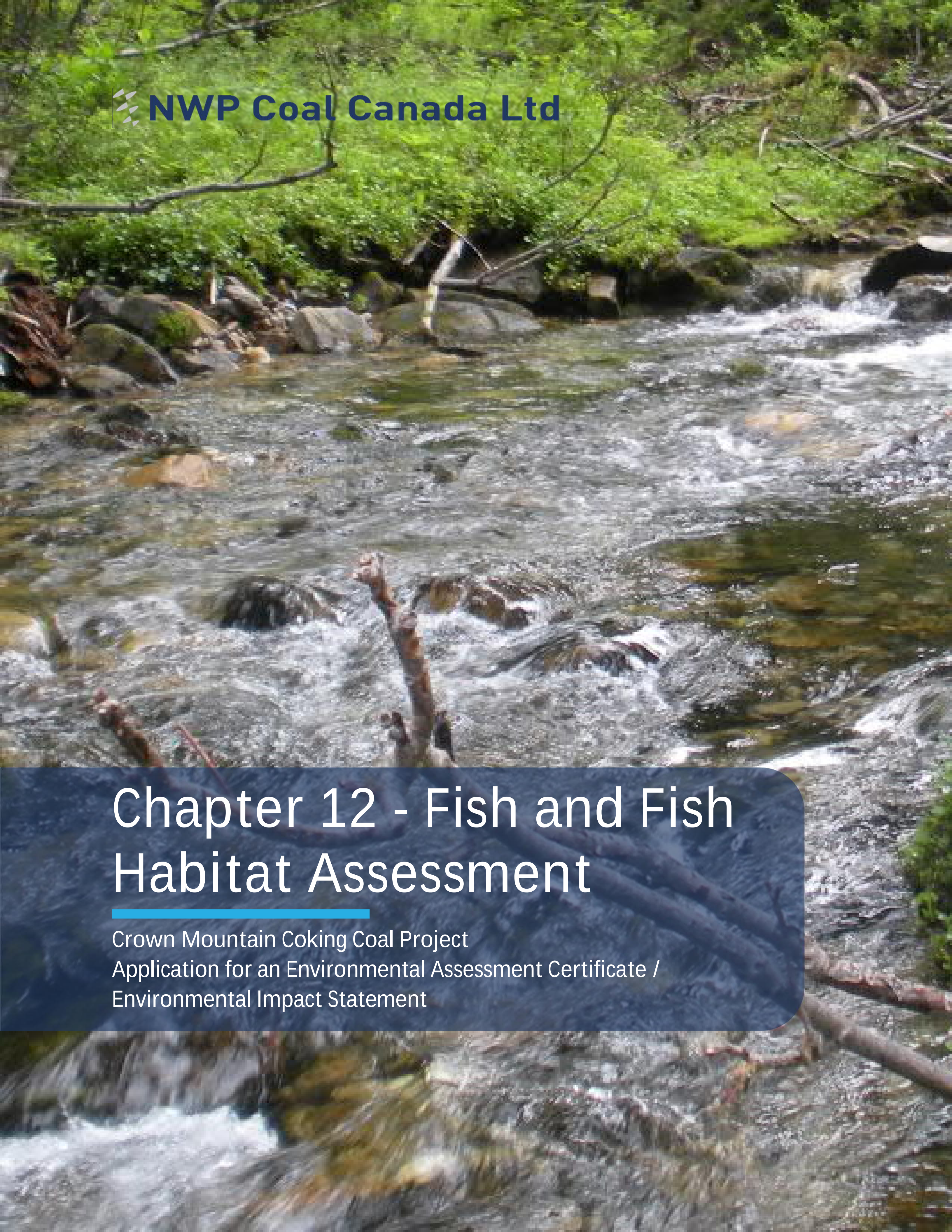

NWP Coal Canada Ltd

Chapter 12 - Fish and Fish Habitat Assessment

Crown Mountain Coking Coal Project
Application for an Environmental Assessment Certificate / Environmental Impact Statement

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12. Fish and Fish Habitat Assessment

12.1 Introduction

This chapter is an assessment of potential fish and fish habitat effects as they relate to the Project. Fish and fish habitat are critical components of the aquatic environment and are protected under the *Fisheries Act* (1985). Fish and fish habitat are thus linked to important identified valued components (or sub-components) including groundwater, surface water quality, surface water quantity, primary and secondary producers, as well as human health. Fish are also important to Canadians from an economic, recreational, and cultural perspective. Many fish species serve an important role in the ecological, economic, and cultural health of British Columbia (B.C.) and Canada. Salmonid species, in particular, are captured for food and sport, supporting local economies and cultures, while other species may serve as indicators of environmental health and water quality. The Project encompasses several fish bearing streams that could potentially be affected by Project development. This chapter provides a review of the existing fish and fish habitat information for the Project site and an assessment of the potential effects of the Project on this local and regional resource.

Benthic invertebrates are secondary producers and represent a critical link between primary producer communities such as periphyton and phytoplankton and higher aquatic trophic levels such as fish. Changes to water and sediment quality can affect the diversity, abundance, and activities of primary and secondary producer communities. Due to their limited mobility and life history characteristics (i.e., living on or in sediment), benthic invertebrate communities are closely linked to physical and chemical habitat factors and, as such, are useful for detecting potential changes in aquatic health (Hilsenhoff, 1988; Poulton et al., 1995).

Given the complex relationships between fish and fish habitat, benthic invertebrates, and the natural environment, representative fish species, their habitat, and benthic invertebrate communities were identified as receptor valued components (VCs) for the Project in the Application Information Requirements (AIR; Environmental Assessment Office [EAO], 2018) and as a VC in the Guidelines for the Preparation of an Environmental Impact Statement for the Crown Mountain Coking Coal Project (EIS

Guidelines; Canadian Environmental Assessment Agency, 2015). An understanding of the potential effects to fish and fish habitat and benthic invertebrates with respect to the Project is critical to the Project design, engineering, operations, and assessment and mitigation of potential environmental effects.

