSTRATE COMPOSITION

Sample Collection

Sampling methods are adapted from Valentine (1995). Four sediment samples were collected at two locations in Lower Slate Creek using a McNeil sampler, which has a 15 cm basal core diameter and 25 cm core depth. Criteria for sample site selection included substrate measuring less than 10 cm—the maximum gravel size used by pink salmon (Lotspeich and Everest 1981, Kondolf and Wolman 1993)—and where the stream gradient was less than 3%. The McNeil sampler was worked into the substrate until the sample core was buried, and sediments were transferred to the upper barrel portion of the sampler. Samples were wet-sieved onsite using sieve sizes 101.6, 50.8, 25.4, 12.7, 6.35, 1.68, 0.42, and 0.15 mm. The contents of each sieve were measured to the nearest 25 mL via volume of water displaced in 600 mL and 1 L plastic beakers; fines that passed through the 0.15 mm sieve were transferred to Imhoff cones and allowed to settle for 10 min; sediment volume was measured to the nearest 1 mL using cone gradations.

For the fines that passed through the 0.15 mm sieve, sediment wet weights were converted to dry weights using standards identified by Zollinger (1981). For all other sediments, wet weights were converted to dry weights using a correction factor derived from Shirazi et al. (1981), assuming a gravel density of 2.6 g/cm³ (Aquatic Science Inc. 2011). Geometric mean particle size (d_g) was calculated using methods developed by Lotspeich and Everest (1981), where the midpoint diameter of particles retained in each sieve (d) are raised to a power equal to the decimal fraction of volume retained by that sieve (w), and multiplied the products of each sieve size to obtain the final product:

$$d_g = d_1^{w_1} \times d_2^{w_2} \times d_3^{w_3} \dots d_n^{w_n}$$

GMPS was estimated for each site by calculating the average GMPS among the four samples.

Data Presentation

Geometric mean particle sizes are presented in a table for the 2011–2023 data at each site. Annual data from 2011 through 2023 are provided in Appendix D.

SEDIMENT COMPOSITION AND ELEMENT CONCENTRATIONS

Sample Collection and Analysis

Wearing latex gloves, one sample of submerged sand and silt was collected at each site within actively flowing channels. For each sample, the top 4 cm of sediment was retained in three glass jars provided by the laboratory^q. To preserve sulfide in the sample jar designated for sulfide analyses, 5–10 mL of zinc acetate was added immediately after sample collection to fill the sample jars; all other samples were filled to the top with stream water to minimize air space.^r Samples

^q In 2015, sieving sediments during collection was discontinued to avoid sample bias.

^r Per laboratory staff instruction (S. Samy, Kelso Laboratory Senior Project Manager, ALS Environmental, Kelso, WA, personal communication).

were stored in a cooler with frozen icepacks during transport and in an ADF&G Douglas laboratory fridge until shipment to the ALS Environmental laboratory in Kelso, WA for analyses.

The samples were shipped in a cooler with frozen icepacks via overnight air freight, maintaining written chain of custody documentation. ALS Environmental measured particle size, total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of Ag, Al, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, and Zn on a dry-weight basis (Table 2).^s The laboratory provided Tier IV quality assurance and quality control information, including results for matrix spikes, sample blanks, and sample duplicates.

Table 2.–Sediment tests, analytes, and methods used in 2023.

Test Description	Analyte	Method
Standard test method for particle-size analysis of soils	Particle size determination	ASTM D422M
Puget Sound Estuary Program sediment total organic carbon	Total organic carbon	PSEP TOC
Total solids on liquids, modified for solids	Total solids	EPA 160.3 Modified
Puget Sound Estuary Program sediment sulfide	Total sulfide	PSEP Sulfide
Total volatile solids, modified for solids	Total volatile solids	EPA 160.4 Modified
Mercury in solid or semisolid waste	Hg	EPA 7471B
Determination of trace elements in waters and wastes by ICP/MS	Ag, Al, As, Cd, Cr, Cu, Ni, Pb, Se, Zn	EPA 200.8

Data Presentation

For each site and by year, all sediment element concentration data are presented in a figure, including the mean values. When duplicate data are provided by the lab, we report the mean values. Sediment element concentrations undetected at the method reporting limit are illustrated as an empty circle (◦) and as a solid circle (•) for measured element concentrations.

The data are compared with the threshold effects concentrations (TEC) and the probable effects concentrations (PEC) for inorganics in freshwater sediment guidelines developed by the National Oceanic and Atmospheric Administration (Buchman 2008). The guidelines are based on results of controlled laboratory bioassays, where element concentrations below the TECs rarely affect aquatic life survival and growth, and element concentrations above the PECs can affect aquatic life survival and growth.

Annual data from 2011–2023 and the 2023 laboratory report are provided in Appendix E.

^s The AECOM Environmental Toxicology lab in Fort Collins, CO completed the 2011–2013 sediment sample analyses; since 2014, the ALS Environmental lab in Kelso, WA has completed the sediment sample analyses.

RESULTS

WEATHER AND STREAMFLOW 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 the mean values reported 1991–2020. Prior to spring (March–April) macroinvertebrate sampling, the Juneau area received near normal precipitation (0.8 cm above) and the air temperature was 1.3 °F below normal. Prior to summer (June–July) periphyton sampling, the Juneau area received precipitation (6.8 cm below) and the air temperature was 1.8 °F above normal.

Streamflow transducers are located in Sherman, Slate, and Johnson Creeks providing pressure data that can be related to water depth. The transducers in Sherman and Slate Creeks malfunctioned in 2023 resulting in data gaps. Figure 16 shows the 2023 pressure data for Johnson Creek from January to mid-November; Sherman and Slate Creeks follow similar streamflow trends being close in proximity.^t There was one peak event in the winter months (January–March) before macroinvertebrate sampling occurred. There were four peak events in summer months (May–July), with one peak event occurring three weeks prior to periphyton sampling. Peak events generally are defined as streamflow at or near bankfull.

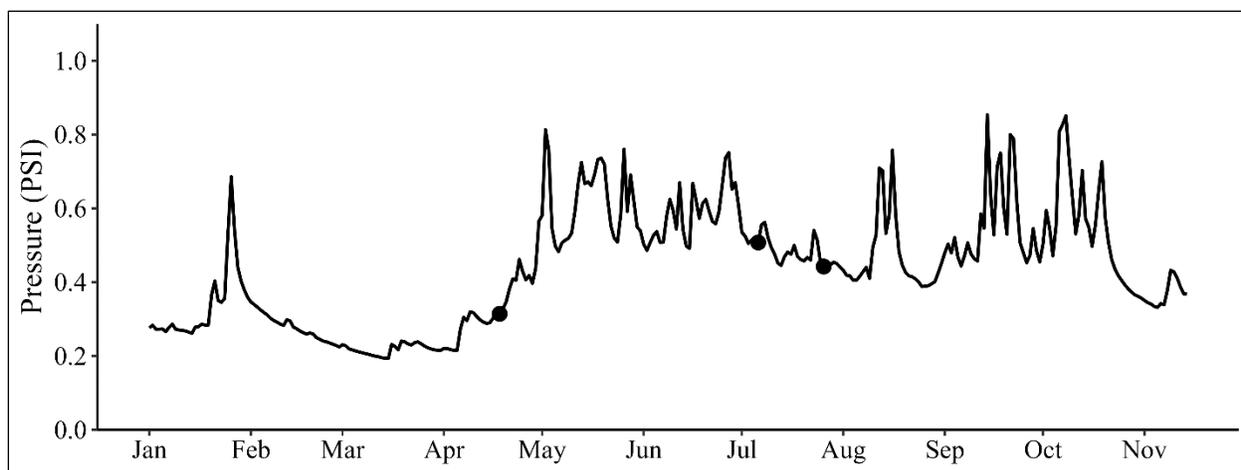


Figure 16.–Pressure from transducer in Johnson Creek from January to mid-November, 2023.

Note: Sampling dates represented by black circles.

^t Irrespective of inputs from Outfalls 001 and 002.

SLATE CREEK

Lower Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2023 Lower Slate Creek mean Chl-a density was 4.81 mg/m², within the middle range of mean densities 2011–2022 and similar to 2022, following 2020 and 2021 mean densities that were in the lower range (Table 3; Figure 17). The samples contained about 87% Chl-a, 12% Chl-c, and 1% Chl-b, consistent with composition observed in previous years (Figure 18).

Table 3.–Lower Slate Creek mean chlorophylls a, b, and c densities, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Chl-a (mg/m ²)	5.15	2.31	12.59	3.97	2.16	5.26	2.30	4.20	33.71	1.22	2.00	4.87	4.81
Chl-b (mg/m ²)	0.43	0.05	0.00	0.85	0.10	0.21	0.23	0.04	0.00	0.11	0.04	0.09	0.06
Chl-c (mg/m ²)	0.26	0.18	1.64	0.30	0.21	0.62	0.23	0.63	6.49	0.06	0.32	0.62	0.64

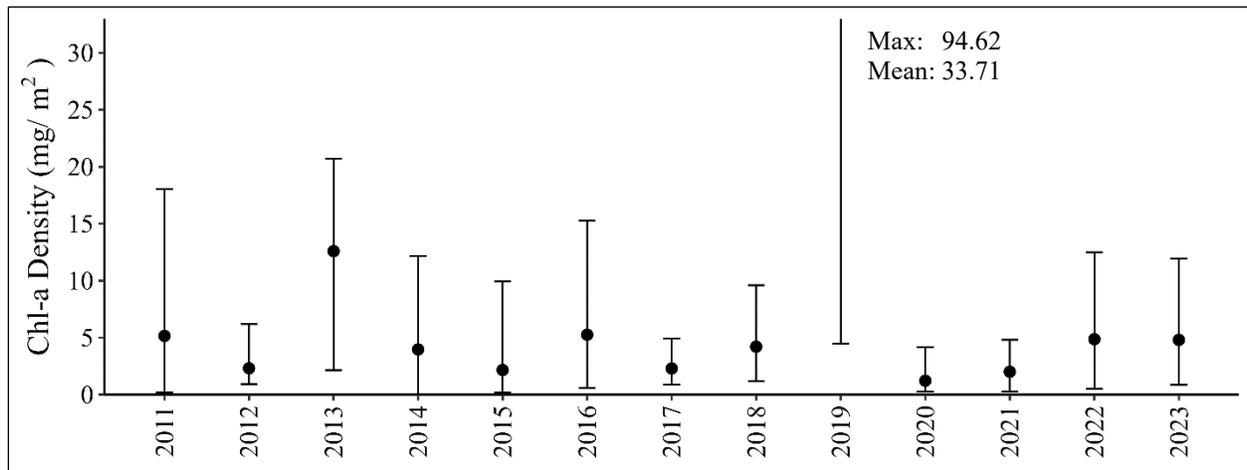


Figure 17.–Lower Slate Creek mean chlorophyll a densities, 2011–2023.

Note: Minimum, mean, and maximum values shown.

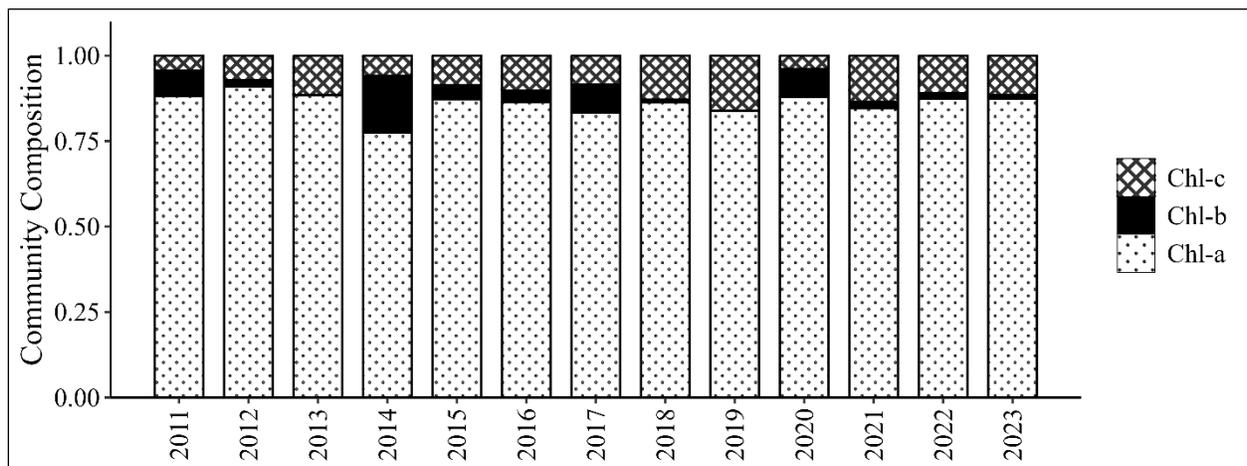


Figure 18.–Lower Slate Creek mean proportions of chlorophylls a, b, and c, 2011–2023.

Benthic Macroinvertebrate Density and Community Composition

The 2023 Lower Slate Creek BMI mean density estimate is 955 BMI/m² and we identified 20 taxa, within the range of BMI densities and taxa observed 2011–2022 (Table 4; Figures 19, 20). We estimate mean EPT density at 744 EPT/m², accounting for 78% of the samples—the highest observed. The Shannon Diversity and Evenness scores were consistent with previous years. Dominant taxa were Ephemeroptera (mayflies) of the genus *Baetis* (27%) and *Cinygmula* (25%).

Table 4.—Lower Slate Creek BMI data summaries, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m ²)	288	1,199	1,316	786	818	509	654	217	532	229	208	312	744
Mean BMI density (per m ²)	2,057	3,154	2,581	4,136	3,407	3,394	1,308	482	934	1,208	425	810	955
Number of EPT Taxa	13	17	16	17	13	11	13	9	9	11	8	10	13
Number of BMI Taxa	29	32	27	32	26	24	27	17	18	24	17	15	20
% EPT	14	38	51	19	24	15	50	45	57	19	49	38	78
Shannon Diversity Score	0.51	0.69	0.85	0.64	0.7	0.65	0.81	0.81	0.83	0.59	0.77	0.59	0.8
Evenness Score	0.48	0.58	0.7	0.52	0.58	0.57	0.73	0.84	0.81	0.56	0.82	0.65	0.77

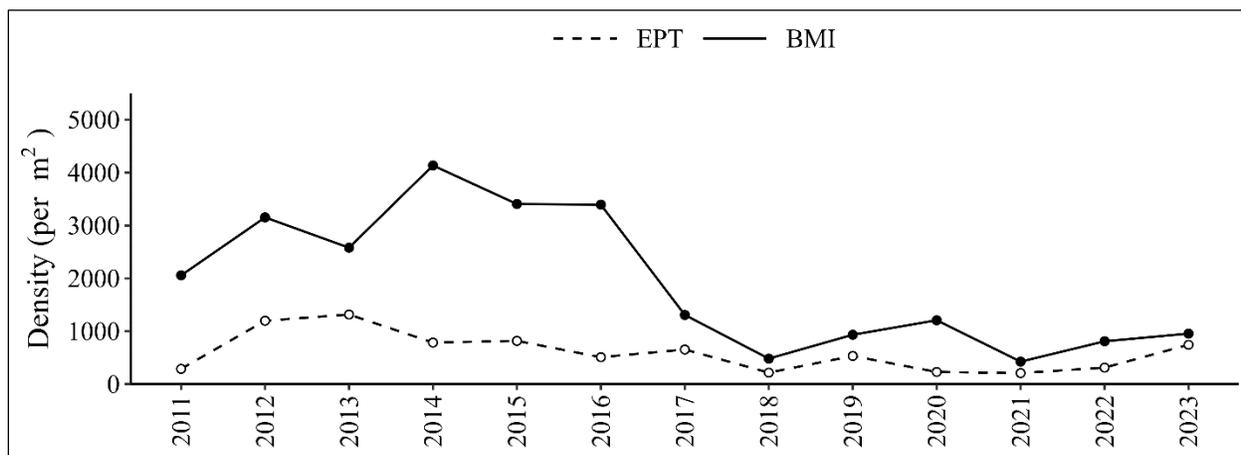


Figure 19.—Lower Slate Creek mean BMI and EPT densities, 2011–2023.

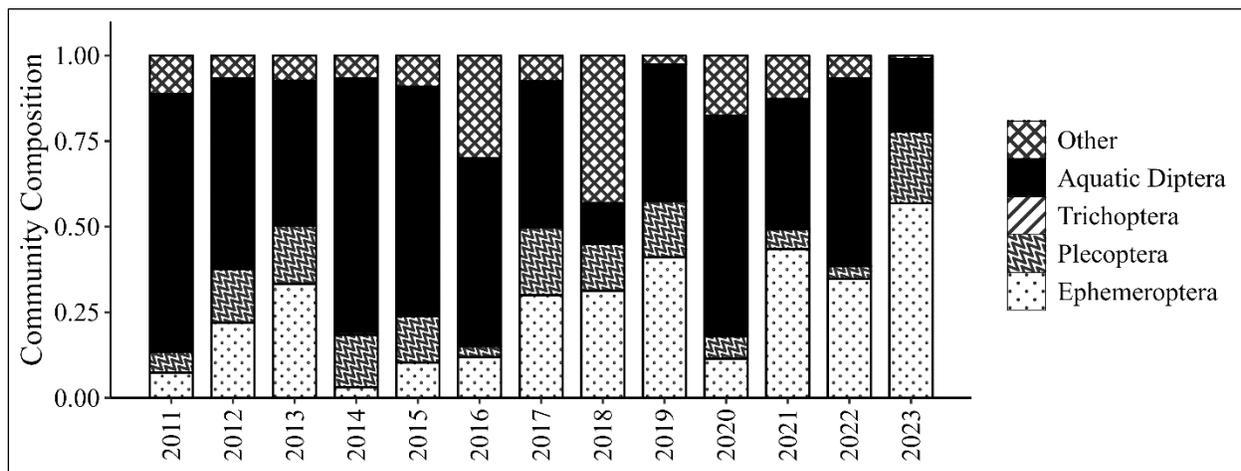


Figure 20.—Lower Slate Creek BMI composition, 2011–2023.

Adult Salmon Counts

In 2023, during seven peak count surveys in Lower Slate Creek, we counted 4,271 pink salmon and zero chum and coho salmon (Table 5). Numerous rainfall events July through October increased stream discharges and reduced visibility, negatively affecting our ability to consistently count salmon during the peak spawning seasons.

Table 5.–Lower Slate Creek adult salmon counts, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Pink salmon	6,254	7,272	3,337	41	7,580	79	7,416	4	837	15	3,661	23	4,271
Chum salmon	59	1	1	0	13	45	1	0	0	0	0	0	0
Coho salmon	0	0	26	5	0	2	5	1	1	4	0	0	0

Note: The 2022 and 2023 data presented are from peak counts during the spawning seasons; all other years include complete spawning season counts.

Spawning Substrate Composition

In 2023, the GMPS at Lower Slate Creek SP1 was 14.1 mm, within the upper range (8.5–15.1 mm) observed 2011–2022; the GMPS at Lower Slate Creek SP2 was 20.6 mm, the second highest observed (Table 6).

Table 6.–Lower Slate Creek spawning substrate geometric mean particle sizes (mm), 2011–2023.

Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Sample Point 1	10.3	10.8	14.2	12.9	13.3	13.6	14.7	14.5	14.8	8.5	12.0	15.1	14.1
Sample Point 2	11.1	11.2	13.2	16.5	17.5	11.6	13.0	17.2	23.1	14.1	20.4	13.7	20.6

Sediment Element Concentrations

The 2023 Lower Slate Creek sediment samples contained As, Cd, Cu, Ni, and Zn element concentrations near or above the TEC freshwater sediment toxicity guidelines, as in previous years (Figure 21). All other element concentrations were below the TEC and PEC freshwater sediment toxicity guidelines, and within ranges previously observed 2011–2022.

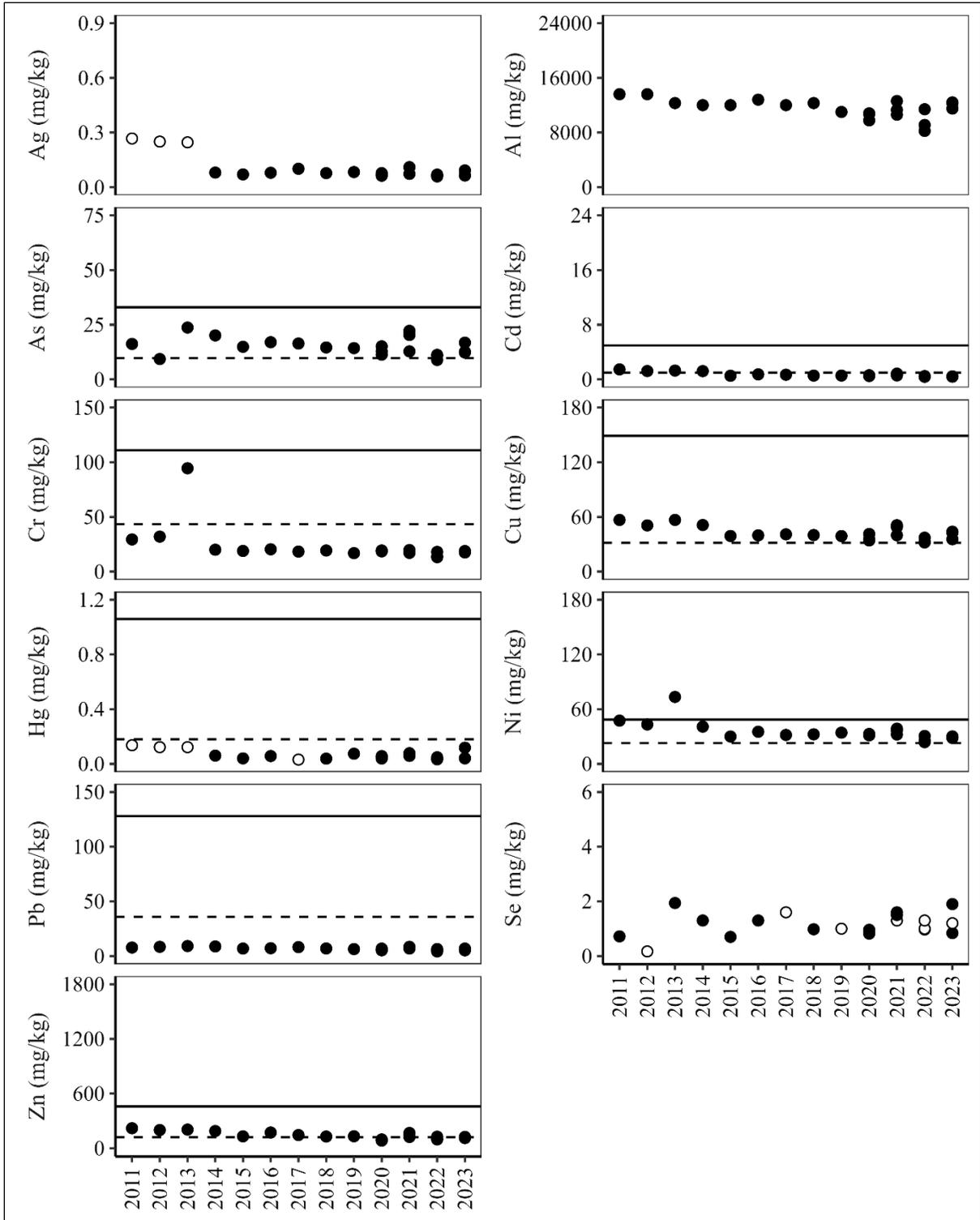


Figure 21.—Lower Slate Creek sediment element concentrations, 2011–2023.

Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

West Fork Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2023 West Fork Slate Creek mean Chl-a density was 16.08 mg/m², the highest observed mean density 2011–2022 and similar to the 2021 density (Table 7; Figure 22). The samples contained about 88% Chl-a, 12% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Figure 23).

Table 7.—West Fork Slate Creek mean chlorophylls a, b, and c densities, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Chl-a (mg/m ²)	3.92	1.01	4.22	0.77	0.92	4.93	4.96	3.84	2.95	1.08	15.66	3.58	16.08
Chl-b (mg/m ²)	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chl-c (mg/m ²)	0.27	0.10	0.61	0.06	0.06	0.66	0.85	0.74	0.46	0.15	2.76	0.42	2.25

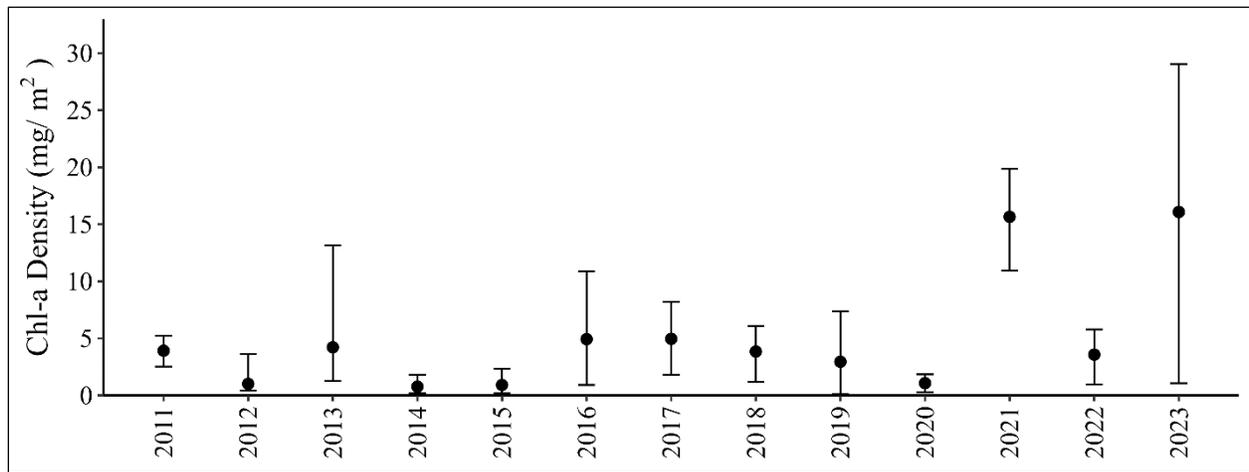


Figure 22.—West Fork Slate Creek mean chlorophyll a densities, 2011–2023.

Note: Minimum, mean, and maximum values.

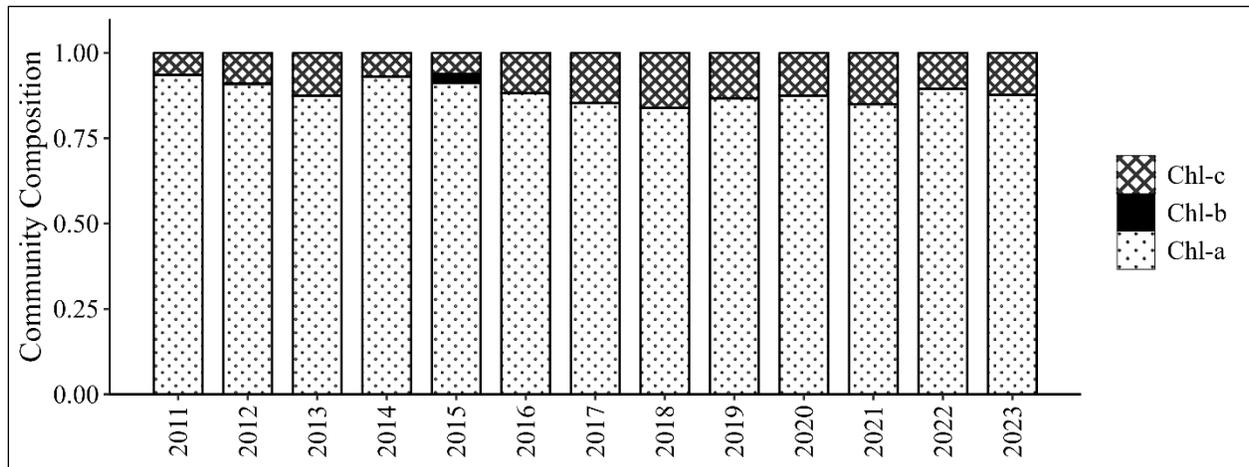


Figure 23.—West Fork Slate Creek mean proportions of chlorophylls a, b, and c, 2011–2023.

Benthic Macroinvertebrate Density and Community Composition

The 2023 West Fork Slate Creek BMI mean density estimate is 1,984 BMI/m² and we identified 21 taxa, within the range of BMI densities and taxa observed 2011–2022 (Table 8; Figures 24, 25). We estimate mean EPT density at 1,833 EPT/m², within the upper range observed, accounting for 92% of the samples. The Shannon Diversity and Evenness scores were consistent with previous years. Dominant taxa were Ephemeroptera (mayflies) of the genus *Cinygmula* (38%) and Plecoptera (stoneflies) of the genus *Despaxia* (17%).

Table 8.–West Fork Slate Creek BMI data summaries, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m ²)	402	1,455	2,202	691	2,160	1,132	726	275	1,182	1,060	668	1,233	1,833
Mean BMI density (per m ²)	502	1,819	2,446	973	2,634	1,470	885	328	1,299	1,358	719	1,437	1,984
Number of EPT Taxa	11	21	18	17	16	15	13	12	11	12	14	15	16
Number of BMI Taxa	21	31	28	29	28	25	21	18	16	18	17	22	21
% EPT	80	80	90	71	82	77	82	84	91	78	93	86	92
Shannon Diversity Score	0.63	0.84	0.73	0.91	0.82	0.72	0.78	0.72	0.64	0.75	0.76	0.62	0.82
Evenness Score	0.78	0.71	0.61	0.79	0.71	0.69	0.78	0.83	0.64	0.74	0.75	0.57	0.72

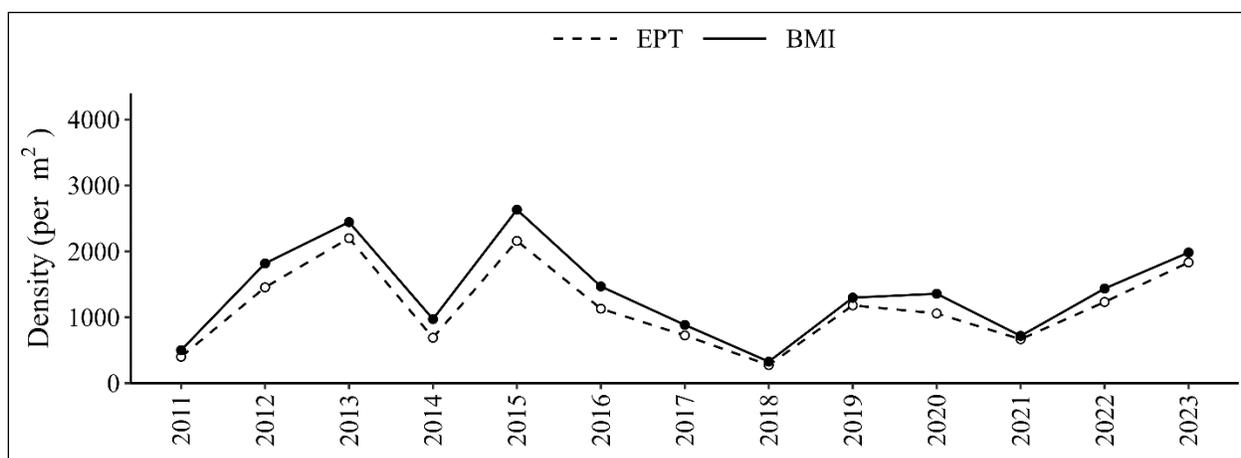


Figure 24.–West Fork Slate Creek mean BMI and EPT densities, 2011–2023.

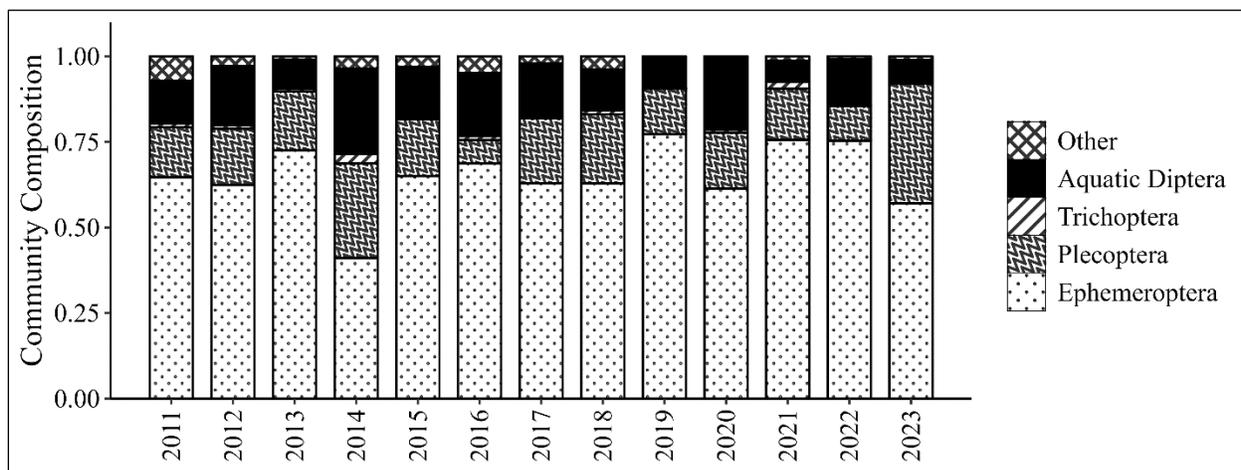


Figure 25.–West Fork Slate Creek BMI composition, 2011–2023.

East Fork Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2023 East Fork Slate Creek mean Chl-a density was 2.47 mg/m², within the range of mean densities 2011–2022 (Table 9; Figure 26). The samples contained about 88% Chl-a, 9% Chl-c, and 3% Chl-b, consistent with composition observed in previous years (Figure 27).

Table 9.—East Fork Slate Creek mean chlorophylls a, b, and c densities, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Chl-a (mg/m ²)	8.84	5.08	2.28	0.27	1.56	1.21	0.64	1.67	3.51	1.39	0.80	1.46	2.47
Chl-b (mg/m ²)	1.56	0.57	0.06	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.06	0.08
Chl-c (mg/m ²)	0.24	0.18	0.20	0.03	0.15	0.15	0.06	0.16	0.34	0.13	0.13	0.11	0.25

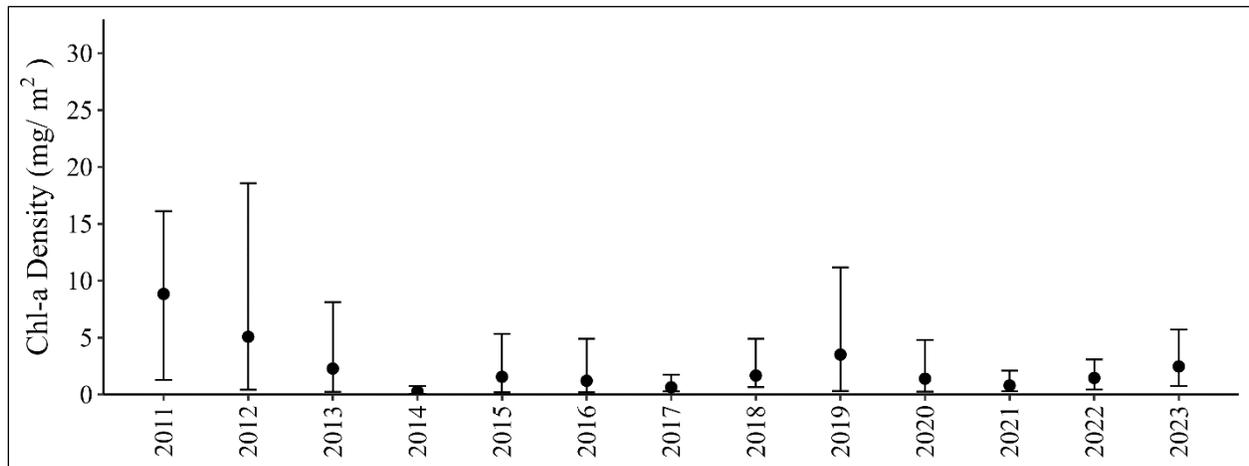


Figure 26.—East Fork Slate Creek mean chlorophyll a densities, 2011–2023.
Note: Minimum, mean, and maximum values shown.

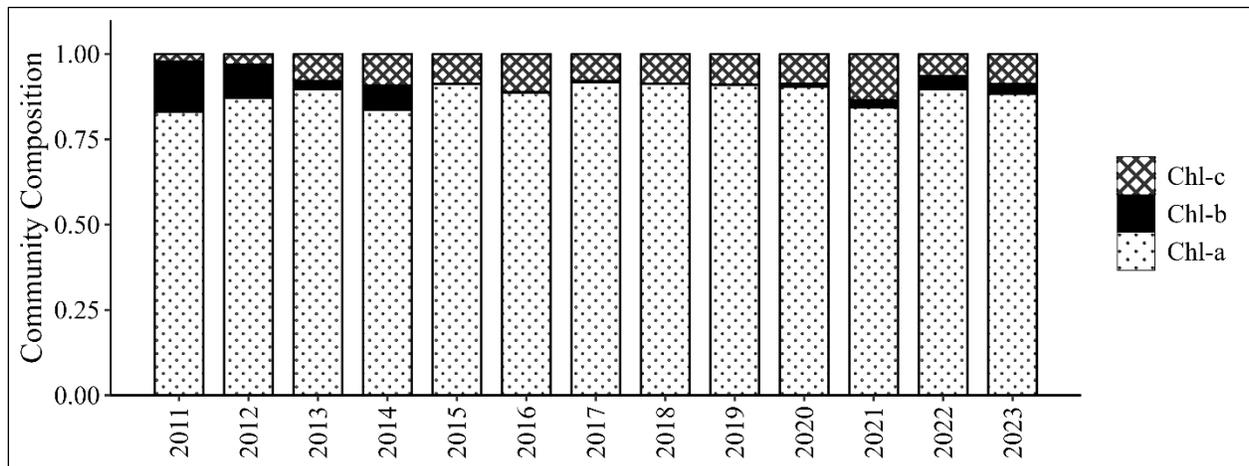


Figure 27.—East Fork Slate Creek mean proportions of chlorophylls a, b, and c, 2011–2023.

