British Columbia and Alaska
Joint Water Quality Program for Transboundary Waters
Data Report

Final Report

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THE SEAL OF THE STATE OF ALASKA

The Joint Water Quality Sampling Program for Transboundary Waters is a collaboration between the State of Alaska and the Province of British Columbia (B.C.) for the purpose of the collection, summarizing and distribution of 2017 to 2019 data on water quality and the condition of fish and other aquatic life potentially impacted by contaminants in rivers spanning the Alaska-B.C. boundary. Three reports, including this one, were written to communicate the scientific knowledge gained through sampling and analysis conducted by the Alaska Department of Environmental Conservation and the B.C. Ministry of Environment and Climate Change Strategy. They also highlight the involvement of scientific, Tribe and First Nation partners who worked in collaboration with state and provincial staff. For additional information, visit:

B.C.'s BC Alaska Transboundary Waters website: https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/compliance-enforcement/bc-alaska-transboundary-waters

State of Alaska website http://dnr.alaska.gov/commis/opmp/Canadian-Mines/index.htm

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Author's Affiliation:
Lisa Torunski
Environmental Impact Assessment Biologist
BC Ministry of Environment and Climate Change Strategy
3726 Alfred Avenue
Smithers, B.C.
Canada V0J 2N0

Meredith Witte
Environmental Program Specialist
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, Alaska, USA
99501

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- B.C. Ministry of Energy, Mines and Low Carbon Innovation (formerly B.C. Ministry of Energy, Mines, and Petroleum Resources)
- Central Council of Tlingit and Haida Indian Tribes of Alaska
- Ketchikan Indian Community
- Tahltan Central Government
- Taku River Tlingit First Nation
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EXECUTIVE SUMMARY

The transboundary region in Southeast Alaska and Northwest British Columbia provide important social, economic and cultural resources. The region is rich in mineral resources and has attracted prospective mines and supported operating mines for decades. The transboundary watersheds in this region are home to economically and culturally significant fisheries.

Public concerns about potential impacts to transboundary waters from historical mining activities, mine development projects, or a future unexpected catastrophic event, such as a tailing impoundment failure, led to the development of the Joint Water Quality Program for Transboundary Waters by the State of Alaska and the Province of British Columbia (B.C.). This coordinated two-year aquatic sampling program focused on collecting information for the Taku, Stikine and Unuk watersheds.

This report summarizes the results of the British Columbia and Alaska Transboundary Rivers Sampling Program (Joint Sampling Program) activities from August 2017 to September 2019 and builds on the British Columbia and Alaska Transboundary Rivers Sampling Program 2019 Status Report (DEC and ENV, 2020). The Joint Sampling Program included physical habitat assessments; physical and chemical analyses of water and sediment; benthic macroinvertebrate taxonomy, and chemical analyses of biological samples including benthic macroinvertebrates, fish and periphyton. Samples were analyzed for physical and chemical constituents, including elements that tend to be of greatest interest due to their potential ecological impacts (i.e., constituents of concern).

Pertinent state standards and provincial guidelines for water and sediment quality to protect aquatic life were used to assess conditions in three transboundary watersheds. These standards and guidelines were developed to prevent adverse effects to the most sensitive aquatic species for which data is available; however, they may not account for adaptations in local biota to naturally elevated conditions. For example, mining exploration and development typically occur in locations with highly mineralized geology and naturally elevated background concentrations for some constituents of concern. These background concentrations, although elevated compared to the B.C. guidelines or Alaskan standards, do not necessarily pose risks to aquatic organisms that may be adapted to these conditions.

Laboratory analyses of water samples identified sites in B.C. with elevated concentrations of cadmium, copper, selenium and zinc relative to long-term B.C. Water Quality Guidelines (WQG). There were no exceedances of Alaska Water Quality Standards (WQS) observed in water samples downstream of the B.C.-Alaska border. In some cases, element concentrations in water upstream from mine sites were above provincial guidelines (e.g., a subset of Unuk River sites), likely reflecting waters with naturally elevated concentrations. Some concentrations were also above provincial guidelines at sites downstream relative to operating or historic mines (e.g., a subset of Tulsequah River sites).

The analysis of sediment samples from all target watersheds identified sites with concentrations of total arsenic, copper and nickel above the B.C. Working Sediment Quality Guidelines (WSQG) and the National Oceanic and Atmospheric Association Sediment Quality Guidelines (NOAA SQG) for aquatic life. Generally, across the watersheds studied, sediment element concentrations above standards and guidelines occurred above and below mineral development. Element concentrations were higher in sediment samples collected in tributaries of the mainstem in all three watersheds. Sediment samples from the Unuk watershed had the highest concentrations of arsenic, copper and iron of the three watersheds.

Benthic macroinvertebrate tissues and community structure were analyzed. In B.C., samples were analyzed for whole body element concentrations. Samples were also collected in B.C. by Taku River Tlingit First Nation (TRTFN) and by Alaska DEC for taxonomic identification and enumeration. Taxonomic

data were assessed for abundance, taxa richness, diversity and evenness, presence of intolerant taxa and the percentage of Ephemeroptera, Plecoptera and Trichoptera (EPT).

Resident fish species from each watershed were analyzed for whole body element concentrations. Although there is no way to determine the length of time an individual fish spent at the capture site, the selection of resident fish species improves the chances that observed concentrations are reflective of local influences. Arsenic concentrations in Dolly Varden char collected in the Taku watershed in 2018 and 2019 were greater downstream of Tulsequah Chief Mine and New Polaris Mine relative to fish collected upstream in the Tulsequah River. This data aligns with data collected in other studies by DFG, above and below the mine sites, in 2014, 2015 and 2016. Concentrations observed in fish collected near the border are generally within the same range or lower than concentrations observed for fish collected in the Tulsequah River. In the Stikine watershed, greater copper concentrations and the lowest selenium concentrations were observed in the Alaska sculpin samples compared to samples from B.C. sites. Concentrations were similar for all other elements at sampling sites throughtout the watershed. In the Unuk River watershed Dolly Varden char element concentrations were lower in Alaska compared to the B.C. mainstem and tributary sites. Despite some differences in fish element concentrations, identifying mechanisms responsible for these differences will require sampling designs that are more focused in area and scope than the objectives of this program.

Over the past three years, the Joint Sampling Program was successful in collecting water, sediment and biological samples from the Taku, Stikine and Unuk watersheds. There was variability in the spatial and temporal analysis of the data, however, no apparent trends were revealed over the course of the sampling program. The results and analysis from the Joint Sampling Program were determined using accepted environmental collection methods and analysis tools. The data suggests that the current environmental conditions in these watersheds continue to support and sustain aquatic resources.

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ACRONYMS

AKMAP	Alaska Monitoring and Assessment Program
AWQMS	Ambient Water Quality Monitoring System
B.C.	British Columbia
CABIN	Canadian Aquatic Biomonitoring Network
DEC	Alaska Department of Environmental Conservation
DFG	Alaska Department of Fish and Game
DNR	Alaska Department of Natural Resources
ENV	B.C. Ministry of Environment and Climate Change Strategy
EMLI	B.C. Ministry of Energy, Mines and Low Carbon Innovation (formerly B.C. Ministry of Energy, Mines, and Petroleum Resources)
EMS	Environmental Monitoring System Database
GLOF	Glacial lake outburst flood
LDL	Lowest detection limit
NOAA SQG	National Oceanic and Atmospheric Administration Sediment Quality Guidelines
NRCE	Natural Resources Compliance and Enforcement
NRSA	National Rivers and Streams Assessment
TRTFN	Taku River Tlingit First Nation
USEPA	United States Environmental Protection Agency
WQG	B.C. Water Quality Guidelines
WQS	Alaska Water Quality Standards
WSQG	B.C. Working Sediment Quality Guidelines

MINING GLOSSARY

The following terms are used to define the operational status of mining projects referenced in this report. The terms were developed by the Alaska Department of Natural Resources (DNR) and the B.C. Ministry of Energy, Mines and and Low Carbon Innovation (EMLI) as part of the Master Project List, which is a key deliverable under the Bilateral Working Group agreement between Alaska and B.C. (DNR and EMLI, 2019).

Advanced exploration project: Exploration with multi-year drill programs, possible permanent camp, access roads, or possible bulk samples from the surface or underground. May include underground drilling and possible dewatering associated with underground exploration activities. These projects are often in preparation for proposed mines. Preliminary engineering or economic assessment may be undertaken.

Proposed mine: This is a mine project that has not yet been certified for construction and operation but is in the process of obtaining necessary certificates or permits.

Operating mine: This is a mine project that has existing authorizations, including permits and an Environmental Assessment Certificate, that allow the production of a mineral, a placer mineral, coal, sand, gravel or rock.

Closed mine: A mine at which all mining activities have ceased but in respect of which the owner, agent, manager or permittee remains responsible for compliance with the B.C. *Mines Act*, the regulations, the code and that person's obligations under the permits for that mine.

Care and maintenance: A mine project that is closed but there is potential to recommence operations. Production is stopped, but the site is managed in order to ensure it remains in safe and stable condition and the owner, agent, manager or permittee remains responsible for compliance with the B.C. *Mines Act*, the regulations, the code and obligations under the permit(s) for that mine.

1. INTRODUCTION

The transboundary region between Southeast Alaska and Northwest British Columbia provides important social, economic and cultural resources. Transboundary watersheds in this region are home to economically and culturally significant fisheries (McDowell, 2016; Fisheries and Oceans Canada, 2019). Exploration of the complex geology of the region has resulted in historic, active and proposed mining operations.

Public concerns about the potential impact of mine impoundment failures, contamination from historical mining activities, and a desire to establish data to characterize current aquatic conditions in anticipation of future proposed projects led to discussions among local communities and governments regarding aquatic environments in transboundary waters (State of Alaska, 2015). In response to these concerns, the State of Alaska and the Province of British Columbia signed a Memorandum of Understanding and Cooperation (November 25, 2015), and a Statement of Cooperation on the Protection of Transboundary Waters (October 6, 2016). These agreements can be found at the B.C. Alaska Transboundary Waters webpage[1] and the State of Alaska website[2].

The Statement of Cooperation outlined a process for development of a Joint Water Quality Sampling Program for Transboundary Waters. The program's objectives were to:

1. Collect aquatic data in the Taku, Stikine and Unuk watersheds to characterize aquatic conditions, and
2. Collaborate between Alaska and B.C. to share methods and exchange environmental data on transboundary rivers.

To assess the current state of the Taku, Stikine and Unuk transboundary watersheds, the Transboundary Rivers Sampling Project was established. Aquatic environmental quality data was collected from August 2017 to September 2019 by staff from the State of Alaska and the Province of British Columbia with the assistance and support of regional Indigenous communities.

2. HISTORY OF NATURAL RESOURCE PRODUCTION

The Taku, Stikine and Unuk river watersheds of Northwest B.C., draining through Southeast Alaska to the Pacific Ocean, are remote and in a wilderness or semi-wilderness state. Indigenous peoples have occupied this land for at least ten thousand years and used the major tributaries as trade routes, as well as claim most of the area as traditional hunting and fishing grounds (Province of B.C., 2000). In the 1860s, people from around the world searching for minerals (primarily gold) began to arrive at the goldfields of Northwest B.C.

TAKU

The Taku River watershed provides high value fish and wildlife habitats, is of great cultural value to local Indigenous peoples, offers wilderness recreation and is home to commercial fisheries and mineral exploration and development. Two closed underground hard rock mine sites are located within the watershed along the Tulsequah River. The New Polaris gold mine operated for 14 years from 1937 to

[1] B.C. Alaska Transboundary Waters webpage: https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/compliance-enforcement/bc-alaska-transboundary-waters

[2] State of Alaska website: http://dnr.alaska.gov/commis/opmp/Canadian-Mines/index.htm

1951. An application was recently approved for exploration activities at the New Polaris site in the summer of 2021. The Tulsequah Chief Mine operated between 1951 and 1957, and currently discharges untreated mine contact water into the Tulsequah River. An ecological risk assessment completed in 2017 (SLR Consulting Ltd., 2017), identified risks associated with acid rock drainage to fish and macroinvertebrates near the mine site that diminish with distance away from the mine site.

STIKINE

The Stikine River watershed is the largest in Northwest B.C. The watershed, in addition to ecological resources, has long-standing cultural value to local Indigenous Nations, and provides non- Indigenous heritage resources dating back to the mid-1800s. There are several small settlements in the drainage. Resource development activities in the watershed include mining, commercial fisheries, hydroelectric power generation, transportation, forestry, agriculture, tourism and recreation.

Mining activity in the Stikine River watershed dates to the mid-1800s. Currently, the only operating mine is the Red Chris copper, gold and silver project, located in the upper Iskut River drainage. Several other significant exploration projects are present in the Stikine watershed. The proposed Galore Creek Mine is located on Galore Creek, which flows northward to the Scud River, a tributary to the Stikine River, in B.C. The project would potentially affect the Galore, Scud, Scotsimpson, Sphaler, Porcupine, More and Iskut drainages, all flowing into the Stikine River. The Schaft Creek advanced exploration project is located approximately 60 km (37.5 miles) south of the village of Telegraph Creek in the upper Schaft Creek watershed. Schaft Creek drains to the north into Mess Creek, a tributary to the Stikine River, in B.C.

UNUK

The Unuk River watershed is the southern most major river along the B.C.-Alaska boundary. The watershed has substantial value in terms of fish, wildlife, recreation, mineral exploration and development and timber harvesting (Province of B.C., 2000). Three existing or proposed mine sites are present in the watershed: the Brucejack Mine, which started mining gold in 2017; the Kerr-Sulphurets-Mitchell (KSM) proposed copper and gold mining project; and the closed Eskay Creek gold and silver project, which operated from 1971 to 2008. The Brucejack Mine is located within the Bell Irving River watershed, but the discharge from mining activities enters the Unuk River watershed. All sites are subject to ongoing monitoring of discharge and the receiving environment monitoring or both.

3. STUDY AREA

The study area for the B.C. and Alaska Joint Sampling Program includes the Taku, Stikine and Unuk river watersheds. Figure 1 shows sampling sites and significant mining activities within these drainages. Selected mining activities are classified based on the Master Project List jointly developed by DNR and EMLI (2019). Further explanation of each classification is found in the glossary.

Figure 1. B.C. and Alaska Joint Water Quality Program for Transboundary Waters sample locations and referenced mining activities

Taku River Watershed

The Taku River is about 87 km (54 miles) long and drains an area of approximately 27,500 km^2 (10,600 square miles) into the Pacific Ocean; the Tulsequah River is a tributary. The Tulsequah River travels within a very broad, flat floodplain. The mainstem gradient is estimated to be 1.0 to 2.5% (Rescan, 1997). Typical of rivers in glaciated valleys, the Tulsequah River contains elevated concentrations of suspended sediment and a larger bedload. The abundant sediments supplied by the glacier immediately upstream and the wide floodplain has resulted in a heavily braided channel. Under typical conditions, this morphology exhibits dynamic and active channel migration, usually associated with seasonal high flows. Within the Tulsequah River, the principal channel-forming flows are associated with annual glacial lake outburst flood (GLOF) events, meaning the rapid release of water from a lake impounded by a moraine or glacier. During a GLOF, the discharge of the Tulsequah River may increase up to 30 times above estimated annual maximum discharges (Palmer et al., 2013).

Throughout much of the year, the river flows are sourced from snow and glacial melt; however, on at least one occasion per year, the river is subject to GLOFs from a glacier-impounded lake that drains quickly, and with little warning, beneath the Tulsequah Glacier. During a GLOF, river flows range from 1,711 to 2,975 m^3/s (60,423 to 105,061 ft^3/s) (SLR, 2017). The water levels rise over a period of 24 to 48 hours and subside to normal summer flow levels of around 100 m^3/s (3,531 ft^3/s) over a similar time period (Rescan, 1997).

Stikine River Watershed

The Stikine River watershed covers more than 80,290 km^2 (31,000 square miles), and the Stikine River is 644 km (400 miles) long from the Spatsizi Plateau Wilderness Park in Northwestern B.C. to the Pacific Ocean in Southeast Alaska. The upper portion of the river basin is a semi-arid plateau of up to 1,900 m (6,233 ft) in elevation, while the lower portion of the river drains a heavily glaciated region of the Coast Mountains characterized by high precipitation. A dominant natural feature of the river is the Grand Canyon of the Stikine, which beginning almost 300 km (186.4 miles) below the source, extends for almost 100 km (62.1 miles) down river. The canyon ends near the community of Telegraph Creek. (B.C. Parks, 2020) The average gradient of the river mainstem is 0.076% (0.76 m/km or 4.0 feet per mile), and within the United States is nearly flat (BLM, 2007).

Unuk River Watershed

The Unuk River is 129 km (80.2 miles) long and drains an area of 3,885 km^2 (1,500 square miles). It originates in the Coast Mountains in B.C and flows southwest, eventually draining into the Pacific Ocean at Burroughs Bay in Alaska. The Unuk watershed is highly glaciated, and lakes and wetland areas cover less than 1% of the watershed. The Unuk River is fed by both non-glacial tributaries and heavily glaciated tributaries, including the South Unuk River and Sulphurets Creek. The average channel gradient is 1%. The Unuk River watershed is a steep basin where not much storage exists to attenuate floods. Therefore, a fast response time and high flood magnitudes are expected after precipitation events (Rescan, 2013).

3.1 Hydrological Regime in the British Columbia-Alaska Transboundary Region

The large transboundary rivers of the Southeast Alaska and British Columbia/Yukon region, such as the Alsek, Chilkat, Taku, Stikine, Whiting and Unuk rivers, straddle the maritime (to the west) and continental (to the east) climatic zones (Kottek et al., 2006). The maritime climate zone is characterized by mild year-round temperatures moderated by proximity to the ocean and precipitation. The continental climate zone has a greater range of temperatures over the seasons and is drier than the maritime zone. The Coastal Mountains range along the border between Alaska and Canada is the transition between the two climatic zones. At this transition, most precipitation falls as snow and is stored in large snow fields or glaciers.

All the transboundary basins are hydrologically driven by the storage and melt of snow and ice (O'Neel et al., 2015). The watersheds exhibit a similar pattern of extended high flows from late spring to the fall months due to prolonged snow and ice melt. During the melt period of the summer months, the primary driver of discharge is snow and ice melt due to incoming solar radiation, which peaks in late June through early July. Discharge fluctuates on a diurnal cycle in concert with night and day (Nienow et al., 2005). Temperatures decrease and precipitation increases in the fall months and discharge becomes more variable; peaking during rainfall events. During the winter and early spring months, precipitation is stored in snowpack and on glaciers. The lowest flows of the year occur in late spring when baseflows are depleted and snowmelt has not yet begun.

4. METHODS

4.1 Site Selection

The location of sampling sites in B.C., are in the mainstem portion of the rivers or side channels. The sites were selected based on accessibility and when possible based on locations relative to mining properties. All sites were accessed by helicopter. In the Taku watershed, sample sites were selected upstream and downstream of mining properties. In the Stikine watershed, sample sites were selected above and below confluences of major tributaries with upstream mining properties. In the Unuk watershed, sample sites were selected above and below confluences of major tributaries, on tributaries located downstream from mining properties or on the South Unuk River, where there is no no mining. In B.C., a total of 23 sites were sampled.

Under the Alaska Monitoring and Assessment Program's (AKMAP) 2018 Southeast Rivers Survey design, up to five sites in each watershed were randomly selected for sampling. Another six sites within each of the priority watersheds were targeted for sampling to maximize coverage. Site selection in Alaska was based on stream order,[3] accessibility and distance from water tidal influences, for a total of 20 sample sites. Sites were eliminated if unsafe conditions (e.g., flooding, hazardous weather conditions and accessibility concerns) were present during sampling.

Efforts were made by DEC and ENV to collect and analyze water, sediment and biota samples using similar or comparable protocols. Table 1 lists the sites, dates and aquatic components sampled during the study. Appendix A contains sample site location information and figures showing the sample sites for each watershed are in Section 6 of the report.

4.2 Physical, Chemical and Biological Sampling Components

To characterize the current state of aquatic conditions in the Taku, Stikine and Unuk watersheds, the sampling program included physical habitat assessments, physical and chemical analyses of water and sediment, and the collection of benthic macroinvertebrates, periphyton and fish. The water, sediment, benthic macroinvertebrates and fish components were also analyzed for a standard suite of elements that tend to be of greatest interest due to their potential ecological effects (i.e., constituents of concern).

4.2.1 Physical Habitat

Site surveys were conducted at each sample site to describe the physical habitat of the stream or river in relation to the collection and analysis of water, biological and sediment samples. DEC's assessment of the physical habitat of Alaskan sites followed the USEPA's National Rivers and Streams (NRSA) protocols throughout the sampling reach of the stream or river (EPA, 2018a and 2018b). At sites within B.C., ENV collected physical habitat descriptions at the reach level during site access, and sampled according to the Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Sites Card Field Guide (Ministry of Environment, 2008). At each transect, the assessments included the investigation and documentation of the riparian habitat, instream fish habitat, vegetation cover, substrate and anthropogenic alterations and uses. Copies of the original habitat field sheets are on file with the DEC and ENV.

[3] The project sample frame came from the U.S. Forest Service StreamNet and University of Montana Riverscape Analysis Project (RAP), which target Strahler order 5 and larger rivers and third-order or larger rivers respectively.

Table 1. DEC and ENV Transboundary Sampling Sites, Aquatic Components and Sampling Dates

Watershed	Waterbody	ENV / DEC	Map display name	Aug 2017	Jun 2018	Jul 2018	Sep 2018	Nov 2018	Feb 2019	Jun 2019	Aug 2019	Sep 2019
Taku	Tulsequah River	ENV	TuMain 1				W, Bt*					
			TuMain 1b Side				F, Bt*				W, F	
			TuMain 2	W, S				W	W	W	W	
			TuMain 3	W, S				W	W	W	W	
			TuMain 4	W, S			W, Bt*	W	W	W	W	
			TuMain 5				W, S, F					
	Whitewater Creek		Whitewater Trib 1				W		W	W	W	
			Whitewater Trib 2				W, F		W	W	W, F	
	Taku River mainstem		TaMain 1	W, S			W, Bt*	W	W	W	W	
			TaMain 2	W, S				W	W	W		
			TaMain 3				W, S, Bt*				W	
		DEC	TaMain 4		W, S, B							
			TaMain 5		W, F, B							
			TaMain 6		W, B							
			TaMain 7		W, B							
			TaMain 8		W, B							
			TaMain 9		W, B							
			TaMain 10		W, S, B							
Stikine	Christina Creek	ENV	Christina Cr 1				F, Bt*					W
	Iskut River		Iskut Main 1	W, S			W, S, Bt*	W	W	W		W
			Johnson R. 1				F					W, F
	Stikine River mainstem		Stikine Main 1				W, Bt*	W	W	W		W, F
			Stikine Main 2	S						W		
			Stikine Main 3	W, S			W	W	W	W		W
			Stikine Main 4	W			W, S	W	W	W		
		DEC**	Stikine Main 5			W, S, B						
			Stikine Main 6			W, B						
			Stikine Main 7			W, B						
			Stikine Main 8			W, B						
			Stikine Main 9			W, B						
			Stikine Main 10			W, S, B						
Unuk	Sulphurets Creek	ENV	URTrib 1				W, S, F, Bt*	W	W	W		W, F
	South Unuk River		URTrib 2				W, S, F, Bt*	W	W	W		W, F
	Unuk River mainstem		URMain 1				W, S, F, Bt*	W	W	W		W, F
			URMain 2				W, S, Bt*	W	W	W		W
			URMain 3				W, S, Bt*	W	W	W		W
		DEC**	URMain 4			W, B						
			URMain 5			W, S, B						
			URMain 6			W, S, B						
			URMain 7			W, B						
			URMain 8			W, B						
			URMain 9			W, B						
			URMain 10			W, B						

Aquatic components sampled: W – water, S – sediment, F – whole body fish, B – benthic community and Bt – benthic tissue metals
*Sampled by B.C. only.
**Alaska DFG collected additional whole body fish samples for the DEC in the Stikine and Unuk watersheds.

4.2.2 Water Chemistry

Water quality sampling followed the standard methods described in either Part E of the B.C. Field Sampling Manual (B.C. Ministry of Environment, 2013) or in the NRSA methods (EPA, 2018a and 2018b) for the collection of regular and replicate grab samples. Samples were filtered and preserved in the field. Table 2 references the water quality parameters assessed in the lab and the field by both the DEC and ENV programs. The selected water quality parameters are relevant for the purpose of characterizing the quality of the water above and below mining activities and comparing the results to long-term B.C. WQG and chronic Alaska WQS for the protection of aquatic life. Dissolved and total elements were of interest in relation to their bioavailability and potential for bioaccumulation and biomagnification in aquatic life.

Water samples were shipped to either ASL Environmental in B.C or the DEC Environmental Health Laboratory in Alaska. Effort was made to use the same or complimentary lab analysis methods for all parameters analyzed by Alaska and B.C. Additional water parameters analyzed by either DEC or ENV are not included in the table, but the data are available in Appendix C.

Table 2. Water Quality Parameters

Parameter				
Field measurements				
Temperature	Dissolved oxygen	Specific conductance[1]	pH[1]	Turbidity
Lab measurements				
Sulfate	Dissolved organic carbon (DOC)	Nitrate and Nitrite	Total suspended solids	Alkalinity
Ammonia	Total kjeldahl nitrogen	Total nitrogen	Total organic nitrogen	Phosphorus
Total elements*				
Calcium	Magnesium	Potassium	Sodium	
Dissolved elements*				
Cadmium	Copper	Lead	Selenium	Zinc

[1]Parameter is measured in the field and in the lab
*The parameters selected for analysis are those commonly of greatest interest due to their potential ecological impacts (i.e., constituents of concern).

4.2.3 Sediment

Sediment sampling followed the standard methods described in either Part D of the B.C. Field Sampling Manual (B.C. Ministry of Environment, 2013) or in the NRSA methods (EPA, 2018a and 2018b) for the collection of regular and replicate grab samples.Ultrafine sediment (<63 µm) deposits were targeted throughout the sample reach at each sediment site location. This size fraction is important to the assessment of sediment quality because these particles can accumulate greater concentrations of contaminants than coarser particles and lead to increased bioavailability of contaminants (B.C. Ministry of Environment, 2016). Sediment (<63 µm) from all sites was analyzed for total element concentrations. For comparison purposes, both <63 µm and <2 mm size fraction sediment samples were collected at two B.C. sites in each watershed. A steel spoon was used to collect sediment. Lab issued plastic sediment bags were half-filled with sediment. Sediment sampling equipment was decontaminated with either nitric acid or Alconox prior to field work and between sample sites. Sampling of submerged sediment was limited to a substrate depth of three centimeters to capture gravimetrically deposited fine sediment for the parameters listed in Table 3. Samples were shipped to ASL Environmental in B.C. or the DEC Environmental Health Laboratory in Alaska.

Table 3. Sediment Quality Parameters

Parameters:					
Particle size analysis	Percent moisture	Total organic carbon	Sulphur	Percent solids	Stable isotopes
***Total elements:**					
Aluminum (Al)	Cadmium (Cd)	Lead (Pb)	Nickel (Ni)	Tin (Sn)	
Antimony (Sb)	Copper (Cu)	Manganese (Mn)	Selenium (Se)	Vanadium (V)	
Arsenic (As)	Iron (Fe)	Mercury (Hg)	Silver (Ag)	Zinc (Zn)	

*The parameters selected for analysis are those commonly of greatest interest due to their potential ecological impacts (i.e., constituents of concern)

4.2.4 Biological

Benthic Invertebrates Macroinvertebrates

DEC collected benthic macroinvertebrates in June 2018 at all sample sites in each watershed (see Table 1, Figure 3 for sample site locations). Alaskan field crews used a D-frame 500 µm mesh net to sample 11 transects at each site following methods as outlined in the NRSA manuals (EPA, 2018a and 2018b). At non-wadeable sites, samples were collected at each transect by taking a linear meter sweep with the 500 µm net in the dominant habitat. The samples were composited after washing and removing large objects from sample media in a 500 µm sieve bucket (EPA, 2018b). At wadeable sites, samples were collected at each transect from a square foot quadrat in the stream channel using the D-frame 500 µm mesh net for 30 seconds and composited (EPA, 2018a). All samples were preserved in the field using 95% ethanol. The physical habitat was categorized and noted for each transect sample. Samples were submitted to the Alaska Center for Conservation Science Aquatic Ecology Lab for taxonomic identification and enumeration.

ENV collected benthic macroinvertebrate samples following Canadian Aquatic Biomonitoring Network (CABIN) field methods (Environment Canada, 2012). Field staff selected safe wadable sections of the mainstem river, side channels or tributaries at three locations in each watershed to collect benthic macroinvertebrate samples in September 2018 (see Table 1). Field crews employed a triangular kick net with 400 µm mesh to collect a timed three minute kick sample (Environment Canada, 2012). A second kick was sometimes necessary to obtain enough sample material for lab analysis. Benthic organisms were hand-picked from kick samples collected at each sample site and placed in lab cleaned glass vials. The total sample weight in each vial was a minimum of three grams. The samples were frozen and submitted to ALS Environmental for whole body total element analysis as originally proposed in the B.C. study design. DEC did not collect benthic macroinvertebrate tissue samples. For these reasons there is no further discussion of these data in this report, however, the results of the ENV lab analysis are in Appendix C, Tables C-1 to C-3.

Taku River Tlingit First Nation (TRTFN) staff collected benthic macroinvertebrates in October 2019 at mainstem and side channel sites on the Tulsequah River in B.C. using CABIN field protocols (Environment Canada, 2012). Sample sites are shown in Figure 3. Samples were submitted to Living Streams Environmental Service for taxonomy identification and enumeration using the protocol described in the CABIN Laboratory methods manual (Environment Canada, 2014).

Taxonomic data from DEC and TRTFN for the Taku watershed were analyzed and various metrics were calculated, including: total abundance, taxa richness, intolerant taxa presence, % EPT and Shannon's diversity index and evenness score.

- Total abundance was the total number of individuals enumerated within each sample,
- Taxa richness was the total number of families found at each site,
- Intolerant taxa was calculated based on taxa with tolerance values of 0 to 2 and sensitivity to disturbance to habitat or changes in water quality (Barbour et al., 1999).
- % EPT identifies the percentage of organisms from the Ephemeroptera, Plecoptera and Trichoptera orders (most of which are considered water quality-sensitive), of the total abundance of the sample.
- Shannon diversity index evaluates both the taxa richness of the samples and the relative abundance of each taxon (Shannon, 1948; Magurran, 2004). Index values range from 0 to 5 and values between 1.5 and 3.5 are common (Margalef, 1972; May, 1975). Increasing index values indicate increased sample diversity.

$$Shannon\ Diversity\ Index\ (H') = -\sum_{i=1}^{n} p_i \ln\ (p_i)$$

Where:
p_i = proportion of organisms belonging to a species out of the total abundance of the original sample

- Shannon evenness score, which ranges from 0 to 1, is the ratio of the observed Shannon's diversity index to the maximum possible Shannon diversity index score, calculated from total number of species (Pielou, 1969 and 1975). A score of close to one indicates the individuals in the sample are evenly distributed across species.

$$Shannon\ Evenness\ Score\ (E_h) = \frac{H'}{\ln(S)}$$

Where:
H' = Shannon diversity index
S = total number of species in the community (taxa richness)

Periphyton

Periphyton samples were collected by Alaska field crews for the sites downstream of the B.C.-Alaska border. Collection was carried out using methodology contained in NRSA 2018-19 Field Operations Manual Non-Wadeable (2018b). Samples were collected from either coarse substrate or soft sediment at each of the 11 transects within the sample reach and composited following methodology in the NRSA manuals for non-wadeable streams and rivers (EPA, 2018b). A 12 cm^2 (1.86 in^2) area delimiter was used to define the sample collection area from all substrates. For coarse substrate samples, field crews scrubbed the delineated area with a stiff-bristled toothbrush and rinsed the surface of the scrubbed substrate and toothbrush with deionized water into one-liter bottles. If soft substrate present, a de-tipped 60 mL syringe vacuum was used to collect up to 25 mL of sediment from the top one centimeter depth of sediments in the 12 cm^2 (1.86 in^2) area. The sample in the syringe was composited in a one-liter bottle and the syringe was rinsed between transect samples. Samples were submitted to the Alaska Center for Conservation Science Aquatic Ecology Lab for periphyton identification and enumeration, and to the Kodiak Island Limnology Lab for chlorophyll-a analysis. At the time of the report's publication, the periphyton identification data was not available for Alaska sites and are not included in this report. Chlorophyll-a sample results from Alaska sites are included in Appendix C. ENV did not sample for periphyton or chlorophyll-a. For these reasons there is no further discussion of these data in this report.

Fish

Fish samples were collected by DEC in Alaska and ENV in B.C. in the targeted watersheds using either baited minnow traps or electrofishing throughout the sample reach of the selected stream or rivers to gather information on whole body element concentrations. Appropriate permits were obtained prior to the collection of fish samples, and proper fish harvesting procedures were followed as outlined in the Fish Collection Methods and Standards Version 4 (B.C. Ministry of Environment, 1997). Dolly Varden char (*Salvelinus malma*) are common fish species present in all three watersheds. Dolly Varden char with a fork length between 90 and 130 mm and weighing at least five grams were targeted at each sample location. A 90 mm fish provides an adequate amount of material for analysis, while the maximum fish size of 130 mm improves the likelihood of sampling resident, non-anadromous fish (Timothy and Kanouse, 2014). Samples were analyzed as individuals or as a composite sample. Composites were two or more individuals of the same species that were pooled and analyzed as a single sample when

individuals did not meet the size criteria. The target sample size was eight fish per site, as per the Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operation (B.C. Ministry of Environment, 2016).

Fish sampling opportunities in Alaska were limited based on time constraints and locations with desirable fish habitat. DEC coordinated with the Alaska Department of Fish and Game (DFG) to collect fish samples prior to DEC's planned stream and river surveys. DEC completed additional fish sampling throughout the 2018 field season when practical, resulting in the capture of additional species including round whitefish (*Prosopium cylindraceum*), threespine stickleback (*Gasterosteus aculeatus*), sockeye salmon (*Oncorhynchus nerka*) and Chinook salmon (*Oncorhynchus tshawytscha*). DFG and DEC staff used baited minnow traps to collect whole body fish samples in ideal habitat locations at samples sites. Staff submitted composited samples of the same species in instances where the target sample size was not met. Fish sampling by ENV targeted three sites per watershed in September of 2018 and 2019 based on physical habitat parameters, site safety and accessibility. Where an insufficient number of Dolly Varden char were captured, slimy sculpin (*Cottus cognatus*) were collected as the alternative species of interest due to their resident nature and presence in all three watersheds.

The primary sampling method in B.C. was to set out 10 minnow traps at each location, baited with whirl-pak sampling bags having small punctures and containing some cat food, and placed in deep-water habitats and pools overnight and retrieved the next day. When the minnow traps yielded no fish, and stream conditions permitted, electroshocking equipment was used to collect the target species. Electroshocking was conducted using a Smith-Root model LR20-B (or LR-24) backpack electrofisher. Shock settings were chosen based on the target species, water temperature and conductivity. Sites were electrofished without exclusion nets by a two or three person crew in approved PPE. One person conducted the backpack electrofishing in an upstream zig-zag fashion until the targeted number of fish were captured with dip nets and placed in buckets.

Fish specimens were handled with latex gloves, measured for fork length and weight and then placed in individually labeled Ziplock bags. The samples were put on ice and frozen for transport to the respective analytical labs (DEC Environmental Health Lab in Alaska and ALS Environmental in B.C.).

Table 4 references all parameters assessed jointly by DEC and ENV in the field and the lab. The parameters were selected to document fish condition and whole body element concentrations. Additional parameters assessed by the individual agencies are not included in the table, but the data are available in the Appendix C.

Table 4. Fish Sampling Parameters

Parameters:						
Field measurements – Water						
Dissolved oxygen	Temperature	Specific conductance	pH			
Field measurements – Fish						
Species	Fork length (mm)	Weight (g)				
Lab measurements – Fish						
Tissue percent moisture						
Total elements (mg/kg ww):						
Arsenic (As)	Cadmium (Cd)	Copper (Cu)	Mercury (Hg)	Lead (Pb)	Selenium (Se)	Zinc (Zn)

4.3 Quality Assurance and Quality Control

4.3.1 Field Staff Training

As part of the program quality assurance, DEC and ENV staff selected to lead and participate in fieldwork for this project were trained on aquatic sampling methods. Training included an overview of protocols for the assessment of physical habitat parameters and the collection of water, sediment, fish, periphyton and benthic macroinvertebrate samples. Internal efforts were made by DEC and ENV staff to ensure similar methods were followed by both organizations using guidance from the U.S. EPA's National Rivers and Streams Assessment Field Operations Manual (EPA, 2018a and 2018b) and the B.C. Field Sampling Manual (B.C. Ministry of Environment, 2013). DEC staff led field crews comprised of University of Alaska Anchorage staff contracted with the AKMAP and volunteers from local communities or both. ENV biologists provided additional training to individuals from the TRTFN and Tahltan Central Government. The trained First Nations individuals sampled with ENV staff on two occasions and led quarterly water quality sampling events in B.C.

4.3.2 Replicate and Blank Samples

Quality control for water samples collected by DEC and ENV staff were verified by collecting replicate and blank samples. Replicate co-located samples were collected by filling two sample bottles one after the other at a monitoring location. The relative percent difference between the laboratory results for the original and replicate samples was calculated using the equation below. The maximum acceptable percentage difference between replicate samples is 25%. The results are available in Appendix B.

$$Relative\ Percent\ Difference\ (RPD)\ = \frac{|\ A - B\ |}{\big((A + B)/2\big)} \times 100$$

Where:

A = original sample result

B = replicate sample result

ENV selected one site per watershed from which to collect five replicate sediment samples for quality control purposes. DEC sediment quality control consisted of collecting two replicate sediment samples as a part of their AKMAP sampling program throughout Southeast Alaska, which included sampling within the transboundary watersheds. The relative percent difference between the laboratory results for the original sample and the replicate average or direct comparison were calculated using the equation above and evaluated using the same criteria.

4.4 Industry Data Validation

As part of the two-year workplan, ENV committed to validate water quality data collected by large active mining projects in the study area to measure data reliability.

ENV was able to meet this commitment in three ways. Firstly, ENV Compliance staff conducted a split sampling quality assurance audit at the Brucejack Mine in the Unuk watershed in 2019. Secondly, ENV Monitoring, Assessment and Stewardship staff collected side-by-side water samples with environmental staff from Brucejack and Red Chris mines in 2019 for quality assurance comparisons. Thirdly, the long-term Unuk River water data collected by the KSM advanced exploration project was obtained for comparison with data collected by ENV in 2018 and 2019. Results from industry data validation are available in Appendix B.

5. SELECTION AND RELEVANCE OF REGULATORY GUIDELINES

We acknowledge that all regulatory water quality guidelines and standards developed by the participating agencies are established to safeguard human and environmental health. Guidelines are developed to prevent adverse effects to the most sensitive aquatic species for which data are available and are designed to be applied province and state-wide. They do not consider site-specific conditions (e.g., highly mineralized areas or glaciated areas) and therefore, exceedances of short- or long-term water quality guidelines for aquatic life do not necessarily pose a risk to aquatic organisms in highly mineralized areas. For this study, long-term B.C. Guidelines (WQG) and chronic Alaska Water Quality Standards (WQS) were used to assess water samples collected within in B.C. and Alaska respectively. Long-term guidelines and chronic standards are the most conservative and are intended to protect the most sensitive species and life stage against sub-lethal and lethal effects for indefinite exposures.

The B.C. Working Sediment Quality Guidelines (WSQG) for aquatic life and the National Oceanic and Atmospheric Administration (NOAA) Sediment Quality Guidelines (SQG) for fresh water were used in the respective jurisdictions to evaluate the results of the sediment study. The guidelines are used here for screening purposes and do not take natural background conditions into consideration. The guidelines are intended to be a benchmark of environmental quality and not used as a method to identify remediation needs. The lower WSQG and SQG Threshold Effects Level (TEL) represents the concentration below which the adverse effects of a toxic substance are rarely expected to occur (Cormack, 2001; ENV, 2020). The upper WSQG and SQG Probable Effects Level (PEL) represents the concentration, that if exceeded, may cause adverse effects to aquatic life. Mining exploration and development typically occur in locations with highly mineralized geology (e.g., the Taku, Stikine and Unuk watersheds) and local aquatic organsisms may be adapted to naturally elevated background concentrations of elements and TSS. Natural conditions present at sampling locations are to be taken into consideration during assessment of the data.

6. RESULTS AND SUMMARY BY WATERSHED

All available results for sites sampled between August 2017 and September 2019 are presented in Appendices B and C.

Water chemistry results are compared with the long-term B.C. WQG and chronic Alaska WQS for aquatic life. Field measurement of pH and temperature for all sampling events were within acceptable limits for aquatic life. Element analysis in water samples from the target watersheds identified sites with elevated concentrations of total and dissolved cadmium, copper, selenium and zinc above long-term B.C. WQG as reported in Tables B-1 through B-7.

Trace element analyses for aluminum, antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, tin, vanadium and zinc and were conducted for sediment samples collected in the study area. Analyses of sieved sediment samples from all target watersheds identified sites with concentrations of total arsenic, copper, iron, manganese and nickel above the lower or upper WSQG or both. Element concentrations in <63 µm depositional sediment were consistently higher than the <2 mm fraction. Results, outlined by watershed and reported in Tables 5, 7 and 8, are referenced against the WSQG and the NOAA SQG threshold levels for aquatic life for identified parameters. A more detailed table of results is available in Appendix B. An expanded elements analysis was completed by ENV for water and sediment samples and the results are included in Appendix C.

Over the two-year period, DEC and ENV collected whole body individual and composite juvenile fish samples for elements analysis. A total of 84 individual fish of the target species, Dolly Varden char, were captured in all three watersheds combined. Sculpin from the Stikine, coho salmon from the Unuk and whitefish, threespine stickleback, coho salmon, sockeye salmon and Chinook salmon captured in the Taku were also submitted for analysis. Elements included in the analysis were arsenic, cadmium, copper, mercury, lead, selenium and zinc. Results identified more variable concentrations of certain elements compared to others, in fish collected from mainstem rivers and in some cases from tributaries. Total mercury concentrations were below the Health Canada standard maximum limit of 0.5 mg/kg (Health Canada, 2019) for all fish sampled.

6.1 Quality Control

Replicate sediment and water samples were collected by ENV and DEC staff for quality control, and relative percent difference (RPD) was used to assess the results as a measure of precision. Acceptable RPD values were below 25%. The RPD for all sediment samples except for a single sample from the Unuk (UnukTrib 1) and an additional replicate sample collected for DEC's AKMAP southeast rivers survey, were below 25% (Appendix B).There were exceedances of the 25% difference with replicate water samples collected by ENV and DEC. Exceedances in total and dissolved elements in replicate samples may be due to the presence of either glacial till or flour and a subsequent lack of homogeneity of material in the water column. The Taku, Stikine and Unuk watersheds are turbid, glacially fed systems and experience high variability in total suspended solids. which can affect element concentrations in samples. While some parameters exceeded the 25% RPD threshold, the overall number of parameters that exceeded 25% RPD was low compared to the total number of parameters analyzed. For this reason, the replicate data were within acceptable limits for data quality. Blank samples also confirmed there was no contamination of the samples in the field.

6.2 Taku Watershed

Sample sites extended from one kilometer (0.6 miles) upstream of the closed Tulsequah Chief Mine to 20 km (12.4 miles) downstream of the B.C.-Alaska border (Figure 2). The overall length of the sampled area was about 30 km (18.6 miles). The B.C. sample sites were along the Tulsequah River above and below the Tulsequah Chief mine; in Whitewater Creek above and below the New Polaris mine; and in the Taku River above and below the Tulsequah River confluence. All sites in B.C. water are glacially fed. Sites in Alaska were in the non-tidally influenced portion of the Taku River.