Fish, fish habitat, and benthic invertebrates have linkages with other intermediate and receptor VCs; these effects are primarily assessed in the following chapters:

- Chapter 6: Atmospheric Environment Assessment;
- Chapter 7: Acoustic Environment Assessment;
- Chapter 9: Groundwater Assessment;
- Chapter 10: Surface Water Quantity Assessment;
- Chapter 11: Surface Water Quality Assessment;
- Chapter 13: Landscapes and Ecosystems Assessment;
- Chapter 22: Human and Ecological Health Assessment; and
- Indigenous Communities discussed in Chapters 23 through 31.

12.1.1 Regulatory and Policy Setting

Fish and fish habitat are key components of the aquatic environment and are protected under the federal *Fisheries Act* (1985, as amended in 2019). Section 2(1) of the *Fisheries Act* defines fish as the "*parts of fish; shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals; and eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals*". Fish habitat is defined as "*water frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas*" (*Fisheries Act* s. 2[1]). The *Fisheries Act* prohibits the "*harmful alteration, disruption or destruction of fish habitat*" without an authorization, prohibits the release of deleterious substances into waters frequented by fish, and prohibits the death of fish by means other than fishing, among other requirements. Fish and their habitat are critical to the functioning of aquatic and terrestrial ecosystems and are important resources for wildlife, Indigenous communities, and the public. Applicable provincial and federal legislation and guidance documents related to fish and fish habitat and the management of aquatic resources are summarized in Table 12.1-1.

The Canadian Council of Ministers of the Environment's (CCME) *Canadian Water and Sediment Quality Guidelines* [CWQG] *for the Protection of Aquatic Life*; CCME, 1999) and provincial (i.e., *British Columbia* [*B.C.] Approved Water Quality Guidelines [WQG]: Aquatic Life*; B.C. Ministry of Environment and Climate Change [ENV], 2019) guidelines cover the protection of freshwater aquatic life. Guidelines are not regulatory instruments but act as targets or triggers for action if not met, and can be used as the basis of regulatory limits.

In addition to the guidelines and legislation outlined in Table 12.1-1, the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (B.C. Ministry of Environment, 2016) outlines and defines the baseline study requirements for mining projects in B.C., including water quality (physical and chemical parameters, aquatic sediments, tissue residues, and aquatic life), fish and fish habitat, and initial environmental impact assessment.

Table 12.1-1: Regulatory Considerations and Guidance Documents Relevant to Fish and Fish Habitat and Aquatic Resources

Legislation/Guideline Name	Year	Description
Federal Legislation		
Fisheries Act	1985, amended 2019	Establishes a framework for the management of fisheries resources and conservation of fish and fish habitat, including prohibiting the death of fish by any means other than fishing, the harmful alteration, disruption, and destruction (HADD) of fish habitat, and the release of deleterious substances into waters frequented by fish, among other requirements.
Species at Risk Act (SARA)	2002	Protects wildlife species (including fish) in Canada from decline or disappearance, and their critical habitat. Aids in the recovery of species that are extirpated, threatened, or endangered resulting from anthropogenic activities, and to manage species of special concern.
Provincial Legislation		
Environmental Management Act	2003	Regulates waste discharge, hazardous waste, pollution, and contaminated sites remediation.
Riparian Areas Protection Act (formerly the Fish Protection Act)	1997, Retitled in 2016	Protects fish and fish habitat to ensure their sustainability.
Riparian Areas Protection Regulation	2004	Protects the many and varied features, functions, and conditions that are vital to maintain aquatic health.
Water Sustainability Act	2016	Manages the use and diversion of water resources in B.C.
Water Protection Act	1996	Protects the province's water by reconfirming B.C.'s ownership of both surface and groundwater, limiting bulk water removal, and not permitting large-scale water diversion amongst watersheds and outside of B.C.
Forest and Range Practices Act	2002	Provides guidance on riparian management around fish bearing streams, lakes, and wetlands, and on the size of harvestable forest and allowable harvesting rates.
Guidelines and Guidance Documents		
British Columbia Field Sampling Manual For Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples	2003	Guidelines for the collection and sampling of environmental monitoring data in B.C.
Water and Air Baseline Monitoring Guidance for Mine Proponents and Operators	2012	Outlines and defines the baseline study requirements and information considerations necessary to propose a mineral development project in the Province of British Columbia.

Legislation/Guideline Name	Year	Description
B.C. WQG (Approved and Working)	2019; 2020	Provides short term maximum "acute" and long term "chronic" comparison values for surface water quality, for the protection of aquatic organisms against severe effects such as lethality due to short term intermittent or transient exposures to contaminants, and from lethal and sub-lethal effects over long term indefinite exposures.
B.C. Ambient WQG for Selenium Update	2014	Provides updated WQGs for selenium in water for the protection of aquatic life. Analytical results can be compared to the guideline value and alert value for selenium in water for comparison purposes.
Derivation of WQG for the Protection of Aquatic Life in British Columbia	2016	Guidance which defines the requirements of baseline studies and monitoring programs for surface water and air effluents for proposed and operating mineral developments in B.C.
Standards and Best Practices for Instream Works	2004	Sets out provincial standards and recommended best practices for the planning, design, and construction of instream projects.
CCME Water and Sediment Quality Guidelines for the Protection of Aquatic Life	1999; 2001	Guidance for the comparison of water quality parameters as they relate to aquatic life in surface water and sediment.
Canadian Benthic Aquatic Biomonitoring Network (CABIN) Field Protocols	2012	Protocols to measure changes in biological communities and obtain a picture of aquatic health. Used for the baseline monitoring of benthic macroinvertebrates
Canadian Biodiversity Strategy (Minister of Supply and Services Canada)	1995	Improves coordination of efforts aimed at conserving and sustainably using biological resources across Canada.
U.S. Environmental Protection Agency Aquatic Life Ambient Water Quality Criterion for Selenium - Freshwater	2016	Provides a basis for a criterion protective of populations of fish, amphibians, aquatic invertebrates, and plants for selenium in freshwater.
Westslope Cutthroat Trout (Oncorhynchus clarkii lewisi): COSEWIC assessment and status report	2016	Updated assessment of habitat loss, overharvesting, and the introduction of non-native species and/or genotypes through inappropriate stocking practices.
Westslope Cutthroat Trout: Recovery Strategy and Action Plan	2019	A proposed plan to protect and maintain the existing distribution of pure populations of Westslope Cutthroat Trout.