Benthic Macroinvertebrate Density and Community Composition

The 2023 East Fork Slate Creek BMI mean density estimate is 6,654 BMI/m² and we identified 29 taxa, within the upper range of BMI densities and taxa observed 2011–2022 (Table 10; Figures 28, 29). We estimate mean EPT density at 828 EPT/m², within the upper range observed, accounting for 12% of the samples. The Shannon Diversity and Evenness scores were consistent with previous years. Dominant taxa were Diptera of the family Chironomidae (47%) and bivalves of the genus *Pisidium* (35%), as in previous years.

Table 10.—East Fork Slate Creek BMI data summaries, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m ²)	891	1,066	188	41	694	561	746	287	696	715	344	400	828
Mean BMI density (per m ²)	4,688	4,633	9,407	2,048	3,854	2,002	6,783	3,588	3,866	5,496	3,437	3,093	6,654
Number of EPT Taxa	15	17	17	9	16	11	13	15	15	14	14	13	15
Number of BMI Taxa	27	33	33	24	28	21	27	26	25	26	23	25	29
% EPT	19	23	2	2	18	28	11	8	18	13	10	13	12
Shannon Diversity Score	0.64	0.78	0.57	0.7	0.92	0.92	0.62	0.54	0.62	0.56	0.59	0.61	0.6
Evenness Score	0.54	0.61	0.47	0.63	0.72	0.78	0.51	0.46	0.53	0.46	0.52	0.53	0.47

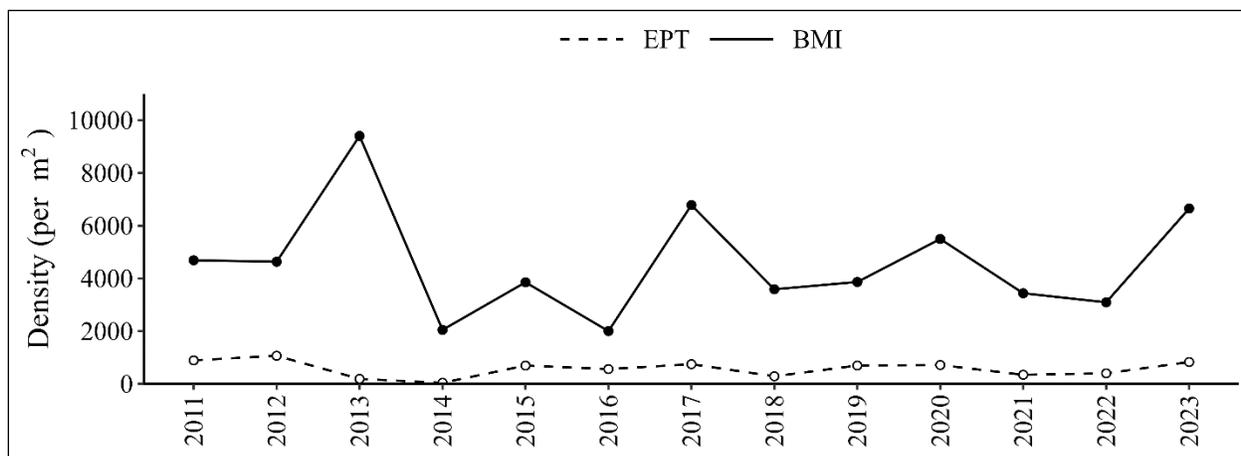


Figure 28.—East Fork Slate Creek mean BMI and EPT densities, 2011–2023.

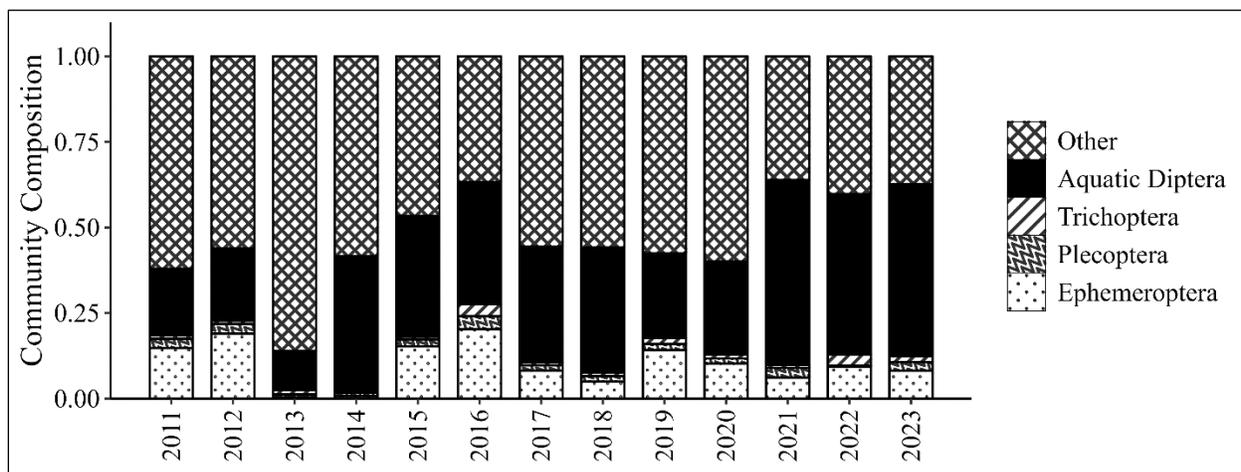


Figure 29.—East Fork Slate Creek BMI community composition, 2011–2023.

Sediment Element Concentrations

One of each of the 2023 East Fork Slate Creek sediment samples contained an As, Cd, or Ni concentration above the PEC freshwater sediment toxicity guidelines (Figure 30); As, Cd, Ni, and Zn concentrations were between the TEC and PEC guidelines, and the remaining sample concentrations were below the guidelines and within ranges previously observed 2011–2022. One of the sediment samples contained an elevated Se concentration while the other two sediment samples were consistent with previous years.

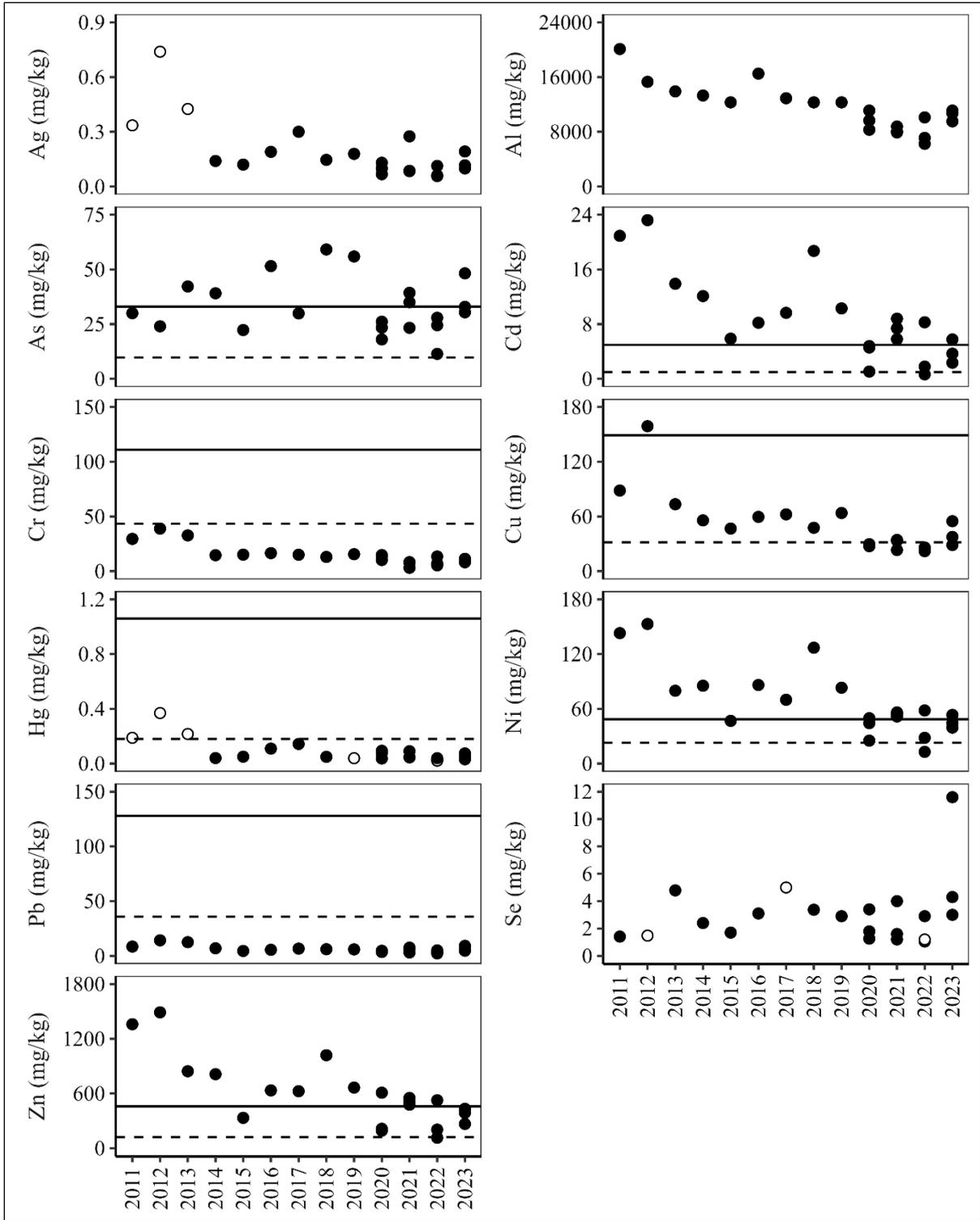


Figure 30.—East Fork Slate Creek sediment element concentrations, 2011–2023.

Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

Upper Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2023 Upper Slate Creek mean Chl-a density was 5.11 mg/m², the second highest observed 2011–2022 (Table 11; Figure 31). The samples contained about 92% Chl-a, 8% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Figure 32).

Table 11.—Upper Slate Creek mean chlorophylls a, b, and c densities, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Chl-a (mg/m ²)	0.76	1.26	2.12	1.09	0.63	3.86	0.83	2.57	7.47	1.13	2.89	1.47	5.11
Chl-b (mg/m ²)	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chl-c (mg/m ²)	0.05	0.07	0.13	0.06	0.09	0.42	0.04	0.36	0.60	0.06	0.46	0.10	0.47

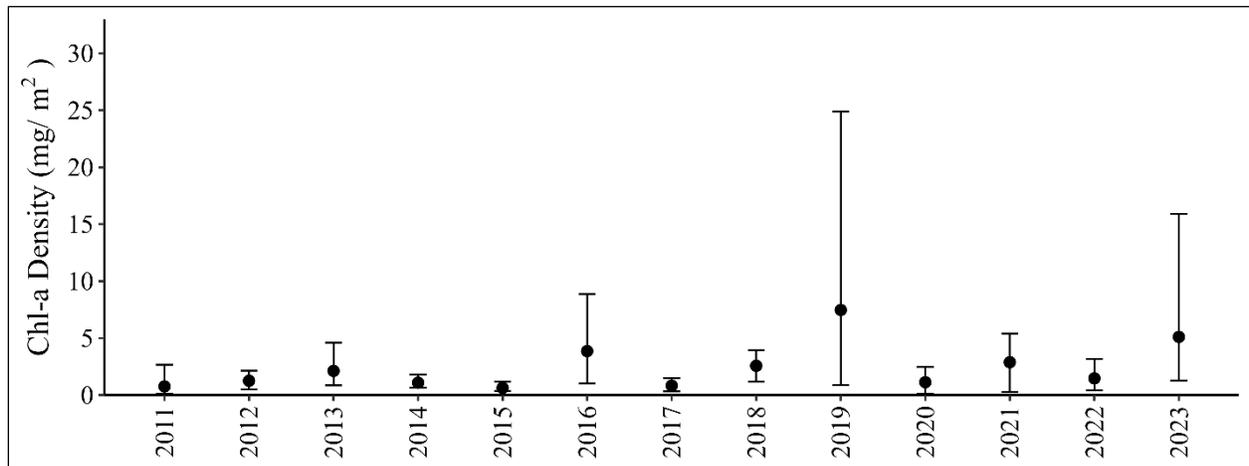


Figure 31.—Upper Slate Creek mean chlorophyll a densities, 2011–2023.

Note: Minimum, mean, and maximum values shown.

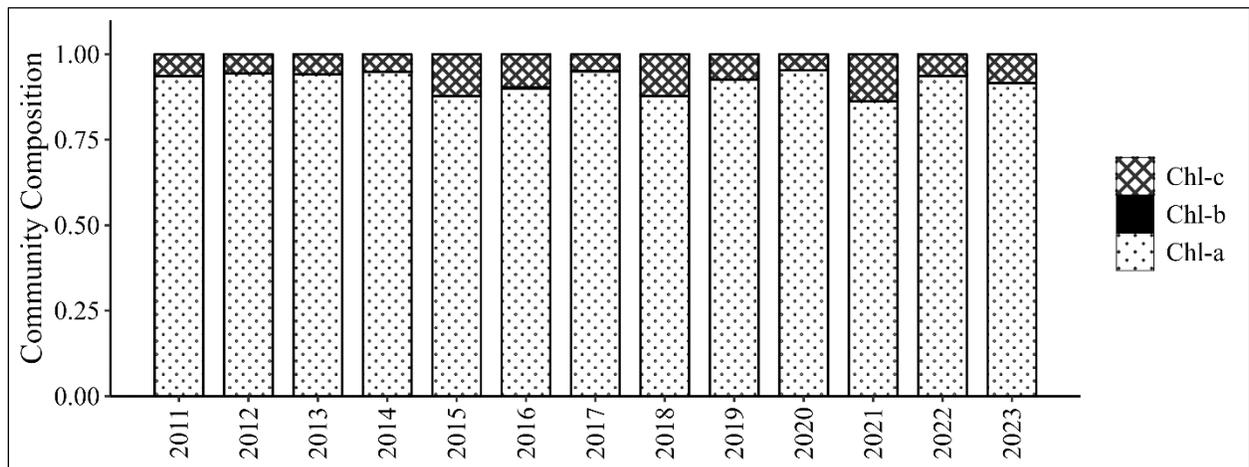


Figure 32.—Upper Slate Creek mean proportions of chlorophylls a, b, and c, 2011–2023.

Benthic Macroinvertebrate Density and Community Composition

The 2023 Upper Slate Creek BMI mean density estimate is 2,412 BMI/m² and we identified 27 taxa, within the upper range of BMI densities and taxa observed 2011–2022 (Table 12; Figures 33, 34). We estimate mean EPT density at 2,079 EPT/m², within the upper range observed, accounting for 86% of the samples. The Shannon Diversity and Evenness scores were consistent with previous years. Dominant taxa were Ephemeroptera (mayflies) of the genus *Baetis* (33%) and Plecoptera (stoneflies) of the genus *Despaxia* (13%).

Table 12.–Upper Slate Creek BMI data summaries, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m ²)	1,589	1,534	2,074	1,969	2,568	1,631	1,237	1,053	1,357	691	1,141	860	2,079
Mean BMI density (per m ²)	2,523	2,256	2,880	3,125	3,776	2,398	2,029	1,548	1,634	973	1,409	1,246	2,412
Number of EPT Taxa	18	21	20	20	19	15	19	18	18	15	18	20	18
Number of BMI Taxa	33	39	34	36	31	28	30	31	24	25	28	29	27
% EPT	63	68	72	63	68	68	61	68	83	71	81	69	86
Shannon Diversity Score	0.97	1.04	1.02	1.03	0.98	1.06	0.96	0.92	0.99	0.92	0.97	0.98	0.94
Evenness Score	0.76	0.79	0.78	0.76	0.74	0.82	0.73	0.75	0.8	0.78	0.77	0.8	0.74

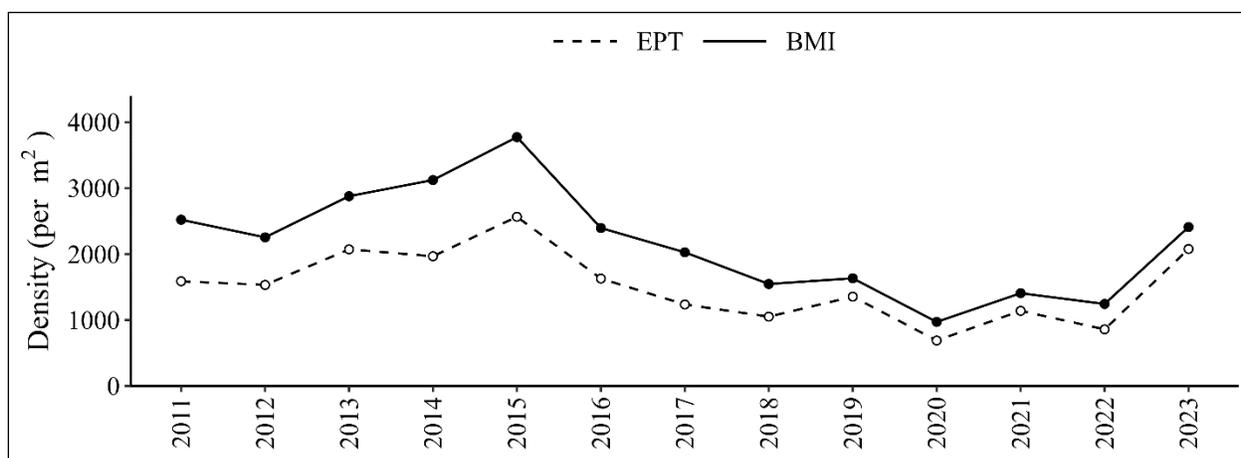


Figure 33.–Upper Slate Creek mean BMI and EPT densities, 2011–2023.

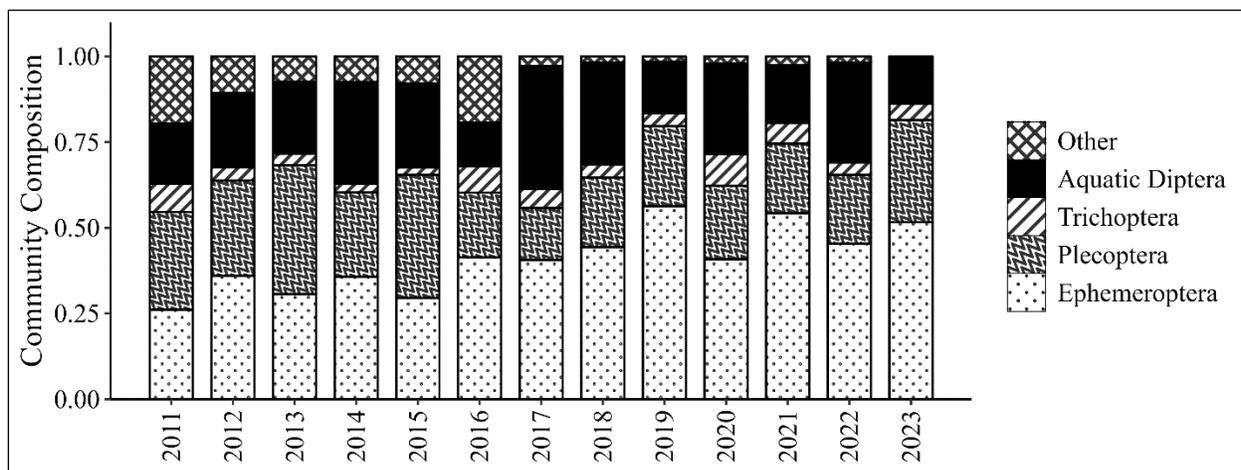


Figure 34.–Upper Slate Creek BMI community composition, 2011–2023.

Sediment Element Concentrations

The 2023 Upper Slate Creek sediment samples contained Ni concentrations above the PEC freshwater sediment toxicity guideline (Figure 35); As, Cr, Cu, and Zn concentrations were near or above the TEC as in previous years. All other element concentrations were below the TEC and PEC freshwater sediment toxicity guidelines, and within ranges previously observed 2011–2022.

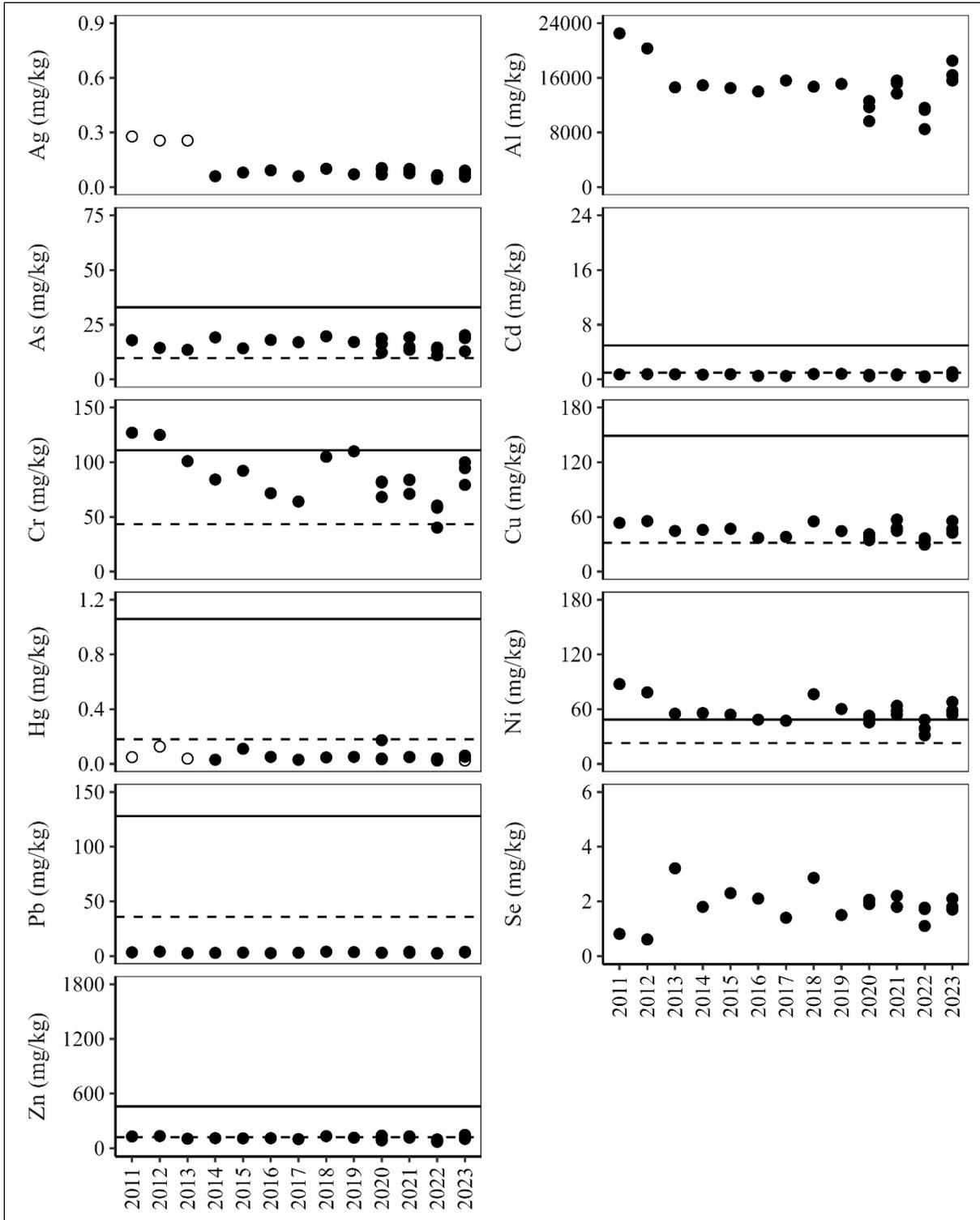


Figure 35.—Upper Slate Creek sediment element concentrations, 2011–2023.

Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

JOHNSON CREEK

Lower Johnson Creek

Adult Salmon Counts

In 2023, during seven peak count surveys in Lower Johnson Creek we counted 4,145 pink salmon, zero chum salmon, and 39 coho salmon (Table 13). Numerous rainfall events July through October increased stream discharge and reduced visibility, as well as multiple bear encounters, which negatively affected our ability to consistently count salmon during peak spawning seasons.

Table 13.–Lower Johnson Creek adult salmon counts, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Pink salmon	17,499	5,016	8,186	189	51,325	428	23,239	434	4,996	2,737	15,393	1,087	4,145
Chum salmon	21	99	17	3	0	39	0	2	334	5	0	22	0
Coho salmon	33	90	64	107	88	24	83	36	94	49	549	43	39

Note: The 2022 and 2023 data presented are from peak counts during the spawning seasons; all other years include complete spawning season counts.

Sediment Element Concentrations

The 2023 Lower Johnson Creek sediment samples contained As, Cu, Ni, and Zn concentrations near or above the TEC freshwater sediment toxicity guidelines, as in previous years (Figure 36). All other element concentrations were below the PEC and TEC guidelines, and within ranges previously observed 2011–2022.

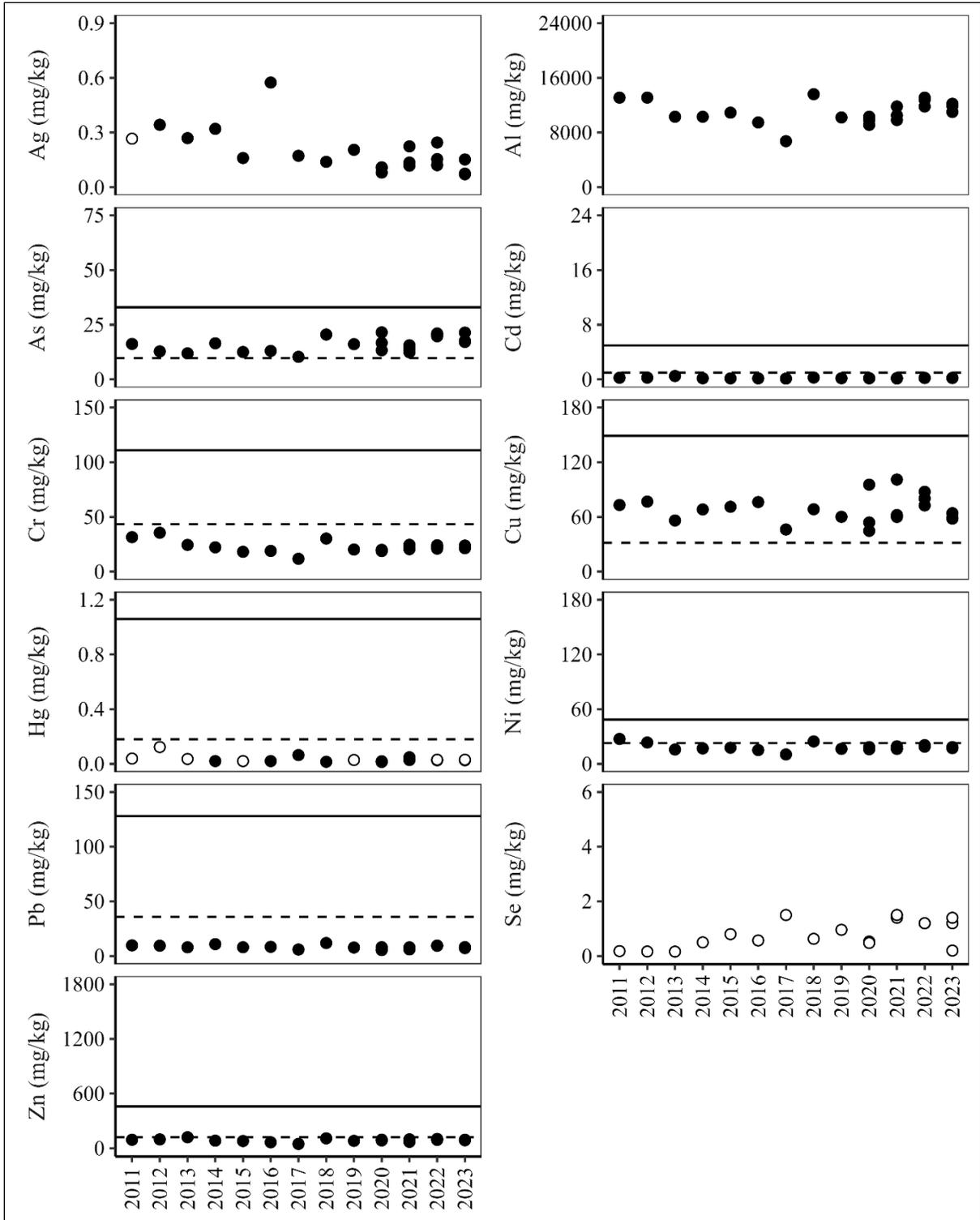


Figure 36.—Lower Johnson Creek sediment element concentrations, 2011–2023.

Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

Upper Johnson Creek

Benthic Macroinvertebrate Density and Community Composition

The 2023 Upper Johnson Creek BMI mean density estimate is 7,086 BMI/m² and we identified 31 taxa, the highest observed BMI density (Table 14; Figures 37, 38). We estimate mean EPT density at 6,161 EPT/m², accounting for 87% of the samples—both the highest observed. The Shannon Diversity and Evenness scores were consistent with previous years. Dominant taxa were Ephemeroptera (mayflies) of the genus *Baetis* (39%) and *Cinygmula* (12%).

Table 14.—Upper Johnson Creek BMI data summaries, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m ²)	2,054	2,540	3,422	1,834	1,980	2,614	1,480	2,008	2,358	1,438	2,108	2,032	6,161
Mean BMI density (per m ²)	3,735	3,968	5,265	2,658	2,789	3,681	2,901	2,996	3,369	1,892	2,634	2,473	7,086
Number of EPT Taxa	14	14	24	21	17	21	19	20	18	19	18	13	23
Number of BMI Taxa	24	28	34	32	28	32	33	31	25	31	29	20	31
% EPT	55	64	65	69	71	71	51	67	70	76	80	82	87
Shannon Diversity Score	0.76	0.81	0.74	0.74	0.87	0.88	0.68	0.81	0.71	0.77	0.74	0.66	0.82
Evenness Score	0.66	0.68	0.59	0.59	0.71	0.7	0.55	0.66	0.61	0.66	0.63	0.62	0.64

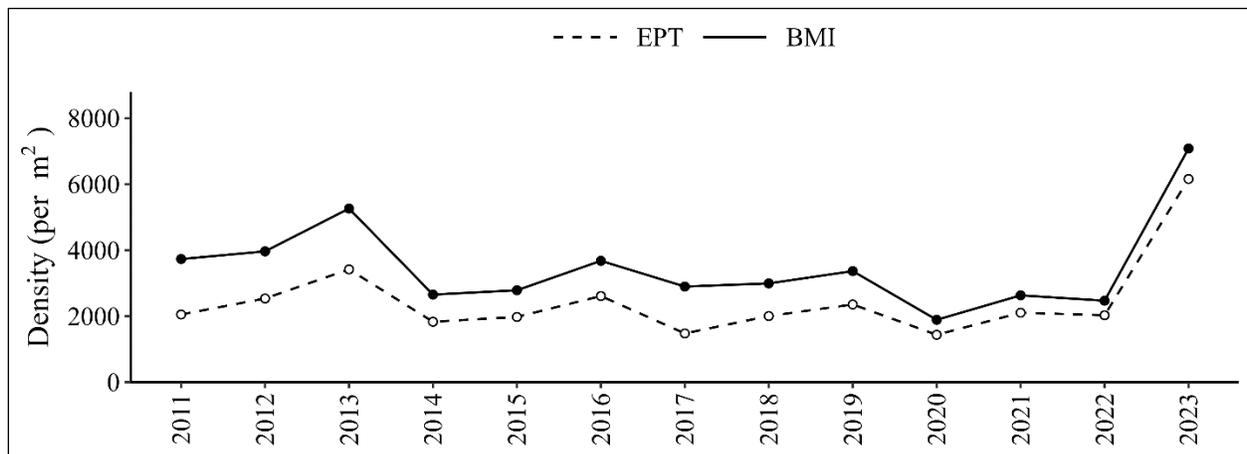


Figure 37.—Upper Johnson Creek mean BMI and EPT densities, 2011–2023.

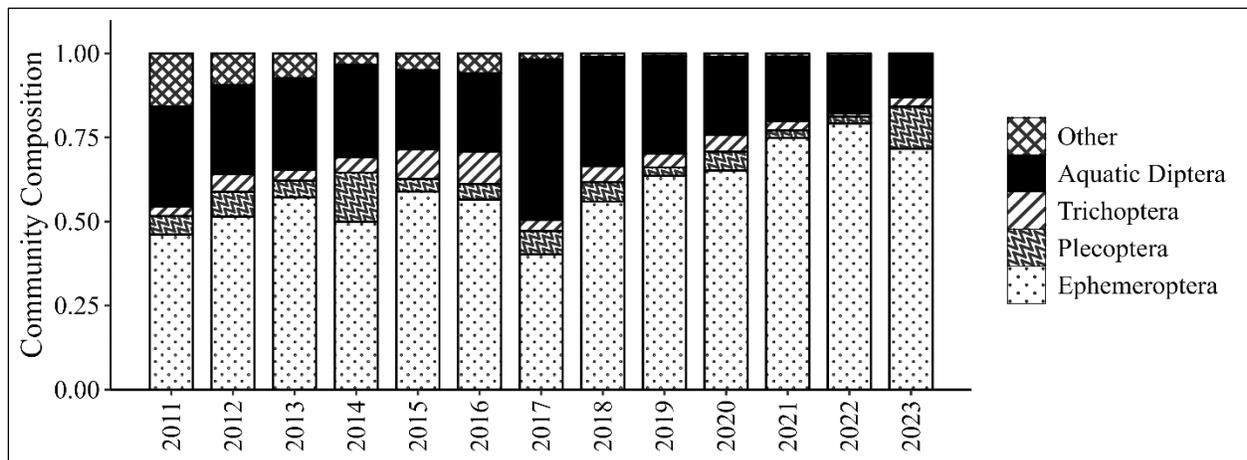


Figure 38.—Upper Johnson Creek BMI community composition, 2011–2023.

SHERMAN CREEK

Lower Sherman Creek

Periphyton: Chlorophyll Density and Composition

Sample Point 1

The 2023 Lower Sherman Creek SP1 mean Chl-a density was 5.13 mg/m², within the upper range of mean densities 2011–2022 (Table 15; Figure 39). The samples contained about 91% Chl-a, 9% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Figure 40).

Table 15.–Lower Sherman Creek SP1 mean chlorophylls a, b, and c densities, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Chl-a (mg/m ²)	7.60	2.54	3.69	1.34	1.36	3.70	3.86	2.64	2.74	6.23	7.41	4.11	5.13
Chl-b (mg/m ²)	0.69	0.93	0.00	0.00	0.00	0.74	0.00	0.00	0.09	0.49	0.00	0.02	0.00
Chl-c (mg/m ²)	0.49	0.08	0.51	0.18	0.17	0.33	0.56	0.33	0.49	0.47	1.15	0.48	0.52

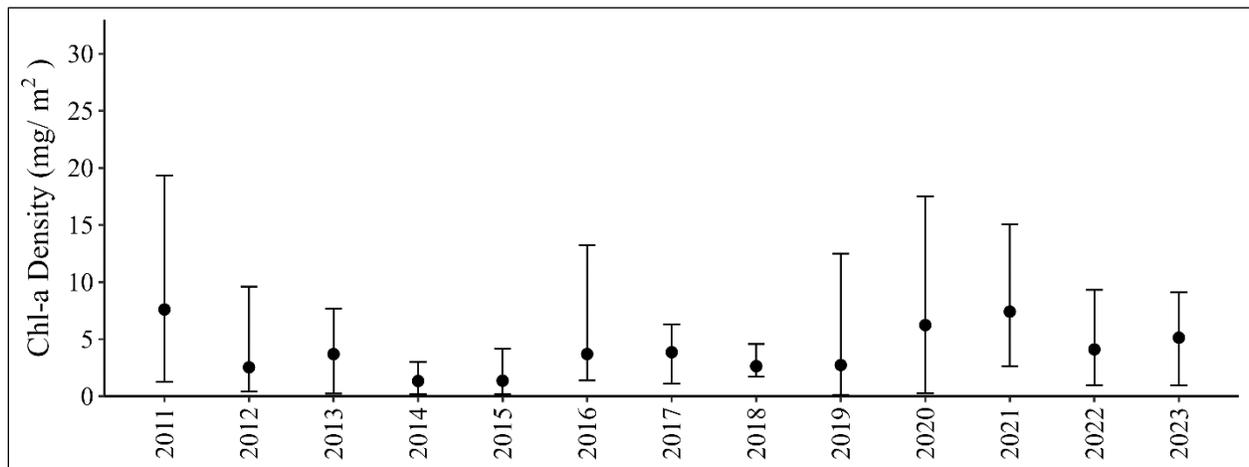


Figure 39.–Lower Sherman SP1 mean chlorophyll a densities, 2011–2023.

Note: Minimum, mean, and maximum values shown.

