Jacobs

# Memorandum

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| **Subject** | **Fish and Fish Habitat Technical Memorandum** |
| **Project Name** | Eagle Mountain – Woodfibre Gas Pipeline Project (EGP Project) |
| **Attention** | John Macleod, FortisBC Energy Inc. (FortisBC) |
| **From** | Bree Milne, Jacobs Consultancy Canada Inc. (Jacobs) |
| **Date** | August 4, 2022 |
| **Copies to** | Ilona Berbekar, FortisBC |

# 1. Introduction

## 1.1 Project Overview

The EGP Project involves the construction of approximately 47 kilometres (km) of 24-inch outside diameter pipeline, including a 9-km tunnel (EGP Tunnel) from the BC Rail Properties Ltd. (BC Rail Site) to the proposed Woodfibre Liquefied Natural Gas Ltd. (WLNG) production facility (WLNG Site) in Squamish, BC. The EGP Project will expand FortisBC's existing natural gas transmission system to supply natural gas to the proposed WLNG Site, located southwest of Squamish, BC. As part of the Environmental Assessment Certificate Application for the Project, FortisBC proposed a horizontal directional drill construction methodology for installing the pipeline under most of the Skwelwil'em Squamish Estuary Wildlife Management Area.

As part of the Project, FortisBC is proposing to discharge wastewater during the BC Rail tunnel site construction at Kilometre Post 38.77. The proposed discharge will utilize existing stormwater management infrastructure (existing network leading to the northern outfall), and the outflow will enter the Squamish River. Construction is expected to begin in late 2022 and will occur over approximately 4 years, spanning all four seasons and likely a wide range of precipitation events.

Figure 1 shows the extent of the Project at the BC Rail site, the wastewater discharge location, existing infrastructure, and notable aquatics features including the Squamish River.


FORTIS BC

December 2021

**FIGURE 1**

**BC RAIL WASTEWATER DISCHARGE PROJECT OVERVIEW**

**EAGLE MOUNTAIN - WOODFIBRE GAS PIPELINE PROJECT**

- Wastewater Discharge
- Discharge Site
- East Shaft
- Public Walking Trails
- Flow direction
- Railway
- Existing Transmission Line
- BC Rail Site Lease Area
- EAO Certified Corridor
- Provincial Park
- Skwelwil'em Squamish Estuary WMA

SCALE: 1:5,000

0 100 200 m

(All Locations Approximate)

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JACOBS Project Number CE777000

UTM Zone 10 North. NAD 1983.
Certified Pipeline Application Corridor: Jacobs 8-30-2019 (Revision 15); Existing Pipeline: FortisBC 2012; Options 1, East Shaft,Discharge Site: Jacobs 2021; Public Walking Trails: District of Squamish: 6-15-2020; Estuary: BC MFLNRO 2008; Railway: BC MLFNRO 2015 Provincial Park: BC MFLNRO 2008; Existing Transmission Line: BC Hydro; Base Imagery: Atlantic Group 2013; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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## 1.2 Objectives

This Fish Habitat Assessment memorandum, utilizing publicly available online information and historical Project field survey data, will support the submission of a Waste Discharge Authorization application. This technical memorandum summarizes the aquatic environment, including fish and fish habitat, near the Project. The technical memorandum outlines Project regulatory requirements and provides recommendations to protect fish and fish habitat.

The objectives of this Fish Habitat Assessment technical memorandum are outlined as follows:

- Complete a desktop study to identify the streams that will be impacted by discharge activity and previously documented fish use
- Present desktop and aquatic field survey results to identify and document stream and fish habitat baseline conditions
- Review reports, historically documented Jacobs' data, and publicly available databases for fish and fish habitat information near the proposed activity
- Identify potential interactions with fish and fish habitat and identify listed or regionally important fish species (that is, as defined by the *Species at Risk Act* [*SARA*] and the Committee on the Status of Endangered Wildlife in Canada [COSEWIC]) that may be impacted by the Project
- Provide Qualified Professional (QP) recommendations to reduce potential environmental impacts from the Project and maintain the aquatic environment's productive capacity
- Provide information to support Project review and Waste Discharge Authorization permitting under the *Environmental Management Act (EMA)*

# 2. Regulatory

The Project is governed by several regulating bodies both federally and provincially. A brief outline of the regulatory requirements that have been considered for the proposed Project activities is as follows. The focus for this technical memorandum is the Waste Discharge Authorization permitting requirements outlined in the *EMA*.

## 2.1 Federal

### 2.1.1 Federal *Fisheries Act*

Water discharge activities that have the potential to impact fish or fish habitat should be constructed and operated in compliance with the federal *Fisheries Act.* The *Fisheries Act* requires projects to avoid the death of fish or harmful alteration, disruption, or destruction (HADD) of fish habitat, unless authorized by Fisheries and Oceans Canada (DFO), Minister of Fisheries and Oceans, and the Canadian Coast Guard. Without authorization from DFO, the *Fisheries Act* prohibits any work, undertaking, or activity that results in the death of fish or HADD to fish habitat. The *Fisheries Act* defines HADD to fish or fish habitat as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish" (DFO 2019a).

