

**ADDENDUM TO THE APPLICATION FOR AN
ENVIRONMENTAL ASSESSMENT CERTIFICATE
FOR THE PROPOSED
FORTISBC ENERGY INC.
EAGLE MOUNTAIN – WOODFIBRE GAS PIPELINE PROJECT**

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Addendum 3
Rev. 0**

Prepared for:

Prepared by:



FortisBC Energy Inc.
16705 Fraser Highway Surrey, British Columbia V4N 0E8
Ph: 250-380-5707



CH2M HILL Energy Canada, Ltd.
Suite 201, 655 Tye Road Victoria, British Columbia V9A 6X5
Ph: 250-592-8500

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1.0 INTRODUCTION AND BACKGROUND

On January 12, 2015, FortisBC Energy Inc. (FortisBC) filed an Environmental Assessment Certificate Application (the Application) with the British Columbia (BC) Environmental Assessment Office (EAO) for the proposed Eagle Mountain – Woodfibre Gas Pipeline Project (the proposed Project). The BC EAO started the Application Review on January 12, 2015. The Public Comment Period started on January 26, 2015 and ended on March 27, 2015. Addendum 1 was filed with BC EAO on February 20, 2015. Addendum 2 and Addendum 3 (this Addendum) to the Application have been developed in response to feedback on the proposed Project as a result of the BC EAO process. Addendum 2 and Addendum 3 are filed as a separate documents.

FortisBC is applying for the following changes to the Application in this Addendum:

- inclusion of a compressor station at the base of Mount Mulligan near KP 32.5 (now referred to as the Mount Mulligan compressor station and located within a new 1 km diameter Facility Siting Area), as a potential alternative for the Squamish compressor station proposed in the Application;
- an Application Corridor expansion to accommodate the Mount Mulligan compressor station and Facility Siting Area, the existing FortisBC pipeline (NPS 10”) pipeline suction and discharge laterals to the Mount Mulligan compressor station;
- removal of the Port Mellon upgrades due to an optimization in compression design;
- a change to the footprint of the Eagle Mountain compressor station to accommodate a shift in workspace;
- in the event that the Mount Mulligan compressor station is constructed instead of the Squamish compressor station proposed in the Application:
 - abandonment of short section of the existing NPS 10” pipeline that currently is located within the Squamish First Nation cultural site near the Stawamus River and relocation of the NPS 10” pipeline to the proposed Project pipeline (NPS 24”) Application Corridor in this area that avoids cultural sites (the Application Corridor is not being expanded for this relocation); and
 - installation of crossover valves to allow inter-connection with the proposed NPS 24” pipeline to allow operational flexibility during maintenance and emergencies.

BC EAO granted FortisBC a suspension for Application Review on June 30, 2015, the 169th day of the 180-day review period. The timeline will resume once BC EAO is satisfied with the information provided for Application Review.

FortisBC has consulted with municipal representatives, Aboriginal groups and the public regarding the proposed Project. Concerns regarding the location of the compressor station in the industrial park within the District of Squamish have been raised. Concerns includes potential conflicts with businesses and recreational opportunities for the land, proximity of the compressor station to residents, visual aesthetics and noise. FortisBC is seeking the necessary expansion to the Application Corridor and project related changes to provide the ability, subject to technical and economic feasibility, to relocate the Squamish compressor station to a new site at approximately KP 32.5 near the base of Mount Mulligan. A 1 km in diameter Facility Siting Area has been identified in which the Mount Mulligan compressor station would be located; however, the facility footprint would be materially smaller. FortisBC has identified potential siting options outside the District of Squamish boundaries on crown land as well as inside the District of Squamish boundaries within the Facility Siting Area. For the purposes of the effects assessment in this Addendum, a preliminary Mount Mulligan compressor station construction footprint has been designated within the Facility Siting Area. The final site location would be determined following additional technical investigations to determine site suitability.

As the technical and economic feasibility analysis of the Mount Mulligan compressor station remains in progress, the Squamish compressor station as described in Section 1.3 of the Application (Volume 1, Part A) near KP 38 is still being put forward by FortisBC to be evaluated. In other words, with the addition of the Mount Mulligan compressor station near KP 32.5 by way of this Addendum to the Application, FortisBC is considering both options (KP 38 and KP 32.5) within the Application. Although technical and economic feasibility of the new option can only be determined with further study, the information required to perform an appropriate environmental assessment of both compressor options is known and has been included in the materials previously filed with the EAO (including the Application, responses to information requests and Addendum 1) and this Addendum.

An overview of the proposed Project location is provided in Figure 1.1-1. An overview of the preliminary Mount Mulligan compression station site, Facility Siting Area, Application Corridor expansion and abandoned NPS 10” section is provided in Figure 1.1-2. An overview of the change in footprint for the Eagle Mountain compressor station upgrade is provided in Figure 1.1-3.

1.1 Changes to the Project Description

This Addendum to the Application provides information for the proposed changes to the Project description. Collectively these changes are referred to as the ‘proposed Addendum 3 changes’. Where appropriate, a summary of relevant additional baseline information and the assessment of potential adverse effects associated these proposed changes are provided.

Information on the proposed Addendum 3 changes is provided in Table 1.1-1.

**TABLE 1.1-1
 COMPONENT LOCATION AND CHANGES FOR ADDENDUM 3**
















Component	Details	Location	Measurements of Corridor or Siting Area	Rationale
Mount Mulligan compressor station	Compressor station	E 493791 N 5505828	Approximately 4 ha	A potential alternative to the Squamish compressor station in the industrial park at KP 38 that was proposed in the Application. Addresses concerns from municipal representatives, Aboriginal and public regarding the location of the Squamish compressor station. Preliminary site identified for the purposes of effects assessment. Technical assessment still underway.
	Facility Siting Area	E 493605 N 5505731	1 km diameter	Established to provide siting options for the Mount Mulligan compressor station during detailed engineering design.
	Application Corridor expansion	KP 32.3 to KP 32.7	515 m by 373 m/ 17 ha	To accommodate the NPS 10” pipeline suction and discharge laterals to the Mount Mulligan compressor station.
	Abandonment Corridor	NPS 10” KP 32.7 to KP 35.2 ¹	18 m by 2.5 km	For the abandonment the NPS 10” pipeline for the laterals to Mount Mulligan compressor station.
	Crossover Valves	KP 32.5	0.25 ha	Installed near the Mount Mulligan compressor station to facilitate inter-connection with the proposed NPS 24” pipeline. This would allow for operational flexibility during maintenance and emergencies.
Port Mellon compressor station	Upgrades not required	E 463778 N 5484592	n/a	Port Mellon upgrades are no longer required due to redesign of compression requirements for the proposed Project
Eagle Mountain compressor station	Change to footprint	E 513719 N 5462443	Area 1: Increase of 350 m by 60 m (2.12 ha) Area 2: Increase of 108 m by 145 m by 163 m by 40 m (1.1 ha) ²	A small increase to the footprint to accommodate a shift in workspace.


- Notes: 1 The abandonment KPs are for the existing FortisBC pipeline and do not match the KPs for the proposed Project.
 2 Refer to Figure 1.1-3 for Area 1 and 2 of the Eagle Mountain compressor station footprint.

FIGURE 1.1-1

REGIONAL LOCATION

EAGLE MOUNTAIN-WOODFIBRE GAS PIPELINE PROJECT ADDENDUM NO.3

-  Kilometre Post
-  Compressor Station
-  Proposed NPS 24 FortisBC Pipeline Route
-  Proposed NPS 10 FortisBC Pipeline Route
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 FortisBC Pipeline to be abandoned or decommissioned
-  Road
-  Highway
-  Railway
-  Watercourse
-  Waterbody
-  Municipality
-  Regional District
-  Park/Protected Area
-  First Nations Reserve

SCALE: 1:200,000

 (All Locations Approximate)



CH2M HILL Project Number 492434

UTM Zone 10 North, NAD 1983.
 Proposed Pipeline Route, KPs: Universal Pegasus International (UPI) 08-21-2014; NPS 10 Proposed and Abandoned Pipeline: FortisBC 08-08-2015; Existing Pipeline: FortisBC 2012; Compressor Stations: UPI 08-21-2014 and FortisBC 08-04-2015; Roads: NRCAN 2014; Railways: NRCAN 2012; Hydrography: NRCAN, 2009, IHS Inc. 2004 and BC MFLNRO 2008; Municipal Boundaries, Regional Districts: BC MFLNRO 2007; Parks, Wildlife Management Areas: BC MFLNRO 2008; First Nation Reserves: Government of Canada 2015; Hillshade: TERA Environmental Consultants 2008.

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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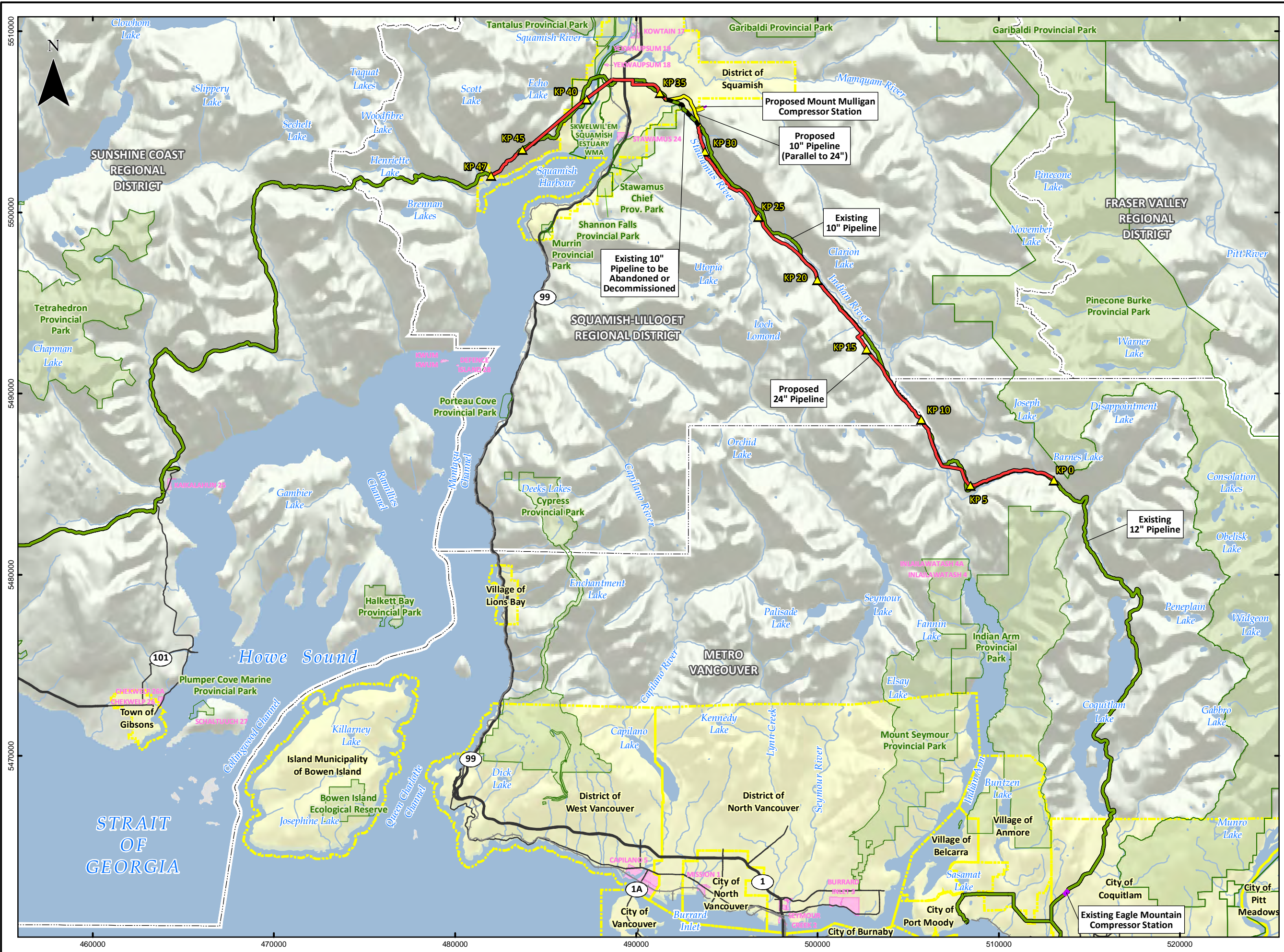