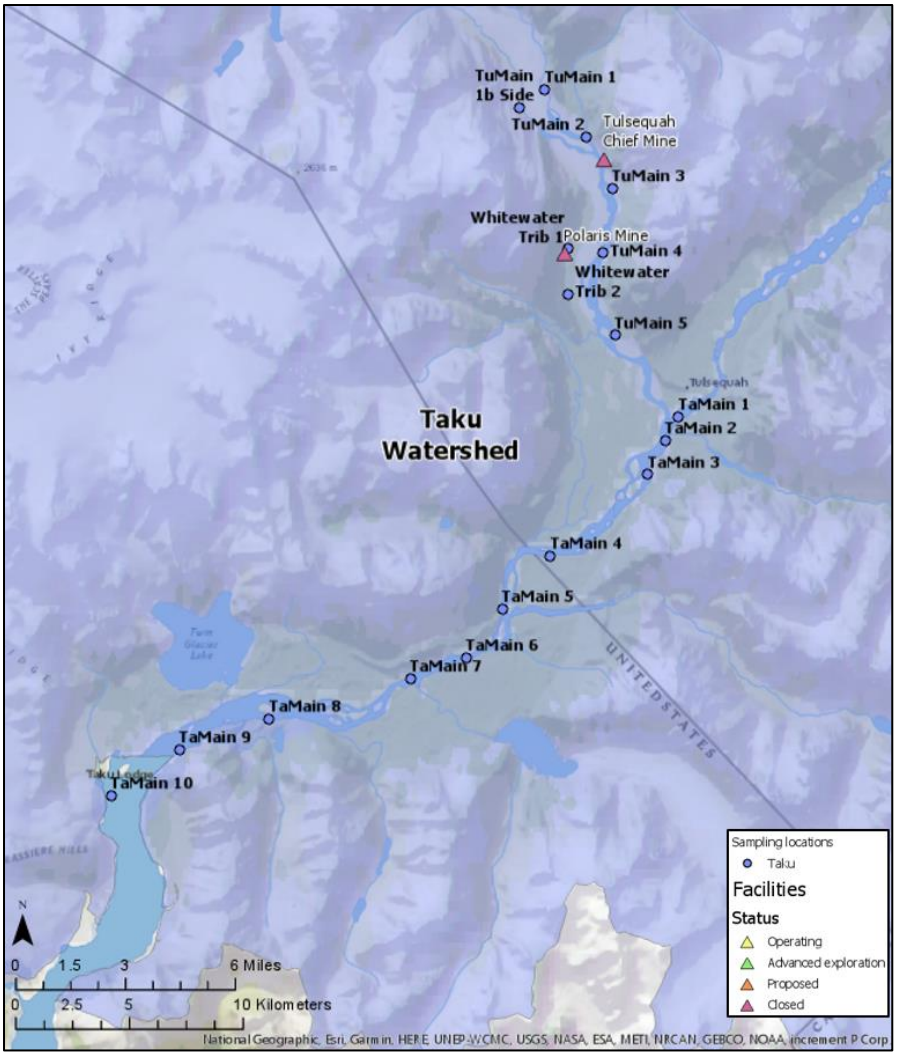

Figure 2. Taku Watershed Study Area and Sampling Locations

6.2.1 Water Quality

Seventeen water quality sites were sampled in the Taku watershed. Seven of these were in the Tulsequah watershed, upstream and downstream of the closed Tulsequah Chief and New Polaris mines. The remaining ten sites were in the Taku River mainstem; one of these was located upstream of the confluence with the Tulsequah River. The water quality sampling sites are identified in Table 1. No exceedances of long-term B.C. WQG were observed upstream of New Polaris Mine (Whitewater Trib1) in Whitewater Creek. Exceedances of long-term B.C. WQG were observed for total zinc at all B.C. sample sites except for TuMain1b Side and upstream of the New Polaris Mine (Whitewater Trib 1). B.C. sample sites on the Tulsequah River and Whitewater Creek had elevated concentrations of dissolved cadmium, copper and zinc downstream of the Tulsequah Chief and New Polaris mines (TuMain 3, TuMain 4 and Whitewater Trib 2) relative to others sample sites in the watershed. The highest concentration of total zinc (69.2 µg/L) and dissolved copper (5.88 µg/L) was at TuMain 3, located 900 m (2,953 feet) downstream of Tulsequah Chief Mine. TuMain 3 is located within the zone of influence for the Tulsequah Chief Mine (Palmer et al., 2013). Concentrations of dissolved elements (except selenium) decreased with increasing distance downstream from the historic mining properties. Dissolved element concentrations were similar in the Taku River sites, upstream and downstream of its confluence with the

Tulsequah River. Exceedances of B.C. long-term guidelines for total zinc and dissolved copper were observed upstream of the B.C.-Alaska border. Dissolved selenium concentrations were similar throughout the Tulsequah and Taku River sampling sites. Downstream of the B.C.-Alaska border, there were no exceedances of Alaska WQS for chronic long-term exposure for aquatic life.

6.2.2 Sediment

Sediment sampling was conducted at nine sites in the watershed and results are reported in Table 5. Of these, four sites were located on the Tulsequah River - one upstream and three downstream of the Tulsequah Chief Mine. Five sites were located on the Taku River. Elevated concentrations of arsenic, copper, and nickel were observed in sediment from all sample locations. Sediments collected from sample locations upstream and downstream of the Tulsequah Chief Mine revealed concentrations of arsenic and iron above the upper WSQG. Sediment sampled at TuMain 3, downstream of the Tulsequah Chief Mine, had the highest concentrations of arsenic (78.50 mg/kg), and nickel (74.40 mg/kg) in the watershed. In addition, cadmium and zinc concentrations were reported above the lower WSQG at sites below the Tulsequah Chief Mine. Downstream of the B.C.-Alaska border, Alaska sediment samples exceeded TEL thresholds for arsenic and copper and PEL thresholds for nickel.

Table 5. Taku Watershed Sediment Element Concentrations

TAKU WATERSHED		Total Organic Carbon	Aluminum	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Nickel	Selenium	Silver	Tin	Vanadium	Zinc	Mercury
B.C Working Sediment Quality Guidelines	**Units**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Lower				5.90	0.60	36.00	21,000	35.00	460.00	16.00	2.00	0.50			120.00	0.17
	Upper				17.00	3.50	200.00	44,000	91.30	1,100.00	75.00					320.00	0.49
Site Name	**Date Sampled**																
Taku Mainstem																	
TaMain 1	08/24/17	1,900	13,400	0.93	16.30	0.27	43.90	34,300	10.20	666.00	49.90	0.26	0.16	0.57	77.30	71.40	0.03
Tulsequah River																	
TuMain 2	08/24/17	5,400	14,400	0.79	29.00	0.43	69.80	40,700	14.40	735.00	48.30	0.85	0.37	1.34	83.40	81.90	0.01
Tulsequah Chief Mine																	
TuMain 3	08/24/17	4,100	13,900	3.74	78.50	1.17	69.00	41,000	17.00	790.00	74.40	1.920	0.293	0.580	70.10	155.00	0.15
TuMain 4	08/24/17	4,100	18,200	2.83	63.10	1.09	78.10	46,100	15.90	905.00	71.70	1.490	0.268	0.730	86.20	167.00	0.11
Whitewater Creek																	
TuMain 5	09/18/18	2,670	10,100	0.57	9.06	0.24	23.10	29,000	4.30	393.00	21.20	0.260	0.070	0.240	74.90	60.70	0.021
Tulsequah River Confluence																	
TaMain 2	08/24/17	3,500	13,700	1.39	26.60	0.46	51.70	39,100	11.20	674.00	60.50	0.55	0.17	0.56	88.90	91.30	0.19
TaMain3[1]	09/10/18	3,100	11,000	0.47	6.92	0.15	26.80	26,500	5.48	482.00	60.20	*0.20*	0.07	0.26	61.30	49.80	0.02
B.C. / AK Border																	
NOAA Sediment Quality Guideline Levels	Threshold Effects				5.9	0.596	35.70		35.00		18.00					123.00	0.174
	Probable Effects				17.00	3.53	197.00		91.30		36.00					315.00	0.486
TaMain 4	06/28/18	-	19,000	1.13	15.10	0.28	40.80	33,100	10.80	628.00	47.90	0.31	0.13	0.89	91.60	75.00	0.04
TaMain 10	06/23/18	5,400	17,300	1.05	15.40	0.30	39.70	31,600	10.90	610.00	46.40	0.36	0.14	0.71	82.10	83.80	0.06
	Average	**4,068**	**14,150**	**1.98**	**28.89**	**0.49**	**49.21**	**35,711**	**11.13**	**653.67**	**53.39**	**0.69**	**0.19**	**0.65**	**79.53**	**92.88**	**0.07**
	Standard Deviation	1,115	3,313	1.55	25.11	0.38	19.46	6,401	4.29	154.67	15.92	0.62	0.10	0.33	9.66	40.67	0.06
	Min	**2,670**	**10,100**	**0.57**	**6.92**	**0.15**	**23.10**	**26,500**	**4.30**	**393.00**	**21.20**	**0.20**	**0.07**	**0.24**	**61.30**	**49.80**	**0.01**
	Max	**5,400**	**18,200**	**3.74**	**78.50**	**1.17**	**78.10**	**46,100**	**17.00**	**905.00**	**74.40**	**1.92**	**0.37**	**1.34**	**91.60**	**167.00**	**0.19**
	Median	**4,100**	**14,150**	**1.81**	**16.30**	**0.30**	**43.90**	**34,300**	**10.90**	**666.00**	**49.90**	**0.36**	**0.16**	**0.58**	**82.10**	**81.90**	**0.04**

Italicized text notes DL = 0.20mg/kg

6.2.3 Benthic Macroinvertebrates

Benthic macroinvertebrate samples were collected at 19 sample sites for taxonomic analysis. DEC staff collected biological samples following NRSA methods (EPA, 2018a and 2018b) at five random and two targeted sites in June 2018 on the Taku downstream of the B.C.-Alaska border. Samples were identified to genus, or lowest taxon practical, by certified taxonomists.[4] B.C. ENV staff collected biological samples from three sites on the Tulsequah River and two sites on the Taku upstream of the B.C.-Alaska border following CABIN methods (Environment Canada, 2012). B.C. samples were analyzed for whole body elemental concentrations. The results of the benthic macroinvertebrate sampling by B.C and Alaska were not comparable due to the difference in analyses. The results from the B.C. whole body analysis are available in Appendix C. TRTFN staff collected 12 biological samples in October 2019 following CABIN field methods (Environment Canada, 2012) on the mainstem and side channels of the Tulsequah River, upstream and downstream of the Tulsequah Chief Mine and the results are included in this report. DEC and TRTFN benthic macroinvertebrate sample locations are shown in Figure 3.

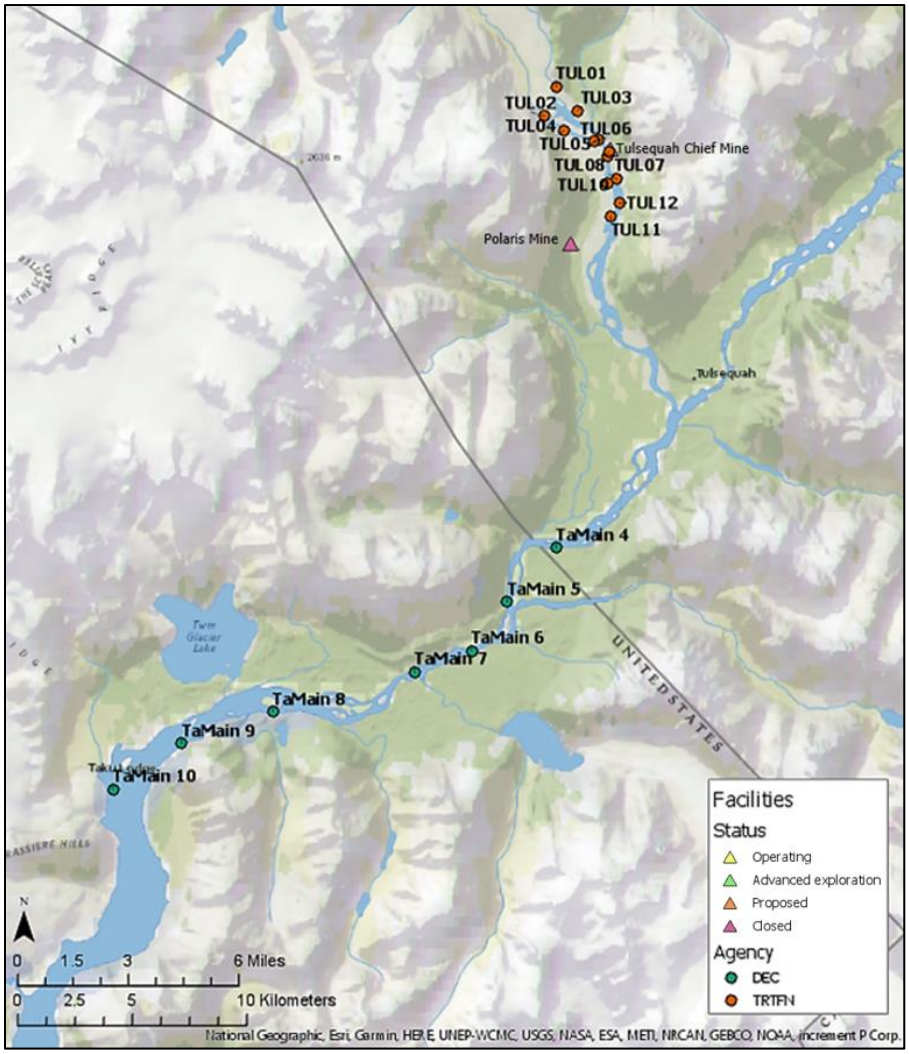

Figure 3. Benthic Macroinvertebrate Sample Sites in Taku Watershed

[4] Alaska's benthic data for all three watersheds are publicly available in the Ambient Water Quality Monitoring System (AWQMS) database.

Variations in sample collection methods and seasonality do not allow for direct comparison between the two datasets, but results from Alaska DEC and TRTFN samples are provided and key findings are included for the Taku and Tulsequah Rivers. Taxonomy data are available in Table C-4 and C-7 in Appendix C. Presence/absence of families (e.g., Plecoptera: Taenioptergids and Capniids) may have been affected by differences in the sampling timeframe, lifecycles and sample substrate variability, but these influences cannot be evaluated because sampling site characteristics were not standardized between Alaska and B.C.

Key findings from DEC samples from the Taku River included:

- Total abundance ranged from 123 to 417 individuals per sample. Taxa richness ranged from 13 to 36 families identified per sample.
- The dominant order for all Alaskan samples was Diptera, shown in Figure 4, which is consistent with DFG observations of insect communities in Southeast Alaska glacial water bodies (Krull, 2019). Diptera: Chironomidae insects are fast colonizers, and can exercise multiple feeding strategies and adapt to dynamic habitats, which are common in glacial rivers (Entrekin et al., 2007).
- Overall, presence of intolerant taxa and EPT taxa in Alaskan samples was low (0.5 to 21.9% and 0 to 25.0%, respectively), which could be a result of the depositional habitat common in glacial rivers. Of the Alaskan samples, TaMain10 had the greatest percentages of intolerant (21.9%) and EPT (25.0%) taxa in the Taku.
- Shannon diversity index scores ranged from 2.07 to 2.78 for the Taku River samples, and are within the commonly acceptable range for the index (Margalef, 1972). Evenness scores for Taku River samples ranged from 0.66 to 0.81, suggesting relatively good distribution of individuals among the taxa. The evenness scores may be influenced by the large proportion of dominant taxa, Diptera, present in the samples.

Key findings from TRTFN samples from the Tulsequah River included:

- Total abundance ranged from 16 to 350 individuals per sample. Taxa richness ranged from 6 to 19 families identified per sample.
- Plecoptera was the dominant order for the majority of TRTFN samples, followed by Diptera for TUL01, TUL03 and TUL10 (Figure 4).
- Presence of intolerant taxa and EPT taxa was high overall at TRTFN sample sites on the Tulsequah River. Some of the variability between the samples may be due to the sampling location, either on a side channel or the mainstem of the Tulsequah River (TRTFN, 2020).
- Shannon diversity index scores ranged from 0.82 to 2.34 for Tulsequah River samples. The variability of scores may be a result of the range of total abundance in the samples. Evenness scores for Tulsequah River samples ranged from 0.40 to 0.91. TUL10 had the highest value (0.91), indicating that the sample population of insects was evenly spread across the taxa present. TUL06 had the lowest score (0.40) indicating poor distribution of individuals among taxa (or some taxa where more common that others).

Table 6. Taku Watershed Benthic Macroinvertebrate Metrics

Site Name	Collecting Agency	Abundance	Taxa Richness	% Intolerant	% EPT	Shannon Diversity	Shannon Evenness
Tulsequah River Mainstem							
TUL01	TRTFN	16	7	25.0	37.5	1.56	0.80
*TUL02	TRTFN	64	9	69.4	79.7	1.62	0.70
TUL03	TRTFN	32	6	28.1	31.3	1.08	0.60
*TUL04	TRTFN	206	19	61.7	75.7	1.83	0.60
TUL05	TRTFN	127	14	74.0	89.0	1.73	0.62
*TUL06	TRTFN	285	8	89.1	88.4	0.82	0.40
Tulsequah Chief Mine							
TUL07	TRTFN	68	8	75.0	79.4	1.24	0.56
*TUL08	TRTFN	61	11	60.7	77.0	1.86	0.78
TUL09	TRTFN	96	10	64.6	66.7	1.65	0.72
*TUL10	TRTFN	51	13	56.9	37.3	2.34	0.91
TUL11	TRTFN	350	13	82.6	88.6	1.14	0.43
*TUL12	TRTFN	319	13	90.3	94.7	1.32	0.51
Taku Mainstem							
TaMain 4	DEC	417	24	4.8	5.3	2.23	0.66
TaMain 5	DEC	191	13	0.5	0.0	2.08	0.77
TaMain 6	DEC	385	36	6.2	6.8	2.76	0.75
TaMain 7	DEC	123	15	1.6	0.0	2.07	0.73
TaMain 8	DEC	156	22	4.5	8.3	2.48	0.78
TaMain 9	DEC	196	28	2.1	3.6	2.70	0.80
TaMain 10	DEC	156	28	21.9	25.0	2.78	0.81

**Side channel sampling location on the Tulsequah River*

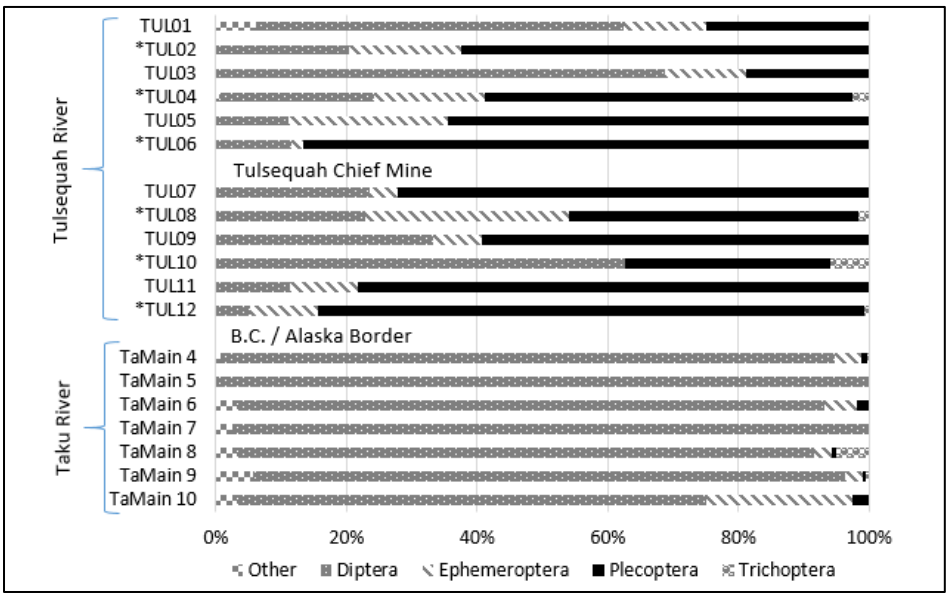

Figure 4. Taku Watershed Benthic Macroinvertebrate Community Composition
**Side channel location on Tulsequah River.*

6.2.4 Fish Whole Body Analysis

B.C. ENV collected Dolly Varden char in the Tulsequah River at locations above and below the Tulsequah Chief Mine in 2018 and 2019. Eighteen fish were collected from an upstream side channel and nine fish were collected from a location approximately 7.5 km (4.7 miles) downstream from the mine site. All fish

met the size class criteria and therefore 27 individual samples were submitted to the lab for whole body element analysis.

In 2018, DEC collected fish from the Taku River in Alaska. Fish captured included, Chinook salmon (n=3), sockeye salmon (n=1), round whitefish (n=2) and threespine stickleback (n=1). Dolly Varden char were not collected. Figure 5 shows the element concentrations for the DEC fish samples and Table B-8 in Appendix B contains the raw data.

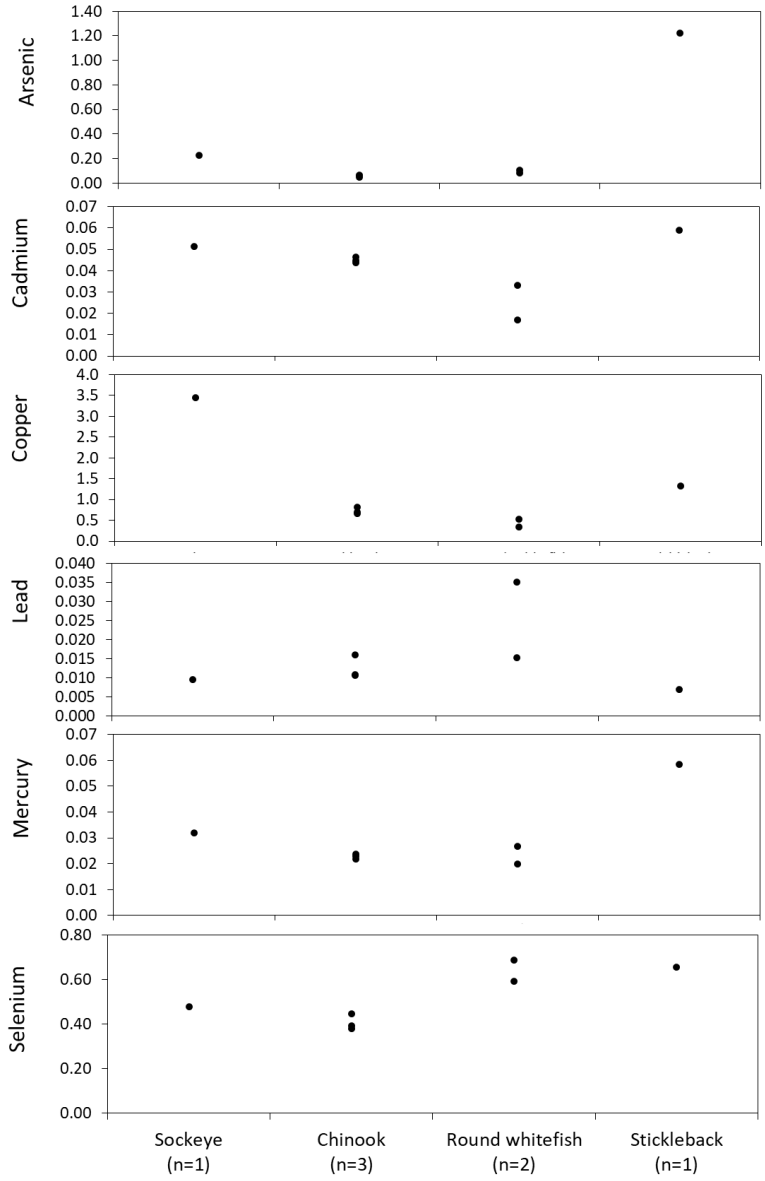

Figure 5. Taku River Whole Body Element Concentrations (w/w mg/kg) in fish collected in Alaska (2018)

Due to differences in the life histories of the different fish species, element concentration comparisons could not be made among fish collected in Alaska and the Dolly Varden char collected in the Tulsequah River.

The whole body element concentrations for Dolly Varden char collected by ENV in 2018 and 2019 are presented in Figure 6 with the results of the Dolly Varden char sample collected in the Taku watershed by DFG in 2014, 2015 and 2016 (Legere and Timothy, 2016). These data are shown together to illustrate the range of values observed across the sample sites in the watershed and relative to the Tulsequah Chief Mine, and to improve our understanding of the variability in Dolly Varden char whole body element concentrations. The data for the elements of interest were graphed according to sample year and location in the watershed (Figure 6). For spatial perspective, the upstream data covers locations between the Tulsequah Glacier and a point 2.5 km upstream of the Tulsequah Chief Mine. The downstream data represents sampling locations between 2.5 km and 7.5 km downstream of the Tulsequah Chief Mine discharge. The sites on the Taku River range from 3.5 km downstream of the Tulsequah River confluence to approximately 3.5 km upstream of the border.

The data collected in 2018 and 2019 show that arsenic concentrations were greater among fish collected downstream of the Tulsequah Chief Mine site, copper and lead concentrations were greater upstream, and cadmium, mercury and selenium concentrations were similar above and below the mine site. A comparison of the recent B.C. data to the earlier data collected by DFG reveals that whole body Dolly Varden char element concentrations above and below the mine sites are relatively similar for samples collected over the last five years, and concentrations observed in fish collected near the border are generally within the same range or lower than concentrations observed for fish collected in the Tulsequah River.

A total of 16 Dolly Varden char were also collected by ENV in 2018 and 2019 from one site on Whitewater Creek, a tributary to the Tulsequah River. The sample location was downstream of the closed New Polaris mine site. Eleven of the 16 fish samples met the size criteria. The other five fish were included in the analysis and due to their smaller size (fork lengths that measured less than 90 mm and two fish weighted less than five grams) they were still judged as representing juvenile, resident fish. Concentrations of arsenic, cadmium, lead and mercury from Whitewater Creek fish samples were greater than concentrations found in the Tulsequah River samples. Copper, selenium and zinc concentrations were similar among sample sites.

The whole body element concentrations for Dolly Varden char collected from these sites are summarized in Appendix B in Table B-9.

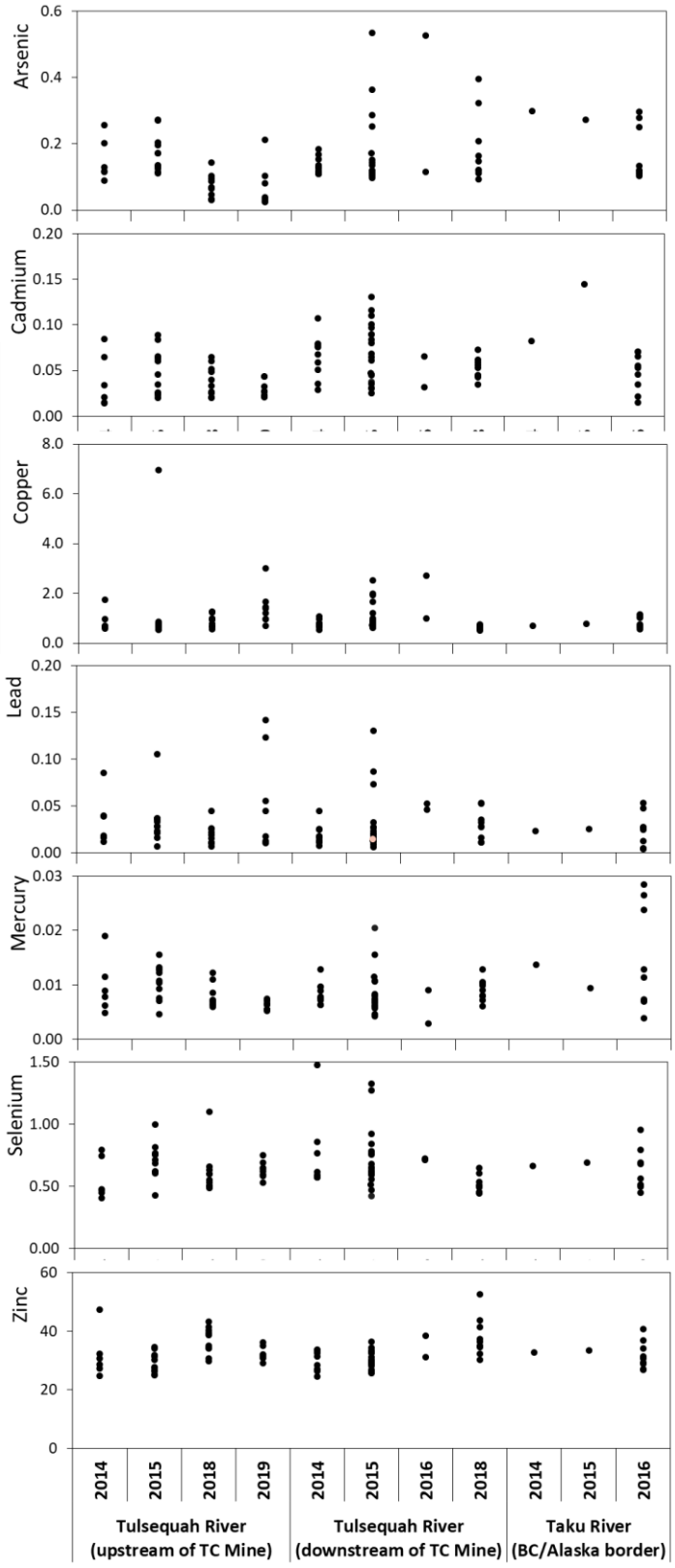

Figure 6 Tulsequah River Whole Body Dolly Varden char Element Concentrations (w/w mg/Kg) above and below Tulsequah Chief Mine (2014-2019)

6.2.5 Summary and Discussion

The B.C.-Alaska Joint Sampling Program collected water, sediment, and biological data at three geographic locations in the Taku watershed over a three-year period (2017 to 2019). Additional benthic macroinvertebrate data collected by the TRTFN in 2019 (TRTFN, 2020) and Dolly Varden fish data collected by DFG from 2014 to 2016 (Legere and Timothy, 2016), were included in the analysis. There were no exceedances of Alaska WQS for chronic long-term exposure at sample sites along the mainstem of the Taku River. Exceedances of B.C. WQG long-term exposure for total zinc and dissolved copper were observed in the mainstem of the Taku River, and exceedances of total zinc and dissolved cadmium, copper and zinc were observed in the Tulsequah River and Whitewater Creek, a tributary to the Tulsequah River. From community composition analysis of Alaska benthic macroinvertebrate samples, Diptera was the dominant taxa which conincides with additional studies completed by DFG on glacial waterbodies in Southeast Alaska (Krull, 2019). Alaskan samples had low presence of intolerant and EPT taxa in samples, possibly due to the dynamic environment of glacial rivers. The dominant taxa for TRTFN samples was Plectoptera, followed by Diptera. The Tulsequah River samples had a greater presence of EPT taxa compared to sample sites downstream of the B.C.-Alaska border. The dynamic habitat present in glacial systems could also account for the variability in benthic macroinvertebrate total abundance and taxa richness in the samples collected in Alaska and B.C. Resident fish (Dolly Varden char) show greater arsenic concentrations downstream of Tulsequah Chief Mine and New Polaris relative to fish collected upstream in the Tulsequah River. As shown by comparing the results from this study with work by DFG (Legere and Timothy, 2016), there does not appear to be notable changes in the element concentrations observed in resident fish (Dolly Varden char) within sites upstream of the mine site, or within sites downstream of the mine site in the last five years.

The results of the water, sediment and biological sampling provides data on the aquatic conditions in the Taku River and select tributaries. Water and sediment element concentrations above guidelines may be due to to natural mineralization present in the region; however, concentrations below mine sites may be linked to historic mining activity. Potential localized effects from historic mining activities can be observed in results from TuMain 3, located 1.25 km (0.8 miles) downstream, within the zone of influence of the Tulsequah Chief Mine (Palmer et al., 2013). Element concentrations at TuMain 3, located approximately less than 2 km (1.2 miles) downstream of the Tulsequah Chief Mine, exceeded both water and sediment quality guidelines. Concentrations of total and dissolved elements in water and sediment samples generally decreased with distance downstream of the mine, and no exceedances were observed in water samples downstream of the B.C.-Alaska border.

6.3 Stikine Watershed

Sample sites in the Stikine Watershed spanned 150 km (93,2 miles), from 12 km (7.5 miles) upstream of the town of Telegraph Creek in Northwest B.C. to 30 km (18.6 miles) downstream of the B.C.-Alaska border (Figure 7). All sites were located on the mainstem of the Stikine River except for one site each on Christina Creek and the Iskut River (glacial tributaries to the Stikine River), and the Johnson River, a glacial tributary to the Iskut River. There is no mining activity within Christina Creek, or the Johnson River and the Red Chris Mine is approximately 115 km (72.5 miles) upstream of Stikine Main 1, the farthest upstream Stikine River sample site.

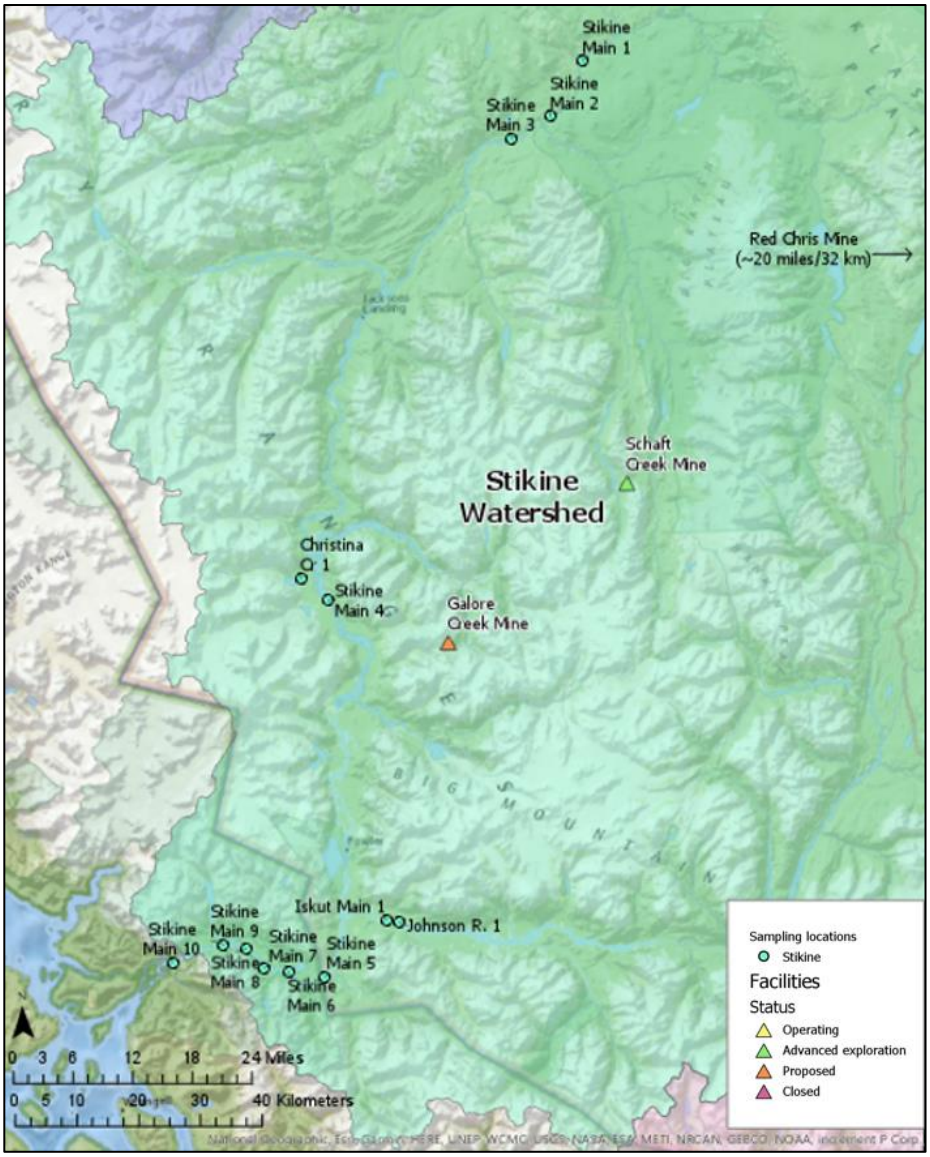

Figure 7 . Stikine Watershed Study Area and Sampling Locations

6.3.1 Water Quality

Thirteen sites were sampled for water quality. Ten sites were on the Stikine River, one was on the Iskut River and the remaining two were on tributaries to the Iskut and Stikine rivers in B.C. All B.C. Stikine mainstem sample sites exceeded long-term B.C. WQG for total zinc, with the highest concentration (65.9 µg/L), observed at Iskut Main 1. Dissolved copper guidelines were exceeded at all sample sites on tributaries to the Stikine River (Christina Creek, Iskut Main and Johnson R), in B.C. No exceedances of chronic Alaska WQS were observed in Alaska samples. Tables B-4 and B-5 in Appendix B detail water chemistry results from the Stikine watershed.

6.3.2 Sediment

Sediment sampling was conducted at five sites on the Stikine River and one site on the Iskut River. Sediment arsenic and iron concentrations were above the upper WSQG on the Iskut River, downstream of mining projects. Sediment iron concentration at the upper sampling site on the Stikine River (Stikine

Main 3), located downstream of the Mess Creek confluence were also above the upper WSQG. Downstream of the B.C.-Alaska border, Alaska sediment samples exceeded NOAA SQG TEL concentrations for arsenic, copper and nickel and NOAA SQG PEL thresholds for nickel. Sediment sample element concentration analysis is shown in Table 7.

Table 7. Stikine Sediment Samples Element Concentrations Results

STIKINE WATERSHED		Total Organic Carbon	Aluminum	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Nickel	Selenium	Silver	Tin	Vanadium	Zinc	Mercury
B.C Working Sediment Quality Guidelines	**Units**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Lower				5.90	0.60	36.00	21,000	35.00	460.00	16.00	2.00	0.50			120.00	0.17
	Upper				17.00	3.50	200.00	44,000	91.30	1,100.00	75.00					320.00	0.49
Site Name	**Date Sampled**																
Stikine Mainstem																	
Stikine Main 3	08/23/17	2,850	18,900	0.47	8.73	0.24	57.30	46,100	6.67	819.00	54.90	0.33	0.15	1.23	106.00	86.60	0.04
Stikine Main 2	08/23/17	6,250	16,500	0.48	6.90	0.42	49.60	37,900	6.54	663.00	63.20	0.40	0.14	0.84	83.10	89.60	0.06
Stikine Main 4	08/23/17	5,000	14,700	0.48	8.10	0.34	49.70	34,600	6.12	720.00	53.10	0.41	0.14	0.54	76.90	78.70	0.03
Stikine Main 4	09/15/18	3,600	12,200	0.49	9.08	0.30	88.30	33,200	7.66	663.00	41.90	0.44	0.21	0.49	93.50	53.90	0.02
Stikine Main 4 *(<2mm)*	09/15/18	1,700	8,730	0.29	3.65	0.13	38.90	18,000	2.99	432.00	22.30	*0.20*	0.08	0.19	48.40	36.70	0.01
Iskut River																	
Iskut Main	08/23/17	3,000	20,600	0.87	16.80	0.48	68.80	50,900	8.68	938.00	46.60	0.74	0.24	0.69	109.00	114.00	0.04
Iskut Main	09/15/18	3,100	18,100	0.69	19.70	0.34	56.20	48,300	7.98	807.00	34.30	0.62	0.23	0.52	113.00	87.30	0.04
Iskut Main *(<2mm)*	09/15/18	1,530	15,600	0.45	6.50	0.20	31.90	35,200	4.35	654.00	30.20	0.26	0.12	0.46	79.50	68.60	0.03
B.C. / AK Border																	
NOAA Sediment Quality Guideline Levels	Threshold Effects				5.9	0.596	35.70		35.00		18.00					123.00	0.174
	Probable Effects				17.00	3.53	197.00		91.30		36.00					315.00	0.486
Stikine Main 5	07/18/18		20,000	0.67	10.80	0.38	55.60	40,800	7.91	694.00	35.80	0.58	0.21	0.98	109.00	72.80	0.04
Stikine Main 10	07/22/18		23,500	0.63	8.64	0.23	50.50	38,200	7.88	579.00	36.60	0.36	0.18	0.99	106.00	74.00	0.04
	Average	**3,379**	**16,883**	**0.55**	**9.89**	**0.31**	**54.68**	**38,320**	**6.68**	**696.90**	**41.89**	**0.43**	**0.17**	**0.69**	**92.44**	**76.22**	**0.03**
	Standard Deviation	1,588	4,318	0.16	4.84	0.11	15.55	9,354	1.79	139.01	12.54	0.17	0.05	0.31	20.48	21.02	0.01
	Min	**1,530**	**8,730**	**0.29**	**3.65**	**0.13**	**31.90**	**18,000**	**2.99**	**432.00**	**22.30**	**0.20**	**0.08**	**0.19**	**48.40**	**36.70**	**0.01**
	Max	**6,250**	**23,500**	**0.87**	**19.70**	**0.48**	**88.30**	**50,900**	**8.68**	**938.00**	**63.20**	**0.74**	**0.24**	**1.23**	**113.00**	**114.00**	**0.06**
	Median	**3,050**	**17,300**	**0.49**	**8.69**	**0.32**	**53.05**	**38,050**	**7.17**	**678.50**	**39.25**	**0.41**	**0.16**	**0.62**	**99.75**	**76.35**	**0.04**

Italicized text notes DL = 0.20mg/kg

6.3.3 Fish Whole Body Analysis

Ten Dolly Varden char and 37 sculpin samples were submitted for whole body element concentration analysis. Since Dolly Varden char were not collected in Alaska and the number of B.C. Dolly Varden char samples was low, we focused on the results of the sculpin samples collected in Alaska and B.C. The sample sites included mainstem areas and Christina Creek in B.C. (Figure 8).

Fewer sculpin met the sculpin size class criteria resulting in more composite samples. Eight individuals and one composite sample were collected from Stikine Main 1. Fifteen individuals and two composite samples were collected from Christina Cr 1, and three individual samples from the Stikine River in Alaska. Except for zinc, which was not analyzed in the Alaska samples, all elements of interest were detected in all samples (Figure 7). The arsenic, lead and mercury concentrations were largely similar in sculpin from all three sample sites except for a single 2018 sample from Christina Cr 1 showing an outlier lead concentration of 1.02 w/w mg/kg. All other lead concentrations were below 0.05 w/w mg/kg. In Alaska, sculpin cadmium concentrations were within the range of concentrations observed in B.C., while greater copper concentrations and the lowest selenium concentrations were observed in the Alaska samples compared to samples from B.C. sites. Zinc concentrations were similar in sculpin from Stikine

Main 1 and Christina Cr 1. The whole body sculpin element concentrations are summarized in Table B-10 of Appendix B.

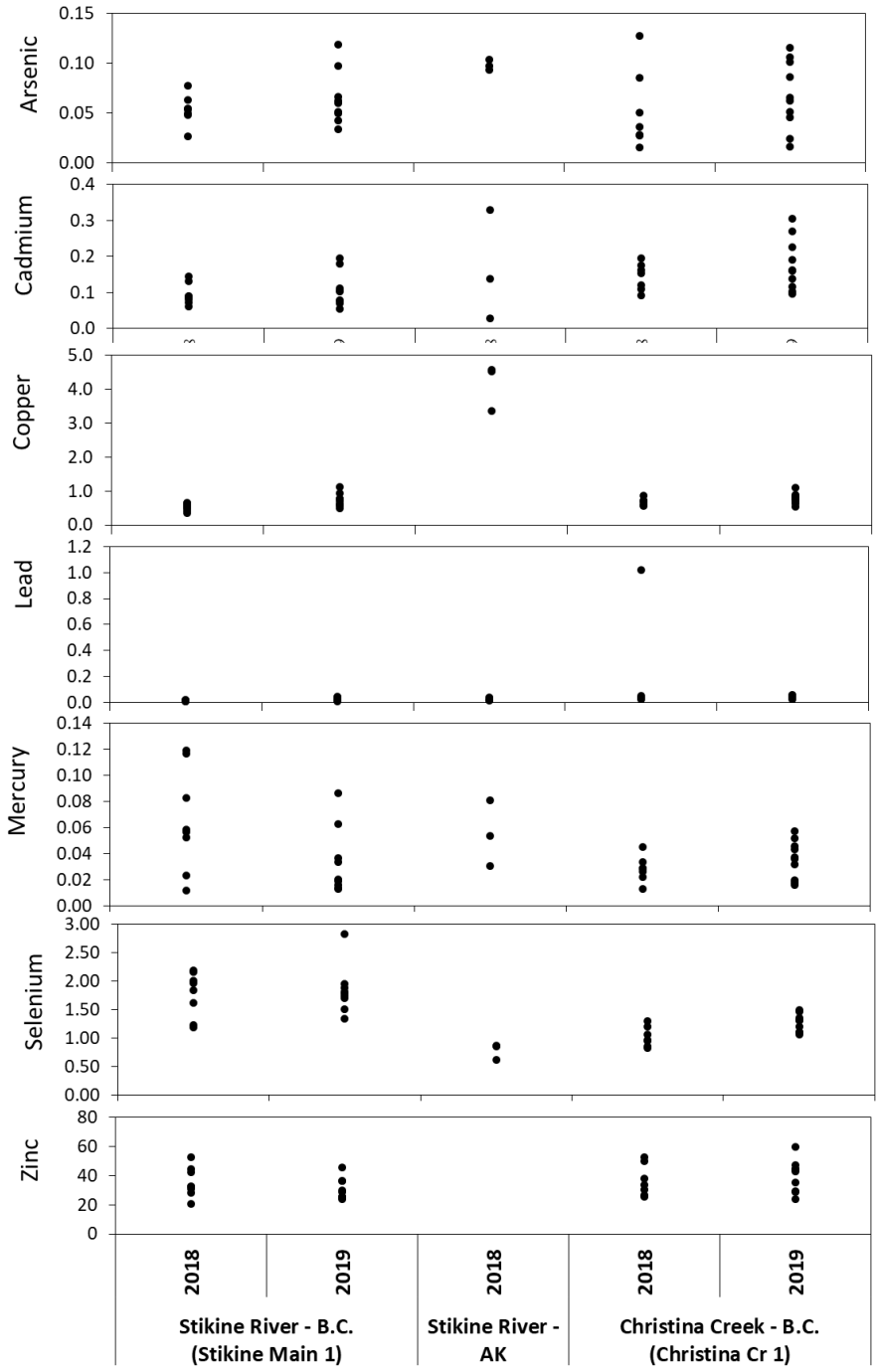

Figure 8. Sculpin Whole Body Element Concentrations (w/w mg/Kg) in Stikine River Mainstem (B.C. Upstream and AK Downstream Site) and B.C. Tributary (Christina Creek)

6.3.4 Summary and Discussion

Within the Stikine watershed there is one operating mine, Red Chris Mine, and two projects under advanced exploration: Schaft Creek and Galore Creek. The sampling design focused on the mainstem of the Stikine River and selected tributaries, including the Iskut and Johnson rivers and Christina Creek.