The *Fisheries Act* also has provisions that:

- prohibit the deposition of deleterious substances into waters used by fish;
- ensure the safe passage of fish;
- require flow of water and passage of fish; and
- require water intakes and diversions to have a fish guard or fish screen.

DFO has introduced measures to facilitate its review process by allowing proponents to assess if projects near water require DFO review (DFO 2019b). The review includes the identification of Measures to Protect Fish and Fish Habitat. If a project can incorporate all measures, DFO review is not required.

DFO review may also not be required if a project's activities are covered under a Code of Practice (COP) provided by DFO. COPs specify procedures, practices, or standards for avoiding the death of fish or HADD of fish habitat for the specific activities covered by the COP (DFO 2021) and consider the requirements for mitigating any residual effects caused by the activity.

Residual effects are not anticipated after applying avoidance and mitigation strategies, however, if changes are made and residual effects are anticipated then a DFO review is recommended. Regardless of whether a project's activities are included in the DFO standards and codes, proponents are still required to avoid causing death of fish or HADD of fish habitat by providing mitigation such as those described in the Measures to Protect Fish and Fish Habitat (DFO 2019b).

### 2.1.2 Committee on the Status of Endangered Wildlife in Canada and the *Species at Risk Act*

COSEWIC is responsible for reviewing criterion used to assess the status of wildlife species in Canada. Using scientific, community, and Indigenous Traditional Knowledge sources, COSEWIC identifies species that may require additional protections under the *SARA* and will provide recommendations on classification or declassification of species.

COSEWIC is overseen by the Canadian Endangered Species Conservation Council, a group of appointed minsters, which include the Minster of Environment, the Minister of Fisheries and Oceans, and the Minister responsible for Parks Canada. The Council provides general direction on the activities of COSEWIC and aids in the preparation of recovery strategies and implementation of action plans (Government of Canada 2021a).

The purposes of the *SARA* are to prevent wildlife species from being Extirpated or becoming Extinct, to provide for the recovery of wildlife species that are Extirpated, Endangered, or Threatened as a result of human activity, and to manage Species of Special Concern to prevent them from becoming Endangered or Threatened (Government of Canada 2021a).

The *SARA* contains several prohibitions to protect species listed under Schedule 1. For species listed as Extirpated, Threatened, or Endangered, as outlined in Sections 32 and 33 of *SARA*, it is an offence to:

- kill, harm, harass, capture, or take an individual of a species listed;
- possess, collect, buy, sell, or trade an individual; and
- damage or destroy the residence of one or more individuals listed if a recovery strategy has been recommended for its reintroduction into the wild in Canada.

Under Section 58 (1) it is an offence to:

- destroy any part of the Critical Habitat of any listed Endangered species or of any listed Threatened species, or of any listed Extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada, if:
    a) the Critical Habitat is on federal land, in the exclusive economic zone of Canada or on the continental shelf of Canada;
    b) the listed species is an aquatic species; or
    c) the listed species is a species of migratory birds protected by the *Migratory Birds Convention Act, 1994*.

If there is potential that a *SARA*-listed species (with an Extirpated, Endangered, or Threatened listing) are encountered outside of Critical Habitat, and the proposed works cannot abide by the prohibitions under Section 32, 33 and 58 (1) of *SARA*, it is recommended that proponents of construction or development projects submit a Request for Review application directly to DFO to obtain a *SARA* Permit prior to the start of construction. Proactively obtaining a *SARA* Permit can reduce the risk of Project delays if a *SARA*-listed species is encountered while working in or near water.

## 2.2 Provincial

### 2.2.1 British Columbia Oil and Gas Commission

The BC Oil and Gas Commission (BC OGC) has authority to issue specific provincial approvals for pipeline activities), including approvals under the *Water Sustainability Act* (*WSA)* (Province of BC 2021a), which includes provisions related to disturbance of watercourses and streams (BC OGC 2021a). Although the Project is not regulated by the *Oil and Gas Activities Act*, the BC OGC will consider the *Environmental Protection and Management Regulation* (*EPMR*) (BC OGC 2021a).

### 2.2.2 British Columbia *Water Sustainability Act*

Approval is required from the BC OGC to make Changes In and About a Stream under the *WSA*. Common Changes In and About a Stream include the construction, maintenance, and removal of pipeline/watercourse crossings and crossing structures. Short-term water use or diversion for applications such as hydrostatic testing, water withdrawals, and groundwater discharging also require approval from the BC OGC.

Changes In and About a Stream refer to:

- any modification to the nature of the stream, including any modification of the land, vegetation, and natural environment of a stream or the flow of water in a stream; and
- any activity or construction within a stream channel that has or may have an impact on a stream or stream channel.

The *WSA* applies to activities on both Crown and private lands. As part of the application process for Changes In and About a Stream, *EPMR*-defined riparian classifications should be provided for streams, wetlands, and lakes and proponents should provide a document (such as, an environmental management plan) describing the conformance of their proposed activities with each of the BC government's environmental objectives in the *EPMR* (BC OGC 2021d).