FIGURE 1.1-2
APPLICATION CORRIDOR
EXPANSION AND
PROPOSED MOUNT MULLIGAN
FACILITY SITING AREA
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3

- Kilometre Post
- Proposed Valve Station
- Proposed NPS 24 FortisBC Pipeline Route
- Proposed NPS 10 FortisBC Pipeline
- Existing NPS 10 FortisBC Pipeline
- Existing NPS 10 Subject to Removal/Abandonment
- Preliminary Mount Mulligan Compressor Station Footprint
- Proposed Compressor Siting Area
- Application Corridor Expansion
- Proposed Application Corridor
- Road
- Resource Road
- Atlantic Power Transmission Line
- BC Hydro Transmission Line
- Watercourse
- Wetland
- Municipality
- Park/Protected Area

SCALE: 1:10,000
 0 100 200 300 400 metres
 (All Locations Approximate)

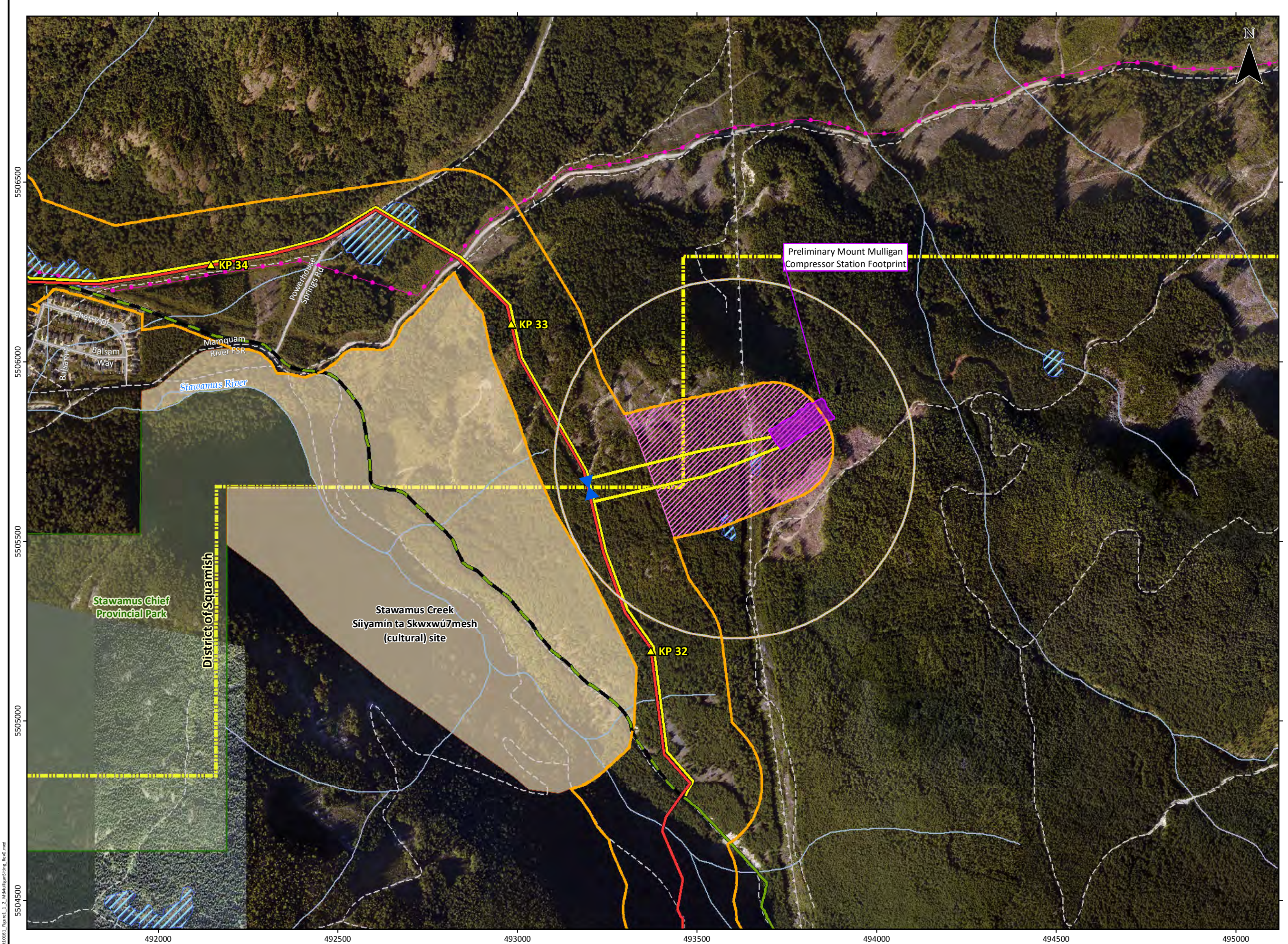


CH2M HILL Project Number 492434

NAD 1983, UTM Zone 10 North.
 Proposed Pipeline 1017, Kilometre Posts 1017: Universal Pegasus International (UPI) 08-21-2014; Planned NPS 10 Alignment through Valleycliffe: FortisBC 08-6-2015; Existing Pipeline: FortisBC 2012; Preliminary Mount Mulligan Compressor Station Footprint: FortisBC 08-04-2015; Supply lines, valve stations: digitized from FortisBC 04-29-2015; Pipeline Application (EA) Corridor: CH2M 08-06-2015 (Rev12); Wetlands: CH2M 2015-08-06; Cultural Sites: BC FLNRO 2009; BC Hydro Transmission Line: BC Hydro 09-29-2014; Atlantic Power Transmission Line: CH2M HILL Energy Canada, Ltd. 05-27-2015; Roads: BC MFLNRO 2012; Rail Line: BC FLNRO 2004; Hydrography: NRCan 2007-2011, BC MFLNRO 2004; Municipal Boundaries: BC MFLNRO 2007; Woodlots, Parks, Protected Areas: BC MFLNRO 2008; LIDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

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FIGURE 1.1-3

**EAGLE MOUNTAIN
COMPRESSOR STATION
FOOTPRINT SHIFT**

**EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Existing NPS 10 FortisBC Pipeline
-  Proposed Compressor Siting Area
-  Compressor Station Footprint Addendum 3 Expansion
-  Compressor Station Footprint Original Application Expansion
-  Existing Compressor Station Footprint
-  Meridian Substation
-  Proposed Substation
-  Proposed Electrical Transmission Line Structure
-  Proposed Electrical Transmission Line
-  Road
-  Resource Road
-  BC Hydro Transmission Line
-  Watercourse
-  Wetland
-  Municipality
-  Park/Protected Area

SCALE: 1:10,000



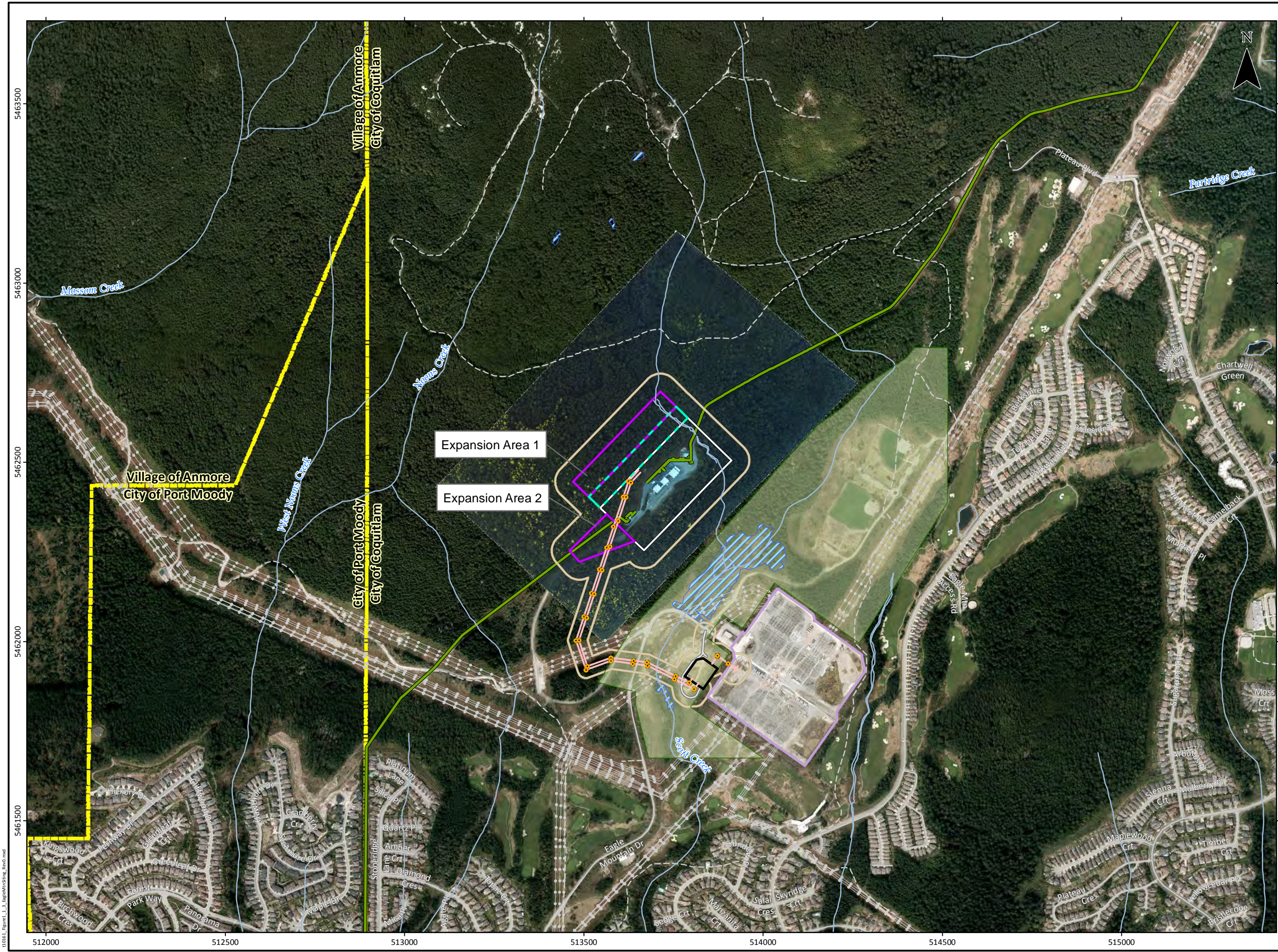
CH2M HILL Project Number 492434

NAD 1983. UTM Zone 10 North.

Compressor Station, existing and original expansion: UPI 07-23-2014; Compressor Station, Addendum 3 Expansion: Solaris Management Consultants Inc. 05-11-2015; Proposed Electrical Transmission Line, Structure and Substation: DBS Energy Inc 06-04-2014; Compressor Siting Area: CH2M 08-12-2015; Existing Pipeline: FortisBC 2012; Wetlands: CH2M 2013-08-06; BC Hydro Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Hydrography: NRCAN 2007-2011, BC MFLNRO 2004; Additional Drainage: McElhannay Associates Land Surveying Ltd. 10-22-2014; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas: BC MFLNRO 2008; LIDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

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1.1.1 Mount Mulligan Compressor Station Construction

The Mount Mulligan compressor station is an alternative option to the Squamish compressor station proposed in the Application. Technical and financial evaluation of the Mount Mulligan compressor station is still underway. The following discussion assumes that Mount Mulligan is determined to be the preferred option following that analysis, in which case the Squamish compressor station would not be required.

In considering a potential relocation of the Squamish compressor station to Mount Mulligan, FortisBC obtained new information that would optimize the compression system as described in Section 1.3 of the Application (Volume 1, Part A). As part of the Mount Mulligan option, FortisBC is designing a system whereby gas delivery on the NPS 24" to the Woodfibre LNG Project site (Woodfibre) would not require compression in the Squamish area. The Mount Mulligan compressor station is required for the NPS 10" pipeline in order to provide reliable service to Squamish, Whistler, Sunshine Coast and Vancouver Island. The NPS 24" would transport gas to be delivered to Woodfibre and would not be required in this option to deliver gas into the NPS 10" under normal operations. Due to the redesign of compression requirements, additional compression at the Port Mellon compressor station is no longer necessary regardless of whether the Mount Mulligan compressor station or Squamish compressor station is selected. Compression requirements at the existing Eagle Mountain compressor station do not change with this option. Although detailed engineering design would determine the final compression horsepower requirements at the Mount Mulligan compressor station, overall compression horsepower requirements are reduced from those described in the Application for the proposed Project.

