



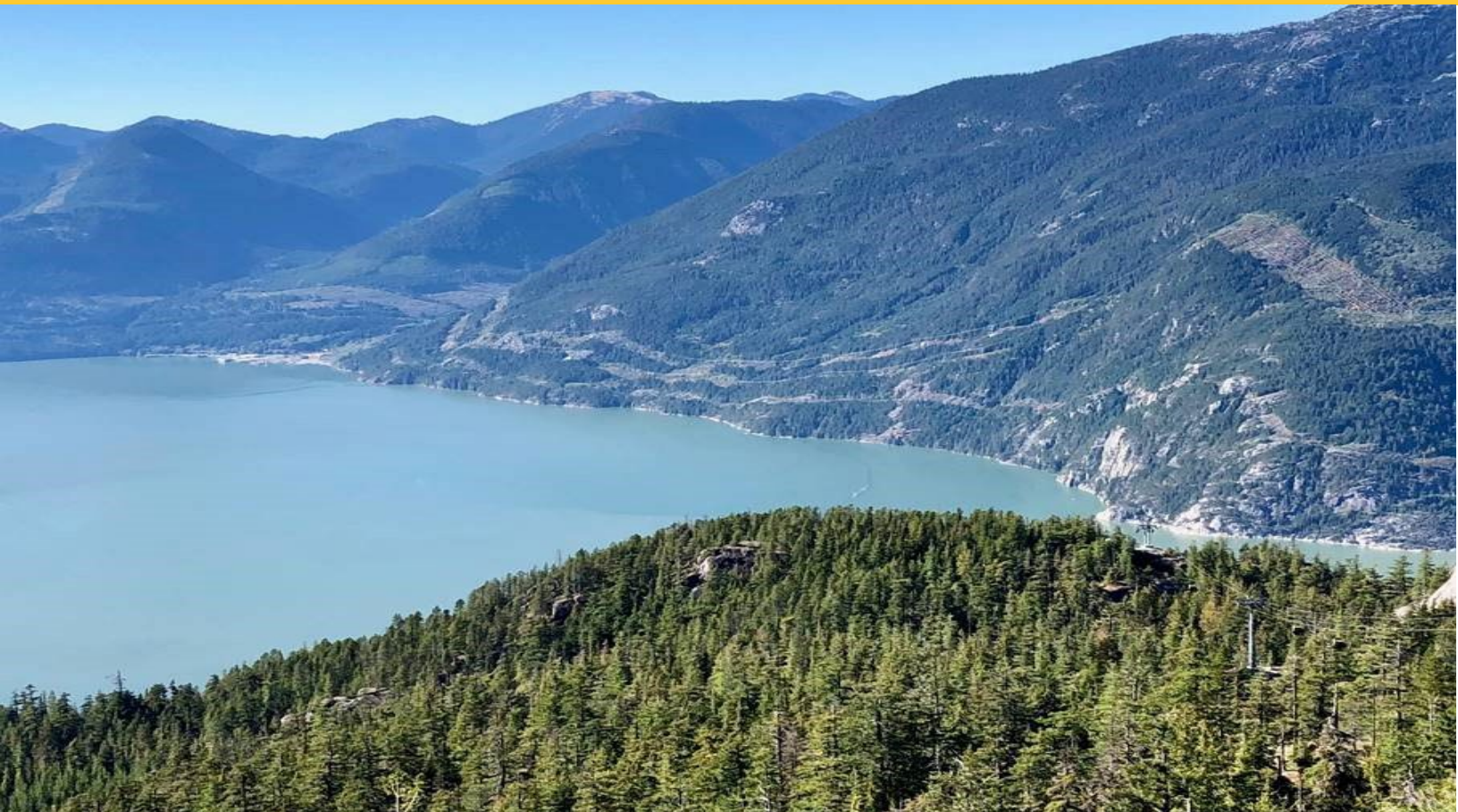
Eagle Mountain - Woodfibre Gas Pipeline Project

Technical Assessment Report for Waste Discharge Authorization at the BC Rail Site

