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To: Todd Lewis and Danielle Samels, FortisBC
Subject: **Eagle Mountain – Woodfibre Gas Pipeline Project Hydrometric Monitoring Plan
(Version 2.0)**

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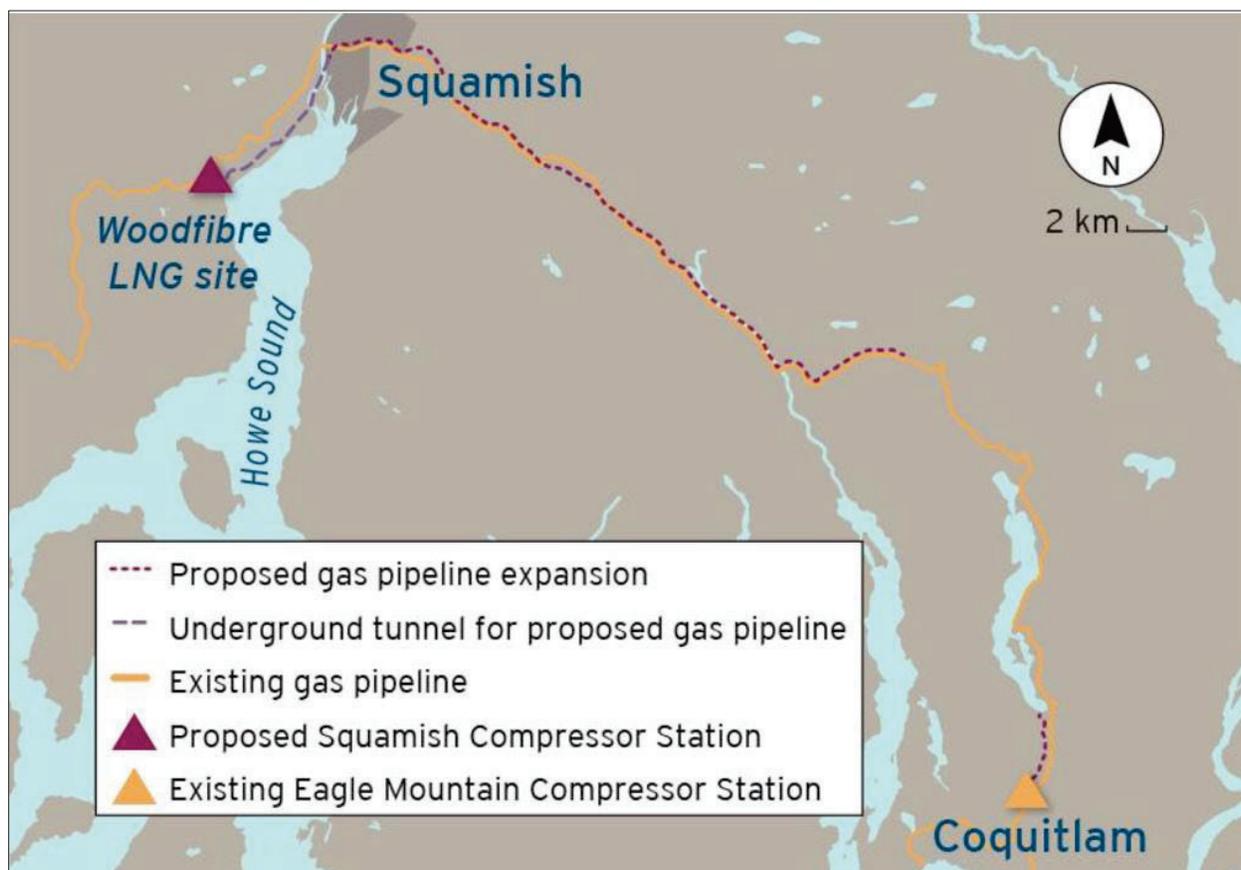
1.0 INTRODUCTION

Hatfield Consultants (Hatfield) is pleased to provide this Hydrometric Monitoring Plan for the FortisBC Eagle Mountain – Woodfibre Gas Pipeline (EGP) Project describing monitoring protocols to support discharge activities from the Woodfibre Liquefied Natural Gas (WLNG) site Water Treatment Plant (WTP) to East Creek. The Hydrometric Monitoring Plan was developed to assess conformance with permit conditions associated with Section 2.3.8 of Waste Discharge Permit (WDP) PE-110163.