Sampling was done over a three year period (2017 to 2019) and focused on water, sediment and fish. Greater element concentrations were observed in water and sediment samples from the Iskut and Johnson Rivers compared to water and sediment samples collected in the mainstem of the Stikine River and Christina Creek. Observable differences in resident fish (sculpin) element concentrations between the B.C. and Alaska sample sites were limited; however greater concentrations of copper and lower concentrations of selenium were found in fish collected in Alaska compared to those collected in at B.C. sites. Elevated element concentrations observed in water, sediment and fish samples in this watershed may be influenced by naturally occurring, metal-rich mineral deposits in the region.

6.4 Unuk Watershed

Sample sites in the Unuk River extended from 3 km (1.9 miles) upstream of the confluence with Sulphurets Creek, to 27 km (16.8 miles) downstream of the B.C.-Alaska border and are shown in Figure 9. Sampling was done on the mainstem of the Unuk River and its tributaries, Sulphurets Creek and the South Unuk River. The overall length of the sampling area was about 46 km (28.6 miles).

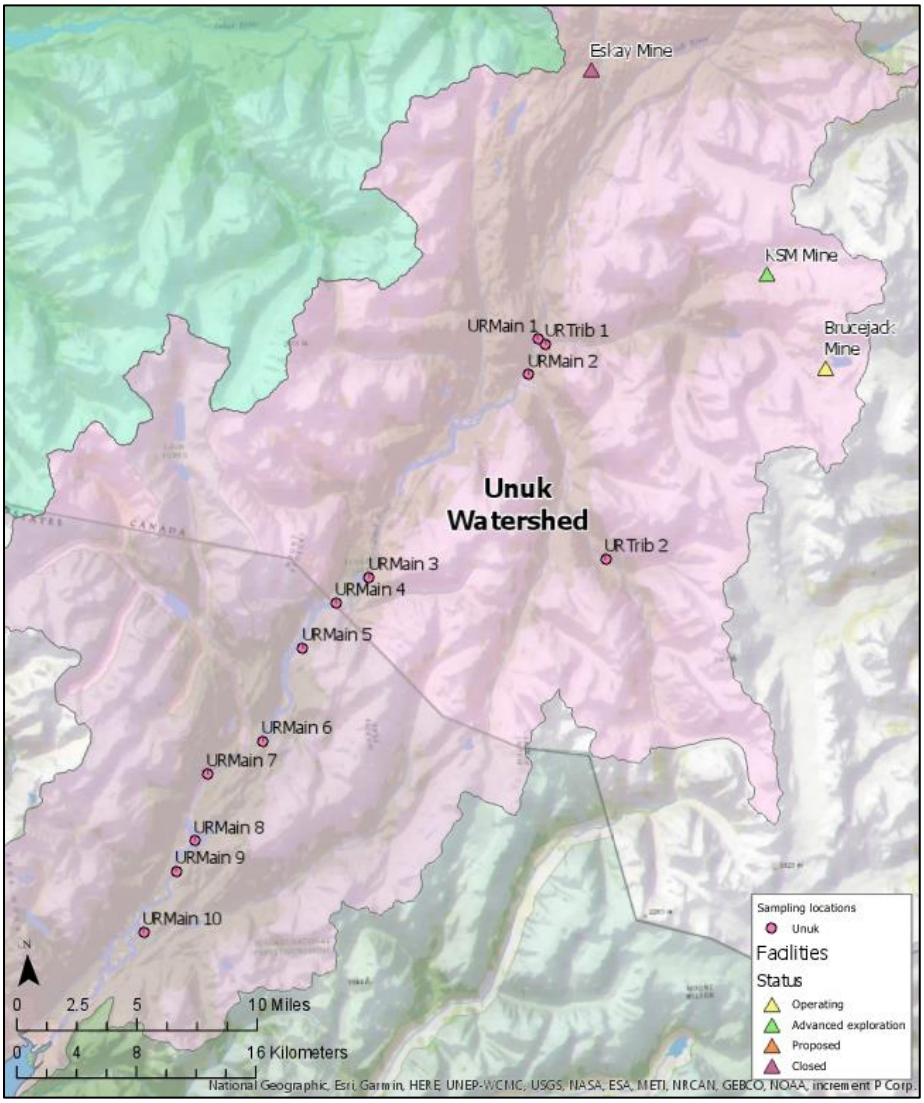

Figure 9. Unuk Watershed Study Area and Sampling Locations

6.4.1 Water Quality

Twelve sites were sampled for water quality: 10 sites on the Unuk River and two on tributaries in B.C. Element concentrations above the B.C. WQG for long-term exposure were measured throughout the watershed. The B.C. WQG for long-term total zinc exposure was exceeded at Sulphurets Creek and the Unuk River downstream of Sulphurets Creek (sample sites URTrib 1 and URMain 2). The greatest dissolved metal concentrations, including cadmium, copper and zinc, and the greatest total concentrations for selenium and zinc were reported in Sulphurets Creek. Unuk River sites upstream and downstream of Sulphurets Creek exceeded B.C. WQG for long-term zinc exposure, with concentrations ranging from 19.2 µg/L to 153.0 µg/L dissolved zinc and 56.0 µg/L to 226.0 µg/L total zinc. No exceedances of WQS were observed in Alaska. Tables B-6 and B-7 in Appendix B detail the expanded water chemistry results from the Unuk watershed.

6.4.2 Sediment

Sediment sampling in the Unuk watershed was conducted at five sites on the mainstem of the Unuk River and at one site each on the South Unuk River and on Sulphurets Creek (Table 8). Concentrations of total arsenic and iron were above the upper WSQG and NOAA SQG PEL for aquatic life at most sites in the Unuk watershed in B.C. UR Main6 had the highest observed iron (142,000 mg/kg) out of all samples in the three watersheds. Copper and manganese concentrations were above the upper WSQG at Sulphurets Creek, and at the Unuk River 2 km (1.2 miles) downstream of Sulphurets Creek, and total mercury and zinc were above the lower WSQG at the same sites. Alaska sites showed high concentrations of copper and nickel above PEL concentrations for NOAA SQG guidelines.

Table 8. Unuk Watershed Sediment Element Concentrations Results

UNUK WATERSHED		Total Organic Carbon	Aluminum	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Nickel	Selenium	Silver	Tin	Vanadium	Zinc	Mercury
B.C Working Sediment Quality Guidelines	**Units**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Lower				5.90	0.60	36.00	21,000	35.00	460.00	16.00	2.00	0.50			120.00	0.17
	Upper				17.00	3.50	200.00	44,000	91.30	1,100.00	75.00					320.00	0.49
Site Name	**Date Sampled**																
Unuk Mainstem																	
URMain 1	09/13/18	3,600	16,400	4.05	104.00	0.76	84.00	44,200	24.00	929.00	42.50	3.35	0.60	0.29	99.60	115.00	0.17
URMain1 *(<2mm)*	09/13/18	3,200	16,000	2.34	29.80	0.35	53.00	36,200	11.90	876.00	31.60	1.28	0.28	0.24	98.40	81.40	0.09
Sulphurets Creek																	
URTrib 1	09/13/18	1,800	17,000	10.30	67.60	3.28	330.00	62,800	44.10	1,110.00	42.80	8.86	1.68	0.44	86.90	268.00	0.25
URMain 2	09/13/18	2,800	19,000	6.26	85.50	2.13	221.00	60,600	29.70	1,110.00	32.10	6.26	1.00	0.38	113.00	216.00	0.19
South Unuk River																	
URTrib 2	09/13/18	1,710	15,200	1.05	18.30	0.57	86.90	48,800	40.00	639.00	35.70	0.66	0.40	0.26	121.00	71.00	0.01
URMain 3	09/13/18	3,200	16,800	2.32	38.50	0.74	96.90	48,700	17.40	771.00	26.90	2.00	0.44	0.48	110.00	101.00	0.07
URMain3 *(<2mm)*	09/13/18	850	14,400	0.64	6.82	0.28	37.50	30,100	5.21	603.00	21.50	0.50	0.14	0.22	72.30	63.70	0.02
B.C. / AK Border																	
NOAA Sediment Quality Guideline Levels	Threshold Effects				5.9	0.596	35.70		35.00		18.00					123.00	0.174
	Probable Effects				17.00	3.53	197.00		91.30		36.00					315.00	0.486
URMain 5	07/26/18	-	26,500	3.72	48.20	1.25	152.00	73,200	26.40	1,150.00	42.50	2.64	8.49	1.14	181.00	174.00	0.07
URMain 6	07/27/18	-	46,900	4.97	62.00	1.94	236.00	142,000	42.00	1,800.00	69.80	3.19	15.20	2.29	376.00	292.00	0.12
	Average	**2,622**	**22,543**	**4.67**	**60.59**	**1.52**	**172.40**	**68,614**	**31.94**	**1,072.71**	**41.76**	**3.85**	**3.97**	**0.75**	**155.36**	**176.71**	**0.13**
	Standard Deviation	841	11,379	3.01	28.83	0.98	93.53	33,886	10.20	373.61	13.78	2.79	5.73	0.74	101.79	85.53	0.08
	Min	**1,710**	**15,200**	**1.05**	**18.30**	**0.57**	**84.00**	**44,200**	**17.40**	**639.00**	**26.90**	**0.66**	**0.40**	**0.26**	**86.90**	**71.00**	**0.01**
	Max	**3,600**	**46,900**	**10.30**	**104.00**	**3.28**	**330.00**	**142,000**	**44.10**	**1,800.00**	**69.80**	**8.86**	**15.20**	**2.29**	**376.00**	**292.00**	**0.25**
	Median	**2,800**	**17,000**	**4.05**	**62.00**	**1.25**	**152.00**	**60,600**	**29.70**	**1,110.00**	**42.50**	**3.19**	**1.00**	**0.44**	**113.00**	**174.00**	**0.12**

Italicized text notes DL = 0.20mg/kg

6.4.3 Fish Whole Body Analysis

Thirty-one Dolly Varden char samples were collected from four locations in the Unuk River. Two sites were mainstem river sites: Unuk River-B.C., 20 km (12.4 miles) downstream of the closed Eskay Creek Mine, and Unuk River-AK site, 26 km (16.2 miles) downstream of the border.The other two sites were on tributaries to the mainstem river, specifically Sulphurets Creek, downgradient of the KSM deposits, and the South Unuk River, which enters the Unuk River 3 km (1.86 miles) downstream of Sulphurets Creek. There is no active mining within either tributary watershed. In total, 29 individual fish and two composite samples were submitted to the lab for whole body element analysis. The Dolly Varden char element concentrations are presented in Figure 10 and the data are summarized in Table B-11 in Appendix B.

The sample size at the Unuk River site in Alaska was small (n=2), which resulted in uncertainty related to the range of variability in fish element concentrations at this site compared to upstream sites and therefore limits the analysis of differences and trends. However, the data as presented here suggests that Dolly Varden char whole body concentrations of arsenic, cadmium and selenium were similar across all four sites sampled in the Unuk watershed, with the results for fish collected in Alaska at the lower range of observed concentrations In the Unuk watershed. Dolly Varden char from Sulphurets Creek showed greater concentrations of copper relative to samples collected in the Unuk River and South Unuk River. Copper concentrations in fish collected from the three mainstem river sites were similar to one another and low. Lead concentrations were greatest in fish samples from the South Unuk River. Mercury concentrations were greater in Sulphurets Creek and the Unuk River mainstem in B.C. Excluding the fish collected in Alaska, for which zinc concentrations were not analyzed, concentrations were similar at mainstem and tributary sites sampled in B.C.

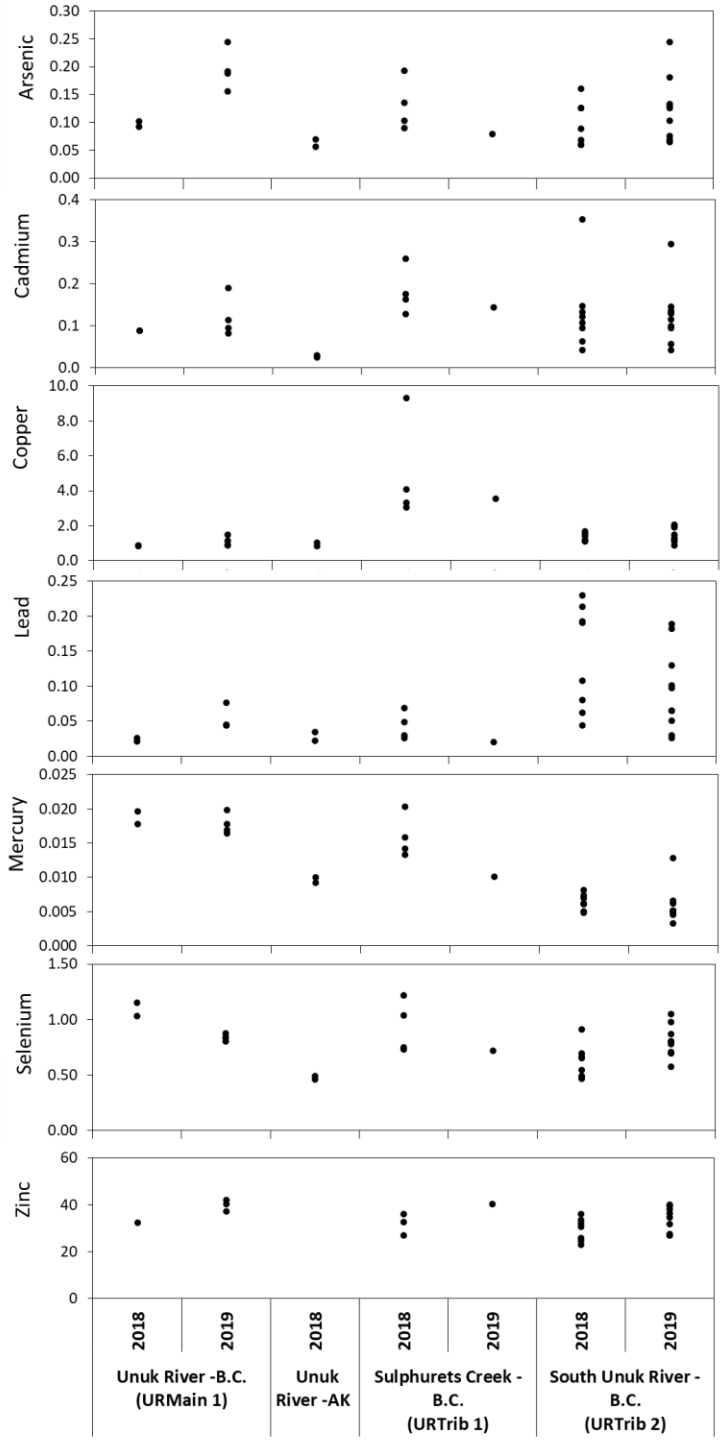

Figure 10. Dolly Varden char Whole Body Element Concentrations (w/w mg/kg) in the Unuk River Mainstem (Unuk River-B.C. and Unuk River-AK) and Tributaries (Sulphurets Creek and South Unuk River (2018-19).

6.4.4 Summary and Discussion

There are two mining properties within the Unuk watershed. These are the closed Eskay Creek gold and silver mine and the proposed KSM copper and gold mine. The operating Brucejack gold mine, although located within the Bell Irving River watershed, has an authorized mining wastewater discharge to the

Unuk River watershed. Water, sediment and fish sampling was done over a two year period (2018 and 2019) on the mainstem of the Unuk River and its tributaries, including Sulphurets Creek and the South Unuk River.

Water samples from the Unuk sites had the greatest concentrations of zinc compared to the other two watersheds as well as higher concentrations of other elements (e.g., cadmium, copper and iron). Of all sites in the three watersheds, URTrib 1 at Sulphurets Creek reported the highest concentrations of dissolved and total zinc (153 µg/L and 226 µg/L, respectively) far exceeding the B.C. WQG for long-term exposure. Downstream of the B.C.-Alaska border, there were no exceedances of Alaska WQS for chronic long-term exposure. All sediment samples from the mainstem and tributaries of the Unuk River upstream of the B.C.-Alaska border exceeded the upper B.C. SWQG for arsenic, copper, iron and manganese. Alaska sediment samples showed exceedances of NOAA SQG PEL concentrations for arsenic, copper and nickel. The high concentrations in the sediment may be correlated with the highly mineralized geology of the region. Element concentrations in Dolly Varden char samples were lower in Alaska compared to the B.C. mainstem and tributary sites including the South Unuk River, which does not currently have mining activity. Dolly Varden char samples from Sulphurets Creek displayed higher levels of copper relative to samples from elsewhere in the watershed.

6.5 Data Validation Results

6.5.1 Split Sampling Quality Assurance Program Audit

In 2018, Red Chris Mine and in 2019, Brucejack Mine participated in the Split Sampling Quality Assurance Program administered by ENV. The split sampling program is a robust audit mechanism that evaluates and monitors the reliability of discharge related environmental data. This is done by comparing the analytical results of industry samples to those obtained by a ministry representative. Evaluations of the split sample test results are conducted by the ministry's Laboratory Standards and Quality Assurance Unit.

Water chemistry results are evaluated via a statistical comparison of the permittee's laboratory results with the Ministry's laboratory results. Evaluation of microbiological test results are scored according to the grading scale developed for the Clinical Microbiology Proficiency Testing data assessment protocol. Toxicity test results are scored by absolute deviation. The maximum allowable deviation for a toxicity test is 30%. Each test result produces a statistical performance score. The average of all performance scores produced in a single audit constitutes the overall Performance Evaluation.

Water samples for the split sample audit were collected at Red Chris from Quarry Creek (W3) and the Klappan River (W40) on July 24, 2018 and analyzed for general chemistry and metal concentrations. The samples from Brucejack were collected at the Brucejack Lake outlet (BJ3.10) on August 28, 2019 and included chemistry (physical tests, anions, nutrients and total and dissolved elements) and toxicity sample results. The total number of tests included in the Red Chris audit was 180. The overall performance evaluation score was 90%, resulting in an audit pass. The Brucejack results indicated a high overall performance evaluation score of 99%. All the tests assessed in the Brucejack audit passed and the majority of results demonstrate strong precision.

Compliance Inspections and audit results are publicly available the Natural Resources Compliance and Enforcement (NRCE) database.[5]

[5] Natural Resources Compliance and Enforcement (NRCE): https://a100.gov.bc.ca/pub/ocers/searchApproved.do?submitType=menu

6.5.2 Side by Side Sampling for Quality Assurance Evaluation

ENV and mine environmental staff conducted side-by-side water quality sampling in September 2019 at two regularly sampled monitoring sites at Brucejack and Red Chris mines. At the Brucejack Mine, water quality samples were collected and compared for Brucejack Creek 1.4 km (0.9 miles) downstream of lake outlet (BJ1.74) and the Brucejack Lake Outlet (BJ 3.10). At Red Chris, samples were collected and compared for Quarry Creek downstream of North Dam (W3) and Klappan River (W40). These sites are part of each mine's regular environmental monitoring programs. Relative percent difference (RPD), a measure of analyte measurement precision was used to assess these results, which and are summarized in Tables B-12 through B-15 in Appendix B.

Parameters were not considered comparable if the lowest detection limits were different and if results were at or below detection limits in one or both samples. The maximum acceptable percentage difference between sample results is 25% (B.C. Ministry of Environment, 2013). However, this interpretation only holds true if the results are at least five times the detection limit. As well, some parameters (i.e. turbidity) are not consistent throughout the water column and therefore we expect to see higher variability between samples.

Side by Side Sampling Results

Samples were collected on September 11, 2019 from Red Chris Mine. Seventy-six parameters from each site were analyzed. Of these, 51 parameters at Quarry Creek (W3) and all 76 at the Klappan River (W40) were comparable. Unlike the Quarry Creek sample, the lowest detection limits (LDLs) were equal for every parameter in the ENV and Red Chris Klappan River samples. Six parameters (phosphorus, total selenium, total and dissolved aluminum, dissolved iron and manganese) differed by more than 25%, at W3, with total aluminum, dissolved iron and manganese results greater than five times the LDL. At W40, four of 76 parameters (phosphorus, dissolved aluminum, iron and zinc) differed by more than 25% and only one of these, dissolved aluminum, had results greater than five times the LDL.

Samples were collected on September 13, 2019 from Brucejack Mine. Seventy-nine parameters from each site were analyzed. Sixty-one parameters at BJ1.74 and 55 at BJ3.10 were comparable based on the criteria related to differences in LDLs. The RPD between samples for these parameters was calculated. Three of 61 parameters differed by more than 25%, at BJ1.74. Of the three, only total aluminum results were greater than five times the LDL. At BJ3.10, five of the 55 comparable parameters differed by more than 25%, with only one of these, turbidity, having results greater than five times the LDL.

Based on these samples, the data from both mines are considered within acceptable limits for data quality.

6.5.3 Unuk River KSM Long-Term Dataset Review

KSM has been collecting and reporting background water quality data since 2007 at numerous locations in the Unuk River watershed as part of its monitoring programs. Included in these sites is Unuk 1 (i.e., URMain 2), which is also a water quality sampling site in the B.C.-Alaska Joint Sampling Program. This is ENV's furthest downstream sampling site. The long-term water quality data (2009-2018) collected by KSM at this site was compared to the 2018 and 2019 water quality results collected by ENV from the same location. The data quality was evaluated by assessing the replicate sampling efforts by KSM and ENV, calculating the relative percent differences for parameter concentrations between replicate samples and comparing ENV recent sample results to the long-term results collected by KSM.

During the 2007 to 2018 monitoring period, KSM submitted 10 replicate samples from URMain 2 for analysis. Replicate samples were submitted for the same analysis as the parent sample. Six out of the 10 replicate samples during the monitoring period had parameters differing by more than 25%. The

parameters included turbidity and dissolved cadmium, copper, lead, selenium and zinc. Based on an evaluation of these samples, the replicate data are within acceptable limits for data quality. Overall, these results suggest sampling is conducted in a manner that produces reproducible results that are acceptable for the purpose of the monitoring report.

In general, the water quality results collected by the B.C. ENV at Unuk 1 between 2018 and 2019 are within the range of variability seen in the KSM long-term water quality results. Graphical presentations of this data for five elements of interest are provided in Figure B-1 in Appendix B. Dissolved cadmium and zinc concentrations were consistently below the B.C. WQGs for short-term exposure, ranging from 0.005 to 0.299 µg/L and 1 to 17.7 µg/L respectively, and showed relatively few exceedances of the B.C. WQG for long-term exposure. Selenium concentrations were consistently below the 2 µg/L B.C. long-term WQG. Most total zinc concentrations were below the WQG for short-term exposure, exceeding it on 10 occasions, typically in the wet spring and fall seasons. Lead was below the 0.05 µg/L lab detection limit, with three September concentrations at 0.2 µg/L. All sample results exceed the dissolved copper BLM guideline concentration of 0.3 ug/L.

6.5.4 Summary and Discussion

The industry data validation activities carried out in 2018 and 2019 by ENV suggest that water quality monitoring data collected by the mining industry should be considered a reliable data source. To further validate the reliability of industry data, similar data validation audits could be conducted on other metrics (i.e. sediment and fish) commonly used in impact assessments. CABIN analysis of benthic macroinvertebrates using the B.C. North Central Coast model could potentially be used to validate this type of data, assuming that the data is collected using CABIN sampling protocols and that supporting geographic information is available.

7. CONCLUSIONS

Alaska and B.C. led a coordinated sampling effort from 2017 to 2019 with Tribes and First Nations to investigate water, sediment, and fish concentrations in water bodies that drain from mineralized deposits and mines in transboundary watersheds.

Most water sample results were within B.C. WQG and Alaska WQS, with a few exceedances of B.C. WQG upstream of the B.C.-Alaska border. There were no exceedances of Alaska WQS for any water samples collected downstream of the B.C.-Alaska border. Of the three watersheds, water samples from the Unuk watershed had the highest concentrations of dissolved elements, followed by the Taku and Stikine, respectively. There were exceedances of B.C. WSQG and NOAA SQG for elements in sediment samples collected in B.C. and Alaska, with the greatest concentrations observed in the Unuk watershed. The naturally occurring mineral deposits in the watersheds likely influence water and sediment quality. Evidence of this is found in the water and sediment guideline and standard exceedences throughout the Unuk watershed on the mainstem and tributaries sample locations. However, in the Taku watershed, both the mine discharge contributions downstream from the Tulsequah Chief Mine and naturally occurring mineral deposits in the watershed likely have a localized influence on sediment and water element concentrations above B.C. guidelines.

The data validation assessment completed by ENV verified that industry monitoring and reporting programs met regulatory standards and requirements set by B.C. for the protection of human and environmental health. Results from the assessment showed significant agreement between data collected by government and industry.

Biological sampling included community composition analysis of benthic macroinvertebrate samples. Alaska benthic macroinvertebrate samples were dominated by Diptera: Chironomidae insects. This is not unexpected as similar results were found in other Southeast Alaska studies in glacial waters (Krull, 2019). Alaska samples had low percentages of intolerant and EPT taxa. The dominant taxa for the TRTFN samples was Plecoptera, followed by Diptera on the Tulsequah River. TRTFN samples had high percentages of intolerant and EPT taxa. No trends were evident between the samples collected from the mainstem and side channels of the Tulsequah River. Benthic macroinvertebrate community composition can be influenced by multiple factors, including habitat differences, sample methodology and timing of collection. Due to these confounding factors, no attempt was made to compare results from Alaska and TRTFN samples. Results from the Tulsequah River samples collected by the TRTFN will help to create a baseline from which future changes might be assessed since available data on benthic invertebrates in the Tulsequah River are limited.

Biological sampling explored potential element uptake by migratory and resident fish species in the watersheds. Resident fish species were sampled in each watershed for whole body element concentrations. With respect to the fish sampling it is important to understand that there is no way to determine what length of time an individual fish spent at the capture site. However, the selection of resident fish species improves the chances that observed concentrations are reflective of local influences. The results of the fish sampling activities showed that the element concentrations in juvenile resident fish varied between sample sites and within sites. There were no notable trends found in the whole body fish samples collected by ENV and DEC in the Taku Watershed. When compared with a previous study completed by DFG in 2016 (Legere and Timothy), the concentrations in the fish remained relatively similar. In the Stikine watershed, greater copper concentrations and the lowest selenium concentrations were observed in the Alaska sculpin samples compared to samples from B.C. sites. All other element concentrations were similar at all sampling sites in this watershed. Element concentrations in Dolly Varden char were lower in Alaska compared to the B.C. mainstem and tributary sites on the Unuk River. As well, Dolly Varden char samples from Sulphurets Creek displayed higher copper concentrations relative to samples collected elsewhere in the watershed.

Due to the large size, diverse habitats and complexity of these watersheds, it is important to recognize that the mechanisms controlling the water quality and biological patterns within them, require sampling designs that are more focused in area and scope than the objectives of this program. The results of the sampling program and data validation efforts indicate that current environmental conditions in Taku, Stikine and Unuk watersheds continue to support aquatic resources.

Outside of the Joint Sampling Program, monitoring of mining activities and the local environment will continue under provincial and state programs, industry aquatic monitoring and reporting programs and provincial compliance and enforcement programs.

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APPENDIX A: SAMPLE SITE LOCATIONS

Table A-1. Taku Watershed Sample Site Location and Description

TAKU RIVER WATERSHED					
Location in Watershed	Map Display Name	Site Name (EMS#)	Site Location Description	NAD 83 Datum**	
				Latitude	Longitude
Tulsequah River upstream of mining	TuMain 2	TAKU 1 (E309507)	Tulsequah River mainstem (site synonym SW16-1), 1 km upstream from Tulsequah Chief mining project	58.744029	-133.6149
	TuMain 1	TAKU 8 (E314930)	Tulsequah River mainstem upstream of Shazah Creek.	58.763	-133.6460
	TuMain 1b Side	TAKU 9 (E314931)	Side channel on opposite side of the Tulsequah River from Taku 1 and Taku 8	58.756	-133.6650
Tulsequah River downstream of mining	TuMain 3	TAKU 2 (E309508)	Tulsequah side-channel, ~1.25 km downstream from Tulsequah Chief mining project	58.724072	-133.5947
	TuMain 4	TAKU 3 (E309509	Tulsequah mainstem. ~3-4km downstream of Tulsequah Mine.	58.698506	-133.6019
	TuMain 5	TAKU 10 (E314932)	Tulsequah River ~7.5km downstream of Tulsequah Mine site.	58.666	-133.593
Taku River Mainstem	TaMain 1	TAKU 4 (E309510)	Taku mainstem, ~1km upstream of confluence with the Tulsequah River.	58.633846	-133.5447
	TaMain 2	TAKU 5 (E309511)	Taku mainstem, 800 m downstream of confluence with the Tulsequah River	58.624369	-133.5550
	TaMain 3	TAKU 11 (E314933)	Taku River mainstem ~2km downstream of confluence with Tulsequah River and downstream of Stuhini Creek confluence.	58.611	-133.5680
Whitewater Creek	Whitewater Trib 1	TAKU 6 (E312910)	"Whitewater Creek" tributary to Tulsequah River, upstream of closed New Polaris Mine.	58.700144	-133.6283
	Whitewater Trib 2	TAKU 7 (E312911)	"Whitewater Creek" tributary to Tulsequah River, downstream of closed New Polaris Mine.	58.682	-133.6280
Downstream of B.C. - Alaska Border	TaMain 7	NRS18-AK-10159	Taku River mainstem near Wright River confluence	58.5304	-133.7479
	TaMain 8	NRS18-AK-10160	Taku River mainstem~ before Johnson Creek confluence	58.5146	-133.8541
	TaMain 6	NRS18-AK-10162	Taku River mainstem	58.5388	-133.7055
	TaMain 9	NRS18-AK-10165	Taku River mainstem~ 15 miles downstream of Alaska Dept. of Fish & Game smolt camp	58.5021	-133.9221
	TaMain 4	NRS18-AK-10167	Taku River mainstem~ near B.C. - Alaska border	58.5791	-133.6418
	TaMain 5	NRS18-AK-Taku1	Taku River mainstem downstream of Fish Creek confluence	58.5579	-133.6785
	TaMain 10	NRS18-AK-Taku2	Taku River mainstem~20 miles downstream of Alaska Dept. of Fish & Game smolt camp	58.484	-133.9735

Table A-2. Stikine Watershed Sample Site Location and Description

STIKINE RIVER WATERSHED					
Location in Watershed	**Map Display Name**	**Site Name (EMS#)**	**Site Location Description**	**NAD 83 Datum**	
				Latitude	**Longitude**
Stikine River downstream of mining	Stikine Main 4	STIKINE 1 (E309512)	Stikine River mainstem - ~7km downstream of Skud River and near confluence with Flood River. (Galore Creek mining project)	57.2067	-131.8039
	Stikine Main 3	STIKINE 2 (E309513)	Stikine River mainstem, ~4km downstream from Mess Creek (Schaft Creek mining project).	57.8702	-131.2675
Christina Creek	Christina Cr 1	STIKINE 6 (E314890)	Christina Creek tributary to Stikine River. ~2km downstream of Stikine /Scud River confluence	57.23947	-131.8750
Stikine River upstream of mining	Stikine Main 2	STIKINE 3 (E309514)	Stikine River mainstem at Telegraph Creek, ~3km upstream of Mess Creek	57.9000	-131.1595
	Stikine Main 1	STIKINE 7 (E314891)	Stikine River mainstem ~12km upstream of Telegraph Creek town site and ~15km upstream of Mess Creek confluence.	57.9790	-131.0647
Iskut River	Iskut Main 1	STIKINE 4 (E279984)	Iskut River mainstem downstream of Johnson River and mining projects.	56.7389	-131.6736
	Johnson R. 1	STIKINE 5 (E314892)	Johnson River upstream of confluence with Iskut River mainstem. Mountain runoff.	56.7354	-131.6371
Downstream of B.C. - Alaska Border	Stikine Main 10	NRS18-AK-10064	Stikine River mainstem downstream of Fifteen Mile Island	56.6853	-132.2414
	Stikine Main 7	NRS18-AK-10139	Stikine River mainstem ~6 miles downstream of the B.C. - Alaska border	56.6747	-131.9988
	Stikine Main 8	NRS18-AK-10147	Stikine River mainstem upstream of Shakes Lake	56.7028	-132.0451
	Stikine Main 5	NRS18-AK-10150	Stikine River mainstem near B.C. - Alaska Border	56.6596	-131.8389
	Stikine Main 9	NRS18-AK-Stik1	Stikine River mainstem at Shakes Lakes confluence	56.7096	-132.1051
	Stikine Main 6	NRS18-AK-Stik2	Stikine River mainstem	56.6677	-131.9352

Table A-3. Unuk Watershed Sample Site Location and Description

UNUK RIVER WATERSHED					
Location in Watershed	**Map Display Name**	**Site Name (EMS#)**	**Site Location Description**	**NAD 83 Datum**	
				Latitude	**Longitude**
Unuk River downstream of mining	URMain 3	UNUK 1 (E312690)	Unuk River mainstem ~3km upstream of B.C. - Alaska and downstream of KSM mine project (UR2 site). Downstream of Unuk River / Canyon Creek confluence.	56.3537	-130.6969
	URMain 2	UNUK 3 (E312692)	Unuk River mainstem downstream of Sulphurets Creek. (aka KSM UR1 site).	56.4717	-130.5141
Sulphurets Creek	URTrib 1	UNUK 4 (E312693)	Sulphurets Creek -downstream of mining projects. (aka KSM SC3)	56.4896	-130.4941
South Unuk River (no mining)	URTrib 2	UNUK 2 (E312691)	South Unuk River reference site ~800m upstream of KSM SUNR E273103. No mining activity	56.358390	-130.4403
Unuk River upstream of mining	URMain 1	UNUK 5 (E312694)	Unuk mainstem upstream of KSM and Brucejack projects. Near KSM site UR1A.	56.49259	-130.50249
Downstream of B.C. - Alaska Border	URMain 9	NRS18-AK-10177	Unuk River, heavily braided section	56.1822	-130.919
	URMain 7	NRS18-AK-10178	Unuk River mainstem, near United States Geological Survey Gage Station	56.2398	-130.8804
	URMain 4	NRS18-AK-10180	Unuk River mainstem at B.C. - Alaska Border	56.3393	-130.7339
	URMain 10	NRS18-AK-10181	Unuk River, heavily braided section	56.1461	-130.9567
	URMain 8	NRS18-AK-10182	Unuk River, heavily braided section	56.1998	-130.8973
	URMain 5	NRS18-AK-Unuk1	Unuk River mainstem near B.C. - Alaska Border	56.313	-130.772
	URMain 6	NRS18-AK-Unuk2	Unuk River mainstem near Blue River confluence, lava rock canyon	56.2582	-130.8194

APPENDIX B: FIELD AND LAB DATA

Table B-1. Taku River Mainstem Water Chemistry Results

TAKU WATERSHED		General Parameters (Water)													Total Elements (Water)						Dissolved Elements (Water)				
TAKU RIVER MAINSTEM SITES		pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3,7]	Copper[5,7]	Lead[3,7]	Selenium[6]	Zinc[3,6,7]
	Units	**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		*>= 20*	<= 2.05		<= 3				*<=310*							<= 7.5	<= 0.17	<0.5	<= 5.6	<2*	<= 7.5*
	Short-term			5 over background			<=14.1		32.8										<= 1	<=33	<=0.45	<2.5	<= 59		<=33
Site Names	**Date Sampled**																								
TAKU MAINSTEM (Hardness of 77mg/L)																									
TaMain 1	08/24/17	7.90	9.8	109	1.33	63.8	0.0087	0.069	0.0338	0.103	*0.0020*	145	12.1	134	24.6	5.78	1.05	1.89	3.22	14.30	*0.0050*	0.476	0.0273	0.249	0.63
TaMain 1	09/10/18	8.06	10.0	23.9	0.83	62.9	*0.0050*	*0.050*	0.0349	0.069	*0.0020*	156	14.9	37.4	21.5	5.11	0.722	1.61	0.796	3.98	*0.0050*	0.358	0.0079	0.200	0.13
TaMain 1	11/19/18	8.12	1.6	8.86	1.15	87.6	*0.0050*	0.061	0.144	0.206	0.0021	210	19.7	16.7	31.0	7.00	0.674	2.33	0.240	1.52	*0.0050*	0.490	0.0252	0.322	0.54
TaMain 1	02/25/19	7.93	-	0.59	0.99	56.7	*0.0050*	*0.050*	0.187	0.191	*0.0020*	172	25.9	*3.0*	35.4	9.10	0.719	2.83	0.0529	1.76	*0.0050*	0.307	0.0071	0.388	0.41
TaMain 1	06/03/19	8.07	9.6	43.3	1.30	69.8	*0.0050*	*0.050*	0.0637	0.108	*0.0020*	161	13.9	45.3	23.4	5.26	0.736	1.72	0.975	4.57	0.0056	0.630	0.0265	0.259	0.27
TaMain 1	08/14/19	7.99	-	187	0.80	51.7	0.0063	1.16	0.0172	1.18	0.0023	118	8.88	247	20.0	4.93	1.83	1.60	4.48	16.70	0.0062	0.288	0.0124	0.112	0.23
Tulsequah River Confluence																									
TaMain 2	08/24/17	7.59	3	85.6	0.54	23.8	*0.0050*	*0.050*	0.0237	*0.030*	*0.0020*	67.8	10.4	39.8	12.8	2.79	1.73	1.30	2.81	18.10	0.0054	0.211	0.0176	0.129	0.94
TaMain 2	11/19/18	8.11	1.8	7.90	1.28	87.8	*0.0050*	*0.050*	0.145	0.187	0.0029	205	19.4	13.1	32.0	6.60	0.680	2.28	0.187	1.68	*0.0050*	0.510	0.0160	0.335	0.57
TaMain 2	02/25/19	8.08	-	0.71	0.87	114	*0.0050*	*0.050*	0.187	0.199	0.0025	260	25.0	*3.0*	35.1	8.16	0.747	3.07	0.0336	0.98	*0.0050*	0.368	0.0084	0.337	0.87
TaMain 2	06/03/19	8.07	9.5	48.4	1.48	70.1	*0.0050*	*0.050*	0.0671	0.114	0.0027	162	13.9	59.4	25.1	5.41	0.746	1.66	1.05	4.99	*0.0050*	0.635	0.0274	0.234	0.60
TaMain 3	09/10/18	8.06	9.6	19.2	0.81	67.0	*0.0050*	*0.050*	0.0349	0.076	*0.0020*	157	14.9	33.6	21.7	4.76	0.700	1.67	0.774	3.79	*0.0050*	0.355	0.0058	0.202	0.20
TaMain 3	08/14/19	7.96	12.4	175	0.95	51.3	0.0060	*0.05*	0.0219	0.043	0.0021	118	8.38	278	18.3	3.98	0.925	1.07	2.45	12.00	0.0058	0.292	0.0191	0.181	0.34
B.C. / AK Border																									
DEC Freshwater Water Quality Standards for Aquatic Life	Chronic Long-term	6.5-8.5	>20	25 or 5 over background		>=20	1.91												1.00		0.244	6.01	1.69	< 5	78.42
	Acute Short Term						4.13														1.36	8.56	26.91		75.6
TaMain 4	06/28/18	8.04	9.3	104	1.1	58	ND	ND	0.07	0.07	ND	150	15	85	21.4	5.42	1.77	1.97	NA	NA	0.03	0.83	0.11	0.25	ND
TaMain 5	06/27/18	8.04	9.4	132	0.95	57	ND	0.34	0.08	0.42	ND	150	14	73	22.9	6.06	2.35	14.1	NA	NA	0.02	0.68	ND	0.25	ND
TaMain 6	06/27/18	8	9.3	121	0.99	55	ND	ND	0.08	0.08	ND	140	14	80	22.3	5.97	2.32	2.15	NA	NA	0.01	0.75	0.08	0.22	ND
TaMain 7	06/26/18	7.93	9.2	149	1.2	59	ND	0.47	0.13	0.6	ND	130	14	91	20.4	5.38	2.04	1.91	NA	NA	ND	0.66	0.07	0.21	ND
TaMain 8	06/25/18	7.98	8.5	218	0.91	52	ND	0.23	0.29	0.52	ND	120	12	150	19.4	5.65	2.61	2.02	NA	NA	ND	0.61	0.1	0.22	ND
TaMain 9	06/24/18	8.16	8.9	259	0.8	49	0.02	ND	0.05	0.05	ND	130	11	160	18.8	6.49	2.96	2.16	NA	NA	0.01	0.66	ND	0.19	ND
TaMain 10	06/23/18	7.99	9.7	266	0.8	48	ND	ND	0.05	0.05	ND	120	11	200	19.5	6.93	3.52	2.34	NA	NA	ND	0.7	0.02	0.18	ND
	Average	**8.00**	**8.2**	**103.08**	**1.00**	**62.3**	**0.0066**	**0.19**	**0.09**	**0.23**	**0.0022**	**151**	**15**	**92**	**23.5**	**5.83**	**1.52**	**2.61**	**1.42**	**7.03**	**0.0083**	**0.52**	**0.03**	**0.24**	**0.48**
	Standard Deviation	0.12	3.1	87.77	0.24	18.9	0.0042	0.30	0.07	0.28	0.0003	42	5	82	6.0	1.41	0.91	2.82	1.46	6.37	0.0070	0.18	0.0336	0.07	0.26
	Min	**7.59**	**1.6**	**0.59**	**0.54**	**23.8**	**0.0050**	**0.05**	**0.0172**	**0.030**	**0.0020**	**68**	**8.38**	**3**	**12.8**	**2.79**	**0.674**	**1.07**	**0.0336**	**0.98**	**0.0050**	**0.211**	**0.0058**	**0.112**	**0.13**
	Max	**8.16**	**12.4**	**266.00**	**1.48**	**114.0**	**0.0200**	**1.16**	**0.29**	**1.18**	**0.0029**	**260**	**25.9**	**278**	**35.4**	**9.10**	**3.52**	**14.1**	**4.48**	**18.1**	**0.03**	**0.83**	**0.11**	**0.388**	**0.94**
	Median	**8.04**	**9.4**	**104.00**	**0.95**	**58.0**	**0.0050**	**0.05**	**0.0671**	**0.108**	**0.0021**	**150**	**14**	**73**	**21.7**	**5.65**	**1.05**	**1.97**	**0.886**	**4.28**	**0.0052**	**0.51**	**0.02**	**0.22**	**0.48**

NA - Not available, ND - Not Detected
Italicized values are at detection limits
Shaded values exceed acute aquatic life guideline
[1] Alkalinity B.C. and Alaska Aquatic Life Long-term Working Water Quality Guidelines (Calcium dependent)
[2] Ammonia B.C. and Alaska Aquatic Life Long / Short-term Water Quality Guidelines is pH and Temperature dependent; most conservative guideline calculated
[3] Parameter is hardness dependent. **Taku River hardness of 77mg/L was used for B.C. WQG thresholds.**
[4] Iron Total B.C. Aquatic Life Short-term Water Quality Guideline <1mg/L (No Fe-T Long-term B.C WQG)
[5] Copper Dissolved BLM B.C. Aquatic Life Short-term Water Quality Guidelines is pH, DOC and Hardness dependent
[6] Parameter is measured as Dissolved by DEC, but compared to B.C. Total Aquatic Life Long-term WQG
[7] Parameter is hardness dependent. Most conservative values were used for Alaska WQS thresholds.