As part of the Provincial Cumulative Effects Framework, the Elk Valley Cumulative Effects Management Framework (EV-CEMF) aims to assess the historic, current, and potential future conditions of selected VCs and to support natural resource management decisions within the region (Province of B.C., 2020). The purpose of EV-CEMF is to develop an approach to understand cumulative effects on the environment from various industries and natural events in the Elk Valley. Aquatic impacts are assessed using two region-specific aquatic VCs selected by the EV-CEMF Working Group: Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) and riparian habitat (Province of B.C., 2020). Riparian habitat was selected as a VC for EV-CEMF because riparian areas have high biodiversity, provide critical habitat for wildlife, and moderate flooding events (Davidson et al., 2018). Westslope Cutthroat Trout (WCT) were selected as a VC because they have ecological, cultural, economic, and social importance to both residents and visitors of the Elk Valley (Davidson et al., 2018).

Other relevant guidance includes the Elk Valley Water Quality Plan (EVWQP; Teck Resources Limited [Teck], 2014]), also known as the Elk Valley Area Based Management Plan, which was developed in response to a Ministerial Order issued to Teck in April 2013 under the B.C. *Environmental Management Act* (2003) to manage the cumulative effects of coal mining on water quality in the Elk Valley. The EVWQP includes specific environmental management objectives for the protection of aquatic ecosystem health and the management of bioaccumulation of contaminants in the receiving environment (including fish tissue; Teck, 2014). The EVWQP applies to all existing and proposed projects located in the Designated Area of the Ministerial Order. The Project is located in Management Unit 4 of the Designated Area, which includes the middle section of the Elk River and its tributaries.

12.1.1.1 Aquatic Species of Conservation Concern

Species of conservation concern are species with rare or declining populations or habitats that are provincially blue- or red-listed, federally-listed under the *Species at Risk Act* (SARA; 2002), or identified as at-risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or globally-listed by NatureServe. Species were identified using the B.C. Conservation Data Centre Species and Ecosystems Explorer (B.C. CDC; British Columbia Species and Ecosystems Explorer [B.C. CDC], 2022). A summary of aquatic species of conservation concern known to occur within the Fish and Fish Habitat Local Study Area (Section 12.2.3.1), Elk River watershed, and Lake Koocanusa is provided in Table 12.1-2. There are no listed aquatic invertebrate species known to be present in the Elk River watershed and Lake Koocanusa.

Table 12.1-2: Species of Conservation Concern in the Elk River Watershed and Lake Koocanusa

Common Name	Scientific Name	B.C. List[1]	Provincial[2]	Provincial FPRA[3]	COSEWIC[4]	SARA[5]
Bull Trout	*Salvelinus confluentus*	B	S3S4 (2018)	Y	SC	-
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	B	S2S3 (2018)	Y	SC	1-SC (2010)

[1] B.C. list: B= Blue (special concern).
[2] NatureServe ranks for the B.C. Provincial Conservation Status Ranks: S1= critically imperiled; S2= imperiled; S3= special concern, vulnerable to extirpation or extinction; S4= apparently secure, with some cause for concern; S5= demonstrably widespread, abundant and secure; ##= range rank- indicates range of uncertainty about conservation status (e.g., S2S3); ? = inexact or uncertain- denotes inexact or uncertain numeric rank.
[3] Formerly Identified Wildlife. Y= species is provincially designated under *FPRA*. More information can be found on the Identified Wildlife Management Strategy site here: http://www.env.gov.bc.ca/wld/frpa/iwms/index.html.
[4] COSEWIC designations: SC – Special Concern.
[5] SARA Federal Species at Risk Act Schedule number (1-3). 1= Schedule 1, official list of wildlife species at risk.

12.2 Scope of the Assessment

12.2.1 Valued Components and Measurement Indicators

Six representative fish species were identified as receptor VCs for the Project in the AIR (EAO, 2018): Westslope Cutthroat Trout (WCT), Bull Trout (*Salvelinus confluentus*), Kokanee (*Oncorhynchus nerka*), Burbot (*Lota lota*), Mountain Whitefish (*Prosopium williamsoni*), and Longnose Sucker (*Catostomus catostomus*). Additionally, benthic invertebrate communities were identified as a receptor VC representative of the aquatic health discipline in the Project area. The EIS Guidelines identified Westslope Cutthroat Trout, Bull Trout, Burbot, Mountain Whitefish, as well as other potentially impacted aquatic species in the Elk River and Lake Koocanusa as species of interest. Measurement indicators for fish and fish habitat and benthic invertebrates are summarized in Table 12.2-1. Details on each species/community and rationale for inclusion as a VC are provided in the following subsections.