#### 2.2.3 British Columbia *Water Sustainability Regulation*

Under the *WSA*, the *Water Sustainability Regulation* sets out the statutory requirements for the issuance of licences or approvals for the diversion, use, or storage of surface water or groundwater, and for making Changes In and About a Stream. The definition of stream under the *WSA* is broad, and includes watercourses, wetlands, lakes, and other aquatic features including:

a) a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel has been modified; or

b) a natural source of water supply, including, without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland, or glacier, whether or not usually containing water, including ice, but does not include an aquifer. (Province of BC 2021b)

#### 2.2.4 *Environmental Management Act*

Under the *EMA*, a Waste Discharge Authorization is required to release waste into the environment which must be applied for prior to discharging waste into the environment. This authorization must be maintained until the discharge activity is complete.

The BC Ministry of Environment and Climate Change Strategy is the management authority and must be notified of any changes throughout the process.

Waste under the *EMA* includes:

- Air contaminants (for example, dust from an industrial site)
- Effluent (for example, wastewater from industry or sewage)
- Garbage (for example, municipal and industrial garbage)
- Hazardous waste (for example, batteries, asbestos and waste oil) (Province of BC 2021b)

# 3. Methods

## 3.1 Desktop Assessment Methods

A detailed literature review was conducted to identify locations with documented fish presence, sensitive habitat, and information on fish species at risk or of special management interest. The literature review was conducted to gather information on the environmental setting within the Project area. This information was used to support the Waste Discharge Authorization by supplementing historical field data.

The information will provide context to develop technical and economically feasible site-specific mitigation measures aimed to avoid or reduce impacts to fish and fish habitat. Sources reviewed during the literature review included, but were not limited to:

- Historical Hydrometric Database was used to source discharge and flow rate information (Government of Canada 2021b)
- Region-specific least risk timing windows (LRTWs) for the Province of British Columbia (Province of BC 2006)
- BC Habitat Wizard database to identify potential stream crossing locations and historical fish capture information, as well as presence of species at risk species (Province of BC 2021c)
- EcoCat Ecological Reports Catalogue to review reports relating to previous fish captures for additional information (Province of BC 2021d)
- DFO's Species at Risk Map to identify Critical Habitat and documented species at risk species presence (Government of Canada 2021a)
- BC Conservation Data Centre (BC CDC) Species and Ecosystem Explorer (Province of BC 2021e) and BC CDC iMap (Province of BC 2021f) to identify status for potential species at risk

## 3.2 Field Survey Methods

This Fish Habitat Assessment was supplemented by aquatics data collected during previous field surveys at the BC Rail site.

Water quality data were obtained from the Water Quality Monitoring for Hydrostatic Pressure Testing technical data report (TDR) which utilized six separate field visits over 2020 and 2021 (Jacobs 2021). The methods used to collect water quality data are listed in the methods section of the TDR.

Fish habitat and fish habitat constraints were assessed by a QP specialized in aquatic biology during field assessment on June 12, 2021. The field assessment included a high-level Fish Habitat Assessment at each proposed water discharge option to determine fish habitat potential, including spawning, rearing, overwintering, migration, and to evaluate potential aquatic environmental constraints at the discharge location.

# 4. Results

## 4.1 Desktop Assessment Results

### 4.1.1 Environmental Setting

The Project area falls under Pacific Ranges Ecoregion and the Coastal Cedar Hemlock biogeoclimatic (BGC) zone of BC. This area is characterized by a lower elevation and close proximity to the ocean, with mild winters with frequent precipitation and cool summers.

The Project is located in the Squamish Watershed in the South Coast Region and the discharge location is 4 km upstream from Howe Sound. The BC Rail tunnel wastewater discharge site is located on the eastern bank of the Squamish River, approximately 4 km upstream from Howe Sound at 10U 488123N 5508169W. The Squamish River (Watershed Code: 900-097600) is a sixth order stream.

### 4.1.2 Hydrology

Based on the historical hydrometric station data from the Brackendale (Station No. 08GA022) and Cheakamus (Station No. 08GA043) stations from 1922 to 2018, the Squamish River has an annual mean discharge of 271.8 cubic metres per second ($m^3/s$) (Government of Canada 2021b). Seasonally the mean discharge varies from approximately 100 $m^3/s$ during the late-winter/early-spring to 550 $m^3/s$ in the summer months (Government of Canada 2021b).

The Project will use stormwater outfall to discharge treated wastewater from the tunneling process into the Squamish River. It is expected to produce an average wastewater discharge of 0.0018 $m^3/s$ during normal operations. The rate of discharge may vary depending on the groundwater conditions at the time of construction however is projected to have a maximum discharge of 0.07 $m^3/s$ during hydrostatic testing. The maximum discharge of wastewater is equivalent to 0.0007 percent of the total discharge during the low flow season.

**Table 1. Historical Streamflow Summary of the Squamish River Near Brackendale Hydrometric Station and the Cheakamus River Near Brackendale**

| Monthly Discharge | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 117.6 | 108.9 | 109.3 | 162.9 | 361.5 | 540.1 | 553.8 | 431.4 | 289.2 | 245.4 | 205.6 | 134.7 |
| Maximum | 338.2 | 301.1 | 231.7 | 343.2 | 594 | 904 | 845 | 762 | 469.5 | 658 | 526 | 421.6 |
| Minimum | 29.9 | 33.16 | 45.6 | 76.1 | 185.5 | 369.3 | 323.3 | 295.2 | 157.4 | 85.26 | 73.79 | 40.61 |

Source: Government of Canada 2021b.