Rev. 0

September 7, 2022

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ACRONYMS AND ABBREVIATIONS

BC	British Columbia
BC EAO	British Columbia Environmental Assessment Office
BC OGC	British Columbia Oil and Gas Commission
BC Rail	BC Rail Properties Ltd.
CEMP	Construction Environmental Management Plan
CMP	Condition Management Plan
DB	Design Build
DFO	Fisheries and Oceans Canada
EAC	Environmental Assessment Certificate
EGP Project	Eagle Mountain – Woodfibre Gas Pipeline Project
EPMG	Environmental Protection Management Guideline
EPP	Environmental Protection Plan
FortisBC	FortisBC Energy Inc.
Jacobs	Jacobs Consultancy Canada Inc.
km	kilometre(s)
m	metre(s)
m ³ /day	cubic metre(s) per day
MJA	McMillen Jacobs Associates
mm	millimetre(s)
NPS	Nominal Pipe Size
O.D.	outside diameter
QEP	Qualified Environmental Professional
RFP	Request for Proposal
SOE	Support of Excavation
TBM	Tunnel Boring Machine
UPI	Universal Pegasus International
WLNG	Woodfibre Liquefied Natural Gas Ltd.
WLNG Site	Woodfibre Liquefied Natural Gas Ltd. production facility
WMA	Wildlife Management Area
WTP	Water Treatment Plant
WQG	Water Quality Guidelines

1. INTRODUCTION

The proposed Eagle Mountain – Woodfibre Gas Pipeline Project (EGP Project) involves the construction of approximately 47 kilometres (km) of Nominal Pipe Size (NPS) 24 (610 millimetres outside diameter [O.D.]) pipeline, including an approximately 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 the District of Squamish, British Columbia (BC). Two parallel NPS 24 (610 mm O.D.) natural gas pipelines will be installed for the EGP Tunnel segment, which will be permanently encased within the tunnel.

FortisBC Energy Inc. (FortisBC) received Environmental Assessment Certificate (EAC) No. E16-01 from the BC Environmental Assessment Office (BC EAO) on August 9, 2016, for the EGP Project. A request to extend the duration of the EAC was submitted to the BC EAO on October 30, 2020 and approval was granted August 5, 2021.

FortisBC has initiated the permitting process for the EGP Tunnel and a permit under the *Oil and Gas Activities Act* was granted by the BC Oil and Gas Commission (BC OGC) on August 24, 2020. At the request of the BC OGC, FortisBC submitted an application to the OGC for a Water Licence under the *Water Sustainability Act* for the EGP Tunnel due to the potential impacts to groundwater aquifers and surface streams from construction activities. The Water Licence Application was submitted on July 3, 2020 and included a Water Management Plan which included results of technical studies (such as, a conceptual hydrogeological model and Environmental Flow Needs assessment). The application was approved and a water license was granted on May 17, 2022. FortisBC also submitted a Water Management Plan with the results of technical studies conducted at the BC Rail Site on June 16, 2021.

In addition to the use of water, tunnel construction activities will require the disposal of treated water. On November 27, 2019, FortisBC submitted a preliminary information package to the BC OGC for a Waste Discharge Authorization under the *Environmental Management Act* under permit PE 110163 (Application Number 388398) to discharge treated water from construction activities for the EGP Tunnel. Upon the completion of additional studies, the proposed discharge locations and anticipated discharge rates submitted under PE 110163 were refined. In December 2020, a Technical Assessment Report was submitted to the OGC with additional permit application deliverables agreed upon between FortisBC and BC OGC. Since the date of submission, FortisBC has conducted additional technical studies and has engaged a Design Build (DB) Contractor for the EGP Tunnel. The Technical Assessment Report presented herein includes additional information on water sources, background conditions of the receiving environment (aquatics, hydrology and water quality) as well as details on water treatment methodologies and mitigations to be implemented during construction.

Refer to Appendices B to G for technical studies and memoranda prepared/signed by qualified professionals.