Table 12.2-1: Measurement Indicators and Effects Pathways for Fish and Fish Habitat and Benthic Invertebrates

Valued Component	Measurement Indicators	Effects Pathways
Fish, as represented by the following VCs: • Westslope Cutthroat Trout • Bull Trout • Kokanee • Burbot • Mountain Whitefish • Longnose Sucker	• Fish species presence/not detected as compared to baseline; • Surface and groundwater quality (including nutrient and potential contaminant concentrations, temperature, pH, conductivity and metals); • Sediment quality; • Habitat quantity relative to baseline (e.g., changes in channel morphology, substrates and calcite formations, changes in habitat connectivity, changes in habitat availability, and riparian habitat); • Fish population metrics (e.g., density, biomass, size-at-age, or related matrices); • Fish growth, survival, and reproduction; • Metal concentrations in fish muscle tissues; and • DELT surveys (visual assessment of deformations, erosions, lesions, and tumours on fish).	VCs or VC groups identified as effects pathways for fish and fish habitat include: • Air quality; • Groundwater quantity and quality; • Surface water quantity; • Surface water quality; • Acoustic environment; • Riparian habitat; and • Benthic invertebrates.
Benthic Invertebrates	• Surface and ground water quality; • Sediment quality; • Benthic invertebrate metrics (e.g., abundance, community structure); • Growth, survival, and reproduction (based on comparison to applicable toxicological benchmarks); and • Metal concentrations in benthic invertebrates.	VCs or VC groups identified as effects pathways for benthic invertebrates include: • Groundwater quantity and quality; • Air quality; • Surface water quantity; and • Surface water quality.

12.2.1.1 Fish Valued Components

12.2.1.1.1 Westslope Cutthroat Trout

Two designatable units (DUs) of Westslope Cutthroat Trout occur in Canada: the Saskatchewan-Nelson Rivers population in Alberta; and the Pacific population in B.C., both of which are federally listed under Schedule 1 of the SARA (2002). The Alberta population is listed as Threatened under Schedule 1 of SARA, whereas the Pacific population is listed as Special Concern. The Project is located in the native range of the Pacific population, which is federally listed as Special Concern and Blue-listed (Special Concern) in B.C. (B.C. Conservation Data Centre [B.C. CDC], 2020).

WCT inhabit most major tributaries, smaller creeks, and lakes in the Kootenay, Flathead, and Pend d'Oreille systems (Committee on the Status of Endangered Wildlife in Canada [COSEWIC], 2016). Resident and migratory sub-populations are both present in these systems. Upstream movement to spawning areas generally occurs during peak spring flows, while spawning occurs as peak flows diminish in May to July (COSEWIC, 2016). Egg incubation rate is dependent on water temperature, but incubation in spawning gravels generally lasts six to seven weeks. Fry emerge from streambeds in early July to late August and migrate to low energy, lateral habitats (COSEWIC, 2016). Although WCT are iteroparous, meaning that they reproduce multiple times throughout their lifetime, spawning typically occurs every year or every other year. WCT feed primarily on invertebrates from both aquatic and riparian inputs (COSEWIC, 2016; Liknes and Grahm, 1988; Shepard et al., 1984).

WCT play an important ecological role, are valued as a traditionally important fish species by several Indigenous communities including the Ktunaxa Nation and are a recreationally important sportfish in western Canada (COSEWIC, 2016). As a result of often being the only native trout species in much of their Canadian range, WCT contribute nutrients to riparian vegetation and forests, thereby playing an important role in structuring many northern temperate aquatic ecosystems (COSEWIC, 2016; McPhail and Carveth, 1992). The species' unique adaptations to colder, less productive ecosystems and smaller size allow WCT to inhabit smaller streams than most other salmonids (COSEWIC. 2016; Rasmussen et al., 2012). Due to its specific habitat requirements, WCT is considered an indicator species of general ecosystem health (COSEWIC, 2016).

WCT were identified as a VC for which potential effects resulting from the Project will be assessed due to its regulatory status, value to recreational and traditional fisheries, and sensitivity to fish habitat degradation and water quality. WCT were also identified as a VC assessed by the Elk Valley Cumulative Effects Management Framework (Province of B.C., 2020).

12.2.1.1.2 Bull Trout

Two Bull Trout (BT) genetic lineages and five DUs are recognized in Canada (COSEWIC, 2012). The Project is located in the native range of the Pacific DU, which is part of Genetic Lineage 2 and is broadly distributed throughout Pacific drainages. The Pacific DU was designated as Not at Risk by COSEWIC in 2012; however, Bull Trout are provincially Blue-listed (Special Concern) in B.C.

Bull Trout require specific habitat characteristics throughout the duration of their lifecycle. The watercourses they inhabit must contain clean and cold water, structural complexity for cover and breeding/rearing habitat, and connectedness of watersheds to allow for migration (COSEWIC, 2012).

Substrate (for juvenile life stages), submerged wood, and undercut banks provide necessary forms of cover (COSEWIC, 2012; Watson and Hillman, 1997). Spawning occurs in the fall from mid-August to late October and is believed to be temperature dependent, with ideal water temperatures ranging from 5 to 10°C (COSEWIC, 2012; Pollard and Down, 2001). Egg incubation rate is dependent on water temperature, but incubation generally lasts 35 to 120 days and fry emergence occurs between April and June.

Bull Trout are an ecologically important species that strongly influence the community structure, food web linkages, and flow of energy and nutrients in aquatic systems (COSEWIC, 2012). They are opportunistic foragers, often top predators in their environment, that feed on a diversity of vertebrate and invertebrate prey including other fish species, benthic invertebrates, terrestrial insects, crustaceans, molluscs, amphibians, birds, and small mammals (COSEWIC, 2012; Stewart et al., 2007).

Bull Trout were identified as a VC for which potential effects resulting from the Project will be assessed due to its provincial status, value to recreational and traditional fisheries in the Elk Valley, and use as an indicator species of general ecosystem health.

12.2.1.1.3 Kokanee

Kokanee (KO) are the non-anadromous, freshwater lake-resident form of sockeye salmon (Arndt; 2009; Roberge et al., 2002). Federally, 24 DU of sockeye salmon were assessed under SARA (2002), with eight subpopulations listed as Endangered, two as Threatened, five as Special Concern, and eight as Not at Risk; however, the Kokanee ecotype was not assessed due to its unique lifecycle (COSEWIC, 2017). Kokanee have also not been assessed by the B.C. CDC at the provincial level to date (B.C. CDC, 2019).