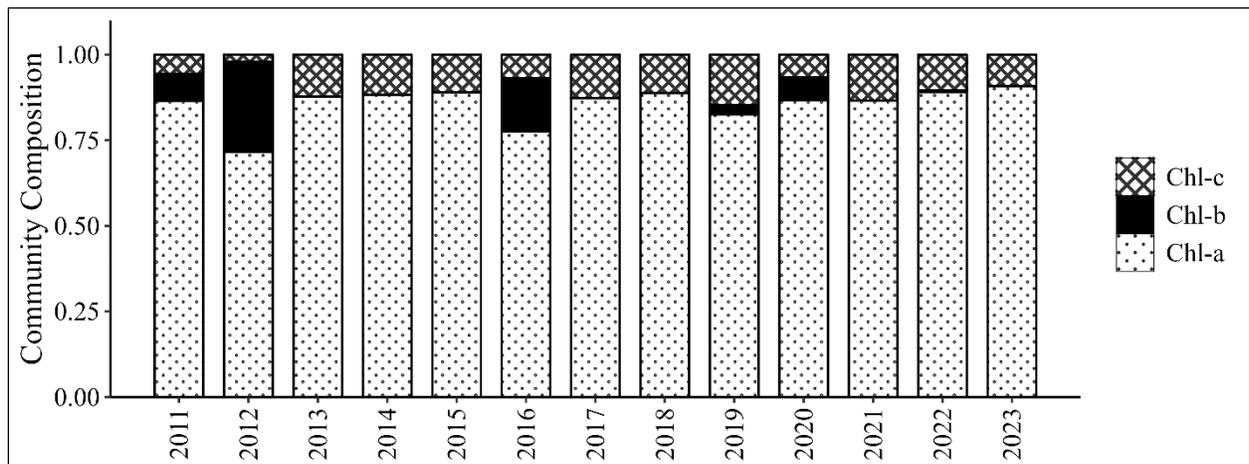


Figure 40.–Lower Sherman SP1 mean proportions of chlorophylls a, b, and c, 2011–2023.

Sample Point 2

The 2023 Lower Sherman Creek SP2 mean Chl-a density was 2.66 mg/m², similar to the 2022 mean (Table 16; Figure 41). The samples contained about 91% Chl-a, 9% Chl-c, and 0% Chl-b, consistent with composition observed in previous years (Figure 42).

Table 16.–Lower Sherman Creek SP2 mean chlorophylls a, b, and c densities, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Chl-a (mg/m ²)	5.61	0.67	2.87	1.32	1.62	1.42	1.15	1.49	2.12	7.60	5.54	2.54	2.66
Chl-b (mg/m ²)	0.02	0.01	0.00	0.00	0.15	0.04	0.00	0.00	0.00	0.87	0.00	0.00	0.01
Chl-c (mg/m ²)	0.32	0.09	0.32	0.12	0.26	0.18	0.12	0.19	0.29	0.49	0.72	0.24	0.26

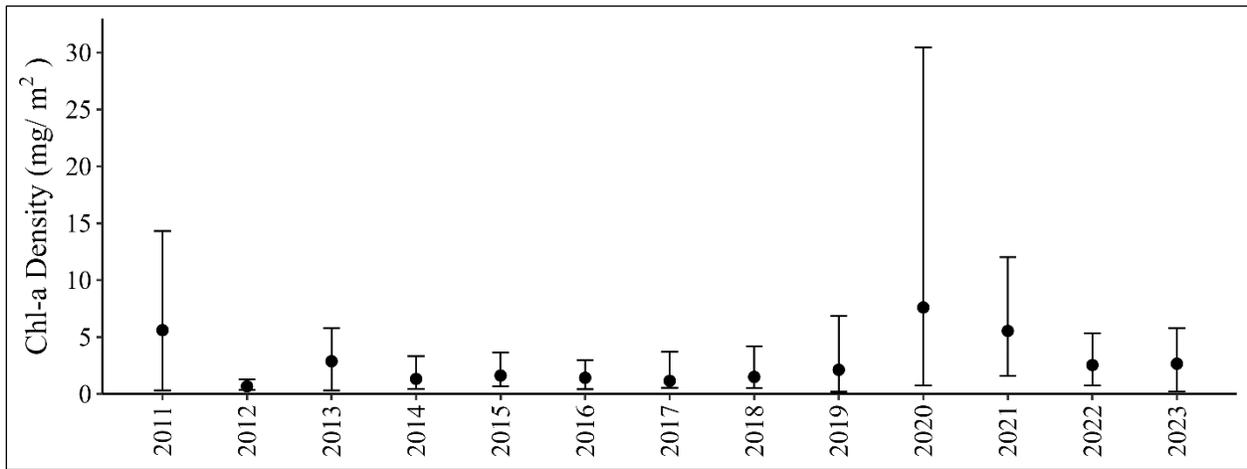


Figure 41.–Lower Sherman SP2 mean chlorophyll a densities, 2011–2023.

Note: Minimum, mean, and maximum values shown.

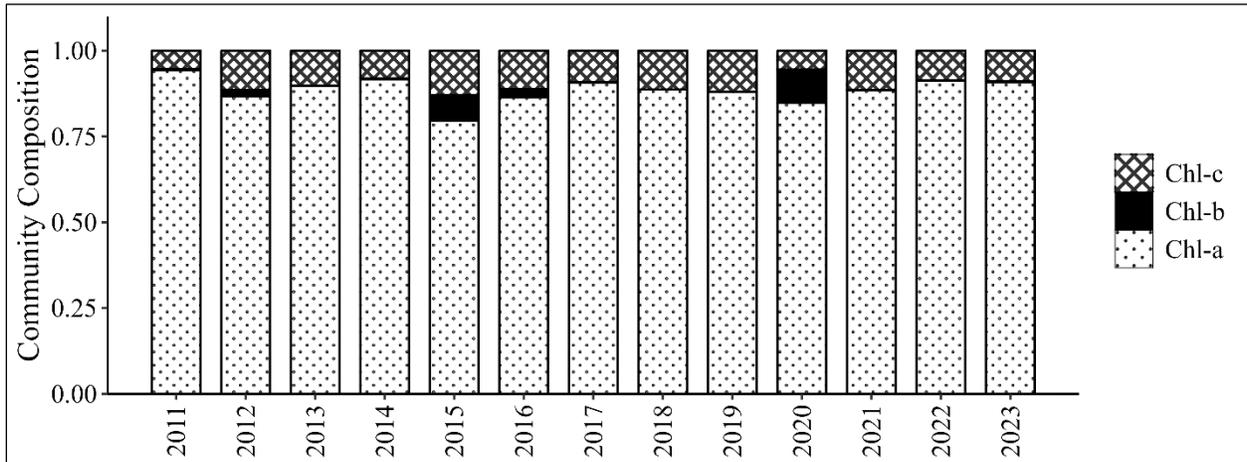


Figure 42.–Lower Sherman SP2 mean proportions of chlorophylls a, b, and c, 2011–2023.

Benthic Macroinvertebrate Density and Community Composition

Sample Point 1

The 2023 Lower Sherman Creek SP1 BMI mean density estimate is 1,970 BMI/m² and we identified 19 taxa, within the upper range of BMI densities observed 2011–2022 (Table 17; Figures 43, 44). We estimate mean EPT density at 1,676 EPT/m², within the upper range observed, accounting for 85% of the samples. The Shannon Diversity and Evenness scores were consistent with previous years. The dominant taxon was Ephemeroptera (mayflies) of the genus *Baetis* (62%).

Table 17.—Lower Sherman Creek SP1 BMI data summaries, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m ²)	358	1,804	1,149	423	446	274	313	629	809	382	880	1,108	1,676
Mean BMI density (per m ²)	1,118	2,733	1,796	3,023	1,651	6,839	1,009	912	1,263	1,272	989	1,504	1,970
Number of EPT Taxa	15	18	16	13	13	13	13	16	14	14	14	15	15
Number of BMI Taxa	26	31	28	30	26	26	25	26	25	24	20	24	19
% EPT	32	66	64	14	27	4	31	69	64	30	89	74	85
Shannon Diversity Score	0.76	0.74	0.85	0.71	0.84	0.32	0.81	0.73	0.79	0.64	0.62	0.62	0.62
Evenness Score	0.71	0.62	0.71	0.57	0.7	0.27	0.69	0.71	0.71	0.61	0.62	0.56	0.55

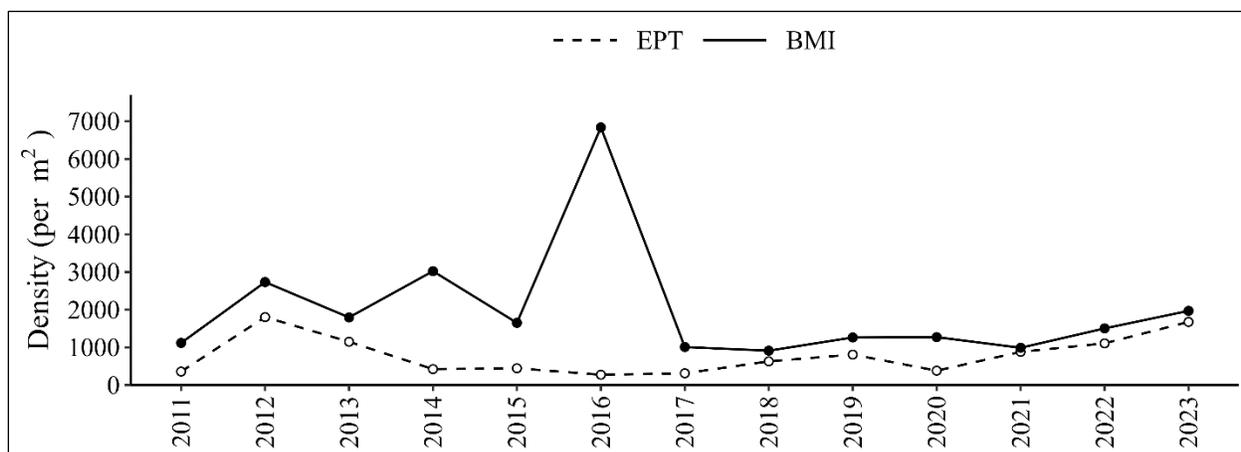


Figure 43.—Lower Sherman Creek SP1 mean BMI and EPT densities, 2011–2023.

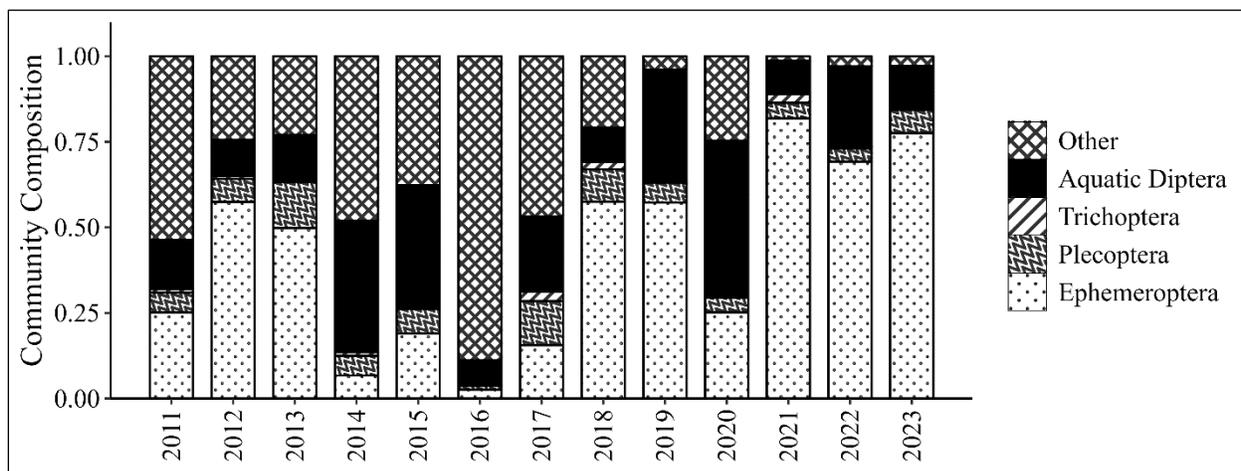


Figure 44.—Lower Sherman Creek SP1 BMI community composition, 2011–2023.

Sample Point 2

The 2023 Lower Sherman Creek SP2 BMI mean density estimate is 3,453 BMI/m² and we identified 24 taxa, the highest observed BMI density 2011–2022 (Table 18; Figures 45, 46). We estimate mean EPT density at 2,959 EPT/m², the highest observed, accounting for 86% of the samples. The Shannon Diversity and Evenness scores were consistent with previous years. The dominant taxon was Ephemeroptera (mayflies) of the genus *Baetis* (51%).

Table 18.–Lower Sherman Creek SP2 BMI data summaries, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Mean EPT density (per m ²)	1,255	2,230	2,437	142	402	225	120	856	1,380	383	598	932	2,959
Mean BMI density (per m ²)	1,651	2,823	3,385	1,185	1,609	1,873	428	973	1,624	871	720	1,156	3,453
Number of EPT Taxa	17	26	25	16	13	13	14	18	15	16	18	12	16
Number of BMI Taxa	30	36	39	28	23	23	26	21	25	23	26	18	24
% EPT	76	79	72	12	25	12	28	88	85	44	83	81	86
Shannon Diversity Score	0.93	0.7	0.84	0.7	0.77	0.53	0.84	0.61	0.64	0.79	0.76	0.54	0.73
Evenness Score	0.76	0.57	0.65	0.62	0.66	0.49	0.8	0.57	0.6	0.73	0.7	0.53	0.61

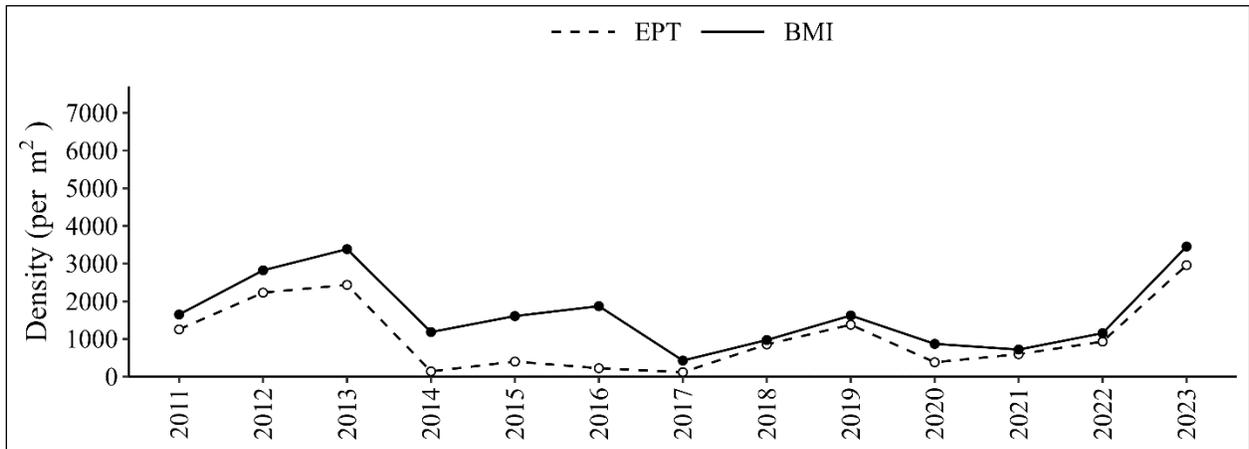


Figure 45.–Lower Sherman Creek SP2 mean BMI and EPT densities, 2011–2023.

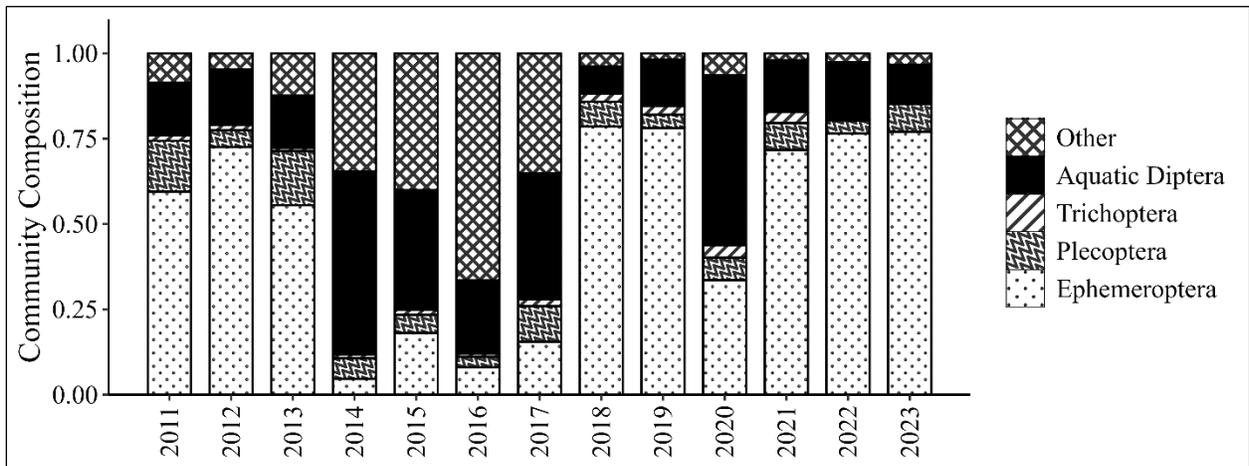


Figure 46.–Lower Sherman Creek SP2 BMI community composition, 2011–2023.

Adult Salmon Counts

In 2023, during three surveys we counted 1,432 pink salmon in Lower Sherman Creek (Table 19). Since coho salmon do not use Sherman Creek, we did not survey for adults. Numerous rainfall events July through August increased stream discharges and reduced visibility, negatively affecting our ability to consistently count salmon during peak spawning.

Table 19.–Lower Sherman Creek adult salmon counts, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Pink salmon	4,605	1,608	4,981	70	2,798	26	5,690	86	2,816	190	1,020	19	1,432
Chum salmon	0	0	12	0	1	5	122	7	147	0	0	0	11

Note: The 2022 and 2023 data presented are from peak counts during the spawning seasons; all other years include complete spawning season counts.

Sediment Element Concentrations

The 2023 Lower Sherman Creek SP2 sediment samples contained As, Cu, Cr, Ni, and Zn near or above the TEC freshwater sediment toxicity guidelines, as in previous years (Figure 47). All other element concentrations were below the TEC and PEC freshwater sediment toxicity guidelines, and within ranges previously observed 2011–2022.

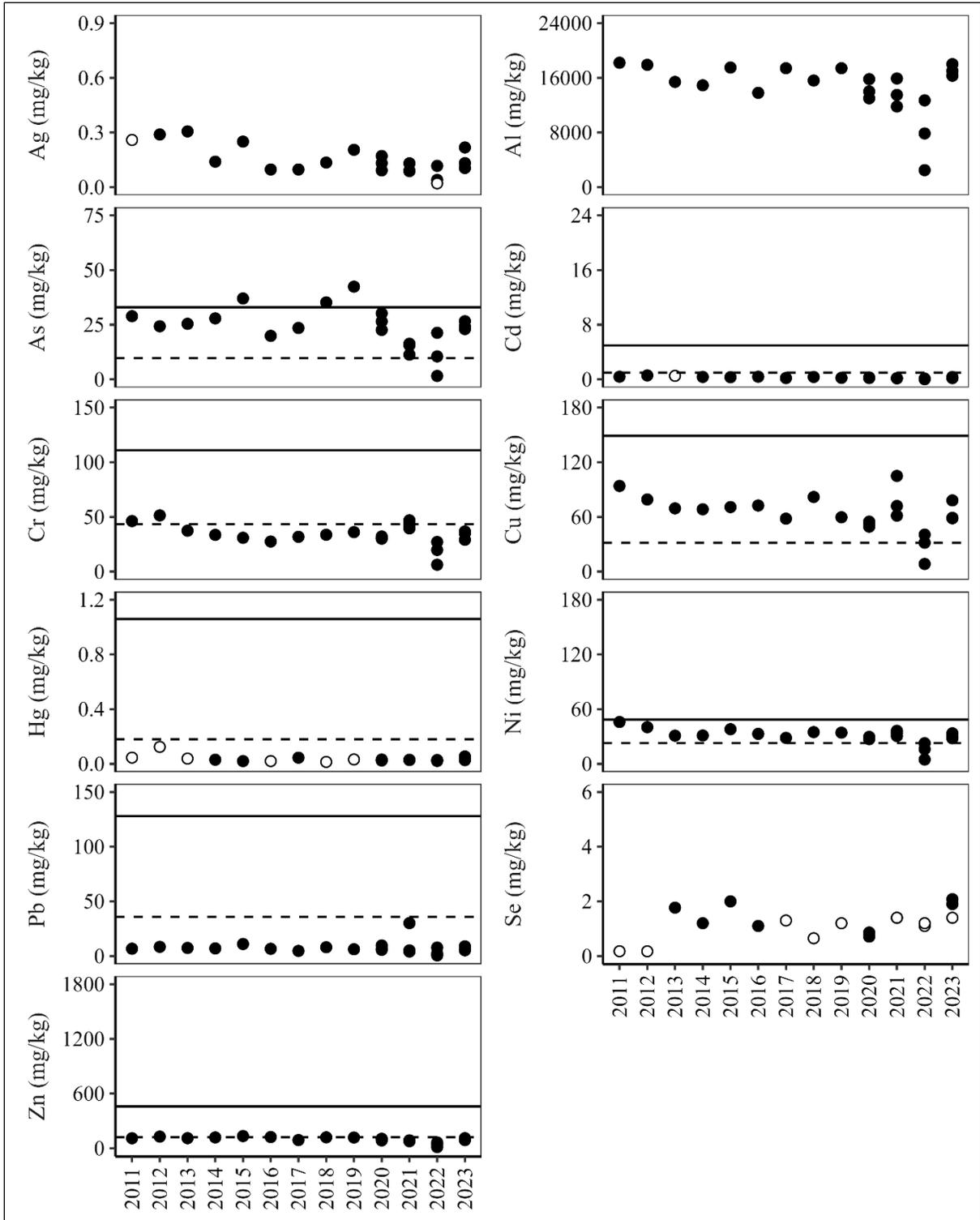


Figure 47.—Lower Sherman Creek sediment element concentrations, 2011–2023.

Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

COMPARISONS AMONG SITES

Periphyton: Chlorophyll Density

For all sites sampled in 2023, mean Chl-a density was in the upper range or the highest observed since 2011, possibly a result of warm summer weather with minimal peak streamflow events prior to sampling (based on the Johnson Creek streamflow data; Figure 16).

Among the four Slate Creek sites sampled from 2011 to 2023, mean Chl-a densities generally followed a similar trend; except Lower Slate Creek had more variability and spiked in 2019, and West Fork Slate Creek had elevated mean densities in 2021 and 2023 (Figure 48). The Slate Creek sample sites vary in physical and environmental conditions, from 9 m elevation at Lower Slate Creek to 229 m elevation at Upper Slate Creek, and with lake influence at East Fork and Lower Slate Creeks, variation among sampling sites is expected. East Fork Slate Creek mean Chl-a densities show the least variability, possibly due to controlled streamflows and changes in seasonal water temperature related to Outfall 002.

Comparing the data from Lower Sherman Creek SP1 and SP2 between 2011 and 2023, mean Chl-a densities followed a similar trend with SP1 having a slightly higher mean Chl-a density each year (Figure 49). The Sherman Creek sample sites are located at 12 m elevation (SP1) and at 26 m elevation (SP2); cobble is dominant at SP2 and gravel at SP1 due to difference in stream gradients. Increased scour due to a larger stream gradient at SP2 could explain slightly lower Chl-a mean density observed most years.

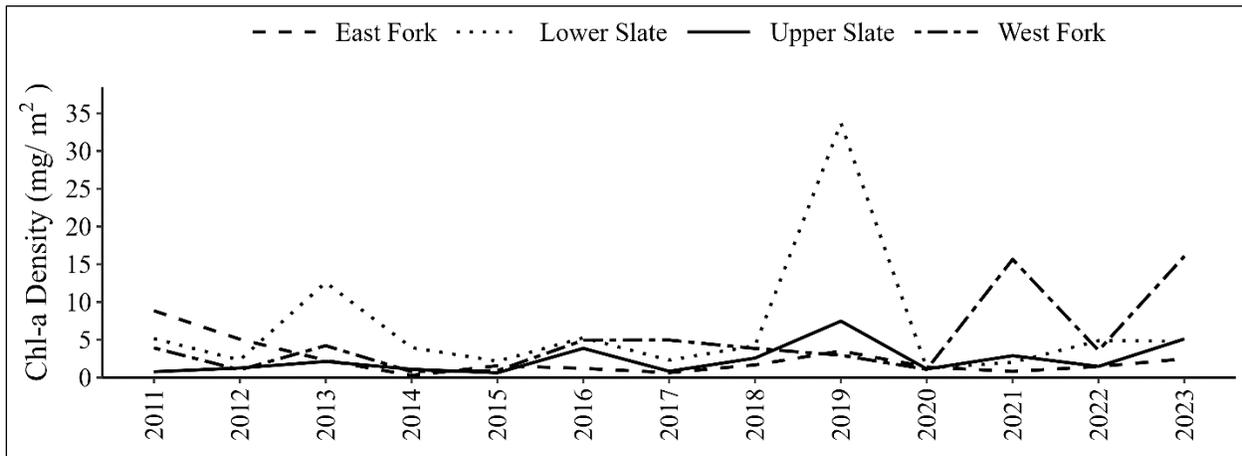


Figure 48.—East Fork Slate, Lower Slate, Upper Slate, and West Fork Slate Creek mean chlorophyll a densities, 2011–2023.

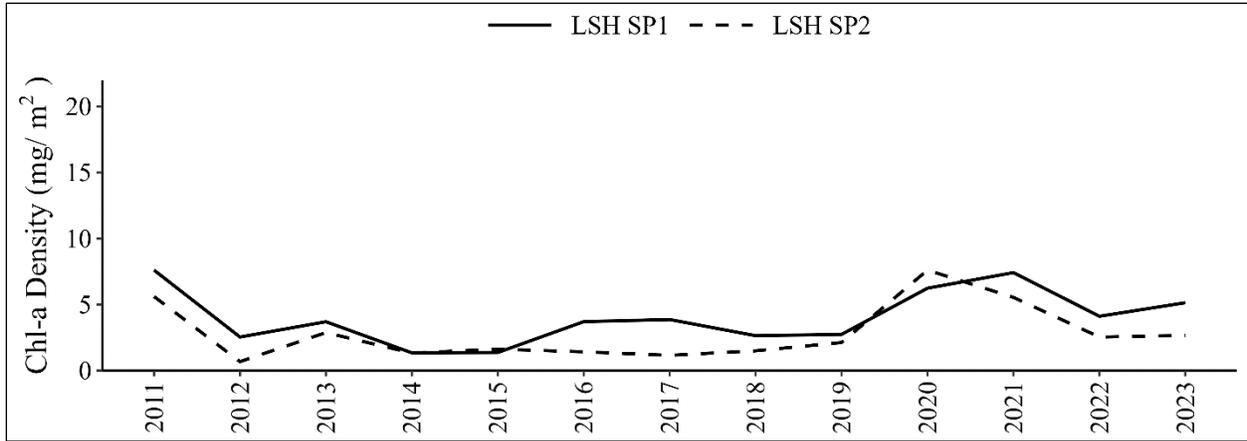


Figure 49.–Lower Sherman Creek Sample Point 1 and 2 mean chlorophyll a densities, 2011–2023.

EPT Density

For all sites sampled in 2023, EPT density was the highest or in the upper range observed 2011–2022, possibly a result of average spring weather with minimal peak streamflow events prior to sampling. Benthic macroinvertebrate densities and percent EPT at Slate, Sherman, and Johnson Creeks follow generally follow a similar trend 2011–2023.

Among the four Slate Creek sites sampled from 2011 to 2023, mean EPT densities and BMI taxa abundance followed similar trends (Figures 50–51). Reduced EPT densities in 2014 at East Fork Slate Creek and at Lower Sherman Creek 2014–2018 may have been a result of the presence of white material on the streambed, related to Outfalls 001 and 002. East Fork Slate Creek continues to have the lowest percent EPT among samples, though usually a greater density due to other benthic macroinvertebrates present such as pea clams, as a result of upstream lake influence.

Comparing the data from Lower Sherman Creek SP1 and SP2 between 2011 and 2023, mean EPT densities and BMI taxa abundance followed similar trends with SP2 having a slightly higher EPT density each year (Figures 52–53), which may be explained by the large gravel and cobble dominated-substrate at SP2 that is exposed to scour more than the lower gradient and smaller substrate at sampling site SP1.

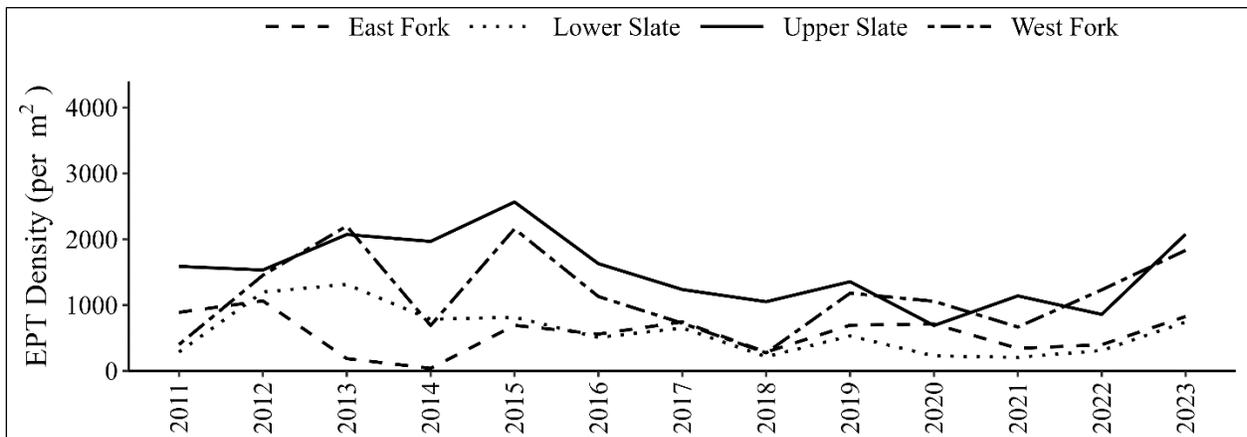


Figure 50.–East Fork Slate, Lower Slate, Upper Slate, and West Fork Slate Creek EPT densities, 2011–2023.

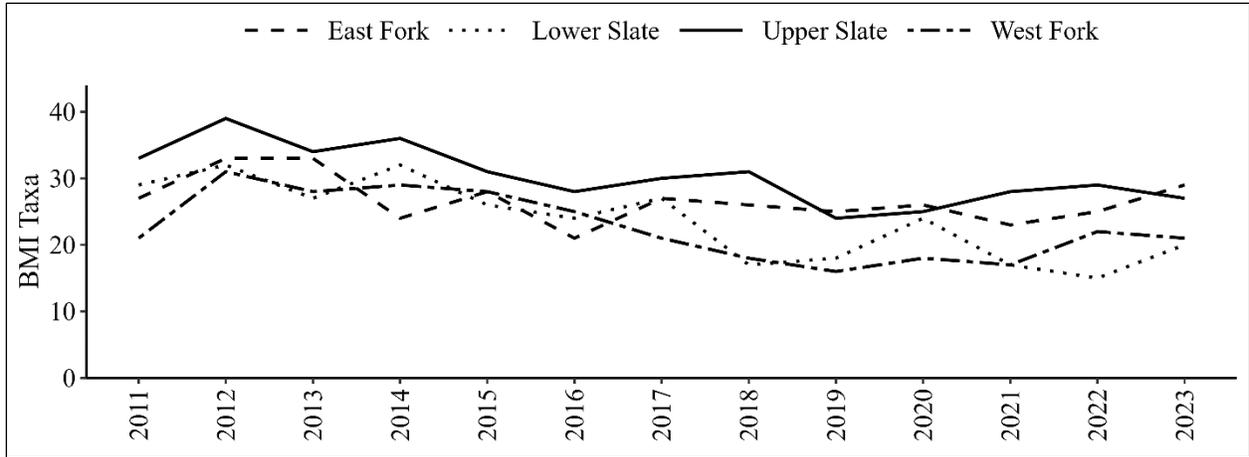


Figure 51.— East Fork Slate, Lower Slate, Upper Slate, and West Fork Slate Creek BMI taxa richness, 2011–2023.

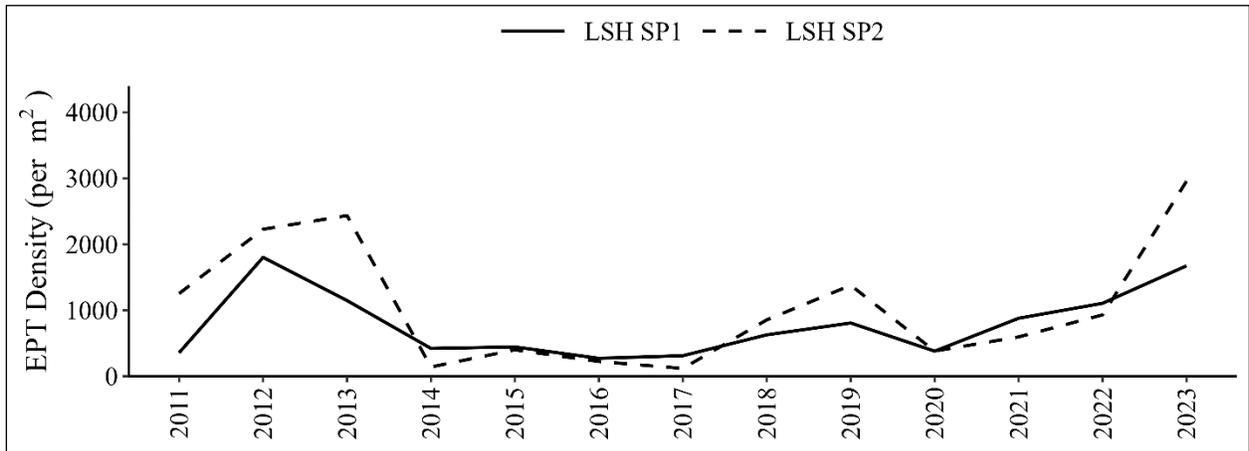


Figure 52.—Lower Sherman Creek SP1 and SP2 EPT densities, 2011–2023.

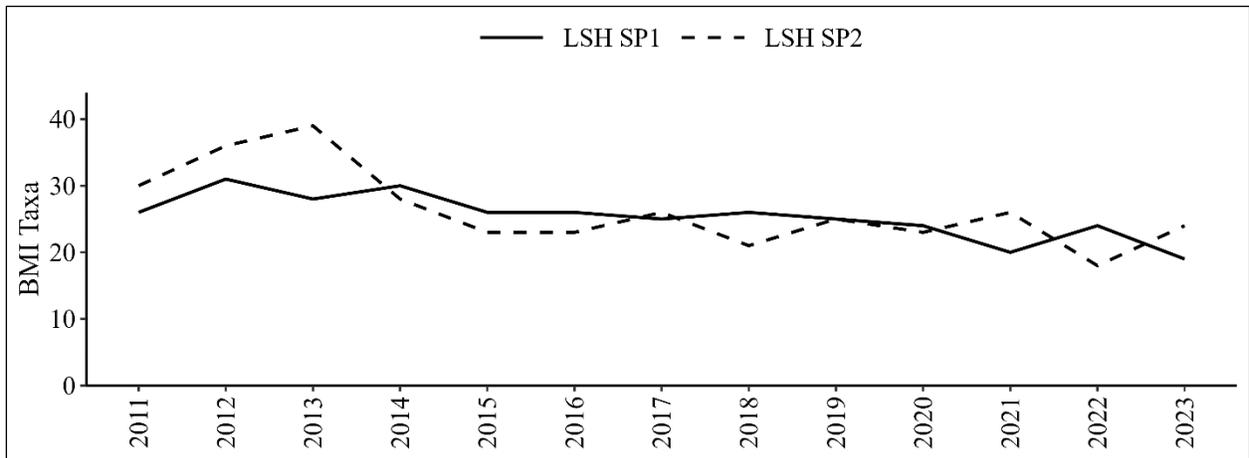


Figure 53.—Lower Sherman Creek SP1 and SP2 BMI taxa richness, 2011–2023.

Sediment Element Concentrations

Among the 2023 sediment samples, mean element concentrations are generally lower than the PEC freshwater sediment toxicity guidelines, except for concentrations of As in East Fork Slate Creek and Ni in Upper Slate Creek (Figure 54). East Fork Slate Creek had one sediment sample with elevated Se concentration raising the mean value, the other two sediment samples were consistent with previous years.

Among the Slate, Johnson, and Sherman Creeks sediment samples collected from 2011 to 2023, Pb and Hg concentrations were below the TEC freshwater sediment toxicity guidelines (Buchman 2008) and Al and Ag concentrations followed similar trends among sites; guidelines are not published for Ag, Al, or Se (Figures 55–57). Reference and mine-influenced reach samples contained As, Cd, Cu, Ni, and Zn concentrations near or above the TEC freshwater sediment toxicity guidelines.

Sediment samples from East Fork Slate Creek are generally more variable with elevated As, Cd, Ni, Se, and Zn concentrations relative to the other sampling sites, possibly related to the graphitic phyllite (acid-generating rock) uncovered during initial TTF dam construction nearly 20 years ago. Upper Slate Creek has naturally elevated concentrations of Al, Cr, and Ni; a potential source for downstream elevated concentrations. East Fork Slate and Lower Sherman Creeks have elevated As concentrations relative to the other sampling sites; however As concentrations at all sites exceeded the TEC or PEC freshwater toxicity guidelines 2011–2023.