Table B-2. Tulsequah River Mainstem Water Chemistry Results

TAKU WATERSHED		General Parameters (Water)													Total Elements (Water)						Dissolved Elements (Water)				
TULSEQUAH RIVER MAINSTEM SITES		pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[5]	Cadmium[3]	Copper[5]	Lead[3]	Selenium[6]	Zinc[5,6]
Units		**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		>=20	<= 1.2		<= 3				<= 220							<=7.5	<= 0.091	<= 0.3	<= 19		<=7.5
	Short-term			5 over background			<=14.1		32.8										< 1	<=33	<=0.18	<=0.8	<= 59		<=33
Site Names	**Date Sampled**																								
TULSEQUAH MAINSTEM RIVER (Hardness 32mg/L)																									
TuMain 1	09/10/18	7.57	0.9	169	0.55	18.7	*0.0050*	*0.050*	0.0208	0.041	0.0024	55.3	7.80	80.2	8.71	3.13	2.13	1.11	4.65	22	*0.0050*	0.152	0.0404	0.114	0.22
TuMain 1b Side	08/14/19	7.51	11.9	13.7	*0.5*	20.3	*0.005*	0.051	0.0544	0.106	*0.002*	59.2	8.47	5.6	6.87	2.21	0.653	0.269	0.439	1.71	0.0094	0.269	0.0066	0.116	0.35
TuMain 2	08/24/17	7.60	0.9	112	*0.50*	21.0	*0.0050*	*0.050*	0.023	*0.030*	*0.0020*	61.2	9.55	35.7	10.5	3.17	1.90	1.30	4.09	19.2	*0.0050*	0.102	0.0151	0.122	0.12
TuMain 2	11/19/18	7.58	0.9	115	1.01	21.7	*0.0050*	*0.050*	0.0746	0.089	0.0048	64.3	8.59	21.9	10.0	1.74	1.49	0.802	1.67	10.1	*0.0050*	0.231	0.0234	0.145	0.30
TuMain 2	02/25/19	7.63	-	17.8	0.76	27.1	*0.0050*	*0.050*	0.0853	0.090	0.0022	81.5	12.4	*3.0*	11.6	1.55	1.35	0.836	0.631	2.92	*0.0050*	0.078	0.0096	0.308	0.26
TuMain 2	06/03/19	7.65	2.3	80.1	*0.5*	21.4	*0.005*	*0.05*	0.0426	0.062	0.0538	74.2	13.2	12.1	11.2	2.03	1.77	1.27	1.73	9.02	*0.0050*	0.170	0.0154	0.250	0.21
TuMain 2	08/14/19	7.50	3.3	158	0.92	19.0	*0.005*	*0.05*	0.0154	0.057	0.0025	57.8	8.43	56.4	8.53	2.07	1.57	0.760	2.70	12.8	*0.0050*	0.186	0.0134	0.097	*0.20*
Tulsequah Chief Mine																									
TuMain 3	08/24/17	7.65	1.9	96.5	0.50	23.6	*0.0050*	*0.050*	0.0259	*0.030*	*0.0020*	68.9	10.6	41.1	12.9	2.73	1.84	1.26	3.10	26.2	0.0249	0.326	0.0192	0.169	5.62
TuMain 3	11/19/18	7.78	2.1	83.1	1.43	35.7	*0.0050*	*0.050*	0.136	0.161	0.0035	115	17.6	42.7	17.8	2.29	1.12	0.791	1.21	69.2*	0.1970	5.880	0.0444	0.268	42.60
TuMain 3	02/25/19	7.94	-	0.41	0.76	55.6	*0.0050*	*0.050*	0.175	0.176	*0.0020*	154	20.0	*3.0*	25.2	1.96	0.784	0.924	0.0134	16.7	0.1940	0.352	*0.0050*	0.365	16.00
TuMain 3	06/03/19	7.70	3.4	68.2	*0.5*	28.7	*0.005*	*0.05*	0.0544	0.071	0.0030	100	14.8	8.9	13.4	2.05	1.47	1.11	1.50	30.9	0.0745	1.040	0.0176	0.270	14.50
TuMain 3	08/14/19	7.62	5	180	0.52	25.7	0.0075	*0.05*	0.0201	0.041	*0.002*	73.0	9.78	132	13.1	2.36	1.63	0.805	3.02	54.7	0.0288	0.232	0.0125	0.169	1.66
TuMain 4	08/24/17	7.60	2	94.7	0.58	22.7	*0.0050*	*0.050*	0.025	*0.030*	*0.0020*	67.0	10.3	37.8	11.3	3.05	1.88	1.22	3.41	18.5	*0.0050*	0.201	0.0165	0.189	1.47
TuMain 4	09/11/18	7.59	3.2	164	0.68	24.0	*0.0050*	*0.050*	0.0249	0.045	0.0020	67.7	9.67	98.7	10.8	2.57	1.68	0.923	3.21	29.3	*0.0050*	0.453	0.0369	0.125	1.78
TuMain 4	11/19/18	7.81	2.4	76.2	1.34	39.0	*0.0050*	*0.050*	0.134	0.168	0.0034	114	15.8	25.1	18.6	2.16	1.05	0.873	1.19	49.1	0.1360	3.930	0.0371	0.262	24.90
TuMain 4	02/25/19	7.92	-	2.69	0.54	57.3	0.0050	*0.050*	0.128	0.176	*0.020*	172	20.5	*3.0*	25.7	2.35	1.31	3.71	0.159	58.7	0.2610	3.960	0.0222	0.401	58.90
TuMain 4	06/03/19	7.70	4.2	59.6	*0.5*	29.8	0.0050	*0.050*	0.0526	0.057	*0.020*	92.6	14.1	19.7	13.2	2.06	1.46	1.13	1.41	21.0	0.0443	0.727	0.0207	0.215	7.02
TuMain 4	08/14/19	7.61	4.4	162	*0.5*	24.9	*0.005*	*0.05*	0.0058	*0.03*	0.0023	69.8	9.38	80.4	11.1	3.19	2.89	1.46	5.68	32.4	0.0100	0.156	0.0086	0.152	0.55
Whitewater Creek																									
TuMain5	09/10/18	7.66	4.5	131	0.51	26.4	*0.0050*	*0.050*	0.0256	0.041	*0.0020*	74.8	10.3	52.2	11.7	2.78	1.90	1.09	3.13	25	*0.0050*	0.186	0.0094	0.200	1.15
	Average	**7.66**	**3.33**	**93.9**	**0.69**	**28.6**	**0.0051**	**0.05**	**0.059**	**0.079**	**0.007**	**85**	**12.2**	**40.0**	**13.3**	**2.39**	**1.57**	**1.14**	**2.26**	**24.5**	**0.054**	**0.981**	**0.0197**	**0.207**	**9.358**
	Standard Deviation	0.12	2.64	58.0	0.29	11.2	0.0006	0.0002	0.0498	0.053	0.013	33	3.9	36.2	5.1	0.49	0.50	0.68	1.58	16.3	0.0807	1.664	0.0118	0.088	16.325
	Min	**7.50**	**0.90**	**0.41**	**0.50**	**18.7**	**0.0050**	**0.050**	**0.006**	**0.030**	**0.002**	**55.3**	**7.8**	**3.0**	**6.87**	**1.55**	**0.653**	**0.269**	**0.013**	**1.71**	**0.0050**	**0.078**	**0.0050**	**0.097**	**0.120**
	Max	**7.94**	**11.90**	**180**	**1.43**	**57.3**	**0.0075**	**0.051**	**0.175**	**0.176**	**0.054**	**172.0**	**20.5**	**132**	**25.7**	**3.19**	**2.89**	**3.71**	**5.68**	**58.7**	**0.2610**	**5.880**	**0.0444**	**0.401**	**58.900**
	Median	**7.63**	**2.8**	**94.7**	**0.54**	**24.9**	**0.0050**	**0.050**	**0.043**	**0.057**	**0.002**	**73.0**	**10.3**	**35.7**	**11.6**	**2.29**	**1.57**	**1.09**	**1.73**	**21.5**	**0.0094**	**0.232**	**0.0165**	**0.189**	**1.470**

NA - Not available, ND - Not Detected
Italicized values are at detection limits
Shaded values exceed aquatic life guideline
[1] Alkalinity B.C. Aquatic Life Long-term Working Water Quality Guidelines (Calcium dependent)
[2] Ammonia B.C. Aquatic Life Long / Short-term Water Quality Guidelines is pH and Temperature dependent; most conservative guideline calculated
[3] Parameter is hardness dependent. **Tulsequah River hardness of 32mg/L was used for WQG thresholds.**
[4] Iron Total B.C. Aquatic Life Short-term Water Quality Guideline <1mg/L (No Fe-T Long-term WQG)
[5] Copper Dissolved BLM B.C. Aquatic Life Long-term Water Quality Guidelines is pH, DOC and Hardness dependent

Table B-3. Whitewater Creek Water Chemistry Results

TAKU WATERSHED		General Parameters (Water)												Total Elements (Water)						Dissolved Elements (Water)				
TULSEQUAH RIVER TRIBUTARY SITES		pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3]	Copper[5]	Lead[3]	Selenium[6]	Zinc[3,6]
Units		**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		>=20	<= 1.6		<= 3				<=220							<=7.5	<=0.15	<= 0.4	<= 5		<=7.6
	Short-term			5 over background			<=12		32.8										< 1	<=33	<=0.36	-<0.9	<= 45		<=33
Site Names	**Date Sampled**																								
WHITEWATER CREEK (Hardness 62.1mg/L)																									
WhitewaterTrib 1	09/11/18	7.72	10.9	0.86	0.95	43.2	0.0206	0.065	0.0325	0.097	*0.0020*	132	17.2	*3.0*	15.4	4.42	0.936	2.55	0.300	5.24	0.0352	0.277	0.0126	0.1830	1.59
WhitewaterTrib 1	02/25/19	7.57		1.23	0.92	47.6	0.0125	*0.050*	0.173	0.217	0.0025	162	16.1	3.2	16.5	4.10	0.960	5.95	0.501	2.51	0.0050	0.270	0.0200	0.2420	4.29
WhitewaterTrib 1	06/03/19	7.78	8.7	0.21	0.79	35.5	*0.005*	*0.05*	0.0302	0.067	*0.002*	89.6	7.48	*3*	10.6	3.21	0.657	1.25	0.101	1.63	0.0076	0.281	0.0189	0.1060	1.49
WhitewaterTrib 1	08/14/19	7.89		1.84	1.12	45.6	0.0062	0.087	0.0106	0.097	0.0025	153	20.7	*3*	16.0	4.67	1.10	3.97	0.744	1.66	0.0067	0.305	0.0369	0.1960	1.78
New Polaris Mine																									
WhitewaterTrib 2	09/11/18	7.87	12.7	1.37	0.99	53.8	0.0148	*0.050*	0.0633	0.102	*0.0020*	151	13.6	*3.0*	19.5	4.11	1.14	4.19	0.436	30.30	0.1380	1.470	0.3500	0.1370	27.9
WhitewaterTrib 2	02/25/19	7.65		1.54	1.01	58.0	0.0226	*0.050*	0.173	0.204	0.0030	172	14.8	*3.0*	20.4	5.19	1.07	5.56	0.488	50.6	0.1630	1.150	0.1420	0.1530	48.1
WhitewaterTrib 2	06/03/19	7.82	10	0.46	0.97	41.2	*0.0050*	*0.050*	0.0474	0.066	*0.0020*	104	7.59	*3.0*	12.6	3.43	0.740	1.70	0.171	15.9	0.0689	1.100	0.2350	0.1020	14.4
WhitewaterTrib 2	08/15/19	8.00	14	3.22	0.99	59.4	0.0395	0.113	0.0268	0.140	*0.002*	172	16.2	*3*	19.5	4.71	1.47	4.94	0.827	46.6	0.1910	0.805	0.0620	0.1250	35.0
	Average	**7.79**	**11.26**	**1.34**	**0.97**	**48.04**	**0.0158**	**0.06**	**0.07**	**0.12**	**0.00**	**141.95**	**14.21**	**3.03**	**16.31**	**4.23**	**1.01**	**3.76**	**0.446**	**19.31**	**0.0769**	**0.707**	**0.1097**	**0.16**	**16.82**
	Standard Deviation	0.14	2.11	0.93	0.09	8.41	0.0118	0.0236	0.0656	0.0584	0.0004	30.92	4.6048	0.0707	3.4725	0.6648	0.2523	1.7593	0.2549	20.57	0.0764	0.487	0.1241	0.0485	18.08
	Min	**7.57**	**8.7**	**0.21**	**0.79**	**35.5**	**0.005**	**0.05**	**0.0106**	**0.066**	**0.002**	**89.6**	**7.48**	**3.0**	**10.6**	**3.21**	**0.657**	**1.25**	**0.101**	**1.63**	**0.0050**	**0.270**	**0.0126**	**0.10**	**1.49**
	Max	**8.00**	**14**	**3.22**	**1.12**	**59.4**	**0.0395**	**0.113**	**0.173**	**0.217**	**0.003**	**172**	**20.7**	**3.20**	**20.4**	**5.19**	**1.47**	**5.95**	**0.827**	**50.6**	**0.1910**	**1.470**	**0.3500**	**0.24**	**48.1**
	Median	**7.80**	**10.90**	**1.30**	**0.98**	**46.60**	**0.01**	**0.05**	**0.04**	**0.10**	**0.002**	**152**	**15.45**	**3.00**	**16.25**	**4.27**	**1.02**	**4.08**	**0.462**	**10.57**	**0.0521**	**0.555**	**0.0495**	**0.15**	**9.35**

NA - Not available, ND - Not Detected
Italicized values are at detection limits
Shaded values exceed aquatic life guideline
[1] Alkalinity B.C. Aquatic Life Long-term Working Water Quality Guidelines (Calcium dependent)
[2] Ammonia B.C. Aquatic Life Long and Short-term Water Quality Guidelines is pH and Temperature dependent; most conservative guideline calculated
[3] Parameter is hardness dependent. **Whitewater Creek hardness of 62.1mg/L was used for WQG thresholds.**
[4] Iron Total B.C. Aquatic Life Short-term Water Quality Guideline <1mg/L (No Fe-T Long-term WQG)
[5] Copper Dissolved BLM B.C. Aquatic Life Long-term Water Quality Guidelines is pH, DOC and Hardness dependent

Table B-4. Stikine River Mainstem Water Chemistry Results

STIKINE WATERSHED		General Parameters (Water)													Total Elements (Water)						Dissolved Elements (Water)				
STIKINE RIVER MAINSTEM SITES		pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3,7]	Copper[5,7]	Lead[3,7]	Selenium[6]	Zinc[3,6,7]
	Units	**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		>= 20	<= 1.2		<=3				<= 310							< = 7.5	<= 1.8	<= 1.1	< 5.7*	< 2*	<=7.5
	Short-term			5 over background			<=14.0		<= 33										<= 1	<=33	<=0.47	<= 3.2	<=61		
Site Name	**Date Sampled**																								
STIKINE MAINSTEM (Hardness 80mg/L)																									
Stikine Main 1	09/15/18	8.05	6.90	4.77	1.57	64.60	*0.0050*	0.062	0.0051	0.067	0.0021	184.00	29.90	9.40	22.10	6.02	0.48	2.78	0.2270	1.82	0.005	0.447	0.005	0.428	0.39
Stikine Main 1	11/27/18	8.22	0.90	0.37	2.75	119.00	0.0067	0.106	0.668	0.774	0.0257	268.00	16.20	4.20	34.40	7.99	1.04	7.04	0.0318	1.66	0.005	0.668	0.036	0.112	1.00
Stikine Main 1	02/26/19	8.10	0.00		1.26	91.20				0.140	0.0066	232.00	31.40		28.90	8.25	0.81	4.60	0.0619	0.50	0.005	0.386	0.005	0.493	0.26
Stikine Main 1	06/03/19	7.85	9.00	49.0	2.85	39.20	0.0104	0.158	0.0166	0.174	0.0037	117.00	16.20	63.50	14.70	4.62	0.48	1.89	1.3400	4.54	0.008	0.784	0.017	0.352	0.81
Stikine Main 1	09/11/19	8.06	11.20	12.2	3.27	62.90	*0.005*	0.112	0.0109	0.123	0.0037	181.00	26.30	13.40	23.30	6.47	0.51	2.70	0.2400	2.25	*0.005*	0.738	0.014	0.473	0.77
Stikine Main 2	08/23/17	8.00	12.40	99.3	2.32	58.80	*0.0050*	0.092	0.0205	0.112	0.0025	163.00	24.60	126.00	20.10	6.55	0.77	2.61	2.3800	15.50	0.005	0.613	0.007	0.403	0.86
Stikine Main 2	06/03/19	7.85	9.10	52.6	2.43	39.40	*0.0050*	0.11	0.0149	0.125	0.0029	116.00	16.00	68.50	14.60	4.57	0.50	1.78	0.9670	4.84	0.012	0.834	0.017	0.291	1.03
Stikine Main 3	08/23/17	8.01	10.30	602	1.75	61.60	*0.0050*	*0.12*	0.0139	*0.12*	0.0036	151.00	16.40	782.00	25.50	7.39	1.54	2.53	7.1500	32.90	0.005	0.686	0.011	0.204	0.34
Stikine Main 3	09/15/18	8.05	7.40	5.23	1.55	66.10	*0.0050*	0.051	0.0098	0.061	0.0028	173.00	25.50	10.00	22.00	5.60	0.60	3.03	0.2380	1.43	0.005	0.433	0.008	0.389	0.34
Stikine Main 3	11/27/18	8.08	0.10	1.80	1.39	82.30	0.0050	0.083	0.0493	0.132	0.0093	220.00	28.00	6.40	24.40	7.17	0.77	4.09	0.1690	2.60	0.007	0.504	0.045	0.406	1.06
Stikine Main 3	02/26/19	7.95	0.00		1.04	92.80	0.0168	0.158	0.277	0.435	0.0042	248.00	32.50		37.60	4.31	1.54	5.02	0.2210	2.70	0.027	0.545	0.025	0.932	2.10
Stikine Main 3	06/03/19	7.84	10.10	55.1	2.97	44.40	0.0064	0.161	0.02	0.181	0.0037	121.00	14.90	60.10	15.60	5.16	0.93	2.34	1.8600	8.75	0.059	1.030	0.030	0.300	1.62
Stikine Main 3	09/11/19	8.07	10.90	14.6	2.57	59.50	*0.005*	0.07	0.0083	0.079	0.0043	167.00	24.20	28.00	23.10	6.10	0.63	2.81	0.3510	2.16	*0.005*	0.618	0.007	0.370	0.28
Stikine Main 4	08/23/17	8.07	9.50	321	1.16	52.80	*0.0050*	0.068	0.0229	0.091	0.0033	125.00	12.80	306.00	23.30	5.08	2.15	1.34	5.2800	28.40	0.005	0.585	0.020	0.374	0.33
Stikine Main 4	09/15/18	8.02	7.90	11.9	1.35	60.90	*0.0050*	*0.050*	0.0235	0.067	0.0022	162.00	23.40	20.20	22.60	4.34	0.80	2.20	0.4360	2.26	0.005	0.592	0.015	0.441	0.19
Stikine Main 4	11/27/18	8.00	1.20	5.13	1.59	64.80	*0.0050*	0.081	0.141	0.222	0.0037	180.00	23.20	6.60	25.60	4.49	1.11	2.77	0.2360	1.95	0.012	0.933	0.046	0.445	1.12
Stikine Main 4	02/26/19	8.10	0.00		0.96	89.30				0.147	0.0065	232.00	28.90		33.10	6.73	1.15	4.19	0.0388	0.43	0.005	0.351	0.006	0.553	0.14
Stikine Main 4	06/03/19	8.00	10.90	24.6	2.16	67.90	*0.0050*	0.147	0.0776	0.224	0.0040	172.00	16.10	24.90	27.40	4.18	1.41	1.67	0.4530	3.07	0.022	0.871	0.012	0.503	0.70
B.C. / AK Border																									
DEC Freshwater Water Quality Guidelines for Aquatic Life	Chronic Long-term	6.5-8.5	>20	25 or 5 over background		>= 20	1.29												1.00		0.22	6.10	1.72	5	79.56
	Acute Short-term						2.59														1.39	8.69	27.14		76.78
Stikine Main 5	07/18/18	8.20	7.60	374	0.9	45.00	0.011	ND	0.057	ND	0.25	110.00	13.00	350.00	21.30	6.75	2.62	1.90	NA	NA	ND	0.191	ND	0.224	ND
Stikine Main 6	07/21/18	8.40	10.60	249	0.73	45.00	ND	ND	0.061	ND	ND	110.00	14.00	150.00	16.70	5.99	2.42	1.93	NA	NA	ND	0.272	ND	0.194	ND
Stikine Main 7	07/17/18	7.50	8.30	252	0.76	44.00	0.013	0.17	0.049	0.22	ND	110.00	13.00	170.00	20.40	5.74	2.26	1.72	NA	NA	ND	0.386	ND	0.233	ND
Stikine Main 8	07/19/18	7.85	9.50	218	2.1	48.00	ND	ND	0.049	ND	ND	120.00	14.00	140.00	21.30	3.40	1.18	1.39	NA	NA	0.011	0.240	ND	0.264	ND
Stikine Main 9	07/20/18	7.70	10.70	200	2.2	45.00	ND	ND	ND	ND	ND	110.00	15.00	140.00	19.60	5.23	2.38	2.06	NA	NA	ND	0.365	ND	0.200	ND
Stikine Main 10	07/22/18	8.37	10.50	300	0.67	40.00	ND	ND	0.04	ND	ND	110.00	11.00	-	20.90	5.00	2.46	1.90	NA	NA	ND	0.266	ND	0.162	ND
	Average	**8.01**	**7.29**	**135.84**	**1.76**	**61.85**	**0.01**	**0.11**	**0.08**	**0.18**	**0.02**	**161.75**	**20.27**	**123.96**	**23.27**	**5.71**	**1.27**	**2.76**	**1.20**	**6.54**	**0.01**	**0.56**	**0.02**	**0.36**	**0.74**
	Standard Deviation	0.19	4.29	164.33	0.78	20.42	0.00	0.04	0.15	0.17	0.06	49.26	6.86	183.74	5.84	1.27	0.73	1.35	1.96	9.49	0.01	0.23	0.01	0.17	0.53
	Min	**7.50**	**0.00**	**0.37**	**0.67**	**39.20**	**0.01**	**0.05**	**0.01**	**0.06**	**0.00**	**110.00**	**11.00**	**4.20**	**14.60**	**3.40**	**0.48**	**1.34**	**0.03**	**0.43**	**0.01**	**0.19**	**0.01**	**0.11**	**0.14**
	Max	**8.40**	**12.40**	**602.00**	**3.27**	**119.00**	**0.02**	**0.17**	**0.67**	**0.77**	**0.25**	**268.00**	**32.50**	**782.00**	**37.60**	**8.25**	**2.62**	**7.04**	**7.15**	**32.90**	**0.06**	**1.03**	**0.05**	**0.93**	**2.10**
	Median	**8.04**	**9.05**	**52.60**	**1.58**	**60.20**	**0.01**	**0.11**	**0.02**	**0.13**	**0.00**	**162.50**	**16.30**	**61.80**	**22.35**	**5.67**	**1.08**	**2.44**	**0.30**	**2.43**	**0.01**	**0.57**	**0.01**	**0.37**	**0.74**
STIKINE RIVER TRIBUTARY SITE		General Parameters (Water)													Total Elements (Water)						Dissolved Elements (Water)				
Site Name	**Date Sampled**	pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3]	Copper[5]	Lead[3]	Selenium	Zinc[3]
	Units	**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		>= 20	<= 1.8		<= 3				<= 130							<= 7.5	<= 0.044	<= 0.2	<= 3.5	<= 2	<=7.5
	Short-term			5 over background			<= 17		<= 33										<= 1	<=33	<= 0.065		<= 5.3		<= 33
Christina Cr (upstream of Stikine Main 4)	09/11/19	7.24	9.90	15.9	0.71	8.40	*0.005*	*0.05*	0.0198	0.041	0.0028	31.60	5.29	11.00	4.67	0.35	1.09	0.26	0.5660	3.03	0.011	0.200	0.026	0.044	0.30

NA – Not Available, ND – Not Detected

Italicized results were reported at or below the detection limit for the analysis

Shaded values exceed aquatic life guideline

[1] Alkalinity B.C. Aquatic Life Long-term Working Water Quality Guidelines (Calcium dependent)

[2] Ammonia B.C. Aquatic Life Long and Short-term Water Quality Guidelines is pH and Temperature dependent; most conservative guideline calculated

[3] Parameter is hardness dependent. **Stikine River hardness of 80mg/L and Christina Creek hardness of 11.7mg/L was used for WQG thresholds.**

[4] Iron Total B.C. Aquatic Life Short-term Water Quality Guideline <1mg/L (No Fe-T Long-term WQG)

[5] Copper Dissolved BLM B.C. Aquatic Life Short-term Water Quality Guidelines is pH, DOC and Hardness dependent, [6] Parameter is measured as Dissolved by DEC, but compared to B.C. Total Aquatic Life Long-term WQG, [7] Parameter is hardness dependent. Most conservative hardness values were used for Alaska WQS thresholds.

Table B-5. Iskut River and Tributary Water Chemistry Results

STIKINE WATERSHED		General Parameters (Water)													Total Elements (Water)						Dissolved Elements (Water)				
ISKUT RIVER MAINSTEM SITES		pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3]	Copper[5]	Lead[3]	Selenium[6]	Zinc[3,6]
Units		**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		>= 20	<= 1.4		<=3				<= 220							<=7.5	<= 0.18	<= 0.5	< 5.3	< 2	<=7.5
	Short-term			5 over background			<=7.4		<= 33										<=1	<=33	<=0.47	<= 2.2	<=52		<=33
Site Name	**Date Sampled**																								
Iskut Mainstem (Hardness 70mg/L)																									
Iskut Main	08/23/17	8.06	6.00	896	1.32	50.90	0.0082	*0.24*	0.0461	*0.24*	0.0044	120.00	11.70	882.00	30.20	5.52	1.97	2.04	11.80	65.90	0.005	0.420	0.023	0.299	0.34
Iskut Main	09/15/18	7.99	5.70	31.2	1.07	57.90	*0.0050*	*0.050*	0.0408	0.074	0.0031	169.00	26.20	59.00	22.80	3.55	1.02	2.82	1.09	5.08	0.005	0.230	0.008	0.442	0.18
Iskut Main	11/27/18	7.93	3.60	8.96	0.94	59.10	*0.0050*	*0.050*	0.165	0.204	0.0024	180.00	26.00	10.40	23.40	3.37	1.12	2.97	0.40	2.54	0.005	0.680	0.022	0.394	0.93
Iskut Main	02/26/19	8.11	0.00		1.25	94.00				0.193	0.0087	241.00	29.90		28.40	8.53	0.91	4.89	0.11	2.45	0.005	0.467	0.015	0.522	1.32
Iskut Main	06/03/19	8.03	8.40	111	0.93	57.00	<0.0050	*0.050*	0.136	0.180	0.0030	160.00	19.30	113.00	24.60	4.29	1.06	2.12	2.23	11.40	0.013	0.408	0.009	0.513	0.35
Iskut Main	09/11/19	7.98	7.80	96.1	0.78	48.20	*0.005*	*0.05*	0.0261	0.049	0.0032	143.00	22.70	96.20	22.30	3.81	1.09	1.97	1.76	8.56	0.010	0.234	0.005	0.374	0.26
	Average	**8.02**	**5.25**	**228.65**	**1.05**	**61.18**	**0.01**	**0.09**	**0.08**	**0.16**	**0.00**	**168.83**	**22.63**	**232.12**	**25.28**	**4.85**	**1.19**	**2.80**	**2.90**	**15.99**	**0.01**	**0.41**	**0.01**	**0.42**	**0.56**
	Standard Deviation	0.19	0.06	3.08	375.51	0.21	16.64	0.00	0.08	0.06	0.08	0.00	41.14	6.44	365.42	3.25	1.96	0.39	1.11	4.43	24.70	0.00	0.01	0.01	0.09
	Min	**7.93**	**0.00**	**8.96**	**0.78**	**48.20**	**0.01**	**0.05**	**0.03**	**0.05**	**0.00**	**120.00**	**11.70**	**10.40**	**22.30**	**3.37**	**0.91**	**1.97**	**0.11**	**2.45**	**0.01**	**0.23**	**0.01**	**0.30**	**0.18**
	Max	**8.11**	**8.40**	**896.00**	**1.32**	**94.00**	**0.01**	**0.24**	**0.17**	**0.24**	**0.01**	**241.00**	**29.90**	**882.00**	**30.20**	**8.53**	**1.97**	**4.89**	**11.80**	**65.90**	**0.01**	**0.68**	**0.02**	**0.52**	**1.32**
	Median	**8.01**	**5.85**	**96.10**	**1.01**	**57.45**	**0.01**	**0.05**	**0.05**	**0.19**	**0.00**	**164.50**	**24.35**	**96.20**	**24.00**	**4.05**	**1.08**	**2.47**	**1.43**	**6.82**	**0.01**	**0.41**	**0.01**	**0.42**	**0.35**

ISKUT RIVER TRIBUTARY SITE		General Parameters (Water)													Total Elements (Water)						Dissolved Elements (Water)				
Site Name	**Date Sampled**	pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3]	Copper[5]	Lead[3]	Selenium[6]	Zinc[3,6]
Units		**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		<= 20	<= 1.9		<= 3				<= 130							<= 7.5	<= 0.08	<= 0.2	<= 3.9	<= 2	<=7.5
	Short-term			5 over background			<= 9.9		<= 33										<= 1	<=33	<= 0.15	<=2	<=15		<=33
Johnson R. (upstream of Iskut Main)	09/12/19	7.73	3.00	220	1.09	26.10	*0.005*	*0.05*	0.0094	0.059	0.0043	61.10	4.54	146.00	11.90	1.33	0.62	0.41	2.42	9.82	0.006	0.379	0.010	0.210	0.39

NA – Not Available, ND – Not Detected
Italicized results were reported at or below the detection limit for the analysis
Shaded values exceed aquatic life guideline
[1] Alkalinity B.C. Aquatic Life Long-term Working Water Quality Guidelines (Calcium dependant)
[2] Ammonia B.C. Aquatic Life Long and Short-term Water Quality Guidelines is pH and Temperature dependant; most conservative guideline calculated
[3] Parameter is hardness dependent. **Iskut River hardness of 70mg/L and Johnson River hardness of 26.5mg/L was used for WQG thresholds.**
[4] Iron Total B.C. Aquatic Life Short-term Water Quality Guideline <1mg/L (No Fe-T Long term WQG)
[5] Copper Dissolved BLM B.C. Aquatic Life Short-term Water Quality Guidelines is pH, DOC and Hardness dependent
[6] Parameter is measured as Dissolved by DEC, but compared to B.C. Total Aquatic Life Long-term WQG

Table B-6. Unuk River Mainstem Water Chemistry Results

UNUK WATERSHED		General Parameters (Water)													Total Elements (Water)						Dissolved Elements (Water)				
UNUK RIVER MAINSTEM SITES		pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3,7]	Copper[5,7]	Lead[3,7]	Selenium[6]	Zinc[3,6,7]
	Units	**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		>=20	<= 2.1		<= 3				<= 310							<=7.5	<= 0.18	<= 0.3	<= 5.6	<2*	<=7.5
	Short-term			5 over background			<=16		<=33										< 1	<=33	<=0.45	<=1.7	<= 59		<=33
Site Names	**Date Sampled**																								
UNUK MAINSTEM RIVER (Hardness 77.54 mg/L)																									
URMain 1	09/13/18	7.96	6.9	46.2	0.67	53.8	*0.0050*	*0.050*	0.027	0.057	0.0022	146	20.9	43.3	22.2	3.23	0.689	1.09	1.70	8.68	0.0086	0.170	0.0178	0.625	0.35
URMain 1	11/27/18	7.95	3.4	0.51	1.01	62.6	*0.0050*	*0.050*	0.0878	0.119	*0.0020*	188	30.0	*3.0*	24.9	4.22	0.532	1.97	0.0744	3.06	0.0349	0.403	0.0160	0.669	2.64
URMain 1*	02/26/19	8.01	0.2	NA	2.02	74.9				0.510	0.0057	237	37.4		35.1	5.15	1.11	3.57	0.103	8.66	0.102	1.060	0.0631	0.834	7.38
URMain 1	06/03/19	7.86	6.5	35.8	0.99	43.2	*0.005*	*0.05*	0.023	0.061	*0.002*	120	16.0	28.1	19.0	3.12	0.563	0.939	1.06	7.84	0.0265	0.435	0.0185	0.487	0.98
URMain 1	09/12/19	8.02	7.5	88.3	1.41	46.7	*0.005*	*0.05*	0.0201	0.054	0.0028	124	15.1	98.8	18.1	2.97	0.837	0.872	2.11	10.4	0.0189	0.298	0.0157	0.486	0.63
SULPHURETS CREEK																									
URMain 2	09/13/18	7.85	4.8	49.3	*0.50*	43.8	*0.0050*	*0.050*	0.0443	0.058	*0.0020*	163	34.0	46.3	23.0	2.60	0.921	0.959	2.12	38.9	0.272	1.020	0.0175	0.761	12.80
URMain 2	09/13/18	7.80		48.7	0.51	43.5	*0.0050*	*0.050*	0.0441	0.055	*0.0020*	163	34.2	50.3	22.5	2.62	0.931	0.962	2.04	39.7	0.281	0.884	0.0157	0.796	13.20
URMain 2	11/27/18	7.90	3.1	15.5	0.67	57.2	*0.0050*	*0.050*	0.17	0.171	*0.0020*	267	72.9	11.4	37.4	4.40	0.983	2.13	3.17	99.9	0.61	2.660	0.0100	1.260	25.80
URMain 2	02/26/19	8.03	0		*0.50*	79.1				0.195	*0.002*	332	87.1		53.7	5.82	1.33	3.13	1.21	62					
URMain 2	06/03/19	7.69	5.9	90.4	*0.50*	30.4	*0.0050*	*0.050*	0.0957	0.094	*0.002*	169	44.5	108	24.4	3.49	0.950	1.17	5.66	98.2	0.719	2.710	0.0000	0.725	36.00
URMain 2	09/12/19	7.85	5.4	84.6	1.09	33.0	*0.005*	*0.05*	0.0703	0.103	*0.002*	122	25.1	99.8	17.5	2.36	1.04	0.852	2.70	37.2	0.202	0.685	*0.0050*	*0.501*	8.64
SOUTH UNUK RIVER																									
URMain 3	09/13/18	7.76	3.9	21.1	*0.50*	39.4	*0.0050*	*0.050*	0.0474	0.061	*0.0020*	128	22.1	23.3	19.7	1.71	0.900	0.970	1.01	12.1	0.0784	0.570	0.0157	0.487	3.59
URMain 3	11/27/18	7.87	3.7	4.61	0.81	53.4	*0.0050*	*0.050*	0.203	0.221	0.0020	197	39.5	3.0	27.2	2.49	1.02	1.75	0.925	27.5	0.216	2.680	0.0180	0.703	10.30
URMain 3	02/26/19	7.97	0.1		0.70	65.0	*0.0050*	*0.050*	0.218	0.234	0.0027	224	46.1		36.0	2.90	1.20	2.78	0.159	10.5	0.127	1.200	0.0194	0.833	7.96
URMain 3	06/03/19	7.77	6.8	40.3	*0.50*	33.9	*0.0050*	*0.050*	0.0891	0.110	*0.002*	140	28.9	54.7	22.2	2.32	0.898	1.12	2.66	38.1	0.218	1.670	*0.0050*	0.509	8.86
URMain 3	09/12/19	7.82	5.9	67.2	0.95	31.5	*0.005*	*0.05*	0.054	0.083	*0.002*	104	18.2	99.6	16.4	1.94	1.06	0.883	2.44	22.5	0.0874	0.565	0.0158	0.328	2.60
B.C. / ALASKA BORDER																									
DEC Freshwater Water Quality Guidelines for Aquatic Life	Chronic Long-term	6.5-8.5	>20	25 or 5 over background		>= 20	2.36												1.00		0.15	3.87	0.94	5	50.13
	Acute Short-term						5.41														0.80	5.27	19.27		48.56
URMain 4	08/15/18	8.02	6.6	81	0.49	31	0.01	0.22	0.05	0.27	ND	88	13	94	14.4	1.48	0.71	0.65	NA	NA	0.05	1.85	ND	0.26	35.5
URMain 5	07/26/18	7.85	8.8	86.6	0.66	28	0.025	ND	0.05	ND	ND	92	14	47	14.2	2.23	1.31	0.9	NA	NA	0.03	0.3	ND	0.29	15
URMain 6	07/27/18	7.55	7.7	114.7	0.45	32	ND	0.25	0.04	0.29	ND	93	12	71	15.3	1.49	0.78	0.69	NA	NA	0.04	0.85	ND	0.22	29.7
URMain 7	07/27/18	7.42	9.8	118.4	0.58	28	ND	0.28	0.05	0.33	ND	78	10	49	12.5	2.56	1.65	1.35	NA	NA	0.03	0.8	0.1	0.2	19.3
URMain 8	07/28/18	7.5	7.8	246	0.63	31	0.051	0.29	0.05	0.34	0.39	82	9.2	140	15.1	1.67	1.14	0.95	NA	NA	0.03	1.13	0.07	0.21	30.8
URMain 9	07/25/18	7.67	8.1	93.3	0.38	28	0.029	0.16	0.05	0.21	ND	80	11	52	12.9	1.45	0.81	1	NA	NA	0.03	0.4	ND	0.22	14.9
URMain 10	07/25/18	7.52	9.5	81.9	0.62	27	ND	0.43	0.04	0.47	ND	80	11	40	13.7	2.04	1.3	1.24	NA	NA	0.03	0.4	ND	0.22	12.8
	Average	**7.81**	**5.6**	**70.72**	**0.75**	**43.32**	**0.01**	**0.12**	**0.07**	**0.19**	**0.03**	**149**	**28.36**	**58.13**	**22.50**	**2.79**	**0.99**	**1.39**	**1.82**	**32.83**	**0.15**	**1.03**	**0.02**	**0.53**	**13.62**
	Standard Deviation	0.12	0.18	2.9	53.96	0.37	15.75	0.01	0.11	0.06	0.14	0.09	67.18	20.04	37.79	9.96	1.17	0.26	0.80	1.41	30.55	0.19	0.80	0.03	0.28
	Min	**7.42**	**0.0**	**0.51**	**0.38**	**27.00**	**0.01**	**0.05**	**0.02**	**0.05**	**0.00**	**78**	**9.20**	**3.0**	**12.50**	**1.45**	**0.53**	**0.65**	**0.07**	**3.06**	**0.01**	**0.17**	**0.00**	**0.20**	**0.35**
	Max	**8.03**	**9.8**	**246.00**	**2.02**	**79.10**	**0.05**	**0.43**	**0.22**	**0.51**	**0.39**	**332**	**87.10**	**140**	**53.70**	**5.82**	**1.65**	**3.57**	**5.66**	**99.90**	**0.72**	**2.71**	**0.10**	**1.26**	**36.00**
	Median	**7.85**	**6.2**	**74.10**	**0.63**	**39.40**	**0.01**	**0.05**	**0.05**	**0.15**	**0.00**	**128**	**22.10**	**49.65**	**19.70**	**2.56**	**0.95**	**1.00**	**1.87**	**25.00**	**0.06**	**0.83**	**0.02**	**0.49**	**11.55**

NA - Not available, ND - Not Detected
Italicized values are at detection limits
Shaded values exceed aquatic life guideline
[1] Alkalinity B.C. Aquatic Life Long-term Working Water Quality Guidelines (Calcium dependent)
[2] Ammonia B.C. Aquatic Life Long and Short-term Water Quality Guidelines is pH and Temperature dependent; most conservative guideline calculated
[3] Parameter is hardness dependent. **Unuk River hardness of 77.54mg/L was used for WQG thresholds.**
[4] Iron Total B.C. Aquatic Life Short-term Water Quality Guideline <1mg/L (No Fe-T Long-term WQG)
[5] Copper Dissolved BLM B.C. Aquatic Life Short-term Water Quality Guidelines is pH, DOC and Hardness dependent
[6] Parameter is measured as Dissolved by DEC, but compared to B.C. Total Aquatic Life Long-term WQG
[7] Parameter is hardness dependent. Most conservative hardness values were used for Alaska WQS thresholds.
*Unuk 4, 5 data review correction – Unuk 4 and 5 samples on 02/26/2019 were switched in the lab, this table presents corrected values.