2. PROJECT OVERVIEW

The EGP Project involves the construction and operation of an approximately 47 km long, NPS 24 sweet natural gas pipeline from an area north of the Coquitlam Watershed, in Metro Vancouver, to Woodfibre, southwest of the District of Squamish, BC. The EGP Project includes approximately 3 km of NPS 24 gas pipeline (Coquitlam Twinning), a 9 km tunnel component (the EGP Tunnel), the installation of additional compression at the existing FortisBC Eagle Mountain Compressor Station in Coquitlam (the Eagle Mountain Compressor Station), and construction of a new compressor station located in Squamish, BC (the Squamish Compressor Station). The EGP Project will require construction logistics, including temporary workspace, temporary infrastructure sites, and the use of ancillary sites to transport people and materials. A Project Overview map is included in Figure 1.

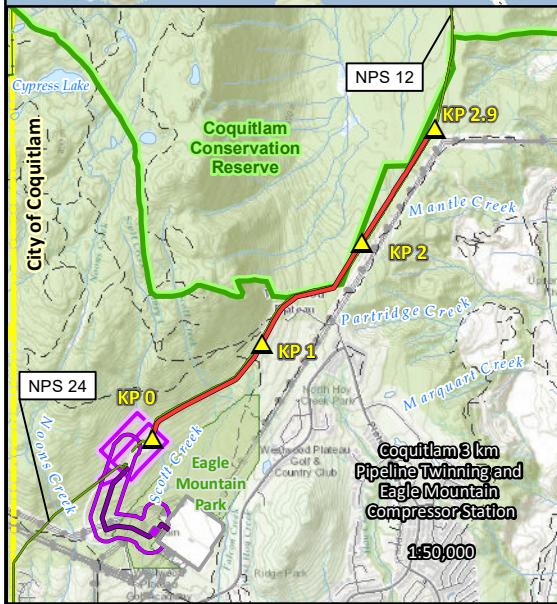
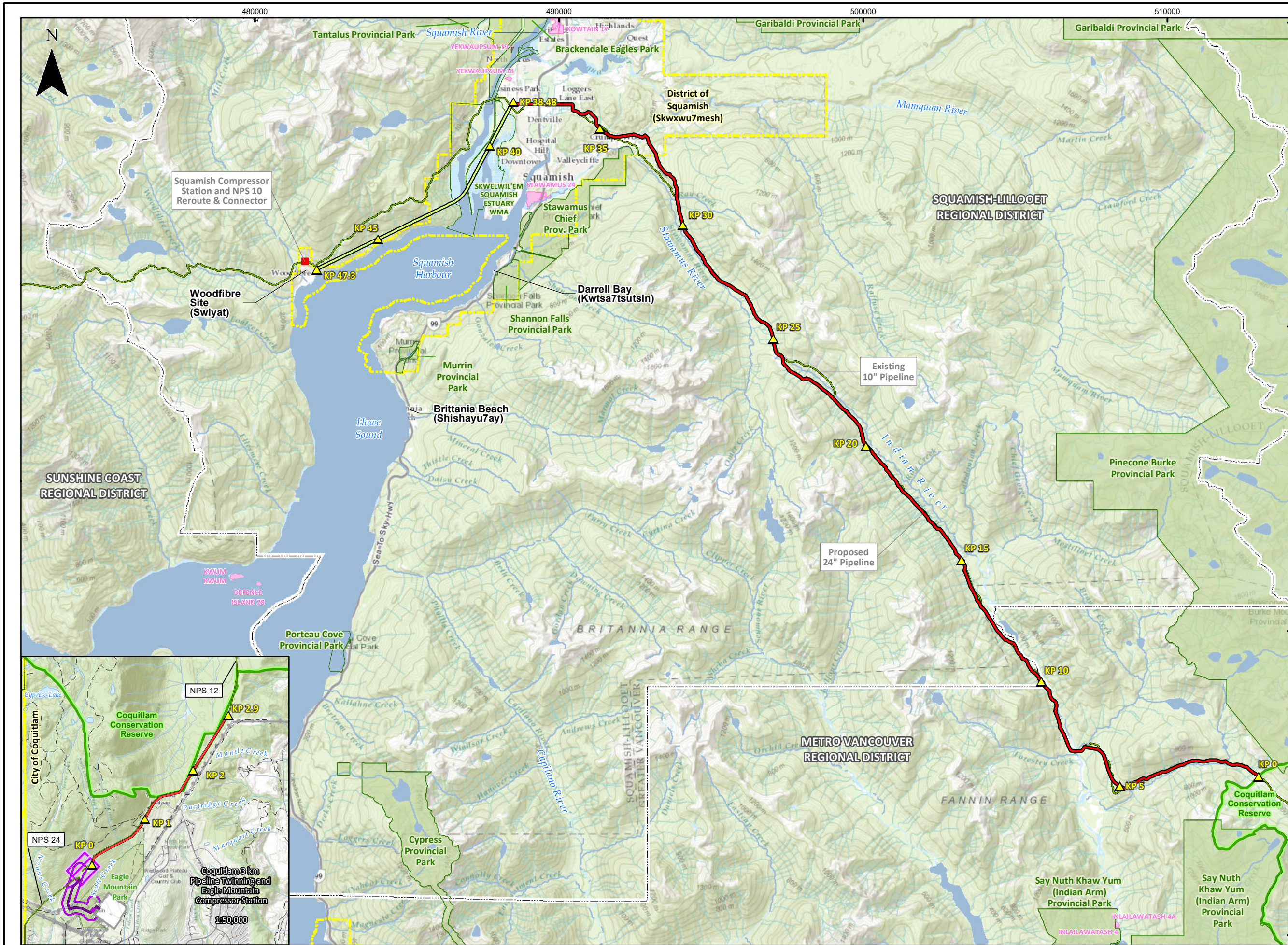
The EGP Tunnel was identified as a solution for the last 9 km of the alignment of the EGP Project to address Indigenous Group and public concerns regarding impacts to the sensitive Skwelwil'em Squamish Estuary Wildlife Management Area, and to avoid steep, difficult terrain in the area of Monmouth Ridge. Two parallel NPS 24 pipelines will be installed for the EGP Tunnel segment, which will be permanently encased within the tunnel. Much like other trenchless construction methods, such as horizontal directional drilling, tunneling will allow the installation of the pipelines while minimizing surface disturbance.