The design of the Mount Mulligan compressor station includes the installation of three 4,700 HP gas turbine driven units. It differs from the Squamish compressor station design described in Section 1.0 in the Application (Volume 1, Part A) that included the installation of two 16,600 HP electric motor driven units. The Mount Mulligan compressor station design would require one gas turbine unit to operate for three months of the year, two gas turbine units to operate for seven months of the year and all three units to operate for up to two months of the year to accommodate seasonal loads on the existing FortisBC pipeline system. Therefore, it is expected over the course of the year at least one compressor unit would be operating 98% of the year (98% station run-time).

The Mount Mulligan compressor station design would incorporate numerous autonomous safety monitoring devices that would automatically shut-down the station and isolate itself from the pipeline in abnormal conditions. The Mount Mulligan compressor station would also be equipped with discharge gas cooling and other auxiliary equipment, including high pressure yard piping, isolation valves, control and gas systems, storage facilities and offices.

Access to the proposed Mount Mulligan compressor station would be via the Raybasin and RB1 logging roads. Raybasin road is a spur off of the Mamquam Forest Service Road (FSR) that is currently under licence to Allen Woods for accessing Woodlot Licence W0028. RB1 road is a spur off of Raybasin road, and is also under licence to Mr. Woods. The roads would be upgraded to provide permanent, year-round access to the proposed compressor station. The total length of permanent access roads is approximately 2.4 km. These permanent access roads would be considered in the Access Management Plan.

1.1.1.1 NPS 10" Laterals to Mount Mulligan Compressor Station

The existing FortisBC pipeline (NPS 10") is part of the natural gas transmission system that services Squamish, Resort Municipality of Whistler, the Sunshine Coast and Vancouver Island. Two NPS 10" pipeline laterals would be constructed to connect the mainline NPS 10" to the Mount Mulligan compressor station. The Application Corridor is expanding to accommodate the length of NPS 10" pipeline laterals near KP 32.5.

1.1.1.2 Crossover Valves

Crossover valves would be installed near the Mount Mulligan compressor station to facilitate inter-connection with the proposed NPS 24" pipeline. This would allow for operational flexibility during maintenance and emergencies. The crossover valves would be installed in the Project Footprint within the Application Corridor described in Section 1.3 of the Application (Volume 1, Part B).

1.1.1.3 Abandonment of NPS 10”

The NPS 10” pipeline between KP 31.5 and KP 35.5 would be abandoned to relocate the NPS 10” to the NPS 24” Application Corridor in this area (as described in Section 1.1.1.1 above). The NPS 10” would be capped and abandoned-in-place. There are no permanent above ground facilities requiring removal in this section and the only surface disturbance for capping the pipeline would occur in the Application Corridor described in Section 1.3 of the Application (Volume 1, Part B). Following abandonment, FortisBC would monitor the pipeline right-of-way and continue to administer the pipeline crossing BC One Call system obligations by maintaining the integrity of the permanent right-of-way (e.g., vegetation management and erosion control) and by identifying the abandoned pipe when required. FortisBC would follow all regulations concerning pipeline abandonment. An abandonment corridor has been created to accommodate the relocation of the NPS 10” pipeline.

1.1.2 Port Mellon Compressor Station

Due to the redesign and optimization of compression requirements for the proposed Project, additional compression at the Port Mellon compressor station is no longer part of the Application.

1.1.3 Eagle Mountain Compressor Station Expansion

The Eagle Mountain compressor station upgrades are the same as described in Section 1.0 of the Application (Volume 1, Part A). Due to further detailed design on the compressor station, the facility footprint has increased. The overall footprint has been expanded for the purposes of the effects assessment in order to allow flexibility and changes resulting from further detailed engineering design changes.

1.2 Alternative Means of Undertaking the Proposed Project

FortisBC’s approach to identifying and reviewing alternative facility siting options is described in Section 1.5 of the Application (Volume 1, Part A). More specifically, FortisBC’s identification and review of required parcel size, site preparation, pipeline routing, operations and maintenance, proximately to residential dwellings, visual aesthetics and cost for the relocation of the Squamish compressor station.

FortisBC considered the following three site areas as a possible alternative to the Squamish site:

- base of Mount Mulligan;
- BC rail yard (Rail yard); and
- Woodfibre.

The following subsections provide information on the compressor station site options reviewed during preliminary design.

1.2.1 Mount Mulligan near KP 32.5 (Preferred)

FortisBC considered compressor station sites on the base of Mount Mulligan near KP 32.5. The area under consideration provided existing forestry road access with potential for road upgrades, site security, distance from residences and location outside the Stawamus cultural site. This site is desirable due to its discrete distance from the nearby community, the sea to sky gondola viewing area and the summit of the Stawamus Chief Mountain. Upon further site investigation, FortisBC determined the proposed construction footprint would require less site preparation and terrain modification than other site options in this area, while reducing the need for additional permanent access roads. The Mount Mulligan compressor station site is the preferred over the Rail Yard and the Woodfibre site.

1.2.2 Rail Yard (East of KP 38)

FortisBC considered relocating the compressor station east of the Sabre property (proposed Squamish compressor station site) in the Rail Yard near KP 38. This site offered existing access and close proximity to the proposed pipeline route however, a location in the Rail Yard would present similar issues in regards to proximity of the compressor station to residents, visual aesthetics and noise. As a result it was deemed that Rail Yard site does not address concerns raised by municipal representatives, Aboriginal Groups and the public regarding the location of the Squamish compressor station. In addition, Rail Yard lands require re-zoning to accommodate the compressor station.

1.2.3 Woodfibre (Approximately KP 47)

FortisBC considered relocating the compressor station to the Woodfibre site. This site provided adequate distance from the nearest resident to address potential noise and visual aesthetics concerns. To align with best engineering practices, compressor stations should be located at least 50 km apart to mitigate operational issues. Locating the compressor station at the Woodfibre site (approximately KP 50) would not meet the minimum separation requirement as it would be less than 50 km from the Port Mellon compressor station at KP 91. In addition, the Woodfibre site did not have adequate suitable land for the compressor station. This site also presented higher capital and operational costs when compared to the Rail Yard and Mount Mulligan site options.

1.3 Project Benefits

The benefits of the proposed Project were provided in Section 1.6 of the Application (Volume 1, Part A). Although the elimination of the Port Mellon compression would lower capital costs, the additional requirement to install new NPS 10” pipeline offset the lower costs. The change in Project costs is not expected to materially affect the relative Project benefits and, therefore, the economic cost-benefit analysis has not been re-evaluated. In addition there are no material changes to employment, contracting and procurement strategy or social benefits as a result of the Mount Mulligan compressor station option.

1.3.1 Project Expenditures

No material changes are expected to the current estimates of the Project capital and operating costs as provided in the Application as a result of implementing the Mount Mulligan compressor station option. The provincial sources of goods and services are expected to remain the same.

1.3.2 Government Revenues

Although the final Mount Mulligan compressor station location has not been determined, FortisBC has recalculated the municipal tax revenues for the purposes of the assessment. In addition, upgrades to the Port Mellon compressor station would no longer be required. These changes would result in a reduction and redistribution in municipal tax revenues resulting from the proposed Project. Table 1.3-1 provides the estimated annual tax revenues as provided in the Application versus the Mount Mulligan compressor station option. The total tax revenue for the Mount Mulligan compressor station option is approximately 69% of the revenues estimated in the Application. Annual municipal tax revenues to the District of Squamish would be reduced by approximately 33% and annual revenues to the Squamish Lillooet Regional District would increase by approximately 27%, if the Mount Mulligan compressor station is located outside the District of Squamish boundary. No tax revenues would accrue to the Sunshine Coast Regional District due to the Port Mellon compressor station upgrades no longer being required.

TABLE 1.3-1

MUNICIPAL TAX REVENUES RESULTING FROM THE PROPOSED PROJECT

Beneficiary	Tax Revenues (\$ per year)	
	Application	Addendum 3
Province (General Revenues) ¹	435,075	366,106
District of Squamish	322,050	107,000
City of Coquitlam	172,280	172,280
Sunshine Coast Regional District	38,595	-
Squamish-Lillooet Regional District	29,720	37,638
Translink	19,065	19,065
Other tax authority ²	14,070	11,444
Sunshine Coast Hospital	2,915	-
Squamish Hospital	1,530	719
Sea-to-Sky Hospital	1,290	2,070
Metro Vancouver Electoral Area A	910	910
Greater Vancouver Regional District	895	895
Total	1,038,395	718,124

Source: Decision Economics 2014; FortisBC

Notes: 1 Taxes to the Province include general rural taxes, school taxes, and rural police tax.
2 "Other Tax Authority" includes BC Assessment and the Municipal Finance Authority.

1.4 Environmental Assessment Process

A description of the environmental assessment process was provided in Section 2.0 of the Application (Volume 1, Part A). This Addendum to the Application will be reviewed through the BC EAO process as part of the Application Review process.

1.5 Assessment Methodology

Section 2.0 of this Addendum provides information on the potential interactions of the Addendum 3 changes (as described in Section 1.1 of this Addendum) with the VCs identified in the Application. The Addendum 3 changes have been assessed for the construction, operations, and decommissioning or abandonment phases of the proposed Project where applicable to determine whether or not there is a material change to the assessment provided in the Application. Material change is defined as a change to the assessment criteria ratings used to make a determination of significance of an impact on a VC as described in Section 3.6 of the Application (Volume 1, Part B) including spatial boundary, duration, frequency, reversibility, magnitude, likelihood and confidence. Since the existing conditions for most VCs are similar to the conditions identified in the Application, the potential adverse effects are not predicted to be materially different from the potential adverse effects considered in the Application. Where a change in existing conditions or potential adverse effects on existing conditions occurs as a result of the proposed Addendum 3 changes, these differences are discussed.

Information on spatial boundaries used in the effects assessment is provided in Section 3.2.1 of the Application (Volume 1, Part B). For some VCs, the Local Study Area (LSA) boundary has changed due to the Addendum 3 changes. These changes are documented in the applicable subsections in Section 2.0 of this Addendum. For the most part, Regional Study Area (RSA) boundaries did not change as the context for the assessment of direct and cumulative adverse effects of the proposed Project did not change. Exceptions include RSA reductions to the Acoustic Environment RSA, Air Quality RSA and the Health RSA due to the removal of the Port Mellon upgrades.

Potential adverse effects of the proposed Project on VCs were identified in the Application. The intent of the assessment in this Addendum is to identify new potential adverse effects on VCs or changes to existing potential adverse effects on VCs related to the proposed Addendum 3 changes as described in Section 1.1 of this Addendum. Potential adverse effects that are unchanged from the Application are not repeated in this Addendum.

The existing conditions for most VCs are similar to the conditions identified in the Application therefore, the potential cumulative effects are not predicted to be different from the cumulative effects considered in the Application.

2.0 EFFECTS ASSESSMENT

The assessment of potential adverse effects of the proposed Project on the environment, economic, social, heritage and health VCs is provided in the Application (Volume 1, Part B). The following subsections evaluate the potential adverse effects potential adverse effects on the environment, economic, social, heritage, and health VCs associated with the construction, operation, and decommissioning or abandonment, where applicable, for the proposed Addendum 3 changes described in Section 1.1 of this Addendum.