Table B-7. Sulphurets Creek and South Unuk River Water Chemistry Results

UNUK WATERSHED		General Parameters (Water)												Total Elements (Water)						Dissolved Elements (Water)				
UNUK TRIBUTARY SITES - SULPHURETS CREEK		pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3]	Copper[5]	Lead[3]	Seleniu m[6]	Zinc[3,6]
	Units	**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		>= 20	<= 2.1		<=3				<= 310							<=7.5	<= 0.23	<= 0.3	< 6.9	< 2	<=7.5
	Short-term			5 over background			<=20		<= 33										<=1	<=33	<=0.64	<= 0.9	<=91		<=33
Site Name	**Date Sampled**																								
SULPHURETS CREEK (Hardness 109mg/L)																									
URTrib 1	09/13/18	7.75	2.7	47.6	*0.50*	35.0	*0.0050*	*0.050*	0.0586	0.076	*0.0020*	163	43.3	71.1	24.7	2.34	1.12	0.945	2.61	66.4	0.498	1.130	0.0050	0.792	27.50
URTrib 1	11/27/18	7.78	2.6	39.7	0.54	49.0	*0.0050*	*0.050*	0.277	0.229	*0.0020*	360	126	23.4	43.5	4.57	1.32	2.10	6.96	225	1.2	1.880	0.0173	2.090	53.70
URTrib 1	02/26/19	8.02	0		*0.50*	80.1	*0.0050*	*0.050*	0.286	0.255	*0.002*	425	135		67.1	5.96	1.79	3.52	2.79	154	1.18	2.560	0.0095	2.160	52.20
URTrib 1	06/03/19	7.20	4.7	90.3	0.61	11.9	0.0063	0.2180	0.198	0.42	*0.002*	227	85.7	95.3	33.2	3.66	1.40	1.61	10.7*	226	2.28	13.900	0.0074	1.060	153.00
URTrib 1	09/12/19	7.70	4.3	88.7	0.86	23.7	*0.005*	*0.05*	0.0957	0.115	*0.002*	118	31.0	131	16.8	2.03	1.28	0.846	3.47	56	0.35	1.110	0.0107	0.523	19.20
	Average	**7.69**	**2.86**	**66.58**	**0.60**	**39.94**	**0.01**	**0.08**	**0.18**	**0.22**	**0.00**	**258.60**	**84.20**	**80.20**	**37.06**	**3.71**	**1.38**	**1.80**	**5.31**	**145.48**	**1.10**	**4.12**	**0.01**	**1.33**	**61.12**
	Standard Deviation	0.30	1.85	26.68	0.15	26.31	0.00	0.08	0.10	0.14	0.00	130.27	46.99	45.16	19.51	1.62	0.25	1.09	3.49	82.37	0.76	5.50	0.00	0.75	53.54
	Min	**7.20**	**0.00**	**39.70**	**0.50**	**11.90**	**0.01**	**0.05**	**0.06**	**0.08**	**0.00**	**118.00**	**31.00**	**23.40**	**16.80**	**2.03**	**1.12**	**0.85**	**2.61**	**56.00**	**0.35**	**1.11**	**0.01**	**0.52**	**19.20**
	Max	**8.02**	**4.70**	**90.30**	**0.86**	**80.10**	**0.01**	**0.22**	**0.29**	**0.42**	**0.00**	**425.00**	**135.00**	**131.00**	**67.10**	**5.96**	**1.79**	**3.52**	**10.70**	**226.00**	**2.28**	**13.90**	**0.02**	**2.16**	**153.00**
	Median	**7.75**	**2.70**	**68.15**	**0.54**	**35.00**	**0.01**	**0.05**	**0.20**	**0.23**	**0.00**	**227.00**	**85.70**	**83.20**	**33.20**	**3.66**	**1.32**	**1.61**	**3.47**	**154.00**	**1.18**	**1.88**	**0.01**	**1.06**	**52.20**

UNUK TRIBUTARY SITES – SOUTH UNUK RIVER		General Parameters (Water)												Total Elements (Water)						Dissolved Elements (Water)				
Site Name	**Date Sampled**	pH	Temperature	Turbidity	Dissolved Organic Carbon	Alkalinity[1]	Ammonia[2]	Kjeldahl Nitrogen as N	Nitrate, Nitrite as N	Total Nitrogen	Phosphorus	Specific Conductance	Sulfate[3]	Total Suspended Solids	Calcium	Magnesium	Potassium	Sodium	Iron[4]	Zinc[3]	Cadmium[3]	Copper[5]	Lead[3]	Seleniu m[6]	Zinc[3]
	Units	**pH**	**°C**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
B.C Freshwater Water Quality Guidelines for Aquatic Life	Long-term	6.5-9		2 over background		<= 20	<= 2		<= 3				<= 220							<= 7.5	<= 0.13	<= 0.3	<= 4.7	<= 2	<=7.5
	Short-term			5 over background			<= 11		<= 33										<= 1	<=33	<= 0.3	<=1.5	<=36		<=33
URTrib 2	09/13/18	7.71	2.8	5.90	1.03	36.3	*0.0050*	*0.050*	0.0505	0.067	*0.0020*	114	18.2	11.7	18.5	1.14	0.780	0.614	0.383	2.18	*0.005*	0.349	0.0556	0.263	0.81
URTrib 2	11/27/18	7.89	2.8	1.46	0.80	53.6	*0.0050*	*0.050*	0.235	0.242	*0.0020*	186	34.1	3.2	28.8	1.74	1.25	1.03	0.0929	0.92	*0.005*	0.660	0.0482	0.435	0.37
URTrib 2	02/26/19	7.99	0.8		*0.50*	65.5	*0.0050*	*0.050*	0.341	0.359	*0.002*	234	47.9		39.4	2.33	1.38	1.25	0.0089	0.33	*0.005*	0.296	0.0182	0.655	0.35
URTrib 2	06/03/19	7.83	5.5	6.60	0.66	35.9	*0.0050*	*0.050*	0.0887	0.111	*0.002*	114	17.1	10.3	18.7	1.23	0.910	0.619	0.323	2.19	0.0203	0.410	0.0322	0.299	0.60
URTrib 2	09/12/19	7.76	5.2	46.4	0.79	25.5	*0.005*	*0.05*	0.0329	0.058	0.0025	74.5	11.0	83.2	12.5	1.20	0.880	0.486	1.45	7.17	0.0104	0.271	0.0454	0.170	0.39
	Average	**7.84**	**3.42**	**15.09**	**0.76**	**43.36**	**0.01**	**0.05**	**0.15**	**0.17**	**0.00**	**144.50**	**25.66**	**27.10**	**23.58**	**1.53**	**1.04**	**0.80**	**0.45**	**2.56**	**0.01**	**0.40**	**0.04**	**0.36**	**0.50**
	Standard Deviation	0.11	1.94	21.00	0.20	15.96	0.00	0.00	0.13	0.13	0.00	64.21	15.08	37.58	10.61	0.51	0.26	0.32	0.58	2.70	0.01	0.16	0.01	0.19	0.20
	Min	**7.71**	**0.80**	**1.46**	**0.50**	**25.50**	**0.01**	**0.05**	**0.03**	**0.06**	**0.00**	**74.50**	**11.00**	**3.20**	**12.50**	**1.14**	**0.78**	**0.49**	**0.01**	**0.33**	**0.01**	**0.27**	**0.02**	**0.17**	**0.35**
	Max	**7.99**	**5.50**	**46.40**	**1.03**	**65.50**	**0.01**	**0.05**	**0.34**	**0.36**	**0.00**	**234.00**	**47.90**	**83.20**	**39.40**	**2.33**	**1.38**	**1.25**	**1.45**	**7.17**	**0.02**	**0.66**	**0.06**	**0.66**	**0.81**
	Median	**7.83**	**2.80**	**6.25**	**0.79**	**36.30**	**0.01**	**0.05**	**0.09**	**0.11**	**0.00**	**114.00**	**18.20**	**11.00**	**18.70**	**1.23**	**0.91**	**0.62**	**0.32**	**2.18**	**0.01**	**0.35**	**0.05**	**0.30**	**0.39**

NA – Not Available, ND – Not Detected
Italicized results were reported at or below the detection limit for the analysis
Shaded values exceed aquatic life guideline
[1] Alkalinity B.C. Aquatic Life Long-term Working Water Quality Guidelines (Calcium dependant)
[2] Ammonia B.C. Aquatic Life Long and Short-term Water Quality Guidelines is pH and Temperature dependant; most conservative guideline calculated
[3] Parameter is hardness dependent. **Sulphurets Creek hardness of 109mg/L and South Unuk River hardness of 52mg/L was used for WQG thresholds.**
[4] Iron Total B.C. Aquatic Life Short Term Water Quality Guideline <1mg/L (No Fe-T Long-term WQG)
[5] Copper Dissolved BLM B.C. Aquatic Life Short-term Water Quality Guidelines is pH, DOC and Hardness dependent
[6] Parameter is measured as Dissolved by DEC, but compared to B.C. Total Aquatic Life Long-term WQG
*Outcome has undergone QA/QC and is accurate.

Table B-8. Alaska Whole Body Fish Element Concentrations (mg/Kg w/w) - Taku River Watershed

TAKU WATERSHED - ALASKA WHOLE BODY FISH ELEMENT CONCENTRATIONS (2018)

		Sample No. (units w/w mg/kg)					
ARSENIC	**n**	**1**	**2**	**3**	median	min	max
Sockeye	1	0.224			0.224	0.224	0.224
Chinook	3	0.0556	0.0494	0.0648	0.056	0.049	0.065
Round Whitefish	2	0.0831	0.104		0.094	0.083	0.104
Stickleback	1	1.22			1.220	1.220	1.220
CADMIUM	**n**	**1**	**2**	**3**	median	min	max
Sockeye	1	0.0514			0.051	0.051	0.051
Chinook	3	0.0464	0.0437	0.0447	0.045	0.044	0.046
Round Whitefish	2	0.017	0.033		0.025	0.017	0.033
Stickleback	1	0.0588			0.059	0.059	0.059
COPPER	**n**	**1**	**2**	**3**	median	min	max
Sockeye	1	3.45			3.450	3.450	3.450
Chinook	3	0.819	0.696	0.656	0.696	0.656	0.819
Round Whitefish	2	0.346	0.519		0.433	0.346	0.519
Stickleback	1	1.33			1.330	1.330	1.330

		Sample No. (units w/w mg/kg)					
LEAD	**n**	**1**	**2**	**3**	median	min	max
Sockeye	1	0.00971			0.010	0.010	0.010
Chinook	3	0.0161	0.011	0.0108	0.011	0.011	0.016
Round Whitefish	2	0.0153	0.0352		0.025	0.015	0.035
Stickleback	1	0.00697			0.007	0.007	0.007
MERCURY	**n**	**1**	**2**	**3**	median	min	max
Sockeye	1	0.0318			0.032	0.032	0.032
Chinook	3	0.0218	0.023	0.0237	0.023	0.022	0.024
Round Whitefish	2	0.02	0.0268		0.023	0.020	0.027
Stickleback	1	0.0585			0.059	0.059	0.059
SELENIUM	**n**	**1**	**2**	**3**	median	min	max
Sockeye	1	0.477			0.477	0.477	0.477
Chinook	3	0.393	0.378	0.446	0.393	0.378	0.446
Round Whitefish	2	0.591	0.689		0.640	0.591	0.689
Stickleback	1	0.656			0.656	0.656	0.656

Stickleback spp = Threespine Stickleback

Table B-9. Taku Watershed -Whole Body Dolly Varden Char Data Comparison (mg/Kg w/w)

TAKU WATERSHED - WHOLE BODY DOLLY VARDEN CHAR DATA COMPARISON																								
				Sample No. (units w/w mg/kg)																				
ARSENIC	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	median	min	max
Tulsequah River (upstream of TC Mine)	2014	DFG	6	0.128	0.090	0.117	0.116	0.202	0.256															0.122	0.090	0.256
	2015	DFG	11	0.116	0.270	0.134	0.172	0.124	0.195	0.203	0.272	0.111	0.172	0.131										0.172	0.111	0.272
	2018	B.C.	10	0.046	0.032	0.069	0.031	0.030	0.102	0.144	0.094	0.065	0.088											0.067	0.030	0.144
	2019	B.C.	8	0.039	0.025	0.028	0.034	0.103	0.212	0.080	0.026													0.036	0.025	0.212
Tulsequah River (downstream of TC Mine)	2014	DFG	10	0.109	0.1284	0.109	0.1278	0.1666	0.119	0.135	0.1836	0.1533	0.1155											0.128	0.109	0.184
	2015	DFG	20	0.111	0.115	0.144	0.117	0.097	0.363	0.120	0.118	0.535	0.287	0.120	0.107	0.136	0.170	0.105	0.252	0.151	0.113	0.112	0.103	0.119	0.097	0.535
	2016	DFG	2	0.526	0.115																			0.320	0.115	0.526
	2018	B.C.	9	0.396	0.122	0.120	0.322	0.111	0.164	0.148	0.093	0.208												0.148	0.093	0.396
Taku River - AK	2014	DFG	1	0.298																				0.298	0.298	0.298
	2015	DFG	1	0.273																				0.273	0.273	0.273
	2016	DFG	9	0.1182	0.12	0.108	0.2968	0.2782	0.113	0.2497	0.102	0.1335												0.120	0.102	0.297
Whitewater Ck (downstream of New Polaris)	2018	B.C.	8	2.38	3.06	0.582	0.604	2.06	0.813	1.33	3.99													1.695	0.582	3.990
	2019	B.C.	8	0.347	0.358	0.466	0.394	0.576	2.28	0.742	0.131													0.430	0.131	2.280
CADMIUM	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	median	min	max
Tulsequah River (upstream of TC Mine)	2014	DFG	6	0.015	0.064	0.014	0.021	0.034	0.085															0.027	0.014	0.085
	2015	DFG	11	0.035	0.089	0.023	0.026	0.025	0.065	0.0203	0.04598	0.08398	0.0602	0.06351										0.046	0.020	0.089
	2018	B.C.	10	0.020	0.025	0.049	0.052	0.021	0.064	0.0605	0.0266	0.0401	0.0333											0.037	0.020	0.064
	2019	B.C.	8	0.023	0.043	0.026	0.0208	0.022	0.044	0.0327	0.0274													0.027	0.021	0.044
Tulsequah River (downstream of TC Mine)	2014	DFG	10	0.076	0.079	0.059	0.051	0.036	0.029	0.0675	0.07548	0.10731	0.07854											0.071	0.029	0.107
	2015	DFG	20	0.07992	0.0687	0.0648	0.02535	0.08372	0.08954	0.1104	0.06136	0.11596	0.13039	0.0456	0.02996	0.0452	0.04664	0.0378	0.10076	0.0972	0.09	0.03568	0.03075	0.067	0.025	0.130
	2016	DFG	2	0.066	0.032																			0.049	0.032	0.066
	2018	B.C.	9	0.062	0.044	0.056	0.045	0.043	0.035	0.073	0.053	0.059												0.053	0.035	0.073
Taku River - AK	2014	DFG	1	0.082																				0.082	0.082	0.082
	2015	DFG	1	0.145																				0.145	0.145	0.145
	2016	DFG	9	0.05516	0.01464	0.0216	0.053	0.07062	0.06554	0.07037	0.03468	0.04539												0.053	0.015	0.071
Whitewater Ck (downstream of New Polaris)	2018	B.C.	8	0.151	0.108	0.0693	0.0526	0.0818	0.0475	0.0983	0.22													0.090	0.048	0.220
	2019	B.C.	8	0.0341	0.0357	0.045	0.0318	0.0317	0.0889	0.0499	0.0255													0.035	0.026	0.089

Table B-9 Cont.

TAKU WATERSHED - WHOLE BODY DOLLY VARDEN CHAR DATA COMPARISON

				Sample No. (units w/w mg/kg)																			
COPPER	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	median	min	max
Tulsequah River (upstream of TC Mine)	2014	DFG	6	0.66	1.74	0.61	0.65	0.96	0.71															0.686	0.606	1.736
	2015	DFG	11	6.95	0.77	0.77	0.77	0.72	0.87	0.55	0.79	0.66	0.65	0.57										0.768	0.548	6.948
	2018	B.C.	10	0.68	0.57	0.96	0.78	0.66	1.25	1.27	0.95	1.00	1.26											0.956	0.568	1.270
	2019	B.C.	8	1.20	1.68	0.98	0.98	1.39	3.01	1.45	0.70													1.295	0.700	3.010
Tulsequah River (downstream of TC Mine)	2014	DFG	10	0.70	0.64	0.96	0.72	0.69	0.55	0.79	1.08	0.77	0.81											0.745	0.547	1.081
	2015	DFG	20	0.999	1.2137	0.84	0.6435	0.8855	1.9844	2.52	0.944	1.9401	1.6575	0.888	0.7276	0.7232	0.7208	0.714	0.8473	0.864	0.765	0.6467	0.615	0.856	0.615	2.520
	2016	DFG	2	2.72	0.98																			1.850	0.985	2.716
	2018	B.C.	9	0.72	0.50	0.63	0.75	0.60	0.65	0.57	0.58	0.68												0.631	0.504	0.749
Taku River - AK	2014	DFG	1	0.71																				0.710	0.710	0.710
	2015	DFG	1	0.78																				0.777	0.777	0.777
	2016	DFG	9	1.0244	0.5612	0.6696	1.06	1.1556	0.7232	1.135	0.7548	0.6408												0.755	0.561	1.156
Whitewater Ck (downstream of New Polaris)	2018	B.C.	8	1.47	1.85	0.58	0.739	1.46	0.651	0.825	1.45													1.138	0.580	1.850
	2019	B.C.	8	1.88	0.639	1.33	1.1	1.86	1.46	0.99	0.617													1.215	0.617	1.880
LEAD	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	median	min	max
Tulsequah River (upstream of TC Mine)	2014	DFG	6	0.039	0.018	0.012	0.016	0.085	0.039															0.028	0.012	0.085
	2015	DFG	11	0.037	0.023	0.021	0.037	0.106	0.028	0.02	0.03	0.04	0.03	0.01										0.028	0.007	0.106
	2018	B.C.	10	0.010	0.010	0.007	0.015	0.011	0.025	0.04	0.03	0.02	0.02											0.017	0.007	0.045
	2019	B.C.	8	0.018	0.123	0.013	0.011	0.055	0.142	0.04	0.01													0.031	0.010	0.142
Tulsequah River (downstream of TC Mine)	2014	DFG	10	0.011	0.017	0.017	0.026	0.012	0.007	0.02	0.04	0.01	0.02											0.017	0.007	0.045
	2015	DFG	20	0.01998	0.01374	0.0168	0.00585	0.01449	0.13068	0.0192	0.0118	0.08697	0.07293	0.0264	0.00856	0.02712	0.01272	0.0147	0.0229	0.0324	0.01575	0.01338	0.01435	0.016	0.006	0.131
	2016	DFG	2	0.046	0.053																			0.049	0.046	0.053
	2018	B.C.	9	0.032	0.011	0.016	0.052	0.011	0.035	0.027	0.028	0.053												0.028	0.011	0.053
Taku River - AK	2014	DFG	1	0.023																				0.023	0.023	0.023
	2015	DFG	1	0.025																				0.025	0.025	0.025
	2016	DFG	9	0.05319	0.00488	0.00432	0.01272	0.04708	0.02486	0.02724	0.00408	0.0267												0.025	0.004	0.053
Whitewater Ck (downstream of New Polaris)	2018	B.C.	8	0.556	0.54	0.124	0.048	0.448	0.116	0.107	0.953													0.286	0.048	0.953
	2019	B.C.	8	0.0589	0.059	0.0607	0.0476	0.0712	0.269	0.077	0.033													0.060	0.033	0.269

Table B-9 Cont.

TAKU WATERSHED - WHOLE BODY DOLLY VARDEN CHAR DATA COMPARISON																								
				Sample No. (units w/w mg/kg)																				
MERCURY	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	median	min	max
Tulsequah River (upstream of TC Mine)	2014	DFG	6	0.008	0.0190	0.006	0.005	0.0089	0.0115															0.008	0.005	0.019
	2015	DFG	11	0.0075	0.0155	0.0107	0.0132	0.0046	0.0104	0.0093	0.0129	0.0071	0.0122	0.0127										0.011	0.005	0.016
	2018	B.C.	10	0.0110	0.0072	0.007	0.007	0.009	0.012	0.0072	0.0065	0.0060	0.0063											0.007	0.006	0.012
	2019	B.C.	8	0.0066	0.0071	0.005	0.006	0.0064	0.0075	0.0055	0.0055													0.006	0.005	0.008
Tulsequah River (downstream of TC Mine)	2014	DFG	10	0.007	0.008	0.010	0.008	0.006	0.013	0.0097	0.0075	0.0090	0.0064											0.008	0.006	0.013
	2015	DFG	20	0.0068	0.0070	0.0073	0.0042	0.0062	0.0083	0.0060	0.0046	0.0074	0.0060	0.0066	0.0106	0.0080	0.0114	0.0204	0.0080	0.0057	0.0108	0.0080	0.0155	0.007	0.004	0.020
	2016	DFG	2	0.009	0.003																			0.006	0.003	0.009
	2018	B.C.	9	0.013	0.009	0.008	0.010	0.008	0.010	0.007	0.006	0.011												0.009	0.006	0.013
Taku River - AK	2014	DFG	1	0.014																				0.014	0.014	0.014
	2015	DFG	1	0.009																				0.009	0.009	0.009
	2016	DFG	9	0.007	0.024	0.011	0.007	0.028	0.026	0.013	0.007	0.004												0.011	0.004	0.028
Whitewater Ck (downstream of New Polaris)	2018	B.C.	8	0.013	0.009	0.012	0.009	0.052	0.036	0.017	0.015													0.014	0.009	0.052
	2019	B.C.	8	0.009	0.016	0.010	0.010	0.004	0.019	0.009	0.004													0.009	0.004	0.019
SELENIUM	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	median	min	max
Tulsequah River (upstream of TC Mine)	2014	DFG	6	0.41	0.45	0.79	0.74	0.47	0.47															0.472	0.407	0.792
	2015	DFG	11	0.42	0.75	0.61	0.60	0.68	1.00	0.71	0.82	0.62	0.75	0.77										0.711	0.425	0.998
	2018	B.C.	10	0.50	0.49	0.50	0.63	0.66	1.10	0.60	0.53	0.55	0.60											0.576	0.486	1.100
	2019	B.C.	8	0.62	0.64	0.58	0.69	0.53	0.59	0.65	0.75													0.631	0.528	0.749
Tulsequah River (downstream of TC Mine)	2014	DFG	10	0.59	0.86	0.59	0.58	0.57	0.57	0.77	0.57	0.61	1.48											0.589	0.571	1.478
	2015	DFG	20	0.6216	0.7557	1.272	1.326	0.4669	0.9196	0.768	0.6136	0.7805	0.6409	0.84	0.6206	0.678	0.5088	0.42	0.5954	0.6048	0.6525	0.5575	0.5945	0.631	0.420	1.326
	2016	DFG	2	0.72	0.71																			0.716	0.710	0.723
	2018	B.C.	9	0.65	0.49	0.53	0.60	0.51	0.44	0.45	0.50	0.45												0.501	0.444	0.645
Taku River - AK	2014	DFG	1	0.66																				0.664	0.664	0.664
	2015	DFG	1	0.69																				0.693	0.693	0.693
	2016	DFG	9	0.6895	0.9516	0.4968	0.5088	0.4494	0.791	0.681	0.51	0.5607												0.561	0.449	0.952
Whitewater Ck (downstream of New Polaris)	2018	B.C.	8	0.496	0.445	0.465	0.517	0.768	0.708	0.334	0.566													0.507	0.334	0.768
	2019	B.C.	8	0.657	0.463	0.739	0.591	0.732	0.62	0.542	0.581													0.606	0.463	0.739

Table B-9 Cont.

TAKU WATERSHED - WHOLE BODY DOLLY VARDEN CHAR DATA COMPARISON

				Sample No. (units w/w mg/kg)																			
ZINC	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	median	min	max
Tulsequah River (upstream of TC Mine)	2014	DFG	6	24.8	47.3	28.7	30.6	27.3	32.3															29.642	24.824	47.256
	2015	DFG	11	25.1	31.5	27.6	27.5	34.2	31.9	25.2	26.5	34.5	26.4	30.2										27.648	25.090	34.476
	2018	B.C.	10	40.3	29.8	34.4	38.6	43.3	41.5	34.2	30.7	35.1	39.4											36.850	29.800	43.300
	2019	B.C.	8	31.0	35.0	29.1	31.0	31.8	36.1	32.1	31.5													31.650	29.100	36.100
Tulsequah River (downstream of TC Mine)	2014	DFG	10	32.5	26.3	33.6	28.3	33.6	27.1	26.8	31.4	24.5	33.0											29.873	24.528	33.572
	2015	DFG	20	31.1	36.4	28.8	26.7	29.9	28.8	32.6	29.3	34.3	33.4	28.8	25.9	26.4	32.9	29.0	32.5	28.1	29.3	30.3	25.6	29.257	25.625	36.411
	2016	DFG	2	38.5	31.1																			34.844	31.144	38.544
	2018	B.C.	9	35.1	34.5	37.4	52.5	43.7	32.2	36.4	30.3	41.4												36.400	30.300	52.500
Taku River - AK	2014	DFG	1	32.7																				32.747	32.747	32.747
	2015	DFG	1	33.4																				33.390	33.390	33.390
	2016	DFG	9	34.1	29.3	28.9	36.9	31.5	26.9	40.6	26.9	30.7												30.705	26.894	40.633
Whitewater Ck (downstream of New Polaris)	2018	B.C.	8	42.5	38.5	35.1	37.5	57.0	35.0	56.6	51.7													40.500	35.000	57.000
	2019	B.C.	8	36.6	31.5	31.3	26.7	31.7	44.8	63.9	40.7													34.150	26.700	63.900

Table B-10. Stikine Watershed – Whole Body Sculpin Data Comparison (mg/Kg w/w).

STIKINE WATERSHED - WHOLE BODY SCULPIN DATA COMPARISON															
				Sample No. (units w/w mg/kg)											
ARSENIC	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Stikine River -B.C. (Stikine Main 1)	2018	B.C.	8	0.048	0.0493	0.0266	0.0544	0.0545	0.0771	0.0629	0.0536			0.054	0.027	0.077
	2019	B.C.	9	0.066	0.0974	0.034	0.0495	0.0621	0.0598	0.119	0.0423	0.0515		0.060	0.034	0.119
Stikine River -AK	2018	AK	3	0.104	0.0972	0.0935								0.097	0.094	0.104
Christina Creek – BC	2018	B.C.	7	0.128	0.0854	0.0273	0.0278	0.036	0.0157	0.0501				0.036	0.016	0.128
(Christina Cr 1)	2019	B.C.	10	0.116	0.106	0.0862	0.101	0.0453	0.0657	0.0515	0.024	0.0162	0.0625	0.064	0.016	0.116
CADMIUM	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Stikine River -B.C. (Stikine Main 1)	2018	B.C.	8	0.132	0.0843	0.09	0.144	0.0808	0.0903	0.0709	0.0606			0.087	0.061	0.144
	2019	B.C.	9	0.194	0.18	0.105	0.102	0.0765	0.112	0.0698	0.0543	0.0782		0.102	0.054	0.194
Stikine River -AK	2018	AK	3	0.0284	0.137	0.329								0.137	0.028	0.329
Christina Creek – BC	2018	B.C.	7	0.109	0.175	0.153	0.161	0.194	0.0927	0.121				0.153	0.093	0.194
(Christina Cr 1)	2019	B.C.	10	0.163	0.269	0.226	0.137	0.191	0.102	0.0972	0.159	0.116	0.305	0.161	0.097	0.305
COPPER	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Stikine River -B.C. (Stikine Main 1)	2018	B.C.	8	0.525	0.553	0.348	0.492	0.665	0.641	0.43	0.59			0.539	0.348	0.665
	2019	B.C.	9	0.77	1.11	0.499	0.616	0.709	0.769	0.93	0.556	0.605		0.709	0.499	1.110
Stikine River -AK	2018	AK	3	4.53	3.35	4.57								4.530	3.350	4.570
Christina Creek – BC	2018	B.C.	7	0.872	0.595	0.551	0.72	0.68	0.592	0.705				0.680	0.551	0.872
(Christina Cr 1)	2019	B.C.	10	1.09	0.838	0.883	0.636	0.786	0.806	0.528	0.768	0.76	0.692	0.777	0.528	1.090
LEAD	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Stikine River -B.C. (Stikine Main 1)	2018	B.C.	8	0.0252	0.0158	0.0133	0.0167	0.0116	0.0185	0.012	0.015			0.015	0.012	0.025
	2019	B.C.	9	0.025	0.0409	0.0132	0.0174	0.0225	0.0143	0.0484	0.0118	0.0183		0.018	0.012	0.048
Stikine River -AK	2018	AK	3	0.0205	0.0399	0.0148								0.021	0.015	0.040
Christina Creek – BC	2018	B.C.	7	0.0506	0.037	0.028	1.02	0.04	0.028	0.032				0.037	0.028	1.020
(Christina Cr 1)	2019	B.C.	10	0.0467	0.0417	0.0564	0.0366	0.0424	0.0279	0.0303	0.0401	0.0369	0.0566	0.041	0.028	0.057
MERCURY	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Stikine River -B.C. (Stikine Main 1)	2018	B.C.	8	0.119	0.0831	0.0585	0.117	0.0569	0.0528	0.0237	0.0123			0.058	0.012	0.119
	2019	B.C.	9	0.0865	0.063	0.0371	0.0207	0.0192	0.0163	0.0337	0.0137	0.0134		0.021	0.013	0.087
Stikine River -AK	2018	AK	3	0.054	0.031	0.0811								0.054	0.031	0.081
Christina Creek – BC	2018	B.C.	7	0.0267	0.0451	0.0291	0.013	0.0336	0.0291	0.0221				0.029	0.013	0.045
(Christina Cr 1)	2019	B.C.	10	0.032	0.0519	0.0373	0.0362	0.0459	0.0199	0.0435	0.0181	0.0162	0.0577	0.037	0.016	0.058
SELENIUM	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Stikine River -B.C. (Stikine Main 1)	2018	B.C.	8	2.19	2.01	1.23	1.84	1.97	2.16	1.19	1.62			1.905	1.190	2.190
	2019	B.C.	9	2.83	1.95	1.88	1.7	1.74	1.78	1.51	1.82	1.34		1.780	1.340	2.830
Stikine River -AK	2018	AK	3	0.866	0.626	0.855								0.855	0.626	0.866
Christina Creek – BC	2018	B.C.	7	0.974	0.954	0.853	1.3	1.2	0.831	1.07				0.974	0.831	1.300
(Christina Cr 1)	2019	B.C.	10	1.5	1.32	1.32	1.06	1.32	1.35	1.11	1.21	1.11	1.47	1.320	1.060	1.500

Table B-10. Cont.

STIKINE WATERSHED - WHOLE BODY SCULPIN DATA COMPARISON															
				Sample No. (units w/w mg/kg)											
ZINC	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Stikine River -B.C. (Stikine Main 1)	2018	B.C.	8	44.5	31	52.6	42.6	28.2	32.7	32.6	20.9			32.650	20.900	52.600
	2019	B.C.	9	28.8	36.7	45.8	36.4	29.9	23.9	25.3	25.6	24.7		28.800	23.900	45.800
Stikine River -AK	2018	AK	3	NA												
Christina Creek – BC (Christina Cr 1)	2018	B.C.	7	38.2	52.9	50.1	25.3	33.8	26.5	30.6				33.800	25.300	52.900
	2019	B.C.	10	44.8	60	47.4	44.6	44	24.1	42.9	29.2	29	35.1	43.450	24.100	60.000

Table B-11. Unuk Watershed Whole Body Dolly Varden char Data Comparison (mg/Kg w/w).

UNUK WATERSHED - WHOLE BODY DOLLY VARDEN CHAR DATA COMPARISON															
				Sample No. (units w/w mg/kg)											
ARSENIC	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Unuk River -B.C. (URMain 1)	2018	B.C.	2	0.0921	0.102									0.097	0.092	0.102
	2019	B.C.	4	0.245	0.192	0.188	0.156							0.190	0.156	0.245
Unuk River -AK	2018	AK	2	0.0694	0.0567									0.063	0.057	0.069
Sulphurets Creek - B.C. (URTrib 1)	2018	B.C.	4	0.103	0.136	0.193	0.0896							0.120	0.090	0.193
	2019	B.C.	1	0.0788										0.079	0.079	0.079
South Unuk River - B.C. (URTrib 2)	2018	B.C.	8	0.0883	0.126	0.126	0.0601	0.161	0.0597	0.0689	0.0604			0.079	0.060	0.161
	2019	B.C.	10	0.0751	0.0678	0.181	0.133	0.129	0.0642	0.103	0.244	0.0686	0.126	0.115	0.064	0.244
CADMIUM	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Unuk River -B.C. (URMain 1)	2018	B.C.	2	0.0882	0.087									0.088	0.087	0.088
	2019	B.C.	4	0.189	0.094	0.082	0.113							0.103	0.082	0.189
Unuk River -AK	2018	AK	2	0.0291	0.025									0.027	0.025	0.029
Sulphurets Creek - B.C. (URTrib 1)	2018	B.C.	4	0.163	0.175	0.260	0.1270							0.169	0.127	0.260
	2019	B.C.	1	0.1440										0.144	0.144	0.144
South Unuk River - B.C. (URTrib 2)	2018	B.C.	8	0.0942	0.062	0.107	0.0412	0.354	0.1460	0.1330	0.1210			0.114	0.041	0.354
	2019	B.C.	10	0.0994	0.1150	0.042	0.095	0.136	0.0569	0.129	0.294	0.1300	0.145	0.122	0.042	0.294

Table B-11 Cont.

UNUK WATERSHED - WHOLE BODY DOLLY VARDEN CHAR DATA COMPARISON															
				Sample No. (units w/w mg/kg)											
COPPER	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Unuk River -B.C. (URMain 1)	2018	B.C.	2	0.8730	0.853									0.863	0.853	0.873
	2019	B.C.	4	1.500	1.140	0.862	0.918							1.029	0.862	1.500
Unuk River -AK	2018	AK	2	1.01	0.843									0.927	0.843	1.010
Sulphurets Creek - B.C. (URTrib 1)	2018	B.C.	4	3.320	4.080	9.310	3.0500							3.700	3.050	9.310
	2019	B.C.	1	3.5500										3.550	3.550	3.550
South Unuk River - B.C. (URTrib 2)	2018	B.C.	8	1.1300	1.540	1.420	1.1700	1.680	1.1400	1.1000	1.1500			1.160	1.100	1.680
	2019	B.C.	10	1.2200	1.0900	1.500	2.040	1.930	1.2700	1.290	1.920	0.8900	1.240	1.280	0.890	2.040
LEAD	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Unuk River -B.C. (URMain 1)	2018	B.C.	2	0.0214	0.026									0.023	0.021	0.026
	2019	B.C.	4	0.076	0.044	0.044	0.045							0.045	0.044	0.076
Unuk River -AK	2018	AK	2	0.022	0.0346									0.028	0.022	0.035
Sulphurets Creek - B.C. (URTrib 1)	2018	B.C.	4	0.030	0.049	0.069	0.0258							0.039	0.026	0.069
	2019	B.C.	1	0.0198										0.020	0.020	0.020
South Unuk River - B.C. (URTrib 2)	2018	B.C.	8	0.1080	0.193	0.214	0.0436	0.230	0.0800	0.1910	0.0620			0.150	0.044	0.230
	2019	B.C.	10	0.0505	0.0262	0.097	0.130	0.182	0.0647	0.065	0.189	0.0295	0.101	0.081	0.026	0.189
MERCURY	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Unuk River -B.C. (URMain 1)	2018	B.C.	2	0.0178	0.020									0.019	0.018	0.020
	2019	B.C.	4	0.016	0.018	0.017	0.020							0.017	0.016	0.020
Unuk River -AK	2018	AK	2	0.01	0.0092									0.010	0.009	0.010
Sulphurets Creek - B.C. (URTrib 1)	2018	B.C.	4	0.014	0.016	0.020	0.0133							0.015	0.013	0.020
	2019	B.C.	1	0.0101										0.010	0.010	0.010
South Unuk River - B.C. (URTrib 2)	2018	B.C.	8	0.0061	0.008	0.006	0.0062	0.007	0.0070	0.0048	0.0050			0.006	0.005	0.008
	2019	B.C.	10	0.0051	0.0051	0.005	0.007	0.013	0.0033	0.006	0.005	0.0051	0.005	0.005	0.003	0.013
SELENIUM	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Unuk River -B.C. (URMain 1)	2018	B.C.	2	1.0300	1.150									1.090	1.030	1.150
	2019	B.C.	4	0.806	0.879	0.835	0.841							0.838	0.806	0.879
Unuk River -AK	2018	AK	2	0.493	0.463									0.478	0.463	0.493
Sulphurets Creek - B.C. (URTrib 1)	2018	B.C.	4	0.750	1.220	1.040	0.7320							0.895	0.732	1.220
	2019	B.C.	1	0.7180										0.718	0.718	0.718
South Unuk River - B.C. (URTrib 2)	2018	B.C.	8	0.6670	0.543	0.697	0.4790	0.911	0.4890	0.4680	0.6550			0.599	0.468	0.911
	2019	B.C.	10	0.7000	0.8010	0.707	0.695	1.050	0.5770	0.977	0.871	0.7800	0.801	0.791	0.577	1.050
ZINC	**Year**	**Collector**	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	median	min	max
Unuk River -B.C. (URMain 1)	2018	B.C.	2	32.4	37.7									35.050	32.400	37.700
	2019	B.C.	4	42.1	47.5	40.3	37.1							41.200	37.100	47.500
Unuk River -AK	2018	AK	2	NA	NA											
Sulphurets Creek - B.C. (URTrib 1)	2018	B.C.	4	27.0	40.1	36.2	32.8							34.500	27.000	40.100
	2019	B.C.	1	40.3										40.300	40.300	40.300
South Unuk River - B.C. (URTrib 2)	2018	B.C.	8	33.6	26.8	36.2	30.6	32.2	22.9	26.0	24.6			28.700	22.900	36.200
	2019	BC	10	27.1	29.6	34.7	31.9	40.0	36.3	38.2	27.6	26.9	39.5	33.300	26.900	40.000

IWQDV Results Tables and Figures

Table B- 12. Comparison of B.C. ENV and Brucejack mine side by side sampling results collected BJ1.74 downstream of from Brucejack Lake outlet on September 13, 2019.

Client Sample ID Date Sampled Time Sampled		BC. ENV BJ1.74 results E298333_REG 13-Sep-2019 11:32		Brucejack BJ1.74 results BJ-1.74 13-Sep-2019 11:32		
Parameter (Water)	Units	Lowest Detection Limit (LDL)	Results	Lowest Detection Limit (LDL)	Results	RPD*
Physical Tests (Water)						
Conductivity	µS/cm	2.0	246	2.0	251	2.01
Hardness (as $CaCO_3$)	mg/L	0.50	62	0.50	58.2	6.32
pH	pH	0.10	7.94	0.10	7.94	0.00
Total Suspended Solids	mg/L	3.0	13.0	3.0	14.0	7.41
Total Dissolved Solids	mg/L	20	156	20	155	0.64
Turbidity	NTU	0.10	6.95	0.10	6.40	8.24
Anions and Nutrients (Water)						
Alkalinity, Total (as $CaCO_3$)	mg/L	1.0	43.1	1.0	43.5	0.92
Ammonia, Total (as N)	mg/L	0.0050	0.0095	0.0050	*0.005*	**62.07**
Nitrate (as N)	mg/L	0.0030	5.50	0.0050	5.49	0.18
Nitrite (as N)	mg/L	0.0010	0.0128	0.0010	0.0130	1.55
Total Kjeldahl Nitrogen	mg/L	0.53	<0.53	0.530	<0.53	0.00
Total Nitrogen	mg/L	0.30	5.35	0.300	5.26	1.70
Orthophosphate-Dissolved (as P)	mg/L	0.0010	<0.0010	0.0010	<0.0010	0.00
Sulfate (SO_4)	mg/L	0.30	43.9	0.30	43.9	0.00
Organic / Inorganic Carbon (Water)						
Dissolved Organic Carbon	mg/L	0.50	*0.5*	0.50	0.71	**34.71**
Total Metals (Undigested) (Water)						
Aluminum (Al)-Total	mg/L	0.00050	0.110	0.0030	0.0851	**25.53**
Antimony (Sb)-Total	mg/L	0.000020	0.00652	0.00010	0.00691	5.81
Arsenic (As)-Total	mg/L	0.000020	0.00668	0.00010	0.00590	12.40
Barium (Ba)-Total	mg/L	0.000020	0.0551	0.00010	0.0479	13.98
Beryllium (Be)-Total	mg/L	0.000010	0.000018	0.00010	<0.0001	-
Bismuth (Bi)-Total	mg/L	0.0000050	<0.0000050	0.000050	<0.000050	-
Boron (B)-Total	mg/L	0.0050	0.0649	0.010	0.070	7.56
Cadmium (Cd)-Total	mg/L	0.0000050	0.000129	0.0000050	0.000110	15.90
Calcium (Ca)-Total	mg/L	0.010	23.3	0.050	23.2	0.43
Chromium (Cr)-Total	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Cobalt (Co)-Total	mg/L	0.0000050	0.000332	0.00010	0.00033	0.60
Copper (Cu)-Total	mg/L	0.000050	0.00136	0.00050	0.00117	15.02
Iron (Fe)-Total	mg/L	0.0010	0.129	0.010	0.117	9.76
Lead (Pb)-Total	mg/L	0.0000050	0.000275	0.000050	0.000298	8.03
Lithium (Li)-Total	mg/L	0.00050	0.0359	0.0010	0.0341	5.14
Magnesium (Mg)-Total	mg/L	0.010	1.12	0.10	1.11	0.90
Manganese (Mn)-Total	mg/L	0.000050	0.0459	0.00010	0.0425	7.69
Molybdenum (Mo)-Total	mg/L	0.000050	0.00403	0.000050	0.00444	9.68
Nickel (Ni)-Total	mg/L	0.000050	0.000391	0.00050	*0.0005*	24.47
Potassium (K)-Total	mg/L	0.020	6.60	0.050	6.17	6.73
Selenium (Se)-Total	mg/L	0.000040	0.000719	0.000050	0.000670	7.06
Silicon (Si)-Total	mg/L	0.050	1.12	0.10	1.20	6.90
Silver (Ag)-Total	mg/L	0.0000050	<0.0000050	0.000010	<0.000010	-
Sodium (Na)-Total	mg/L	0.020	19.5	0.050	19.0	2.60
Strontium (Sr)-Total	mg/L	0.000050	0.422	0.00020	0.447	5.75
Thallium (Tl)-Total	mg/L	0.0000020	0.0000427	0.000010	0.000049	13.74
Tin (Sn)-Total	mg/L	0.000050	<0.000050	0.00010	<0.00010	-
Uranium (U)-Total	mg/L	0.0000020	0.000491	0.000010	0.000569	14.72
Vanadium (V)-Total	mg/L	0.00020	0.00024	0.00050	<0.0005	-
Zinc (Zn)-Total	mg/L	0.00020	0.00847	0.0030	0.0070	19.00
Dissolved Metals (Water)						
Aluminum (Al)-Dissolved	mg/L	0.00050	0.0371	0.0010	0.0357	3.85
Antimony (Sb)-Dissolved	mg/L	0.000020	0.00652	0.00010	0.00636	2.48
Arsenic (As)-Dissolved	mg/L	0.000020	0.00391	0.00010	0.00381	2.59
Barium (Ba)-Dissolved	mg/L	0.000020	0.0501	0.00010	0.0466	7.24
Beryllium (Be)-Dissolved	mg/L	0.000010	<0.000010	0.00010	<0.00010	-
Bismuth (Bi)-Dissolved	mg/L	0.0000050	<0.0000050	0.000050	<0.000050	-
Boron (B)-Dissolved	mg/L	0.0050	0.0629	0.010	0.064	1.73
Cadmium (Cd)-Dissolved	mg/L	0.0000050	0.0000978	0.0000050	0.0000978	0.00
Calcium (Ca)-Dissolved	mg/L	0.010	23.0	0.050	21.5	6.74
Chromium (Cr)-Dissolved	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Cobalt (Co)-Dissolved	mg/L	0.0000050	0.000278	0.00010	0.00027	2.92
Copper (Cu)-Dissolved	mg/L	0.000050	0.000466	0.00020	0.00045	3.49
Iron (Fe)-Dissolved	mg/L	0.0010	0.0052	0.010	<0.01	-
Lead (Pb)-Dissolved	mg/L	0.0000050	0.0000123	0.000050	<0.00005	-
Lithium (Li)-Dissolved	mg/L	0.00050	0.0357	0.0010	0.0325	9.38
Magnesium (Mg)-Dissolved	mg/L	0.010	1.09	0.10	1.07	1.85
Manganese (Mn)-Dissolved	mg/L	0.000050	0.0371	0.00010	0.0357	3.85
Molybdenum (Mo)-Dissolved	mg/L	0.000050	0.00411	0.000050	0.00411	0.00
Nickel (Ni)-Dissolved	mg/L	0.000050	0.000325	0.00050	<0.0005	-
Potassium (K)-Dissolved	mg/L	0.020	6.58	0.050	6.11	7.41
Selenium (Se)-Dissolved	mg/L	0.000040	0.000697	0.000050	0.000649	7.13
Silicon (Si)-Dissolved	mg/L	0.050	1.01	0.050	1.08	6.70
Silver (Ag)-Dissolved	mg/L	0.0000050	<0.0000050	0.000010	<0.000010	-
Sodium (Na)-Dissolved	mg/L	0.020	19.3	0.050	18.4	4.77
Strontium (Sr)-Dissolved	mg/L	0.000050	0.421	0.00020	0.410	2.65
Thallium (Tl)-Dissolved	mg/L	0.0000020	0.0000404	0.000010	0.000041	1.47
Tin (Sn)-Dissolved	mg/L	0.000050	<0.000050	0.00010	<0.00010	-
Uranium (U)-Dissolved	mg/L	0.0000020	0.000439	0.000010	0.000503	13.59
Vanadium (V)-Dissolved	mg/L	0.00020	<0.00020	0.00050	<0.00050	-
Zinc (Zn)-Dissolved	mg/L	0.00020	0.0120	0.0010	0.0045	-

* RPD = Relative Percent Difference, Bold greater than 25%
- parameter does not meet comparison criteria
Red Industry LDL differs from B.C. ENV LDL
Results in italics are less than the detection limit

Total # parameters analyzed 79
Total # comparable parameters 61

Table B- 13. Comparison of B.C. ENV and Brucejack mine side by side sampling results collected BJ3.10 Brucejack Lake outlet on September 13, 2019.