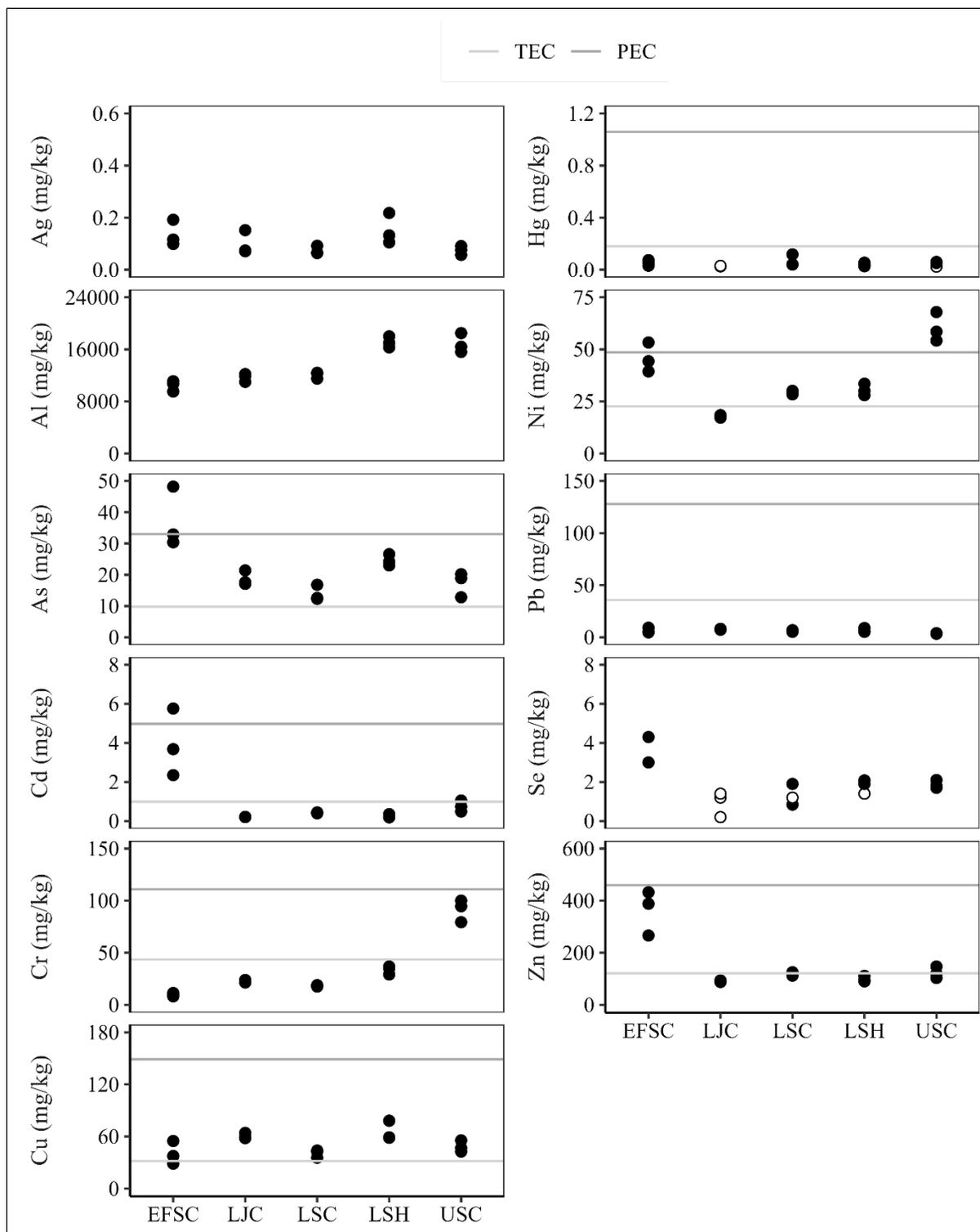


Figure 54.—East Fork Slate (EFSC), Lower Johnson (LJC), Lower Slate (LSC), Lower Sherman (LSH), and Upper Slate (USC) Creeks element concentrations, 2023.

Note: Elements undetected (o) are presented at the method reporting limit. TEC and PEC guidelines are not published for Ag, Al, or Se (Buchman 2008).

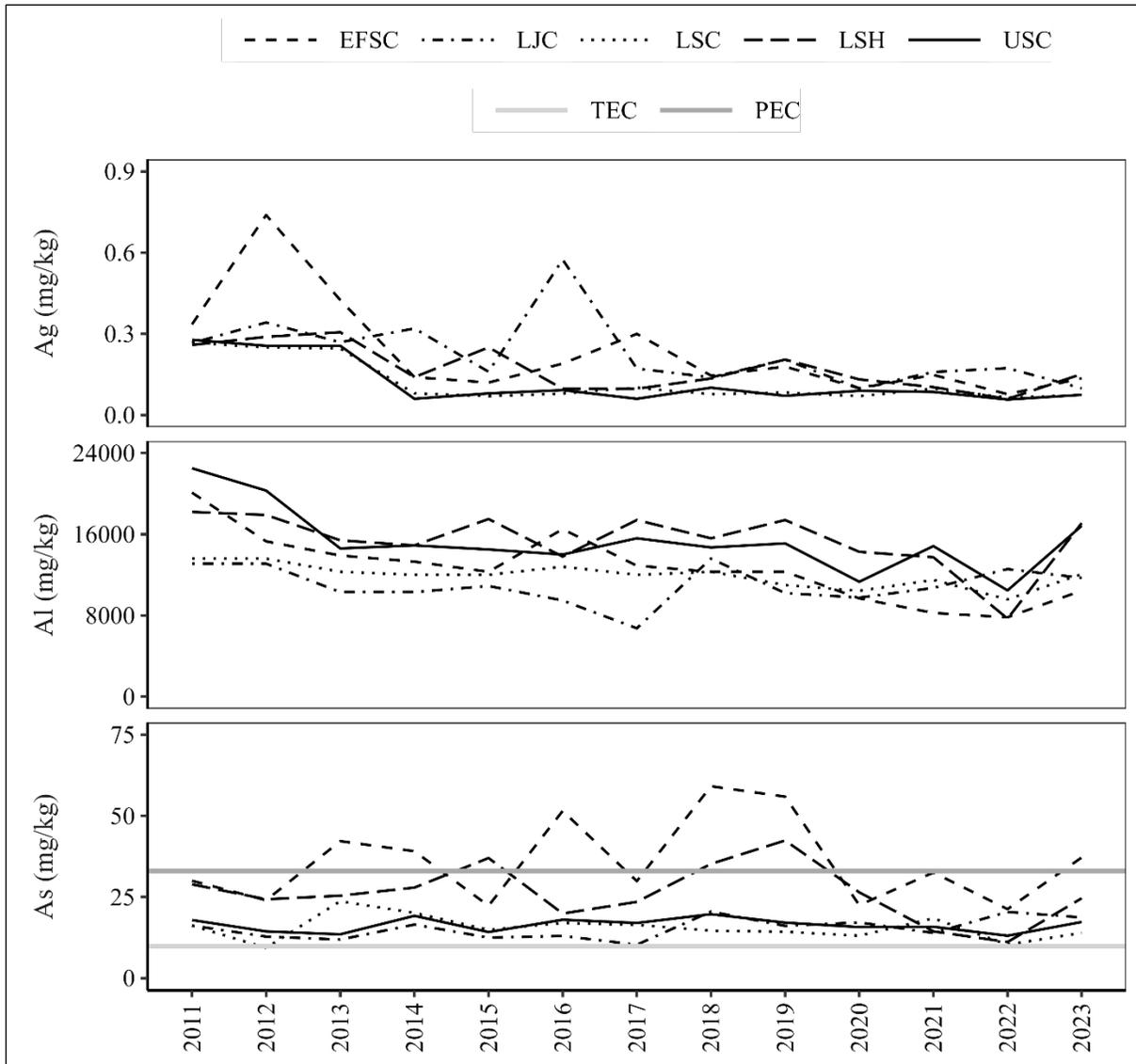


Figure 55.—East Fork Slate (EFSC), Lower Johnson (LJC), Lower Slate (LSC), Lower Sherman (LSH), and Upper Slate (USC) Creeks mean Ag, Al, and As concentrations, 2011–2023.

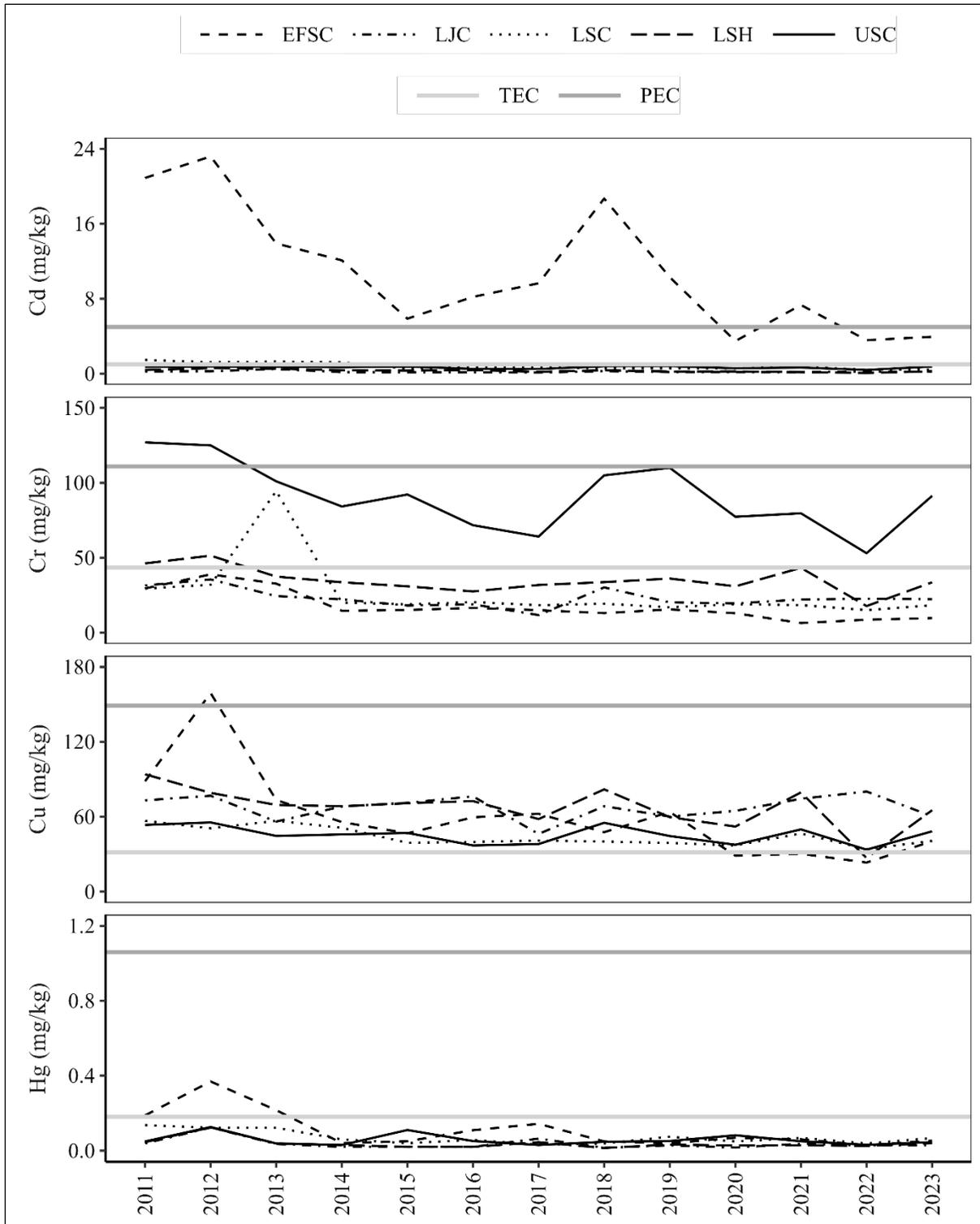


Figure 56.—East Fork Slate (EFSC), Lower Johnson (LJC), Lower Slate (LSC), Lower Sherman (LSH), and Upper Slate (USC) Creeks mean Cd, Cr, Cu, and Hg concentrations, 2011–2023.

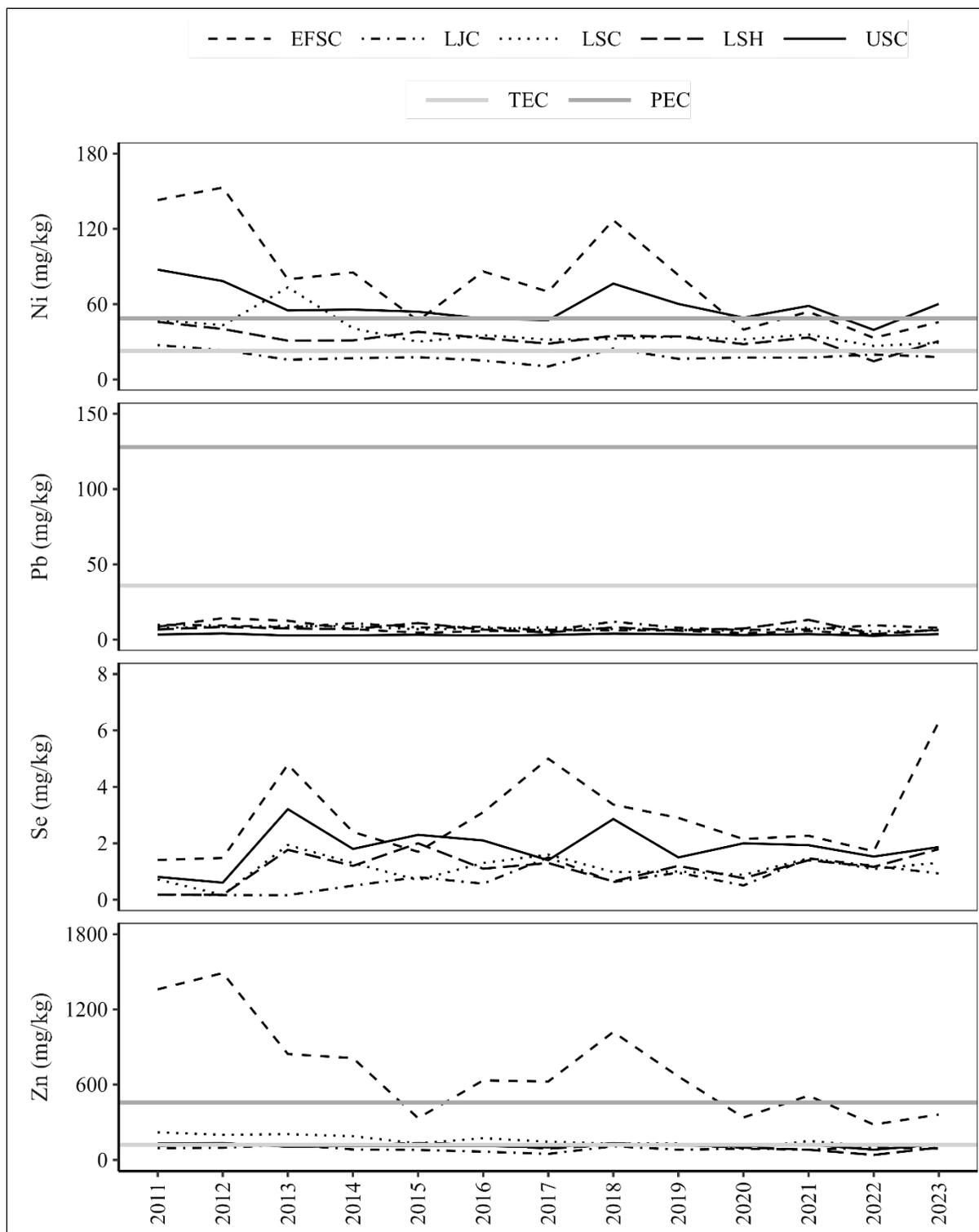


Figure 57.—East Fork Slate (EFSC), Lower Johnson (LJC), Lower Slate (LSC), Lower Sherman (LSH), and Upper Slate (USC) Creeks mean Ni, Pb, Se, and Zn concentrations, 2011–2023.

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APPENDIX A: CHLOROPHYLL DATA

Appendix A.1.–Lower Slate Creek chlorophylls a, b, and c densities, 2011–2023.

mg/m ²	07/29/11			07/25/12		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.21	0.05	0.00	1.60	0.13	0.07
	1.28	0.02	0.11	4.06	0.00	0.39
	0.85	0.01	0.07	2.03	0.00	0.18
	3.31	0.08	0.25	0.96	0.00	0.04
	11.85	3.11	0.30	2.56	0.04	0.22
	18.05	0.42	0.91	0.92	0.00	0.01
	0.72	0.13	0.00	1.49	0.13	0.13
	0.43	0.05	0.00	2.35	0.12	0.19
	8.54	0.39	0.58	6.19	0.05	0.54
	6.30	0.03	0.38	0.96	0.00	0.06
mean	5.15	0.43	0.26	2.31	0.05	0.18
maximum	18.05	3.11	0.91	6.19	0.13	0.54
minimum	0.21	0.01	0.00	0.92	0.00	0.01
mg/m ²	07/31/13			07/30/14		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	14.10	0.00	1.56	0.00	0.00	0.00
	20.72	0.00	3.11	9.29	3.22	0.48
	10.89	0.00	1.01	1.45	0.00	0.23
	17.84	0.00	2.66	12.18	5.27	0.38
	2.14	0.00	0.24	0.75	0.00	0.05
	6.09	0.00	0.95	4.70	0.00	0.67
	15.49	0.00	1.99	2.88	0.00	0.49
	12.71	0.00	1.58	1.82	0.00	0.15
	11.32	0.00	1.87	0.73	0.00	0.07
	14.63	0.00	1.46	5.87	0.00	0.51
mean	12.59	0.00	1.64	3.97	0.85	0.30
maximum	20.72	0.00	3.11	12.18	5.27	0.67
minimum	2.14	0.00	0.24	0.00	0.00	0.00
mg/m ²	07/28/15			07/26/16		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.45	0.10	0.01	0.60	0.00	0.12
	3.06	0.00	0.28	15.27	0.00	2.14
	0.95	0.09	0.04	6.41	0.00	0.97
	0.85	0.00	0.06	2.35	0.00	0.22
	0.72	0.13	0.00	9.51	0.76	0.88
	2.24	0.44	0.12	2.88	0.66	0.20
	9.93	0.00	1.13	3.52	0.00	0.40
	0.19	ND	ND	2.03	0.00	0.28
	2.88	0.14	0.28	5.34	0.67	0.36
	0.32	0.01	0.00	4.70	0.00	0.65
mean	2.16	0.10	0.21	5.26	0.21	0.62
maximum	9.93	0.44	1.13	15.27	0.76	2.14
minimum	0.19	0.00	0.00	0.60	0.00	0.12

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Appendix A.1.–Page 2 of 3.

mg/m ²	07/24/17			08/07/18		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	3.84	0.33	0.19	2.35	0.00	0.42
	1.71	0.00	0.27	3.31	0.00	0.56
	1.60	0.00	0.26	7.16	0.00	1.27
	2.14	0.00	0.41	3.63	0.00	0.59
	2.14	0.06	0.09	1.17	0.00	0.19
	4.91	1.86	0.16	3.10	0.08	0.26
	0.87	0.00	0.14	4.45	0.00	0.61
	2.14	0.00	0.36	9.61	0.30	1.21
	1.60	0.05	0.11	1.50	0.00	0.26
	2.01	0.00	0.32	5.77	0.00	0.91
mean	2.30	0.23	0.23	4.21	0.04	0.63
maximum	4.91	1.86	0.41	9.61	0.30	1.27
minimum	0.87	0.00	0.09	1.17	0.00	0.19
mg/m ²	08/01/19			07/29/20		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	6.73	0.00	1.02	0.55	0.00	0.02
	66.22	0.00	12.14	0.28	0.00	0.00
	4.49	0.00	0.71	0.96	0.07	0.03
	22.11	0.00	3.96	1.71	0.00	0.12
	15.38	0.00	3.57	0.73	0.04	0.04
	94.62	0.00	17.74	0.64	0.00	0.01
	8.12	0.00	1.59	2.15	0.00	0.20
	39.41	0.00	6.52	0.27	0.03	0.00
	14.95	0.00	2.64	4.17	0.98	0.13
	65.04	0.00	15.02	0.73	0.00	0.00
mean	33.71	0.00	6.49	1.22	0.11	0.06
maximum	94.62	0.00	17.74	4.17	0.98	0.20
minimum	4.49	0.00	0.71	0.27	0.00	0.00
mg/m ²	07/29/21			07/25/22		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	3.95	0.00	0.61	5.66	0.00	0.81
	3.31	0.00	0.61	3.63	0.00	0.22
	3.31	0.40	0.33	6.91	0.00	0.88
	1.42	0.00	0.17	6.73	0.00	0.95
	4.81	0.00	0.6	0.77	0.09	0.10
	0.55	0.00	0.12	12.50	0.00	1.84
	0.43	0.00	0.07	0.53	0.07	0.15
	0.43	0.00	0.07	5.13	0.48	0.53
	1.55	0.00	0.28	0.85	0.00	0.11
	0.29	ND	ND	5.95	0.23	0.56
mean	2.01	0.04	0.32	4.87	0.09	0.62
maximum	4.81	0.40	0.61	12.50	0.48	1.84
minimum	0.29	0.00	0.07	0.53	0.00	0.10

- continued -

07/26/23			
mg/m ²	Chl-a	Chl-b	Chl-c
	1.71	0.00	0.32
	11.85	0.57	1.60
	2.14	0.00	0.37
	4.70	0.00	0.47
	4.91	0.00	0.57
	11.96	0.00	1.73
	0.85	0.00	0.04
	5.45	0.00	0.72
	2.88	0.00	0.33
	1.60	0.00	0.20
mean	4.81	0.06	0.64
maximum	11.96	0.57	1.73
minimum	0.85	0.00	0.04

Appendix A.2.—West Fork Slate Creek chlorophylls a, b, and c densities, 2011–2023.

mg/m ²	07/29/11			07/25/12		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	2.52	0.00	0.19	1.15	0.00	0.04
	4.70	0.00	0.43	0.41	0.00	0.08
	2.78	0.00	0.26	0.53	0.00	0.02
	3.35	0.00	0.04	0.64	0.00	0.16
	4.27	0.00	0.25	3.62	0.00	0.24
	4.91	0.00	0.42	0.85	0.00	0.14
	3.95	0.00	0.27	0.96	0.01	0.07
	3.10	0.00	0.25	0.41	0.00	0.08
	4.38	0.00	0.39	0.60	0.00	0.12
	5.23	0.00	0.20	0.96	0.00	0.06
mean	3.92	0.00	0.27	1.01	0.00	0.10
maximum	5.23	0.00	0.43	3.62	0.01	0.24
minimum	2.52	0.00	0.04	0.41	0.00	0.02
mg/m ²	07/31/13			07/30/14		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	4.70	0.00	0.74	0.32	0.00	0.01
	1.39	0.00	0.16	0.19	0.00	0.00
	13.14	0.00	2.19	0.75	0.00	0.05
	4.38	0.00	0.47	0.88	0.00	0.00
	1.28	0.00	0.11	1.60	0.00	0.19
	3.10	0.00	0.50	0.23	0.00	0.03
	3.74	0.00	0.53	0.41	0.00	0.00
	2.03	0.00	0.33	0.33	0.00	0.02
	5.02	0.00	0.67	1.18	0.00	0.13
	3.40	0.00	0.36	1.82	0.00	0.15
mean	4.22	0.00	0.61	0.77	0.00	0.06
maximum	13.14	0.00	2.19	1.82	0.00	0.19
minimum	1.28	0.00	0.11	0.19	0.00	0.00
mg/m ²	07/28/15			07/26/16		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.34	0.00	0.21	7.48	0.00	1.16
	0.92	0.00	0.01	4.70	0.00	0.71
	0.77	0.02	0.03	3.22	0.00	0.25
	0.54	0.05	0.00	5.34	0.00	0.61
	0.19	ND	ND	2.67	0.00	0.34
	1.64	0.00	0.04	3.31	0.00	0.45
	2.35	0.00	0.21	4.27	0.00	0.44
	0.53	0.12	0.00	0.92	0.00	0.01
	0.56	0.00	0.06	10.89	0.00	1.64
	0.32	0.05	0.00	6.51	0.00	0.95
mean	0.92	0.03	0.06	4.93	0.00	0.66
maximum	2.35	0.12	0.21	10.89	0.00	1.64
minimum	0.19	0.00	0.00	0.92	0.00	0.01

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mg/m ²	07/24/17			07/25/18		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	5.13	0.00	0.60	1.17	0.00	0.22
	5.13	0.00	0.96	4.17	0.00	0.86
	1.82	0.00	0.19	2.35	0.00	0.32
	3.95	0.00	0.83	5.02	0.00	0.93
	5.87	0.00	1.22	5.55	0.00	1.22
	8.22	0.00	1.38	4.91	0.00	1.12
	8.22	0.00	1.58	3.10	0.00	0.53
	3.74	0.00	0.53	1.71	0.00	0.24
	2.78	0.00	0.33	4.38	0.00	0.75
	4.70	0.00	0.92	6.09	0.00	1.16
mean	4.96	0.00	0.85	3.85	0.00	0.74
maximum	8.22	0.00	1.58	6.09	0.00	1.22
minimum	1.82	0.00	0.19	1.17	0.00	0.22
mg/m ²	08/01/19			07/29/20		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.10	ND	ND	1.84	0.00	0.24
	4.17	0.00	0.49	1.65	0.00	0.27
	6.15	0.00	0.88	1.65	0.00	0.27
	1.28	0.00	0.14	ND	ND	ND
	3.42	0.00	0.27	1.42	0.00	0.17
	7.38	0.00	1.17	0.50	0.00	0.13
	4.04	0.00	0.34	0.28	0.00	0.03
	0.73	0.00	0.16	0.78	0.00	0.06
	2.14	0.00	0.19	0.96	0.00	0.10
	0.10	ND	ND	0.60	0.00	0.12
mean	2.95	0.00	0.46	1.08	0.00	0.15
maximum	7.38	0.00	1.17	1.84	0.00	0.27
minimum	0.10	0.00	0.14	0.28	0.00	0.03
mg/m ²	07/29/21			07/25/22		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	15.38	0.00	3.12	4.22	0.00	0.48
	15.27	0.00	2.99	3.62	0.00	0.46
	12.07	0.00	2.19	5.46	0.00	0.61
	13.95	0.00	2.38	3.53	0.00	0.41
	17.71	0.00	2.99	2.29	0.00	0.18
	10.93	0.00	2.03	1.6	0.00	0.17
	19.86	0.00	3.39	5.79	0.00	0.73
	15.56	0.00	2.49	2.89	0.00	0.3
	19.70	0.00	3.25	0.96	0.01	0.07
	16.13	0.00	2.76	5.41	0.00	0.81
mean	15.66	0.00	2.76	3.58	0.00	0.42
maximum	19.86	0.00	3.39	5.79	0.01	0.81
minimum	10.93	0.00	2.03	0.96	0.00	0.07

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07/26/23			
mg/m ²	Chl-a	Chl-b	Chl-c
	22.77	0.00	3.29
	13.59	0.00	1.64
	15.04	0.00	2.60
	26.81	0.00	2.88
	16.86	0.00	2.15
	13.49	0.00	2.12
	1.07	0.00	0.29
	29.05	0.00	4.18
	10.70	0.00	1.71
	11.43	0.00	1.67
mean	16.08	0.00	2.25
maximum	29.05	0.00	4.18
minimum	1.07	0.00	0.29

Appendix A.3.–East Fork Slate Creek chlorophylls a, b, and c densities, 2011–2023.

mg/m ²	07/28/11			07/24/12		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	9.51	2.16	0.24	11.53	3.24	0.28
	9.18	0.02	0.20	0.41	0.04	0.04
	1.28	0.03	0.00	0.88	0.00	0.05
	5.13	1.15	0.11	0.50	0.00	0.03
	16.02	0.18	0.44	3.42	0.00	0.11
	8.86	1.94	0.70	0.64	0.08	0.05
	4.70	0.70	0.13	18.58	0.00	0.66
	16.13	5.35	0.28	13.67	2.32	0.57
	4.91	0.49	0.12	0.69	0.00	0.00
	12.71	3.59	0.15	0.43	0.00	0.00
mean	8.84	1.56	0.24	5.08	0.57	0.18
maximum	16.13	5.35	0.70	18.58	3.24	0.66
minimum	1.28	0.02	0.00	0.41	0.00	0.00
mg/m ²	07/30/13			07/30/14		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	8.12	0.00	0.67	0.14	0.00	0.00
	0.24	ND	ND	0.64	0.00	0.07
	1.07	0.03	0.07	0.05	ND	ND
	0.32	0.07	0.00	0.75	0.14	0.10
	0.64	0.10	0.00	0.05	ND	ND
	5.02	0.16	0.35	0.37	0.00	0.00
	0.43	0.00	0.03	0.05	ND	ND
	6.41	0.11	0.50	0.11	0.00	0.00
	0.32	0.00	0.00	0.53	0.00	0.01
	0.24	ND	ND	0.05	ND	ND
mean	2.28	0.06	0.20	0.27	0.02	0.03
maximum	8.12	0.16	0.67	0.75	0.14	0.10
minimum	0.24	0.00	0.00	0.05	0.00	0.00
mg/m ²	07/27/15			07/25/16		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.85	0.00	0.12	0.23	0.00	0.03
	0.19	ND	ND	4.91	0.00	0.69
	1.92	0.00	0.09	0.75	0.00	0.05
	0.96	0.00	0.09	1.42	0.00	0.14
	1.60	0.00	0.22	0.85	0.02	0.17
	5.34	0.00	0.55	1.56	0.00	0.12
	2.14	0.00	0.09	0.64	0.00	0.08
	0.37	0.00	0.00	0.19	ND	ND
	0.92	0.00	0.11	0.87	0.00	0.02
	1.28	0.00	0.08	0.64	0.00	0.06
mean	1.56	0.00	0.15	1.21	0.00	0.15
maximum	5.34	0.00	0.55	4.91	0.02	0.69
minimum	0.19	0.00	0.00	0.19	0.00	0.02

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mg/m ²	07/25/17			07/24/18		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.56	0.00	0.00	0.64	0.00	0.00
	0.51	0.00	0.00	2.14	0.00	0.12
	0.27	0.03	0.00	1.39	0.00	0.00
	0.41	0.00	0.08	0.75	0.00	0.02
	0.96	0.00	0.00	4.91	0.00	0.92
	0.85	0.00	0.15	0.69	0.00	0.00
	0.32	0.00	0.08	0.88	0.00	0.05
	1.74	0.00	0.16	1.61	0.00	0.11
	0.32	0.00	0.08	2.71	0.00	0.36
	0.46	0.00	0.00	0.96	0.00	0.00
mean	0.64	0.00	0.06	1.67	0.00	0.16
maximum	1.74	0.03	0.16	4.91	0.00	0.92
minimum	0.27	0.00	0.00	0.64	0.00	0.00
mg/m ²	08/01/19			07/30/20		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.75	0.00	0.02	1.60	0.07	0.00
	1.92	0.00	0.33	1.84	0.00	0.05
	5.07	0.00	0.31	4.81	0.00	0.80
	1.60	0.00	0.19	0.92	0.00	0.04
	0.63	0.07	0.15	0.25	ND	ND
	9.51	0.00	1.15	1.28	0.00	0.19
	0.32	0.00	0.08	0.50	0.00	0.00
	0.85	0.01	0.07	0.51	0.00	0.00
	11.17	0.00	0.80	0.60	0.00	0.02
	3.30	0.00	0.34	1.60	0.05	0.11
mean	3.51	0.01	0.34	1.39	0.01	0.13
maximum	11.17	0.07	1.15	4.81	0.07	0.80
minimum	0.32	0.00	0.02	0.25	0.00	0.00
mg/m ²	07/29/21			07/26/22		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.92	0.00	0.25	1.41	0.01	0.21
	0.32	0.06	0.05	1.05	0.00	0.06
	0.43	0.07	0.10	0.75	0.00	0.00
	2.09	0.06	0.35	0.43	0.00	0.07
	0.55	0.00	0.12	3.08	0.32	0.12
	0.29	ND	ND	0.82	0.00	0.12
	0.56	0.00	0.06	1.17	0.00	0.16
	0.85	0.00	0.04	2.99	0.29	0.21
	0.33	0.00	0.02	2.21	0.00	0.03
	0.64	0.00	0.16	0.64	0.00	0.08
mean	0.80	0.02	0.13	1.46	0.06	0.11
maximum	2.09	0.07	0.35	3.08	0.32	0.21
minimum	0.29	0.00	0.02	0.43	0.00	0.00

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07/27/23			
mg/m ²	Chl-a	Chl-b	Chl-c
	1.39	0.00	0.13
	0.75	0.03	0.28
	1.28	0.00	0.18
	1.79	0.00	0.05
	1.71	0.00	0.15
	0.75	0.03	0.08
	3.52	0.74	0.25
	5.66	0.00	0.26
	5.72	0.00	0.84
	2.11	0.00	0.24
mean	2.47	0.08	0.25
maximum	5.72	0.74	0.84
minimum	0.75	0.00	0.05

Appendix A.4.—Upper Slate Creek chlorophylls a, b, and c densities, 2011–2023.

mg/m ²	07/29/11			07/24/12		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.41	0.00	0.00	2.03	0.00	0.14
	0.32	0.00	0.04	0.96	0.00	0.09
	0.96	0.01	0.07	0.75	0.00	0.00
	0.11	0.00	0.00	0.50	0.00	0.03
	2.67	0.00	0.26	2.03	0.00	0.14
	0.28	0.00	0.00	1.07	0.00	0.14
	0.60	0.00	0.12	0.55	0.00	0.02
	1.14	0.00	0.01	1.71	0.00	0.06
	0.53	0.00	0.00	2.14	0.00	0.12
	0.60	0.00	0.02	0.83	0.00	0.00
mean	0.76	0.00	0.05	1.26	0.00	0.07
maximum	2.67	0.01	0.26	2.14	0.00	0.14
minimum	0.11	0.00	0.00	0.50	0.00	0.00
mg/m ²	07/30/13			07/30/14		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.82	0.00	0.27	0.92	0.00	0.11
	0.85	0.01	0.07	1.20	0.00	0.07
	2.94	0.00	0.13	1.52	0.00	0.06
	1.39	0.00	0.12	1.82	0.00	0.15
	2.99	0.00	0.11	0.85	0.00	0.00
	4.59	0.00	0.20	0.64	0.00	0.01
	0.85	0.00	0.01	1.18	0.00	0.07
	2.03	0.00	0.20	0.96	0.00	0.00
	0.85	0.00	0.00	0.64	0.00	0.01
	2.94	0.00	0.20	1.17	0.00	0.12
mean	2.13	0.00	0.13	1.09	0.00	0.06
maximum	4.59	0.01	0.27	1.82	0.00	0.15
minimum	0.85	0.00	0.00	0.64	0.00	0.00
mg/m ²	07/27/15			07/25/16		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.37	0.00	0.08	1.15	0.00	0.07
	0.64	0.00	0.08	8.86	0.00	1.12
	0.64	0.00	0.07	1.52	0.00	0.06
	0.51	0.00	0.06	5.34	0.00	0.93
	0.43	0.00	0.08	2.85	0.00	0.14
	0.55	0.00	0.28	1.01	0.00	0.09
	0.64	0.00	0.02	4.81	0.00	0.40
	0.64	0.00	0.08	2.40	0.16	0.21
	0.69	0.00	0.00	4.49	0.00	0.36
	1.17	0.00	0.13	6.19	0.00	0.79
mean	0.63	0.00	0.09	3.86	0.02	0.42
maximum	1.17	0.00	0.28	8.86	0.16	1.12
minimum	0.37	0.00	0.00	1.01	0.00	0.06

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mg/m ²	07/24/17			07/25/18		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.43	0.00	0.00	3.95	0.00	0.67
	1.06	0.00	0.00	3.31	0.00	0.73
	0.64	0.00	0.00	1.82	0.00	0.13
	0.50	0.00	0.03	2.88	0.00	0.37
	0.96	0.00	0.00	2.24	0.00	0.14
	1.17	0.00	0.03	1.17	0.00	0.03
	1.07	0.00	0.14	3.52	0.00	0.55
	0.64	0.00	0.00	2.56	0.00	0.35
	0.32	0.01	0.00	1.60	0.00	0.41
	1.47	0.00	0.23	2.67	0.00	0.18
mean	0.83	0.00	0.04	2.57	0.00	0.36
maximum	1.47	0.01	0.23	3.95	0.00	0.73
minimum	0.32	0.00	0.00	1.17	0.00	0.03
mg/m ²	08/01/19			07/30/20		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	24.88	0.00	1.78	2.46	0.00	0.05
	23.39	0.00	2.08	1.19	0.00	0.04
	2.78	0.00	0.16	1.52	0.00	0.00
	3.11	0.00	0.21	0.43	0.00	0.00
	2.43	0.00	0.23	0.97	0.00	0.03
	1.70	0.00	0.17	1.80	0.00	0.08
	7.67	0.00	0.57	0.96	0.00	0.10
	0.87	0.00	0.11	1.34	0.00	0.02
	3.71	0.00	0.29	0.11	0.00	0.18
	4.17	0.00	0.36	0.51	0.00	0.06
mean	7.47	0.00	0.60	1.13	0.00	0.06
maximum	24.88	0.00	2.08	2.46	0.00	0.18
minimum	0.87	0.00	0.11	0.11	0.00	0.00
mg/m ²	07/28/21			07/26/22		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	3.95	0.00	0.50	0.96	0.00	0.00
	5.41	0.00	0.49	2.14	0.00	0.32
	2.67	0.00	0.14	3.16	0.00	0.20
	0.53	0.01	0.18	0.41	0.00	0.00
	ND	ND	ND	1.79	0.00	0.05
	4.04	0.00	0.57	2.94	0.00	0.23
	0.29	ND	ND	0.83	0.00	0.05
	3.44	0.00	0.72	0.51	0.00	0.06
	1.60	0.00	0.25	0.43	0.00	0.00
	4.06	0.00	0.83	1.50	0.00	0.08
mean	2.89	0.00	0.46	1.47	0.00	0.10
maximum	5.41	0.01	0.83	3.16	0.00	0.32
minimum	0.29	0.00	0.14	0.41	0.00	0.00