FortisBC will use the Design Build (DB) procurement approach for the EGP Tunnel. FortisBC utilized a request for proposal (RFP) process to select Frontier-Kemper Michels (FKM) as the DB Contractor. The information presented within this report is based on the DB Contractor's detailed design and plans.

The eastern portion of the tunnel alignment crosses under the Squamish River Estuary. In this portion, the surface generally consists of low-lying, flat ground and braided river channels. The western portion of the tunnel alignment crosses under steep, rugged mountainous terrain. These mountains climb steeply from the estuary valley margin, reaching elevations of over 800 metres (m) above sea level. Geology and groundwater conditions can be analyzed in three distinct reaches:

- Soft Ground Reach, under the estuary (Soft Ground Tunnel)
- Interface Reach (located at the estuary-rock transition)
- Bedrock Reach, which extends from the estuary-rock transition to the Woodfibre Portal (Bedrock Tunnel)

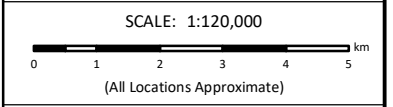
The DB Contractor's design for the EGP Tunnel shows an alignment starting from a declined portal located on the BC Rail Site west of Industrial Way in Squamish (East Shaft) and terminating in a portal structure at the WLNG Site (Woodfibre Portal), northeast of the future WLNG production facility. The Soft Ground Tunnel is approximately 3.8 km in length and will be constructed from the BC Rail Site by a slurry tunnel boring machine (TBM). The DB Contractor will use support of excavation (SOE) to create a decline or ramp structure which will provide access for tunneling operations and pipeline installation. The East Shaft will be as shallow and narrow as practicable to reduce groundwater inflows, while maintaining enough overburden and space for tunneling operations. The East Shaft and BC Rail Site will accommodate all construction activities for the Soft Ground Tunnel, including removal of excavated tunnel spoils and the treatment and discharge of all construction affected water. Several of the DB Contractor's key EGP Tunnel design drawings have been included in Appendix A for reference.