Client Sample ID Date Sampled Time Sampled		BC. ENV BJ3.10 results E298312_REG 13-Sep-2019 12:30		Brucejack BJ3.10 results BJ-3.10 13-Sep-2019 12:30		
Parameter (Water)	Units	Lowest Detection Limit (LDL)	Results	Lowest Detection Limit (LDL)	Results	RPD*
Physical Tests (Water)						
Conductivity	µS/cm	2.0	257	2.0	267	3.82
Hardness (as $CaCO_3$)	mg/L	0.50	65.6	0.50	60.8	7.59
pH	pH	0.10	8.04	0.10	8.02	0.25
Total Suspended Solids	mg/L	3.0	10.0	3.0	3	**107.69**
Total Dissolved Solids	mg/L	20	164	20	164	0.00
Turbidity	NTU	0.10	2.16	0.10	1.48	**37.36**
Anions and Nutrients (Water)						
Alkalinity, Total (as $CaCO_3$)	mg/L	1.0	52.1	1.0	49.5	5.12
Ammonia, Total (as N)	mg/L	0.0050	0.0148	0.0050	0.0066	**76.64**
Nitrate (as N)	mg/L	0.0030	6.40	0.0050	6.25	2.37
Nitrite (as N)	mg/L	0.0010	0.0172	0.0010	0.0160	7.23
Total Kjeldahl Nitrogen	mg/L	0.630	<0.63	0.630	<0.63	0.00
Total Nitrogen	mg/L	0.300	6.29	0.150	6.27	0.32
Orthophosphate-Dissolved (as P)	mg/L	0.0010	<0.0010	0.0010	<0.0010	0.00
Sulfate (SO_4)	mg/L	0.30	46.4	0.30	45.4	2.18
Organic / Inorganic Carbon (Water)						
Dissolved Organic Carbon	mg/L	0.50	0.58	0.50	0.79	**30.66**
Total Metals (Undigested) (Water)						
Aluminum (Al)-Total	mg/L	0.00050	0.0529	0.0030	0.0415	24.15
Antimony (Sb)-Total	mg/L	0.000020	0.00703	0.00010	0.00782	10.64
Arsenic (As)-Total	mg/L	0.000020	0.00645	0.00010	0.00594	8.23
Barium (Ba)-Total	mg/L	0.000020	0.0546	0.00010	0.0492	10.40
Beryllium (Be)-Total	mg/L	0.000010	<0.000010	0.00010	<0.00010	-
Bismuth (Bi)-Total	mg/L	0.0000050	<0.0000050	0.000050	<0.000050	-
Boron (B)-Total	mg/L	0.0050	0.0748	0.010	0.076	1.59
Cadmium (Cd)-Total	mg/L	0.0000050	0.0000105	0.0000050	0.0000088	17.62
Calcium (Ca)-Total	mg/L	0.010	24.2	0.050	23.8	1.67
Chromium (Cr)-Total	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Cobalt (Co)-Total	mg/L	0.0000050	0.0000434	0.00010	<0.0001	-
Copper (Cu)-Total	mg/L	0.000050	0.000196	0.00050	<0.0005	-
Iron (Fe)-Total	mg/L	0.0010	0.0106	0.010	<0.01	-
Lead (Pb)-Total	mg/L	0.0000050	0.000125	0.000050	0.000140	11.32
Lithium (Li)-Total	mg/L	0.00050	0.0414	0.0010	0.0382	8.04
Magnesium (Mg)-Total	mg/L	0.010	1.17	0.10	1.13	3.48
Manganese (Mn)-Total	mg/L	0.000050	0.0187	0.00010	0.0178	4.93
Molybdenum (Mo)-Total	mg/L	0.000050	0.00456	0.000050	0.00498	8.81
Nickel (Ni)-Total	mg/L	0.000050	0.000141	0.00050	<0.0005	-
Potassium (K)-Total	mg/L	0.020	7.35	0.050	6.72	8.96
Selenium (Se)-Total	mg/L	0.000040	0.000885	0.000050	0.000688	**25.05**
Silicon (Si)-Total	mg/L	0.050	1.18	0.10	1.13	4.33
Silver (Ag)-Total	mg/L	0.0000050	<0.0000050	0.000010	<0.000010	-
Sodium (Na)-Total	mg/L	0.020	21.5	0.050	20.6	4.28
Strontium (Sr)-Total	mg/L	0.000050	0.449	0.00020	0.513	13.31
Thallium (Tl)-Total	mg/L	0.0000020	0.0000467	0.000010	0.000052	10.74
Tin (Sn)-Total	mg/L	0.000050	<0.000050	0.00010	<0.00010	-
Uranium (U)-Total	mg/L	0.0000020	0.000541	0.000010	0.000626	14.57
Vanadium (V)-Total	mg/L	0.00020	0.00023	0.00050	<0.0005	-
Zinc (Zn)-Total	mg/L	0.00020	0.00078	0.0030	<0.003	-
Dissolved Metals (Water)						
Aluminum (Al)-Dissolved	mg/L	0.00050	0.0262	0.0010	0.0234	11.29
Antimony (Sb)-Dissolved	mg/L	0.000020	0.00748	0.00010	0.00732	2.16
Arsenic (As)-Dissolved	mg/L	0.000020	0.00659	0.00010	0.00597	9.87
Barium (Ba)-Dissolved	mg/L	0.000020	0.0523	0.00010	0.0484	7.75
Beryllium (Be)-Dissolved	mg/L	0.000010	<0.000010	0.00010	<0.00010	-
Bismuth (Bi)-Dissolved	mg/L	0.0000050	<0.0000050	0.000050	<0.000050	-
Boron (B)-Dissolved	mg/L	0.0050	0.0746	0.010	0.072	3.55
Cadmium (Cd)-Dissolved	mg/L	0.0000050	0.0000118	0.0000050	0.0000094	22.64
Calcium (Ca)-Dissolved	mg/L	0.010	24.3	0.050	22.5	7.69
Chromium (Cr)-Dissolved	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Cobalt (Co)-Dissolved	mg/L	0.0000050	0.0000202	0.00010	*<0.0001*	-
Copper (Cu)-Dissolved	mg/L	0.000050	0.000096	0.00020	*0.0002*	-
Iron (Fe)-Dissolved	mg/L	0.0010	<0.0010	0.010	<0.010	0.00
Lead (Pb)-Dissolved	mg/L	0.0000050	0.0000129	0.000050	<0.00005	-
Lithium (Li)-Dissolved	mg/L	0.00050	0.0410	0.0010	0.0371	9.99
Magnesium (Mg)-Dissolved	mg/L	0.010	1.18	0.10	1.09	7.93
Manganese (Mn)-Dissolved	mg/L	0.000050	0.00857	0.00010	0.00816	4.90
Molybdenum (Mo)-Dissolved	mg/L	0.000050	0.00481	0.000050	0.00469	2.53
Nickel (Ni)-Dissolved	mg/L	0.000050	0.000137	0.00050	<0.0005	-
Potassium (K)-Dissolved	mg/L	0.020	7.47	0.050	6.74	10.27
Selenium (Se)-Dissolved	mg/L	0.000040	0.000812	0.000050	0.000843	3.75
Silicon (Si)-Dissolved	mg/L	0.050	1.04	0.050	1.11	6.51
Silver (Ag)-Dissolved	mg/L	0.0000050	<0.0000050	0.000010	<0.000010	-
Sodium (Na)-Dissolved	mg/L	0.020	21.9	0.050	20.7	5.63
Strontium (Sr)-Dissolved	mg/L	0.000050	0.470	0.00020	0.466	0.85
Thallium (Tl)-Dissolved	mg/L	0.0000020	0.0000454	0.000010	0.000049	7.63
Tin (Sn)-Dissolved	mg/L	0.000050	0.000081	0.00010	<0.0001	-
Uranium (U)-Dissolved	mg/L	0.0000020	0.000514	0.000010	0.000586	13.09
Vanadium (V)-Dissolved	mg/L	0.00020	<0.00020	0.00050	<0.00050	-
Zinc (Zn)-Dissolved	mg/L	0.00020	0.00194	0.0010	<0.0010	-

* RPD = Relative Percent Difference, Bold greater than 25%
\- parameter does not meet comparison criteria
Red Industry LDL differ from B.C. ENV LDL
Results in italics are less than the detection limit

Total # parameters analyzed 79
Total # comparable parameters 55

Table B- 14. Comparison of B.C. ENV and Red Chris Mine side by side sampling results collected Quarry Creek (W3) on Sept. 13, 2019.

Client Sample ID		BC. ENV W3 results		Red Chris W3 results		
Date Sampled		E288857_REG		W3		
Time Sampled		11-Sep-2019		11-Sep-2019		
		9:40		9:40		
Parameter	Units	Lowest Detection Limit (LDL)	Results	Lowest Detection Limit (LDL)	Results	RPD*
Physical Tests (Water)						
Conductivity	µS/cm	2.0	341	2.0	332	2.67
Hardness (as $CaCO_3$)	mg/L	0.50	188	0.50	182	3.24
pH	pH	0.10	8.39	0.10	8.47	0.95
Total Suspended Solids	mg/L	3.0	<3.0	3.0	<3.0	0.00
Total Dissolved Solids	mg/L	20	229	20	199	14.02
Turbidity	NTU	0.10	0.54	0.10	0.48	11.76
Anions and Nutrients (Water)						
Alkalinity, Total (as $CaCO_3$)	mg/L	1.0	190	1.0	222	15.53
Ammonia, Total (as N)	mg/L	0.0050	<0.0050	0.0050	<0.0050	0.00
Nitrate (as N)	mg/L	0.0030	<0.0030	0.0050	<0.0050	-
Nitrite (as N)	mg/L	0.0010	<0.0010	0.0010	<0.0010	0.00
Orthophosphate-Dissolved (as P)	mg/L	0.0010	<0.0010	0.0010	<0.0010	0.00
Phosphorus (P)-Total Dissolved	mg/L	0.0020	0.0044	0.0020	0.0034	**25.64**
Sulfate (SO_4)	mg/L	0.30	10.8	0.30	10.6	1.87
Organic / Inorganic Carbon (Water)						
Dissolved Organic Carbon	mg/L	0.50	5.16	0.50	5.17	0.19
Total Metals (Water)						
Mercury (Hg)-Total	mg/L	0.0000050	<0.0000050	0.0000050	<0.0000050	0.00
Total Metals (Undigested) (Water)						
Aluminum (Al)-Total	mg/L	0.00050	0.00642	0.0030	0.0133	**69.78**
Antimony (Sb)-Total	mg/L	0.000020	0.000154	0.00010	0.00016	3.82
Arsenic (As)-Total	mg/L	0.000020	0.000818	0.00010	0.00079	3.48
Barium (Ba)-Total	mg/L	0.000020	0.0567	0.00010	0.0570	0.53
Beryllium (Be)-Total	mg/L	0.000010	<0.000010	0.00010	<0.00010	-
Bismuth (Bi)-Total	mg/L	0.0000050	<0.0000050	0.000050	<0.000050	-
Boron (B)-Total	mg/L	0.0050	<0.0050	0.010	<0.010	-
Cadmium (Cd)-Total	mg/L	0.0000050	0.0000074	0.0000050	0.0000062	17.65
Calcium (Ca)-Total	mg/L	0.010	52.4	0.050	54.0	3.01
Chromium (Cr)-Total	mg/L	0.00010	*0.0001*	0.00010	0.00012	18.18
Cobalt (Co)-Total	mg/L	0.0000050	0.0000239	0.00010	*0.0001*	-
Copper (Cu)-Total	mg/L	0.000050	0.000619	0.00050	0.00050	21.27
Iron (Fe)-Total	mg/L	0.0010	0.0701	0.010	0.076	8.08
Lead (Pb)-Total	mg/L	0.0000050	0.0000153	0.000050	*0.00005*	-
Lithium (Li)-Total	mg/L	0.00050	0.00093	0.0010	*0.001*	-
Magnesium (Mg)-Total	mg/L	0.010	13.1	0.10	13.8	5.20
Manganese (Mn)-Total	mg/L	0.000050	0.00883	0.00010	0.00829	6.31
Molybdenum (Mo)-Total	mg/L	0.000050	0.00147	0.000050	0.00168	13.33
Nickel (Ni)-Total	mg/L	0.000050	0.000404	0.00050	*0.0005*	-
Potassium (K)-Total	mg/L	0.020	0.790	0.050	0.769	2.69
Selenium (Se)-Total	mg/L	0.000040	0.000097	0.000050	0.000207	**72.37**
Silicon (Si)-Total	mg/L	0.050	3.47	0.10	3.50	0.86
Silver (Ag)-Total	mg/L	0.0000050	<0.0000050	0.000010	<0.00001	-
Sodium (Na)-Total	mg/L	0.020	2.91	0.050	2.95	1.37
Strontium (Sr)-Total	mg/L	0.000050	0.227	0.00020	0.245	7.63
Thallium (Tl)-Total	mg/L	0.0000020	<0.0000020	0.000010	<0.00001	-
Tin (Sn)-Total	mg/L	0.000050	<0.000050	0.00010	<0.0001	-
Uranium (U)-Total	mg/L	0.0000020	0.000106	0.000010	0.000117	9.87
Vanadium (V)-Total	mg/L	0.00020	<0.00020	0.00050	<0.0005	-
Zinc (Zn)-Total	mg/L	0.00020	0.00086	0.0030	*0.003*	-
Dissolved Metals (Water)						
Aluminum (Al)-Dissolved	mg/L	0.00050	0.00132	0.0010	0.0020	**40.96**
Antimony (Sb)-Dissolved	mg/L	0.000020	0.000133	0.00010	0.00016	18.43
Arsenic (As)-Dissolved	mg/L	0.000020	0.000788	0.00010	0.00072	9.02
Barium (Ba)-Dissolved	mg/L	0.000020	0.0548	0.00010	0.0578	5.33
Beryllium (Be)-Dissolved	mg/L	0.000010	<0.000010	0.00010	<0.00010	-
Bismuth (Bi)-Dissolved	mg/L	0.0000050	<0.0000050	0.000050	<0.000050	-
Boron (B)-Dissolved	mg/L	0.0050	<0.0050	0.010	<0.010	-
Cadmium (Cd)-Dissolved	mg/L	0.0000050	<0.0000050	0.0000050	<0.0000050	0.00
Calcium (Ca)-Dissolved	mg/L	0.010	52.6	0.050	51.7	1.73
Chromium (Cr)-Dissolved	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Cobalt (Co)-Dissolved	mg/L	0.0000050	0.0000183	0.00010	*0.0001*	-
Copper (Cu)-Dissolved	mg/L	0.000050	0.000386	0.00020	0.00044	13.08
Iron (Fe)-Dissolved	mg/L	0.0010	0.0181	0.010	0.033	**58.32**
Lead (Pb)-Dissolved	mg/L	0.0000050	*0.000005*	0.000050	*0.00005*	-
Lithium (Li)-Dissolved	mg/L	0.00050	0.00091	0.0010	*0.001*	-
Magnesium (Mg)-Dissolved	mg/L	0.010	13.9	0.10	13.0	6.69
Manganese (Mn)-Dissolved	mg/L	0.000050	0.000765	0.00010	0.00099	**25.64**
Mercury (Hg)-Dissolved	mg/L	0.0000050	<0.0000050	0.0000050	<0.0000050	0.00
Molybdenum (Mo)-Dissolved	mg/L	0.000050	0.00159	0.000050	0.00155	2.55
Nickel (Ni)-Dissolved	mg/L	0.000050	0.000348	0.00050	*0.0005*	-
Potassium (K)-Dissolved	mg/L	0.020	0.811	0.050	0.743	8.75
Selenium (Se)-Dissolved	mg/L	0.000040	0.000202	0.000050	0.000176	13.76
Silicon (Si)-Dissolved	mg/L	0.050	3.47	0.050	3.28	5.63
Silver (Ag)-Dissolved	mg/L	0.0000050	*0.000005*	0.000010	*0.00001*	-
Sodium (Na)-Dissolved	mg/L	0.020	3.00	0.050	2.94	2.02
Strontium (Sr)-Dissolved	mg/L	0.000050	0.223	0.00020	0.217	2.73
Thallium (Tl)-Dissolved	mg/L	0.0000020	*0.000002*	0.000010	*0.00001*	-
Tin (Sn)-Dissolved	mg/L	0.000050	*0.00005*	0.00010	*0.0001*	-
Uranium (U)-Dissolved	mg/L	0.0000020	0.000113	0.000010	0.000102	10.23
Vanadium (V)-Dissolved	mg/L	0.00020	*0.0002*	0.00050	*0.0005*	-
Zinc (Zn)-Dissolved	mg/L	0.00020	0.00500	0.0010	*0.001*	-

* RPD = Relative Percent Difference, Bold greater than 25%
\- parameter does not meet comparison criteria
Red Industry LDL differ from B.C. ENV LDL
Results in italics are less than the detection limit

Total # parameters analyzed 76
Total # comparable parameters 51

Table B- 15. Comparison of B.C. ENV and Red Chris mine side by side sampling results collected at W40 Klappan River on September 13, 2019.

Client Sample ID Date Sampled Time Sampled		BC. ENV W40 results E295168_REG 11-Sep-2019 8:35		Red Chris W40 results W40 11-Sep-2019 8:37		
Parameter	Units	Lowest Detection Limit (LDL)	Results	Lowest Detection Limit (LDL)	Results	RPD*
Physical Tests (Water)						
Conductivity	µS/cm	2.0	321	2.0	323	0.62
Hardness (as $CaCO_3$)	mg/L	0.50	163	0.50	169	3.61
pH	pH	0.10	8.19	0.10	8.16	0.37
Total Suspended Solids	mg/L	3.0	14.0	3.0	12.4	12.12
Total Dissolved Solids	mg/L	20	227	20	221	2.68
Turbidity	NTU	0.10	13.9	0.10	13.7	1.45
Anions and Nutrients (Water)						
Alkalinity, Total (as $CaCO_3$)	mg/L	1.0	85.1	1.0	85.1	0.00
Ammonia, Total (as N)	mg/L	0.0050	<0.0050	0.0050	<0.0050	0.00
Nitrate (as N)	mg/L	0.0050	0.0273	0.0050	0.0250	8.80
Nitrite (as N)	mg/L	0.0010	<0.0010	0.0010	<0.0010	0.00
Orthophosphate-Dissolved (as P)	mg/L	0.0010	<0.0010	0.0010	<0.0010	0.00
Phosphorus (P)-Total Dissolved	mg/L	0.0020	0.0021	0.0020	0.0037	**55.17**
Sulfate (SO_4)	mg/L	0.30	84.1	0.30	83.8	0.36
Organic / Inorganic Carbon (Water)						
Dissolved Organic Carbon	mg/L	0.50	1.54	0.50	1.53	0.65
Total Metals (Water)						
Mercury (Hg)-Total	mg/L	0.0000050	<0.0000050	0.0000050	<0.0000050	0.00
Total Metals (Water)						
Aluminum (Al)-Total	mg/L	0.0030	0.424	0.0030	0.389	8.61
Antimony (Sb)-Total	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Arsenic (As)-Total	mg/L	0.00010	0.00025	0.00010	0.00025	0.00
Barium (Ba)-Total	mg/L	0.00010	0.0527	0.00010	0.0538	2.07
Beryllium (Be)-Total	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Bismuth (Bi)-Total	mg/L	0.000050	<0.000050	0.000050	<0.000050	0.00
Boron (B)-Total	mg/L	0.010	<0.010	0.010	<0.010	0.00
Cadmium (Cd)-Total	mg/L	0.0000050	0.0000246	0.0000050	0.0000259	5.15
Calcium (Ca)-Total	mg/L	0.050	35.4	0.050	36.2	2.23
Chromium (Cr)-Total	mg/L	0.00010	0.00151	0.00010	0.00136	10.45
Cobalt (Co)-Total	mg/L	0.00010	0.00039	0.00010	0.00040	2.53
Copper (Cu)-Total	mg/L	0.00050	0.00133	0.00050	0.00136	2.23
Iron (Fe)-Total	mg/L	0.010	0.645	0.010	0.607	6.07
Lead (Pb)-Total	mg/L	0.000050	0.000172	0.000050	0.000185	7.28
Lithium (Li)-Total	mg/L	0.0010	0.0027	0.0010	0.0027	0.00
Magnesium (Mg)-Total	mg/L	0.10	18.9	0.10	19.6	3.64
Manganese (Mn)-Total	mg/L	0.00010	0.0150	0.00010	0.0152	1.32
Molybdenum (Mo)-Total	mg/L	0.000050	0.000813	0.000050	0.000807	0.74
Nickel (Ni)-Total	mg/L	0.00050	0.00271	0.00050	0.00259	4.53
Potassium (K)-Total	mg/L	0.050	0.459	0.050	0.471	2.58
Selenium (Se)-Total	mg/L	0.000050	0.00131	0.000050	0.00124	5.49
Silicon (Si)-Total	mg/L	0.10	2.77	0.10	2.79	0.72
Silver (Ag)-Total	mg/L	0.000010	<0.000010	0.000010	<0.000010	0.00
Sodium (Na)-Total	mg/L	0.050	3.23	0.050	3.40	5.13
Strontium (Sr)-Total	mg/L	0.00020	0.369	0.00020	0.374	1.35
Thallium (Tl)-Total	mg/L	0.000010	<0.000010	0.000010	<0.000010	0.00
Tin (Sn)-Total	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Uranium (U)-Total	mg/L	0.000010	0.000093	0.000010	0.000091	2.17
Vanadium (V)-Total	mg/L	0.00050	0.00108	0.00050	0.00098	9.71
Zinc (Zn)-Total	mg/L	0.0030	<0.0030	0.0030	<0.0030	0.00
Dissolved Metals (Water)						
Aluminum (Al)-Dissolved	mg/L	0.0010	0.0090	0.0010	0.0120	**28.57**
Antimony (Sb)-Dissolved	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Arsenic (As)-Dissolved	mg/L	0.00010	*0.0001*	0.00010	0.00012	*18.18*
Barium (Ba)-Dissolved	mg/L	0.00010	0.0474	0.00010	0.0479	1.05
Beryllium (Be)-Dissolved	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Bismuth (Bi)-Dissolved	mg/L	0.000050	<0.000050	0.000050	<0.000050	0.00
Boron (B)-Dissolved	mg/L	0.010	<0.010	0.010	<0.010	0.00
Cadmium (Cd)-Dissolved	mg/L	0.0000050	0.0000105	0.0000050	0.0000112	6.45
Calcium (Ca)-Dissolved	mg/L	0.050	35.2	0.050	36.2	2.80
Chromium (Cr)-Dissolved	mg/L	0.00010	0.00020	0.00010	0.00020	0.00
Cobalt (Co)-Dissolved	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Copper (Cu)-Dissolved	mg/L	0.00020	0.00033	0.00020	0.00036	8.70
Iron (Fe)-Dissolved	mg/L	0.010	*0.01*	0.010	0.030	**100.00**
Lead (Pb)-Dissolved	mg/L	0.000050	<0.000050	0.000050	<0.000050	0.00
Lithium (Li)-Dissolved	mg/L	0.0010	0.0022	0.0010	0.0023	4.44
Magnesium (Mg)-Dissolved	mg/L	0.10	18.2	0.10	19.1	4.83
Manganese (Mn)-Dissolved	mg/L	0.00010	0.00206	0.00010	0.00231	11.44
Mercury (Hg)-Dissolved	mg/L	0.0000050	<0.0000050	0.0000050	<0.0000050	0.00
Molybdenum (Mo)-Dissolved	mg/L	0.000050	0.000808	0.000050	0.000852	5.30
Nickel (Ni)-Dissolved	mg/L	0.00050	0.00052	0.00050	0.00056	7.41
Potassium (K)-Dissolved	mg/L	0.050	0.388	0.050	0.406	4.53
Selenium (Se)-Dissolved	mg/L	0.000050	0.00121	0.000050	0.00120	0.83
Silicon (Si)-Dissolved	mg/L	0.050	2.14	0.050	2.18	1.85
Silver (Ag)-Dissolved	mg/L	0.000010	<0.000010	0.000010	<0.000010	0.00
Sodium (Na)-Dissolved	mg/L	0.050	3.18	0.050	3.35	5.21
Strontium (Sr)-Dissolved	mg/L	0.00020	0.365	0.00020	0.371	1.63
Thallium (Tl)-Dissolved	mg/L	0.000010	<0.000010	0.000010	<0.000010	0.00
Tin (Sn)-Dissolved	mg/L	0.00010	<0.00010	0.00010	<0.00010	0.00
Uranium (U)-Dissolved	mg/L	0.000010	0.000084	0.000010	0.000087	3.51
Vanadium (V)-Dissolved	mg/L	0.00050	<0.00050	0.00050	<0.00050	0.00
Zinc (Zn)-Dissolved	mg/L	0.0010	0.0044	0.0010	*0.001*	**125.93**

*RPD = Relative Percent Difference, Bold greater than 25%
- parameter does not meet comparison criteria
Industry and B.C. ENV LDLs did not differ for any parameter
Results in italics are less than the detection limit

Total # parameters analyzed 76
Total # comparable parameters 76

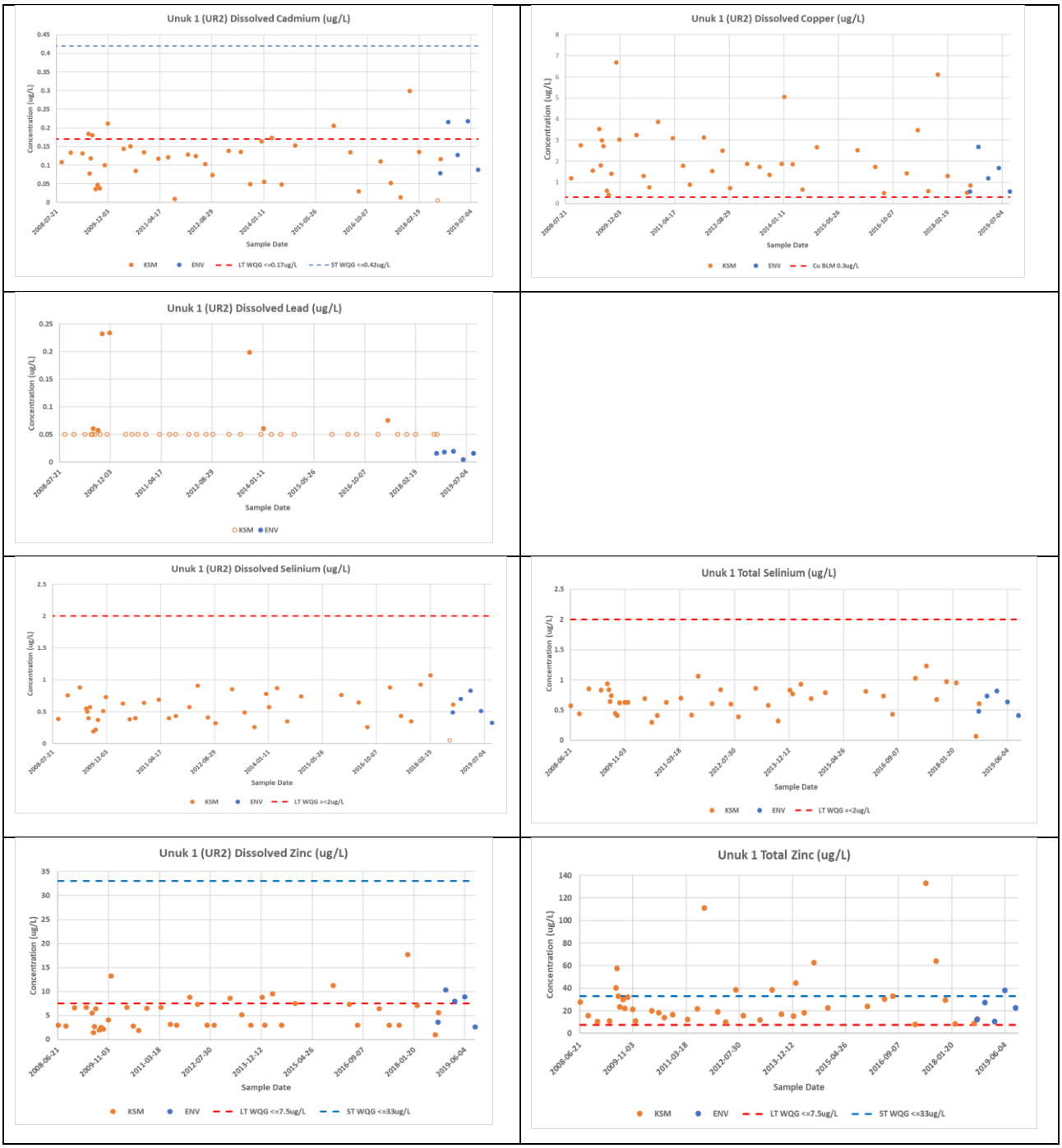

Figure B- 1. Comparison of B.C. ENV and Pretivum KSM mine project results for the Unuk River water quality near the B.C.-Alaska border. Open circles indicate results at detection limits.

Table B- 16. B.C. Stikine Water Chemistry Relative Percent Difference Results

Site Name			Stikine 1	Stikine 1		Stikine 1	Stikine 1		Stikine 1	Stikine 1		Stikine 4	Stikine 4	
Client Sample ID			E309512_REG	E309512_REP	RPD	E309512_REG	E309512_REP	RPD	E309512_REG	E309512_REP	RPD	E279984_REG	E279984_REP	RPD
Date Sampled			23-Aug-2017	23-Aug-2017		15-Sep-2018	15-Sep-2018		27-Nov-2018	27-Nov-2018		3-Jun-2019	3-Jun-2019	
Time Sampled			10:55	10:55		12:00	12:00		10:45	10:45		10:49	10:49	
Parameter (Water)	Units	LDL	Water	Water		Water	Water		Water	Water		Water	Water	
Field Tests (Water)														
Conductivity, Client Supplied	µS/cm	2	61.9	-	-	158.2	-	-	95.7	-	-	83.9	-	-
Diss. Oxygen, Client Supplied	mg/L	0.01	-	-	-	11.64	-	-		-	-		-	-
pH, Client Supplied	pH	0.1	7.72	-	-	8.11	-	-	8.13	-	-	7.72	-	-
Temperature, Client Supplied	C	-50	9.5	-	-	7.9	-	-	1.2	-	-	8.4	-	-
Physical Tests (Water)														
Conductivity	µS/cm	2	125	124	0.80	162	162	0.00	180	175	2.82	160	159	0.63
Hardness (as CaCO3)	mg/L	0.5	52.2	52.1	0.19	73.5	72.8	0.96	84.9	80.9	4.83	77.6	75	3.41
pH	pH	0.1	8.07	8.11	0.49	8.02	8.03	0.12	8.00	7.98	0.25	8.03	8.02	0.12
Total Suspended Solids	mg/L	3	306	315	2.90	20.2	40.6	67.11	6.6	5.3	21.85	113	111	1.79
Total Dissolved Solids	mg/L	20	125	135	7.69	99	107	7.77	114	99	14.08	125 [2]	118 [2]	5.76
Turbidity	NTU	0.1	321	323	0.62	11.9	15.7	27.54	5.13	4.53	12.42	111	95.5	15.01
Anions and Nutrients (Water)														
Alkalinity, Total (as $CaCO_3$)	mg/L	1	52.8	51.1	3.27	60.9	59.9	1.66	64.8	62.3	3.93	57.0	56.8	0.35
Ammonia, Total (as N)	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	*0.005*	*0.005*	0.00
Nitrate and Nitrite (as N)	mg/L	0.0032	0.0229	0.021	8.66	0.0235	0.0232	1.28	0.141	0.114	21.18	0.136	0.137	0.73
Nitrate (as N)	mg/L	0.003	0.0229	0.0210	8.66	0.0235	0.0232	1.28	0.141	0.114	21.18	0.136	0.137	0.73
Nitrite (as N)	mg/L	0.001	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00
Total Kjeldahl Nitrogen	mg/L	0.06	0.068	0.061	10.85	*0.050*	*0.050*	0.00	0.081	0.107	27.66	*0.050*	0.057	13.08
Total Nitrogen	mg/L	0.06	0.091	0.082	10.40	0.067	0.064	4.58	0.222	0.222	0.00	0.180	0.193	6.97
Total Organic Nitrogen	mg/L	0.06	0.064	*0.060*	6.45	*0.050*	*0.050*	0.00	0.077	0.103	28.89	*0.050*	0.052	3.92
Orthophosphate-Dissolved (as P)	mg/L	0.001	0.0028	0.0027	3.64	0.0018	0.0022	20.00	0.0012	*0.0010*	18.18	*0.0010*	*0.0010*	0.00
Phosphorus (P)-Total Dissolved	mg/L	0.002	0.0033	0.0037	11.43	0.0022	0.0027	20.41	0.0037	0.0026	34.92	0.0030	0.0027	10.53
Sulfate (SO_4)	mg/L	0.3	12.8	12.8	0.00	23.4	23.4	0.00	23.2	22.2	4.41	19.3	19.4	0.52
Organic / Inorganic Carbon (Water)														
Dissolved Organic Carbon	mg/L	0.5	1.16	0.96	18.87	1.35	1.20	11.76	1.59	1.43	10.60	0.93	1.01	8.25
Total Metals (Water)														
Mercury (Hg)-Total	mg/L	0.00005	*0.000050*	*0.000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	0.0000097	*0.0000050*	63.95
Total Metals (Undigested) (Water)														
Aluminum (Al)-Total	mg/L	0.0002	3.08	3.16	2.56	0.293	0.274	6.70	0.144	0.152	5.41	1.56	1.71	9.17
Antimony (Sb)-Total	mg/L	0.00002	0.000062	0.000064	3.17	0.000067	0.000065	3.03	0.000049	0.000046	6.32	0.000116	0.000125	7.47
Arsenic (As)-Total	mg/L	0.00002	0.00211	0.00229	8.18	0.000433	0.000393	9.69	0.000325	0.000338	3.92	0.00137	0.00130	5.24
Barium (Ba)-Total	mg/L	0.00002	0.146	0.143	2.08	0.0412	0.0405	1.71	0.0423	0.0402	5.09	0.0745	0.0797	6.74
Beryllium (Be)-Total	mg/L	0.00001	0.000218	0.000234	7.08	0.000021	0.000018	15.38	*0.000010*	*0.000010*	0.00	0.000111	0.000117	5.26
Bismuth (Bi)-Total	mg/L	0.000005	0.0000065	0.0000073	11.59	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	0.0000052	3.92
Boron (B)-Total	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	*0.0050*	0.0050	0.00	*0.0050*	*0.0050*	0.00
Cadmium (Cd)-Total	mg/L	0.000005	0.000232	0.000237	2.13	0.0000073	*0.0000050*	37.40	0.0000164	0.0000142	14.38	0.0000663	0.0000919	32.36
Calcium (Ca)-Total	mg/L	0.01	23.3	24.3	4.20	22.6	22.2	1.79	25.6	24.7	3.58	24.6	24.2	1.64
Chromium (Cr)-Total	mg/L	0.0001	0.0113	0.0119	5.17	0.00065	0.00059	9.68	0.00035	0.00032	8.96	0.00205	0.00222	7.96
Cobalt (Co)-Total	mg/L	0.000005	0.00409	0.00425	3.84	0.000251	0.000228	9.60	0.000146	0.000152	4.03	0.00147	0.00162	9.71
Copper (Cu)-Total	mg/L	0.00005	0.0238	0.0234	1.69	0.00146	0.00163	11.00	0.00230	0.00237	3.00	0.00688	0.00745	7.96
Iron (Fe)-Total	mg/L	0.001	5.28	5.49	3.90	0.436	0.393	10.37	0.236	0.238	0.84	2.23	2.33	4.39
Lead (Pb)-Total	mg/L	0.000005	0.00481	0.00507	5.26	0.000247	0.000220	11.56	0.000205	0.000215	4.76	0.00122	0.00138	12.31
Lithium (Li)-Total	mg/L	0.0005	0.00432	0.00453	4.75	0.00131	0.00120	8.76	0.00097	0.00091	6.38	0.00185	0.00189	2.14

Magnesium (Mg)-Total	mg/L	0.01	5.08	5.22	2.72	4.34	4.37	0.69	4.49	4.57	1.77	4.29	4.49	4.56
Manganese (Mn)-Total	mg/L	0.00005	0.233	0.236	1.28	0.0189	0.0166	12.96	0.0159	0.0162	1.87	0.109	0.123	12.07
Molybdenum (Mo)-Total	mg/L	0.00005	0.000332	0.000297	11.13	0.00157	0.00165	4.97	0.00182	0.00169	7.41	0.000489	0.000511	4.40
Nickel (Ni)-Total	mg/L	0.00005	0.0124	0.0122	1.63	0.000982	0.000908	7.83	0.000576	0.000593	2.91	0.00321	0.00360	11.45
Potassium (K)-Total	mg/L	0.005	2.15	2.23	3.65	0.798	0.804	0.75	1.11	1.10	0.90	1.06	1.11	4.61
Selenium (Se)-Total	mg/L	0.00004	0.000269	0.000350	26.17	0.000442	0.000436	1.37	0.000426	0.000424	0.47	0.000477	0.000533	11.09
Silicon (Si)-Total	mg/L	0.05	7.84	7.80	0.51	2.83	2.82	0.35	3.44	3.63	5.37	4.41	4.77	7.84
Silver (Ag)-Total	mg/L	0.000005	0.0000511	0.0000577	12.13	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	0.0000158	0.0000173	9.06
Sodium (Na)-Total	mg/L	0.01	1.34	1.35	0.74	2.20	2.14	2.76	2.77	2.73	1.45	2.12	2.27	6.83
Strontium (Sr)-Total	mg/L	0.00005	0.119	0.124	4.12	0.131	0.137	4.48	0.147	0.140	4.88	0.126	0.135	6.90
Thallium (Tl)-Total	mg/L	0.000002	0.0000592	0.0000669	12.21	0.0000056	0.0000053	5.50	0.0000043	0.0000045	4.55	0.0000159	0.0000182	13.49
Tin (Sn)-Total	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.00005*	*0.00005*	0.00
Uranium (U)-Total	mg/L	0.000002	0.00130	0.00140	7.41	0.000483	0.000483	0.00	0.000621	0.000638	2.70	0.000233	0.000260	10.95
Vanadium (V)-Total	mg/L	0.0002	0.0150	0.0157	4.56	0.00113	0.00104	8.29	0.00073	0.00076	4.03	0.00478	0.00521	8.61
Zinc (Zn)-Total	mg/L	0.0001	0.0284	0.0300	5.48	0.00226	0.00269	17.37	0.00195	0.00202	3.53	0.0114	0.0126	10.00
Dissolved Metals (Water)														
Aluminum (Al)-Dissolved	mg/L	0.0002	0.0332	0.0350	5.28	0.0275	0.0150	58.82	0.0220	0.0233	5.74	0.0277	0.0218	23.84
Antimony (Sb)-Dissolved	mg/L	0.00002	0.000052	0.000056	7.41	0.000064	0.000059	8.13	0.000053	0.000056	5.50	0.000101	0.000102	0.99
Arsenic (As)-Dissolved	mg/L	0.00002	0.000324	0.000373	14.06	0.000273	0.000290	6.04	0.000259	0.000248	4.34	0.000241	0.000261	7.97
Barium (Ba)-Dissolved	mg/L	0.00002	0.0333	0.0317	4.92	0.0339	0.0331	2.39	0.0393	0.0424	7.59	0.0294	0.0275	6.68
Beryllium (Be)-Dissolved	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00
Bismuth (Bi)-Dissolved	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00
Boron (B)-Dissolved	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	0.0053	0.0059	10.71	*0.0050*	*0.0050*	0.00
Cadmium (Cd)-Dissolved	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	0.0000121	0.0000130	7.17	0.0000130	0.0000088	38.53
Calcium (Ca)-Dissolved	mg/L	0.01	16.7	16.6	0.60	22.3	21.7	2.73	26.5	25.1	5.43	24.9	24.3	2.44
Chromium (Cr)-Dissolved	mg/L	0.0001	*0.00010*	*0.00010*	0.00	0.00015	*0.00010*	40.00	0.00014	0.00014	0.00	0.00011	*0.0001*	9.52
Cobalt (Co)-Dissolved	mg/L	0.000005	0.0000295	0.0000341	14.47	0.0000201	0.0000136	38.58	0.0000293	0.0000274	6.70	0.0000376	0.0000316	17.34
Copper (Cu)-Dissolved	mg/L	0.00005	0.000585	0.000896	42.00	0.000592	0.000422	33.53	0.000933	0.000910	2.50	0.000408	0.000368	10.31
Iron (Fe)-Dissolved	mg/L	0.001	0.0190	0.0213	11.41	0.0217	0.0082	90.30	0.0314	0.0318	1.27	0.0130	0.0052	85.71
Lead (Pb)-Dissolved	mg/L	0.000005	0.0000204	0.0000227	10.67	0.0000149	*0.0000050*	99.50	0.0000463	0.0000546	16.45	0.0000085	0.0000053	46.38
Lithium (Li)-Dissolved	mg/L	0.0005	0.00069	0.00066	4.44	0.00095	0.00093	2.13	0.00088	0.00099	11.76	0.00103	0.00102	0.98
Magnesium (Mg)-Dissolved	mg/L	0.01	2.53	2.57	1.57	4.32	4.49	3.86	4.55	4.42	2.90	3.73	3.47	7.22
Manganese (Mn)-Dissolved	mg/L	0.00005	0.00617	0.00658	6.43	0.00393	0.00347	12.43	0.00794	0.00765	3.72	0.00922	0.00897	2.75
Mercury (Hg)-Dissolved	mg/L	0.00005	*0.000050*	*0.000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00
Molybdenum (Mo)-Dissolved	mg/L	0.00005	0.00143 [1]	0.00158 [1]	9.97	0.00180	0.00179	0.56	0.00199	0.00211	5.85	0.00109 [1]	0.00114 [1]	4.48
Nickel (Ni)-Dissolved	mg/L	0.00005	0.000280	0.000264	5.88	0.000278	0.000205	30.23	0.000324	0.000332	2.44	0.000210	0.000199	5.38
Potassium (K)-Dissolved	mg/L	0.005	0.990	0.985	0.51	0.753	0.768	1.97	1.12	1.07	4.57	0.792	0.799	0.88
Selenium (Se)-Dissolved	mg/L	0.00004	0.000374	0.000365	2.44	0.000441	0.000425	3.70	0.000445	0.000412	7.70	0.000513	0.000479	6.85
Silicon (Si)-Dissolved	mg/L	0.05	1.71	1.72	0.58	2.49	2.55	2.38	3.30	3.29	0.30	2.01	2.00	0.50
Silver (Ag)-Dissolved	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00
Sodium (Na)-Dissolved	mg/L	0.01	1.17	1.14	2.60	2.10	2.13	1.42	2.85	2.74	3.94	1.92	1.91	0.52
Strontium (Sr)-Dissolved	mg/L	0.00005	0.0934	0.0972	3.99	0.140	0.139	0.72	0.137	0.126	8.37	0.114	0.118	3.45
Thallium (Tl)-Dissolved	mg/L	0.000002	0.0000043	0.0000045	4.55	0.0000022	0.0000022	0.00	0.0000025	0.0000030	18.18	0.0000025	0.0000023	8.33
Tin (Sn)-Dissolved	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.00005*	*0.00005*	0.00
Uranium (U)-Dissolved	mg/L	0.000002	0.000570	0.000586	2.77	0.000426	0.000432	1.40	0.000592	0.000619	4.46	0.000153	0.000154	0.65
Vanadium (V)-Dissolved	mg/L	0.0002	0.00030	0.00031	3.28	0.00030	0.00028	6.90	0.00030	0.00029	3.39	0.00025	0.00023	8.33
Zinc (Zn)-Dissolved	mg/L	0.0001	0.00033	0.00025	27.59	0.00019	0.00025	27.27	0.00112	0.00115	2.64	0.00035	0.00043	20.51
RPD = Relative Percent Difference, results >25 are highlighted														
- Parameter does not meet comparison criteria														
Results in italics are less than detection limit														
1 - DTC: Dissolved concentration exceeds total														
2 - Dilution Limit is 13 mg/L														