1.1 SITE CHARACTERIZATION

The EGP Project is a natural gas pipeline project, which includes tunneling between the BC Rail site in Squamish and the WLNG site on the northwestern shore of Howe Sound, BC (Figure 1). The proposed tunnel alignment starts from a portal located on the BC Rail site just west of Industrial Way in Squamish (East Portal) and terminates in a portal structure on the WLNG site (West Portal), which is located northeast of the proposed WLNG Facility. Tunneling under the Skwelwil'em Squamish Estuary and Wildlife Management Area (WMA) was the avoidance strategy chosen to reduce potential adverse impacts to the area.

Figure 1 Project setting.



Construction activities associated with the EGP tunnel include hard rock tunneling, equipment to support tunneling, and WTPs situated at the mouths of the West Portal on the WLNG site (i.e., WLNG WTP) and at the East Portal at the BC Rail site (BC Rail WTP). The source of the water that is managed at these WTPs and is ultimately discharged to either East Creek (WLNG WTP) or the Squamish River (BC Rail WTP), includes water generated from construction activities related to precipitation, runoff, groundwater ingress within the bedrock tunnel, as well as water used by the tunnel boring machine for drilling, probing, and cleaning equipment.

1.2 EAST CREEK

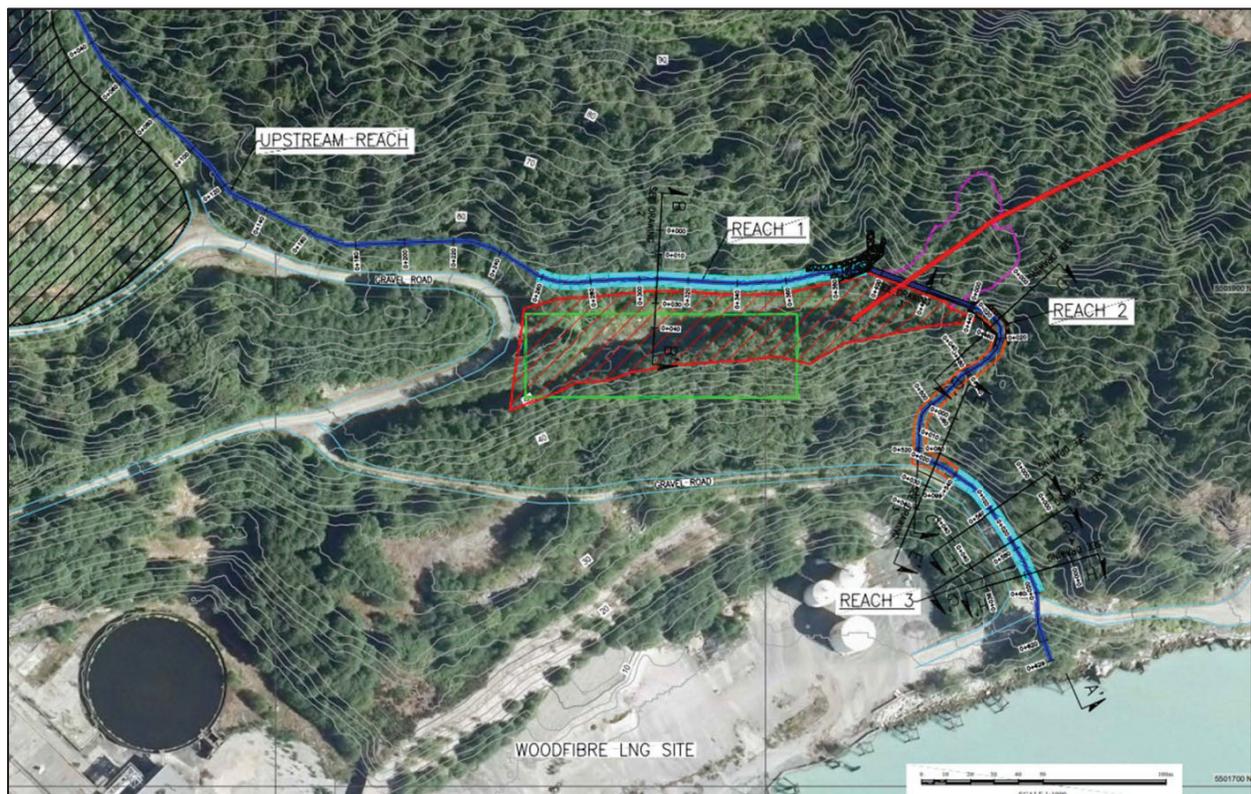
East Creek (also known as WC 309-S6) is a small and partially ephemeral, incised channel that is divided into three reaches (Stantec 2022), as outlined in Figure 2. Reach 1 flows along the base of a hillslope and is bound by a parallel gravel access road. This reach is considered to have a modest gradient and flows east until the location of the WTP WLNG discharge pipe outlet. At this location, the water pools before entering a culvert. The channel is then conveyed through the culvert for approximately 10 m before it discharges onto a small flat and descends into a steep (40%), incised gully. At the outlet of the culvert, rip rap has been placed along both banks and across the bed of the channel for armoring purposes, before water descends the slope.