**FIGURE 1
PROJECT OVERVIEW**

**EAGLE MOUNTAIN-WOODFIBRE
GAS PIPELINE PROJECT**

- Certified Compressor Station
- ▲ Kilometre Post (KP)
- Proposed NPS 24 FortisBC Pipeline Route
- Proposed Tunnel Route
- Existing FortisBC Pipeline
- Certified 230 kV Transmission Line
- Meridian Substation
- Certified Electrical Transmission Corridor
- Certified Compressor Station Area
- Watercourse
- Waterbody
- Regional District
- Municipality
- First Nation Reserve
- Park and Protected Area
- Coquitlam Conservation Reserve



Jacobs Project Number CE833400

UTM Zone 10 North, NAD 1983.
Proposed Pipeline Route: KP Universal Pegasus International (UPI) 12-14-2021 (Route 1025.1/A003); Proposed Tunnel Route: UPI 10-24-2019 (SSEID 6002); Existing Pipeline: FortisBC 2012; Proposed Squamish Compressor Station: Solaris 06-18-2020; Mount Mulligan CS: FortisBC 08-04-2015; Certified 230kV Transmission Line: Primary Engineering and Construction 01-07-2020; Certified Compressor Station Area: McInerney Associates Land Surveying Ltd. 10-16-2014; Certified Electrical Transmission Corridor: CH2M 30-07-2014; Conservation Reserve: Metro Vancouver 07-02-2017; Morgan Stewart and Company, 1995 provided by Fortis BC 2015 (modified by Jacobs 05-12-2020); Meridian Substation: DBS Energy Services 03-04-2014; Roads: NRCAN 2014; Railways: BC Gov 2019; Hydrography: NRCAN 2009, BC MFNR 2008; Municipal Boundaries, Regional Districts: BC MFNR 2017; Parks, Wildlife Management Areas: BC MFNR 2008; First Nation Reserves: Government of Canada 2018; Base Map Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Geobase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community.

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3. SOURCES OF WATER

Water will be produced during construction activities of the EGP Tunnel at BC Rail Site, including water from precipitation, groundwater generated during construction, and industrial water which is water used in construction processes such as drilling, grouting, excavation and TBM operation. Any potential water discharge from the EGP Tunnel will be conducted in accordance with regulatory requirements and Best Management Practices. Prior to discharge, the water will be sampled, tested, and treated (as required) to meet BC Approved Water Quality Guidelines (WQG) (BC ENV 2021), and BC OGC criteria. As part of the EGP Tunnel construction, the need for temporary water discharge has been identified at the BC Rail Site. The following sections provide details to support the flow capability, water quality, and aquatic influence at the discharge location.

Water is expected to be produced from the following sources during the construction of the East Shaft and the Soft Ground Tunnel:

- industrial water generated during construction of the East Shaft (approximately 7 m wide and 5 m deep);
- groundwater inflow into the shaft during tunnel construction and pipeline installation;
- TBM industrial water including waste bentonite slurry mixture and water for cleaning of equipment;
- precipitation on-site, including runoff collected from stockpiles, and wet weather surface flows that are affected by construction activities; and
- water used for hydrostatic testing of the pipelines.

The Soft Ground Tunnel will be supported by a continuous, precast concrete segmental lining (inner diameter of 3.3 m and outer diameter of 3.8 m). Groundwater inflow into the continuously lined tunnel excavation is considered to be negligible as the precast concrete tunnel lining segments are fitted with rubber gaskets.