Table B- 17. B.C. Taku Water Chemistry Relative Percent Difference Results

Site Name			Taku 1	Taku 1		Taku 3	Taku 3		Taku 4	Taku 4		Taku 5	Taku 5	
Client Sample ID			E309507_REG	E309507_REP	RPD	E309508_REG	E309508_REP	RPD	E309510_REG	E309510_REP	RPD	E309511_REG	E309511_REP	RPD
Date Sampled			25-Feb-2019	25-Feb-2019		11-Sep-2018	11-Sep-2018		24-Aug-2017	24-Aug-2017		3-Jun-2019	3-Jun-2019	
Time Sampled			NA	NA		11:00	11:20		12:40	12:50		12:30	12:50	
Parameter (Water)	Units	LDL	Water	Water		Water	Water		Water	Water		Water	Water	
Field Tests (Water)														
Conductivity, Client Supplied	µS/cm	2	-	-	-	66.9	-	-	90.9	-	-	0.1542	-	-
Diss. Oxygen, Client Supplied	mg/L	0.01	-	-	-	12.18	-	-		-	-		-	-
pH, Client Supplied	pH	0.1	-	-	-	7.87	-	-	7.27	-	-	7.93	-	-
Temperature, Client Supplied	C	-50	-	-	-	3.2	-	-	9.8	-	-	9.5	-	-
Physical Tests (Water)														
Conductivity	µS/cm	2	81.5	82.9	1.70	67.7	70.9	4.62	145	143	1.39	162	161	0.62
Hardness (as CaCO3)	mg/L	0.5	35.9	37.8	5.16	30.9	30.9	0.00	80.5	76.3	5.36	77.4	78.3	1.16
pH	pH	0.1	7.63	7.69	0.78	7.59	7.66	0.92	7.90	8.02	1.51	8.07	8.06	0.12
Total Suspended Solids	mg/L	3	*3.0*	*3.0*	0.00	98.7	57.9	52.11	134	129	3.80	59.4	62.2	4.61
Total Dissolved Solids	mg/L	20	63 [2]	63 [2]	0.00	93 [2]	98 [2]	5.24	106 [2]	110 [2]	3.70	108 [2]	102 [2]	5.71
Turbidity	NTU	0.1	17.8	17.6	1.13	164	157	4.36	109	104	4.69	48.4	55.2	13.13
Anions and Nutrients (Water)														
Alkalinity, Total (as $CaCO_3$)	mg/L	1	27.1	27.6	1.83	24.0	25.0	4.08	63.8	63.0	1.26	70.1	70.7	0.85
Ammonia, Total (as N)	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	0.0087	0.0079	9.64	*0.0050*	*0.0050*	0.00
Nitrate and Nitrite (as N)	mg/L	0.0032	0.0853	0.086	0.82	0.0249	0.0242	2.85	0.0338	0.0344	1.76	0.0671	0.0667	0.60
Nitrate (as N)	mg/L	0.003	0.0853	0.0860	0.82	0.0249	0.0242	2.85	0.0338	0.0344	1.76	0.0671	0.0667	0.60
Nitrite (as N)	mg/L	0.001	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00
Total Kjeldahl Nitrogen	mg/L	0.06	*0.050*	*0.050*	0.00	*0.050*	*0.050*	0.00	0.069	0.056	20.80	*0.050*	0.062	21.43
Total Nitrogen	mg/L	0.06	0.090	0.094	4.35	0.045	*0.030*	40.00	0.103	0.090	13.47	0.114	0.129	12.35
Total Organic Nitrogen	mg/L	0.06	*0.050*	*0.050*	0.00	*0.050*	*0.050*	0.00	0.061	*0.050*	19.82	*0.050*	0.059	16.51
Orthophosphate-Dissolved (as P)	mg/L	0.001	0.0019	0.0017	11.11	0.0018	0.0019	5.41	0.002 [3]	0.0019 [3]	5.13	*0.0010*	*0.0010*	0.00
Phosphorus (P)-Total Dissolved	mg/L	0.002	0.0022	0.0022	0.00	0.0020	*0.0020*	0.00	*0.0020*	*0.0020*	0.00	0.0027	0.0030	10.53
Sulfate (SO_4)	mg/L	0.3	12.4	12.4	0.00	9.67	9.71	0.41	12.1	12.2	0.82	13.9	13.9	0.00
Organic / Inorganic Carbon (Water)														
Dissolved Organic Carbon	mg/L	0.5	0.76	0.54	33.85	0.68	0.66	2.99	1.33	1.30	2.28	1.48	1.30	12.95
Total Metals (Water)														
Mercury (Hg)-Total	mg/L	0.00005	*0.00005*	*0.00005*	0.00	*0.00010*	*0.00010*	0.00	*0.000025*	*0.000025*	0.00	*0.00005*	*0.00005*	0.00
Total Metals (Undigested) (Water)														
Aluminum (Al)-Total	mg/L	0.0002	0.721	0.528	30.90	3.08	2.48	21.58	2.24	2.34	4.37	0.757	0.775	2.35
Antimony (Sb)-Total	mg/L	0.00002	0.000122	0.000118	3.33	0.000179	0.000141	23.75	0.000104	0.000102	1.94	0.000109	0.000111	1.82
Arsenic (As)-Total	mg/L	0.00002	0.000569	0.000574	0.87	0.00199	0.00167	17.49	0.00224	0.00217	3.17	0.00128	0.00135	5.32
Barium (Ba)-Total	mg/L	0.00002	0.0353	0.0316	11.06	0.0932	0.0785	17.12	0.0722	0.0705	2.38	0.0470	0.0467	0.64
Beryllium (Be)-Total	mg/L	0.00001	0.000023	0.000017	30.00	0.000135	0.000119	12.60	0.000117	0.000111	5.26	0.000039	0.000040	2.53
Bismuth (Bi)-Total	mg/L	0.000005	0.0000095	0.0000082	14.69	0.0000397	0.0000289	31.49	0.0000090	0.0000099	9.52	0.0000079	0.0000086	8.48
Boron (B)-Total	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	0.0069	0.0070	1.44	0.0063	0.0061	3.23
Cadmium (Cd)-Total	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	0.000180	0.000148	19.51	0.0000713	0.0000669	6.37	0.0000385	0.0000342	11.83
Calcium (Ca)-Total	mg/L	0.01	11.6	11.9	2.55	10.8	10.7	0.93	24.6	26.9	8.93	25.1	24.4	2.83
Chromium (Cr)-Total	mg/L	0.0001	0.00105	0.00081	25.81	0.00457	0.00383	17.62	0.00426	0.00500	15.98	0.00154	0.00159	3.19
Cobalt (Co)-Total	mg/L	0.000005	0.000326	0.000294	10.32	0.00224	0.00194	14.35	0.00189	0.00183	3.23	0.000816	0.000766	6.32
Copper (Cu)-Total	mg/L	0.00005	0.00136	0.00144	5.71	0.0104	0.00994	4.52	0.00753	0.00758	0.66	0.00390	0.00363	7.17
Iron (Fe)-Total	mg/L	0.001	0.631	0.526	18.15	3.21	2.70	17.26	3.22	3.45	6.90	1.05	1.99	61.84
Lead (Pb)-Total	mg/L	0.000005	0.000510	0.000472	7.74	0.00402	0.00374	7.22	0.00297	0.00331	10.83	0.00124	0.00128	3.17
Lithium (Li)-Total	mg/L	0.0005	0.00065	0.00055	16.67	0.00302	0.00268	11.93	0.00320	0.00284	11.92	0.00127	0.00127	0.00

Magnesium (Mg)-Total	mg/L	0.01	1.55	1.61	3.80	2.57	2.35	8.94	5.78	5.61	2.99	5.41	5.24	3.19
Manganese (Mn)-Total	mg/L	0.00005	0.0142	0.0127	11.15	0.102	0.0877	15.08	0.116	0.122	5.04	0.0580	0.0562	3.15
Molybdenum (Mo)-Total	mg/L	0.00005	0.00294	0.00285	3.11	0.000831	0.000690	18.54	0.000679	0.000632	7.17	0.000935	0.00101	7.71
Nickel (Ni)-Total	mg/L	0.00005	0.00128	0.00126	1.57	0.00832	0.00700	17.23	0.00510	0.00562	9.70	0.00306	0.00303	0.99
Potassium (K)-Total	mg/L	0.005	1.35	1.31	3.01	1.68	1.64	2.41	1.05	1.19	12.50	0.746	0.751	0.67
Selenium (Se)-Total	mg/L	0.00004	0.000256	0.000233	9.41	0.000140	0.000110	24.00	0.000167	0.000176	5.25	0.000210	0.000264	22.78
Silicon (Si)-Total	mg/L	0.05	2.90	2.50	14.81	7.80	5.95	26.91	6.15	6.71	8.71	3.17	3.34	5.22
Silver (Ag)-Total	mg/L	0.000005	0.0000064	*0.0000050*	24.56	0.0000221	0.0000200	9.98	0.0000283	0.0000259	8.86	0.0000082	0.0000076	7.59
Sodium (Na)-Total	mg/L	0.01	0.836	0.856	2.36	0.923	0.871	5.80	1.89	2.09	10.05	1.66	1.68	1.20
Strontium (Sr)-Total	mg/L	0.00005	0.0570	0.0570	0.00	0.0533	0.0562	5.30	0.120	0.129	7.23	0.155	0.156	0.64
Thallium (Tl)-Total	mg/L	0.000002	0.0000109	0.0000092	16.92	0.0000725	0.0000544	28.53	0.0000268	0.0000292	8.57	0.0000121	0.0000123	1.64
Tin (Sn)-Total	mg/L	0.00001	0.000011	*0.000010*	9.52	0.000058	0.000035	49.46	0.000018	0.000013	32.26	*0.00005*	*0.00005*	0.00
Uranium (U)-Total	mg/L	0.000002	0.000536	0.000481	10.82	0.000859	0.000838	2.47	0.000888	0.000903	1.68	0.000640	0.000655	2.32
Vanadium (V)-Total	mg/L	0.0002	0.00183	0.00138	28.04	0.00897	0.00721	21.76	0.00702	0.00708	0.85	0.00245	0.00249	1.62
Zinc (Zn)-Total	mg/L	0.0001	0.00292	0.00278	4.91	0.0293	0.0266	9.66	0.0143	0.0124	14.23	0.00499	0.00493	1.21
Dissolved Metals (Water)														
Aluminum (Al)-Dissolved	mg/L	0.0002	0.0230	0.0307	28.68	0.0542	0.0583	7.29	0.0372	0.0335	10.47	0.0319	0.0363	12.90
Antimony (Sb)-Dissolved	mg/L	0.00002	0.000123	0.000120	2.47	0.000142	0.000133	6.55	0.000099	0.000102	2.99	0.000108	0.000108	0.00
Arsenic (As)-Dissolved	mg/L	0.00002	0.000365	0.000407	10.88	0.000467	0.000498	6.42	0.000564	0.000653	14.63	0.000563	0.000564	0.18
Barium (Ba)-Dissolved	mg/L	0.00002	0.0198	0.0211	6.36	0.0143	0.0141	1.41	0.0298	0.0282	5.52	0.0285	0.0284	0.35
Beryllium (Be)-Dissolved	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00
Bismuth (Bi)-Dissolved	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00
Boron (B)-Dissolved	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	0.0065	0.0064	1.55	0.0061	0.0062	1.63
Cadmium (Cd)-Dissolved	mg/L	0.000005	*0.000005*	*0.000005*	0.00	*0.0000050*	0.0000112	76.54	*0.0000050*	*0.0000050*	0.00	*0.000005*	0.0000069	31.93
Calcium (Ca)-Dissolved	mg/L	0.01	12.1	12.8	5.62	10.6	10.5	0.95	25.2	23.5	6.98	23.3	23.8	2.12
Chromium (Cr)-Dissolved	mg/L	0.0001	0.00011	0.00016	37.04	*0.00010*	*0.00010*	0.00	0.00020	0.00023	13.95	0.00024	0.00024	0.00
Cobalt (Co)-Dissolved	mg/L	0.000005	0.0000051	0.0000095	60.27	0.0000366	0.0000360	1.65	0.0000251	0.0000204	20.66	0.0000339	0.0000328	3.30
Copper (Cu)-Dissolved	mg/L	0.00005	0.000078	0.000182	80.00	0.000453	0.000273	49.59	0.000476	0.000458	3.85	0.000635	0.000576	9.74
Iron (Fe)-Dissolved	mg/L	0.001	0.0050	0.0130	88.89	0.0228	0.0200	13.08	0.0196	0.0171	13.62	0.0202	0.0214	5.77
Lead (Pb)-Dissolved	mg/L	0.000005	0.0000096	0.0000305	104.24	0.0000369	0.0000328	11.76	0.0000273	0.0000225	19.28	0.0000274	0.0000280	2.17
Lithium (Li)-Dissolved	mg/L	0.0005	*0.00050*	*0.00050*	0.00	*0.00050*	*0.00050*	0.00	0.00076	0.00070	8.22	0.00072	0.00072	0.00
Magnesium (Mg)-Dissolved	mg/L	0.01	1.42	1.40	1.42	1.05	1.11	5.56	4.28	4.27	0.23	4.67	4.58	1.95
Manganese (Mn)-Dissolved	mg/L	0.00005	0.000149	0.000333	76.35	0.00281	0.00291	3.50	0.00600	0.00576	4.08	0.00677	0.00681	0.59
Mercury (Hg)-Dissolved	mg/L	0.00005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00
Molybdenum (Mo)-Dissolved	mg/L	0.00005	0.00334	0.00341	2.07	0.00211	0.00194 [1]	8.40	0.00183 [1]	0.00178 [1]	2.77	0.00173 [1]	0.00176 [1]	1.72
Nickel (Ni)-Dissolved	mg/L	0.00005	0.000112	0.000100	11.32	0.000328	0.000279	16.14	0.000428	0.000441	2.99	0.000503	0.000494	1.81
Potassium (K)-Dissolved	mg/L	0.005	1.16	1.21	4.22	0.843	0.852	1.06	0.708	0.679	4.18	0.587	0.590	0.51
Selenium (Se)-Dissolved	mg/L	0.00004	0.000308	0.000261	16.52	0.000125	0.000145	14.81	0.000249 [1]	0.000174	35.46	0.000234	0.000229	2.16
Silicon (Si)-Dissolved	mg/L	0.05	1.33	1.36	2.23	0.711	0.742	4.27	2.21	2.19	0.91	2.16	2.15	0.46
Silver (Ag)-Dissolved	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00
Sodium (Na)-Dissolved	mg/L	0.01	0.869	0.888	2.16	0.680	0.651	4.36	1.96	1.78	9.63	1.57	1.60	1.89
Strontium (Sr)-Dissolved	mg/L	0.00005	0.0558	0.0527	5.71	0.0478	0.0444	7.38	0.115	0.112	2.64	0.144	0.144	0.00
Thallium (Tl)-Dissolved	mg/L	0.000002	0.0000020	*0.0000020*	0.00	0.0000057	0.0000048	17.14	0.0000041	0.0000038	7.59	0.0000029	0.0000031	6.67
Tin (Sn)-Dissolved	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.00005*	*0.00005*	0.00
Uranium (U)-Dissolved	mg/L	0.000002	0.000425	0.000413	2.86	0.000413	0.000400	3.20	0.000546	0.000587	7.24	0.000572	0.000566	1.05
Vanadium (V)-Dissolved	mg/L	0.0002	*0.00020*	*0.00020*	0.00	0.00024	0.00024	0.00	0.00032	0.00030	6.45	0.00033	0.00032	3.08
Zinc (Zn)-Dissolved	mg/L	0.0001	0.00026	0.00040	42.42	0.00178	0.00206	14.58	0.00063	0.00049	25.00	0.00060	0.00036	50.00
RPD = Relative Percent Difference, results >25 are highlighted														
- Parameter does not meet comparison criteria														
Results in italics are less than detection limit														
1 - DTC: Dissolved concentration exceeds total														
2 - Dilution Limit is 13 mg/L, 3 - Parameter exceeded recommended holding time prior to analysis.														

Table B- 18. B.C. Unuk Water Chemistry Relative Percent Difference Results

Site Name			Unuk 1	Unuk 1		Unuk 1	Unuk 1		Unuk 3	Unuk 3	
Client Sample ID			E312690_REG	E312690_REP	RPD	E312690_REG	E312690_REP	RPD	E312692_REG	E312692_REP	RPD
Date Sampled			27-Nov-2018	27-Nov-2018		3-Jun-2019	3-Jun-2019		13/Sep/18	13-Sep-2018	
Time Sampled			12:20	12:20		13:40	13:40		14:08	14:08	
Parameter (Water)	Units	LDL	Water	Water		Water	Water		Water	Water	
Field Tests (Water)											
Conductivity, Client Supplied	µS/cm	2	111.9	-	-	133	-	-	152.9	-	-
Diss. Oxygen, Client Supplied	mg/L	0.01	-	-	-		-	-	12.99	-	-
pH, Client Supplied	pH	0.1	8.01	-	-	7.72	-	-	7.80	-	-
Temperature, Client Supplied	C	-50	3.7	-	-	6.8	-	-	4.8	-	-
Physical Tests (Water)											
Conductivity	µS/cm	2	197	185	6.28	140	138	1.44	163	163	0.00
Hardness (as CaCO3)	mg/L	0.5	78.9	85.6	8.15	59	60.2	2.01	68.4	70.1	2.45
pH	pH	0.1	7.87	7.89	0.25	7.77	7.75	0.26	7.85	7.80	0.64
Total Suspended Solids	mg/L	3	3.0	18.4	143.93	54.7	30.5	56.81	46.3	50.3	8.28
Total Dissolved Solids	mg/L	20	116	127	9.05	86 [2]	91 [2]	5.65	105	106	0.95
Turbidity	NTU	0.1	4.61	8.76	62.08	40.3	42.0	4.13	49.3	48.7	1.22
Anions and Nutrients (Water)											
Alkalinity, Total (as $CaCO_3$)	mg/L	1	53.4	54.7	2.41	33.9	34.1	0.59	43.8	43.5	0.69
Ammonia, Total (as N)	mg/L	0.005	*0.0050*	0.0053	5.83	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00
Nitrate and Nitrite (as N)	mg/L	0.0032	0.203	0.191	6.09	0.0891	0.0849	4.83	0.0443	0.0441	0.45
Nitrate (as N)	mg/L	0.003	0.203	0.191	6.09	0.0891	0.0849	4.83	0.0443	0.0441	0.45
Nitrite (as N)	mg/L	0.001	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00
Total Kjeldahl Nitrogen	mg/L	0.06	*0.050*	*0.050*	0.00	*0.050*	*0.050*	0.00	*0.050*	*0.050*	0.00
Total Nitrogen	mg/L	0.06	0.221	0.239	7.83	0.110	0.102	7.55	0.058	0.055	5.31
Total Organic Nitrogen	mg/L	0.06	*0.050*	*0.050*	0.00	*0.050*	*0.050*	0.00	*0.050*	*0.050*	0.00
Orthophosphate-Dissolved (as P)	mg/L	0.001	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	0.00	*0.0010*	*0.0010*	5.13
Phosphorus (P)-Total Dissolved	mg/L	0.002	0.0020	0.0021	4.88	*0.002*	*0.002*	0.00	*0.0020*	*0.0020*	0.00
Sulfate (SO_4)	mg/L	0.3	39.5	38.3	3.08	28.9	28.7	0.69	34.0	34.2	0.59
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.5	0.81	1.45	56.64	*0.50*	0.53	5.83	*0.50*	0.51	1.98
Total Metals (Water)											
Mercury (Hg)-Total	mg/L	0.00005	*0.00005*	*0.00005*	0.00	*0.0000050*	*0.0000050*	0.00	0.0000149	0.0000115	25.76
Total Metals (Undigested) (Water)											
Aluminum (Al)-Total	mg/L	0.0002	0.185	0.218	16.38	0.956	0.984	2.89	0.945	0.904	4.43
Antimony (Sb)-Total	mg/L	0.00002	0.000333	0.000298	11.09	0.000411	0.000424	3.11	0.000651	0.000669	2.73
Arsenic (As)-Total	mg/L	0.00002	0.00148	0.00143	3.44	0.00380	0.00366	3.75	0.00276	0.00265	4.07
Barium (Ba)-Total	mg/L	0.00002	0.0327	0.0320	2.16	0.0367	0.0401	8.85	0.0460	0.0478	3.84
Beryllium (Be)-Total	mg/L	0.00001	0.000026	0.000027	3.77	0.000067	0.000065	3.03	0.000068	0.000066	2.99
Bismuth (Bi)-Total	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	0.0000059	0.0000056	5.22	*0.0000050*	*0.0000050*	0.00
Boron (B)-Total	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00
Cadmium (Cd)-Total	mg/L	0.000005	0.000332	0.000307	7.82	0.000494	0.000483	2.25	0.000465	0.000492	5.64
Calcium (Ca)-Total	mg/L	0.01	27.2	30.1	10.12	22.2	21.4	3.67	23.0	22.5	2.20
Chromium (Cr)-Total	mg/L	0.0001	0.00014	0.00017	19.35	0.00096	0.00098	2.06	0.00135	0.00117	14.29
Cobalt (Co)-Total	mg/L	0.000005	0.000476	0.000535	11.67	0.00158	0.00160	1.26	0.00128	0.00128	0.00
Copper (Cu)-Total	mg/L	0.00005	0.0239	0.0256	6.87	0.0678	0.0686	1.17	0.0292	0.0295	1.02
Iron (Fe)-Total	mg/L	0.001	0.925	1.01	8.79	2.66	2.82	5.84	2.12	2.04	3.85
Lead (Pb)-Total	mg/L	0.000005	0.000341	0.000324	5.11	0.00164	0.00171	4.18	0.00184	0.00184	0.00
Lithium (Li)-Total	mg/L	0.0005	0.00080	0.00085	6.06	0.00121	0.00121	0.00	0.00144	0.00147	2.06

Magnesium (Mg)-Total	mg/L	0.01	2.49	2.69	7.72	2.32	2.37	2.13	2.60	2.62	0.77
Manganese (Mn)-Total	mg/L	0.00005	0.0674	0.0723	7.02	0.0934	0.0933	0.11	0.0990	0.0989	0.10
Molybdenum (Mo)-Total	mg/L	0.00005	0.00216	0.00203	6.21	0.00138	0.00139	0.72	0.000924	0.000941	1.82
Nickel (Ni)-Total	mg/L	0.00005	0.000604	0.000634	4.85	0.00178	0.00175	1.70	0.00182	0.00175	3.92
Potassium (K)-Total	mg/L	0.005	1.02	1.02	0.00	0.898	0.919	2.31	0.921	0.931	1.08
Selenium (Se)-Total	mg/L	0.00004	0.000737	0.000674	8.93	0.000638	0.000621	2.70	0.000795	0.000755	5.16
Silicon (Si)-Total	mg/L	0.05	2.70	3.06	12.50	2.82	2.62	7.35	2.36	2.38	0.84
Silver (Ag)-Total	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	0.0000159	0.0000207	26.23	0.0000260	0.0000309	17.22
Sodium (Na)-Total	mg/L	0.01	1.75	1.77	1.14	1.12	1.11	0.90	0.959	0.962	0.31
Strontium (Sr)-Total	mg/L	0.00005	0.165	0.156	5.61	0.125	0.124	0.80	0.138	0.144	4.26
Thallium (Tl)-Total	mg/L	0.000002	0.0000054	0.0000048	11.76	0.0000151	0.0000145	4.05	0.0000164	0.0000156	5.00
Tin (Sn)-Total	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.0000500*	*0.0000500*	0.00	*0.000010*	*0.000010*	0.00
Uranium (U)-Total	mg/L	0.000002	0.000396	0.000358	10.08	0.000273	0.000285	4.30	0.000125	0.000125	0.00
Vanadium (V)-Total	mg/L	0.0002	0.00060	0.00069	13.95	0.00336	0.00348	3.51	0.00407	0.00392	3.75
Zinc (Zn)-Total	mg/L	0.0001	0.0275	0.0273	0.73	0.0381	0.0383	0.52	0.0389	0.0397	2.04
Dissolved Metals (Water)											
Aluminum (Al)-Dissolved	mg/L	0.0002	0.0191	0.0275	36.05	0.0404	0.0501	21.44	0.0295	0.0325	9.68
Antimony (Sb)-Dissolved	mg/L	0.00002	0.000318	0.000274	14.86	0.000314	0.000314	0.00	0.000558	0.000564	1.07
Arsenic (As)-Dissolved	mg/L	0.00002	0.000141	0.000156	10.10	0.000168	0.000196	15.38	0.000160	0.000167	4.28
Barium (Ba)-Dissolved	mg/L	0.00002	0.0321	0.0313	2.52	0.0205	0.0208	1.45	0.0292	0.0291	0.34
Beryllium (Be)-Dissolved	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00	*0.000010*	*0.000010*	0.00
Bismuth (Bi)-Dissolved	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00
Boron (B)-Dissolved	mg/L	0.005	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00	*0.0050*	*0.0050*	0.00
Cadmium (Cd)-Dissolved	mg/L	0.000005	0.000216	0.000196	9.71	0.000218	0.000217	0.46	0.000272	0.000281	3.25
Calcium (Ca)-Dissolved	mg/L	0.01	27.9	30.0	7.25	20.5	20.9	1.93	23.8	24.4	2.49
Chromium (Cr)-Dissolved	mg/L	0.0001	*0.00010*	*0.00010*	0.00	*0.00010*	*0.00010*	0.00	*0.00010*	0.00015	40.00
Cobalt (Co)-Dissolved	mg/L	0.000005	0.000365	0.000434	17.27	0.000718	0.000717	0.14	0.000467	0.000472	1.06
Copper (Cu)-Dissolved	mg/L	0.00005	0.00268	0.00343	24.55	0.00167	0.00254	41.33	0.00102	0.000884	14.29
Iron (Fe)-Dissolved	mg/L	0.001	0.0190	0.0372	64.77	0.0065	0.0234	113.04	0.0154	0.0211	31.23
Lead (Pb)-Dissolved	mg/L	0.000005	0.0000180	0.0000274	41.41	*0.0000050*	0.0000154	101.96	0.0000175	0.0000157	10.84
Lithium (Li)-Dissolved	mg/L	0.0005	0.00093	0.00080	15.03	0.00095	0.00096	1.05	0.00084	0.00089	5.78
Magnesium (Mg)-Dissolved	mg/L	0.01	2.25	2.62	15.20	1.91	1.96	2.58	2.21	2.23	0.90
Manganese (Mn)-Dissolved	mg/L	0.00005	0.0586	0.0677	14.41	0.0556	0.0558	0.36	0.0621	0.0624	0.48
Mercury (Hg)-Dissolved	mg/L	0.00005	*0.0000050*	*0.0000050*	0.00	*0.0000050*	*0.0000050*	0.00	0.0000133	*0.0000050*	90.71
Molybdenum (Mo)-Dissolved	mg/L	0.00005	0.00219	0.00211	3.72	0.00165	0.00167	8.40	0.00133 [1]	0.00137 [1]	2.96
Nickel (Ni)-Dissolved	mg/L	0.00005	0.000480	0.000539	11.58	0.000550	0.000551	0.18	0.000639	0.000611	4.48
Potassium (K)-Dissolved	mg/L	0.005	0.953	0.985	3.30	0.737	0.747	1.35	0.744	0.744	0.00
Selenium (Se)-Dissolved	mg/L	0.00004	0.000703	0.000688	2.16	0.000509	0.000538	5.54	0.000761	0.000796	35.46
Silicon (Si)-Dissolved	mg/L	0.05	2.28	2.80	20.47	1.50	1.52	1.32	1.07	1.09	1.85
Silver (Ag)-Dissolved	mg/L	0.000005	*0.0000050*	*0.0000050*	0.00	*0.000005*	*0.000005*	0.00	*0.0000050*	*0.0000050*	0.00
Sodium (Na)-Dissolved	mg/L	0.01	1.77	1.74	1.71	1.07	1.08	0.93	0.956	0.945	1.16
Strontium (Sr)-Dissolved	mg/L	0.00005	0.154	0.141	8.81	0.125	0.124	0.80	0.149	0.138	7.67
Thallium (Tl)-Dissolved	mg/L	0.000002	0.0000047	0.0000042	11.24	0.0000043	0.0000042	2.35	0.0000048	0.000005	4.08
Tin (Sn)-Dissolved	mg/L	0.00001	*0.000010*	*0.000010*	0.00	*0.00005*	*0.00005*	0.00	*0.000010*	*0.000010*	0.00
Uranium (U)-Dissolved	mg/L	0.000002	0.000326	0.000313	4.07	0.000113	0.000115	1.75	0.0000504	0.0000523	3.70
Vanadium (V)-Dissolved	mg/L	0.0002	*0.00020*	*0.00020*	0.00	*0.0002*	*0.0002*	0.00	*0.00020*	*0.00020*	0.00
Zinc (Zn)-Dissolved	mg/L	0.0001	0.0103	0.0110	6.57	0.00886	0.00934	5.27	0.0128	0.0132	3.08
RPD = Relative Percent Difference, results >25 are highlighted											
- Parameter does not meet comparison criteria											
Results in italics are less than detection limit											
1 - DTC: Dissolved concentration exceeds total											
2 - Dilution Limit is 13 mg/L, 3 - Parameter exceeded recommended holding time prior to analysis.											

Table B- 19. DEC Water Chemistry Relative Percent Difference Results

Site Name	Date Sampled	Total Calcium	Total Magnesium	Total Potassium	Total Sodium	Dissolved Cadmium	Dissolved Copper	Dissolved Lead	Dissolved Selenium	Dissolved Zinc
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
NRSA18-AK-10143	07/09/18	3950	1160	1600	798	ND	0.8070	0.0611	0.0678	35.4000
NRSA18-AK-10143 Replicate	07/09/18	4140	1270	1820	895	ND	0.9880	ND	0.0555	18.7000
DEC Relative Percent Difference		**4.70%**	**9.05%**	**12.87%**	**11.46%**	**-**	**20.17%**	**-**	**19.95%**	**61.74%**
NRSA18-AK-10002	8/7/2018	12700	4580	4200	2160	ND	0.1970	ND	0.1480	ND
NRSA18-AK-10002 Replicate	8/7/2018	16400	3600	3060	1190	0.0167	0.2210	ND	0.1620	ND
DEC Relative Percent Difference		**25.43%**	**23.96%**	**31.40%**	**57.91%**	**-**	**11.48%**	**-**	**9.03%**	**-**

Table B- 20. Sediment Relative Percent Difference Results

Site Name	**Date Sampled**	Total Organic Carbon	Aluminum	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Nickel	Selenium	Silver	Tin	Vanadium	Zinc	Mercury
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Stikine Main 4	8/23/17	5,000	14,700	0.48	8.10	0.34	49.70	34,600	6.12	720.00	53.10	0.41	0.14	0.54	76.90	78.70	0.03
Average Stikine Main 4 Replicate	**8/23/17**	5,650	15,250	0.52	7.97	0.37	51.15	34,175	6.17	737.75	53.20	0.44	0.16	0.62	78.15	79.10	0.03
Relative Percent Difference		**12.21%**	**3.67%**	**7.04%**	**1.68%**	**8.39%**	**2.88%**	**1.24%**	**0.77%**	**2.44%**	**0.19%**	**5.92%**	**10.68%**	**14.19%**	**1.61%**	**0.51%**	**13.80%**
TaMain 1	8/24/17	1,900	13,400	0.93	16.30	0.27	43.90	34,300	10.20	666.00	49.90	0.26	0.16	0.57	77.30	71.40	0.03
Average TaMain 1 Replicate	8/24/17	1,800	14,325	0.93	16.15	0.29	45.30	34,825	10.78	694.00	51.85	0.27	0.16	0.64	79.70	73.13	0.03
Relative Percent Difference		**5.41%**	**6.67%**	**0.54%**	**0.92%**	**9.08%**	**3.14%**	**1.52%**	**5.48%**	**4.12%**	**3.83%**	**1.90%**	**1.38%**	**11.57%**	**3.06%**	**2.39%**	**11.84%**
URTrib 1	9/13/18	1,800	17,000	10.30	67.60	3.28	330.00	62,800	44.10	1,110.00	42.80	8.86	1.68	0.44	86.90	268.00	0.25
Average URTrib 1 Replicate	9/13/18	1,568	14,850	9.79	70.93	2.80	298.00	68,025	40.28	940.75	22.18	9.93	1.55	0.28	79.58	224.00	0.22
Relative Percent Difference		**13.81%**	**13.50%**	**5.05%**	**4.80%**	**15.97%**	**10.19%**	**7.99%**	**9.07%**	**16.51%**	**63.49%**	**11.41%**	**8.05%**	**44.44%**	**8.80%**	**17.89%**	**12.70%**
NRS18-AK-10002	8/7/18	-	11,400	0.271	3.86	0.232	51.4	42,600	3.32	462	18	0.337	0.0966	0.464	156	60.4	0.00764
NRS18-AK-10002 Replicate	8/7/18	-	13,400	0.268	3.84	0.227	56.9	41,400	3.23	482	17.1	0.357	ND	0.43	147	60	0.00949
Relative Percent Difference		**-**	**16.13%**	**1.11%**	**0.52%**	**2.18%**	**10.16%**	**2.86%**	**2.75%**	**4.24%**	**5.13%**	**5.76%**	**-**	**7.61%**	**5.94%**	**0.66%**	**21.60%**

Appendix C: ADDITIONAL FIELD AND LAB DATA

Table C- 1 Stikine Watershed B.C. Benthic Macroinvertebrates Tissue Elements Results

Site names (2020)			**Stikine Main 1**	**Christina Creek**	**Christina Creek**	**Christina Creek**	**Iskut Main 1**
2018 Collection Site Name			Stikine 7	Stikine 6	Stikine 6	Stikine 6	Stikine 4
Client Sample ID			E314891_REG	E314890_REG	E314890_REP	E314890_REP	E279984_REG
Date Sampled			15-Sep-2018	15-Sep-2018	15-Sep-2018	15-Sep-2018	15-Sep-2018
ALS Sample ID			L2213641-1	L2213640-1	L2213640-2	L2213640-3	L2213642-1
Fresh Sample wet weight (g)			6.4	1.5	3.5	3.0	3.9
Parameter	Lowest Detection Limit (LDL)	Units	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests (Tissue)							
% Moisture	0.50	%	79.8	89.0	92.3	90.3	91.4
Metals (Tissue)							
Aluminum (Al)-Total	0.40	mg/kg wwt	2400	712	454	297	406
Antimony (Sb)-Total	0.0020	mg/kg wwt	0.0492	0.0034	0.0027	0.0025	0.0119
Arsenic (As)-Total	0.0040	mg/kg wwt	1.72	0.0721	0.0589	0.0427	0.184
Barium (Ba)-Total	0.010	mg/kg wwt	52.1	21.6	19.0	13.3	9.88
Beryllium (Be)-Total	0.0020	mg/kg wwt	0.204	0.0169	0.0130	0.0093	0.0081
Bismuth (Bi)-Total	0.0020	mg/kg wwt	0.0344	0.0234	0.0192	0.0128	0.0021
Boron (B)-Total	0.20	mg/kg wwt	4.14	1.05	0.48	0.25	0.45
Cadmium (Cd)-Total	0.0010	mg/kg wwt	0.279	0.261	0.424	0.165	0.174
Calcium (Ca)-Total	4.0	mg/kg wwt	2550	725	594	469	509
Cesium (Cs)-Total	0.0010	mg/kg wwt	0.288	0.126	0.0950	0.0551	0.0185
Chromium (Cr)-Total	0.010	mg/kg wwt	8.83	0.971	0.721	0.731	2.07
Cobalt (Co)-Total	0.0040	mg/kg wwt	2.51	0.870	1.62	0.645	0.443
Copper (Cu)-Total	0.020	mg/kg wwt	7.25	3.51	4.94	2.32	2.70
Iron (Fe)-Total	0.60	mg/kg wwt	6160	1210	835	550	667
Lead (Pb)-Total	0.0040	mg/kg wwt	1.37	0.095	0.015	0.038	<0.010
Lithium (Li)-Total	0.10	mg/kg wwt	2.76	0.84	0.68	0.48	0.26
Magnesium (Mg)-Total	0.40	mg/kg wwt	1650	367	287	203	342
Manganese (Mn)-Total	0.010	mg/kg wwt	297	118	220	107	40.8
Mercury (Hg)-Total	0.0010	mg/kg wwt	0.0114	0.0022	<0.0010	0.0011	0.0027
Molybdenum (Mo)-Total	0.0040	mg/kg wwt	0.386	0.376	0.466	0.217	0.0910
Nickel (Ni)-Total	0.040	mg/kg wwt	12.4	1.19	2.49	1.00	1.07
Phosphorus (P)-Total	2.0	mg/kg wwt	274	275	202	191	151
Potassium (K)-Total	4.0	mg/kg wwt	370	353	236	221	124
Rubidium (Rb)-Total	0.010	mg/kg wwt	2.37	1.60	1.17	0.940	0.225
Selenium (Se)-Total	0.010	mg/kg wwt	0.166	0.238	0.130	0.096	0.086
Silver (Ag)-Total	0.0010	mg/kg wwt	0.0188	0.0165	0.0122	0.0070	0.0096
Sodium (Na)-Total	4.0	mg/kg wwt	275	228	129	150	95.9
Strontium (Sr)-Total	0.010	mg/kg wwt	21.8	5.86	4.36	3.22	2.07
Tellurium (Te)-Total	0.0040	mg/kg wwt	<0.0080	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	0.00040	mg/kg wwt	0.0222	0.0244	0.0202	0.0113	0.00422
Tin (Sn)-Total	0.020	mg/kg wwt	0.465	0.405	2.46	1.21	0.327
Titanium (Ti)-Total	0.020	mg/kg wwt	158	79.2	53.5	36.5	22.3
Uranium (U)-Total	0.00040	mg/kg wwt	0.132	0.740	1.00	0.481	0.0440
Vanadium (V)-Total	0.020	mg/kg wwt	8.58	3.00	1.97	1.27	1.68
Zinc (Zn)-Total	0.10	mg/kg wwt	27.6	18.0	18.0	13.1	10.7
Zirconium (Zr)-Total	0.040	mg/kg wwt	7.78	0.082	0.098	0.082	0.284

Legend	
Red text indicates a higher detection limit was used in the analysis	**** Stikine Main 1 was within the impact area of the 2018 B.C. Telegraph Creek fires**
Grey cells indicate max values across sample sites	

Table C- 2 Taku Watershed B.C. Benthic Macroinvertebrates Tissue Elements Results

			Tulsequah River Mainstem and Side Channel	Taku River Mainstem

Site names (2020)			TuMain 1	TuMain 1b Side	TuMain 4		TaMain 1	TaMain3
2018 Collection Site Name			Taku 8	Taku 9 (ALS Submit as Taku1)	**Taku 3**		Taku 4	Taku 11
Client Sample ID			E314930_REG	E309507_REG	E309509_REG		E309510_REG	E314933_REG
Date Sampled			11-Sep-2018	11-Sep-2018	11-Sep-2018		11-Sep-2018	16-Sep-2018
ALS Sample ID			L2213650-1	L2177868-7	L2213646-1		L2213651-1	L2213652-1
Fresh Sample wet weight (g)			na	3.5	0.1		2.4	5.4
Parameter	Lowest Detection Limit (LDL)	Units	Tissue	Tissue	**LDL**	**Tissue**	Tissue	Tissue
Physical Tests (Tissue)								
% Moisture	0.50	%	93.8	66.5	2.0	65.1	72.6	96.7
Metals (Tissue)								
Aluminum (Al)-Total	0.40	mg/kg wwt	319	2250	3.0	1070	696	240
Antimony (Sb)-Total	0.0020	mg/kg wwt	0.0122	0.0428	0.0060	0.246	0.255	0.0102
Arsenic (As)-Total	0.0040	mg/kg wwt	0.228	1.23	0.018	4.12	1.18	0.144
Barium (Ba)-Total	0.010	mg/kg wwt	17.3	33.6	0.030	95.8	108	2.79
Beryllium (Be)-Total	0.0020	mg/kg wwt	0.0103	0.0376	0.0060	0.0497	0.040	0.0070
Bismuth (Bi)-Total	0.0020	mg/kg wwt	0.0060	0.0285	0.0060	0.0391	0.079	0.0210
Boron (B)-Total	0.20	mg/kg wwt	0.92	0.43	0.60	83.9	26.3	0.50
Cadmium (Cd)-Total	0.0010	mg/kg wwt	0.334	0.132	0.0060	0.678	0.386	0.0308
Calcium (Ca)-Total	4.0	mg/kg wwt	613	995	12	2250	3130	288
Cesium (Cs)-Total	0.0010	mg/kg wwt	0.0766	0.240	0.0030	0.356	0.106	0.0225
Chromium (Cr)-Total	0.010	mg/kg wwt	1.75	6.39	0.12	5.37	6.65	2.29
Cobalt (Co)-Total	0.0040	mg/kg wwt	1.31	1.28	0.012	1.43	1.53	0.311
Copper (Cu)-Total	0.020	mg/kg wwt	9.90	8.18	0.12	17.1	19.2	1.44
Iron (Fe)-Total	0.60	mg/kg wwt	657	3550	3.0	2250	2080	540
Lead (Pb)-Total	0.0040	mg/kg wwt	0.296	1.15	0.030	69.6	1.88	0.121
Lithium (Li)-Total	0.10	mg/kg wwt	0.38	2.07	0.30	1.20	<0.70	0.32
Magnesium (Mg)-Total	0.40	mg/kg wwt	355	1600	1.2	1120	773	467
Manganese (Mn)-Total	0.010	mg/kg wwt	122	78.8	0.030	110	157	17.9
Mercury (Hg)-Total	0.0010	mg/kg wwt	<0.0090	0.0035	0.014	0.028	<0.034	<0.0040
Molybdenum (Mo)-Total	0.0040	mg/kg wwt	0.262	0.407	0.024	2.06	0.380	0.107
Nickel (Ni)-Total	0.040	mg/kg wwt	6.14	4.00	0.12	7.99	9.99	3.87
Phosphorus (P)-Total	2.0	mg/kg wwt	112	1070	6.0	1080	717	26.2
Potassium (K)-Total	4.0	mg/kg wwt	109	922	12	607	268	45.9
Rubidium (Rb)-Total	0.010	mg/kg wwt	0.501	2.37	0.030	2.31	0.787	0.243
Selenium (Se)-Total	0.010	mg/kg wwt	0.231	0.460	0.060	0.862	0.31	<0.020
Silver (Ag)-Total	0.0010	mg/kg wwt	0.0150	0.0252	0.0030	0.0284	0.0194	0.0033
Sodium (Na)-Total	4.0	mg/kg wwt	94.9	270	12	703	648	76.3
Strontium (Sr)-Total	0.010	mg/kg wwt	1.91	6.12	0.060	14.2	30.9	0.929
Tellurium (Te)-Total	0.0040	mg/kg wwt	<0.0080	0.0047	0.012	<0.012	<0.028	<0.0040
Thallium (Tl)-Total	0.00040	mg/kg wwt	0.00971	0.0232	0.0012	0.157	0.0293	0.00287
Tin (Sn)-Total	0.020	mg/kg wwt	0.678	0.862	0.060	2.72	0.42	1.05
Titanium (Ti)-Total	0.020	mg/kg wwt	15.4	119	0.30	51.1	58.2	21.4
Uranium (U)-Total	0.00040	mg/kg wwt	0.222	0.265	0.0012	2.40	0.563	0.0284
Vanadium (V)-Total	0.020	mg/kg wwt	1.35	9.04	0.060	4.46	3.51	1.33
Zinc (Zn)-Total	0.10	mg/kg wwt	21.0	26.0	0.60	62.7	23.3	2.76
Zirconium (Zr)-Total	0.040	mg/kg wwt	<0.080	0.293	0.12	0.49	0.77	0.135

Legend
Red text indicates a higher detection limit was used in the analysis
Grey cells indicate max values across sample sites

Table C- 3 Unuk Watershed B.C. Benthic Macroinvertebrates Tissue Elements Results

Site names (2020)			URMain 1	URTrib 2	URMain 3	URTrib 1 (aka Sulphurets Cr)	URMain 2 (aka South Unuk River)

2018 Collection Site Name			Unuk 5	Unuk 2	Unuk 1	Unuk 4	Unuk 3	
Client Sample ID			E312694_REG	E312691_REG	E312690_REG	E312693_REG	E312692_REG	
Date Sampled			13-Sep-2018	13-Sep-2018	13-Sep-2018	13-Sep-2018	13-Sep-2018	
ALS Sample ID			L2213647-1	L2213645-1	L2213643-1	L2213649-1	L2213644-1	
Fresh Sample wet weight (g)			4.1	3.9	2.5	4.4		0.8
Parameter	Lowest Detection Limit (LDL)	Units	Tissue	Tissue	Tissue	Tissue	LDL	Tissue
Physical Tests (Tissue)								
% Moisture	0.50	%	81.8	85.1	88.8	88.7	2.0	80.4
Metals (Tissue)								
Aluminum (Al)-Total	0.40	mg/kg wwt	2330	1290	851	686	1.0	1320
Antimony (Sb)-Total	0.0020	mg/kg wwt	0.210	0.0169	0.0528	0.327	0.0020	0.213
Arsenic (As)-Total	0.0040	mg/kg wwt	7.11	0.799	0.840	1.12	0.0060	3.67
Barium (Ba)-Total	0.010	mg/kg wwt	21.0	17.0	8.52	151	0.010	13.9
Beryllium (Be)-Total	0.0020	mg/kg wwt	0.0836	0.0173	0.0229	0.0296	0.0020	0.0599
Bismuth (Bi)-Total	0.0020	mg/kg wwt	0.0131	0.0717	0.0068	0.142	0.0020	0.0092
Boron (B)-Total	0.20	mg/kg wwt	0.53	0.27	0.67	1.04	0.20	0.39
Cadmium (Cd)-Total	0.0010	mg/kg wwt	2.79	0.882	0.990	0.908	0.0020	5.56
Calcium (Ca)-Total	4.0	mg/kg wwt	2610	741	659	1130	4.0	1600
Cesium (Cs)-Total	0.0010	mg/kg wwt	0.203	0.109	0.0645	0.0764	0.0010	0.131
Chromium (Cr)-Total	0.010	mg/kg wwt	6.12	2.55	1.36	2.83	0.040	1.98
Cobalt (Co)-Total	0.0040	mg/kg wwt	4.48	1.81	1.08	1.51	0.0040	3.11
Copper (Cu)-Total	0.020	mg/kg wwt	15.0	7.78	9.04	28.0	0.040	34.4
Iron (Fe)-Total	0.60	mg/kg wwt	5440	2500	1550	1740	1.0	3440
Lead (Pb)-Total	0.0040	mg/kg wwt	3.42	1.22	0.060	3.08	1.2	<1.2
Lithium (Li)-Total	0.10	mg/kg wwt	2.23	0.78	0.65	0.85	0.10	0.97
Magnesium (Mg)-Total	0.40	mg/kg wwt	1900	954	676	530	0.40	1110
Manganese (Mn)-Total	0.010	mg/kg wwt	128	61.2	47.8	170	0.010	100
Mercury (Hg)-Total	0.0010	mg/kg wwt	0.0444	0.0022	0.0051	0.0139	0.0010	0.0248
Molybdenum (Mo)-Total	0.0040	mg/kg wwt	0.478	0.306	0.192	0.626	0.0080	0.526
Nickel (Ni)-Total	0.040	mg/kg wwt	7.02	1.81	1.42	2.79	0.040	2.79
Phosphorus (P)-Total	2.0	mg/kg wwt	522	558	343	255	2.0	1390
Potassium (K)-Total	4.0	mg/kg wwt	511	671	390	115	4.0	1430
Rubidium (Rb)-Total	0.010	mg/kg wwt	1.45	1.56	0.807	0.580	0.010	2.11
Selenium (Se)-Total	0.010	mg/kg wwt	1.45	0.294	0.341	0.292	0.020	1.90
Silver (Ag)-Total	0.0010	mg/kg wwt	0.173	0.0188	0.0142	0.0460	0.0010	0.0421
Sodium (Na)-Total	4.0	mg/kg wwt	203	242	190	171	4.0	727
Strontium (Sr)-Total	0.010	mg/kg wwt	15.4	3.39	3.39	13.3	0.020	6.42
Tellurium (Te)-Total	0.0040	mg/kg wwt	0.0099	0.0065	<0.0040	0.0093	0.0040	0.0083
Thallium (Tl)-Total	0.00040	mg/kg wwt	0.0267	0.0186	0.00918	0.0289	0.00040	0.0158
Tin (Sn)-Total	0.020	mg/kg wwt	1.79	0.136	0.540	1.46	0.020	1.09
Titanium (Ti)-Total	0.020	mg/kg wwt	77.5	96.1	64.6	39.5	0.10	63.3
Uranium (U)-Total	0.00040	mg/kg wwt	0.0433	0.0859	0.0650	0.0785	0.00040	0.0526
Vanadium (V)-Total	0.020	mg/kg wwt	13.2	6.00	3.57	4.04	0.020	8.13
Zinc (Zn)-Total	0.10	mg/kg wwt	53.6	22.0	39.7	35.7	0.20	118
Zirconium (Zr)-Total	0.040	mg/kg wwt	0.968	0.166	0.317	0.266	0.040	0.559