The valley walls and channel banks of Reach 2 consist of glacial till, which is comprised of small-grained matrices mixed with large and unsorted boulders, cobbles, and gravels. Large woody debris, boulders, and

a mix of cobbles comprise the channel bed. The top of slope on both sides of the gully are lined with mature trees, shrubs, and ferns. The channel flows through this steep, gullied morphology for approximately 15 m, before a distinct reduction in gradient for approximately 8 m occurs, before it descends into a narrow and inaccessible segment of the channel. At the time of the QP site visit (April 11, 2025), the bed and banks of the channel upstream of this location appeared to be in stable condition, despite the elevated flow conditions experienced for approximately three (3) months (i.e., February to April). At the base of the gullied morphology, the channel immediately bends (southwest). At this location, it has been estimated (Stantec 2022) that the channel will overtop the left bank under high flow conditions. Although the left bank is denuded, it is not expected for significant additional erosion to occur, as there is a floodplain accessible to dissipate flows. Beyond the bend, the channel narrows, straightens, and flows through forested terrain that could not be accessed or observed in detail. However, according to existing topographic data (Stantec 2022), it is known to be a steep section of creek (approximately 30% with some short lower-gradient stretches).

The channel emerges at the base of the hillslope as it descends over a bedrock outcrop and is bounded by a gravel access road and a constructed barrier. From this location, the channel was previously conveyed under the constructed gravel access road via a culvert and into Howe Sound. However, in November 2025, the constructed barrier was removed by Woodfibre and East Creek now flows down the original Reach 3 channel. Reach 3 has been modified through construction of the WLNG site (i.e., independent of the EGP project), with the channel designed to be able to contain and convey a 200-year flood event. The new Reach 3 channel consists of an excavated channel armored with rip-rap and concrete (McDermott, 2025). Culvert 3 is located at the downgradient end of Reach 3, just prior to its discharge into Howe Sound, and consists of a double barrel 1.2 m diameter pipe culvert.

Figure 2 East Creek reaches.



1.3 BACKGROUND

To support the requested amendment to PE-110163, SRK (2025) performed hydraulic modelling using hydrometric data collected by Hatfield (2025) and LiDAR data collected in 2025 by FortisBC. These data were utilized in the open channel 2D flood modelling software, HEC-RAS 2D, and culvert capacity verification software HY-8, to assess the capacity of East Creek under various discharge scenarios (i.e., current permitted discharge rates of 1,500 m³/s, recent elevated flow conditions assessed by Hatfield [2025] of 3,000 m³/day, current WTP treatment capacity limits of 4,090 m³/day, and potential additional future increases in WTP treatment capacity limits of 6,815 m³/day). SRK (2025) then evaluated these discharge scenarios under low-flow conditions (i.e., summer conditions identified by Hatfield [2025]), rainfall driven events (i.e., atmospheric river event identified in Hatfield [2025]), and a 2-year return period flow event. Key findings of the SRK (2025) assessment were:

- Localized increases in erosion potential are expected as discharge volumes from the WTP increases. These relative changes would be more significant during low flow conditions and become negligible during greater flow conditions.
- Usual flow conditions at East Creek present overall lower erosion potential relative to freshet conditions.
- The velocity and shear stress profiles during usual conditions increase with WTP discharge; however, the range and order of magnitude of modelled maximum velocity and modelled maximum shear stress statistical distribution over the flood areas is unchanged, suggesting hydraulic-driven erosion behavior would not change significantly with increased discharge from the WTP.
- Under 2-year return period flow conditions, flows are expected to remain confined within the bankfull width of the channel, regardless of the three WTP flow volume scenarios assessed. Higher flows may be contained within the banks of the channel but estimating this carries significant uncertainty due to model limitations.
- The main takeaways of the structure capacity verification were:
 - Culvert 1 and Culvert 3 are adequate to convey East Creek flows during the construction phase of the WLNG site, independently of the WTP discharge scenario;
 - Culvert 2 decommissioning and East Creek redirection through the Reach 3 constructed channel and Culvert 3 represented a significant improvement to East Creek conveyance capacity and operability, significantly reducing overtopping likelihood and associated risks; and
 - Potential increases in WTP discharge are unlikely to impact constructed channel performance on Reach 3.

The combined findings from the erosion risk assessment and monitoring program suggest that Reach 2 of East Creek can accommodate increased discharge volumes from the WTP without significant acceleration of erosion processes, relative to currently approved conditions. However, continued monitoring and adaptive management were recommended to assess the long-term health of the channel, particularly around the high velocity/shear stress areas along the channel banks.

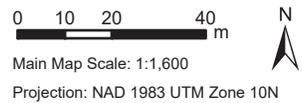
In case of an extreme flood event, SRK (2025) identified Culvert 1 as the first East Creek conveyance structure expected to reach its capacity at around 5,600 L/s flows. Implementation of mitigation strategies, such as peak flow attenuation, could help avoid overtopping Culvert 1 and potential damage to other structures. As a result, continued hydrometric and geomorphic monitoring performed between May and August 2025 by Hatfield (2025a) was recommended to continue to refine the site-specific stage-discharge relationship, monitor for adverse flow conditions defined by SRK (2025) above, and monitor for evidence of accelerated erosional changes within the channel. This additional monitoring is outlined below in Section 2.0 and will be used to refine the existing modelling outputs as needed and provide continued assessment of the channel conditions to support adaptive management planning, if required.

Figure 3 WLNG discharge and monitoring stations.



Legend

- Compliance Station
- Reference Station
- ▲ Hydrometric Station
- WTP WLNG Discharge Pipe Outlet
- Geomorphic Transect



Data Sources:
 a) Project data, Hatfield 2025.
 b) Background image, District of Squamish 7.5 cm, 14 June 2024, Esri Online Service.



Indian Arm Barge Landing Habitat Assessment

2.0 ROUTINE MONITORING

The Hydrometric Monitoring Plan has been developed to provide effective management strategies to monitor, assess, and adapt to East Creek conditions during active WTP discharge. Monthly field visits are proposed during active discharge periods over the wet months (i.e., September to June) and will include both hydrometric and geomorphic monitoring. During the dry summer months (i.e., July through September), field visits will be conducted once every 3 months, or after an extreme rain event (e.g., atmospheric river). During each field visit, the existing hydrometric monitoring station will be evaluated, data will be collected at two geomorphic transects, and ground-based photos will be collected, as described in Table 1.

Table 1 Proposed monitoring locations.

Station Name	Station Description	Station Location	Monitoring Activities
EC_Hydro	Hydrometric station	10 m upstream of WTP WLNG discharge pipe outlet.	Water level surveys, discrete manual flow measurements, and routine review of data from the data logger deployed at this established hydrometric monitoring station.
EC_Geomorph_XS1	Geomorphic transect	30 m D/S of culvert outlet.	Channel dimensions, vegetation abundance and rooting depth, bed and bank characterization.
EC_Geomorph_XS2	Geomorphic transect	15 m D/S of culvert outlet.	vegetation abundance and rooting depth, bed and bank characterization
Multiple locations in channel	Ground-based photos	Throughout channel.	Repeat ground-based photos to capture condition of the channel.