Monthly, mean discharge rates have been averaged for years ranging from 1922 to 2018.

### 4.1.3 Fish Species Considered to be of Regional Importance

There are 22 fish species in the Squamish River (Province of BC 2021c), including provincially Blue-listed species, COSEWIC-listed species, and species listed as Special Concern on Schedule 1 of *SARA* (Government of Canada 2021a; Province of BC 2021e). The species that appear on the Red list for BC are either Extirpated, Endangered, or Threatened, or are being legally considered for such status, while the species that are Blue-listed are species that are considered to be vulnerable (Province of BC 2021e). The species with the highest regional importance are discussed in more detail as follows.

#### Green Sturgeon

The green sturgeon (*Acipenser medirostris*) is Blue-listed in BC and was listed as Special Concern in 2006 on *SARA* Schedule 1 (Province of BC 2021e; Government of Canada 2021a). The documentation for green sturgeon (*Acipenser medirostris*) is rare and has been limited to offshore incidental catches from commercial fishing vessels, suggesting that marine and estuarine environments are the preferred habitats of green sturgeon in Canadian waters.

There are no known spawning populations of green sturgeon in Canada, and they likely originate from spawning populations along the United States west coast. However, green sturgeon are known to concentrate and feed in estuarine areas in the summer and fall (Province of BC 2021e), which may include the Area of Interest.

**Coastal Cutthroat Trout**

Coastal cutthroat trout is one of two subspecies of cutthroat trout in BC (Province of BC 2021e). Coastal cutthroat trout are native to the Fish and Fish Habitat Regional Study Area, and they are found in the South Coast Rivers Watershed. Coastal cutthroat trout are Blue-listed (Province of BC 2021e). Coastal cutthroat trout are managed as a recreational fishery in BC. Coastal cutthroat trout have three life history types: anadromous; stream-resident; and lacustrine (McPhail 2007). They use many habitat types depending upon their life history form and stage (McPhail 2007). Timing of migration and spawning for anadromous coastal cutthroat trout is highly variable. Declines in coastal cutthroat trout populations in BC can be attributed to habitat loss and degradation (such as, forestry and urbanization), overharvesting and hatchery releases of other species such as steelhead and coho salmon (McPhail 2007).

**Rainbow Trout and Steelhead**

Both freshwater resident rainbow trout and anadromous rainbow trout (steelhead) are Yellow-listed (Province of BC 2021d) and steelhead are listed as a high-priority candidate for a detailed status assessment by COSEWIC (Government of Canada 2021a). Rainbow trout and steelhead are managed as recreational fisheries within BC. Rainbow trout are ubiquitous in cool and cold freshwater environments throughout BC while steelhead occur along the entire coast of BC.

Resident rainbow trout spawn during spring, migrating to spawning sites after ice-out from mid-April to late June (McPhail 2007). The timing of spawning depends on temperature, typically occurring when water temperatures are 8 degrees Celsius (°C) to 15°C, from late-April to July (McPhail 2007). Rainbow trout spawn in small tributaries or inlet or outlet streams of lakes, at sites with gravel substrate often at pool tail-outs upstream from riffles or areas of upwelling. The egg incubation period and subsequent gravel emergence vary with temperature and geographic location (McPhail 2007).

Steelhead have two life history types, relative to timing of entry to fresh water, that occur in BC. Winter-run steelhead enter fresh water during fall and winter (that is, November to April) and summer-run steelhead migrate from spring through summer (that is, May to September) (McPhail 2007). Migration timing is related to distance to spawning areas and seasonal flow patterns. Steelhead typically spawn in spring when water temperature is between 4°C and 10°C (McPhail 2007).

Steelhead spawning habitat preferences are similar to those of resident rainbow trout, although larger-bodied steelhead may spawn in faster and deeper water over larger substrate (McPhail 2007). Egg incubation time is dependent on water temperature. Juvenile steelhead spend 2 to 3 years rearing in streams before migrating to the ocean where they stay for 1 to 4 years before returning to fresh water to spawn.

Unlike Pacific salmon species, steelhead can spawn more than once, although only a small percentage live to spawn a second time (McPhail 2007). Steelhead adults that spawn and return to the ocean are known as kelts. Freshwater habitat used by rainbow trout and steelhead is variable and includes anadromous, lacustrine, large river, stream, and headwater habitats (McPhail 2007).

In flowing water, they inhabit riffles, runs, and pools. Juveniles are typically found in shallower and slower water than adults. In the fall, they move into large pools with cover to overwinter. Juveniles often use the substrate for cover during winter. In streams, fry and juveniles feed on aquatic insects. As they grow, terrestrial insects are added to the diet and some become piscivorous (McPhail 2007).