Sockeye salmon are distributed throughout B.C., with the Kokanee ecotype in freshwater streams and lakes within the overall sockeye distribution; however, specific demographic data on Kokanee are limited (COSEWIC, 2017; Holtby and Ciruna, 2007). Kokanee generally spawn in streams but for all other activities, Kokanee utilize cold, well oxygenated mountain lake and reservoir habitats (Arndt, 2009; B.C. CDC, 2010). Spawning occurs from late August to early October (Arndt, 2009; Tredger and Taylor, 1977). Kokanee are semelparous, meaning that they only reproduce once in a lifetime, and generally die a few days or weeks following spawning (Arndt, 2009; McPhail, 2007). Egg incubation is dependent on water temperature but usually lasts 39 to 140 days, with eggs hatching from spawning gravels by spring (Ford et al., 1995; Roberge et al., 2002).

Kokanee consume phytoplankton, zooplankton, and benthic invertebrates, and are a prey source for high-order fish species. They play an important role in transferring energy from lower to higher trophic levels in aquatic environments (Arndt, 2009; Koski and Johnson, 2002). As such, they are considered an indicator of environmental health, specifically related to food web relationships.

Although present in Grave Lake, Kokanee have not been observed in Alexander Creek or Grave Creek since 1995 (B.C. CDC, 2020). Kokanee were introduced to Lake Koocanusa in the 1980s (Leschied, 2017). Kokanee were identified as a VC for which potential downstream effects to water quality resulting from the Project will be assessed, because it is a representative planktivore species that is directly linked to aquatic impacts at lower trophic levels (e.g., phytoplankton, benthic invertebrates). They also are valuable to recreational and traditional fisheries in B.C.

12.2.1.1.4 Burbot

Burbot (BB) are the only freshwater cod species found in Canada, and are widely distributed throughout B.C. (B.C. CDC, 2015; McPhail, 2007; McPhail and Paragamian, 2000). Burbot status in Canada has not been federally assessed, but provincially the species is Yellow-listed (at the least risk of being lost; B.C. CDC, 2004), with the exception of the Red-listed Lower Kootenay population that ranges between Kootenai Falls, Montana, and Kootenay Lake, B.C. (B.C. CDC, 2001).

The habitat requirements of Burbot varies with life history stages. Spawning occurs in the winter or early spring, often under ice conditions, at low water temperatures (McPhail and Paragamian, 2000; Boag, 1989; McCrimmon and Devitt, 1954). Developmental rate of Burbot eggs and zygote mortality are functions of water temperature, with an optimal incubation regime between 1 to 7°C, thus making Burbot sensitive to altered thermal regimes (Jager et al., 1981; McPhail and Paragramian, 2000). Adfluvial spawning migrations, meaning that fish reside in lakes but migrate to rivers to spawn, have been observed in the Kootenay region (McPhail and Paragamian, 2000). Outside of spawning activities, Burbot are generally sedentary individuals (B.C. CDC, 2004).

Age zero Burbot consume a variety of benthic prey, including copepods, cladocerans, dipterans, amphipods, insects, and occasionally young-of-the-year fish (Ryder and Pesendorfer, 1992; McPhail and Paragramian, 2000; Robins and Deubler, 1955). Sub-adult individuals primarily feed on insect prey but, as they grow larger, their diet is progressively dominated by fish (McPhail and Paragramian, 2000; Beeton, 1956; Bishop, 1975). Adult Burbot are mainly piscivorous, consuming a variety of fish species including whitefish, pike, suckers, perch, and sculpins, but opportunistic consumption of insects and macroinvertebrates persists into adulthood (McPhail and Paragramian, 2000).

Burbot have not been documented within the Project footprint or Fish and Fish Habitat Local Study Area (LSA; B.C. CDC, 2020), but are present in Lake Koocanusa in low densities (Leschied, 2017). Burbot were therefore identified as a VC for which potential downstream effects to water quality resulting from the Project will be assessed due to their position as top predator in aquatic ecosystems, making them a valuable indicator of environmental health, specifically related to food web relationships.

12.2.1.1.5 Mountain Whitefish

Mountain Whitefish (MW) status in Canada has not been federally assessed, but provincially the species is Yellow-listed (at the least risk of being lost; (B.C. CDC, 1993).

Mountain Whitefish inhabit cold mountain lakes and fast streams that are clear or silty with large pools (B.C. CDC, 1993). Spawning generally occurs from late October to early December, with eggs hatching approximately five months later (B.C. CDC, 1993). Stream dwelling populations exhibit little or no migration for spawning activities, and often spawn in riffles over gravel and small cobble substrates (B.C. CDC, 1993; Northcote, 1957). Lake dwelling populations will undergo extensive spawning migrations to outlet and tributary streams or less often, spawn in gravel shoals along lake edges (B.C. CDC, 1993; Northcote, 1957). Following hatching, Mountain Whitefish fry can be found along the edges of streams and in backwaters for several weeks, until they reach approximately 30 to 40 millimetres (mm) in length and move into the central portions of streams (Northcote, 1957).

Mountain Whitefish exhibit both piscivorous and invertivorous life history characteristics, consuming aquatic invertebrates, terrestrial insects, fish eggs, and occasionally fish (B.C. CDC, 1993). They preferentially feed on benthic prey, but where benthic organisms are less abundant, will feed on plankton mid-water or at the surface (Northcote, 1957). Mountain Whitefish have also been reported to feed on eggs from its own species, salmon eggs, or trout eggs (Northcote, 1957).

Mountain Whitefish were identified as a representative species for fish populations in the Fish and Fish Habitat LSA and Aquatic Regional Study Area (RSA; both defined in Section 12.2.3.1) because they are typically found in a diverse variety of habitats and have varied diets depending on availability of food resources. The species is also important to recreational and traditional fisheries in the Elk Valley.