2.1 Geophysical Environment

The assessment of potential adverse effects of the proposed Project on the Soil Capability VC, Terrain Integrity VC and the Acid Rock Drainage (ARD) VC is presented in Section 4.0 of the Application (Volume 1, Part B). The following subsections describe changes to the assessment of potential adverse effects on the Soil Capability VC, Terrain Integrity VC and the ARD VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.1.1 Existing Conditions

Table 2.1-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.1-1

CHANGES IN EXISTING CONDITIONS FOR THE GEOPHYSICAL ENVIRONMENT VALUED COMPONENTS RELATED TO THE PROPOSED ADDENDUM 3 CHANGES

VC	Existing Conditions
Soil Capability	<p>Application Corridor Expansion and Facility Siting Area: There is no change in the existing conditions for the Soil Capability VC. There would be surface disturbance associated with the Mount Mulligan compressor station and the NPS 10 pipeline lateral, however, the existing conditions are comparable to those presented in Section 4.0 of the Application (Volume 1, Part B). The Application Corridor expansion and the Facility Siting Area extends the Soil Capability Local Study Area (LSA) assessed in Section 4.0 of the Application. There is no change in existing conditions for the Soil Capability VC at these LSA expansion locations.</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Soil Capability VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Soil Capability VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Soil Capability VC.</p>
Terrain Integrity	<p>Application Corridor Expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the Terrain Integrity VC. Refer to Appendix A of this Addendum for a complete description of geotechnical conditions in the Facility Siting Area and preliminary Mount Mulligan compressor station construction footprint. The Application Corridor expansion and the Facility Siting Area for the Mount Mulligan compressor station extends the Geophysical Environment LSA assessed in Section 4.0 of the Application (refer to Figure 2.1-1 for spatial boundary extension).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Terrain Integrity VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Terrain Integrity VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Terrain Integrity VC.</p>
ARD	<p>Application Corridor expansion and Facility Siting Area: The ARD report for the proposed Project (Appendix D1 of Volume 2, Appendix 1B) noted visual sightings of ARD permissive rock 0.2 km west of KP 31.4. There is potential for ARD for the Facility Siting Area. Please refer to Appendix A of this Addendum for a complete description of geotechnical conditions in the Facility Siting Area and preliminary Mount Mulligan compressor station construction footprint. The Application Corridor expansion and the Facility Siting Area for the Mount Mulligan compressor station extends the Geophysical Environment LSA assessed in Section 4.0 of the Application (refer to Figure 2.1-1 for spatial boundary extension).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the ARD VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the ARD VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the ARD VC.</p>

Facility Siting Area – Terrain Integrity

During a site reconnaissance in summer 2015, terrain integrity specialists gathered information on the Facility Siting Area and the preliminary Mount Mulligan compression station site.

Based on site reconnaissance and review of bare earth terrain models, overall slopes in Facility Siting Area are assessed as being moderate to moderately steep. Terrain can be described as hummocky to ridged and bedrock-controlled, with gentle to flat-lying hollows between ridges.


















Terrain mapping previously completed for the proposed Project indicates the majority of the Facility Siting Area is underlain by blankets and mantles of moraine (glacial till) deposits overlying bedrock, with lesser extents of colluvial materials overlying bedrock.

Review of bedrock geology mapping completed indicates the area is underlain by Cretaceous or earlier Coast Plutonic Rocks consisting of mesocratic and melanocratic rocks such as quartz diorite, diorite, granodiorite, minor hornblende gabbro and leucocratic rocks. Southeast of the general preliminary Mount Mulligan compression station site, geology mapping identifies Jurassic and Cretaceous Gambier Group rocks consisting of tuff, breccia, agglomerate, andesite, argillite, chert, greywacke, quartzite, conglomerate, minor schist, granulite, lime-silicate rock, and scarn (Bostock 1963).

Facility Siting Area – Acid Rock Drainage

It should be noted that previous screening assessments indicate the Gambier Group rocks are associated with increased ML/ARD potential. While the Gambier Group rocks are not specifically mapped within preliminary Mount Mulligan compression station site, the location of contacts between rocks units are anticipated to vary, given the scale of the mapping, such that Gambier Group rocks may occur within the Facility Siting Area. Sulphide weathering and oxidation was observed in localized areas of existing rock cuts along the switchback access road downslope and to the west of the preliminary Mount Mulligan compression station site.

FIGURE 2.1-1
GEOPHYSICAL STUDY AREA
BOUNDARY EXPANSIONS
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3

-  Kilometre Post
-  Proposed NPS 24
-  FortisBC Pipeline Route
-  Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
-  Proposed NPS 10 to Compressor
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 Subject to Removal/Abandonment
-  Proposed Application Corridor
-  Proposed Compressor Siting Area
-  Geophysical Local Study Area
-  Geophysical LSA Expansion (Addendum 3)
-  Preliminary Mount Mulligan Compressor Station Footprint
-  Road
-  Electrical Transmission Line
-  Watercourse / Shoreline
-  Municipality
-  Park/Protected Area

SCALE: 1:20,000
 0 200 400 600 800 metres
 (All Locations Approximate)

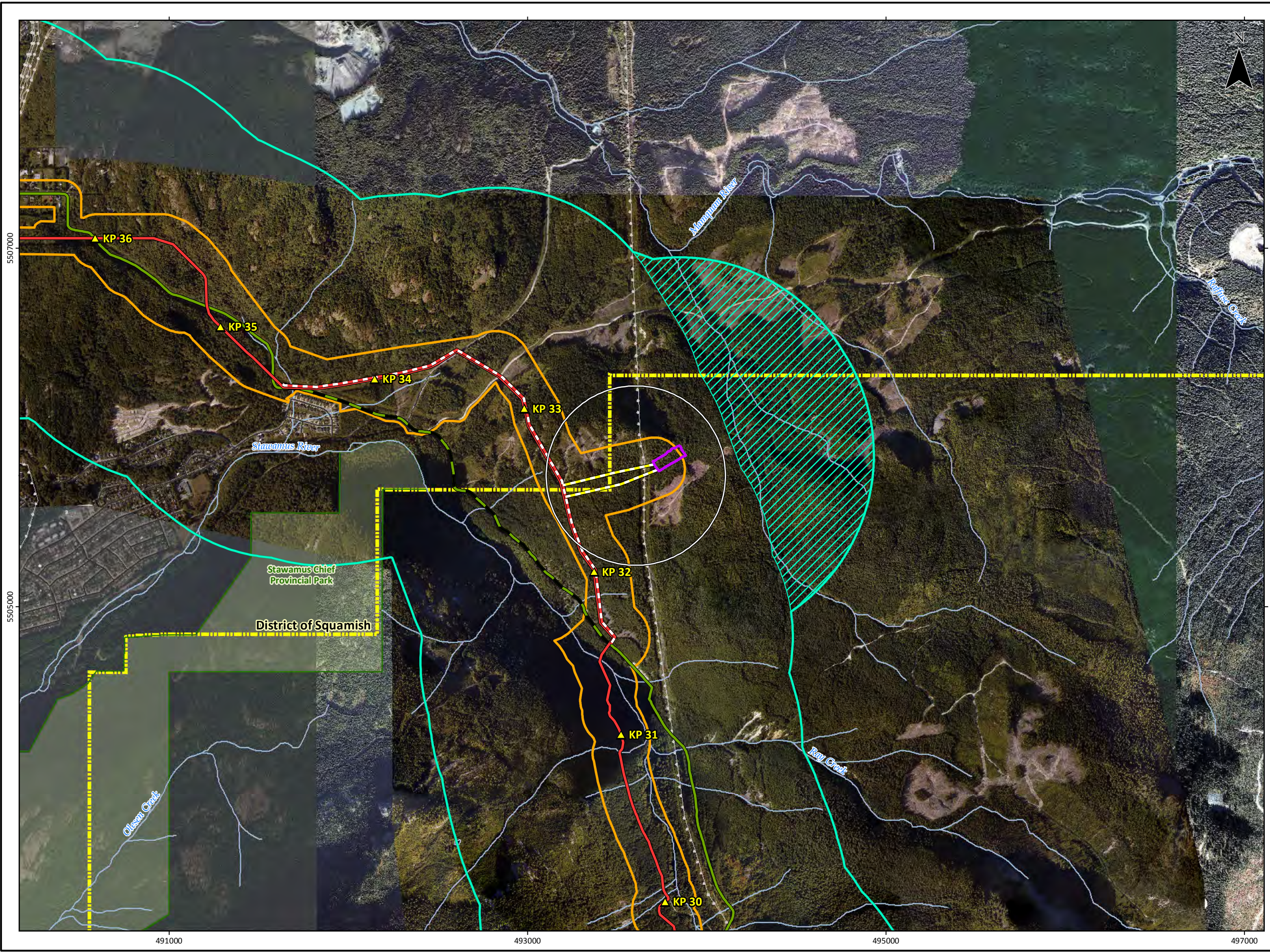


CH2M HILL Project Number 492434

NAD 1983, UTM Zone 10 North.
 Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCan 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LiDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, 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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2.1.2 Soil Capability Effects Assessment

As noted in Table 2.1-1, the proposed Addendum 3 changes do not result in any change in the existing conditions for the Soil Capability VC. The conditions at this location are comparable to the area assessed in Section 4.0 of the Application (Volume 1, Part B) and, therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Soil Capability VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 4.0 of the Application (Volume 1, Part B). As a result, it is concluded that the significance conclusions identified in the Application with respect to the Soil Capability VC remain the same.

2.1.3 Soil Capability Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Soil Capability VC since it was determined that there are no changes in the existing conditions or effects assessment for the Soil Capability VC.

2.1.4 Terrain Integrity Effects Assessment

As noted in Table 2.1-1, there is expected to be a change in the existing conditions for the Facility Siting Area. However, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Terrain Integrity VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 4.0 of the Application (Volume 1, Part B). As a result, it is concluded that the significance conclusions identified in the Application with respect to the Terrain Integrity VC remain the same.

2.1.5 Terrain Integrity Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Terrain Integrity VC since the potential residual adverse effects are not expected to interact cumulatively with other existing and reasonably foreseeable developments due to their localized nature.

2.1.6 Acid Rock Drainage Effects Assessment

As noted in Table 2.1-1, there is expected to be a change in the existing conditions for the Facility Siting Area. However, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the ARD VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 4.0 of the Application (Volume 1, Part B). As a result, it is concluded that the significance conclusions identified in the Application with respect to the ARD VC remain the same.

2.1.7 Acid Rock Drainage Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the ARD VC since the potential residual adverse effects are not expected to interact cumulatively with other existing and reasonably foreseeable developments due to their localized nature.

2.2 Atmospheric Environment

The assessment of potential adverse effects of the proposed Project on the Acoustic Environment VC, Air Quality VC, and Greenhouse Gas (GHG) VC is provided in Section 5.0 of the Application (Volume 1, Part B). The following subsections describe changes to the assessment of potential adverse effects on the Acoustic Environment VC, Air Quality VC, and GHG VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.2.1 Existing Conditions

Table 2.2-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.2-1

**CHANGES IN EXISTING CONDITIONS FOR THE ATMOSPHERIC ENVIRONMENT
 VALUED COMPONENTS RELATED TO THE PROPOSED ADDENDUM 3 CHANGES**

VC	Existing Conditions
Acoustic Environment	<p>Application Corridor Expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the Acoustic Environment VC. Table 2.2-2 provides acoustic modelling results at the monitoring locations for the Mount Mulligan compressor station. Refer to Appendix B of this Addendum for a complete description of acoustic information for the Mount Mulligan compressor station. The Application Corridor expansion and the Facility Siting Area for the Mount Mulligan compressor station extends the Acoustic Environment LSA assessed in Section 5.0 of the Application (refer to Figure 2.2-1 for spatial boundary extension).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Acoustic Environment VC.</p> <p>Port Mellon Upgrade Removal: There is expected to be a change in existing conditions for the Acoustic Environment VC. With the removal of the Port Mellon upgrades, associated sound levels reported for the Port Mellon compressor station are avoided with Addendum 3 changes. The LSA and Regional Study Area (RSA) for Acoustic Environment have been reduced due to the removal of the Port Mellon upgrades (refer to Figure 2.2-2 for spatial boundary reduction).</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Acoustic Environment VC.</p>
Air Quality	<p>Application Corridor Expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the Air Quality VC. Table 2.2-3 provides information on the total estimated annual emissions for operations related to the Mount Mulligan compressor station. Refer to Appendix C of this Addendum for a complete description of air quality information for the Mount Mulligan compressor station.</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Air Quality VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Air Quality VC. The RSA for Air Quality has been reduced due to the removal of the Port Mellon upgrades (refer to Figure 2.2-3 for spatial boundary reduction).</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Air Quality VC.</p>
GHG Emissions	<p>Application Corridor Expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the GHG VC. Refer to Appendix D of this Addendum for a complete description of GHG information for the Mount Mulligan compressor station.</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the GHG Emissions VC.</p> <p>Port Mellon Upgrade Removal: There is a positive net change (<i>i.e.</i>, reduction of GHG emissions) in the existing conditions for the GHG Emissions VC. See Table 2.2-5 for the GHG emission values related to the proposed Addendum 3 changes.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the GHG Emissions VC.</p>

Acoustic Environment

Details on the acoustic environment studies conducted for the operation of the Mount Mulligan compressor station as well as the acoustic modelling results are provided in Appendix B of this Addendum. Construction noise from the proposed Mount Mulligan compressor station is comparable to the proposed Squamish compressor station evaluated in the Acoustic Environmental Technical Data Report in the Application (Volume 2) and is not repeated in this Addendum.