4. QUANTITY AND QUALITY OF WATER DURING CONSTRUCTION

Construction is currently scheduled to start in early-2023, operating 20 hours/day from Q3 2023 for the duration of construction (approximately 3 years). Hydrostatic testing for the pipelines inside the tunnel will be completed in mid- to late-2025 and will take approximately 3 to 4 months to complete. The estimated quantity and duration of water production from each water source at the BC Rail Site are presented in Table 1.

Source	Estimated Rate		Duration and Description
	L/min	m ³ /day	
Portal (East Shaft) Construction	50	72	<ul style="list-style-type: none"> • 3-month duration • Water produced during portal construction activities such as support installation, concrete slab placement and water removal • Groundwater may have pre-existing contaminants and quality of water could degrade from exposure to construction activities
Portal (East Shaft) Operation - Groundwater Inflow	35	100	<ul style="list-style-type: none"> • 2.5-year duration • Leakage of groundwater into the shaft through joints in the concrete walls and floor • Groundwater may have pre-existing contaminants
Soft Ground Slurry TBM Industrial Water	288	415	<ul style="list-style-type: none"> • 1.5-year duration • Process water cycled through the TBM and returned to surface, including slurry, cooling water and tunnel and equipment washdown • The provided discharge rate is anticipated to be reduced through detailed engineering and implementation processes
Affected precipitation on-site	Negligible	Negligible	<ul style="list-style-type: none"> • 3-year duration • Most of the precipitation will be drained to the existing storm sewer drainage or ground infiltration • Water may contact contaminants on-site. Water quality may be improved by strategic ditching and diversion from potential sources of contamination or treated accordingly
Natural Gas Pipeline Hydrostatic Testing	1,826	2,629	<ul style="list-style-type: none"> • Once tunnel construction and pipeline installation is complete, hydrostatic testing will take place, which will involve filling the pipelines with approximately 2,630,000 litres of water • Water will be transferred from one pipeline to the other, as the pipelines will be hydrostatically tested one at a time • Water will be discharged as discharge infrastructure and permit conditions allow. No contamination is expected to occur from this process

The BC Rail Site is part of a larger area owned by BCR Properties Ltd. that is the subject of a Risk-Based Certificate of Compliance issued May 16, 2016. There were four areas of environmental concern (AEC) identified in the area where the BC Rail Site is located, and an additional two AEC located north and upgradient to the BC Rail Site. The constituents of concern identified in soil and groundwater at the AEC are outlined in Appendix B. These AEC were either remediated to meet numerical standards or risk-based standards.

Quarterly baseline groundwater quality monitoring in the area of the BC Rail Site has been ongoing since 2020 and is anticipated to continue through to the end of 2022. The groundwater monitoring program confirmed the presence

of select total metals (beryllium, cobalt, chromium, iron, and zinc) and various polycyclic aromatic hydrocarbon (PAH) parameters at concentrations greater than the current BC Approved WQG. A Sampling and Analysis Plan has been developed by a Jacobs Consultancy Canada Inc. (Jacobs) Qualified Environmental Professional (QEP) which outlines the existing groundwater quality – refer to Appendix B.

5. PROPOSED DISCHARGE LOCATION

Three discharge locations at the BC Rail Site were evaluated based on several factors, including drainage capacity and environmental impact. The preferred water discharge location is the existing storm sewer system at the north end of the BC Rail Site that drains to an existing outfall into a deep flowing reach of the Squamish River, which is shown as Option 1 in Appendix C. Option 1 does not interact with any Red-listed ecosystems, presents minimal sedimentation concerns due to existing rip-rap, and has minimal visibility to the public. The preferred water discharge location has a lower receiving capacity than the other options due to limitation of the 300 mm outfall pipe. However, the capacity is still considered sufficient and this location has the lowest potential for environmental impacts compared to the other options. Details of the discharge location selection criteria can be found in Appendix C.

5.1 AQUATICS

The Squamish River is a fish bearing stream with S1A stream riparian classification per the Environmental Protection Management Guideline (EPMG) (BC OGC 2018), with known fish presence and channel width upwards of 200 m in the area of the proposed discharge options. The Squamish River is known to be tidally influenced from Howe Sound upstream to its confluence with the Mamquam River.