2.1 HYDROMETRIC STATION FLOW MONITORING

East Creek was an ungauged channel, meaning no hydrometric station was previously located on the channel, and direct measurements of discharge were not possible. As such, to accurately quantify the discharge in East Creek (independent of the WTP discharge), a hydrometric monitoring station (EC_Hydro) was installed on May 23, 2025, to provide water level measurements so that a stage-discharge relationship (SDR) could be developed, and a more accurate estimate of the discharge within East Creek could be established.

EC_Hydro was installed approximately 10 m upstream of the WTP WLNG discharge pipe outlet, and outlet culvert at 49.6694°N, 123.2492°W. The hydrometric station location was selected to measure discharge from upstream tributaries, and at a location that was expected to sustain year-round, or near year-round flows. A Solinst Levellogger 5 data logger (pressure transducer) was deployed within a 0.4 m long stilling well installed mid-channel and was secured using 1 m long rebar. A Solinst Barologger 5 was also mounted sub-aerially approximately 3 m downstream of the transect to support calculations for measurements of water level.

To refine stage-discharge relationships to support interpretation of the data generated from the Solinst Levellogger 5, the transect previously established 1 m downstream of the EC_Hydro station by installing

one rebar pin on the left bank and one on the right bank will continue to be used. Moving forward, this transect will continue to be used for water level surveys and discrete manual flow measurements during site visits. The methods used to conduct the water level surveys and flow measurements will follow standard procedures outlined by the Water Survey of Canada (WSC) in the BC RISC manual (BC MOE 2018) and are summarized as follows:

- Water level will be measured using an Engineer's Leveling Rod reading to the nearest millimetre;
- Instrument height will be calculated from the elevation of three independently surveyed benchmarks;
- Water levels will be verified by conducting two surveys;
- A Sontek FlowTracker2 will be used to collect velocity readings across the transect at 60% of the channel depth; and
- Velocity measurements will be collected using a minimum spacing of 0.05 m and averaged over forty (40) seconds.

These measures will be following field visits to refine the stage-discharge calculation provided in Hatfield (2025) to more accurately calculate flows in East Creek upstream of the discharge outlet location so that when combined with discharge rates reported at the WTP, will provide an estimate of the total discharge in East Creek downstream of the WTP.

2.2 GEOMORPHIC ASSESSMENTS

Geomorphic assessments were previously conducted by Hatfield (2025) at 2 transects established on East Creek. These transects, and condition of the accessible channel, will continue to be monitored during hydrometric field visits by conducting repeat geomorphic surveys and ground-based photo monitoring. The geomorphic monitoring assessments will include evaluation of the following stream parameters:

- Bankfull width and depth, wetted width, and channel slope;
- Bank height, slope, dominant vegetation, and dominant material;
- Channel bed form and grain size; and
- Identification of instream features, such as scour features, large woody debris, and drops.

Ground-based photos will also continue to be taken at each transect location and at additional ground-photo monitoring locations.

3.0 ROLES AND RESPONSIBILITIES

It is FortisBC EGP Environment Manager's responsibility to confirm that monitoring protocols recommended under this Hydraulic Monitoring Plan are implemented. Roles and responsibilities are outlined in the EGP Project's Construction Environmental Management Plan (CEMP).

4.0 UPDATES TO THE HYDROMETRIC MONITORING PLAN

Updates to the Hydrometric Monitoring Plan will be developed by a Qualified Professional (QP). The Hydrometric Monitoring Plan will be reviewed by the FortisBC EGP Environmental Manager and the QP on an annual basis for the duration of the WTP operation during tunnel construction. The monitoring outlined in this plan is intended to end once tunneling has been completed

5.0 CLOSURE

We trust the above information meets your requirements. If you have any questions or comments, please contact the undersigned.



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