**Chinook Salmon**

Chinook salmon are Yellow-listed (Province of BC 2021e) and managed for commercial, recreational, and Aboriginal fisheries. Chinook salmon are anadromous and occur in most medium to large rivers along the BC coast, including the Squamish River. Small numbers of Chinook salmon have historically been observed as far as 680 km inland (McPhail 2007). Typically, Chinook salmon are fall spawners and often spawn in streams and mainstem rivers with higher water velocities and larger substrate than other Pacific salmon species (McPhail 2007).

However, the Squamish River is a summer-run population that returns to Howe Sound from June to August and enters the Squamish River after a short delay near Britannia Beach (McPhail 2007). Like other Pacific salmon species, Chinook salmon die after spawning. Eggs incubate over the winter and hatch in the spring. In fresh water, juvenile Chinook salmon rear in shallow edge habitat with low water velocities and fine substrate, backwater areas, off-channel habitat, and sloughs for up to 2 years (McPhail and Carveth 1993). Overwintering habitat includes pools and interstitial spaces between cobble and boulder substrate in large rivers. Juvenile Chinook salmon feed on terrestrial and aquatic insects in fresh water, while in the ocean they feed on small fish (such as, herring and sand lance) and invertebrates (McPhail 2007).

**Bull Trout**

Bull trout are Blue-listed (Province of BC 2021e) and listed as Special Concern by COSEWIC (Government of Canada 2021a). Bull trout are found in most large inland drainage systems in BC (McPhail 2007). Bull trout spawn from late-summer to early-fall when water temperatures are between 5°C and 9°C (Government of Canada 2012), often in close proximity to cover in small streams with low water velocity. They require clean gravel and groundwater inflow for spawning (McPhail 2007).

Fry emerge in spring (April and May) shortly after hatching in late-winter to early-spring (Government of Canada 2012). Juvenile bull trout rear in streams for 2 to 4 years, where they prefer pools and deep side channel habitat (McPhail 2007). Bull trout are frequently referenced as having the most sensitive habitat requirements among trout and char species in western North America (McPhail and Carveth 1993). They prefer cool, fast-flowing streams and rivers with good water quality and diverse habitat features (such as, riffles and pools, coarse woody debris, and medium to large substrate).

Bull trout display several life history forms including resident (such as, stream-resident or lacustrine) and anadromous forms (McPhail 2007). They are often a top predator in the ecosystems where they occur. Their susceptibility to angler overharvest, slow maturity, and sensitive habitat requirements, as well as competition from introduced non-native species and habitat fragmentation, are a few of the factors contributing to the species' decline through most of their range in North America (McPhail and Carveth 1993).

Table 2 provides a comprehensive list of documented fish species within the Squamish River including the species, population specific spawning seasons, and the provincial and federal species status.

**Table 2. Fish Species Previously Documented within the Squamish River**

| Common Name[a] Scientific Name[a] | Population[a,c,d] | Spawning Season[b,c] | BC General Status[c] | COSEWIC Status [d] | *SARA* Listed[d] |
|---|---|---|---|---|---|
| ***Sportfish*** | | | | | |
| Atlantic Salmon *Salmo salar* | Introduced | Winter | Exotic SNA (2019) | - | - |

**Table 2. Fish Species Previously Documented within the Squamish River**

| Common Name[a] Scientific Name[a] | Population[a,c,d] | Spawning Season[b,c] | BC General Status[c] | COSEWIC Status [d] | *SARA* Listed[d] |
|---|---|---|---|---|---|
| Bull Trout *Salvelinus confluentus* | South Coast | Spring | Blue S2S3 (2018) | Special Concern | Special Concern |
| Chinook Salmon *Oncorhynchus tshawytscha* | South Coast, Georgia Strait | Fall | No Status SNR (2019) | Data Deficient | - |
| Chum Salmon *Oncorhynchus keta* | General | Summer/Fall | No Status SNR (2019) | - | - |
| Cutthroat Trout *Oncorhynchus clarki* | General | Spring | No Status S4 (2004) | - | - |
| Coastal Cutthroat Trout *Oncorhynchus clarki clarki* | General | Spring | Blue S3S4 (2004) | - | - |
| Coho Salmon *Oncorhynchus kisutch* | General | Late Fall | No Status SNR (2019) | - | - |
| Dolly Varden *Salvelinus malma* | Southern | Fall | Yellow S4 (2012) | - | - |
| Green Sturgeon *Acipenser medirostris* | General | Winter | Blue S2S3N (2019) | Special Concern | Special Concern |
| Pink Salmon *Oncorhynchus keta* | General | Summer/Fall | No Status SNR (2019) | - | - |
| Steelhead (Rainbow Trout) *Oncorhynchus mykiss* | Coastal | Spring | No Status SNR (2010) | - | - |
| Sockeye Salmon *Oncorhynchus nerka* | General | Summer/Fall | Yellow SNR (2019) | - | - |
| ***Non-Sportfish*** | | | | | |
| American Shad *Alosa sapidissima* | General | Spring | Exotic SNR (2019) | - | - |
| Coastrange Sculpin *Cotta aleuticus* | General | Spring | Yellow S5 (2019) | - | - |
| Pacific Lamprey *Entosphenus tridentatus* | General | Spring | Yellow S5 (2019) | - | - |
| Prickly Sculpin *Cottus asper* | General | Spring | Yellow S5 (2019) | - | - |