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07/26/23			
mg/m ²	Chl-a	Chl-b	Chl-c
	2.83	0.00	0.34
	2.39	0.00	0.17
	5.60	0.00	0.30
	6.88	0.00	0.26
	1.84	0.00	0.05
	4.91	0.00	0.36
	1.29	0.00	0.02
	2.53	0.00	0.25
	6.89	0.00	0.68
	15.91	0.00	2.29
mean	5.11	0.00	0.47
maximum	15.91	0.00	2.29
minimum	1.29	0.00	0.02

Appendix A.5.–Lower Sherman Creek SP1 chlorophylls a, b, and c densities, 2011–2023.

mg/m ²	07/28/11			07/26/12		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.28	0.00	0.05	1.07	0.00	0.14
	5.34	0.00	0.36	2.88	0.87	0.16
	5.98	0.00	0.54	0.41	0.04	0.04
	3.84	0.10	0.48	2.67	1.27	0.00
	15.59	3.98	0.17	0.60	0.00	0.12
	11.11	2.64	0.28	1.07	0.00	0.11
	19.33	0.00	1.65	3.63	1.56	0.03
	7.26	0.00	0.74	9.61	4.12	0.08
	1.92	0.04	0.19	2.99	1.43	0.02
	4.38	0.17	0.44	0.43	0.00	0.06
mean	7.60	0.69	0.49	2.54	0.93	0.08
maximum	19.33	3.98	1.65	9.61	4.12	0.16
minimum	1.28	0.00	0.05	0.41	0.00	0.00
mg/m ²	07/29/13			07/28/14		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	4.06	0.00	0.38	2.46	0.00	0.30
	5.55	0.00	0.73	0.74	0.00	0.10
	0.24	ND	ND	0.19	0.00	0.00
	4.67	0.00	0.55	0.92	0.00	0.14
	7.69	0.00	0.89	0.83	0.00	0.15
	7.37	0.00	0.62	2.99	0.00	0.47
	0.24	ND	ND	1.39	0.00	0.17
	2.67	0.00	0.35	2.46	0.00	0.25
	0.75	0.03	0.08	0.45	0.01	0.04
	ND	ND	ND	0.96	0.00	0.16
mean	3.69	0.00	0.51	1.34	0.00	0.18
maximum	7.69	0.03	0.89	2.99	0.01	0.47
minimum	0.24	0.00	0.08	0.19	0.00	0.00
mg/m ²	07/27/15			07/25/16		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.28	0.00	0.03	3.31	0.52	0.31
	0.19	ND	ND	4.27	0.00	0.76
	0.92	0.00	0.11	1.39	0.00	0.16
	0.64	0.00	0.01	2.14	0.00	0.37
	2.67	0.00	0.31	2.28	0.00	0.32
	0.79	0.00	0.00	13.24	6.47	0.31
	2.78	0.00	0.32	2.78	0.13	0.23
	0.19	ND	ND	2.24	0.00	0.31
	4.17	0.00	0.49	3.31	0.12	0.35
	1.01	0.00	0.09	2.03	0.20	0.17
mean	1.36	0.00	0.17	3.70	0.74	0.33
maximum	4.17	0.00	0.49	13.24	6.47	0.76
minimum	0.19	0.00	0.00	1.39	0.00	0.16

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mg/m ²	07/25/17			07/24/18		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	5.02	0.00	0.68	2.88	0.00	0.36
	5.13	0.00	0.93	3.95	0.00	0.50
	2.35	0.00	0.28	2.14	0.00	0.38
	2.99	0.00	0.40	2.43	0.00	0.23
	4.49	0.00	0.64	2.56	0.00	0.36
	3.84	0.00	0.55	2.06	0.00	0.15
	6.30	0.00	1.05	1.82	0.00	0.20
	4.06	0.00	0.63	4.58	0.00	0.63
	1.10	0.00	0.05	2.24	0.00	0.35
	3.31	0.00	0.39	1.71	0.00	0.15
mean	3.86	0.00	0.56	2.64	0.00	0.33
maximum	6.30	0.00	1.05	4.58	0.00	0.63
minimum	1.10	0.00	0.05	1.71	0.00	0.15
mg/m ²	08/02/19			07/29/20		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	ND	ND	ND	17.52	0.00	1.73
	0.10	ND	ND	8.01	0.00	0.80
	0.43	0.07	0.10	2.66	0.00	0.07
	0.50	0.00	0.13	5.55	0.35	0.29
	0.10	ND	ND	13.67	4.03	0.31
	5.66	0.47	0.45	0.25	ND	ND
	0.10	ND	ND	1.15	0.00	0.04
	5.02	0.00	0.66	6.51	0.00	0.48
	12.50	0.00	1.56	1.89	0.00	0.14
	0.21	0.00	0.03	5.13	0.00	0.41
mean	2.74	0.09	0.49	6.23	0.49	0.47
maximum	12.50	0.47	1.56	17.52	4.03	1.73
minimum	0.10	0.00	0.03	0.25	0.00	0.04
mg/m ²	07/28/21			07/26/22		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	7.47	0.00	1.03	3.16	0.00	0.27
	4.44	0.00	0.78	9.32	0.00	0.94
	6.83	0.00	1.05	1.42	0.00	0.17
	5.66	0.00	0.96	1.65	0.00	0.17
	7.29	0.00	1.02	0.98	0.18	0.46
	14.20	0.00	2.48	1.55	0.00	0.09
	5.23	0.00	0.77	5.45	0.00	0.68
	2.62	0.00	0.40	6.51	0.00	0.86
	5.34	0.00	0.95	8.28	0.00	0.89
	15.05	0.00	2.04	2.75	0.00	0.32
mean	7.41	0.00	1.15	4.11	0.02	0.49
maximum	15.05	0.00	2.48	9.32	0.18	0.94
minimum	2.62	0.00	0.40	0.98	0.00	0.09

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07/27/23			
mg/m ²	Chl-a	Chl-b	Chl-c
	5.64	0.00	0.75
	6.25	0.00	0.70
	5.66	0.00	0.41
	9.10	0.00	0.84
	7.69	0.00	0.83
	6.41	0.00	0.66
	4.49	0.00	0.48
	3.72	0.00	0.28
	0.96	0.00	0.09
	1.42	0.00	0.17
mean	5.13	0.00	0.52
maximum	9.10	0.00	0.84
minimum	0.96	0.00	0.09

Appendix A.6.–Lower Sherman Creek SP2 chlorophylls a, b, and c densities, 2011–2023.

mg/m ²	07/28/11			07/26/12		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	3.10	0.00	0.26	1.05	0.04	0.12
	6.30	0.19	0.62	0.64	0.00	0.11
	4.59	0.00	0.38	0.73	0.00	0.07
	0.32	0.00	0.00	0.50	0.07	0.10
	13.88	0.00	0.54	0.34	ND	ND
	7.37	0.00	0.46	0.51	0.00	0.06
	1.50	0.00	0.09	0.96	0.00	0.16
	14.31	0.00	0.59	0.37	0.00	0.00
	0.85	0.00	0.01	1.28	0.00	0.09
	3.84	0.00	0.25	0.34	ND	ND
mean	5.61	0.02	0.32	0.67	0.01	0.09
maximum	14.31	0.19	0.62	1.28	0.07	0.16
minimum	0.32	0.00	0.00	0.34	0.00	0.00
mg/m ²	07/29/13			07/28/14		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	1.07	0.00	0.14	0.74	0.00	0.10
	3.84	0.00	0.34	1.38	0.00	0.18
	0.96	0.00	0.15	2.83	0.00	0.15
	4.81	0.00	0.49	3.31	0.00	0.31
	5.77	0.00	0.78	0.75	0.00	0.06
	0.32	0.02	0.10	0.85	0.03	0.08
	4.70	0.00	0.44	0.85	0.00	0.01
	3.52	0.00	0.35	1.39	0.00	0.16
	0.53	0.00	0.02	0.43	0.01	0.04
	3.20	0.00	0.43	0.69	0.00	0.07
mean	2.87	0.00	0.32	1.32	0.00	0.12
maximum	5.77	0.02	0.78	3.31	0.03	0.31
minimum	0.32	0.00	0.02	0.43	0.00	0.01
mg/m ²	07/27/15			07/25/16		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.69	0.00	0.00	1.50	0.00	0.17
	0.96	0.00	0.00	2.03	0.00	0.30
	0.85	0.00	0.11	0.43	0.00	0.13
	1.28	0.00	0.16	2.98	0.00	0.38
	2.14	0.00	0.24	0.96	0.00	0.09
	3.63	0.65	0.43	1.28	0.04	0.26
	0.96	0.07	0.03	1.71	0.00	0.22
	2.14	0.78	1.30	1.92	0.35	0.16
	1.07	0.00	0.14	0.41	0.00	0.08
	2.46	0.00	0.24	0.96	0.00	0.06
mean	1.62	0.15	0.27	1.42	0.04	0.19
maximum	3.63	0.78	1.30	2.98	0.35	0.38
minimum	0.69	0.00	0.00	0.41	0.00	0.06

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mg/m ²	07/25/17			07/24/18		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.75	0.00	0.05	0.96	0.00	0.09
	0.85	0.01	0.07	1.38	0.00	0.21
	0.88	0.00	0.05	1.60	0.00	0.17
	0.69	0.00	0.07	0.53	0.00	0.02
	3.70	0.00	0.46	1.50	0.00	0.26
	0.69	0.00	0.07	1.60	0.00	0.23
	0.64	0.00	0.07	0.64	0.00	0.11
	1.82	0.00	0.20	4.17	0.00	0.58
	0.92	0.00	0.11	0.96	0.00	0.09
	0.55	0.00	0.02	1.60	0.00	0.15
mean	1.15	0.00	0.12	1.49	0.00	0.19
maximum	3.70	0.01	0.46	4.17	0.00	0.58
minimum	0.55	0.00	0.02	0.53	0.00	0.02
mg/m ²	08/02/19			07/29/20		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.43	0.00	0.03	5.42	0.04	0.33
	1.60	0.00	0.23	1.65	0.00	0.20
	6.84	0.00	1.07	2.78	0.29	0.20
	1.11	0.00	0.08	1.93	0.00	0.20
	1.33	0.00	0.18	4.38	0.48	0.25
	0.18	0.00	0.00	6.84	0.39	0.70
	5.02	0.00	0.63	5.18	0.00	0.45
	0.85	0.00	0.13	0.75	0.00	0.00
	2.14	0.00	0.31	30.44	5.80	1.15
	1.71	0.00	0.21	16.66	1.69	1.44
mean	2.12	0.00	0.29	7.60	0.87	0.49
maximum	6.84	0.00	1.07	30.44	5.80	1.44
minimum	0.18	0.00	0.00	0.75	0.00	0.00
mg/m ²	07/28/21			07/26/22		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	4.50	0.00	0.71	0.82	0.00	0.12
	3.76	0.00	0.51	3.81	0.00	0.21
	1.60	0.00	0.14	4.38	0.00	0.29
	12.02	0.00	1.66	1.75	0.00	0.19
	4.17	0.00	0.50	0.85	0.03	0.08
	3.17	0.00	0.43	2.46	0.00	0.36
	5.73	0.00	0.77	5.34	0.00	0.39
	6.55	0.00	0.83	0.74	0.00	0.10
	5.34	0.00	0.72	3.63	0.00	0.50
	8.53	0.00	0.95	1.60	0.00	0.17
mean	5.54	0.00	0.72	2.54	0.00	0.24
maximum	12.02	0.00	1.66	5.34	0.03	0.50
minimum	1.60	0.00	0.14	0.74	0.00	0.08

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07/27/23			
mg/m ²	Chl-a	Chl-b	Chl-c
	4.54	0.00	0.50
	0.85	0.00	0.04
	2.35	0.00	0.32
	5.77	0.00	0.61
	2.12	0.00	0.08
	2.88	0.00	0.28
	2.78	0.00	0.32
	0.21	0.05	0.00
	2.44	0.00	0.16
	2.62	0.00	0.30
mean	2.66	0.01	0.26
maximum	5.77	0.05	0.61
minimum	0.21	0.00	0.00

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–Lower Slate Creek BMI data summary, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total BMI Taxa	29	32	27	32	26	24	27	17	18	24	17	15	20
Total EPT Taxa	13	17	16	17	13	11	13	9	9	11	8	10	13
Total BMI Counted	1,148	1,760	1,200	2,308	1,901	1,894	730	269	521	674	237	452	533
Ephemeroptera	85	387	400	73	196	225	219	84	214	77	103	157	303
Plecoptera	70	274	203	352	258	61	145	37	85	44	14	17	112
Trichoptera	2	8	6	17	6	3	3	0	0	4	0	0	0
Aquatic Diptera	862	975	503	1,711	1,268	1,038	308	32	208	431	90	248	112
Other	129	116	88	155	173	567	55	116	14	118	30	30	6
% Ephemeroptera	7.4	22	33	3.2	10	12	30	31	41	11	43	34.7	56.8
% Plecoptera	6.1	16	17	15	14	3	20	14	16	7	6	3.8	21
% Trichoptera	0.2	0.5	0.5	0.7	0.3	0.2	0.4	0	0	0.6	0	0	0
% Aquatic Diptera	75	55	42	74	67	55	42	12	40	64	38	54.9	21
% Other	11	7	7.3	6.7	9	30	8	43	3	18	13	6.6	1.1
% EPT	14	38	51	19	24	15	50	45	57	19	49	38	78
% Chironomidae	72	53	35	68	64	51	36	11	29	57	31	53	19
Shannon Diversity Score	0.51	0.69	0.85	0.64	0.7	0.65	0.81	0.81	0.83	0.59	0.77	0.59	0.8
Evenness Score	0.48	0.58	0.7	0.52	0.58	0.57	0.73	0.84	0.81	0.56	0.82	0.65	0.77
Total Sample Area (m ²)	0.56	0.56	0.47	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
Mean BMI/m ²	2,057	3,154	2,581	4,136	3,407	3,394	1,308	482	934	1,208	425	810	955
±1 SD	1,046	1,849	551	3,592	2,458	1,667	436	461	267	629	167	358	320
Terrestrial Invertebrates	0	4	0	1	3	88	1	0	7	1	0	3	2
Juvenile Fish	1	0	0	1	0	0	0	1	0	0	0	1	0

Appendix B.4.—Upper Slate Creek BMI data summary, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total BMI Taxa	33	39	34	36	31	28	30	31	24	25	28	29	27
Total EPT Taxa	18	21	20	20	19	15	19	18	18	15	18	20	18
Total BMI Counted	1,408	1,259	1,607	1,744	2,107	1,338	1,132	864	912	543	786	695	1,346
Ephemeroptera	368	454	492	622	622	554	460	383	513	222	426	315	695
Plecoptera	401	349	604	429	758	252	172	175	213	116	160	140	401
Trichoptera	116	48	55	44	44	104	62	33	35	50	47	25	64
Aquatic Diptera	248	273	338	518	517	169	406	258	137	144	133	202	179
Other	275	135	118	131	166	259	32	15	14	11	20	13	7
% Ephemeroptera	26.1	36.1	30.6	36	29.5	41.4	40.6	44.3	56.3	40.9	54.2	45.3	51.6
% Plecoptera	28.5	27.7	37.6	25	36	18.8	15.2	20.3	23.4	21.4	20.4	20.1	29.8
% Trichoptera	8.2	3.8	3.4	2.5	2.1	7.8	5.5	3.8	3.8	9.2	6	3.6	4.8
% Aquatic Diptera	17.6	21.7	21	30	24.5	12.6	35.9	29.9	15	26.5	16.9	29.1	13.3
% Other	19.5	10.7	7.3	8	7.9	19.4	2.8	1.7	1.5	2	2.5	1.9	0.5
% EPT	63	68	72	63	68	68	61	68	83	71	81	69	86
% Chironomidae	15	20	19	28	22	11	34	28	11	22	15	26	12
Shannon Diversity Score	0.97	1.04	1.02	1.03	0.98	1.06	0.96	0.92	0.99	0.92	0.97	0.98	0.94
Evenness Score	0.76	0.79	0.78	0.76	0.74	0.82	0.73	0.75	0.8	0.78	0.77	0.8	0.74
Total Sample Area (m ²)	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
Mean BMI/m ²	2,523	2,256	2,880	3,125	3,776	2,398	2,029	1,548	1,634	973	1,409	1,246	2,412
±1 SD	1,173	1,321	1,049	660	1,174	520	1,143	574	170	295	494	667	574
Terrestrial Invertebrates	1	0	0	1	3	6	3	1	0	4	2	2	1
Juvenile Fish	0	0	0	0	0	0	0	0	2	0	0	0	0

Appendix B.6.–Lower Sherman Creek SP1 BMI data summary, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total BMI Taxa	26	31	28	30	26	26	25	26	25	24	20	24	19
Total EPT Taxa	15	18	16	13	13	13	13	16	14	14	14	15	15
Total BMI Counted	624	1,525	1,002	1,687	921	3,816	563	509	705	710	552	839	1,099
Ephemeroptera	157	876	499	114	175	101	88	293	404	179	452	581	852
Plecoptera	36	103	135	97	67	41	72	48	41	30	25	32	75
Trichoptera	7	14	6	18	6	9	16	11	4	3	14	5	8
Aquatic Diptera	89	160	131	648	326	273	123	51	228	322	54	196	133
Other	335	372	231	810	347	3,392	264	106	28	176	7	25	31
% Ephemeroptera	25	58	50	7	19	2.6	15.6	57.6	57.3	25.2	81.9	69.2	77.5
% Plecoptera	6	7	13	6	7	1.1	12.8	9.4	5.8	4.2	4.5	3.8	6.8
% Trichoptera	1.1	0.9	0.6	1.1	1	0.2	2.8	2.2	0.6	0.4	2.5	0.6	0.7
% Aquatic Diptera	14	11	13	38	35	7.2	21.8	10	32.3	45.4	9.8	23.4	12.1
% Other	54	24	23	48	38	88.9	46.9	20.8	4	24.8	1.3	3	2.8
% EPT	32	66	64	14	27	4	31	69	64	30	89	74	85
% Chironomidae	6	8	12	33	33	7	13	7	27	42	9	21	9
Shannon Diversity Score	0.76	0.74	0.85	0.71	0.84	0.32	0.81	0.73	0.79	0.64	0.62	0.62	0.62
Evenness Score	0.71	0.62	0.71	0.57	0.7	0.27	0.69	0.71	0.71	0.61	0.62	0.56	0.55
Total Sample Area (m ²)	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
Mean BMI/m ²	1,118	2,733	1,796	3,023	1,651	6,839	1,009	912	1,263	1,272	989	1,504	1,970
±1 SD	1,000	1,410	247	936	718	1,398	168	408	345	638	464	462	1,058
Terrestrial Invertebrates	1	0	14	1	14	21	1	0	2	0	1	4	0
Juvenile Fish	10	12	0	8	0	77	0	11	0	2	0	0	0

Appendix B.7.–Lower Sherman Creek SP2 BMI data summary, 2011–2023.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total BMI Taxa	30	36	39	28	23	23	26	21	25	23	26	18	24
Total EPT Taxa	17	26	25	16	13	13	14	18	15	16	18	12	16
Total BMI Counted	921	1,573	1,889	661	898	1,045	239	543	906	486	402	645	1,927
Ephemeroptera	548	1,143	1,049	31	163	84	37	427	708	163	288	494	1,485
Plecoptera	137	77	299	40	47	32	25	39	35	32	32	24	155
Trichoptera	14	26	18	7	13	10	5	13	23	18	13	2	11
Aquatic Diptera	143	254	289	354	315	224	88	43	124	242	61	108	211
Other	79	75	234	229	360	695	84	21	16	31	8	17	65
% Ephemeroptera	60	73	56	4.7	18.2	8	15.5	78.6	78.1	33.5	71.6	76.6	77.1
% Plecoptera	15	4.9	16	6	5.2	3.1	10.5	7.2	3.9	6.6	8	3.7	8
% Trichoptera	1.5	1.7	1	1.1	1.4	1	2.1	2.4	2.5	3.7	3.2	0.3	0.6
% Aquatic Diptera	16	16	15	54	35.1	21.4	36.8	7.9	13.7	49.8	15.2	16.7	10.9
% Other	9	4.8	12	35	40.1	66.5	35.1	3.9	1.8	6.4	2	2.6	3.4
% EPT	76	79	72	12	25	12	28	88	85	44	83	81	86
% Chironomidae	11	15	14	48	33	20	24	6	11	44	12	15	7
Shannon Diversity Score	0.93	0.7	0.84	0.7	0.77	0.53	0.84	0.61	0.64	0.79	0.76	0.54	0.73
Evenness Score	0.76	0.57	0.65	0.62	0.66	0.49	0.8	0.57	0.6	0.73	0.7	0.53	0.61
Total Sample Area (m ²)	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
Mean BMI/m ²	1,651	2,823	3,385	1,185	1,609	1,873	428	973	1,624	871	720	1,156	3,453
±1 SD	927	1,174	1,471	769	748	982	219	370	712	410	321	169	1,830
Terrestrial Invertebrates	1	2	18	1	10	4	2	1	4	0	0	1	1
Juvenile Fish	0	0	14	0	0	6	0	13	0	0	0	12	0

APPENDIX C: ADULT SALMON DATA

Appendix C.1.—Lower Slate, Johnson, and Sherman Creek weekly adult pink salmon counts, 2011–2023.

Site	Statistical Week	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Slate	29	ND	0	0	0	ND	ND	0	ND	ND	ND	ND	ND	ND
	30	0*	0	7	0	12	0	0	0	0	0	0	ND	ND
	31	0	364	66	2	487	0	7	ND	0	1	0	ND	ND
	32	369	1,106	604	14	1,769	1	386	0	0	0	0	3	129
	33	763	3,152	864	13	1,783	0	477*	3	200	ND	ND	ND	1,369
	34	1,394	2,331	1,199	12	1,543	64	2,818	1	11	4	1,156	5	2,138
	35	1,646	318	472	0	850	12	1,340*	ND	532	8	1,055	11	635
	36	1,807	1	97	ND	527	2	1,811	ND	69	ND	1,336	4	ND
	37	229	0	27	ND	575	ND	577	ND	25	2	ND	ND	ND
	38	46	ND	1	ND	32	ND	ND	ND	ND	ND	114	ND	ND
	39	0	ND	ND	ND	2	ND	0	ND	ND	ND	ND	ND	ND
40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Johnson	29	ND	0	59	ND	ND	ND	109	ND	ND	ND	ND	ND	ND
	30	1	73	200	44	4,512	0	1,222	42	96	31	0	ND	ND
	31	180	411	2,250	48	568	6	3,291	90	457	319	34	ND	ND
	32	1,891	753	1,456	84	17,517	154	2,272	91	514	1,806	164	570*	580
	33	3,850	1,698	1,873	2	19,028	125	3,364	145	783	ND	ND	ND	1,020
	34	5,264	1,816	1,557	11	5,444	15	4,010	66*	976	ND	8,394	309	1,523
	35	1,350	198	545	0	2,057	95	5,165	0	1,241	482	3,236	178*	1,022
	36	3,712	60	149	ND	1,238	33	1,775	0	574	ND	2,380	30	ND
	37	670	7	97	ND	702	ND	1,587	ND	337	99	ND	ND	ND
	38	436	0	ND	ND	249	ND	288*	ND	18	ND	1,185	ND	ND
	39	145	ND	ND	ND	10	ND	156*	ND	ND	ND	ND	ND	ND
40	ND	ND	ND	ND	ND	ND	0	ND	ND	ND	ND	ND	ND	
Sherman	29	ND	0	2	ND	ND	ND	0	ND	ND	ND	ND	ND	ND
	30	1	2	164	0	120	0	4	0	0	0	0	ND	ND
	31	298	9	860	6	38	0	61	0	214	0	5	ND	ND
	32	773	97	979	40	348	0	778	4	438	17	37	0	453
	33	1,049	285	765	10	723	0	1,076	81	850	0	ND	ND	357
	34	397	521	549	4	334	0*	730	1	460	74	368	17	622
	35	157	521	785	10	ND	24	941	ND	220	99	254	2	ND
	36	870	145	624	0	413	2*	781	ND	322	ND	222	0	ND
	37	416*	25	232	ND	648	ND	841	ND	237	ND	ND	ND	ND
	38	609	3	21	ND	159	ND	478	ND	75	ND	134	ND	ND
	39	35*	ND	ND	ND	15	ND	ND	ND	ND	ND	ND	ND	ND
40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

Note: * = Incomplete survey.

APPENDIX D: SPAWNING SUBSTRATE DATA

Appendix D.1.–Lower Slate Creek SP1 pink salmon spawning substrate data, 2011–2023.

Sample Date	Sample No.	Volume (mL) Retained Each Sieve (mm)									
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15	Imhoff	GMPS
8/17/2011	1	0	0	470	260	340	425	225	20	22.0	9.8
8/17/2011	2	750	70	460	250	200	280	100	25	8.0	14.0
8/17/2011	3	525	280	240	210	290	440	100	70	20.5	12.2
8/17/2011	4	0	0	250	340	495	1425	525	55	68.0	5.2
7/9/2012	1	1050	140	140	280	190	395	95	15	24.0	10.6
7/9/2012	2	0	0	200	225	140	325	140	15	24.0	8.2
7/9/2012	3	0	515	310	225	250	580	240	27	65.0	12.8
7/9/2012	4	0	570	510	260	290	750	435	53	54.0	11.8
7/2/2013	1	0	400	460	430	320	365	145	25	66.0	15.4
7/2/2013	2	0	150	400	250	245	515	225	36	53.0	9.8
7/2/2013	3	0	800	325	320	255	445	205	25	60.0	18.0
7/2/2013	4	0	275	565	385	245	495	250	19	28.0	13.5
7/1/2014	1	600	420	375	225	235	320	165	22	57.0	15.5
7/1/2014	2	0	50	350	300	175	225	25	7	41.0	14.0
7/1/2014	3	0	100	510	465	275	420	250	38	52.0	11.0
7/1/2014	4	400	275	260	220	225	375	225	19	51.0	11.2
7/6/2015	1	0	75	300	350	325	350	325	70	42.0	8.2
7/6/2015	2	0	225	350	400	325	525	300	24	20.5	10.8
7/6/2015	3	0	150	475	150	150	200	50	6	6.5	19.6
7/6/2015	4	0	275	400	225	275	375	150	16	17.0	14.6
7/5/2016	1	0	175	600	300	375	625	100	25	34.0	12.8
7/5/2016	2	0	500	375	375	300	700	100	50	26.0	14.6
7/5/2016	3	0	275	300	475	725	500	100	25	15.0	12.9
7/5/2016	4	0	100	725	250	300	500	125	25	15.0	13.9
7/6/2017	1	0	625	400	425	400	600	300	62	47.0	13.7
7/6/2017	2	0	550	275	350	250	575	275	44	34.0	13.3
7/6/2017	3	0	775	200	325	300	575	175	14	13.0	17.6
7/6/2017	4	0	550	325	325	400	525	250	44	25.0	14.0
6/28/2018	1	0	700	150	200	150	300	100	18	7.5	23.2
6/28/2018	2	700	275	250	450	300	375	125	13	6.0	14.5
6/28/2018	3	0	100	500	375	400	625	250	50	33.0	9.9
6/28/2018	4	0	250	400	350	450	700	225	66	39.0	10.3
7/22/2019	1	0	350	200	175	150	100	25	2	2.0	26.9
7/22/2019	2	0	300	325	350	300	450	225	25	56.0	11.7
7/22/2019	3	0	225	350	300	325	600	275	30	57.0	9.7
7/22/2019	4	0	125	425	300	25	450	225	25	31.0	10.8

Note: GMPS = Geometric mean particle size.

Appendix D.1.–Page 2 of 2.

Sample Date	Sample No.	Volume (mL) Retained Each Sieve (mm)									
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15	Imhoff	GMPS
7/8/2020	1	0	75	525	525	475	925	400	75	40.0	8.3
7/8/2020	2	0	300	200	450	425	750	450	75	75.0	7.9
7/8/2020	3	0	275	450	575	450	775	325	25	70.0	10.3
7/8/2020	4	0	150	325	550	350	625	450	50	117.0	7.6
7/7/2021	1	0	225	550	500	400	725	500	75	55.0	9.2
7/7/2021	2	0	275	550	475	350	525	400	50	38.0	11.3
7/7/2021	3	0	325	525	525	350	650	325	25	37.0	12.1
7/7/2021	4	0	575	475	425	325	600	250	25	26.0	15.3
7/5/2022	1	0	50	800	825	500	700	275	25	11.0	12.2
7/5/2022	2	0	150	800	650	350	250	50	0	3.0	19.8
7/5/2022	3	0	225	825	450	425	575	225	25	16.5	14.2
7/5/2022	4	0	325	575	450	700	250	325	25	17.0	14.1
7/6/2023	1	0	425	600	350	350	700	400	75	60.0	11.3
7/6/2023	2	275	300	725	425	300	500	300	75	30.0	13.4
7/6/2023	3	0	425	500	400	350	600	225	25	20.0	14.2
7/6/2023	4	0	450	425	550	300	300	200	25	8.0	17.5

Note: GMPS = Geometric mean particle size.

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Appendix D.2.–Lower Slate Creek SP2 pink salmon spawning substrate data, 2011–2023.

Sample Date	Sample No.	Volume (mL) Retained Each Sieve (mm)									
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15	Imhoff	GMPS
8/17/2011	1	1050	130	305	210	205	350	200	20	11.5	11.0
8/17/2011	2	0	120	320	405	335	740	415	85	53.0	7.3
8/17/2011	3	0	400	350	295	290	540	200	40	17.5	13.4
8/17/2011	4	0	100	450	580	320	390	160	15	25.0	12.8
7/9/2012	1	0	250	380	270	260	475	195	23	46.5	11.8
7/9/2012	2	600	75	395	295	180	375	135	15	18.5	12.0
7/9/2012	3	0	450	340	370	340	590	295	30	18.0	12.8
7/9/2012	4	0	0	320	460	285	545	300	28	16.5	8.3
7/2/2013	1	0	310	490	440	505	640	410	35	107.5	9.8
7/2/2013	2	0	420	270	240	215	560	150	34	42.0	13.1
7/2/2013	3	0	550	885	375	290	570	290	45	108.0	15.0
7/2/2013	4	0	785	230	340	240	580	330	30	46.5	14.8
7/1/2014	1	0	1225	450	495	305	760	300	12	110.0	17.7
7/1/2014	2	0	450	250	250	200	300	100	11	65.0	16.5
7/1/2014	3	0	850	480	200	175	490	175	30	106.0	18.4
7/1/2014	4	0	150	350	200	225	300	120	15	20.0	13.3
7/6/2015	1	0	75	175	325	425	475	50	6	5.5	10.7
7/6/2015	2	500	825	225	225	175	250	50	11	8.0	28.9
7/6/2015	3	300	225	500	200	175	300	50	15	21.5	18.1
7/6/2015	4	275	100	200	200	150	225	100	22	9.0	12.2
7/5/2016	1	0	300	275	400	350	525	100	25	26.0	13.1
7/5/2016	2	0	0	200	600	575	550	150	25	30.0	9.0
7/5/2016	3	0	0	100	1150	450	650	100	25	26.0	10.1
7/5/2016	4	125	275	575	525	450	475	150	25	39.0	14.3
7/6/2017	1	0	0	675	600	550	525	350	82	47.0	9.8
7/6/2017	2	0	300	300	650	475	500	375	60	28.0	10.8
7/6/2017	3	0	525	450	500	475	400	50	5	3.0	19.7
7/6/2017	4	0	375	375	550	475	625	325	58	22.0	11.7
6/28/2018	1	0	450	575	475	600	625	175	28	14.0	14.9
6/28/2018	2	725	325	400	400	300	375	150	22	18.0	15.4
6/28/2018	3	700	525	500	275	225	200	100	28	12.0	23.1
6/28/2018	4	0	575	400	250	375	725	125	20	8.0	15.6
7/25/2019	1	0	550	225	225	200	175	25	4	4.0	27.3
7/25/2019	2	0	1150	375	275	425	575	325	75	62.0	17.5
7/25/2019	3	0	800	200	325	325	375	175	15	22.0	19.7
7/25/2019	4	0	975	550	300	375	275	75	5	5.0	28.0

Note: GMPS = Geometric mean particle size.

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Appendix D.2.–Page 2 of 2.

Sample Date	Sample No.	Volume (mL) Retained Each Sieve (mm)									
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15	Imhoff	GMPS
7/8/2020	1	0	550	475	375	275	750	225	25	67.0	13.5
7/8/2020	2	0	350	575	250	225	575	100	25	21.0	15.7
7/8/2020	3	0	175	375	300	250	500	250	25	21.0	10.7
7/8/2020	4	0	375	700	475	650	425	100	25	28.0	16.6
7/7/2021	1	0	300	550	375	300	675	275	25	11.0	12.5
7/7/2021	2	0	700	700	625	400	175	100	50	30.0	23.2
7/7/2021	3	0	1075	475	300	325	350	75	25	13.0	27.2
7/7/2021	4	0	875	350	350	300	475	250	50	12.0	18.8
7/5/2022	1	0	350	575	400	400	650	200	75	8.5	13.4
7/5/2022	2	0	0	500	575	600	400	200	50	41.0	10.6
7/5/2022	3	0	350	450	425	375	500	125	25	14.0	15.2
7/5/2022	4	850	500	275	325	275	425	200	25	15.0	15.5
7/6/2023	1	1250	150	300	175	50	50	25	5	3.0	26.3
7/6/2023	2	0	500	250	250	200	325	50	5	3.0	21.6
7/6/2023	3	0	175	200	125	50	125	25	5	1.0	22.6
7/6/2023	4	600	375	350	500	425	625	225	75	34.0	11.9

Note: GMPS = Geometric mean particle size.

APPENDIX E: SEDIMENT DATA AND LAB REPORT

Appendix E.1.–Lower Slate Creek sediment compositions, 2011–2023.

Sample Date	Particle Size Data				% Total Solids	% Total Volatile Solids	Total Sulfide (mg/kg)	% Total Organic Carbon
	% Clay	% Silt	% Sand	% Coarse material (>2mm)				
10/3/2011	2	4	94	0.4	78	3.38	<0.55	2.04
7/3/2012	2	0	98	0.1	79.2	3.37	<1.5	1.67
7/2/2013	2	2	96	0	74.6	1.63	ND	1.67
7/28/2014	2.3	3.8	91.8	0.9	75.4	3.22	<1.3	0.577
7/6/2015	1.8	3.1	72.2	22.8	84.4	ND	<1.2	0.473
7/5/2016	0	23.1	55.1	21.8	70.3	7.7	<2.5	0.585
7/7/2017	1.5	6.9	84.5	7.1	59.6	2.8	<3.2	0.494
6/28/2018	1.5	3.3	69.6	25.6	64.2	3	<2.9	0.416
7/22/2019	0	2.6	37.4	60	67.2	2.9	<2.6	0.366
7/8/2020	0.9	2.6	85.5	1.2	73.8	3.15	<1.4	0.612
7/8/2020	0.3	0.7	77.8	19.1	72.8	2.9	1.7	0.376
7/8/2020	0.3	0.4	84.4	13	74.1	2.8	1.33	0.402
7/7/2021	0.1	0.3	76.4	21.6	74	2.75	<1.3	0.352
7/7/2021	0.2	2.5	86.5	8.9	68.6	3.5	<1.5	0.563
7/7/2021	0.3	3.3	99.6	12.8	68.4	3.2	<4.8	0.586
7/5/2022	ND	1.4	84.6	14	70.4	2.4	<0.84	0.411
7/5/2022	ND	1.4	66.9	31.7	71.2	2.6	<0.82	0.469
7/5/2022	ND	1.6	81	17.4	69.5	2.7	<0.82	0.424
7/6/2023	0.5	2	83.1	15.9	70.6	2.2	<1.4	0.32
7/6/2023	0.9	4	76.5	23	67.9	2	<1.4	0.48
7/6/2023	1.1	2	83.2	14.8	72.1	1.9	<1.3	0.32

Note: In 2022, lab results did not distinguish between clay and silt. ND = no data.

Appendix E.2.—East Fork Slate Creek sediment compositions, 2011–2023.