Table 2.2-2 provides information on the sound level measurements presented as daytime and nighttime averages for the Mount Mulligan compressor station along with the other compressor stations present in Section 5.0 of the Application (Volume 1, Part B).

TABLE 2.2-2

**PREDICTED SOUND LEVELS AT SQUAMISH MONITORING
LOCATIONS CONSIDERING THE MOUNT MULLIGAN COMPRESSOR STATION**

Receptor Site	Predicted Facility Sound Level Leq (dBA)	Permissible Sound Level Leq (dBA)	BC Oil and Gas Commission (BC OGC) ¹ Compliant?	Ambient Sound Level, Ldn (dBA)	Cumulative Sound Level, Ldn (dBA) ²	Increase in Highly Annoyed Persons (%) ³
1.5 km from facility	38	40	Yes	n/a	n/a	n/a
13	29	n/a	n/a	47	47	0.1
14	29	n/a	n/a	52	52	0.0
15	23	n/a	n/a	n/a	38 ⁴	n/a ⁵

- Notes:
- 1 BC OGC noise limit compliance is only determined for a single location 1.5 km from the fence line of proposed Mount Mulligan compressor station, at the location where the predicted sound level is at a maximum.
 - 2 Cumulative sound level = Addition of predicted facility sound level and ambient sound level, summed logarithmically.
 - 3 Increase in highly annoyed persons are listed for receptor sites 13 and 14 since they represent the closest dwellings to the proposed Mount Mulligan compressor station.
 - 4 Calculated assuming 38 dBA measured at Site 15 on July 29 is representative of the sound level at the site at all times.
 - 5 %HA is calculated relative to regulatory noise limits or guidance. %HA was not calculated for Site 15 because no dwelling exists at the location.

Sound levels were monitored at a fourth site (site 15) at an Aboriginal cultural site at request of Squamish First Nation. The predicted facility sound level at Site 15 was estimated at 23 dBA. This sound level is lower than Sites 13 and 14 because of terrain effects, even though it is closer to the proposed Mount Mulligan compressor station. If the 38 dBA measured at Site 15 on July 29 is representative of the sound level at the site at all times, the cumulative sound level (*i.e.*, with the predicted facility sound level) would be 38 dBA.

The primary sources of noise detected in the East Valleycliffe area for the Mount Mulligan compressor station were cars and all-terrain vehicles, the Stawamus River, wildlife and foliage, and infrequent aircraft flyovers.

Air Quality

Details on the maximum off-site predicted air quality concentrations for the operation of the Mount Mulligan compressor station are provided in Appendix C of this Addendum. A one year air quality simulation was completed to identify the Maximum Emissions-Scenario air quality concentrations associated with the preliminary Mount Mulligan compressor station site location, assuming gas turbines and additional gas-fired equipment are necessary to operate the facility. The Maximum Emissions Scenario modelled is higher than the actual maximum operations conditions expected over a calendar year. Detailed information for the Maximum Emissions-Scenario for the Mount Mulligan compressor station is provided in Appendix C of this Addendum. Table 2.2-3 provides a summary of the maximum model air quality predictions over different averaging periods of interest. These averaging periods were selected to determine compliance with applicable BC Ambient Air Quality Objectives (AAQOs).

TABLE 2.2-3

MAXIMUM OFF-SITE PREDICTED AIR QUALITY CONCENTRATIONS

Air Contaminant	Predicted Ambient Concentrations (µg/m ³)				BC AAQOs (µg/m ³)			
	1-hour	8-hour	24-hour	Annual	1-hour	8-hour	24-hour	Annual
NO ₂ *	110	-	-	14.8	188	-	-	60
CO	221	147	-	-	14,300	5,500	-	-
SO ₂ **	0.4	-	-	-	200	-	-	-
PM _{2.5}	-	-	0.6	0.13	-	-	25	8
PM ₁₀	-	-	4.5	-	-	-	50	-

- Notes:
- * 1-hour concentrations are 98th percentile of daily maximum levels over a year.
 - ** 1-hour concentrations are 99th percentile of daily maximum levels over a year.
 - ' No air quality objective for the time period indicated.

Although the Maximum Emissions-Scenario air quality concentrations associated with the preliminary Mount Mulligan compressor station site location are higher than the proposed Squamish compressor station described in Section 5.0 of the Application (Volume 1, Part B), the modelling results indicate that there are no expected exceedances of the BC AAQOs.

Greenhouse Gas Emissions

Details on the GHG emissions for Addendum 3 changes are provided in Appendix D of this Addendum. Table 2.2-4 provides the summary of net changes (*i.e.*, difference between new and avoided emissions) to the construction GHG emissions associated with the proposed Addendum 3 changes.

TABLE 2.2-4

CHANGES IN EXISTING CONDITIONS FOR THE CONSTRUCTION GREENHOUSE GAS EMISSIONS VALUED COMPONENT RELATED TO THE ADDENDUM 3 CHANGES

Affected Construction GHG Emission Sources	Construction GHG Emissions (in kt ¹)		
	Squamish Compressor Station	Mount Mulligan Compressor Station	Net Change in Construction GHG Emissions ²
Vehicles and Equipment – Power line and substation construction	-4.45	0	-4.45
Land Clearing	0	4.15	4.15
Overall Net Change in GHG Emissions			-0.30

- Notes: 1 kt = kilotonnes of CO₂ equivalent.
 2 Negative values indicate a reduction of emissions.

Table 2.2-5 provides the summary of net changes (*i.e.*, difference between new and avoided emissions) to the operation GHG emissions associated with the proposed Addendum 3 changes.


















TABLE 2.2-5

CHANGES IN EXISTING CONDITIONS FOR THE OPERATION GREENHOUSE GAS EMISSIONS VALUED COMPONENT RELATED TO THE ADDENDUM 3 CHANGES

Affected Operation GHG Emission Sources	Operation GHG Emissions (in kt/yr ¹)			
	Squamish Compressor Station	Port Mellon Compressor Station	Mount Mulligan Compressor Station	Net Change in Operation GHG Emissions ²
Compressor Station Operation	-26.29	-11.25	26.76	-10.79

- Notes: 1 kt/yr = kilotonnes of CO₂ equivalent per year.
 2 Negative values indicate a reduction of emissions.

**FIGURE 2.2-1
ACOUSTIC ENVIRONMENT
STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post
-  Proposed NPS 24
-  FortisBC Pipeline Route
-  Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
-  Proposed NPS 10 to Compressor
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 Subject to Removal/Abandonment
-  Proposed Application Corridor
-  Proposed Compressor Siting Area
-  Acoustic Environment Local Study Area
-  Acoustic Environment LSA Expansion (Addendum 3)
-  Preliminary Mount Mulligan Compressor Station Footprint
-  Road
-  Electrical Transmission Line
-  Watercourse / Shoreline
-  Municipality
-  Park/Protected Area

SCALE: 1:20,000



CH2M HILL Project Number 492434

NAD 1983, UTM Zone 10 North.

Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCan 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LiDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, 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.

Mapped By: JRO Checked By: DN

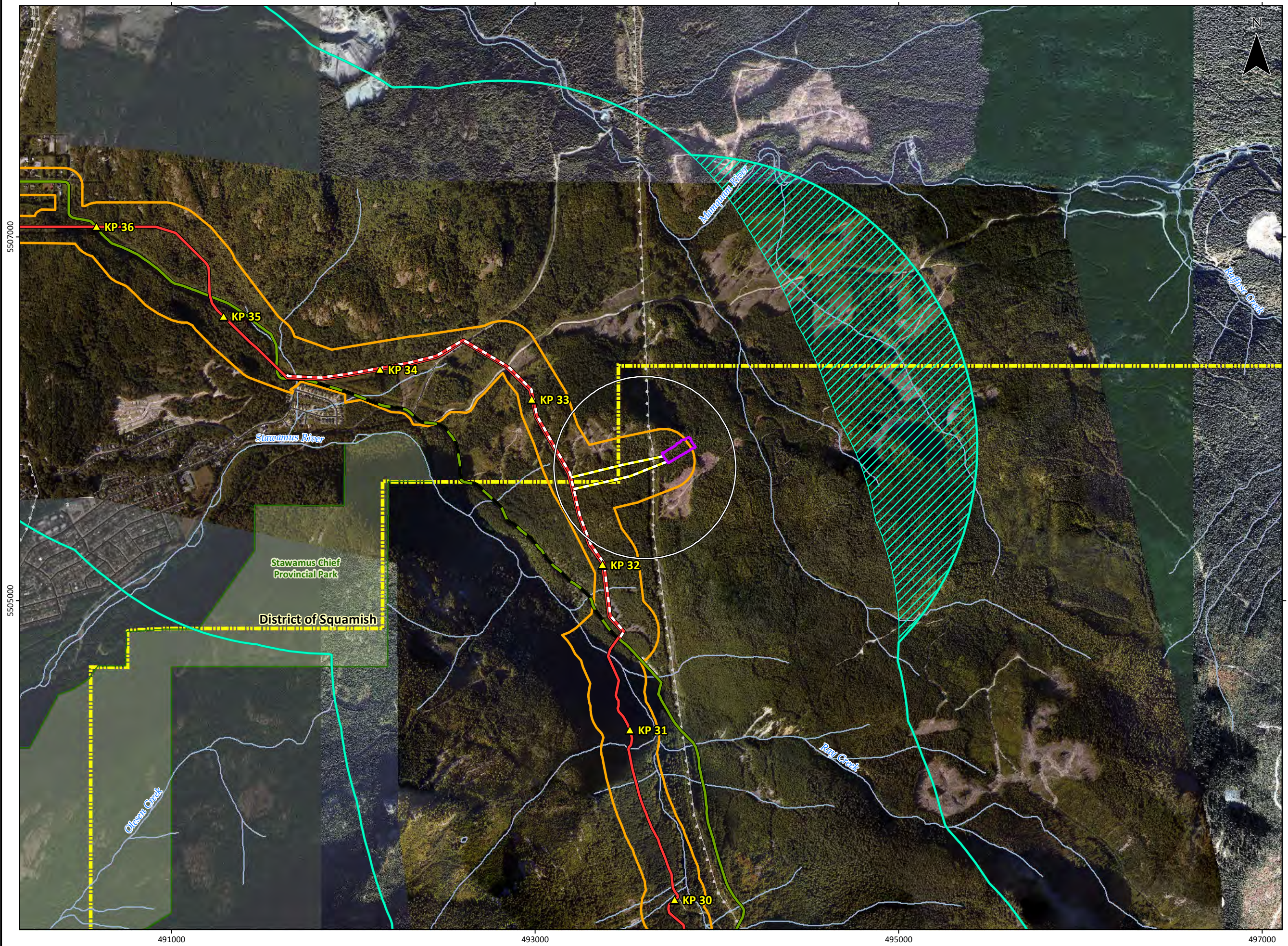
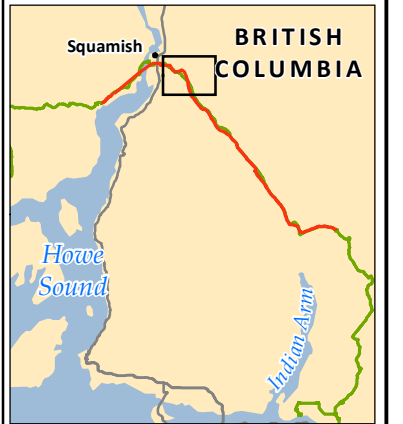












FIGURE 2.2-2

**ACOUSTIC ENVIRONMENT
STUDY AREA BOUNDARY
REDUCTION**

**EAGLE MOUNTAIN-WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post
-  Compressor Station
-  Proposed NPS 24
-  FortisBC Pipeline Route
-  Existing NPS 10 FortisBC Pipeline
-  Acoustic Environment Regional Study Area
-  Acoustic Environment RSA Reduction (Addendum 3)
-  Highway
-  Road
-  Railway
-  Watercourse
-  Waterbody
-  Municipality
-  Regional District
-  Park/Protected Area
-  First Nations Reserve

SCALE: 1:320,000



(All Locations Approximate)