**Table 2. Fish Species Previously Documented within the Squamish River**

| Common Name[a] Scientific Name[a] | Population[a,c,d] | Spawning Season[b,c] | BC General Status[c] | COSEWIC Status [d] | *SARA* Listed[d] |
|---|---|---|---|---|---|
| Threespine Stickleback *Gasterosteus aculeatus* | General | Spring/Summer | Yellow S5 (2018) | - | - |

Notes:

[a] Habitat Wizard (Province of BC 2021c; Roberge et al. 2002)

[b] McPhail and Carveth 1993; McPhail 2007

[c] BC Ecosystem Explorer (Province of BC 2021e)

[d] Species at Risk Public Registry (Government of Canada 2021a)

All fish species listed in this table require a BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD) Scientific Fish Permit (BC MFLNRO 2006)

-- Not listed or not required

## 4.2 Field Survey Results

In 2020, six surveys were conducted by environmental consultants at Jacobs on the Squamish River at a location 600 metres (m) downstream from the Project's discharge site. Water quality data collected during the survey have been used in this technical memorandum to estimate the flow rate near Project.

On June 12, 2021, a QP specialized in aquatic biology conducted a field assessment to confirm desktop findings and identify potential fish and fish habitat constraints. The field assessment included a high-level Fish Habitat Assessment at each proposed water discharge option to determine fish habitat potential, including spawning, rearing, overwintering, migration, and to evaluate any potential aquatic environmental constraints at the discharge location.

The following subsections describe the combined results of the field surveys conducted historically at the discharge outfall on the Squamish River. The Riparian Stream Classification, BC MFLNRORD's and DFO's LRTWs, and fish habitat rating results are also included in the following subsections. A summary of the Squamish River Project interaction can be found in Table 3. Photographs of the existing discharge infrastructure and the area surrounding the Project are provided in Attachment 1.

**Table 3. Summary of the Aquatic Interactions on the Project**

| Stream ID[a] | Stream Name[a] | UTM Coordinates (10U) | Riparian Stream Classification[b] | Riparian Management[b] | Primary Interaction |
|---|---|---|---|---|---|
| WC-1 | Squamish River | 488123E 5508169N | S1A | RRZ = 0<br>RMZ = 100 m<br>RMA = 100 m | Wastewater discharge |

Notes:

[a] Habitat Wizard (Province of BC 2021c).

[b] Riparian Management Area Guidebook (Province of BC 2004a)

RMA = Riparian Management Area
RMZ = Riparian Management Zone
RRZ = Riparian Reserve Zone
UTM = Universal Transverse Mercator
WC = watercourse

### 4.2.1 Squamish River

#### Stream Morphology and Water Quality

The stream bank at the discharge outfall was a mix of undercut and vertical in shape and consisted primarily of large boulders. There was angular riprap beneath the outfall pipe that prevented streambed scour upon discharge. The grades of the approach slopes were moderate (14 percent) and anthropogenically modified during the construction of the dike.

Overall, there was a lack of fine alluvial sediments at the discharge outfall, reducing the potential for sedimentation or erosion events to impact downstream fish habitat.

Water quality data are provided in Table 4 (including temperature, pH, dissolved oxygen, and conductivity). The data were collected during instream surveys on six occasions from October 28, 2020 to August 4, 2021 600 m from the discharge outfall. Other stream morphology measurements recorded were estimated from desktop resources or observed during land-based site assessments.

**Table 4. Stream Morphology and Water Quality Measurements**

| Stream ID[a] Stream Namea | Temp. (°C)[b] | pH[b] | Dissolved Oxygen (mg/L)[b] | Background Discharge Rate ($m^3/s$)[c] | Wetted Width, and Water Depth[b] (m) | Dominant Substrate[d] | Mean Bank Height[b] (m) | Bank Shape[d] |
|---|---|---|---|---|---|---|---|---|
| WC-1 Squamish River | 6.9 | 6.44 | 12.46 | 281 | 150[e] 83.3 | Cobble/ large gravel | LBH: 3.55 RBH: 0.83 | LB: Undercut |

Notes:

[a] Habitat Wizard (Province of BC 2021c)

[b] Water Quality Monitoring for Hydrostatic Pressure Testing TDR (Jacobs 2021)

[c] Discharge attained from the hydrometric station at Squamish River near Brackendale (08GA022) (Province of BC 2021d)

[d] Obtained during June 12, 2021 field survey

[e] Estimated from desktop imagery

LB = left bank
LBH = left bank height
mg/L = milligram(s) per litre
RBH = right bank height

#### Fish Habitat Characteristics

Near the outfall, fish habitat consisted of instream large woody debris along the length of bank, abundant overhanging vegetation, and creating a dense canopy cover. The undercut bank structure and a backwater eddy was providing important flow refuge along the margin of the river. Overhang riparian vegetation at the discharge outfall was providing functional fish habitat cover extending approximately 10 m in length into the Squamish River from the edge of the channel. The mature riparian vegetation located within the RMZ was playing an important role in maintaining the stability of the steep banks.

#### Fish Habitat Potential Ratings

The species dependant habitat ratings given in Table 5 summarize the spawning, rearing, adult suitability, and overwintering potential based on the morphometric data collected and publicly available desktop resources (Levy and Slaney 1993).