Sample Date	Particle Size Data				% Total Solids	% Total Volatile Solids	Total Sulfide (mg/kg)	% Total Organic Carbon
	% Clay	% Silt	% Sand	% Coarse material (>2mm)				
10/3/2011	10	4	86	1.6	60.2	7.81	<0.55	11
7/10/2012	40	34	26	0	23.7	28.54	<1.5	16.7
7/1/2013	6	12	82	0	43.7	13.3	ND	18.3
7/30/2014	3.8	21.1	75	0	65.5	6.21	<1.5	1.84
7/7/2015	2.3	6.9	82.3	8.5	76.2	ND	<1.3	0.792
7/6/2016	3.5	24.8	53.7	18	21	31.4	<6.8	13
7/7/2017	34.9	32.2	28.8	4	18.9	32.5	<9	16.3
6/29/2018	1.5	6.5	53.5	38.5	74.8	6.7	<1.8	1.75
7/22/2019	0.5	4.5	47.5	47.5	39.1	9.3	<4.5	1.72
7/9/2020	0.9	2.7	59.8	48.9	61.6	7.6	4.8	2.68
7/9/2020	0.9	2.2	24.6	58.6	77.4	3.2	2.1	7.52
7/9/2020	0.6	0.1	31.3	63.8	81.4	3.8	1.9	1.21
7/6/2021	0.1	0.3	17.9	63.1	75.3	3.8	<0.4	0.307
7/6/2021	0.2	0.3	35.9	67.3	72.7	3.5	<0.4	0.733
7/6/2021	0.1	0.3	36.4	58.1	77	4.9	<1.2	5.36
7/6/2022	1.5	3.2	58.6	34	76.5	3.4	<0.74	2.72
7/6/2022	0.8	5.2	35	57.1	84.6	3.4	0.71	2.65
7/6/2022	1.5	6.6	79.2	4.1	84	2.4	<0.69	3.19
7/5/2023	2	11.7	33.1	57.3	55.3	4.3	<1.6	3.07
7/5/2023	0.3	2.5	35	64.8	70.9	5.1	<1.3	1.59
7/5/2023	0.7	3	54.8	39.6	68.4	3.7	<1.4	1.31

Note: ND = no data.

Appendix E.3.—Upper Slate Creek sediment compositions, 2011–2023.

Sample Date	Particle Size Data				% Total Solids	% Total Volatile Solids	Total Sulfide (mg/kg)	% Total Organic Carbon
	% Clay	% Silt	% Sand	% Coarse material (>2mm)				
10/6/2011	4	2	94	0	72.1	4.12	<1.5	5.46
7/2/2012	2	0	98	0.3	79.6	2.9	<1.5	3.74
7/1/2013	4	0	96	0.1	74.2	2.73	ND	5.5
7/30/2014	4.3	8.2	87.5	0	72.4	3.88	<1.4	0.868
7/7/2015	1.5	0.2	31.9	66.3	76.5	ND	<1.3	1.04
7/6/2016	0	2.9	73.1	24	62.9	5	<2.2	2.14
7/7/2017	3	4.6	89.9	2.5	72.7	3.45	<2.4	0.843
6/28/2018	2.7	5.3	80.6	11.4	67.6	4.1	<2.7	0.815
8/5/2019	2.5	0.3	60.5	36.6	72.4	3.75	<2.4	0.676
7/9/2020	0.6	0.3	12.4	97.4	76.9	3.5	2.5	0.328
7/9/2020	0.7	0.5	74.4	22.4	70.6	4.1	1.8	0.734
7/9/2020	0.6	0.4	52.3	41	75.5	4.5	2.9	1.05
7/7/2021	0.1	0.9	90.9	4.5	68.2	3.9	<1.5	0.871
7/7/2021	0	0.3	93.3	6.8	67.7	3.7	<1.5	0.585
7/7/2021	0.2	0.7	93.9	5.3	63.7	4.4	<5.2	0.818
7/6/2022	1.4	6	73.3	20.6	86.7	1.3	<0.69	0.775
7/6/2022	0.7	2.7	56.4	27	82.4	1.6	<0.72	0.694
7/6/2022	0.8	4.4	81.1	9.5	83.8	1.5	<0.71	0.72
7/5/2023	0.3	3.4	55.3	42.5	72.6	2.8	<1.3	0.47
7/5/2023	1.9	11.4	83.3	7.5	63.2	3.7	<1.6	0.89
7/5/2023	2.5	13.4	73.9	9.2	64.1	4	<1.5	1.34

Note: ND = no data.

Appendix E.4.–Lower Johnson Creek sediment compositions, 2011–2023.

Sample Date	Particle Size Data				% Total Solids	% Total Volatile Solids	Total Sulfide (mg/kg)	% Total Organic Carbon
	% Clay	% Silt	% Sand	% Coarse material (>2mm)				
10/3/2011	2	2	96	0	74.3	2.01	<0.55	0.89
7/2/2012	8	0	92	0	77.7	2.55	<1.5	1.19
7/1/2013	2	2	96	0.3	73.2	0.9	ND	1.08
7/30/2014	2.9	4.8	91.4	0.2	73.7	1.93	<1.4	0.263
7/6/2015	0.4	1.1	41.9	56.6	80	ND	<1.3	0.376
8/8/2016	5.1	25.4	69.4	0	71.9	2.4	<2.5	0.422
7/7/2017	4.1	20.8	72.6	2.5	ND	ND	ND	ND
6/29/2018	2.8	5.6	89.4	2.2	77.6	2.35	<2.5	0.483
7/22/2019	1.1	2.4	89.5	7	71.3	2.5	<2.8	0.452
7/9/2020	0.2	1	80.8	15.2	77.4	2.2	2.5	0.298
7/9/2020	0.6	1.7	88.2	6.5	74.2	2.4	3.6	0.341
7/9/2020	0.7	0.8	84.1	3.2	78.8	2.1	1.4	0.269
7/6/2021	0.1	3.8	97.2	1.8	65.4	2.2	<1.4	0.319
7/6/2021	0.2	2.1	87.3	4.7	72.1	2.4	<1.3	0.34
7/6/2021	0.2	2.9	101.6	0.1	62.5	3.4	<1.5	0.27
7/5/2022	2.1	8.6	89.1	0.1	64.3	2.45	<0.92	0.398
7/5/2022	4.2	4.5	89.2	2.1	66.5	2.4	<0.89	0.34
7/5/2022	5.3	18.7	74.7	1.4	59.4	3.7	<1	0.811
7/5/2023	1.7	5.6	86	6.1	71.5	1.75	<1.3	0.277
7/5/2023	1.5	8.1	81.5	9.8	69.4	2.1	<1.4	0.31
7/5/2023	2.2	8.8	74.4	19.6	65.4	1.9	<1.5	0.38

Note: ND = no data.

Appendix E.5.–Lower Sherman Creek sediment compositions, 2011–2023.

Sample Date	Particle Size Data				% Total Solids	% Total Volatile Solids	Total Sulfide (mg/kg)	% Total Organic Carbon
	% Clay	% Silt	% Sand	% Coarse material (>2mm)				
10/4/2011	2	2	96	0.1	73.2	2.75	1.5	0.54
7/3/2012	4	0	96	0.1	78.6	3.05	<0.55	0.82
7/1/2013	2	2	96	0.6	75.7	0.75	ND	0.61
7/28/2014	3.4	6.5	89.9	0.3	76.7	2.5	<1.3	0.354
7/7/2015	1.8	3	86.1	9	76.2	ND	<1.3	0.399
7/6/2016	0.1	0.9	71.2	27.8	80.5	3.1	<2.4	0.322
7/7/2017	1.5	5.4	67	26.1	76.5	2	<2.5	0.288
6/29/2018	2.3	2.5	88.9	6.3	69.3	2.5	<2.6	0.294
7/22/2019	0	1.6	72.2	26.2	61.4	2.6	<3.2	0.317
7/9/2020	1	1	87.3	10.7	68.4	3.2	1.5	0.443
7/9/2020	0.2	1.3	97.7	14.5	70.1	2.6	3.5	0.417
7/9/2020	0.3	0.9	89	14.5	70.5	2.8	3	0.417
7/6/2021	0.3	0.3	104.7	1	70	2.55	<0.5	0.252
7/6/2021	0.3	0	93.5	11.9	67.8	2.1	<1.4	0.19
7/6/2021	0	0.5	88.3	11.1	68.5	2.3	<1.4	0.281
7/6/2022	1.2	11.5	81.6	4.9	70.2	2.25	<0.85	0.501
7/6/2022	0.4	0.7	71	16	81.1	2.1	<0.73	0.291
7/6/2022	0.5	2.4	85.3	8.9	71.1	2.2	<0.79	0.278
7/5/2023	1.4	6.7	79.8	10.8	68.6	1.95	<1.4	0.37
7/5/2023	1.3	4.5	81.3	10.5	77.1	1.7	<1.3	0.3
7/5/2023	1.5	7	82.2	17.4	69.9	1.5	<1.4	0.35

Note: ND = no data.

Appendix E.6.—Lower Slate Creek sediment element concentrations, 2011–2023.

Sample Date	Concentration (mg/kg dry weight)										
	Al	As	Ag	Cd	Cr	Cu	Hg	Pb	Ni	Se	Zn
10/3/2011	13,600	16.2	<0.267	1.46	29.4	56.7	<0.136	7.79	47.4	0.72	220
7/3/2012	13,600	9.31	<0.25	1.22	32	50.7	<0.122	8.45	43.2	<0.17	200
7/2/2013	12,300	23.7	<0.246	1.29	94.5	56.7	<0.122	9.14	73.4	1.94	205
7/28/2014	12,000	20.1	0.08	1.21	20	51.1	0.06	8.78	40.8	1.3	189
7/6/2015	12,000	14.9	0.07	0.53	18.9	39.1	0.04	6.86	30	0.7	131
7/5/2016	12,800	17	0.079	0.735	20.4	39.8	0.057	7.16	35.2	1.3	173
7/7/2017	12,000	16.4	0.101	0.681	18.3	40.9	<0.031	8.16	31.7	<1.6	145
6/28/2018	12,300	14.6	0.077	0.554	19.3	40.1	0.038	6.93	32.4	0.98	129
7/22/2019	11,000	14.3	0.083	0.559	16.9	39	0.074	6.36	34.2	<1	132
7/8/2020	10,700	15.1	0.077	0.602	19.1	41.3	0.0513	6.8	32.8	0.96	84.1
7/8/2020	10,800	12.8	0.063	0.489	19.3	35.5	0.0565	5.57	31.3	0.82	89.9
7/8/2020	9,770	11.3	0.0688	0.587	18.5	34.2	0.039	5.27	31.7	0.87	96.9
7/7/2021	10,600	12.8	0.073	0.58	17.1	39.9	0.058	6.88	32.2	<1.3	124
7/7/2021	12,600	20.3	0.109	0.811	19.7	50.9	0.067	8.07	38.6	1.5	168
7/7/2021	11,300	22.2	0.11	0.838	18.3	48.9	0.078	8.43	36.5	1.6	160
7/5/2022	8,230	8.88	0.065	0.396	13.2	32	0.048	4.19	25.6	<0.97	97.2
7/5/2022	9,100	10.9	0.059	0.381	13.9	32.8	0.034	5.61	23.8	<1	100
7/5/2022	11,400	11.2	0.069	0.482	18	37.2	0.033	6.42	30.6	<1.3	127
7/6/2023	12,300	12.6	0.092	0.441	17.5	43.8	0.118	6.85	29.2	0.84	112
7/6/2023	12,400	12.3	0.065	0.428	18.7	42.7	0.04	5.91	30.1	<1.2	125
7/6/2023	11,500	16.8	0.064	0.394	18.8	35.5	0.042	5.23	28.4	1.9	121

Appendix E.7.—East Fork Slate Creek sediment element concentrations, 2011–2023.

Sample Date	Concentration (mg/kg dry weight)										
	Al	As	Ag	Cd	Cr	Cu	Hg	Pb	Ni	Se	Zn
10/3/2011	20,100	30	<0.335	20.9	29.5	88.4	<0.188	8.5	143	1.41	1360
7/10/2012	15,300	24	<0.739	23.2	38.9	159	<0.369	14.2	153	<1.48	1490
7/1/2013	13,900	42.2	<0.425	13.9	32.7	73.4	<0.216	12.5	79.8	4.79	844
7/30/2014	13,300	39.1	0.14	12.1	14.6	55.7	0.04	6.94	85.3	2.4	812
7/7/2015	12,300	22.3	0.12	5.87	15.1	46.7	0.05	4.48	46.8	1.7	333
7/6/2016	16,500	51.5	0.19	8.2	16.5	59.5	0.109	5.54	86.1	3.1	634
7/7/2017	12,900	29.9	0.3	9.65	15	62.3	0.143	6.61	69.9	<5	625
6/29/2018	12,300	59.1	0.146	18.7	13	47.6	0.049	6.07	127	3.37	1020
7/22/2019	12,300	55.9	0.179	10.3	15.5	63.8	<0.039	5.93	83.1	2.9	665
7/9/2020	11,100	23.4	0.13	1.06	14.7	27.4	0.0758	4.5	25.1	1.79	193
7/9/2020	8,290	18	0.0674	4.58	10.2	29.3	0.0368	3.55	44.3	1.26	609
7/9/2020	9,650	26.1	0.0991	4.79	13.9	29.6	0.0932	4.66	49.7	3.4	213
7/6/2021	7,900	35	0.084	8.8	3.1	34.3	0.045	7.5	51.6	1.2	477
7/6/2021	8,770	39.3	0.275	7.39	8.29	33.4	0.046	6.11	56.1	4	551
7/6/2021	8,050	23.3	0.086	5.81	7.76	23.2	0.09	3.12	54.3	1.6	509
7/6/2022	10,100	24.5	0.113	1.79	13.4	22	0.026	5.01	28.2	2.9	204
7/6/2022	6,240	27.9	0.061	8.27	5.32	25.9	<0.021	2.25	58.2	1.05	526
7/6/2022	7,110	11.4	0.057	0.656	7.11	22	0.039	3.25	12.8	<1.2	115
7/5/2023	9,520	30.4	0.116	2.35	9.63	54.8	0.074	4.7	39.4	3	266
7/5/2023	11,100	48.2	0.099	3.68	11.3	37.5	0.054	9.16	44.3	11.6	388
7/5/2023	10,700	32.9	0.192	5.76	8.16	28.7	0.031	5.23	53.3	4.3	432

Appendix E.8.—Upper Slate Creek sediment element concentrations, 2011–2023.

Sample Date	Concentration (mg/kg dry weight)										
	Al	As	Ag	Cd	Cr	Cu	Hg	Pb	Ni	Se	Zn
10/6/2011	22,500	17.9	<0.278	0.722	127	53.4	<0.0489	3.37	87.5	0.809	130
7/2/2012	20,300	14.4	<0.256	0.776	125	55.4	<0.126	4.05	78.4	0.606	134
7/1/2013	14,600	13.5	<0.256	0.75	101	44.6	<0.038	2.7	55	3.21	105
7/30/2014	14,900	19.2	0.06	0.69	84.2	45.8	0.03	2.86	55.7	1.8	111
7/7/2015	14,500	14.2	0.08	0.76	92.2	47	0.11	3.17	54	2.3	109
7/6/2016	14,000	18	0.092	0.507	71.7	37	0.051	2.69	48.5	2.1	111
7/7/2017	15,600	17	0.06	0.49	64.1	38.1	0.03	3.06	47.3	1.4	101
6/28/2018	14,700	19.7	0.101	0.789	105	55.1	0.047	3.97	76.4	2.86	133
8/5/2019	15,100	17.1	0.071	0.808	110	44.5	0.051	3.58	60.2	1.5	116
7/9/2020	9,650	12.3	0.105	0.561	68.2	34.5	0.0393	2.93	45.5	1.9	94.4
7/9/2020	12,600	16.2	0.095	0.472	81.5	37.1	0.173	2.94	49.5	2.06	139
7/9/2020	11,700	18.7	0.0687	0.672	82.3	41	0.0336	3.1	52.7	2.04	86.8
7/7/2021	15,600	14.8	0.08	0.609	83.7	47.7	0.05	3.04	58.3	1.8	117
7/7/2021	13,700	13.5	0.076	0.611	71.1	44.7	0.049	3.75	53.9	1.8	118
7/7/2021	15,200	19.2	0.1	0.73	84.1	57.1	0.051	3.94	63.7	2.2	131
7/6/2022	8,490	14.6	0.066	0.383	40.2	29.5	0.024	2.65	31.3	1.77	71.1
7/6/2022	11,300	13.6	0.061	0.457	58.4	36.5	0.04	2.66	48.3	1.72	97
7/6/2022	11,600	11	0.045	0.342	60.4	34.8	0.029	2.28	38.9	1.1	76.3
7/5/2023	15,600	12.8	0.057	0.485	94.6	42.6	<0.024	3.49	54.2	1.7	103
7/5/2023	16,400	18.9	0.076	0.738	79.3	46.8	0.06	3.38	58.5	1.8	120
7/5/2023	18,500	20.2	0.091	1.05	100	55.5	0.052	3.92	67.9	2.1	147

Appendix E.9.–Lower Johnson Creek sediment element concentrations, 2011–2023.

Sample Date	Concentration (mg/kg dry weight)										
	Al	As	Ag	Cd	Cr	Cu	Hg	Pb	Ni	Se	Zn
10/3/2011	13,100	16.2	<0.266	0.238	31.5	73.1	<0.0386	9.76	27.3	<0.181	93.3
7/2/2012	13,100	12.8	0.342	0.25	35.5	76.8	<0.123	9.45	23.4	<0.167	97.3
7/1/2013	10,300	11.9	0.269	0.492	24.4	56.1	<0.0354	8	15.7	<0.163	121
7/30/2014	10,300	16.5	0.32	0.16	22.2	68.2	0.02	10.9	16.9	<0.5	83.4
7/6/2015	10,900	12.5	0.16	0.15	18.1	71.1	<0.02	8.04	17.7	<0.8	79.7
8/8/2016	9,470	13	0.574	0.15	18.9	76.3	0.02	8.41	15.1	<0.57	65.7
7/6/2017	6,730	10.3	0.172	0.115	11.7	46.2	0.064	5.96	10.3	<1.5	48
6/29/2018	13,600	20.5	0.139	0.264	30.2	68.4	0.015	11.9	24.6	<0.63	109
7/22/2019	10,200	16.1	0.205	0.168	20.2	60.1	<0.028	7.8	16.4	<0.96	81.2
7/9/2020	10,300	21.5	0.107	0.158	19.8	95.4	0.0137	5.44	17.9	<0.51	89.3
7/9/2020	9,850	16.7	0.08	0.181	19.9	53.9	0.0171	8.1	18.4	<0.53	85.8
7/9/2020	9,110	13.3	0.109	0.164	18.8	44.7	0.0187	5.7	16	<0.48	94.1
7/6/2021	9,820	13.8	0.135	0.127	20.5	60	0.034	6.16	16.4	<1.5	70.3
7/6/2021	10,500	12.4	0.118	0.161	21.4	62.1	0.028	6.14	16.4	<1.4	76.4
7/6/2021	11,800	15.6	0.224	0.188	24.5	101	0.048	7.98	19.2	<1.5	98.1
7/5/2022	12,800	20.5	0.154	0.208	22.7	72.6	<0.027	9.37	20.2	<1.2	102
7/5/2022	13,100	19.7	0.121	0.211	24.1	80.3	0.026	9.46	20.5	<1.2	101
7/5/2022	11,800	21	0.245	0.212	21	87.6	<0.03	9.57	18.8	<1.2	91.9
7/5/2023	12,200	17.1	0.074	0.209	21.8	58.1	<0.026	7.24	18.4	<0.2	91.5
7/5/2023	11,900	21.4	0.071	0.201	21.4	58.8	<0.028	8.11	18	<1.2	93.4
7/5/2023	11,000	17.6	0.152	0.214	23.8	64.1	<0.03	8.01	17.2	<1.4	87.6

Appendix E.10.–Lower Sherman Creek sediment element concentrations, 2011–2023.

Sample Date	Concentration (mg/kg dry weight)										
	Al	As	Ag	Cd	Cr	Cu	Hg	Pb	Ni	Se	Zn
10/4/2011	18,200	28.9	<0.259	0.389	46.2	94	<0.0455	6.7	45.9	<0.176	110
7/3/2012	17,900	24.3	0.289	0.578	51.4	79.1	<0.124	8.43	40.2	<0.174	128
7/1/2013	15,400	25.4	0.306	<0.52	37.4	69.4	<0.0384	7.39	30.9	1.77	111
7/28/2014	14,900	27.9	0.14	0.36	33.6	68.4	0.03	6.97	31.1	1.2	119
7/7/2015	17,500	37	0.25	0.32	30.9	70.8	0.02	11	38	2	134
7/6/2016	13,800	19.9	0.097	0.388	27.5	72.5	<0.02	6.6	32.9	1.1	123
7/7/2017	17,400	23.5	0.097	0.194	31.8	58.1	0.045	4.69	28.5	<1.3	90.2
6/29/2018	15,600	35.2	0.135	0.353	33.7	81.9	<0.014	8.05	34.8	<0.65	120
7/22/2019	17,400	42.4	0.205	0.222	36.1	59.6	<0.032	6.19	34.2	<1.2	118
7/9/2020	15,800	30.2	0.092	0.276	32.1	49.3	0.0313	6.65	29.6	0.71	86.5
7/9/2020	14,000	22.6	0.132	0.223	30.1	52.2	0.0262	5.66	27.7	0.72	104
7/9/2020	13,000	26.5	0.171	0.201	30.5	54.8	0.0243	9.68	27.1	0.86	104
7/6/2021	15,900	16.3	0.088	0.171	46.9	72	<0.028	30.1	36.2	<1.4	87
7/6/2021	11,800	11.3	0.131	0.156	39.5	61.4	<0.029	5.16	33.6	<1.4	77.8
7/6/2021	13,500	15.6	0.09	0.161	43.3	105	0.029	4.1	30.5	<1.4	79.2
7/6/2022	7,860	10.5	0.04	0.087	19.8	31.7	<0.027	2.24	16.1	<1.2	41.8
7/6/2022	2,490	1.57	<0.021	<0.021	6.3	8.41	<0.021	0.585	4.72	<1.1	13
7/6/2022	12,700	21.3	0.117	0.109	27.1	40.6	0.027	7.75	22.6	<1.2	64.1
7/5/2023	16,300	24.2	0.105	0.189	29.1	59	<0.027	5.25	28	<1.4	90
7/5/2023	17,000	23	0.132	0.198	36.7	58.5	0.054	5.9	30	2.08	95.2
7/5/2023	18,000	26.6	0.218	0.353	35	78.1	0.038	8.89	33.5	1.9	111



ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

August 14, 2023

Analytical Report for Service Request No: K2308139

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

RE: Coeur AK Biomonitoring

Dear Bill,

Enclosed are the results of the sample(s) submitted to our laboratory July 19, 2023
For your reference, these analyses have been assigned our service request number **K2308139**.

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



for Mark Harris
Project Manager



ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

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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.pjllabs.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/analyte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Received: 07/19/2023

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:

Six soil samples were received for analysis at ALS Environmental on 07/19/2023. 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:

No significant anomalies were noted with this analysis.

General Chemistry:

Method PSEP Sulfide, 07/24/2023: Samples in this delivery group were received past holding time. The analysis was performed as soon as possible after receipt by the laboratory. The data was flagged to indicate the holding time violation.
Method PSEP TOC, 07/24/2023: Samples in this delivery group were received past holding time. The analysis was performed as soon as possible after receipt by the laboratory. The data was flagged to indicate the holding time violation.

Approved by 

Date 08/14/2023



Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com



CHAIN OF CUSTODY

124481

001

SR# K2308139

COC Set _____ of _____

COC# _____

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

Project Name: <u>Coeur AK Biomonitoring</u>		Project Number: _____		NUMBER OF CONTAINERS	7D	14D	28D	180D	999D						Remarks			
Project Manager: <u>Erika King</u>					160.4 Modified / TVS	P-SEP Sulfide / P-SEP Sulfide	P-SEP TOC / P-SEP TOC	P-SEP TOC / P-SEP TOC T	7471B / Hg	200 B / Metals T	ASTM D422M / Partsize	160.3 Modified / TS	1	2		3	4	5
Company: <u>Coeur AK / ADF&B</u>													6	7		8	9	10
Address: <u>8023rd st Douglas, AK 99824</u>													11	12		13	14	15
Phone #: <u>907-465-6979</u>		Email: <u>erika.king@alaska.gov</u>																
Sampler Signature: <u>[Signature]</u>		Sampler Printed Name: <u>Erika King</u>																
CLIENT SAMPLE ID	LABID	SAMPLING Date Time	Matrix															
1. <u>2023KGM LSC S1</u>		<u>7/5/23 10:15</u>	<u>soil</u>	<u>3</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>							
2. <u>2023KGM LSC S2</u>		<u>7/5/23 10:15</u>	<u>soil</u>	<u>3</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>							
3. <u>2023KGM LSC S3</u>		<u>7/5/23 10:15</u>	<u>soil</u>	<u>3</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>							
4. <u>2023KGM LSC S1</u>		<u>7/5/23 09:00</u>	<u>soil</u>	<u>3</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>							
5. <u>2023KGM LSC S2</u>		<u>7/5/23 9:00</u>	<u>soil</u>	<u>3</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>							
6. <u>2023KGM LSC S3</u>		<u>7/5/23 9:00</u>	<u>soil</u>	<u>3</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>							
7.																		
8.																		
9.																		
10.																		

- 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.# _____

Bill To: Coeur, AK

pstrom@coeur.com

Turnaround Requirements

24 hr. 48 hr.

Standard

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 Ti 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 Ti Sn V Zn Hg

Special Instructions/Comments: please send lab report to: kate kanouse: kate.kanouse@alaska.gov / erika.king: erika.king@alaska.gov

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other _____ (Circle One)

please send billing info to pete strow: ~~pstrom~~ pstrom@coeur.com

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: <u>[Signature]</u>	Signature: <u>[Signature]</u>	Signature: _____	Signature: _____	Signature: _____	Signature: _____
Printed Name: <u>Erika King</u>	Printed Name: <u>Diane Piro</u>	Printed Name: _____	Printed Name: _____	Printed Name: _____	Printed Name: _____
Firm: <u>ADF&B</u>	Firm: <u>ALS</u>	Firm: _____	Firm: _____	Firm: _____	Firm: _____
Date/Time: <u>7/18/23 9:00</u>	Date/Time: <u>7/19/23 1050</u>	Date/Time: _____	Date/Time: _____	Date/Time: _____	Date/Time: _____

Cooler Receipt and Preservation Form

Client Coquer AK Service Request K23 08139
 Received: 7/19/23 Opened: 7/19/23 By: PDP Unloaded: 7/19/23 By: PDP

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
<u>3.4</u>		<u>IR010</u>				<u>781.310043049</u>	

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

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Analysis Method: 160.3 Modified
Prep Method: None

Service Request: K2308139
Date Collected: 07/5/23
Date Received: 07/19/23
Units: Percent
Basis: As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
2023KGMLJCS1	K2308139-001	71.6	-	-	1	07/20/23 11:17	
2023KGMLJCS2	K2308139-002	69.4	-	-	1	07/20/23 11:17	
2023KGMLJCS3	K2308139-003	65.4	-	-	1	07/20/23 11:17	
2023KGMLSCS1	K2308139-004	70.6	-	-	1	07/20/23 11:17	
2023KGMLSCS2	K2308139-005	67.9	-	-	1	07/20/23 11:17	
2023KGMLSCS3	K2308139-006	72.1	-	-	1	07/20/23 11:17	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/20/23

Replicate Sample Summary
Inorganic Parameters

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001

Units: Percent
Basis: As Received

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>Sample Result</u>	<u>Duplicate Sample K2308139-001DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total	160.3 Modified	-	71.6	71.3	71.5	<1	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.

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Analysis Method: 160.4 Modified
Prep Method: None

Service Request: K2308139
Date Collected: 07/5/23
Date Received: 07/19/23

Units: Percent
Basis: Dry, per Method

Solids, Total Volatile

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
2023KGMLJCS1	K2308139-001	1.80	0.10	-	1	07/20/23 13:35	*
2023KGMLJCS2	K2308139-002	2.10	0.10	-	1	07/20/23 13:35	*
2023KGMLJCS3	K2308139-003	1.90	0.10	-	1	07/20/23 13:35	*
2023KGMLSCS1	K2308139-004	2.20	0.10	-	1	07/20/23 13:35	*
2023KGMLSCS2	K2308139-005	2.00	0.10	-	1	07/20/23 13:35	*
2023KGMLSCS3	K2308139-006	1.90	0.10	-	1	07/20/23 13:35	*
Method Blank	K2308139-MB	ND U	0.10	-	1	07/20/23 13:35	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/20/23

Replicate Sample Summary
General Chemistry Parameters

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001

Units: Percent
Basis: Dry, per Method

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>MDL</u>	<u>Sample Result</u>	<u>Duplicate Sample K2308139-001DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total Volatile	160.4 Modified	0.10	-	1.80	1.70	1.75	6	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.



General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Analysis Method: PSEP Sulfide
Prep Method: Method

Service Request: K2308139
Date Collected: 07/5/23
Date Received: 07/19/23
Units: mg/Kg
Basis: Dry

Sulfide, Total

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
2023KGMLJCS1	K2308139-001	0.8 J	1.3	0.5	1	07/24/23 18:00	7/24/23	*
2023KGMLJCS2	K2308139-002	ND U	1.4	0.5	1	07/24/23 18:00	7/24/23	*
2023KGMLJCS3	K2308139-003	ND U	1.5	0.5	1	07/24/23 18:00	7/24/23	*
2023KGMLSCS1	K2308139-004	ND U	1.4	0.5	1	07/24/23 18:00	7/24/23	*
2023KGMLSCS2	K2308139-005	ND U	1.4	0.5	1	07/24/23 18:00	7/24/23	*
2023KGMLSCS3	K2308139-006	ND U	1.3	0.5	1	07/24/23 18:00	7/24/23	*
Method Blank	K2308139-MB	ND U	1.0	0.3	1	07/24/23 18:00	7/24/23	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/24/23

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: 2023KGMLJCS2 Units: mg/Kg
Lab Code: K2308139-002 Basis: Dry
Analysis Method: PSEP Sulfide
Prep Method: Method

Table with 9 columns: Analyte Name, MRL, MDL, Sample Result, Duplicate K2308139-002DUP Result, Triplicate K2308139-002TRP Result, Average, RSD, RSD Limit. Row 1: Sulfide, Total, 1.4, 0.5, ND, ND, ND, NC, NC, 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.

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/24/23
Date Extracted: 07/24/23

Duplicate Matrix Spike Summary
Sulfide, Total

Sample Name: 2023KGMLJCS2
Lab Code: K2308139-002
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	Sample Result	Result	Matrix Spike K2308139-002MS		Result	Duplicate Matrix Spike K2308139-002DMS		% Rec Limits	RPD	RPD Limit
			Spike Amount	% Rec		Spike Amount	% Rec			
Sulfide, Total	ND U	440	480	93	410	460	89	28-175	9	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.

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.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Analyzed: 07/24/23
Date Extracted: 07/24/23

Lab Control Sample Summary
Sulfide, Total

Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 811640

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K2308139-LCS	380	370	103	39-166

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request: K2308139

Continuing Calibration Verification (CCV) Summary

Sulfide, Total

Analysis Method: PSEP Sulfide

Units: mg/L

	Analysis		Date	True	Measured	Percent	Acceptance
	Lot	Lab Code	Analyzed	Value	Value	Recovery	Limits
CCV1	811640	KQ2313273-01	07/24/23 18:00	0.518	0.525	101	90-110
CCV2	811640	KQ2313273-02	07/24/23 18:00	0.518	0.516	100	90-110
CCV3	811640	KQ2313273-03	07/24/23 18:00	0.518	0.517	100	90-110
CCV4	811640	KQ2313273-04	07/24/23 18:00	0.518	0.525	101	90-110

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request:K2308139

Continuing Calibration Blank (CCB) Summary
Sulfide, Total

Analysis Method: PSEP Sulfide

Units:mg/Kg

	Analysis Lot	Lab Code	Date Analyzed	MRL	MDL	Result	Q
CCB1	811640	KQ2313273-05	07/24/23 18:00	1.0	0.3	ND	U
CCB2	811640	KQ2313273-06	07/24/23 18:00	1.0	0.3	ND	U
CCB3	811640	KQ2313273-07	07/24/23 18:00	1.0	0.3	ND	U
CCB4	811640	KQ2313273-08	07/24/23 18:00	1.0	0.3	ND	U

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Service Request: K2308139
Date Collected: 07/5/23
Date Received: 07/19/23

Units: Percent
Basis: Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
2023KGMLJCS1	K2308139-001	0.28	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMLJCS2	K2308139-002	0.31	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMLJCS3	K2308139-003	0.38	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMLSCS1	K2308139-004	0.32	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMLSCS2	K2308139-005	0.48	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMLSCS3	K2308139-006	0.32	0.10	0.005	1	07/24/23 13:42	7/24/23	*
Method Blank	K2308139-MB	ND U	0.10	0.005	1	07/24/23 13:42	7/24/23	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/24/23

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	MRL	MDL	Sample Result	Duplicate K2308139-001DUP Result	Triplicate K2308139-001TRP Result	Average	RSD	RSD Limit
Carbon, Total Organic (TOC)	0.10	0.005	0.28	0.28	0.27	0.277	2	27

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
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/24/23
Date Extracted: 07/24/23

Duplicate Matrix Spike Summary
Carbon, Total Organic (TOC)

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	Sample Result	Matrix Spike K2308139-001MS			Duplicate Matrix Spike K2308139-001DMS			% Rec Limits	RPD	RPD Limit
		Result	Spike Amount	% Rec	Result	Spike Amount	% Rec			
Carbon, Total Organic (TOC)	0.28	2.62	2.42	97	2.66	2.43	98	69-123	1	27

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: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Analyzed: 07/24/23
Date Extracted: 07/24/23

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method
Analysis Lot: 811704

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K2308139-LCS	4.43	4.40	101	74-118

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request: K2308139

Continuing Calibration Verification (CCV) Summary

Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC

Units: Percent

	Analysis Lot	Lab Code	Date Analyzed	True Value	Measured Value	Percent Recovery	Acceptance Limits
CCV1	811704	KQ2313014-01	07/24/23 13:42	12.0	12.0	100	90-110
CCV2	811704	KQ2313014-02	07/24/23 13:42	12.0	12.1	101	90-110
CCV3	811704	KQ2313014-03	07/24/23 13:42	12.0	12.1	101	90-110
CCV4	811704	KQ2313014-04	07/24/23 13:42	12.0	12.0	100	90-110

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request:K2308139

Continuing Calibration Blank (CCB) Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC

Units:Percent

	Analysis Lot	Lab Code	Date Analyzed	MRL	MDL	Result	Q
CCB1	811704	KQ2313014-05	07/24/23 13:42	0.10	0.005	ND	U
CCB2	811704	KQ2313014-06	07/24/23 13:42	0.10	0.005	ND	U
CCB3	811704	KQ2313014-07	07/24/23 13:42	0.10	0.005	ND	U
CCB4	811704	KQ2313014-08	07/24/23 13:42	0.10	0.005	ND	U

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001

Sand Fraction: Dry Weight (Grams) 22.3342
Sand Fraction: Weight Recovered (Grams) 22.2524
Sand Fraction: Percent Recovery 99.63

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.0000	0.00
Gravel, Fine	-2 Ø to -1 Ø	1.4671	6.10
Sand, Very Coarse	-1 to 0 Ø	4.5230	18.80
Sand, Coarse	0 to 1 Ø	8.9205	37.07
Sand, Medium	1 to 2 Ø	5.2226	21.70
Sand, Fine	2 to 3 Ø	1.8559	7.71
Sand, Very Fine	3 to 4 Ø	0.1807	0.75
75.0 µm	4 Ø	0.7000	2.91
31.3 µm	5 Ø	0.0400	0.17
15.6 µm	6 Ø	0.5050	2.10
7.8 µm	7 Ø	0.1000	0.42
3.9 µm	8 Ø	0.2900	1.21
1.95 µm	9 Ø	0.0850	0.35
0.98 µm	> 10 Ø	0.0300	0.12
		23.9198	99.41

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLJCS2
Lab Code: K2308139-002

Sand Fraction: Dry Weight (Grams) 20.6637
Sand Fraction: Weight Recovered (Grams) 20.5789
Sand Fraction: Percent Recovery 99.59

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.3856	1.72
Gravel, Fine	-2 Ø to -1 Ø	1.8139	8.08
Sand, Very Coarse	-1 to 0 Ø	3.9250	17.49
Sand, Coarse	0 to 1 Ø	5.6992	25.40
Sand, Medium	1 to 2 Ø	6.4621	28.80
Sand, Fine	2 to 3 Ø	2.0000	8.91
Sand, Very Fine	3 to 4 Ø	0.2057	0.92
75.0 µm	4 Ø	0.5350	2.38
31.3 µm	5 Ø	0.4300	1.92
15.6 µm	6 Ø	0.4300	1.92
7.8 µm	7 Ø	0.4100	1.83
3.9 µm	8 Ø	0.2050	0.91
1.95 µm	9 Ø	0.0650	0.29
0.98 µm	> 10 Ø	0.0750	0.33
		22.6415	100.89

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLJCS3
Lab Code: K2308139-003

Sand Fraction: Dry Weight (Grams) 20.1144
Sand Fraction: Weight Recovered (Grams) 20.0265
Sand Fraction: Percent Recovery 99.56

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	1.2833	6.06
Gravel, Fine	-2 Ø to -1 Ø	2.8664	13.55
Sand, Very Coarse	-1 to 0 Ø	1.4265	6.74
Sand, Coarse	0 to 1 Ø	1.1485	5.43
Sand, Medium	1 to 2 Ø	4.7050	22.23
Sand, Fine	2 to 3 Ø	7.9989	37.80
Sand, Very Fine	3 to 4 Ø	0.4717	2.23
75.0 µm	4 Ø	0.5450	2.58
31.3 µm	5 Ø	0.5450	2.58
15.6 µm	6 Ø	0.3950	1.87
7.8 µm	7 Ø	0.3850	1.82
3.9 µm	8 Ø	0.3700	1.75
1.95 µm	9 Ø	0.0250	0.12
0.98 µm	> 10 Ø	0.0800	0.38
		22.2453	105.12