12.2.1.1.6 Longnose Sucker

Longnose Sucker (LNS) are the most widely distributed sucker species in northern North America, including abundant populations in B.C. (B.C. CDC, 2011). Longnose Sucker status in Canada has not been federally assessed, but provincially the species is Yellow-listed (at the least risk of being lost; B.C. CDC, 2011).

Longnose Suckers are a bottom dwelling species that commonly inhabit cold, clear, deep water in lakes and tributary streams (B.C. CDC, 2011; Edwards, 1983). Spawning occurs during the spring, usually in tributary streams of large bodies of water and occasionally, in shallow area of large lakes or reservoirs (B.C. CDC, 2011; Edwards, 1983; Ryan, 1980; Walton, 1980). In riffle areas of tributary streams and along wave-swept shorelines of large lakes or reservoirs, adhesive eggs are broadcast over clean gravel and rocks (Edwards, 1983; Walton, 1980). Eggs hatch approximately two weeks after incubation and newly hatched young will stay in the gravel substrates for approximately one to two weeks before emerging (B.C. CDC, 2011; Edwards, 1983; Scott and Crossman, 1979). Longnose Suckers are omnivorous and their feeding requirements vary with life history stages (Edwards, 1983).

Longnose Suckers were identified as a representative species for fish populations in the Fish and Fish Habitat LSA and Aquatic RSA because they are found in a diverse variety of habitats and have varied diets depending on availability of food resources. Like Mountain Whitefish, this species is an important recreational sportfish in the Elk Valley.

12.2.1.2 Benthic Invertebrate Valued Component

Benthic invertebrates perform a variety of functions in freshwater food webs and play a vital ecological role in the ecosystems that they inhabit. They are primary consumers in aquatic ecosystems and feed on algae, macrophytes, biofilms, periphyton, riparian leaf litter, and other low-order consumers (Beatty et al., 2006; Covich et al., 1999; Jones, 2011). Benthic invertebrates are an important food source for many higher-order aquatic organisms, including fish, turtles, amphibians, and birds (Beatty et al., 2006; Covich et al., 1999). Resulting from their role as a primary consumer and an important prey source, benthic invertebrates play an important role in energy transfer between trophic levels (Covich et al., 1999). They accelerate decomposition of detrital matter through consumption, physical breakdown of organic matter into smaller fragments, and resuspension of fragments into the water column (Covich et al., 1999; van de Bund et al., 1994; Wallace and Webster, 1996). In addition, benthic invertebrates release bound nutrients into solution through their feeding, excretion, and burrowing activities in sediments (Covich et al., 1999).

Benthic invertebrates have differing levels of tolerance to pollution, which makes them a good bio-indicator of environmental change at the community level (Li et al., 2010).

Benthic invertebrates were identified as a VC for which potential effects resulting from the Project will be assessed because they provide a baseline level indicator of aquatic community health, are indicators of physical and chemical aquatic health, and are important food resources for other VCs including fish, amphibians, and birds. There are no listed aquatic invertebrate species known to be present in the study areas.

12.2.2 Indigenous and Stakeholder Consultation

NWP engaged with Indigenous groups and conducted consultation with public stakeholders and regulators. A summary of all consultation and engagement activities undertaken to date is presented in Chapter 4. A summary of consultation feedback specific to fish and fish habitat and aquatic health is presented in Table 12.2-2. Indigenous and stakeholder consultation feedback received was used to inform the fish and fish habitat baseline sampling program, the human health and ecological risk assessment, and the residual and cumulative effects assessments for fish and fish habitat.

12.2.3 Assessment Boundaries

12.2.3.1 Spatial Boundaries

Three spatial boundaries were considered in the fish and fish habitat and aquatic health assessment: the Project footprint, the Fish and Fish Habitat LSA, and the Aquatic RSA. As detailed in Chapter 5, Table 5.3-2, the spatial boundaries for the fish and fish habitat VCs have changed from the study areas presented in the AIR. A discussion on the spatial boundaries used in the assessment is provided below.

The Project footprint encompasses the location of temporary and permanent works associated with the Project and covers approximately 1,283 hectares (ha) or 13 square kilometres (km^2; Figure 12.2-1). The centre of the Project is positioned approximately 12 kilometres (km) northeast of the District of Sparwood and approximately 5 km west of the provincial boundary between B.C. and Alberta (Figure 12.2-1). The Project footprint consists of the proposed surface extraction areas (three pits - North Pit, East Pit, and South Pit); Mine Rock Storage Facility; mine infrastructure and support facilities, including the plant area (raw coal stockpile area and processing plant); clean coal transportation route; rail loadout facility and rail siding; and ancillary facilities (i.e., water supply, power supply, natural gas supply, water, sewage treatment, fuel storage and explosives storage). All watersheds in the Project footprint are located on the western side of the Continental Divide. The Project footprint is located within portions of two watersheds, Grave Creek and Alexander Creek. The majority of the Project footprint is located within the Alexander Creek watershed, while the access roads leading to the mine are generally located within the Grave Creek watershed.