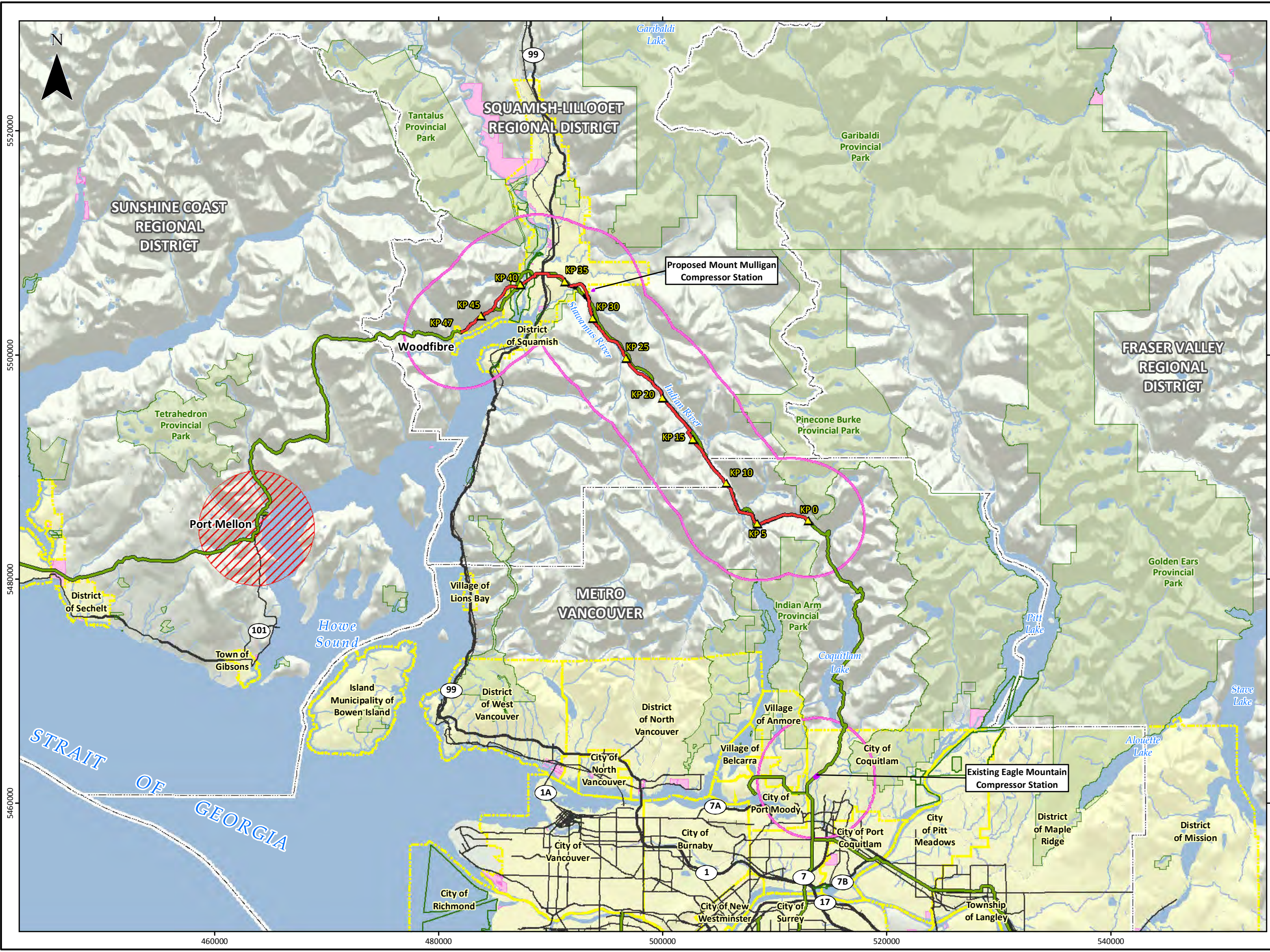


CH2M HILL Project Number 492434

UTM Zone 10 North, NAD 1983.
Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Compressor Stations: UPI 07-23-2014; FortisBC 08-04-2015; Roads: NRCAN 2014; Railways: USNIMA 2000; Hydrography: NRCAN 2009, ESRI 2005, USNIMA 2000 and BC MFLNRO 2008; Municipal Boundaries, Regional Districts: BC MFLNRO 2007; Parks, Wildlife Management Areas: BC MFLNRO 2008; First Nation Reserves: Government of Canada 2015; Hillshade: TERA Environmental Consultants 2008.
















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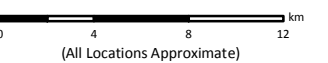


**AIR QUALITY
STUDY AREA BOUNDARY
REDUCTION**

**EAGLE MOUNTAIN-WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post
-  Compressor Station
-  Proposed NPS 24 FortisBC Pipeline Route
-  Existing NPS 10 FortisBC Pipeline
-  Air Quality Regional Study Area
-  Air Quality RSA Reduction (Addendum 3)
-  Highway
-  Road
-  Railway
-  Watercourse
-  Waterbody
-  Municipality
-  Regional District
-  Park/Protected Area
-  First Nations Reserve

SCALE: 1:320,000



(All Locations Approximate)

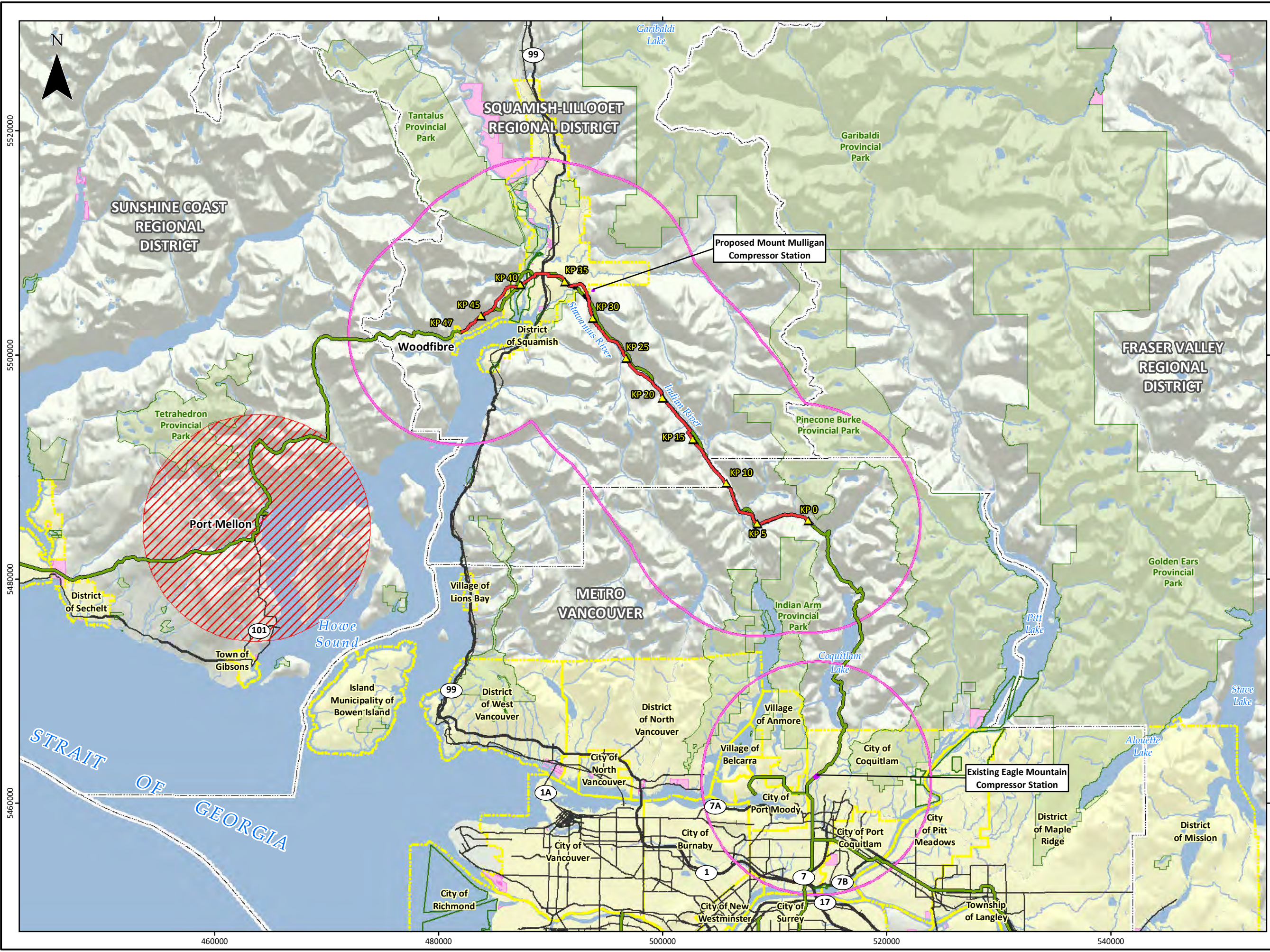


CH2M HILL Project Number 492434

UTM Zone 10 North, NAD 1983.
Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Compressor Stations: UPI 07-23-2014; FortisBC 08-04-2015; Roads: NRCAN 2014; Railways: USNIMA 2000; Hydrography: NRCAN 2009, ESRI 2005, USNIMA 2000 and BC MFLNRO 2008; Municipal Boundaries, Regional Districts: BC MFLNRO 2007; Parks, Wildlife Management Areas: BC MFLNRO 2008; First Nation Reserves: Government of Canada 2015; Hillshade: TERA Environmental Consultants 2008.

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2.2.2 Acoustic Environment Effects Assessment

As noted in Table 2.2-1, the Mount Mulligan compressor station changes the existing conditions for sound levels change from the information identified in the Section 5.0 of the Application. The permissible sound level at 1.5 km from the Mount Mulligan compressor station is 40 dBA at night, calculated following the BC OGC *Noise Control Best Practices Guideline*. The highest sound level at 1.5 km from the Mount Mulligan compressor station is predicted at 38 dBA, which is below the permissible sound level of 40 dBA. Therefore, the Mount Mulligan compressor station does not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Acoustic Environment VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 5.0 of the Application (Volume 1, Part B). As a result, it is concluded that the significance conclusions identified in the Application with respect to the Acoustic Environment VC remain the same.

2.2.3 Acoustic Environment Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Acoustic Environment VC. The change in the existing conditions does not change the assessment of the proposed Project’s contribution to cumulative change in the Acoustic Environment VC.

2.2.4 Air Quality Effects Assessment

The following new potential adverse effect identified for the Air Quality VC in the Application would be added:

- criteria air contaminants (CACs) during operations due to combustion sources.

Table 2.2-6 provides information on the new potential adverse effect to the Air Quality VC as a result of the Mount Mulligan compressor station, including identification of the potential residual adverse effects and additional mitigation measures.

TABLE 2.2-6

POTENTIAL ADVERSE EFFECT, MITIGATION MEASURE AND RESIDUAL ADVERSE EFFECT OF THE MOUNT MULLIGAN COMPRESSOR STATON ON AIR QUALITY

Project Phase	Potential Adverse Effect	Project Component/ Location/Activity	Spatial Boundary	Key Recommendations/Mitigation	Potential Residual Adverse Effect(s)
Air Quality - CACs					
Operations	CACs during operations due to combustion sources	Mount Mulligan compressor station	RSA	Avoid additional electrical infrastructure and significant activity and emissions associated with electric driven compressors.	Elevated concentrations of CACs during operations due to combustion sources

Table 2.2-7 characterizes the potential residual adverse effect to the Air Quality VC as a result of the Mount Mulligan compressor station.

TABLE 2.2-7

ASSESSMENT OF POTENTIAL RESIDUAL ADVERSE EFFECTS ON THE AIR QUALITY VALUED COMPONENT

Residual Adverse Effect	Criteria Rating	Effects Characterization Rationale
Air Quality - CACs		
Elevated concentrations of CACs during operations due to combustion sources	Spatial Boundary: Air Quality RSA	CAC emissions associated combustion sources will not be detectable outside the RSA.
	Duration: Long-term	Emissions from combustion sources will be throughout the operations phase.
	Frequency: Isolated	The emissions are confined to the operations phase.
	Reversibility: Immediate	Once operations are complete, the emissions will cease and air quality effects will be reversed within 2 days.
	Magnitude: Low	Air quality effects from construction or decommissioning within the RSA will be detectable but compliant with BC AAQOs.
	Probability of Occurrence: High	Combustion sources associated with the Mount Mulligan compressor station will emit CACs.
	Confidence: High	Based on a good understanding of the cause-effect relationships associated with air quality and compressor stations.
	Significance: Not significant	The potential adverse residual effect of elevated concentrations of CACs is not significant, as the residual effect is determined to have a low magnitude.