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSCS1
Lab Code: K2308139-004

Sand Fraction: Dry Weight (Grams) 24.3774
Sand Fraction: Weight Recovered (Grams) 24.4292
Sand Fraction: Percent Recovery 100.21

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.1370	0.57
Gravel, Fine	-2 Ø to -1 Ø	4.1759	17.23
Sand, Very Coarse	-1 to 0 Ø	12.3696	51.04
Sand, Coarse	0 to 1 Ø	6.2441	25.76
Sand, Medium	1 to 2 Ø	1.0622	4.38
Sand, Fine	2 to 3 Ø	0.3384	1.40
Sand, Very Fine	3 to 4 Ø	0.0644	0.27
75.0 µm	4 Ø	0.1450	0.60
31.3 µm	5 Ø	0.0600	0.25
15.6 µm	6 Ø	0.2050	0.85
7.8 µm	7 Ø	0.0250	0.10
3.9 µm	8 Ø	0.0050	0.02
1.95 µm	9 Ø	0.0050	0.02
0.98 µm	> 10 Ø	0.0750	0.31
		24.9116	102.78

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSCS1
Lab Code: K2308139-004DUP

Sand Fraction: Dry Weight (Grams) 23.2618
Sand Fraction: Weight Recovered (Grams) 23.2029
Sand Fraction: Percent Recovery 99.75

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.0000	0.00
Gravel, Fine	-2 Ø to -1 Ø	3.3317	14.02
Sand, Very Coarse	-1 to 0 Ø	10.9220	45.97
Sand, Coarse	0 to 1 Ø	7.1684	30.17
Sand, Medium	1 to 2 Ø	1.2793	5.38
Sand, Fine	2 to 3 Ø	0.3884	1.63
Sand, Very Fine	3 to 4 Ø	0.0696	0.29
75.0 µm	4 Ø	0.2150	0.91
31.3 µm	5 Ø	0.0900	0.38
15.6 µm	6 Ø	0.1050	0.44
7.8 µm	7 Ø	0.1300	0.55
3.9 µm	8 Ø	0.0600	0.25
1.95 µm	9 Ø	0.0050	0.02
0.98 µm	> 10 Ø	0.0700	0.29
		23.8344	100.33

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSCS2
Lab Code: K2308139-005

Sand Fraction: Dry Weight (Grams) 22.7415
Sand Fraction: Weight Recovered (Grams) 22.6865
Sand Fraction: Percent Recovery 99.76

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	1.1487	5.06
Gravel, Fine	-2 Ø to -1 Ø	4.0849	17.98
Sand, Very Coarse	-1 to 0 Ø	6.2219	27.39
Sand, Coarse	0 to 1 Ø	6.0879	26.80
Sand, Medium	1 to 2 Ø	3.4307	15.10
Sand, Fine	2 to 3 Ø	1.4626	6.44
Sand, Very Fine	3 to 4 Ø	0.1767	0.78
75.0 µm	4 Ø	0.3700	1.63
31.3 µm	5 Ø	0.3000	1.32
15.6 µm	6 Ø	0.0350	0.15
7.8 µm	7 Ø	0.2150	0.95
3.9 µm	8 Ø	0.2000	0.88
1.95 µm	9 Ø	0.0050	0.02
0.98 µm	> 10 Ø	0.0050	0.02
		23.7434	104.51

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSCS3
Lab Code: K2308139-006

Sand Fraction: Dry Weight (Grams) 22.7617
Sand Fraction: Weight Recovered (Grams) 22.7227
Sand Fraction: Percent Recovery 99.83

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.3440	1.49
Gravel, Fine	-2 Ø to -1 Ø	3.0740	13.28
Sand, Very Coarse	-1 to 0 Ø	10.0848	43.57
Sand, Coarse	0 to 1 Ø	6.8996	29.81
Sand, Medium	1 to 2 Ø	1.6737	7.23
Sand, Fine	2 to 3 Ø	0.5270	2.28
Sand, Very Fine	3 to 4 Ø	0.0837	0.36
75.0 µm	4 Ø	0.2200	0.95
31.3 µm	5 Ø	0.1750	0.76
15.6 µm	6 Ø	0.0350	0.15
7.8 µm	7 Ø	0.0350	0.15
3.9 µm	8 Ø	0.1750	0.76
1.95 µm	9 Ø	0.0600	0.26
0.98 µm	> 10 Ø	0.0100	0.04
		23.3968	101.08



Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001

Service Request: K2308139
Date Collected: 07/05/23 10:15
Date Received: 07/19/23 10:50
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	11400	mg/Kg	2.1	0.6	5	07/27/23 09:03	07/25/23	
Arsenic	200.8	17.8	mg/Kg	0.53	0.06	5	07/27/23 09:03	07/25/23	
Cadmium	200.8	0.203	mg/Kg	0.021	0.007	5	07/27/23 09:03	07/25/23	
Chromium	200.8	19.5	mg/Kg	0.21	0.06	5	07/27/23 09:03	07/25/23	
Copper	200.8	53.5	mg/Kg	0.11	0.04	5	07/27/23 09:03	07/25/23	
Lead	200.8	7.65	mg/Kg	0.053	0.021	5	07/27/23 09:03	07/25/23	
Mercury	7471B	0.014 J	mg/Kg	0.026	0.003	1	07/24/23 12:03	07/21/23	
Nickel	200.8	16.8	mg/Kg	0.21	0.03	5	07/27/23 09:03	07/25/23	
Selenium	200.8	0.2 J	mg/Kg	1.1	0.10	5	07/27/23 09:03	07/25/23	
Silver	200.8	0.063	mg/Kg	0.021	0.004	5	07/27/23 09:03	07/25/23	
Zinc	200.8	86.8	mg/Kg	0.53	0.21	5	07/27/23 09:03	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLJCS2
Lab Code: K2308139-002

Service Request: K2308139
Date Collected: 07/05/23 10:15
Date Received: 07/19/23 10:50
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	11900	mg/Kg	2.5	0.7	5	07/27/23 09:11	07/25/23	
Arsenic	200.8	21.4	mg/Kg	0.61	0.07	5	07/27/23 09:11	07/25/23	
Cadmium	200.8	0.201	mg/Kg	0.025	0.009	5	07/27/23 09:11	07/25/23	
Chromium	200.8	21.4	mg/Kg	0.25	0.07	5	07/27/23 09:11	07/25/23	
Copper	200.8	58.8	mg/Kg	0.12	0.05	5	07/27/23 09:11	07/25/23	
Lead	200.8	8.11	mg/Kg	0.061	0.025	5	07/27/23 09:11	07/25/23	
Mercury	7471B	0.016 J	mg/Kg	0.028	0.003	1	07/24/23 12:13	07/21/23	
Nickel	200.8	18.0	mg/Kg	0.25	0.04	5	07/27/23 09:11	07/25/23	
Selenium	200.8	0.3 J	mg/Kg	1.2	0.1	5	07/27/23 09:11	07/25/23	
Silver	200.8	0.071	mg/Kg	0.025	0.005	5	07/27/23 09:11	07/25/23	
Zinc	200.8	93.4	mg/Kg	0.61	0.25	5	07/27/23 09:11	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLJCS3
Lab Code: K2308139-003

Service Request: K2308139
Date Collected: 07/05/23 10:15
Date Received: 07/19/23 10:50
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	11000	mg/Kg	2.8	0.8	5	07/27/23 09:13	07/25/23	
Arsenic	200.8	17.6	mg/Kg	0.70	0.08	5	07/27/23 09:13	07/25/23	
Cadmium	200.8	0.214	mg/Kg	0.028	0.010	5	07/27/23 09:13	07/25/23	
Chromium	200.8	23.8	mg/Kg	0.28	0.08	5	07/27/23 09:13	07/25/23	
Copper	200.8	64.1	mg/Kg	0.14	0.06	5	07/27/23 09:13	07/25/23	
Lead	200.8	8.01	mg/Kg	0.070	0.028	5	07/27/23 09:13	07/25/23	
Mercury	7471B	0.022 J	mg/Kg	0.030	0.003	1	07/24/23 12:15	07/21/23	
Nickel	200.8	17.2	mg/Kg	0.28	0.04	5	07/27/23 09:13	07/25/23	
Selenium	200.8	0.3 J	mg/Kg	1.4	0.1	5	07/27/23 09:13	07/25/23	
Silver	200.8	0.152	mg/Kg	0.028	0.006	5	07/27/23 09:13	07/25/23	
Zinc	200.8	87.6	mg/Kg	0.70	0.28	5	07/27/23 09:13	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLSCS1
Lab Code: K2308139-004

Service Request: K2308139
Date Collected: 07/05/23 09:00
Date Received: 07/19/23 10:50
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	12300	mg/Kg	1.6	0.5	5	07/27/23 09:16	07/25/23	
Arsenic	200.8	12.6	mg/Kg	0.40	0.05	5	07/27/23 09:16	07/25/23	
Cadmium	200.8	0.441	mg/Kg	0.016	0.006	5	07/27/23 09:16	07/25/23	
Chromium	200.8	17.5	mg/Kg	0.16	0.05	5	07/27/23 09:16	07/25/23	
Copper	200.8	43.8	mg/Kg	0.080	0.032	5	07/27/23 09:16	07/25/23	
Lead	200.8	6.85	mg/Kg	0.040	0.016	5	07/27/23 09:16	07/25/23	
Mercury	7471B	0.118	mg/Kg	0.026	0.003	1	07/24/23 12:16	07/21/23	
Nickel	200.8	29.2	mg/Kg	0.16	0.02	5	07/27/23 09:16	07/25/23	
Selenium	200.8	0.84	mg/Kg	0.80	0.07	5	07/27/23 09:16	07/25/23	
Silver	200.8	0.092	mg/Kg	0.016	0.003	5	07/27/23 09:16	07/25/23	
Zinc	200.8	112	mg/Kg	0.40	0.16	5	07/27/23 09:16	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLSCS2
Lab Code: K2308139-005

Service Request: K2308139
Date Collected: 07/05/23 09:00
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	12400	mg/Kg	2.4	0.7	5	07/27/23 09:19	07/25/23	
Arsenic	200.8	12.3	mg/Kg	0.60	0.07	5	07/27/23 09:19	07/25/23	
Cadmium	200.8	0.428	mg/Kg	0.024	0.008	5	07/27/23 09:19	07/25/23	
Chromium	200.8	18.7	mg/Kg	0.24	0.07	5	07/27/23 09:19	07/25/23	
Copper	200.8	42.7	mg/Kg	0.12	0.05	5	07/27/23 09:19	07/25/23	
Lead	200.8	5.91	mg/Kg	0.060	0.024	5	07/27/23 09:19	07/25/23	
Mercury	7471B	0.040	mg/Kg	0.028	0.003	1	07/24/23 12:18	07/21/23	
Nickel	200.8	30.1	mg/Kg	0.24	0.04	5	07/27/23 09:19	07/25/23	
Selenium	200.8	0.8 J	mg/Kg	1.2	0.1	5	07/27/23 09:19	07/25/23	
Silver	200.8	0.065	mg/Kg	0.024	0.005	5	07/27/23 09:19	07/25/23	
Zinc	200.8	125	mg/Kg	0.60	0.24	5	07/27/23 09:19	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLSCS3
Lab Code: K2308139-006

Service Request: K2308139
Date Collected: 07/05/23 09:00
Date Received: 07/19/23 10:50
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	11500	mg/Kg	2.5	0.7	5	07/27/23 09:21	07/25/23	
Arsenic	200.8	16.8	mg/Kg	0.62	0.07	5	07/27/23 09:21	07/25/23	
Cadmium	200.8	0.394	mg/Kg	0.025	0.009	5	07/27/23 09:21	07/25/23	
Chromium	200.8	18.8	mg/Kg	0.25	0.07	5	07/27/23 09:21	07/25/23	
Copper	200.8	35.5	mg/Kg	0.12	0.05	5	07/27/23 09:21	07/25/23	
Lead	200.8	5.23	mg/Kg	0.062	0.025	5	07/27/23 09:21	07/25/23	
Mercury	7471B	0.042	mg/Kg	0.025	0.003	1	07/24/23 12:20	07/21/23	
Nickel	200.8	28.4	mg/Kg	0.25	0.04	5	07/27/23 09:21	07/25/23	
Selenium	200.8	1.9	mg/Kg	1.2	0.1	5	07/27/23 09:21	07/25/23	
Silver	200.8	0.064	mg/Kg	0.025	0.005	5	07/27/23 09:21	07/25/23	
Zinc	200.8	121	mg/Kg	0.62	0.25	5	07/27/23 09:21	07/25/23	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: Method Blank
Lab Code: KQ2312762-05

Service Request: K2308139
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	1.1 J	mg/Kg	2.0	0.6	5	07/27/23 08:58	07/25/23	
Arsenic	200.8	ND U	mg/Kg	0.5	0.06	5	07/27/23 08:58	07/25/23	
Cadmium	200.8	ND U	mg/Kg	0.020	0.007	5	07/27/23 08:58	07/25/23	
Chromium	200.8	0.07 J	mg/Kg	0.20	0.06	5	07/27/23 08:58	07/25/23	
Copper	200.8	ND U	mg/Kg	0.10	0.04	5	07/27/23 08:58	07/25/23	
Lead	200.8	ND U	mg/Kg	0.05	0.020	5	07/27/23 08:58	07/25/23	
Nickel	200.8	ND U	mg/Kg	0.20	0.03	5	07/27/23 08:58	07/25/23	
Selenium	200.8	ND U	mg/Kg	1.0	0.09	5	07/27/23 08:58	07/25/23	
Silver	200.8	ND U	mg/Kg	0.020	0.004	5	07/27/23 08:58	07/25/23	
Zinc	200.8	ND U	mg/Kg	0.5	0.20	5	07/27/23 08:58	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil
Sample Name: Method Blank
Lab Code: KQ2312773-03

Service Request: K2308139
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	0.002	1	07/24/23 12:00	07/21/23	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/27/23

Replicate Sample Summary
Total Metals

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001

Units: mg/Kg
Basis: Dry

Table with 9 columns: Analyte Name, Analysis Method, MRL, MDL, Sample Result, Duplicate Sample KQ2312762-03 Result, Average, RPD, RPD Limit. Rows include Aluminum, Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, and Zinc.

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
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/24/23

Replicate Sample Summary

Total Metals

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample	Average	RPD	RPD Limit
					KQ2312773-01			
Mercury	7471B	0.027	0.003	0.014 J	0.013 J	0.014	11	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
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/27/23
Date Extracted: 07/25/23

Matrix Spike Summary
Total Metals

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001
Analysis Method: 200.8
Prep Method: EPA 3050B

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ2312762-04

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	11400	14200	482	583 #	70-130
Arsenic	17.8	137	121	99	70-130
Cadmium	0.203	12.2	12.1	99	70-130
Chromium	19.5	73.5	48.2	112	70-130
Copper	53.5	110	60.2	94	70-130
Lead	7.65	130	121	101	70-130
Nickel	16.8	139	121	101	70-130
Selenium	0.2 J	121	121	100	70-130
Silver	0.063	11.3	12.1	93	70-130
Zinc	86.8	214	121	106	70-130

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.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/24/23
Date Extracted: 07/21/23

Matrix Spike Summary
Total Metals

Sample Name: 2023KGMLJCS1
Lab Code: K2308139-001
Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ2312773-02

<u>Analyte Name</u>	<u>Sample Result</u>	<u>Result</u>	<u>Spike Amount</u>	<u>% Rec</u>	<u>% Rec Limits</u>
Mercury	0.014 J	0.679	0.665	100	80-120

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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dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Analyzed: 07/27/23

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ2312762-06

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	200.8	397	400	99	85-115
Arsenic	200.8	100	100	100	85-115
Cadmium	200.8	9.94	10.0	99	85-115
Chromium	200.8	40.4	40.0	101	85-115
Copper	200.8	48.1	50.0	96	85-115
Lead	200.8	101	100	101	85-115
Nickel	200.8	99.9	100	100	85-115
Selenium	200.8	98.8	100	99	85-115
Silver	200.8	9.78	10.0	98	85-115
Zinc	200.8	99.4	100	99	85-115

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139
Date Analyzed: 07/24/23

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ2312773-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	0.488	0.500	98	80-120

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Prep Summary Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139

Metals

Prep Method: EPA 3050B
Analytical Method: 200.8

Extraction Lot: 423399
Extraction Date: 07/25/23 07:00

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
2023KGMLJCS1	K2308139-001	7/5/23	7/19/23	1.311 g	100 mL	
2023KGMLJCS2	K2308139-002	7/5/23	7/19/23	1.173 g	100 mL	
2023KGMLJCS3	K2308139-003	7/5/23	7/19/23	1.092 g	100 mL	
2023KGMLSCS1	K2308139-004	7/5/23	7/19/23	1.773 g	100 mL	
2023KGMLSCS2	K2308139-005	7/5/23	7/19/23	1.223 g	100 mL	
2023KGMLSCS3	K2308139-006	7/5/23	7/19/23	1.112 g	100 mL	
Duplicate	KQ2312762-03DUP	7/5/23	7/19/23	1.207 g	100 mL	
Matrix Spike	KQ2312762-04MS	7/5/23	7/19/23	1.159 g	100 mL	
Method Blank	KQ2312762-05MB	NA	NA	1 g	100 mL	
Lab Control Sample	KQ2312762-06LCS	NA	NA	1 g	100 mL	

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Prep Summary Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308139

Metals

Prep Method: Method
Analytical Method: 7471B

Extraction Lot: 423405
Extraction Date: 07/21/23 10:31

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
2023KGMLJCS1	K2308139-001	7/5/23	7/19/23	0.528 g	50 mL	
2023KGMLJCS2	K2308139-002	7/5/23	7/19/23	0.523 g	50 mL	
2023KGMLJCS3	K2308139-003	7/5/23	7/19/23	0.509 g	50 mL	
2023KGMLSCS1	K2308139-004	7/5/23	7/19/23	0.550 g	50 mL	
2023KGMLSCS2	K2308139-005	7/5/23	7/19/23	0.526 g	50 mL	
2023KGMLSCS3	K2308139-006	7/5/23	7/19/23	0.552 g	50 mL	
Duplicate	KQ2312773-01DUP	7/5/23	7/19/23	0.522 g	50 mL	
Matrix Spike	KQ2312773-02MS	7/5/23	7/19/23	0.525 g	50 mL	
Method Blank	KQ2312773-03MB	NA	NA	0.5 g	50 mL	
Lab Control Sample	KQ2312773-04LCS	NA	NA	0.5 g	50 mL	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request: K2308139

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID	Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
ICV 07/24/23 11:37	Mercury	7471B	811621	4.93	5.00	99	90-110
CCV 07/24/23 11:42	Mercury	7471B	811621	5.19	5.00	104	90-110
CCV 07/24/23 12:08	Mercury	7471B	811621	4.96	5.00	99	90-110
CCV 07/24/23 12:29	Mercury	7471B	811621	4.94	5.00	99	90-110
ICV 07/27/23 08:42	Aluminum	200.8	811984	101	100	101	90-110
	Arsenic	200.8	811984	23.9	25.0	96	90-110
	Cadmium	200.8	811984	12.4	12.5	100	90-110
	Chromium	200.8	811984	9.94	10.0	99	90-110
	Copper	200.8	811984	12.2	12.5	98	90-110
	Lead	200.8	811984	25.4	25.0	101	90-110
	Nickel	200.8	811984	25.1	25.0	100	90-110
	Selenium	200.8	811984	25.0	25.0	100	90-110
	Silver	200.8	811984	12.2	12.5	98	90-110
	Zinc	200.8	811984	25.1	25.0	100	90-110
CCV 07/27/23 08:45	Aluminum	200.8	811984	248	250	99	90-110
	Arsenic	200.8	811984	25.6	25.0	102	90-110
	Cadmium	200.8	811984	24.9	25.0	99	90-110
	Chromium	200.8	811984	25.3	25.0	101	90-110
	Copper	200.8	811984	24.9	25.0	99	90-110
	Lead	200.8	811984	25.3	25.0	101	90-110
	Nickel	200.8	811984	25.5	25.0	102	90-110
	Selenium	200.8	811984	25.2	25.0	101	90-110
	Silver	200.8	811984	12.3	12.5	99	90-110
	Zinc	200.8	811984	25.2	25.0	101	90-110
CCV 07/27/23 09:24	Aluminum	200.8	811984	264	250	106	90-110
	Arsenic	200.8	811984	24.9	25.0	100	90-110
	Cadmium	200.8	811984	25.2	25.0	101	90-110
	Chromium	200.8	811984	25.1	25.0	100	90-110
	Copper	200.8	811984	24.8	25.0	99	90-110
	Lead	200.8	811984	25.5	25.0	102	90-110

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request: K2308139

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID	Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
CCV 07/27/23 09:24	Nickel	200.8	811984	25.7	25.0	103	90-110
	Selenium	200.8	811984	25.2	25.0	101	90-110
	Silver	200.8	811984	12.4	12.5	99	90-110
	Zinc	200.8	811984	26.0	25.0	104	90-110

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request: K2308139

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID	Analyte	Method	Analysis Batch:	Result	C
ICB 07/24/23 11:39	Mercury	7471B	811621	0.02	U
CCB 07/24/23 11:44	Mercury	7471B	811621	0.02	U
CCB 07/24/23 12:09	Mercury	7471B	811621	0.02	U
CCB 07/24/23 12:31	Mercury	7471B	811621	0.02	U
ICB 07/27/23 08:47	Aluminum	200.8	811984	1.2	U
	Arsenic	200.8	811984	0.1	U
	Cadmium	200.8	811984	0.014	U
	Chromium	200.8	811984	0.12	U
	Copper	200.8	811984	0.08	U
	Lead	200.8	811984	0.04	U
	Nickel	200.8	811984	0.06	U
	Selenium	200.8	811984	0.2	U
	Silver	200.8	811984	0.008	U
	Zinc	200.8	811984	0.4	U
CCB 07/27/23 08:50	Aluminum	200.8	811984	1.2	U
	Arsenic	200.8	811984	0.1	U
	Cadmium	200.8	811984	0.014	U
	Chromium	200.8	811984	0.12	U
	Copper	200.8	811984	0.08	U
	Lead	200.8	811984	0.04	U
	Nickel	200.8	811984	0.06	U
	Selenium	200.8	811984	0.2	U
	Silver	200.8	811984	0.008	U
	Zinc	200.8	811984	0.4	U

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request: K2308139

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
LLICV								
	Mercury	7471B	811621	0.19	0.2	95	50-150	07/24/23 11:41
LLICVS								
	Aluminum	200.8	811984	4.5	4.0	113	50-199	07/27/23 08:53
	Arsenic	200.8	811984	1.1	1.0	105	50-199	07/27/23 08:53
	Cadmium	200.8	811984	0.038	0.04	95	50-199	07/27/23 08:53
	Chromium	200.8	811984	0.53	0.4	133	50-199	07/27/23 08:53
	Copper	200.8	811984	0.19	0.2	93	50-199	07/27/23 08:53
	Lead	200.8	811984	0.094	0.1	94	50-199	07/27/23 08:53
	Nickel	200.8	811984	0.48	0.4	120	50-199	07/27/23 08:53
	Selenium	200.8	811984	1.9	2.0	96	50-199	07/27/23 08:53
	Silver	200.8	811984	0.040	0.04	99	50-199	07/27/23 08:53
	Zinc	200.8	811984	1.2	1.0	116	50-199	07/27/23 08:53

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring

Service Request: K2308139

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
K2308139-001A	Mercury	7471B	811621	0.11 J	4.89	5.00	96	80-120	07/24/23 12:12

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

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring/

Service Request: K2308139

Detection Limits

Instrument: K-CVAA-03

Matrix: Soil

Analyte	Wavelength (nm)	Units	MRL	MDL	Method
Mercury	253	ug/L	0.2	0.02	7471B

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring/

Service Request: K2308139

Detection Limits

Instrument: K-ICP-MS-05

Matrix: Soil

Analyte	Mass	Units	MRL	MDL	Method
Aluminum	27	ug/L	4	1.2	200.8
Arsenic	75	ug/L	1	0.12	200.8
Cadmium	111	ug/L	0.04	0.014	200.8
Chromium	52	ug/L	0.4	0.12	200.8
Copper	65	ug/L	0.2	0.08	200.8
Lead	208	ug/L	0.1	0.04	200.8
Nickel	60	ug/L	0.4	0.06	200.8
Selenium	78	ug/L	2	0.18	200.8
Silver	107	ug/L	0.04	0.008	200.8
Zinc	66	ug/L	1	0.4	200.8

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring/

Service Request: K2308139

ICP Linear Range (Quarterly)

Instrument: K-CVAA-03

Analyte	Concentration (ug/L)	Method
Mercury	10	7471B

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring/

Service Request: K2308139

ICP Linear Range (Quarterly)

Instrument: K-ICP-MS-05

Analyte	Concentration (ug/L)	Method
Aluminum 27	45000	200.8
Arsenic 75	3150	200.8
Cadmium 111	3150	200.8
Chromium 52	3150	200.8
Copper 65	3150	200.8
Lead 208	3150	200.8
Nickel 60	3150	200.8
Selenium 78	3150	200.8
Silver 107	180	200.8
Zinc 66	3150	200.8



ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

August 14, 2023

Analytical Report for Service Request No: K2308142

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

RE: Couer AK Biomonitoring

Dear Bill,

Enclosed are the results of the sample(s) submitted to our laboratory July 19, 2023
For your reference, these analyses have been assigned our service request number **K2308142**.

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

for Mark Harris
Project Manager



ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

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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.pjllabs.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/analyte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Received: 07/19/2023

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:

Nine soil samples were received for analysis at ALS Environmental on 07/19/2023. 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:

No significant anomalies were noted with this analysis.

General Chemistry:

Method PSEP Sulfide, 07/26/2023: Samples in this delivery group were received past holding time. The analysis was performed as soon as possible after receipt by the laboratory. The data was flagged to indicate the holding time violation.
Method PSEP TOC, 07/24/2023: Samples in this delivery group were received past holding time. The analysis was performed as soon as possible after receipt by the laboratory. The data was flagged to indicate the holding time violation.

Approved by 

Date 08/14/2023



Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Cooler Receipt and Preservation Form

Client Coeur AK Biomonitoring Service Request K23 68142
 Received: 7/19/23 Opened: 7/19/23 By: PDP Unloaded: 7/19/23 By: PDP

- Samples were received via? USPS Fed Ex UPS DHL PDX Courier Hand Delivered
- Samples were received in: (circle) Cooler Box Envelope Other NA
- 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
<u>1.9</u>		<u>IR02</u>				<u>781310043050</u>	

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

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Analysis Method: 160.3 Modified
Prep Method: None

Service Request: K2308142
Date Collected: 07/5/23
Date Received: 07/19/23
Units: Percent
Basis: As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
2023KGMLSHS1	K2308142-001	68.4	-	-	1	07/20/23 11:20	
2023KGMLSHS2	K2308142-002	77.1	-	-	1	07/20/23 11:20	
2023KGMLSHS3	K2308142-003	69.9	-	-	1	07/20/23 11:20	
2023KGMEFSCS1	K2308142-004	55.3	-	-	1	07/20/23 11:20	
2023KGMEFSCS2	K2308142-005	70.9	-	-	1	07/20/23 11:20	
2023KGMEFSCS3	K2308142-006	68.4	-	-	1	07/20/23 11:20	
2023KGMUSCS1	K2308142-007	72.6	-	-	1	07/20/23 11:20	
2023KGMUSCS2	K2308142-008	63.2	-	-	1	07/20/23 11:20	
2023KGMUSCS3	K2308142-009	64.1	-	-	1	07/20/23 11:20	
Method Blank	K2308142-MB	ND U	-	-	1	07/20/23 11:20	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/20/23

Replicate Sample Summary

Inorganic Parameters

Sample Name: 2023KGMLSHS1
Lab Code: K2308142-001

Units: Percent
Basis: As Received

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample K2308142-001DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	-	68.4	68.7	68.6	<1	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.

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Analysis Method: 160.4 Modified
Prep Method: None

Service Request: K2308142
Date Collected: 07/5/23
Date Received: 07/19/23

Units: Percent
Basis: Dry, per Method

Solids, Total Volatile

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
2023KGMLSHS1	K2308142-001	1.90	0.10	-	1	07/20/23 11:20	*
2023KGMLSHS2	K2308142-002	1.70	0.10	-	1	07/20/23 11:20	*
2023KGMLSHS3	K2308142-003	1.50	0.10	-	1	07/20/23 11:20	*
2023KGMEFSCS1	K2308142-004	4.30	0.10	-	1	07/20/23 11:20	*
2023KGMEFSCS2	K2308142-005	5.10	0.10	-	1	07/20/23 11:20	*
2023KGMEFSCS3	K2308142-006	3.70	0.10	-	1	07/20/23 11:20	*
2023KGMUSCS1	K2308142-007	2.80	0.10	-	1	07/20/23 11:20	*
2023KGMUSCS2	K2308142-008	3.70	0.10	-	1	07/20/23 11:20	*
2023KGMUSCS3	K2308142-009	4.00	0.10	-	1	07/20/23 11:20	*
Method Blank	K2308142-MB	ND U	0.10	-	1	07/20/23 11:20	

ALS Group USA, Corp.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/20/23

Replicate Sample Summary
General Chemistry Parameters

Sample Name: 2023KGMLSHS1
Lab Code: K2308142-001

Units: Percent
Basis: Dry, per Method

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>MDL</u>	<u>Sample Result</u>	<u>Duplicate Sample K2308142-001DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total Volatile	160.4 Modified	0.10	-	1.90	2.00	1.95	5	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.



General Chemistry

ALS Environmental—Kelso Laboratory
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www.alsglobal.com

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dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Analysis Method: PSEP Sulfide
Prep Method: Method

Service Request: K2308142
Date Collected: 07/5/23
Date Received: 07/19/23
Units: mg/Kg
Basis: Dry

Sulfide, Total

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
2023KGMLSHS1	K2308142-001	ND U	1.4	0.5	1	07/26/23 21:50	7/26/23	*
2023KGMLSHS2	K2308142-002	ND U	1.3	0.4	1	07/26/23 21:50	7/26/23	*
2023KGMLSHS3	K2308142-003	ND U	1.4	0.5	1	07/26/23 21:50	7/26/23	*
2023KGMEFSCS1	K2308142-004	0.5 J	1.6	0.5	1	07/26/23 21:50	7/26/23	*
2023KGMEFSCS2	K2308142-005	0.5 J	1.3	0.4	1	07/26/23 21:50	7/26/23	*
2023KGMEFSCS3	K2308142-006	ND U	1.4	0.5	1	07/26/23 21:50	7/26/23	*
2023KGMUSCS1	K2308142-007	ND U	1.3	0.4	1	07/26/23 21:50	7/26/23	*
2023KGMUSCS2	K2308142-008	ND U	1.6	0.5	1	07/26/23 21:50	7/26/23	*
2023KGMUSCS3	K2308142-009	ND U	1.5	0.5	1	07/26/23 21:50	7/26/23	*
Method Blank	K2308142-MB	ND U	1.0	0.3	1	07/26/23 21:50	7/26/23	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/26/23

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: 2023KGMUSCS3
Lab Code: K2308142-009
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	MRL	MDL	Sample Result	Duplicate K2308142-009DUP Result	Triplicate K2308142-009TRP Result	Average	RSD	RSD Limit
Sulfide, Total	1.5	0.5	ND	ND	ND	NC	NC	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.

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/26/23
Date Extracted: 07/26/23

**Duplicate Matrix Spike Summary
Sulfide, Total**

Sample Name: 2023KGMUSCS3
Lab Code: K2308142-009
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	Sample Result	Result	Matrix Spike K2308142-009MS		Duplicate Matrix Spike K2308142-009DMS		% Rec Limits	RPD	RPD Limit	
			Spike Amount	% Rec	Result	Spike Amount				% Rec
Sulfide, Total	ND U	460	510	91	420	510	83	28-175	9	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.