The fish habitat within the section of river near the Squamish River discharge outfall has been rated as important for adult suitability, overwintering, and rearing life histories of coastal cutthroat trout, rainbow trout/steelhead, Chinook salmon, and bull trout. This large river is foundational migratory component for most BC salmonid species, supporting their movement from the ocean and estuarine environments in Howe Sound to their natal spawning streams.

A wide variety of functional habitat is available to smaller bodied fish in this area including flow refuges along the margins of the river, backwater snyes near the outfall, and within side channels located on the west bank of the river across from the Project. The area within the zone-of-influence downstream comprises of vast, a mix of shallow gravel bars and deep fast-flowing waters long the thalweg. Having low flow refuge is important for smaller bodied species or rearing and juvenile stages of larger migratory salmonids to conserve energy for growth and to not be swept downstream. Cover used by young-of the year and juvenile coastal cutthroat trout includes boulder substrate and large woody debris which has been observed at the discharge outfall.

Having deep pools and cold, thoroughly oxygenated water is key habitat feature for sensitive cold-water salmonids during overwintering periods, especially prior to the start of migrations in the spring and fall where densities of fish can increase, decreasing available oxygen (Levy and Slaney 1993).

Spawning for coastal cutthroat trout and bull trout has been rated as marginal at the Project location. Spawning for coastal cutthroat trout usually takes place in small headwater streams, in pea-sized gravel, 0.15 m to 0.45 m of water with velocities ranging from 0.15 to 0.8 metres per second (m/s) to confirm successful rearing. Velocity must remain under 0.8 m/s to ensure viable egg development. There are some shallow, low velocity areas within the margins of the Squamish River that may support this type of habitat but is infrequent.

Bull trout prefer to spawn in smaller rivers and tributary streams where there are high gradients and a velocity of 0.14 to 0.52 m/s. Spawning usually takes place over small gravel and rubble substrates in slow moving water, which can be found in the Squamish River near the Project. Velocity must remain under 0.72 m/s to ensure viable egg development (Levy and Slaney 1993).

Rainbow trout and steelhead are more flexible in their spawning requirements such that they spawn in deeper faster flowing water in both the upper reaches and lower reaches of larger rivers. Rearing juveniles require velocities ranging between 0.1 and 0.3 m/s and viable egg development is less restrictive ranging from 0.1 to 1.0 m/s.

Chinook salmon also tend to spawn primarily in large rivers where there was pool-riffle habitat in depths less than 5 m. Rearing juvenile Chinook salmon require velocities ranging between 0.3 and 0.9 m/s, therefore the Squamish River has been rated as important for spawning for these species.

The Squamish River has been rated as marginal for green sturgeon. There is very little freshwater information for the species, and they are rarely documented in freshwater systems in Canada. Their dominant habitat are back eddies and margins of rivers in depths of 3 m to 6 m, however they remain primarily in brackish water along the coast of BC (Roberge et al. 2002). They would have access to the Project area; however, the Squamish River would only provide marginal freshwater habitat if they were to migrate upstream.

**Table 5. WC-1 (Squamish River) Fish Habitat Potential Ratings**

| Species | Spawning | Rearing | Adult Suitability | Wintering |
|---|---|---|---|---|
| Green sturgeon | Marginal | Marginal | Marginal | Marginal |
| Coastal cutthroat | Marginal | Important | Important | Important |
| Rainbow trout/steelhead | Important | Important | Important | Important |
| Chinook salmon | Important | Important | Important | Important |
| Bull trout | Marginal | Important | Important | Important |

### 4.2.2 Least Risk Timing Window

Due to the documented presence fish species such as chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), cutthroat trout (*Oncorhynchus clarki clarki*), Dolly Varden (*Salvelinus malma*), and rainbow trout (*Oncorhynchus mykiss),* the Squamish River has a provincial LRTW of August 1 to August 31 (Province of BC 2006). The DFO LRTW for Howe Sound has been included as follows given that the BC Rail site is only 4 km upstream from Howe Sound and the Project would still be influenced by tidal waters.

The LRTW for Howe Sound is August 16 to January 31 (DFO 2014). There are no concerns with Project work outside the LRTWs since anticipated effects from the Project discharging activities on fish and fish habitat are negligible.

# 5. Assessment of Discharge Activities

The wastewater discharge continuous rate will be 0.00175 $m^3/s$, with a maximum of 150 cubic metres per day. The wastewater will enter directly into the Squamish River, where the background average discharge rate is approximately 300 $m^3/s$ (hydrometric station near Brackendale). The discharge rates may vary depending on the groundwater conditions during hydrostatic testing, however discharge will be released over a daily period of 10 hours, with a maximum discharge rate of 0.07 $m^3/s$.

The maximum generated discharge from construction activity (0.07 $m^3/s$ of additional discharge) will only be 0.0007 percent of the minimum background Squamish River discharge of 100 $m^3/s$ (low estimate using hydrometric data in Table 1). This percentage was calculated using discharge rates recorded for the Squamish River during the low flow period as a conservative measure, indicating that the impact of the increase in water levels would negligible.