Legend
Red text indicate a higher detection limit was used in the analysis
Grey cells indicate max values across sample sites

Table C- 4. DEC Taku Watershed Benthic Macroinvertebrate Taxonomic Identification Results

Site	Date	Taxon	TSN	Phylum	Class	Order	Family	Subfamily	Tribe	Genus (sub gen)	Species	Count	Life Stage	ID date	Processing date
NRS18-AK-10159	6/26/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	39	L	8/20/19	5/28/19
	6/26/18	Polypedilum tritum	129719	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum	tritum	20	L	8/20/19	5/28/19
	6/26/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		9	L	8/20/19	5/28/19
	6/26/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			3	P	8/20/19	5/28/19
	6/26/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/ Orthocladius		2	L	8/20/19	5/28/19
	6/26/18	Heterotrissocladius subpilosus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Heterotrissocladius	subpilosus group	2	L	8/20/19	5/28/19
	6/26/18	Heterotrissocladius marcidus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Heterotrissocladius	marcidus group	2	L	8/20/19	5/28/19
	6/26/18	Hydrobaenus sp.	128750	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Hydrobaenus		21	L	8/20/19	5/28/19
	6/26/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		1	L	8/20/19	5/28/19
	6/26/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		15	L	8/20/19	5/28/19
	6/26/18	Parametriocnemus sp.	128978	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parametriocnemus		1	L	8/20/19	5/28/19
	6/26/18	Pseudosmittia sp.	129071	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Pseudosmittia		1	L	8/20/19	5/28/19
	6/26/18	Tvetenia sp.	129197	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Tvetenia		2	L	8/20/19	5/28/19
	6/26/18	Oreodytes sp.	112314	Arthropoda	Insecta	Coleoptera	Dytiscidae			Oreodytes		1	A	9/5/19	5/28/19
	6/26/18	Oligochaeta	68422	Annelida	Oligochaeta							2	U	9/5/19	5/28/19
	6/26/18	Clinocera sp.	135849	Arthropoda	Insecta	Diptera	Empididae			Clinocera		1	L	9/5/19	5/28/19
	6/26/18	Simuliidae	126640	Arthropoda	Insecta	Diptera	Simuliidae					1	L	9/5/19	5/28/19
NRS18-AK-10160	6/25/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	34	L	8/21/19	6/4/19
	6/25/18	Polypedilum tritum	129719	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum	tritum	23	L	8/21/19	6/4/19
	6/25/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		19	L	8/21/19	6/4/19
	6/25/18	Conchapelopia sp.	128130	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Conchapelopia		3	L	8/21/19	6/4/19
	6/25/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	P	8/21/19	6/4/19
	6/25/18	Corynoneura sp.	128563	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Corynoneura		1	L	8/21/19	6/4/19
	6/25/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	4	L	8/21/19	6/4/19
	6/25/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	3	L	8/21/19	6/4/19
	6/25/18	Eukiefferiella claripennis group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	claripennis group	1	L	8/21/19	6/4/19
	6/25/18	Eukiefferiella devonica group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	devonica group	2	L	8/21/19	6/4/19
	6/25/18	Hydrobaenus sp.	128750	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Hydrobaenus		16	L	8/21/19	6/4/19
	6/25/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		1	L	8/21/19	6/4/19
	6/25/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		21	L	8/21/19	6/4/19
	6/25/18	Pseudosmittia sp.	129071	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Pseudosmittia		1	L	8/21/19	6/4/19
	6/25/18	Tvetenia sp.	129197	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Tvetenia		6	L	8/21/19	6/4/19
	6/25/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		3	L	9/5/19	6/4/19
	6/25/18	Ephemerella sp.	101233	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerella		1	L	9/5/19	6/4/19
	6/25/18	Isoperla sp.	102995	Arthropoda	Insecta	Plecoptera	Perlodidae			Isoperla		1	L	9/5/19	6/4/19
	6/25/18	Hydra										2	U	9/5/19	6/4/19
	6/25/18	Oribatida	733326	Arthropoda	Arachnida	Sarcoptiformes						1	A	9/5/19	6/4/19
	6/25/18	Oligochaeta	68422	Annelida	Oligochaeta							2	U	9/5/19	6/4/19
	6/25/18	Limnephilidae	115933	Arthropoda	Insecta	Trichoptera	Limnephilidae					6	L	9/5/19	6/4/19
	6/25/18	Onocosmoecus sp.	116315	Arthropoda	Insecta	Trichoptera	Limnephilidae			Onocosmoecus		2	L	9/5/19	6/4/19
	6/25/18	Simulium sp.	126774	Arthropoda	Insecta	Diptera	Simuliidae			Simulium		2	L	10/11/19	6/4/19
NRS18-AK-10162	6/27/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	49	L	8/21/19	6/22/19
	6/27/18	Polypedilum tritum	129719	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum	tritum	50	L	8/21/19	6/22/19
	6/27/18	Sergentia sp.	129739	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Sergentia		1	L	8/21/19	6/22/19
	6/27/18	Pagastia partica	128403	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Pagastia	partica	1	L	8/21/19	6/22/19
	6/27/18	Tanypodinae	127994	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae			1	P	8/21/19	6/22/19
	6/27/18	Conchapelopia sp.	128130	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Conchapelopia		16	L	8/21/19	6/22/19
	6/27/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		21	L	8/21/19	6/22/19

	6/27/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			3	P	8/21/19	6/22/19
	6/27/18	Corynoneura sp.	128563	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Corynoneura		1	L	8/21/19	6/22/19
	6/27/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	28	L	8/21/19	6/22/19
	6/27/18	Cricotopus tremulus	128651	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	tremulus	1	L	8/21/19	6/22/19
	6/27/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		4	L	8/21/19	6/22/19
	6/27/18	Eukiefferiella sp.	128689	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella		2	P	8/21/19	6/22/19
	6/27/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	16	L	8/21/19	6/22/19
	6/27/18	Eukiefferiella devonica group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	devonica group	1	L	8/21/19	6/22/19
	6/27/18	Heterotrissocladius marcidus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Heterotrissocladius	marcidus group	1	L	8/21/19	6/22/19
	6/27/18	Hydrobaenus sp.	128750	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Hydrobaenus		43	L	8/21/19	6/22/19
	6/27/18	Krenosmittia sp.	128771	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Krenosmittia		1	L	8/21/19	6/22/19
	6/27/18	Orthocladius (Orthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Orthocladius)		10	L	8/21/19	6/22/19
	6/27/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		67	L	8/21/19	6/22/19
	6/27/18	Parametriocnemus sp.	128978	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parametriocnemus		1	L	8/21/19	6/22/19
	6/27/18	Rheocricotopus sp.	129086	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Rheocricotopus		1	L	8/21/19	6/22/19
	6/27/18	Thienemanniella sp.	129182	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Thienemanniella		1	L	8/21/19	6/22/19
	6/27/18	Tvetenia sp.	129197	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Tvetenia		15	L	8/21/19	6/22/19
	6/27/18	Oliveridia sp.	128867	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Oliveridia		1	L	8/21/19	6/22/19
	6/27/18	Brillia retifinis	128482	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Brillia	retifinis	1	L	8/21/19	6/22/19
	6/27/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		1	L	9/9/19	6/22/19
	6/27/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	3	L	9/9/19	6/22/19
	6/27/18	Baetis tricaudatus	100817	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	tricaudatus	1	L	9/9/19	6/22/19
	6/27/18	Serratella sp.	101395	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Serratella		14	L	9/9/19	6/22/19
	6/27/18	Chloroperlidae	103202	Arthropoda	Insecta	Plecoptera	Chloroperlidae					4	L	9/9/19	6/22/19
	6/27/18	Capniidae	102643	Arthropoda	Insecta	Plecoptera	Capniidae					1	L	9/9/19	6/22/19
	6/27/18	Lebertia sp.	83034	Arthropoda	Arachnida	Trombidiformes	Lebertiidae			Lebertia		1	A	9/9/19	6/22/19
	6/27/18	Oligochaeta	68422	Annelida	Oligochaeta							9	U	9/9/19	6/22/19
	6/27/18	Nematoda	59490	Nematoda								2	U	9/9/19	6/22/19
	6/27/18	Metachela/Chelifera sp.	136347/ 136305	Arthropoda	Insecta	Diptera	Empididae			Metachela/Chelifera		6	L	9/9/19	6/22/19
	6/27/18	Simulium sp.	126774	Arthropoda	Insecta	Diptera	Simuliidae			Simulium		2	L	9/9/19	6/22/19
	6/27/18	Erioptera sp.	120503	Arthropoda	Insecta	Diptera	Tipulidae			Erioptera		1	L	9/9/19	6/22/19
	6/27/18	Zapada frigida	102601	Arthropoda	Insecta	Plecoptera	Nemouridae			Zapada	frigida	2	L	9/9/19	6/22/19
	6/27/18	Syrphidae	139621	Arthropoda	Insecta	Diptera	Syrphidae					1	L	9/9/19	6/22/19
NRS18-AK-10165	6/24/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	36	L	8/21/19	6/26/19
	6/24/18	Polypedilum tritum	129719	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum	tritum	28	L	8/21/19	6/26/19
	6/24/18	Conchapelopia sp.	128130	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Conchapelopia		5	L	8/21/19	6/26/19
	6/24/18	Tanytarsus sp.	129978	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsus		1	L	8/21/19	6/26/19
	6/24/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		12	L	8/21/19	6/26/19
	6/24/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			2	P	8/21/19	6/26/19
	6/24/18	Brillia retifinis	128482	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Brillia	retifinis	3	L	8/21/19	6/26/19
	6/24/18	Corynoneura sp.	128563	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Corynoneura		1	L	8/21/19	6/26/19
	6/24/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	20	L	8/21/19	6/26/19
	6/24/18	Cricotopus tremulus	128651	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	tremulus	1	L	8/21/19	6/26/19
	6/24/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		13	L	8/21/19	6/26/19
	6/24/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	20	L	8/21/19	6/26/19
	6/24/18	Hydrobaenus sp.	128750	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Hydrobaenus		13	L	8/21/19	6/26/19
	6/24/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		1	L	8/21/19	6/26/19
	6/24/18	Orthocladius (Orthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Orthocladius)		1	L	8/21/19	6/26/19
	6/24/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		6	L	8/21/19	6/26/19
	6/24/18	Parametriocnemus sp.	128978	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parametriocnemus		3	L	8/21/19	6/26/19
	6/24/18	Pseudosmittia sp.	129071	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Pseudosmittia		3	L	8/21/19	6/26/19
	6/24/18	Rheocricotopus sp.	129086	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Rheocricotopus		1	L	8/21/19	6/26/19

	6/24/18	Tvetenia sp.	129197	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Tvetenia		7	L	8/21/19	6/26/19
	6/24/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		1	L	9/9/19	6/26/19
	6/24/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	2	L	9/9/19	6/26/19
	6/24/18	Serratella sp.	101395	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Serratella		2	L	9/9/19	6/26/19
	6/24/18	Isoperla sp.	102995	Arthropoda	Insecta	Plecoptera	Perlodidae			Isoperla		1	L	9/9/19	6/26/19
	6/24/18	Oribatida	733326	Arthropoda	Arachnida	Sarcoptiformes						1	A	9/9/19	6/26/19
	6/24/18	Oligochaeta	68422	Annelida	Oligochaeta							9	U	9/9/19	6/26/19
	6/24/18	Limnephilidae	115933	Arthropoda	Insecta	Trichoptera	Limnephilidae					1	L	9/9/19	6/26/19
	6/24/18	Simulium sp.	126774	Arthropoda	Insecta	Diptera	Simuliidae			Simulium		1	L	9/9/19	6/26/19
	6/24/18	Nematoda	59490	Nematoda								1	U	9/9/19	6/26/19
NRS18-AK-10167	6/28/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	60	L	8/22/19	6/28/19
	6/28/18	Polypedilum tritum	129719	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum	tritum	75	L	8/22/19	6/28/19
	6/28/18	Conchapelopia sp.	128130	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Conchapelopia		12	L	8/22/19	6/28/19
	6/28/18	Conchapelopia sp.	128130	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Conchapelopia		1	P	8/22/19	6/28/19
	6/28/18	Micropsectra sp.	129890	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Micropsectra		1	L	8/22/19	6/28/19
	6/28/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		32	L	8/22/19	6/28/19
	6/28/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			6	P	8/22/19	6/28/19
	6/28/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	4	L	8/22/19	6/28/19
	6/28/18	Diplocladius sp.	128670	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Diplocladius		2	L	8/22/19	6/28/19
	6/28/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	1	L	8/22/19	6/28/19
	6/28/18	Eukiefferiella gracei group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	gracei group	3	L	8/22/19	6/28/19
	6/28/18	Hydrobaenus sp.	128750	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Hydrobaenus		57	L	8/22/19	6/28/19
	6/28/18	Orthocladius (Orthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Orthocladius)		5	L	8/22/19	6/28/19
	6/28/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		118	L	8/22/19	6/28/19
	6/28/18	Thienemanniella xena	129190	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Thienemanniella	xena	1	L	8/22/19	6/28/19
	6/28/18	Tvetenia sp.	129197	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Tvetenia		4	L	8/22/19	6/28/19
	6/28/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		3	L	8/22/19	6/28/19
	6/28/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		2	P	8/22/19	6/28/19
	6/28/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		4	L	9/10/19	6/28/19
	6/28/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	1	L	9/10/19	6/28/19
	6/28/18	Serratella sp.	101395	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Serratella		11	L	10/11/19	6/28/19
	6/28/18	Cinygmula sp.	100557	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Cinygmula		1	L	9/10/19	6/28/19
	6/28/18	Chloroperlidae	103202	Arthropoda	Insecta	Plecoptera	Chloroperlidae					1	L	9/10/19	6/28/19
	6/28/18	Perlodidae	102994	Arthropoda	Insecta	Plecoptera	Perlodidae					1	L	9/10/19	6/28/19
	6/28/18	Isoperla sp.	102995	Arthropoda	Insecta	Plecoptera	Perlodidae			Isoperla		2	L	9/10/19	6/28/19
	6/28/18	Oligochaeta	68422	Annelida	Oligochaeta							3	U	9/10/19	6/28/19
	6/28/18	Onocosmoecus sp.	116315	Arthropoda	Insecta	Trichoptera	Limnephilidae			Onocosmoecus		1	L	9/10/19	6/28/19
	6/28/18	Metachela/Chelifera sp.	136347/136305	Arthropoda	Insecta	Diptera	Empididae			Metachela/Chelifera		4	L	9/10/19	6/28/19
	6/28/18	Tipulidae	118840	Arthropoda	Insecta	Diptera	Tipulidae					1	L	9/10/19	6/28/19
NRS18-AK-TAKU1	6/27/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	35	L	8/22/19	7/15/19
	6/27/18	Polypedilum tritum	129719	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum	tritum	29	L	8/22/19	7/15/19
	6/27/18	Pagastia partica	128403	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Pagastia	partica	1	L	8/22/19	7/15/19
	6/27/18	Conchapelopia sp.	128130	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Conchapelopia		3	L	8/22/19	7/15/19
	6/27/18	Odontomesa sp.	128446	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Odontomesa		1	L	8/22/19	7/15/19
	6/27/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		25	L	8/22/19	7/15/19
	6/27/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			7	P	8/22/19	7/15/19
	6/27/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		5	L	8/22/19	7/15/19
	6/27/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	2	L	8/22/19	7/15/19
	6/27/18	Eukiefferiella devonica group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	devonica group	2	L	8/22/19	7/15/19
	6/27/18	Orthocladius (Orthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Orthocladius)		1	L	8/22/19	7/15/19
	6/27/18	Orthocladius (Euorthocladius) nr. luteipes		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)	nr. luteipes	1	L	8/22/19	7/15/19
	6/27/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		39	L	8/22/19	7/15/19

	6/27/18	Tvetenia sp.	129197	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Tvetenia		5	L	8/22/19	7/15/19
	6/27/18	Hydrobaenus sp.	128750	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Hydrobaenus		35	L	8/22/19	7/15/19
NRS18-AK-TAKU2	6/23/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	24	L	8/22/19	7/17/19
	6/23/18	Polypedilum tritum	129719	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum	tritum	22	L	8/22/19	7/17/19
	6/23/18	Stictochironomus sp.	129785	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Stictochironomus		1	L	8/22/19	7/17/19
	6/23/18	Conchapelopia sp.	128130	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Conchapelopia		4	L	8/22/19	7/17/19
	6/23/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		9	L	8/22/19	7/17/19
	6/23/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	P	8/22/19	7/17/19
	6/23/18	Chaetocladius sp.	128520	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Chaetocladius		1	L	8/22/19	7/17/19
	6/23/18	Corynoneura sp.	128563	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Corynoneura		1	L	8/22/19	7/17/19
	6/23/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	2	L	8/22/19	7/17/19
	6/23/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		15	L	8/22/19	7/17/19
	6/23/18	Hydrobaenus sp.	128750	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Hydrobaenus		18	L	8/22/19	7/17/19
	6/23/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		2	L	8/22/19	7/17/19
	6/23/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		2	P	8/22/19	7/17/19
	6/23/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		1	L	8/22/19	7/17/19
	6/23/18	Tvetenia sp.	129197	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Tvetenia		1	L	8/22/19	7/17/19
	6/23/18	Paramerina sp.	128207	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodinae	Paramerina		2	L	8/22/19	7/17/19
	6/23/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		7	L		7/17/19
	6/23/18	Ephemerella sp.	101233	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerella		1	L		7/17/19
	6/23/18	Oribatida	733326	Arthropoda	Arachnida	Sarcoptiformes						1	L		7/17/19
	6/23/18	Lymnaeidae	76483	Mollusca	Gastropoda	Basommatophora	Lymnaeidae					1	U		7/17/19
	6/23/18	Oligochaeta	68422	Annelida	Oligochaeta							1	U		7/17/19
	6/23/18	Simulium sp.	126774	Arthropoda	Insecta	Diptera	Simuliidae			Simulium		3	L		7/17/19
	6/23/18	Tipulidae	118840	Arthropoda	Insecta	Diptera	Tipulidae					1	L		7/17/19
	6/23/18	Limnophila sp.	120164	Arthropoda	Insecta	Diptera	Tipulidae			Limnophila		1	L		7/17/19
	6/27/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		4	L	9/9/19	7/15/19
	6/27/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	1	L	9/9/19	7/15/19
	6/27/18	Ephemerella sp.	101233	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerella		18	L	9/9/19	7/15/19
	6/27/18	Cinygmula sp.	100557	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Cinygmula		4	L	9/9/19	7/15/19
	6/27/18	Chloroperlidae	103202	Arthropoda	Insecta	Plecoptera	Chloroperlidae					4	L	9/9/19	7/15/19
	6/27/18	Oligochaeta	68422	Annelida	Oligochaeta							2	L	9/9/19	7/15/19
	6/27/18	Simulium sp.	126774	Arthropoda	Insecta	Diptera	Simuliidae			Simulium		1	L	9/9/19	7/15/19

Table C- 5. DEC Stikine Watershed Benthic Macroinvertebrate Taxonomic Identification Results

Site	Date	Taxon	TSN	Phylum	Class	Order	Family	Subfamily	Tribe	Genus (sub gen)	Species	Count	Life Stage	ID date	Processing date
NRS18-AK-10139	7/17/18	Simulium sp.	126774	Arthropoda	Insecta	Diptera	Simuliidae			Simulium		1	L	5/30/19	5/7/19
	7/17/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	P	5/30/19	5/7/19
	7/17/18	Cryptochironomus sp.	129368	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Cryptochironomus		1	L	5/30/19	5/7/19
	7/17/18	Gastropoda	69459	Mollusca	Gastropoda							1	U	5/30/19	5/7/19
	7/17/18	Oligochaeta	68422	Annelida	Oligochaeta							1	U	5/30/19	5/7/19
NRS18-AK-10147	7/19/18	Oligochaeta	68422	Annelida	Oligochaeta							1	U	5/30/19	5/7/19
	7/19/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			2	P	5/30/19	5/7/19
	7/19/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	2	L	8/16/19	5/7/19
	7/19/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		2	L	8/16/19	5/7/19
	7/19/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	1	L	8/16/19	5/7/19
NRS18-AK-10150	7/18/18	No inverts													5/17/19
NRS18	7/20/18	Isoperla sp.	102995	Arthropoda	Insecta	Plecoptera	Perlodidae			Isoperla		1	L	8/12/19	7/18/19

	7/20/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		2	L	8/12/19	7/18/19
	7/20/18	Oligochaeta	68422	Annelida	Oligochaeta							3	U	8/12/19	7/18/19
	7/20/18	Baetis sp.	100800	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis		1	L	8/12/19	7/18/19
	7/20/18	Serratella sp.	101395	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Serratella		1	L	8/12/19	7/18/19
	7/20/18	Limnephilidae	115933	Arthropoda	Insecta	Trichoptera	Limnephilidae					1	L	8/12/19	7/18/19
	7/20/18	Odontomesa sp.	128446	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Odontomesa		1	L	8/16/19	7/18/19
	7/20/18	Platysmittia sp.	129013	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Platysmittia		1	L	8/16/19	7/18/19
NRS18-AK-STIK2	7/21/18	Oligochaeta	68422	Annelida	Oligochaeta							1	U	8/16/19	7/18/19
NRS18-AK-10064	7/22/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		1	L	5/30/19	5/7/19
	7/22/18	Perlodidae	102994	Arthropoda	Insecta	Plecoptera	Perlodidae					1	L	5/30/19	5/7/19
	7/22/18	Cinygmula sp.	100557	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Cinygmula		1	L	5/30/19	5/7/19
	7/22/18	Oligochaeta	68422	Annelida	Oligochaeta							2	U	5/30/19	5/7/19

Table C- 6. DEC Unuk Watershed Benthic Macroinvertebrate Taxonomic Identification Results

Site	Date	Taxon	TSN	Phylum	Class	Order	Family	Subfamily	Tribe	Genus (sub gen)	Species	Count	Life Stage	ID date	Processing date
NRS18-AK-10177	7/25/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	18	L	8/19/19	5/30/19
	7/25/18	Polypedilum sp.	129657	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum		1	P	8/19/19	5/30/19
	7/25/18	Micropsectra sp.	129890	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Micropsectra		4	L	8/19/19	5/30/19
	7/25/18	Monodiamesa sp.	128440	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Monodiamesa		1	L	8/19/19	5/30/19
	7/25/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	P	8/19/19	5/30/19
	7/25/18	Brillia retifinis	128482	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Brillia	retifinis	1	L	8/19/19	5/30/19
	7/25/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		1	L	8/19/19	5/30/19
	7/25/18	Cricotopus/Orthocladius 5 AKBB2015		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		1	L	8/19/19	5/30/19
	7/25/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	1	L	8/19/19	5/30/19
	7/25/18	Cricotopus annulaor complex		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	annulator complex	1	L	8/19/19	5/30/19
	7/25/18	Eukiefferiella gracei group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	gracei group	1	L	8/19/19	5/30/19
	7/25/18	Limnophyes sp.	128776	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Limnophyes		1	L	8/19/19	5/30/19
	7/25/18	Orthocladius (Euorthocladius) nr. luteipes		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)	nr. luteipes	3	L	8/19/19	5/30/19
	7/25/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		2	L	8/19/19	5/30/19
	7/25/18	Smittia sp.	129110	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Smittia		2	L	8/19/19	5/30/19
	7/25/18	Ephemerellidae	101232	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae					1	L	9/3/19	5/30/19
	7/25/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	1	L	9/3/19	5/30/19
	7/25/18	Isoperla sp.	102995	Arthropoda	Insecta	Plecoptera	Perlodidae			Isoperla		1	L	9/3/19	5/30/19
	7/25/18	Maerkelotritia alaskensis		Arthropoda	Arachnida	Sarcoptiformes	Oribotritiidae			Maerkelotritia	alaskensis	1	A	9/3/19	5/30/19
	7/25/18	Sperchon sp.	83006	Arthropoda	Arachnida	Trombidiformes	Sperchonidae			Sperchon		1	A	9/3/19	5/30/19
	7/25/18	Oligochaeta	68422	Annelida	Oligochaeta							6	U	9/3/19	5/30/19
	7/25/18	Erioptera sp.	120503	Arthropoda	Insecta	Diptera	Tipulidae			Erioptera		5	L	9/3/19	5/30/19
	7/25/18	Oreogeton sp.	136377	Arthropoda	Insecta	Diptera	Empididae			Oreogeton		1	L	9/3/19	5/30/19
	7/25/18	Diptera	118831	Arthropoda	Insecta	Diptera						1	L	9/3/19	5/30/19
	7/25/18	Oribatida	733326	Arthropoda	Arachnida	Sarcoptiformes						2	A	10/7/19	5/30/19
NRS18-AK-10178	7/27/18	Diamesa sp.	128355	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Diamesa		1	L	8/19/19	6/6/19
	7/27/18	Pagastia partica	128403	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Pagastia	partica	1	L	8/19/19	6/6/19
	7/27/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	2	L	8/19/19	6/6/19
	7/27/18	Orthocladius (Euorthocladius) nr. luteipes		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)	nr. luteipes	1	L	8/19/19	6/6/19
	7/27/18	Platysmittia sp.	129013	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Platysmittia		2	L	8/19/19	6/6/19
	7/27/18	Baetis sp.	100800	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis		2	L	9/4/19	6/6/19
	7/27/18	Ephemerellidae	101232	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae					4	L	9/4/19	6/6/19
	7/27/18	Drunella coloradensis	101389	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Drunella	coloradensis	1	L	9/4/19	6/6/19
	7/27/18	Cinygmula sp.	100557	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Cinygmula		7	L	9/4/19	6/6/19
	7/27/18	Sweltsa sp.	103273	Arthropoda	Insecta	Plecoptera	Chloroperlidae			Sweltsa		1	L	9/4/19	6/6/19
	7/27/18	Perlodidae	102994	Arthropoda	Insecta	Plecoptera	Perlodidae					2	L	9/4/19	6/6/19
	7/27/18	Oligochaeta	68422	Annelida	Oligochaeta							4	U	9/4/19	6/6/19
	7/27/18	Onocosmoecus sp.	116315	Arthropoda	Insecta	Trichoptera	Limnephilidae			Onocosmoecus		1	L	9/4/19	6/6/19
	7/27/18	Probezzia sp.	127729	Arthropoda	Insecta	Diptera	Ceratopogonidae			Probezzia		1	L	9/4/19	6/6/19
	7/27/18	Oreogeton sp.	136377	Arthropoda	Insecta	Diptera	Empididae			Oreogeton		1	L	9/4/19	6/6/19
	7/26/18	Diamesa latitarsis		Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Diamesa	latitarsis	2	L	8/19/19	6/18/19
	7/26/18	Diamesa sp.	128355	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Diamesa		1	L	8/19/19	6/18/19
	7/26/18	Micropsectra sp.	129890	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Micropsectra		1	L	8/19/19	6/18/19
NRS18-AK-10180	7/26/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			3	P	8/19/19	6/18/19
	7/26/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	L	8/19/19	6/18/19
	7/26/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	1	L	8/19/19	6/18/19
	7/26/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		1	L	8/19/19	6/18/19
	7/26/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	6	L	8/19/19	6/18/19

	7/26/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		9	L	8/19/19	6/18/19
	7/26/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		1	L	8/19/19	6/18/19
	7/26/18	Platysmittia sp.	129013	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Platysmittia		55	L	8/19/19	6/18/19
	7/26/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		4	L	9/9/19	6/18/19
	7/26/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	35	L	9/9/19	6/18/19
	7/26/18	Heptageniidae	100504	Arthropoda	Insecta	Ephemeroptera	Heptageniidae					5	L	9/9/19	6/18/19
	7/26/18	Cinygmula sp.	100557	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Cinygmula		19	L	9/9/19	6/18/19
	7/26/18	Rhithrogena sp.	100572	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena		11	L	9/9/19	6/18/19
	7/26/18	Sweltsa sp.	103273	Arthropoda	Insecta	Plecoptera	Chloroperlidae			Sweltsa		33	L	9/9/19	6/18/19
	7/26/18	Chloroperlidae	103202	Arthropoda	Insecta	Plecoptera	Chloroperlidae					7	L	9/9/19	6/18/19
	7/26/18	Zapada sp.	102591	Arthropoda	Insecta	Plecoptera	Nemouridae			Zapada		1	L	9/9/19	6/18/19
	7/26/18	Perlodidae	102994	Arthropoda	Insecta	Plecoptera	Perlodidae					2	L	9/9/19	6/18/19
	7/26/18	Isoperla sp.	102995	Arthropoda	Insecta	Plecoptera	Perlodidae			Isoperla		2	L	9/9/19	6/18/19
	7/26/18	Lebertia sp.	83034	Arthropoda	Arachnida	Trombidiformes	Lebertiidae			Lebertia		1	A	9/9/19	6/18/19
	7/26/18	Oreogeton sp.	136377	Arthropoda	Insecta	Diptera	Empididae			Oreogeton		1	L	9/9/19	6/18/19
NRS18-AK-10181	7/29/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	3	L	8/19/19	6/6/19
	7/29/18	Diamesa sp.	128355	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Diamesa		1	L	8/19/19	6/6/19
	7/29/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	P	8/19/19	6/6/19
	7/29/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	L	8/19/19	6/6/19
	7/29/18	Bryophaenocladius sp.	128488	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Bryophaenocladius		2	L	8/19/19	6/6/19
	7/29/18	Cricotopus/Orthocladius 1 AKBB2015		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		1	L	8/19/19	6/6/19
	7/29/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	1	L	8/19/19	6/6/19
	7/29/18	Parametriocnemus sp.	128978	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parametriocnemus		1	L	8/19/19	6/6/19
	7/29/18	Pseudosmittia sp.	129071	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Pseudosmittia		1	L	8/19/19	6/6/19
	7/29/18	Odontomesa sp.	128446	Arthropoda	Insecta	Diptera	Chironomidae	Prodiamesinae	Prodiamesinae	Odontomesa		1	L	8/19/19	6/6/19
	7/29/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		5	L	9/5/19	6/6/19
	7/29/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	1	L	9/5/19	6/6/19
	7/29/18	Ephemerellidae	101232	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae					1	L	9/5/19	6/6/19
	7/29/18	Heptageniidae	100504	Arthropoda	Insecta	Ephemeroptera	Heptageniidae					1	L	9/5/19	6/6/19
	7/29/18	Zapada sp.	102591	Arthropoda	Insecta	Plecoptera	Nemouridae			Zapada		1	L	9/5/19	6/6/19
	7/29/18	Hydrophilidae		Arthropoda	Insecta	Coleoptera	Hydrophilidae					1	A	9/5/19	6/6/19
	7/29/18	Oligochaeta	68422	Annelida	Oligochaeta							1	U	9/5/19	6/6/19
	7/29/18	Limnephilidae	115933	Arthropoda	Insecta	Trichoptera	Limnephilidae					2	L	9/5/19	6/6/19
NRS18-AK-10182	7/28/18	Paracladopelma undine	129612	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma	undine	6	L	8/19/19	6/20/19
	7/28/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			1	P	8/19/19	6/20/19
	7/28/18	Brillia retifinis	128482	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Brillia	retifinis	1	L	8/19/19	6/20/19
	7/28/18	Corynoneura sp.	128563	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Corynoneura		1	L	8/19/19	6/20/19
	7/28/18	Cricotopus infuscatus group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus	infuscatus group	1	L	8/19/19	6/20/19
	7/28/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		1	L	8/19/19	6/20/19
	7/28/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	1	L	8/19/19	6/20/19
	7/28/18	Limnophyes sp.	128776	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Limnophyes		1	L	8/19/19	6/20/19
	7/28/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		1	L	8/19/19	6/20/19
	7/28/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		5	L	8/19/19	6/20/19
	7/28/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		2	L	9/9/19	6/20/19
	7/28/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	1	L	9/9/19	6/20/19
	7/28/18	Baetis sp.	100800	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis		2	L	9/9/19	6/20/19
	7/28/18	Ephemerellidae	101232	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae					1	L	9/9/19	6/20/19
	7/28/18	Chloroperlidae	103202	Arthropoda	Insecta	Plecoptera	Chloroperlidae					2	L	9/9/19	6/20/19
	7/28/18	Lymnaeidae	76483	Mollusca	Gastropoda	Basommatophora	Lymnaeidae					1	U	9/9/19	6/20/19
	7/28/18	Oligochaeta	68422	Annelida	Oligochaeta							2	U	9/9/19	6/20/19
	7/28/18	Limnephilidae	115933	Arthropoda	Insecta	Trichoptera	Limnephilidae					1	L	9/9/19	6/20/19
	7/28/18	Erioptera sp.	120503	Arthropoda	Insecta	Diptera	Tipulidae			Erioptera		1	L	9/9/19	6/20/19

NRS18-AK-UNUK1	7/28/18	Diamesa sp.	128355	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Diamesa		2	L	8/19/19	6/19/19
	7/28/18	Pagastia partica	128403	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Pagastia	partica	5	L	8/19/19	6/19/19
	7/28/18	Orthocladiinae	128457	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae			3	P	8/19/19	6/19/19
	7/28/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		2	L	8/19/19	6/19/19
	7/28/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	4	L	8/19/19	6/19/19
	7/28/18	Eukiefferiella sp.	128689	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella		1	P	8/19/19	6/19/19
	7/28/18	Orthocladius (Euorthocladius) nr. luteipes		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)	nr. luteipes	1	L	8/19/19	6/19/19
	7/28/18	Parakiefferiella sp.	128968	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Parakiefferiella		2	L	8/19/19	6/19/19
	7/28/18	Platysmittia sp.	129013	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Platysmittia		16	L	8/19/19	6/19/19
	7/28/18	Psilometriocnemus sp.	129083	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Psilometriocnemus		1	L	8/19/19	6/19/19
	7/28/18	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		5	L	9/10/19	6/19/19
	7/28/18	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	44	L	9/10/19	6/19/19
	7/28/18	Heptageniidae	100504	Arthropoda	Insecta	Ephemeroptera	Heptageniidae					1	L	9/10/19	6/19/19
	7/28/18	Cinygmula sp.	100557	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Cinygmula		33	L	9/10/19	6/19/19
	7/28/18	Rhithrogena sp.	100572	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena		6	L	9/10/19	6/19/19
	7/28/18	Chloroperlidae	103202	Arthropoda	Insecta	Plecoptera	Chloroperlidae					4	L	9/10/19	6/19/19
	7/28/18	Sweltsa sp.	103273	Arthropoda	Insecta	Plecoptera	Chloroperlidae			Sweltsa		68	L	9/10/19	6/19/19
	7/28/18	Zapada sp.	102591	Arthropoda	Insecta	Plecoptera	Nemouridae			Zapada		5	L	9/10/19	6/19/19
	7/28/18	Perlodidae	102994	Arthropoda	Insecta	Plecoptera	Perlodidae					12	L	9/10/19	6/19/19
	7/28/18	Isoperla sp.	102995	Arthropoda	Insecta	Plecoptera	Perlodidae			Isoperla		2	L	9/10/19	6/19/19
	7/28/18	Megarcys sp.	103110	Arthropoda	Insecta	Plecoptera	Perlodidae		Perlodinae	Megarcys		2	L	9/10/19	6/19/19
	7/28/18	Hydroporinae	678402	Arthropoda	Insecta	Coleoptera	Dytiscidae					1	L	9/10/19	6/19/19
	7/28/18	Hygrobates sp.	83297	Arthropoda	Arachnida	Trombidiformes	Hygrobatidae			Hygrobates		2	A	9/10/19	6/19/19
	7/28/18	Sperchon sp.	83006	Arthropoda	Arachnida	Trombidiformes	Sperchonidae			Sperchon		1	A	9/10/19	6/19/19
	7/28/18	Dicranota sp.	121027	Arthropoda	Insecta	Diptera	Tipulidae			Dicranota		1	L	9/10/19	6/19/19
	7/28/18	Tipula sp.	119037	Arthropoda	Insecta	Diptera	Tipulidae			Tipula		2	L	9/10/19	6/19/19
NRS18-AK-UNUK2	7/27/18	Diamesa sp.	128355	Arthropoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesinae	Diamesa		1	L	8/19/19	6/19/19
	7/27/18	Micropsectra sp.	129890	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Micropsectra		1	L	8/19/19	6/19/19
	7/27/18	Cricotopus/Orthocladius sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Cricotopus/Orthocladius		1	L	8/19/19	6/19/19
	7/27/18	Eukiefferiella brehmi group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	brehmi group	1	L	8/19/19	6/19/19
	7/27/18	Eukiefferiella claripennis group		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Eukiefferiella	claripennis group	1	L	8/19/19	6/19/19
	7/27/18	Orthocladius (Euorthocladius) sp.		Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiinae	Orthocladius (Euorthocladius)		1	L	8/19/19	6/19/19
	7/27/08	Ameletus sp.	100996	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus		3	L	9/4/19	6/19/19
	7/27/08	Baetis bicaudatus	100823	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis	bicaudatus	10	L	9/4/19	6/19/19
	7/27/08	Ephemerellidae	101232	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae					2	L	9/4/19	6/19/19
	7/27/08	Ephemerella sp.	101233	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerella		1	L	9/4/19	6/19/19
	7/27/08	Cinygmula sp.	100557	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Cinygmula		5	L	9/4/19	6/19/19
	7/27/08	Chloroperlidae	103202	Arthropoda	Insecta	Plecoptera	Chloroperlidae					12	L	9/4/19	6/19/19
	7/27/08	Zapada sp.	102591	Arthropoda	Insecta	Plecoptera	Nemouridae			Zapada		1	L	9/4/19	6/19/19
	7/27/08	Perlodidae	102994	Arthropoda	Insecta	Plecoptera	Perlodidae					1	L	9/4/19	6/19/19
	7/27/08	Oligochaeta	68422	Annelida	Oligochaeta							4	U	9/4/19	6/19/19

Table C- 7. TRTFN Benthic Taxonomic Study Results

Living Streams Environmental Services

1506 East 35th Ave., Vancouver, BC
E-mail: livingstreams@live.ca
Cell: (778)-385-1447

Tulsequah River Invertebrate Quality Monitoring

Phylum	Class	Order	Family	Genus/Species	TUL01	TUL02	TUL03	TUL04	TUL05	TUL06	TUL07	TUL08	TUL09	TUL10	TUL11	TUL12	Total
P. ANNELIDA	Cl. CLITELLATA	O. Lumbriculida	F. Enchytraeidae	(damaged)	1												1
		O. Opisthopora	F. Lumbricidae	(unidentified)				1									1
P. ARTHROPODA	Cl. INSECTA	O. Ephemeroptera	F. Ameletidae	*Ameletus sp.*		1	2		8				4				15
			F. Baetidae	*Baetis sp.*	2	7	1	27	9	4	1	10	2		22	20	105
			F. Ephemerellidae	*Drunella doddsii*					1							1	2
			F. Heptageniidae	*Cinygmula sp.*				1	10						1		12
				Epeorus sp.					1								1
				Rhithrogena sp.		3	1	7	2	1	2	9	1		13	12	51
		O. Plecoptera	F Capniidae	*(immature)*	2	2		11	8	13		3	4	5	1		49
			F. Chloroperlidae	*Alloperla sp.*				2	2		1			11		84	100
				(immature)		2	2	4				2	33		19		62
			F. Leuctridae	*Despaxia sp.*				1									1
			F. Nemouridae	*Visoka cataractae*					1								1
				Zapada sp.	1			1	1			1					4
				Zapada cinctipes					1								1
				Zapada columbiana												4	4
			F. Perlodidae	*Megarcys sp.*		4		2	1	7	3	1			3		21
			F. Taeniopterygidae	(immature)	1	32	4	95	68	227	45	20	20		251	179	942
		O. Trichoptera	F. Hydropsychidae	(immature)												1	1
			F. Limnephilidae	(immature)								1		2			3
				Ecclisomyia sp.				4									4
			F. Philopotamidae	(immature)				1						1			2
			F. Rhyacophilidae	*Rhyacophila sp.*												1	1
		O. Diptera	F. Ceratopogonidae	*Forcipomyia sp.*				1									1
		_	F. Chironomidae	Diamesinae (immature)							2				1		3
		_		Orthocladiinae (immatures)				3			9		1	2			15
		_		*Brillia sp.*				1	1								2
		_		*Cricotopus sp./Orthocladius sp.*				1				1					2
		_		*Diamesa sp.*	8	11	22	38	12	25	4	12	27	2	29	3	193
		_		*Diplocladius sp.*										2	1		3
		_		*Eukiefferiella sp.*				1	1								2
				Parametriocnemus sp.				3		2	1		3	4	3	3	19
				Pagastia sp.		1				6		1		8	2	7	25
				Pseudodiamesa sp.										5	1		6
				Rheocricotopus sp.	1												1
				Tanytarsus sp.		1		1					1	2	3		8
			F. Tipulidae	*Dicranota sp.*										2		3	5
				Hesperoconopa sp.										5			5
				Tipula sp												1	1
				Total Number of Organisms	**16**	**64**	**32**	**206**	**127**	**285**	**68**	**61**	**96**	**51**	**350**	**319**	**1675**
				Total Number of Taxa	**7**	**10**	**6**	**21**	**16**	**8**	**9**	**11**	**10**	**13**	**14**	**13**	**39**

Table C- 8. DEC Periphyton Chlorophyll-a Results

Date	Sample ID	Type	Fraction	Chlorophyll a (µg/L)	Phaeophytin a (µg/L)
6/23/18	NRS18-AK-TAKU2	Grab	Periphyton	32.04	12.82
6/24/18	NRS18-AK-10165	Grab	Periphyton	64.08	10.68
6/25/18	NRS18-AK-10160	Grab	Periphyton	96.12	8.54
6/26/18	NRS18-AK-10159	Grab	Periphyton	10.68	4.27
6/27/18	NRS18-AK-10162	Grab	Periphyton	170.88	38.45
6/27/18	NRS18-AK-TAKU1	Grab	Periphyton	299.04	119.62
6/28/18	NRS18-AK-10167	Grab	Periphyton	21.36	1.07
7/17/18	NRS18-AK-10139	Grab	Periphyton	74.76	29.90
7/18/18	NRS18-AK-10150	Grab	Periphyton	53.40	6.41
7/19/18	NRS18-AK-10147	Grab	Periphyton	21.36	1.07
7/20/18	NRS18-AK-STIK1	Grab	Periphyton	0.00	7.48
7/21/18	NRS18-AK-STIK2	Grab	Periphyton	32.04	12.82
7/22/18	NRS18-AK-10064	Grab	Periphyton	21.36	8.54
7/25/18	NRS18-AK-10177	Grab	Periphyton	42.72	9.61
7/26/18	NRS18-AK-10180	Grab	Periphyton	112.14	3.74
7/26/18	NRS18-AK-UNUK1	Grab	Periphyton	32.04	1.60
7/27/18	NRS18-AK-UNUK2	Grab	Periphyton	48.06	8.01
7/27/18	NRS18-AK-10178	Grab	Periphyton	21.36	1.07
7/28/18	NRS18-AK-10182	Grab	Periphyton	53.40	25.10
7/29/18	NRS18-AK-10181	Grab	Periphyton	26.70	3.20