The Fish and Fish Habitat LSA was selected on the basis of the Project footprint, the boundaries of local watersheds, and the geographic extent of potential immediate direct and indirect effects (both short and long-term) of the Project on fish and fish habitat, water quality, surface water hydrology, and hydrogeology. The Fish and Fish Habitat LSA has the same spatial extent as the Aquatic LSA (used for the surface water quality and surface water quantity assessments), with the exception of Harmer Creek upstream of Harmer Dam. A dam and spillway are located on Harmer Creek, about 0.5 km upstream from

Table 12.2-2: Summary of Consultation Feedback on Fish and Fish Habitat and Aquatic Health

Topic	Feedback Received*:				Consultation Feedback	Feedback Source	Response or Actions Identified
	IG	G	P/S	O			
Aquatic Bioaccumulation Modelling		✓			Comment on areas where potential bioaccumulation in fish could be occurring within the Aquatic LSA.	Comment received from the Impact Assessment Agency of Canada (IAAC) during the June 6, 2019 Aquatics Working Group Meeting.	Potential bioaccumulation in fish is considered to only be relevant in streams and wetlands that are confirmed to be fish bearing and have the potential to be impacted by the Project. These areas are also considered a priority for monitoring potential bioaccumulation effects during Operations.
Aquatic Bioaccumulation Modelling		✓			Discuss bioaccumulation modelling with risk assessors and the potential evaluation of lentic, lotic, and overwintering habitats in the risk assessment	Comment received from IAAC during the June 6, 2019 Aquatics Working Group Meeting.	The Human Health and Ecological Risk Assessment (HHERA) includes bioaccumulation modelling in these aquatic environments at specific sensitive receptor locations based on predicted changes to water quality as a result of the Project. The aquatic health data collected to date were used to support the bioaccumulation modelling of lentic, lotic, and overwintering habitats.
Fish Sampling Locations		✓			The baseline study includes only one downstream fish sampling location in Alexander Creek (ALE7). Environment and Climate Change Canada (ECCC) suggests that the fish health baseline study include ideally 3+ locations within Alexander Creek after the confluence of West Alexander Creek. Sampling locations near the locations of the surface water quality stations A2, A3, and A3b are preferred.	Comment received from ECCC on July 8, 2019 as a follow-up item to the June 6, 2019 Aquatics Working Group Meeting.	Two additional sampling locations (ALE1 and ALE2) for both disciplines were added further downstream from ALE7 in fall 2019, bringing the total to three baseline sampling locations. While these new sites are further downstream than the recommended locations near the surface water quality stations A2, A3, and A3b, they provide valuable baseline conditions at the downstream limit of this system in the Fish and Fish Habitat LSA.

Topic	Feedback Received*:				Consultation Feedback	Feedback Source	Response or Actions Identified
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Aquatic Health Sampling Locations		✓			To monitor environmental effects, baseline studies should include fish tissue, benthic invertebrates, surface water and sediment sampling from all stations when possible.	Comment received from ECCC on July 8, 2019 as a follow-up item to the June 6, 2019 Aquatics Working Group Meeting.	It is standard for fish and fish habitat sampling (FFH) and aquatic health sampling to occur at different scales during baseline assessments. FFH occurred at a reach scale, resulting in FFH data (i.e., community/taxonomy data) being systematically collected at each morphologically distinct unit along a stream reach. The assumption is that habitat most strongly governs the fish and benthic communities, and that stream reaches represent distinct habitat nodes. Aquatic health sampling is a water quality topic. Therefore, aquatic health sample locations were set at appropriate nodes to describe where notable changes in water quality are expected to occur. Typically, aquatic health nodes more closely correspond with major tributary confluences. In many instances, this results in more FFH sites than aquatic health throughout the Fish and Fish Habitat LSA. In summary, FFH is based on morphologic reaches and aquatic health is based on “water quality nodes”.
Reference Sampling Locations		✓			Background (reference) sampling for Alexander Creek was limited to two locations (ALE10 and ALE11) in close proximity to each other. ECCC suggests having a minimum of three background locations distributed throughout the upper reaches of Alexander Creek where fish tissue,	Comment received from ECCC on July 8, 2019 as a follow-up item to the June 6, 2019 Aquatics Working Group Meeting.	During the June 6, 2019 Aquatics Working Group Meeting, it was discussed that because fish density is relatively low to non-existent and therefore limiting throughout the LSA, benthic invertebrate tissue would be used as a modelling endpoint with fish tissue used opportunistically for model validation. Benthic community and tissue data have been collected from ALE10, meaning that only one reference site is provided in the baseline for upper Alexander Creek (Note, a migratory fish

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	IG	G	P/S	O			
					benthic invertebrates, surface water and sediment sampling are conducted.		barrier is what was used to differentiate between ALE10 and ALE11. Therefore, tissue sampling from both would be considered pseudoreplication). Benthic community and tissue data were also collected from GRA4, another reference area in the Fish and Fish Habitat LSA, giving two upper tributary habitat reference areas in the Fish and Fish Habitat LSA.
Reference Sampling Locations		✓			Neither of the two background sampling locations detected fish in Alexander Creek (ALE10 and ALE11). If fish samples are unable to be obtained at ALE10 and ALE11, then additional effort should be taken to detect and sample fish in the upper reaches of Alexander Creek and its tributaries in locations that will not be impacted by the proposed mine.	Comment received from ECCC on July 8, 2019 as a follow-up item to the June 6, 2019 Aquatics Working Group Meeting.	Extensive efforts to describe fish distribution in the Fish and Fish Habitat LSA have been made. In some cases, such as upper Alexander Creek, the streams default to fish bearing status due to a lack of a migratory barrier. However, likely due to habitat limitations in the headwaters, fish were not captured. Therefore, extending effort further upstream is unlikely to provide fish tissue samples.
Aquatic Health Sampling Locations		✓			Given lentic/lotic environments may influence the bioaccumulation pattern of selenium, ensuring that sampling locations reflect these environments, and it is suggested that the results are tabulated based on this criterion.	Comment received from ECCC on July 8, 2019 as a follow-up item to the June 6, 2019 Aquatics Working Group Meeting.	Both lentic and lotic environments have been assessed to characterize fish and fish habitat, including aquatic health considerations (e.g., water and sediment quality). Data collected from lentic and lotic environments is presented in this chapter. Water quality modelling was used to predict potential risk of bioaccumulation occurring at sample sites downstream of the Project.