For areas near the Project outfall previously used for spawning or egg incubation, which is usually the most sensitive life stages to velocity changes, the proposed 0.0007 percent increase in discharge would not likely decrease habitat viability or availability.

# 6. Recommendations and Mitigation Measures

The proposed activities are not anticipated to have negative impacts to hydrology and water quality, and water will be managed in accordance with the Construction Environmental Management Plan. Recommendations are based on aquatic survey results and consideration of measures from DFO's Measures to Protect Fish and Fish Habitat (DFO 2019a), BC OGC's Environmental Protection and Management Guideline (BC OGC 2021d), and BC's Standards and Best Practices for Instream Works (Province of BC 2004b).

Recommendations are based on current Project designs and should be reviewed and modified as needed should designs or plans change. Additional mitigation measures or conditions may be included in permits issued to the Project.

**Table 6. Mitigation Measures to Protect Fish and Fish Habitat**

| Mitigation Type | Mitigation Description |
|---|---|
| ***General Mitigation Measures*** | |
| Regulatory | ▪ Confirm that necessary approvals, licences, and permits are secured before commencing applicable construction activities, and verify that notifications related to the approvals, licences, and permits are provided, as necessary.<br>▪ Review all mitigation and regulatory requirements before construction to confirm mitigation requirements are understood and implemented as described. |
| Timing | ▪ Halt construction when adverse construction conditions caused by inclement weather occur (that is, weather that may cause an increase in erosion or sedimentation). |
| Containment and Spill Measures | ▪ All water will be treated prior to discharging in accordance with the BC Water Quality Guidelines for Aquatic Life (Province of BC 2021f).<br>▪ Cease all work immediately if deleterious substances are entering the stream. The containment and cleanup of this material is to occur immediately (if feasible, without causing further environmental damage) to prevent it from moving downstream. |
| Erosion and Sediment Control | ▪ Develop and implement an Erosion and Sediment Control Plan for the site that reduces risk of sediment mobilization to the stream during all phases of the Project. The plan will include the following, where applicable:<br>– Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the stream<br>– Measures for containing and stabilizing waste material above the high watermark of the stream to prevent mobilization<br>– Regular inspection and maintenance of erosion and sediment control measures and structures during construction<br>– Repairs to erosion and sediment control measures and structures if damage occurs<br>– Removal of nonbiodegradable erosion and sediment control materials once the site is stabilized |
| Bank Protection | ▪ Minimize the clearing of riparian vegetation if such clearing is necessary. Use existing trails and roads where practical, to avoid disturbance to the riparian vegetation and prevent soil compaction.<br>▪ Make efforts to avoid the unnecessary disturbance of the stream bank. If unplanned degradation of either bank occurs during construction, a site-specific bank reclamation plan will be developed and implemented. Immediately stabilize banks disturbed by any activity associated with the Project to prevent erosion and sedimentation. |
| Fish Protection | ▪ Perform water quality monitoring during instream construction activity to confirm that adverse effects related to turbidity and total suspended solids are avoided.<br>▪ Clean, drain, and dry equipment that contacted water before arriving on-site and after construction is completed.<br>▪ Verify that workers who will be instream (including fisheries workers) take appropriate measures for disinfecting equipment to avoid transporting aquatic invasive species. |
| Instream Discharging Activities | ▪ Confirm that pre- and post-construction photographic records are developed and kept on file. The photographic records must use the same photograph points.<br>▪ Confirm that disturbance of the access or the stream's approach is reduced, immediately stabilized, and restored, where feasible, to approximate pre-construction conditions. |

# 7. Summary and Closing

After reviewing the available data and the proposed Project activities, the Professional Biologist (QP) has determined that the DFO Measures to Protect Fish and Fish Habitat and the BC OGC Environmental Protection and Management Guidelines cannot be fully implemented during the Project since instream works are needed (discharge). Given the relatively small amount of discharge compared with that of the Squamish River, the QP is confident that the additional discharge proposed during the Project activities should not result in HADD of fish or fish habitat since:

- Changes in sediment load, flow, and erosion potential are anticipated to be minor relative to background conditions when discharge rates are increased during Project activities. These changes should remain within tolerance limits of all sensitive life stages of Squamish River fish species.
- Changes will be localized to the left bank, leaving much of the river channel at the discharge location free of Project influence.
- Water will be treated in accordance with BC Water Quality Guidelines for Aquatic Life prior to release into the Squamish River.

If you have any questions or concerns regarding this information, do not hesitate to contact Carissa Stenzel at 587.591.8375 or via email at carissa.stenzel@jacobs.com.

Sincerely
Jacobs Consultancy Canada Inc.

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# Attachment 1
# Photographs

*Photo 1. View north along the dike, east of the existing discharge outfall. The outfall is located on the left, on the far side of the riparian community (June 10, 2021).*

*Photo 2. View south along the dike, east of the existing discharge outfall. The outfall is located on the right, on the far side of the riparian community (June 10, 2021)*

*Photo 3. View of the existing outfall pipe protruding from the Squamish River left bank (June 12, 2021).*

*Photo 5. View of the river margin facing downstream from the existing outfall pipe (June 12, 2021).*