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.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Analyzed: 07/26/23
Date Extracted: 07/26/23

Lab Control Sample Summary
Sulfide, Total

Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 811939

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K2308142-LCS	397	350	112	39-166

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request: K2308142

Continuing Calibration Verification (CCV) Summary

Sulfide, Total

Analysis Method: PSEP Sulfide

Units: mg/L

	Analysis		Date	True	Measured	Percent	Acceptance Limits
	Lot	Lab Code	Analyzed	Value	Value	Recovery	
CCV1	811939	KQ2313275-01	07/26/23 21:50	0.492	0.505	103	90-110
CCV2	811939	KQ2313275-02	07/26/23 21:50	0.492	0.516	105	90-110
CCV3	811939	KQ2313275-03	07/26/23 21:50	0.492	0.508	103	90-110

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request:K2308142

Continuing Calibration Blank (CCB) Summary
Sulfide, Total

Analysis Method: PSEP Sulfide

Units:mg/Kg

	Analysis Lot	Lab Code	Date Analyzed	MRL	MDL	Result	Q
CCB1	811939	KQ2313275-04	07/26/23 21:50	1.0	0.3	ND	U
CCB2	811939	KQ2313275-05	07/26/23 21:50	1.0	0.3	ND	U
CCB3	811939	KQ2313275-06	07/26/23 21:50	1.0	0.3	ND	U

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Service Request: K2308142
Date Collected: 07/5/23
Date Received: 07/19/23

Units: Percent
Basis: Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
2023KGMLSHS1	K2308142-001	0.37	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMLSHS2	K2308142-002	0.30	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMLSHS3	K2308142-003	0.35	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMEFSCS1	K2308142-004	3.07	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMEFSCS2	K2308142-005	1.59	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMEFSCS3	K2308142-006	1.31	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMUSCS1	K2308142-007	0.47	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMUSCS2	K2308142-008	0.89	0.10	0.005	1	07/24/23 13:42	7/24/23	*
2023KGMUSCS3	K2308142-009	1.34	0.10	0.005	1	07/24/23 13:42	7/24/23	*
Method Blank	K2308142-MB	ND U	0.10	0.005	1	07/24/23 13:42	7/24/23	

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Analyzed: 07/24/23
Date Extracted: 07/24/23

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method
Analysis Lot: 811704

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K2308142-LCS	4.43	4.40	101	74-118

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request: K2308142

Continuing Calibration Verification (CCV) Summary

Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC

Units: Percent

	Analysis Lot	Lab Code	Date Analyzed	True Value	Measured Value	Percent Recovery	Acceptance Limits
CCV1	811704	KQ2313014-01	07/24/23 13:42	12.0	12.0	100	90-110
CCV2	811704	KQ2313014-02	07/24/23 13:42	12.0	12.1	101	90-110
CCV3	811704	KQ2313014-03	07/24/23 13:42	12.0	12.1	101	90-110
CCV4	811704	KQ2313014-04	07/24/23 13:42	12.0	12.0	100	90-110

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request:K2308142

Continuing Calibration Blank (CCB) Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC

Units:Percent

	Analysis Lot	Lab Code	Date Analyzed	MRL	MDL	Result	Q
CCB1	811704	KQ2313014-05	07/24/23 13:42	0.10	0.005	ND	U
CCB2	811704	KQ2313014-06	07/24/23 13:42	0.10	0.005	ND	U
CCB3	811704	KQ2313014-07	07/24/23 13:42	0.10	0.005	ND	U
CCB4	811704	KQ2313014-08	07/24/23 13:42	0.10	0.005	ND	U

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSHS1
Lab Code: K2308142-001

Sand Fraction: Dry Weight (Grams) 24.4883
Sand Fraction: Weight Recovered (Grams) 24.3641
Sand Fraction: Percent Recovery 99.49

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.0000	0.00
Gravel, Fine	-2 Ø to -1 Ø	2.5589	9.32
Sand, Very Coarse	-1 to 0 Ø	6.5200	23.74
Sand, Coarse	0 to 1 Ø	7.4275	27.05
Sand, Medium	1 to 2 Ø	4.2416	15.45
Sand, Fine	2 to 3 Ø	2.9477	10.73
Sand, Very Fine	3 to 4 Ø	0.4756	1.73
75.0 µm	4 Ø	0.7150	2.60
31.3 µm	5 Ø	0.3100	1.13
15.6 µm	6 Ø	0.4550	1.66
7.8 µm	7 Ø	0.3800	1.38
3.9 µm	8 Ø	0.2400	0.87
1.95 µm	9 Ø	0.0350	0.13
0.98 µm	> 10 Ø	0.0900	0.33
		26.3963	96.12

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSHS1
Lab Code: K2308142-001DUP

Sand Fraction: Dry Weight (Grams) 25.7503
Sand Fraction: Weight Recovered (Grams) 25.6625
Sand Fraction: Percent Recovery 99.66

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.2575	0.94
Gravel, Fine	-2 Ø to -1 Ø	3.0938	11.30
Sand, Very Coarse	-1 to 0 Ø	7.0225	25.66
Sand, Coarse	0 to 1 Ø	7.6220	27.85
Sand, Medium	1 to 2 Ø	4.2786	15.63
Sand, Fine	2 to 3 Ø	2.7834	10.17
Sand, Very Fine	3 to 4 Ø	0.4361	1.59
75.0 µm	4 Ø	0.7650	2.80
31.3 µm	5 Ø	0.4750	1.74
15.6 µm	6 Ø	0.3650	1.33
7.8 µm	7 Ø	0.1800	0.66
3.9 µm	8 Ø	0.1300	0.47
1.95 µm	9 Ø	0.2500	0.91
0.98 µm	> 10 Ø	0.0000	0.00
		27.6589	101.06

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSHS2
Lab Code: K2308142-002

Sand Fraction: Dry Weight (Grams) 28.8197
Sand Fraction: Weight Recovered (Grams) 28.7250
Sand Fraction: Percent Recovery 99.67

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.1064	0.34
Gravel, Fine	-2 Ø to -1 Ø	3.1600	10.16
Sand, Very Coarse	-1 to 0 Ø	9.5820	30.80
Sand, Coarse	0 to 1 Ø	9.9128	31.86
Sand, Medium	1 to 2 Ø	3.8020	12.22
Sand, Fine	2 to 3 Ø	1.7239	5.54
Sand, Very Fine	3 to 4 Ø	0.2701	0.87
75.0 µm	4 Ø	0.4950	1.59
31.3 µm	5 Ø	0.3350	1.08
15.6 µm	6 Ø	0.2250	0.72
7.8 µm	7 Ø	0.3350	1.08
3.9 µm	8 Ø	0.2700	0.87
1.95 µm	9 Ø	0.0000	0.00
0.98 µm	> 10 Ø	0.1200	0.39
		30.3372	97.51

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMLSHS3
Lab Code: K2308142-003

Sand Fraction: Dry Weight (Grams) 28.2470
Sand Fraction: Weight Recovered (Grams) 28.1542
Sand Fraction: Percent Recovery 99.67

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	1.2279	4.37
Gravel, Fine	-2 Ø to -1 Ø	3.6492	12.98
Sand, Very Coarse	-1 to 0 Ø	9.0683	32.27
Sand, Coarse	0 to 1 Ø	7.8037	27.77
Sand, Medium	1 to 2 Ø	3.6640	13.04
Sand, Fine	2 to 3 Ø	2.1578	7.68
Sand, Very Fine	3 to 4 Ø	0.3913	1.39
75.0 µm	4 Ø	0.9250	3.29
31.3 µm	5 Ø	0.2750	0.98
15.6 µm	6 Ø	0.4050	1.44
7.8 µm	7 Ø	0.3750	1.33
3.9 µm	8 Ø	0.3150	1.12
1.95 µm	9 Ø	0.0050	0.02
0.98 µm	> 10 Ø	0.1100	0.39
		30.3722	108.07

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMEFSCS1
Lab Code: K2308142-004

Sand Fraction: Dry Weight (Grams) 20.3948
Sand Fraction: Weight Recovered (Grams) 20.3909
Sand Fraction: Percent Recovery 99.98

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	9.1020	40.82
Gravel, Fine	-2 Ø to -1 Ø	3.6736	16.48
Sand, Very Coarse	-1 to 0 Ø	2.8478	12.77
Sand, Coarse	0 to 1 Ø	1.7037	7.64
Sand, Medium	1 to 2 Ø	0.9515	4.27
Sand, Fine	2 to 3 Ø	1.4642	6.57
Sand, Very Fine	3 to 4 Ø	0.4091	1.83
75.0 µm	4 Ø	1.0300	4.62
31.3 µm	5 Ø	0.7250	3.25
15.6 µm	6 Ø	0.4500	2.02
7.8 µm	7 Ø	0.3950	1.77
3.9 µm	8 Ø	0.2850	1.28
1.95 µm	9 Ø	0.0000	0.00
0.98 µm	> 10 Ø	0.1500	0.67
		23.1869	103.99

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMEFSCS2
Lab Code: K2308142-005

Sand Fraction: Dry Weight (Grams) 49.9716
Sand Fraction: Weight Recovered (Grams) 50.0121
Sand Fraction: Percent Recovery 100.08

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	13.7167	27.56
Gravel, Fine	-2 Ø to -1 Ø	18.5551	37.28
Sand, Very Coarse	-1 to 0 Ø	11.9058	23.92
Sand, Coarse	0 to 1 Ø	3.8311	7.70
Sand, Medium	1 to 2 Ø	0.9218	1.85
Sand, Fine	2 to 3 Ø	0.5952	1.20
Sand, Very Fine	3 to 4 Ø	0.1548	0.31
75.0 µm	4 Ø	0.3900	0.78
31.3 µm	5 Ø	0.3900	0.78
15.6 µm	6 Ø	0.2700	0.54
7.8 µm	7 Ø	0.1900	0.38
3.9 µm	8 Ø	0.0200	0.04
1.95 µm	9 Ø	0.0000	0.00
0.98 µm	> 10 Ø	0.1250	0.25
		51.0655	102.59

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMEFSCS3
Lab Code: K2308142-006

Sand Fraction: Dry Weight (Grams) 26.1778
Sand Fraction: Weight Recovered (Grams) 26.1543
Sand Fraction: Percent Recovery 99.91

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	2.7277	9.93
Gravel, Fine	-2 Ø to -1 Ø	8.1599	29.71
Sand, Very Coarse	-1 to 0 Ø	10.5896	38.55
Sand, Coarse	0 to 1 Ø	3.5642	12.98
Sand, Medium	1 to 2 Ø	0.4558	1.66
Sand, Fine	2 to 3 Ø	0.3508	1.28
Sand, Very Fine	3 to 4 Ø	0.1029	0.37
75.0 µm	4 Ø	0.2550	0.93
31.3 µm	5 Ø	0.2350	0.86
15.6 µm	6 Ø	0.1800	0.66
7.8 µm	7 Ø	0.1400	0.51
3.9 µm	8 Ø	0.0650	0.24
1.95 µm	9 Ø	0.0200	0.07
0.98 µm	> 10 Ø	0.1000	0.36
		26.9459	98.10

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMUSCS1
Lab Code: K2308142-007

Sand Fraction: Dry Weight (Grams) 28.5486
Sand Fraction: Weight Recovered (Grams) 28.5372
Sand Fraction: Percent Recovery 99.96

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	4.2621	14.65
Gravel, Fine	-2 Ø to -1 Ø	8.1191	27.90
Sand, Very Coarse	-1 to 0 Ø	10.2474	35.22
Sand, Coarse	0 to 1 Ø	4.4904	15.43
Sand, Medium	1 to 2 Ø	0.9262	3.18
Sand, Fine	2 to 3 Ø	0.3469	1.19
Sand, Very Fine	3 to 4 Ø	0.0746	0.26
75.0 µm	4 Ø	0.3700	1.27
31.3 µm	5 Ø	0.1500	0.52
15.6 µm	6 Ø	0.1950	0.67
7.8 µm	7 Ø	0.2850	0.98
3.9 µm	8 Ø	0.0100	0.03
1.95 µm	9 Ø	0.0100	0.03
0.98 µm	> 10 Ø	0.0700	0.24
		29.5567	101.58

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMUSCS2
Lab Code: K2308142-008

Sand Fraction: Dry Weight (Grams) 17.7211
Sand Fraction: Weight Recovered (Grams) 17.6605
Sand Fraction: Percent Recovery 99.66

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.5636	2.92
Gravel, Fine	-2 Ø to -1 Ø	0.8893	4.61
Sand, Very Coarse	-1 to 0 Ø	2.4731	12.83
Sand, Coarse	0 to 1 Ø	7.1266	36.98
Sand, Medium	1 to 2 Ø	4.6391	24.07
Sand, Fine	2 to 3 Ø	1.6200	8.41
Sand, Very Fine	3 to 4 Ø	0.2049	1.06
75.0 µm	4 Ø	0.6850	3.55
31.3 µm	5 Ø	0.4200	2.18
15.6 µm	6 Ø	0.5600	2.91
7.8 µm	7 Ø	0.5350	2.78
3.9 µm	8 Ø	0.1100	0.57
1.95 µm	9 Ø	0.1150	0.60
0.98 µm	> 10 Ø	0.1400	0.73
		20.0816	104.20

dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 7/5/2023
Date Received: 7/19/2023
Date Analyzed: 8/5/2023

Particle Size Determination
ASTM D422M

Sample Name: 2023KGMUSCS3
Lab Code: K2308142-009

Sand Fraction: Dry Weight (Grams) 16.4294
Sand Fraction: Weight Recovered (Grams) 16.3676
Sand Fraction: Percent Recovery 99.62

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	<-2 Ø	0.3937	2.03
Gravel, Fine	-2 Ø to -1 Ø	1.3987	7.20
Sand, Very Coarse	-1 to 0 Ø	2.7216	14.01
Sand, Coarse	0 to 1 Ø	4.5260	23.31
Sand, Medium	1 to 2 Ø	4.0790	21.00
Sand, Fine	2 to 3 Ø	2.6408	13.60
Sand, Very Fine	3 to 4 Ø	0.3926	2.02
75.0 µm	4 Ø	0.9050	4.66
31.3 µm	5 Ø	0.6400	3.30
15.6 µm	6 Ø	0.6350	3.27
7.8 µm	7 Ø	0.4200	2.16
3.9 µm	8 Ø	0.2600	1.34
1.95 µm	9 Ø	0.0900	0.46
0.98 µm	> 10 Ø	0.1400	0.72
		19.2424	99.08



Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLSHS1
Lab Code: K2308142-001

Service Request: K2308142
Date Collected: 07/05/23 09:00
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	15900	mg/Kg	2.8	0.8	5	07/27/23 09:29	07/25/23	
Arsenic	200.8	24.8	mg/Kg	0.69	0.08	5	07/27/23 09:29	07/25/23	
Cadmium	200.8	0.169	mg/Kg	0.028	0.010	5	07/27/23 09:29	07/25/23	
Chromium	200.8	30.0	mg/Kg	0.28	0.08	5	07/27/23 09:29	07/25/23	
Copper	200.8	54.3	mg/Kg	0.14	0.06	5	07/27/23 09:29	07/25/23	
Lead	200.8	4.73	mg/Kg	0.069	0.028	5	07/27/23 09:29	07/25/23	
Mercury	7471B	0.021 J	mg/Kg	0.027	0.003	1	07/24/23 12:22	07/21/23	
Nickel	200.8	27.0	mg/Kg	0.28	0.04	5	07/27/23 09:29	07/25/23	
Selenium	200.8	1.0 J	mg/Kg	1.4	0.1	5	07/27/23 09:29	07/25/23	
Silver	200.8	0.099	mg/Kg	0.028	0.006	5	07/27/23 09:29	07/25/23	
Zinc	200.8	86.1	mg/Kg	0.69	0.28	5	07/27/23 09:29	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLSHS2
Lab Code: K2308142-002

Service Request: K2308142
Date Collected: 07/05/23 09:00
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	17000	mg/Kg	1.9	0.6	5	07/27/23 09:37	07/25/23	
Arsenic	200.8	23.0	mg/Kg	0.48	0.06	5	07/27/23 09:37	07/25/23	
Cadmium	200.8	0.198	mg/Kg	0.019	0.007	5	07/27/23 09:37	07/25/23	
Chromium	200.8	36.7	mg/Kg	0.19	0.06	5	07/27/23 09:37	07/25/23	
Copper	200.8	58.5	mg/Kg	0.097	0.039	5	07/27/23 09:37	07/25/23	
Lead	200.8	5.90	mg/Kg	0.048	0.019	5	07/27/23 09:37	07/25/23	
Mercury	7471B	0.054	mg/Kg	0.025	0.002	1	07/24/23 12:24	07/21/23	
Nickel	200.8	30.0	mg/Kg	0.19	0.03	5	07/27/23 09:37	07/25/23	
Selenium	200.8	2.08	mg/Kg	0.97	0.09	5	07/27/23 09:37	07/25/23	
Silver	200.8	0.132	mg/Kg	0.019	0.004	5	07/27/23 09:37	07/25/23	
Zinc	200.8	95.2	mg/Kg	0.48	0.19	5	07/27/23 09:37	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMLSHS3
Lab Code: K2308142-003

Service Request: K2308142
Date Collected: 07/05/23 09:00
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	18000	mg/Kg	2.8	0.8	5	07/27/23 10:03	07/25/23	
Arsenic	200.8	26.6	mg/Kg	0.69	0.08	5	07/27/23 10:03	07/25/23	
Cadmium	200.8	0.353	mg/Kg	0.028	0.010	5	07/27/23 10:03	07/25/23	
Chromium	200.8	35.0	mg/Kg	0.28	0.08	5	07/27/23 10:03	07/25/23	
Copper	200.8	78.1	mg/Kg	0.14	0.06	5	07/27/23 10:03	07/25/23	
Lead	200.8	8.89	mg/Kg	0.069	0.028	5	07/27/23 10:03	07/25/23	
Mercury	7471B	0.038	mg/Kg	0.025	0.003	1	07/24/23 12:26	07/21/23	
Nickel	200.8	33.5	mg/Kg	0.28	0.04	5	07/27/23 10:03	07/25/23	
Selenium	200.8	1.9	mg/Kg	1.4	0.1	5	07/27/23 10:03	07/25/23	
Silver	200.8	0.218	mg/Kg	0.028	0.006	5	07/27/23 10:03	07/25/23	
Zinc	200.8	111	mg/Kg	0.69	0.28	5	07/27/23 10:03	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMEFSCS1
Lab Code: K2308142-004

Service Request: K2308142
Date Collected: 07/05/23 11:30
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	9520	mg/Kg	3.4	1.0	5	07/27/23 09:42	07/25/23	
Arsenic	200.8	30.4	mg/Kg	0.85	0.10	5	07/27/23 09:42	07/25/23	
Cadmium	200.8	2.35	mg/Kg	0.034	0.012	5	07/27/23 09:42	07/25/23	
Chromium	200.8	9.63	mg/Kg	0.34	0.10	5	07/27/23 09:42	07/25/23	
Copper	200.8	54.8	mg/Kg	0.17	0.07	5	07/27/23 09:42	07/25/23	
Lead	200.8	4.70	mg/Kg	0.085	0.034	5	07/27/23 09:42	07/25/23	
Mercury	7471B	0.074	mg/Kg	0.031	0.003	1	07/24/23 12:27	07/21/23	
Nickel	200.8	39.4	mg/Kg	0.34	0.05	5	07/27/23 09:42	07/25/23	
Selenium	200.8	3.0	mg/Kg	1.7	0.2	5	07/27/23 09:42	07/25/23	
Silver	200.8	0.116	mg/Kg	0.034	0.007	5	07/27/23 09:42	07/25/23	
Zinc	200.8	266	mg/Kg	0.85	0.34	5	07/27/23 09:42	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMEFSCS2
Lab Code: K2308142-005

Service Request: K2308142
Date Collected: 07/05/23 11:30
Date Received: 07/19/23 10:50
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	11100	mg/Kg	2.4	0.7	5	07/27/23 09:44	07/25/23	
Arsenic	200.8	48.2	mg/Kg	0.60	0.07	5	07/27/23 09:44	07/25/23	
Cadmium	200.8	3.68	mg/Kg	0.024	0.008	5	07/27/23 09:44	07/25/23	
Chromium	200.8	11.3	mg/Kg	0.24	0.07	5	07/27/23 09:44	07/25/23	
Copper	200.8	37.5	mg/Kg	0.12	0.05	5	07/27/23 09:44	07/25/23	
Lead	200.8	9.16	mg/Kg	0.060	0.024	5	07/27/23 09:44	07/25/23	
Mercury	7471B	0.054	mg/Kg	0.025	0.002	1	07/24/23 12:32	07/21/23	
Nickel	200.8	44.3	mg/Kg	0.24	0.04	5	07/27/23 09:44	07/25/23	
Selenium	200.8	11.6	mg/Kg	1.2	0.1	5	07/27/23 09:44	07/25/23	
Silver	200.8	0.099	mg/Kg	0.024	0.005	5	07/27/23 09:44	07/25/23	
Zinc	200.8	388	mg/Kg	0.60	0.24	5	07/27/23 09:44	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMEFSCS3
Lab Code: K2308142-006

Service Request: K2308142
Date Collected: 07/05/23 11:30
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	10700	mg/Kg	2.6	0.8	5	07/27/23 09:47	07/25/23	
Arsenic	200.8	32.9	mg/Kg	0.66	0.08	5	07/27/23 09:47	07/25/23	
Cadmium	200.8	5.76	mg/Kg	0.026	0.009	5	07/27/23 09:47	07/25/23	
Chromium	200.8	8.16	mg/Kg	0.26	0.08	5	07/27/23 09:47	07/25/23	
Copper	200.8	28.7	mg/Kg	0.13	0.05	5	07/27/23 09:47	07/25/23	
Lead	200.8	5.23	mg/Kg	0.066	0.026	5	07/27/23 09:47	07/25/23	
Mercury	7471B	0.031	mg/Kg	0.028	0.003	1	07/24/23 12:34	07/21/23	
Nickel	200.8	53.3	mg/Kg	0.26	0.04	5	07/27/23 09:47	07/25/23	
Selenium	200.8	4.3	mg/Kg	1.3	0.1	5	07/27/23 09:47	07/25/23	
Silver	200.8	0.192	mg/Kg	0.026	0.005	5	07/27/23 09:47	07/25/23	
Zinc	200.8	432	mg/Kg	0.66	0.26	5	07/27/23 09:47	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMUSCS1
Lab Code: K2308142-007

Service Request: K2308142
Date Collected: 07/05/23 12:30
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	15600	mg/Kg	2.3	0.7	5	07/27/23 09:50	07/25/23	
Arsenic	200.8	12.8	mg/Kg	0.58	0.07	5	07/27/23 09:50	07/25/23	
Cadmium	200.8	0.485	mg/Kg	0.023	0.008	5	07/27/23 09:50	07/25/23	
Chromium	200.8	94.6	mg/Kg	0.23	0.07	5	07/27/23 09:50	07/25/23	
Copper	200.8	42.6	mg/Kg	0.12	0.05	5	07/27/23 09:50	07/25/23	
Lead	200.8	3.49	mg/Kg	0.058	0.023	5	07/27/23 09:50	07/25/23	
Mercury	7471B	0.016 J	mg/Kg	0.024	0.002	1	07/24/23 12:35	07/21/23	
Nickel	200.8	54.2	mg/Kg	0.23	0.03	5	07/27/23 09:50	07/25/23	
Selenium	200.8	1.7	mg/Kg	1.2	0.1	5	07/27/23 09:50	07/25/23	
Silver	200.8	0.057	mg/Kg	0.023	0.005	5	07/27/23 09:50	07/25/23	
Zinc	200.8	103	mg/Kg	0.58	0.23	5	07/27/23 09:50	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMUSCS2
Lab Code: K2308142-008

Service Request: K2308142
Date Collected: 07/05/23 12:30
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	16400	mg/Kg	2.8	0.8	5	07/27/23 09:52	07/25/23	
Arsenic	200.8	18.9	mg/Kg	0.70	0.08	5	07/27/23 09:52	07/25/23	
Cadmium	200.8	0.738	mg/Kg	0.028	0.010	5	07/27/23 09:52	07/25/23	
Chromium	200.8	79.3	mg/Kg	0.28	0.08	5	07/27/23 09:52	07/25/23	
Copper	200.8	46.8	mg/Kg	0.14	0.06	5	07/27/23 09:52	07/25/23	
Lead	200.8	3.38	mg/Kg	0.070	0.028	5	07/27/23 09:52	07/25/23	
Mercury	7471B	0.060	mg/Kg	0.028	0.003	1	07/24/23 12:37	07/21/23	
Nickel	200.8	58.5	mg/Kg	0.28	0.04	5	07/27/23 09:52	07/25/23	
Selenium	200.8	1.8	mg/Kg	1.4	0.1	5	07/27/23 09:52	07/25/23	
Silver	200.8	0.076	mg/Kg	0.028	0.006	5	07/27/23 09:52	07/25/23	
Zinc	200.8	120	mg/Kg	0.70	0.28	5	07/27/23 09:52	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: 2023KGMUSCS3
Lab Code: K2308142-009

Service Request: K2308142
Date Collected: 07/05/23 12:30
Date Received: 07/19/23 10:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	18500	mg/Kg	3.0	0.9	5	07/27/23 10:00	07/25/23	
Arsenic	200.8	20.2	mg/Kg	0.74	0.09	5	07/27/23 10:00	07/25/23	
Cadmium	200.8	1.05	mg/Kg	0.030	0.010	5	07/27/23 10:00	07/25/23	
Chromium	200.8	100	mg/Kg	0.30	0.09	5	07/27/23 10:00	07/25/23	
Copper	200.8	55.5	mg/Kg	0.15	0.06	5	07/27/23 10:00	07/25/23	
Lead	200.8	3.92	mg/Kg	0.074	0.030	5	07/27/23 10:00	07/25/23	
Mercury	7471B	0.052	mg/Kg	0.029	0.003	1	07/24/23 12:39	07/21/23	
Nickel	200.8	67.9	mg/Kg	0.30	0.04	5	07/27/23 10:00	07/25/23	
Selenium	200.8	2.1	mg/Kg	1.5	0.1	5	07/27/23 10:00	07/25/23	
Silver	200.8	0.091	mg/Kg	0.030	0.006	5	07/27/23 10:00	07/25/23	
Zinc	200.8	147	mg/Kg	0.74	0.30	5	07/27/23 10:00	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: Method Blank
Lab Code: KQ2312762-05

Service Request: K2308142
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	1.1 J	mg/Kg	2.0	0.6	5	07/27/23 08:58	07/25/23	
Arsenic	200.8	ND U	mg/Kg	0.5	0.06	5	07/27/23 08:58	07/25/23	
Cadmium	200.8	ND U	mg/Kg	0.020	0.007	5	07/27/23 08:58	07/25/23	
Chromium	200.8	0.07 J	mg/Kg	0.20	0.06	5	07/27/23 08:58	07/25/23	
Copper	200.8	ND U	mg/Kg	0.10	0.04	5	07/27/23 08:58	07/25/23	
Lead	200.8	ND U	mg/Kg	0.05	0.020	5	07/27/23 08:58	07/25/23	
Nickel	200.8	ND U	mg/Kg	0.20	0.03	5	07/27/23 08:58	07/25/23	
Selenium	200.8	ND U	mg/Kg	1.0	0.09	5	07/27/23 08:58	07/25/23	
Silver	200.8	ND U	mg/Kg	0.020	0.004	5	07/27/23 08:58	07/25/23	
Zinc	200.8	ND U	mg/Kg	0.5	0.20	5	07/27/23 08:58	07/25/23	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil
Sample Name: Method Blank
Lab Code: KQ2312773-03

Service Request: K2308142
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	0.002	1	07/24/23 12:00	07/21/23	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/27/23

Replicate Sample Summary

Total Metals

Sample Name: 2023KGMLSHS1
Lab Code: K2308142-001

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample	Average	RPD	RPD Limit
					KQ2312762-01 Result			
Aluminum	200.8	2.8	0.8	15900	16700	16300	4	30
Arsenic	200.8	0.70	0.08	24.8	23.5	24.2	5	30
Cadmium	200.8	0.028	0.010	0.169	0.209	0.189	22	30
Chromium	200.8	0.28	0.08	30.0	28.2	29.1	6	30
Copper	200.8	0.14	0.06	54.3	63.7	59.0	16	30
Lead	200.8	0.070	0.028	4.73	5.77	5.25	20	30
Nickel	200.8	0.28	0.04	27.0	29.0	28.0	7	30
Selenium	200.8	1.4	0.1	1.0 J	1.0 J	1.0	3	30
Silver	200.8	0.028	0.006	0.099	0.110	0.105	10	30
Zinc	200.8	0.70	0.28	86.1	93.9	90.0	9	30

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
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Collected: 07/05/23
Date Received: 07/19/23
Date Analyzed: 07/27/23
Date Extracted: 07/25/23

Matrix Spike Summary
Total Metals

Sample Name: 2023KGMLSHS1
Lab Code: K2308142-001
Analysis Method: 200.8
Prep Method: EPA 3050B

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ2312762-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	15900	18500	537	489 #	70-130
Arsenic	24.8	161	134	101	70-130
Cadmium	0.169	13.7	13.4	101	70-130
Chromium	30.0	85.4	53.7	103	70-130
Copper	54.3	122	67.0	100	70-130
Lead	4.73	143	134	103	70-130
Nickel	27.0	164	134	102	70-130
Selenium	1.0 J	135	134	100	70-130
Silver	0.099	12.7	13.4	94	70-130
Zinc	86.1	224	134	103	70-130

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: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Analyzed: 07/27/23

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ2312762-06

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	200.8	397	400	99	85-115
Arsenic	200.8	100	100	100	85-115
Cadmium	200.8	9.94	10.0	99	85-115
Chromium	200.8	40.4	40.0	101	85-115
Copper	200.8	48.1	50.0	96	85-115
Lead	200.8	101	100	101	85-115
Nickel	200.8	99.9	100	100	85-115
Selenium	200.8	98.8	100	99	85-115
Silver	200.8	9.78	10.0	98	85-115
Zinc	200.8	99.4	100	99	85-115

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request: K2308142
Date Analyzed: 07/24/23

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ2312773-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	0.488	0.500	98	80-120

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Prep Summary Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request:K2308142

Metals

Prep Method: EPA 3050B
Analytical Method: 200.8

Extraction Lot: 423399
Extraction Date: 07/25/23 07:00

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
2023KGMLSHS1	K2308142-001	7/5/23	7/19/23	1.059 g	100 mL	
2023KGMLSHS2	K2308142-002	7/5/23	7/19/23	1.339 g	100 mL	
2023KGMLSHS3	K2308142-003	7/5/23	7/19/23	1.038 g	100 mL	
2023KGMEFSCS1	K2308142-004	7/5/23	7/19/23	1.059 g	100 mL	
2023KGMEFSCS2	K2308142-005	7/5/23	7/19/23	1.177 g	100 mL	
2023KGMEFSCS3	K2308142-006	7/5/23	7/19/23	1.109 g	100 mL	
2023KGMUSCS1	K2308142-007	7/5/23	7/19/23	1.185 g	100 mL	
2023KGMUSCS2	K2308142-008	7/5/23	7/19/23	1.128 g	100 mL	
2023KGMUSCS3	K2308142-009	7/5/23	7/19/23	1.052 g	100 mL	
Duplicate	KQ2312762-01DUP	7/5/23	7/19/23	1.047 g	100 mL	
Matrix Spike	KQ2312762-02MS	7/5/23	7/19/23	1.091 g	100 mL	
Method Blank	KQ2312762-05MB	NA	NA	1 g	100 mL	
Lab Control Sample	KQ2312762-06LCS	NA	NA	1 g	100 mL	

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Prep Summary Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring
Sample Matrix: Soil

Service Request:K2308142

Metals

Prep Method: Method
Analytical Method: 7471B

Extraction Lot: 423405
Extraction Date: 07/21/23 10:31

Sample Name	Lab Code	Date Collected	Date Received	Sample Amount	Final Amount	Percent Solids
2023KGMLSHS1	K2308142-001	7/5/23	7/19/23	0.551 g	50 mL	
2023KGMLSHS2	K2308142-002	7/5/23	7/19/23	0.529 g	50 mL	
2023KGMLSHS3	K2308142-003	7/5/23	7/19/23	0.567 g	50 mL	
2023KGMEFSCS1	K2308142-004	7/5/23	7/19/23	0.585 g	50 mL	
2023KGMEFSCS2	K2308142-005	7/5/23	7/19/23	0.575 g	50 mL	
2023KGMEFSCS3	K2308142-006	7/5/23	7/19/23	0.526 g	50 mL	
2023KGMUSCS1	K2308142-007	7/5/23	7/19/23	0.576 g	50 mL	
2023KGMUSCS2	K2308142-008	7/5/23	7/19/23	0.559 g	50 mL	
2023KGMUSCS3	K2308142-009	7/5/23	7/19/23	0.539 g	50 mL	
Method Blank	KQ2312773-03MB	NA	NA	0.5 g	50 mL	
Lab Control Sample	KQ2312773-04LCS	NA	NA	0.5 g	50 mL	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request: K2308142

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID	Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
ICV 07/24/23 11:37	Mercury	7471B	811621	4.93	5.00	99	90-110
CCV 07/24/23 11:42	Mercury	7471B	811621	5.19	5.00	104	90-110
CCV 07/24/23 12:08	Mercury	7471B	811621	4.96	5.00	99	90-110
CCV 07/24/23 12:29	Mercury	7471B	811621	4.94	5.00	99	90-110
CCV 07/24/23 12:50	Mercury	7471B	811621	4.90	5.00	98	90-110
ICV 07/27/23 08:42	Aluminum	200.8	811984	101	100	101	90-110
	Arsenic	200.8	811984	23.9	25.0	96	90-110
	Cadmium	200.8	811984	12.4	12.5	100	90-110
	Chromium	200.8	811984	9.94	10.0	99	90-110
	Copper	200.8	811984	12.2	12.5	98	90-110
	Lead	200.8	811984	25.4	25.0	101	90-110
	Nickel	200.8	811984	25.1	25.0	100	90-110
	Selenium	200.8	811984	25.0	25.0	100	90-110
	Silver	200.8	811984	12.2	12.5	98	90-110
	Zinc	200.8	811984	25.1	25.0	100	90-110
CCV 07/27/23 08:45	Aluminum	200.8	811984	248	250	99	90-110
	Arsenic	200.8	811984	25.6	25.0	102	90-110
	Cadmium	200.8	811984	24.9	25.0	99	90-110
	Chromium	200.8	811984	25.3	25.0	101	90-110
	Copper	200.8	811984	24.9	25.0	99	90-110
	Lead	200.8	811984	25.3	25.0	101	90-110
	Nickel	200.8	811984	25.5	25.0	102	90-110
	Selenium	200.8	811984	25.2	25.0	101	90-110
	Silver	200.8	811984	12.3	12.5	99	90-110
	Zinc	200.8	811984	25.2	25.0	101	90-110
CCV 07/27/23 09:24	Aluminum	200.8	811984	264	250	106	90-110
	Arsenic	200.8	811984	24.9	25.0	100	90-110
	Cadmium	200.8	811984	25.2	25.0	101	90-110
	Chromium	200.8	811984	25.1	25.0	100	90-110

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request: K2308142

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Concentration Units: ug/L

Sample ID	Analyte	Method	Analysis Batch:	Result	True Value	% Rec	% Rec. Limits
CCV 07/27/23 09:24	Copper	200.8	811984	24.8	25.0	99	90-110
	Lead	200.8	811984	25.5	25.0	102	90-110
	Nickel	200.8	811984	25.7	25.0	103	90-110
	Selenium	200.8	811984	25.2	25.0	101	90-110
	Silver	200.8	811984	12.4	12.5	99	90-110
	Zinc	200.8	811984	26.0	25.0	104	90-110
CCV 07/27/23 09:55	Aluminum	200.8	811984	271	250	109	90-110
	Arsenic	200.8	811984	25.7	25.0	103	90-110
	Cadmium	200.8	811984	25.2	25.0	101	90-110
	Chromium	200.8	811984	25.2	25.0	101	90-110
	Copper	200.8	811984	25.0	25.0	100	90-110
	Lead	200.8	811984	24.9	25.0	100	90-110
	Nickel	200.8	811984	25.2	25.0	101	90-110
	Selenium	200.8	811984	24.9	25.0	100	90-110
	Silver	200.8	811984	12.4	12.5	99	90-110
	Zinc	200.8	811984	25.5	25.0	102	90-110
CCV 07/27/23 10:22	Aluminum	200.8	811984	250	250	100	90-110
	Arsenic	200.8	811984	25.1	25.0	100	90-110
	Cadmium	200.8	811984	24.8	25.0	99	90-110
	Chromium	200.8	811984	24.7	25.0	99	90-110
	Copper	200.8	811984	24.3	25.0	97	90-110
	Lead	200.8	811984	24.8	25.0	99	90-110
	Nickel	200.8	811984	25.0	25.0	100	90-110
	Selenium	200.8	811984	25.3	25.0	101	90-110
	Silver	200.8	811984	12.2	12.5	98	90-110
	Zinc	200.8	811984	25.1	25.0	101	90-110

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request: K2308142

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID	Analyte	Method	Analysis Batch:	Result	C
ICB 07/24/23 11:39	Mercury	7471B	811621	0.02	U
CCB 07/24/23 11:44	Mercury	7471B	811621	0.02	U
CCB 07/24/23 12:09	Mercury	7471B	811621	0.02	U
CCB 07/24/23 12:31	Mercury	7471B	811621	0.02	U
CCB 07/24/23 12:51	Mercury	7471B	811621	0.02	U
ICB 07/27/23 08:47	Aluminum	200.8	811984	1.2	U
	Arsenic	200.8	811984	0.1	U
	Cadmium	200.8	811984	0.014	U
	Chromium	200.8	811984	0.12	U
	Copper	200.8	811984	0.08	U
	Lead	200.8	811984	0.04	U
	Nickel	200.8	811984	0.06	U
	Selenium	200.8	811984	0.2	U
	Silver	200.8	811984	0.008	U
	Zinc	200.8	811984	0.4	U
CCB 07/27/23 08:50	Aluminum	200.8	811984	1.2	U
	Arsenic	200.8	811984	0.1	U
	Cadmium	200.8	811984	0.014	U
	Chromium	200.8	811984	0.12	U
	Copper	200.8	811984	0.08	U
	Lead	200.8	811984	0.04	U
	Nickel	200.8	811984	0.06	U
	Selenium	200.8	811984	0.2	U
	Silver	200.8	811984	0.008	U
	Zinc	200.8	811984	0.4	U
CCB 07/27/23 09:26	Aluminum	200.8	811984	1.2	U
	Arsenic	200.8	811984	0.1	U
	Cadmium	200.8	811984	0.014	U
	Chromium	200.8	811984	0.12	U

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request: K2308142

INITIAL AND CONTINUING CALIBRATION BLANKS

Concentration Units: ug/L

Sample ID	Analyte	Method	Analysis Batch:	Result	C
CCB 07/27/23 09:26					
	Copper	200.8	811984	0.08	U
	Lead	200.8	811984	0.04	U
	Nickel	200.8	811984	0.06	U
	Selenium	200.8	811984	0.2	U
	Silver	200.8	811984	0.008	U
	Zinc	200.8	811984	0.4	U
CCB 07/27/23 09:57					
	Aluminum	200.8	811984	1.2	U
	Arsenic	200.8	811984	0.1	U
	Cadmium	200.8	811984	0.014	U
	Chromium	200.8	811984	0.12	U
	Copper	200.8	811984	0.08	U
	Lead	200.8	811984	0.04	U
	Nickel	200.8	811984	0.06	U
	Selenium	200.8	811984	0.2	U
	Silver	200.8	811984	0.008	U
	Zinc	200.8	811984	0.4	U
CCB 07/27/23 10:24					
	Aluminum	200.8	811984	1.2	U
	Arsenic	200.8	811984	0.1	U
	Cadmium	200.8	811984	0.014	U
	Chromium	200.8	811984	0.12	U
	Copper	200.8	811984	0.08	U
	Lead	200.8	811984	0.04	U
	Nickel	200.8	811984	0.06	U
	Selenium	200.8	811984	0.2	U
	Silver	200.8	811984	0.008	U
	Zinc	200.8	811984	0.4	U

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring

Service Request: K2308142

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
LLICV								
	Mercury	7471B	811621	0.19	0.2	95	50-150	07/24/23 11:41
LLICVS								
	Aluminum	200.8	811984	4.5	4.0	113	50-199	07/27/23 08:53
	Arsenic	200.8	811984	1.1	1.0	105	50-199	07/27/23 08:53
	Cadmium	200.8	811984	0.038	0.04	95	50-199	07/27/23 08:53
	Chromium	200.8	811984	0.53	0.4	133	50-199	07/27/23 08:53
	Copper	200.8	811984	0.19	0.2	93	50-199	07/27/23 08:53
	Lead	200.8	811984	0.094	0.1	94	50-199	07/27/23 08:53
	Nickel	200.8	811984	0.48	0.4	120	50-199	07/27/23 08:53
	Selenium	200.8	811984	1.9	2.0	96	50-199	07/27/23 08:53
	Silver	200.8	811984	0.040	0.04	99	50-199	07/27/23 08:53
	Zinc	200.8	811984	1.2	1.0	116	50-199	07/27/23 08:53

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring/

Service Request: K2308142

Detection Limits

Instrument: K-CVAA-03

Matrix: Soil

Analyte	Wavelength (nm)	Units	MRL	MDL	Method
Mercury	253	ug/L	0.2	0.02	7471B

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring/

Service Request: K2308142

Detection Limits

Instrument: K-ICP-MS-05

Matrix: Soil

Analyte	Mass	Units	MRL	MDL	Method
Aluminum	27	ug/L	4	1.2	200.8
Arsenic	75	ug/L	1	0.12	200.8
Cadmium	111	ug/L	0.04	0.014	200.8
Chromium	52	ug/L	0.4	0.12	200.8
Copper	65	ug/L	0.2	0.08	200.8
Lead	208	ug/L	0.1	0.04	200.8
Nickel	60	ug/L	0.4	0.06	200.8
Selenium	78	ug/L	2	0.18	200.8
Silver	107	ug/L	0.04	0.008	200.8
Zinc	66	ug/L	1	0.4	200.8

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring/

Service Request: K2308142

ICP Linear Range (Quarterly)

Instrument: K-CVAA-03

Analyte	Concentration (ug/L)	Method
Mercury	10	7471B

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Couer AK Biomonitoring/

Service Request: K2308142

ICP Linear Range (Quarterly)

Instrument: K-ICP-MS-05

Analyte	Concentration (ug/L)	Method
Aluminum 27	45000	200.8
Arsenic 75	3150	200.8
Cadmium 111	3150	200.8
Chromium 52	3150	200.8
Copper 65	3150	200.8
Lead 208	3150	200.8
Nickel 60	3150	200.8
Selenium 78	3150	200.8
Silver 107	180	200.8
Zinc 66	3150	200.8