Topic	Feedback Received*:				Consultation Feedback	Feedback Source	Response or Actions Identified
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Tissue and Water Quality Sampling Locations		✓			It appears that the fish tissue, benthic invertebrates and water quality locations occur in different areas, sometimes with tributaries in between. As per the updated 2012 B.C. WQG for selenium, all water quality stations assessing environmental effects to aquatic life should measure fish tissue (egg/ovary, whole-body, muscle/muscle plug), invertebrate tissue (benthics), sediment and water column when possible. To allow for comparison to the B.C. guidelines, ECCC recommends that baseline sampling at all stations assessing water quality should also sample the above-mentioned parameters. Further, ECCC generally recommends that 2 years of baseline sampling be conducted to assess the seasonality of the water quality pre-operations. This applies to baseline sampling for reference (background) locations as well as to sample locations set at appropriate	Comment received from ECCC on November 1, 2019 as a follow-up item to the June 6, 2019 Aquatics Working Group Meeting.	Two separate programs were conducted to assess the chemical aquatic baseline conditions for the Project: the surface water quality program and the aquatic health program. The baseline water quality program began in 2012 and is ongoing. Twelve water quality stations were established in the Fish and Fish Habitat LSA and were sampled monthly between 2012 and 2015. A statistical power analysis of this data in 2015 demonstrated that the potential temporal and spatial variability of water quality parameters had firmly been accounted for, and sampling was reduced to quarterly in accordance with the 2016 *Guidelines for Designing and Implementing a Water Quality Monitoring Program in British Columbia* and the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* and approval from the B.C. Ministry of Environment. The aquatic health baseline program was established in 2017 and included sampling of sediments and tissues (fish, benthic invertebrates, and periphyton) in lotic environments in the Fish and Fish Habitat LSA. The stations selected for sampling were largely based on areas where fish were present. Some of the aquatic health stations were in close proximity to the surface water quality sampling stations, but as these samples were not collected during the same programs, they were never in the exact same locations. In

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	IG	G	P/S	O			
					nodes to describe where notable changes in water quality are expected to occur. ECCC recognizes that benthics and fish tissue may be more difficult to sample, however, it should be collected, when possible, to assess seasonality. Water and sediment sampling should be conducted monthly to assess the seasonality of water quality.		2019, the aquatic health program was expanded to include six lentic stations and one additional lotic station. Sampling at the lentic stations included sediments, benthic invertebrate and periphyton tissues, and water quality samples. Overall, the aquatic health and corresponding surface water quality stations are located within the same creek nodes despite being spatially separated. Samples are considered to have been collected within the same node if there are no substantial inputs between the sampling locations. Water quality data collected are therefore considered to be representative of the aqueous environment that the tissue samples were collected in at all aquatic health sites, other than potentially at ALE1 and ALE2. These sites are located in a different node from nearby water quality station A1, as a small tributary (Summit Creek) enters Alexander Creek between A1 and ALE2. To address this potential data gap, a new surface water quality sampling station (A0) was implemented at ALE1 in March 2020 to determine if Summit Creek has a measurable influence on the water quality in Alexander Creek. Quarterly sampling at A0 will be ongoing. The aquatic health program was conducted in accordance with *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators*, which states that tissue site density will adhere to the following: "At a

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							minimum and within each affected waterbody/watershed, locations upstream from, adjacent to, and downstream from mine influence should be targeted for tissue sample collection." Tissue sampling for the aquatic health program exceeds this minimum, as there are multiple sampling stations upstream, within/adjacent, and downstream of the proposed mine influence.
Reference Sampling Locations		✓			ECCC recommends that baseline data (surface water quality, fish tissue, benthic invertebrate tissue, and sediment quality) be collected at multiple background/reference sites (>3 locations) in the upper reaches of Alexander Creek.	Comment received from ECCC on November 1, 2019 as a follow-up to the June 6, 2019 Aquatics Working Group Meeting.	Sampling to date adequately describes the baseline environment and satisfies baseline assessment requirements. As part of the aquatic effects monitoring program (AEMP), additional sites will likely be established, including reference sites, in both Alexander and Grave Creeks. It is more advantageous to begin AEMP at a pre-mining state closer to the actual start of mining to avoid potential regional changes in various aquatic metrics. As part of the AEMP, it is anticipated that water quality sampling will be more frequent than is currently conducted. Additional sampling in upper Alexander Creek would not include fish tissue sampling as fish are not present in the upper reaches of these creeks.
Local Study Area	✓				Update the Fish and Fish Habitat LSA to include the entirety of the Project Footprint.	Comment received from the (Ktunaxa Nation Council) KNC during the April 29, 2020 Aquatics Working Group Meeting.	The Fish and Fish Habitat LSA was updated accordingly.

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	IG	G	P/S	O			
Cumulative Effects Assessment	✓				How are other fish species besides Westslope Cutthroat Trout going to be assessed for cumulative effects? There are several other species important to the Ktunaxa.	Comment received from the KNC during the November 4, 2020 Aquatic Effects Modelling Meeting.	Only Westslope Cutthroat Trout were found in Grave Creek and it is the most abundant/well distributed species in the Alexander drainage. In the regional area, it is a good surrogate for fish and fish habitat.
Cumulative Effects Assessment	✓				Different fish species have different requirements at different times of the year like Mountain Whitefish. Is using Westslope Cutthroat Trout to assess all fish and fish habitat effective?	Comment received from the KNC during the November 4, 2020 Aquatic Effects Modelling Meeting.	Within the Fish and Fish Habitat LSA, it is appropriate to use WCT given its distribution. Provincial framework indicators are not species specific. The EV-CEMF model is called the WCT model but indicators are general and not specific to WCT. Within the Aquatic RSA, effects will be captured by the water quality discipline and other effects assessments.

Note:
*IG = Indigenous Group (group specified in column); G = Government (provincial or federal agencies); P/S = Public/Stakeholder (Interest group, local government, tenure and license holders, members of the public); O = Other