A portion of the Squamish River (including the discharge locations) is designated as the Skwelwil'em Squamish Estuary Wildlife Management Area (WMA) with the purpose of maintaining and restoring fish and wildlife habitat productivity. Several areas within the WMA have been identified by Fisheries and Oceans Canada (DFO) as sensitive fish habitat including along the banks of the Squamish River and the central basin (BC MOE 2007).

The Squamish River contains feeding, spawning, and rearing habitat for eulachon and salmonids and is a migration route for species such as pink salmon to upstream tributaries. The brackish water and tidal channels of the estuarine portion provides habitat for salmonids to adjust to the marine environment and also provides refuge habitat to avoid predators. Additional salmonid spawning and rearing channels off the main stem have been created by DFO (BC MOE 2007). A Jacobs QEP has prepared a Fish and Fish Habitat Technical Memorandum detailing of the aquatic environment, including fish and fish habitat, near the Project attached as Appendix D. Given the relatively small volume of proposed discharge compared with the volume and flow rate of the Squamish River, the QEP is confident that the additional discharge proposed during the Project activities should not result in harmful alteration, disruption, or destruction 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.
- Water will be treated to meet BC Approved WQG for Aquatic Life prior to release into the Squamish River.

5.2 HYDROLOGY

Typical flow in the Squamish River ranges between 100 and 500 cubic metres per second (m^3/s), depending on the season. During the large flood of 2003, the river peaked at 3,140 m^3/s , and was the largest recorded flood in more than 100 years. Average high-water events range from 1,200 to 1,600 m^3/s , which translates to approximately a 6 to 7 m change in water level. Due to the seasonal variability in flow in the Squamish River in addition to the high flow

rates, it is anticipated that the discharged water will have a negligible effect on the river's hydrology. Refer to the Hydraulic Assessment in Section 3.2 of Appendix E for additional details.

5.3 WATER QUALITY

A water sampling program was completed on the Squamish River by Jacobs QEPs at 49°43'32.53"N 123° 9'54.89"W. A total of 6 sampling events were conducted over an 11-month period (from October 2020 to August 2021) to capture seasonal variability in water quality. The results indicated that the background levels of the river system are suitable for the protection of aquatic life when compared to the BC Approved WQG.

Slight exceedances were observed for temperature, aluminum, and heterotrophic plate count (HPC). However, chronic duration of these exceedances could not be confirmed with this program. The total suspended solids (TSS) concentration varied, with high TSS during high flow periods. Below neutral pH levels were observed, which is common for coastal areas and near Squamish, BC. Deviations from more natural levels (such as, temperature and turbidity) are likely attributed to the variances seen in weather systems across the province during the 2020-2021 assessment program. Details of the Squamish River water quality assessment program can be found in Appendix F.

6. WATER SAMPLING AND ANALYSIS

During Construction, water quality sampling, (both manual and automated), will be conducted within the DB Contractor's water treatment plant (WTP) prior to discharge at the BC Rail Site. The purpose of the sampling program is to monitor the effectiveness of the water treatment system, verify compliance with the Waste Discharge Authorization, and to verify that the treated water meets BC Approved WQG and BC OGC criteria. This includes water from all sources indicated in Section 3 above. If the water does not meet the discharge criteria, it will be continuously recirculated through the WTP until the criteria are met. Discrete water quality monitoring (field samples and visual observations) will be conducted prior to, during, and after discharge. All water quality sampling will be conducted in accordance with the BC Field Sampling Manual.

The Sampling and Analysis Plan developed by a Jacobs QEP includes testing parameters and sampling frequency for the proposed points of discharge at the BC Rail Site. The Sampling and Analysis Plan is included in Appendix B and has been provided to the DB Contractor for implementation.

7. MITIGATION MEASURES

A Construction Environmental Management Plan (CEMP) has been developed by FortisBC and approved by the BC EAO for the EGP Project. In addition, Condition Management Plans (CMPs) are being developed as part of compliance with the Project's EAC. The CMPs will ensure that the commitments made in the CEMP communicate environmental procedures and mitigation relevant to the scope of the EGP Tunnel.