Elevated Concentrations of Criteria Air Contaminants during Operations Due to Combustion Sources

Ambient concentrations of CACs will increase within the RSA due to continuous combustion emission sources from the Mount Mulligan compressor station the predicted CACs are modelling at the maximum emissions scenario and are higher than would be expected with the facility under normal operation.

As noted in Table 2.2-1, the Mount Mulligan compressor station does result in change to the existing conditions for the Air Quality VC and the changes lead to a new potential residual effect. However, the expected increase in CACs is within the BC AAQO guidelines. As a result, it is concluded that the significance conclusions identified in the Application with respect to the Air Quality VC remain the same.

2.2.5 Air Quality Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Air Quality VC. The change in the existing conditions does not change the assessment of the proposed Project’s contribution to cumulative change in the Air Quality VC.

2.2.6 Greenhouse Gas Emissions Effects Assessment

The Addendum 3 changes lead to a net decrease of GHG emissions from the calculations in Section 5.0 of the Application (Volume, part B). A net reduction in GHG emissions of 10.8 kt/year on an ongoing annual basis and a one-time reduction of 0.3 kt is expected. The reduction is due to cancellation of electrical transmission line and substation construction related to the Squamish compressor station as well as the removal of the Port Mellon compressor station upgrades. The total Addendum 3 GHG emissions are still below federal, provincial or regional GHG reporting requirements, including the BC *Reporting Regulation* and the Western Climate Initiative reporting mandates. Detailed GHG technical information for the Mount Mulligan compressor station is provided in Appendix D of this Addendum.

The GHG reduction does not result in any material change to the characterization of potential residual adverse effects on the GHG Emissions VC assessed in the Application. Therefore, the proposed Addendum 3 does not change the conclusions identified in the Application with respect to the GHG Emissions VC.

2.2.7 Greenhouse Gas Emissions Cumulative Effects Assessment

As noted in Section 5.0 (Volume 1, Part B) of the Application, a cumulative effects assessment was not conducted for the GHG Emissions VC. Given the inherently cumulative nature of GHGs and their contribution to climate change, it was deemed unnecessary to conduct a cumulative effects assessment of GHG emissions for the proposed Project and, therefore, a cumulative effects assessment for GHG emissions is not provided in this Addendum.

2.3 Water

The assessment of potential adverse effects of the proposed Project on the Surface Water VC and Groundwater VC is provided in Section 6.0 of the Application (Volume 1, Part B). The following subsections describe changes to the assessment of the potential adverse effects on the Surface Water VC and Groundwater VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.3.1 Existing Conditions

Table 2.3-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.3-1

CHANGES IN EXISTING CONDITIONS FOR THE WATER VALUED COMPONENTS RELATED TO THE MOUNT MULLIGAN COMPRESSOR STATION

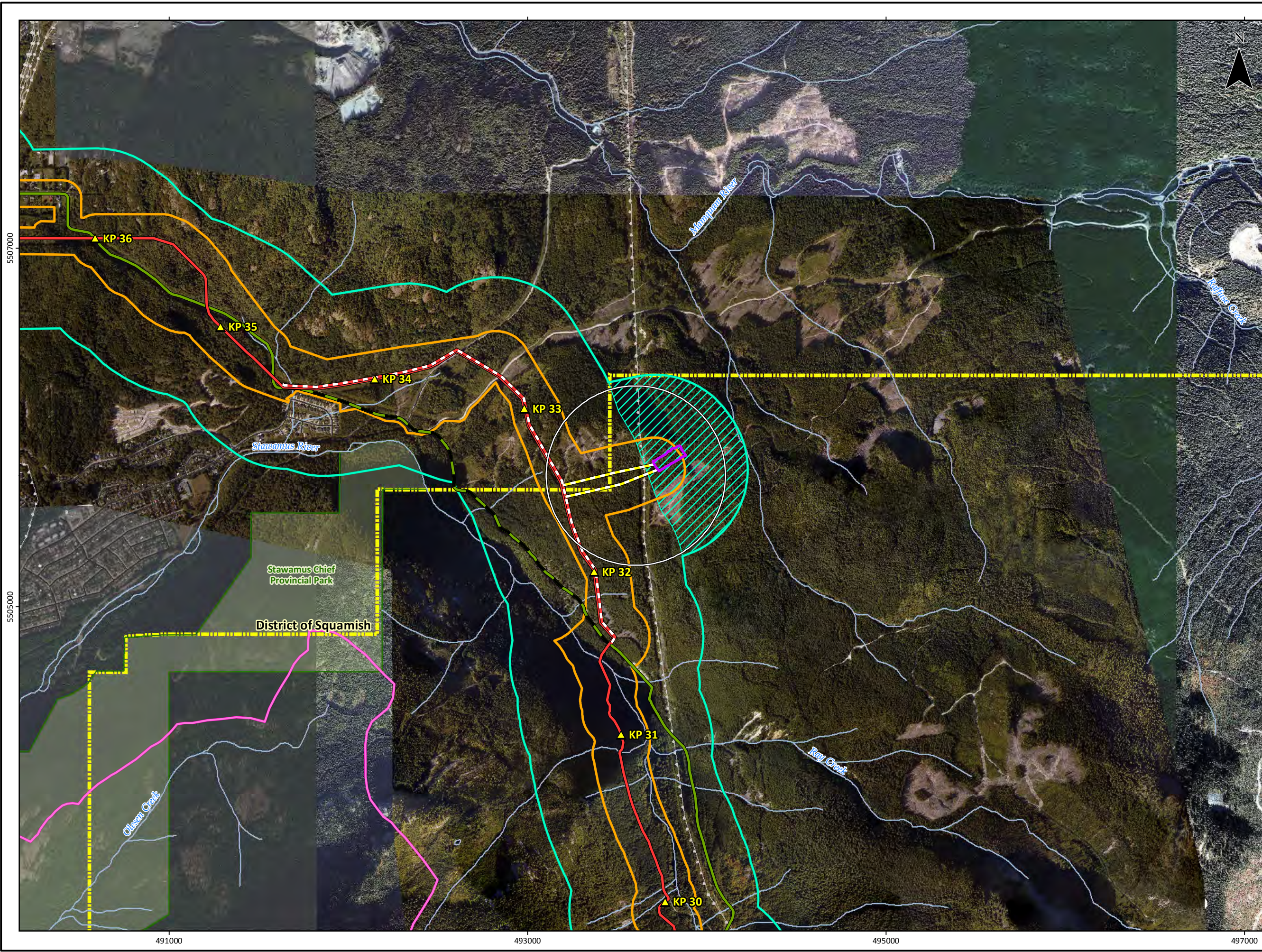
VC	Existing Conditions
Surface Water	<p>Application Corridor Expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the Surface Water VC. There are NCDs and a watercourse located in the Facility Siting Area however the preliminary Mount Mulligan compressor station construction footprint that is currently being evaluated is not crossed by NCDs or a watercourse.</p> <p>The Application Corridor expansion and the Facility Siting Area for the Mount Mulligan compressor station extends the Surface Water LSA assessed in Section 6.0 of the Application (refer to Figure 2.3-1 for spatial boundary extension). There is expected to be a change in existing conditions for the Surface Water VC at these LSA expansion locations however the conditions are comparable to Section 6.0 of the Application (Volume 1, Part B).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Surface Water VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Surface Water VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Surface Water VC.</p>
Groundwater	<p>Application Corridor Expansion and Facility Siting Area: There is no change in the existing conditions for the Groundwater VC as the existing conditions are comparable to those presented in Section 6.0 of the Application.</p> <p>The Application Corridor expansion and the Facility Siting Area for the Mount Mulligan compressor station extends the Groundwater LSA assessed in Section 6.0 of the Application (Figure 2.3-1). There is no change in existing conditions for the Groundwater VC at these LSA expansion locations.</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Groundwater VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Groundwater VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Groundwater VC.</p>

Facility Siting Area – Surface Water Valued Component

With the exception of the northeast segment, land within the Facility Siting Area drains southwest towards Stawamus River. The Stawamus River drains into the Mamquam Blind channel, an estuarine feature that extends from Howe Sound into Squamish. The northeast segment of the siting area drains north towards the Mamquam River, which flows northwest then drains into the Squamish River.

A small watercourse with a defined channel (between 1 m and 5 m wide) and ephemeral flow regime runs along the south end of the Facility Siting Area, exiting at the site’s southwest edge before flowing southwest for approximately 400 m to its confluence with Stawamus River. Flow conditions in the watercourse during the summer 2014 aquatic assessment were low, with water depths ranging from 0.04 m to 0.20 m and velocities between 0.10 and 0.15 m/s, while flow conditions were dry during a field visit in summer 2015. No additional watercourses are expected to occur within the Facility Siting Area.

There were two NCDs identified in the southwest segment of the Facility Siting Area during aquatic field studies however, the preliminary Mount Mulligan compressor station construction footprint that is currently being evaluated is not crossed by the NCDs or a watercourse.



**FIGURE 2.3-1
SURFACE WATER STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

- Kilometre Post
- Proposed NPS 24
- FortisBC Pipeline Route
- Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
- Proposed NPS 10 to Compressor
- Existing NPS 10 FortisBC Pipeline
- Existing NPS 10 Subject to Removal/Abandonment
- Proposed Application Corridor
- Proposed Compressor Siting Area
- Surface Water Local Study Area
- Surface Water LSA Expansion (Addendum 3)
- Surface Water Regional Study Area
- Preliminary Mount Mulligan Compressor Station Footprint
- Road
- Electrical Transmission Line
- Watercourse / Shoreline
- Municipality
- Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)



CH2M HILL Project Number 492434

NAD 1983. UTM Zone 10 North.
Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCAN 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LIDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.





















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**FIGURE 2.3-2
GROUNDWATER STUDY AREA
BOUNDARY EXPANSIONS
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post
-  Proposed NPS 24
-  FortisBC Pipeline Route
-  Proposed NPS 24 and NPS 10
-  Parallel FortisBC Pipeline Route
-  Proposed NPS 10 to Compressor
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 Subject to Removal/Abandonment
-  Proposed Application Corridor
-  Proposed Compressor Siting Area
-  Groundwater Local Study Area
-  Groundwater LSA Expansion (Addendum 3)
-  Groundwater Regional Study Area
-  Groundwater RSA Expansion (Addendum 3)
-  Preliminary Mount Mulligan Compressor Station Footprint
-  Road
-  Electrical Transmission Line
-  Watercourse / Shoreline
-  Municipality
-  Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)

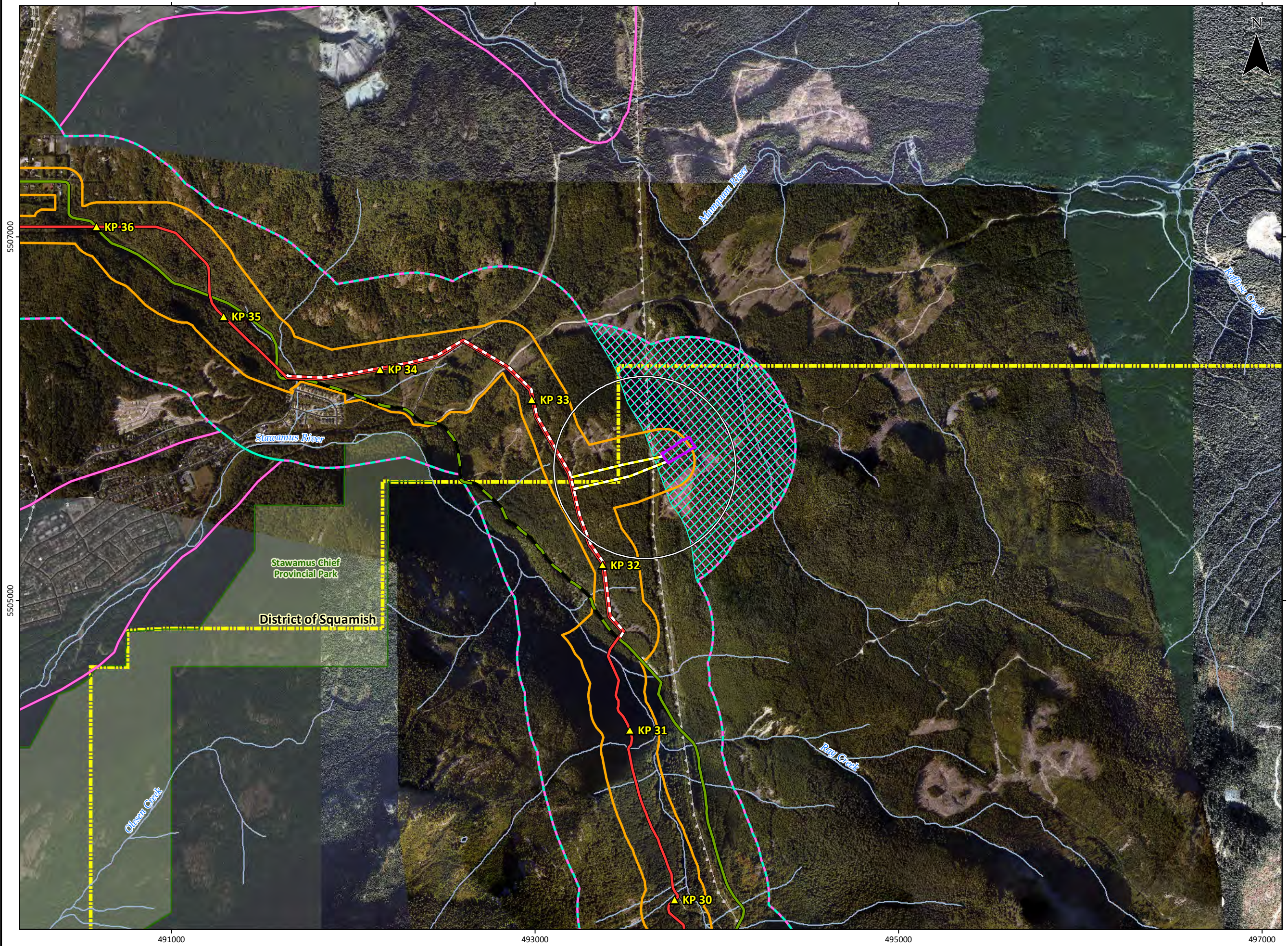


CH2M HILL Project Number 492434

NAD 1983, UTM Zone 10 North.
Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCan 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LiDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the USA User Community.