FortisBC has initiated consultation with Indigenous Groups and other specified agencies for the development of the CMPs. Mitigation measures described in the CMPs will be implemented during construction of the EGP Tunnel to avoid or reduce potential adverse effects on the environment.

The DB Contractor for the EGP Tunnel will adhere to the directions provided in the CMPs and will provide an EGP Tunnel-specific Environmental Protection Plan (EPP), for FortisBC's review and acceptance, which shall meet or exceed the standards outlined in the CMPs. The EGP Tunnel-specific EPP developed by the DB Contractor will be prepared in advance of construction and will be submitted to the BC OGC.

7.1 WATER TREATMENT

Water treatment at the BC Rail Site is expected to consist of sedimentation/storage ponds, flocculant and carbon dioxide addition, sand filtration, and/or oil water separation at a minimum. If required, additional treatment in the modular form of activated carbon media can be added to the existing system to treat hydrocarbons and metals. This process is consistent with other recent underground construction and major excavation projects in British Columbia.

The DB Contractor must submit a Water Treatment Plan for collecting, handling, treating, measuring, and disposing of groundwater and other wastewater generated from construction activities (see Appendix G). The Water Treatment Plan includes drawings and designs, treatment goals, and detailed process descriptions with a corresponding flowchart. All treatment measures to be implemented must not exceed the applicable BC Approved WQG for discharge of treated water to the environment. The Water Treatment Plan includes details on the means and methods of treatment, frequencies of monitoring water quality to check compliance with regulatory requirements prior to discharge, a water quality monitoring program, and contingency plans, amongst others.

The DB Contractor will also be required to prepare a Groundwater Management Work Plan for each dewatering system utilized, if any.

The WTP at the BC Rail Site will be established prior to excavation of the East Shaft and will be operational until the Soft Ground Tunnel is finished and the East Shaft is permanently backfilled. Refer to the Design Basis Memorandum, submitted by the DB Contractor, in Appendix G for additional details on water treatment and discharge management.

7.2 RE-USE OF SLURRY

The Slurry TBM used to excavate the Soft Ground Tunnel will utilize a bentonite-water slurry, which is used to:

- support the excavation face in front of the TBM; and
- mobilize excavated soil at the face, transporting it through pipes and depositing it through the slurry separation plant on surface at the BC Rail Site.

After the soil is removed through the separation plant process, the slurry will be reconditioned and reused in a closed loop system, which helps reduce water demand and discharge. As tunnel excavation progresses, additional slurry is required to accommodate the increased distance to the face of the TBM.

The Slurry TBM is a closed loop system, but occasionally slurry may exceed operable limits of salinity and fines during excavation. In this event, the slurry will be routed through a centrifuge where the fines will be dried into filter cakes for disposal at a certified facility and the centrate water will be treated in the WTP.

8. REFERENCES

British Columbia Ministry of Environment (BC MOE). 2007. Skwelwil'em Squamish Estuary Wildlife Management Area - Management Plan. Environmental Stewardship Division, Lower Mainland Region. Surrey, BC 71 pp.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV, 2021). British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Quality Guideline Series, WQG-20. Accessed January 5, 2022 https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wggs/wgg_summary_aquaticlife_wildlife_agri.pdf. British Columbia Oil and Gas Commission (BC OGC). 2018. Environmental Protection and Management Guideline, Version 2.7. 126 pp.

Appendix A

EGP Tunnel Design Drawings

Appendix B

Waste Discharge Authorization Sampling and Analysis for the BC Rail Site

Appendix C

Evaluation of BC Rail Site Water Discharge Options

Appendix D

Fish and Fish Habitat Technical Memorandum

Appendix E
Water Management Plan – EGP Tunnel East Shaft
Dewatering

Appendix F

Squamish River Water Quality Assessment

Appendix G
Eagle Mountain – Woodfibre Gas Pipeline Project
Construction Water Treatment Design Basis
Memorandum