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2.3.2 Surface Water Effects Assessment

As noted in Table 2.3-1, there is expected to be a change to the existing conditions for the Facility Siting Area, however, the conditions for the Facility Siting Area and the other proposed Addendum 3 changes are within the three sub-basins assessed in Section 6.0 of the Application (Volume 1, Part B). The proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Surface Water VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 6.0 of the Application (Volume 1, Part B). As a result, it is concluded that the significance conclusions identified in the Application with respect to the Surface Water VC remain the same.

2.3.3 Surface Water Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Surface Water VC. The change in the existing conditions does not change the assessment of the proposed Project’s contribution to cumulative change in the Surface Water VC.

2.3.4 Groundwater Effects Assessment

As noted in Table 2.3-1, the proposed Addendum 3 changes do not result in a change in the existing conditions for the Groundwater VC. The conditions at these locations are within the four watersheds assessed in Section 6.0 of the Application (Volume 1, Part B). Therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Groundwater VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 6.0 of the Application (Volume 1, Part B). As a result, it is concluded that the significance conclusions identified in the Application with respect to the Groundwater VC remain the same.

2.3.5 Groundwater Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Groundwater VC. There is no change in the existing conditions for the Groundwater VC and, therefore, there is no change to the assessment of the proposed Project’s contribution to cumulative change in the Groundwater VC.

2.4 Fish and Fish Habitat

The assessment of potential adverse effects of the proposed Project on the Fish and Fish Habitat VC is provided in Section 7.0 of the Application (Volume 1, Part B). The following subsections describe any change to the assessment of potential adverse effects on the Fish and Fish Habitat VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.4.1 Existing Conditions

Table 2.4-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.4-1

CHANGES IN EXISTING CONDITIONS FOR THE FISH AND FISH HABITAT VALUED COMPONENT RELATED TO THE PROPOSED ADDENDUM 3 CHANGES

VC	Existing Conditions
Fish and Fish Habitat	<p>Application Corridor expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the Fish and Fish Habitat VC. There are NCDs and a watercourse located in the Facility Siting Area however, the site that is currently being evaluated is not crossed by these features. The conditions are comparable to those presented in Section 7 of the Application (Volume 1, Part B).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Fish and Fish Habitat VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Fish and Fish Habitat VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Fish and Fish Habitat VC.</p>

Facility Siting Area

With the exception of the northeast segment, land within the Facility Siting Area drains southwest towards Stawamus River. The Stawamus River drains into the Mamquam Blind channel, an estuarine feature that extends from Howe Sound into Squamish. The northeast segment of the siting area drains north towards the Mamquam River, which flows northwest then drains into the Squamish River.

A small watercourse with a defined channel (between 1 m and 5 m wide) and ephemeral flow regime runs along the south end of the siting area, exiting at the site's southwest edge before flowing southwest for approximately 400 m to its confluence with Stawamus River. During aquatic field studies conducted in summer 2014, this watercourse was determined to be inaccessible to fish from the Stawamus River due to steep gradients (measuring 62% and 104% at two locations) and numerous waterfalls. While not fish-bearing, this stream has an S3 classification because it is located in a community watershed. Therefore, the stream has a 40 m Riparian Management Area (RMA), consisting of a 20 m Riparian Reserve Zone and 20 m Riparian Management Zone. Flow conditions in the watercourse during the summer 2014 aquatic assessment were low, with water depths ranging from 0.04 m to 0.20 m and velocities between 0.10 m/s and 0.15 m/s, while flow conditions were dry during a field visit in summer 2015. No additional watercourses are expected to occur within the Facility Siting Area.

There were two NCDs identified in the southwest segment of the Facility Siting Area during aquatic field studies. Due to steep gradients, structural confinement and a lack of water and habitat, these NCDs were determined to not provide fish habitat. Additional ephemeral NCDs may be present within the Facility Siting Area and would also be expected to lack fish habitat potential due to similar constraints, as determined through desktop assessment and initial field reconnaissance.

The preliminary Mount Mulligan compressor station construction footprint that is currently being evaluated is not crossed by the NCDs or a watercourse. Following confirmation of the final Mount Mulligan compressor station footprint, subsequent studies would be conducted to confirm that no NCDs are affected by facility construction and surface drainage is maintained to reflect natural conditions. This work would occur in conjunction with Project permitting.

2.4.2 Fish and Fish Habitat Effects Assessment

As noted in Table 2.4-1, there is expected to be a change to the existing conditions for the Facility Siting Area, however, the conditions are within in the sub-basins and watershed assessed for the Fish and Fish Habitat VC in Section 7.0 of the Application (Volume 1, Part B). Therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Fish and Fish Habitat VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 7.0 of the Application (Volume 1, Part B). As a result, it is concluded that the significance conclusions identified in the Application with respect to the Fish and Fish Habitat VC remain the same.

2.4.3 Fish and Fish Habitat Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Fish and Fish Habitat VC. The change in the existing conditions for the Fish and Fish Habitat VC does not change the assessment of the proposed Project's contribution to cumulative change in the Fish and Fish Habitat VC.

2.5 Vegetation

The assessment of potential adverse effects of the proposed Project on the Vegetation VC is provided in Section 8.0 of the Application (Volume 1, Part B). The following subsections describe any change to the assessment of potential adverse effects on the Vegetation VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.5.1 Existing Conditions

Table 2.5-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.5-1

**CHANGES IN EXISTING CONDITIONS FOR THE VEGETATION
VALUED COMPONENT RELATED TO THE PROPOSED ADDENDUM 3 CHANGES**

VC	Existing Conditions
Vegetation	<p>Application Corridor Expansion and Facility Siting Area: There is expected to be a change to existing conditions for the Vegetation VC. Disturbance to native vegetation would occur at the Mount Mulligan compressor station site (approximately 1.1 ha), however, approximately 0.15 ha of the proposed site has recently been logged.</p> <p>The Application Corridor expansion and the Facility Siting Area for the Mount Mulligan compressor station extends the Vegetation LSA (refer to Figure 2.5-1 for spatial boundary extension). The existing conditions for the area beyond the LSA boundaries described in the Application for the Vegetation VC are described in Table 2.5.2. Despite the expanded Vegetation VC LSA, the existing conditions are comparable to the vegetation communities described in Section 8.0 of the Application</p> <p>Eagle Mountain Footprint: There is expected to be a change in existing conditions for the Vegetation VC. The Vegetation LSA is expanded by approximately 17.6 ha, however, the expanded Vegetation VC LSA, the existing conditions are comparable to the vegetation communities described in Section 8.0 of the Application. There are no additional Old Growth Management Areas (OGMAs) or potential species of concern within the vicinity of the LSA expansion and therefore, this change is not discussed in further detail (refer to Figure 2.5-1 for spatial boundary extension).</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Vegetation VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Vegetation VC.</p>

Facility Siting Area – Vegetation Valued Component

The proposed Mount Mulligan compressor station site is within the Coastal Western Hemlock (CWH) Biogeoclimatic (BGC) Zone, in the Dry Maritime (dm) subzone. The Facility Siting Area crosses the CWHdm subzone as well as the Submontane Very Wet Maritime (vm1) and Montane Very Wet Maritime (vm2) subzone variants. These BGC subzone variants were described in Section 8.0 of the Application (Volume 1, Part B).

A site visit was conducted at the proposed Mount Mulligan compressor station site on August 19, 2015. The vegetation community observed at the proposed location represents CWHdm 01HM site series (western hemlock/flat moss) with young coniferous forest dominated by western hemlock (60%), and coastal Douglas-fir and western redcedar as secondary species. Common understory species included huckleberry, salal, dogwood, false azalea, step moss and lanky moss. Analysis of the publicly available provincial Vegetation Resources Inventory (VRI) data identified two VRI polygons adjacent to the preliminary Mount Mulligan compressor station construction footprint (DataBC 2015). The VRI polygon to the northwest represents mature coniferous forest dominated by coastal Douglas-fir (70%) and western hemlock, with western redcedar as a secondary species, whereas the VRI polygon to the southeast represents young coniferous forest dominated by western redcedar (60%) and western hemlock, with coastal Douglas-fir as a secondary species (DataBC 2015). Approximately 0.15 ha of the proposed Mount Mulligan compressor station location was cleared in 2013.

Table 2.5-2 provides a summary existing conditions to the expanded Vegetation LSA where the Application Corridor and Facility Siting Area for the Mount Mulligan compressor station extends the Vegetation LSA considered in Section 8.0 of the Application (Volume 1, Part B). The total area of the Vegetation LSA expansion accounts for 66.1 ha. Figure 2.5-1 provides an overview of the Vegetation LSA boundary expansion.

TABLE 2.5-2

EXISTING CONDITIONS FOR THE VEGETATION LOCAL STUDY AREA EXPANSION

Vegetation Features	Changes in the Existing Conditions
Potential ecological communities of concern	Analysis of the Terrestrial Ecosystem Mapping data (BC Ministry of Environment, Ecosystems Branch 2010, District of Squamish 2008) available for 37% of the Vegetation LSA expansion area identified an additional 20.7 ha of potential ecological communities of concern within the Vegetation LSA expansion. These potential ecological communities of concern were previously described in Section 8.0 of the Application (Volume 1, Part B).
OGMA	The proposed Vegetation LSA expansion does not cross any legal or non-legal OGMAs, therefore, there is no changes to existing conditions associated with OGMAs

TABLE 2.5-2 Cont'd

Vegetation Features	Changes in the Existing Conditions
Previously recorded occurrences of ecological communities or plant species of concern	Analysis of the records of known occurrences of ecological communities and plant species of concern within 10 km of the preliminary Mount Mulligan compressor station construction footprint acquired from the BC Conservation Data Centre (2012) identified three previously recorded plant species of concern: Roell's Brotherella (4.1 km and 8.4 km from the proposed footprint), nodding semaphoregrass (6.1 km from the proposed footprint) and Vancouver Island Beggarticks (5.5 km from the proposed footprint). These known plant species of concern were previously described in Section 8.0 of the Application (Volume 1, Part B) as occurring within 10 km of the proposed Project Footprint.

**FIGURE 2.5-1
VEGETATION STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

- Kilometre Post
- Proposed NPS 24 FortisBC Pipeline Route
- Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
- Proposed NPS 10 to Compressor
- Existing NPS 10 FortisBC Pipeline
- Existing NPS 10 Subject to Removal/Abandonment
- Proposed Application Corridor
- Proposed Compressor Siting Area
- Vegetation Local Study Area
- Vegetation LSA Expansion (Addendum 3)
- Vegetation Regional Study Area
- Preliminary Compressor Station Footprint
- Road
- Electrical Transmission Line
- Watercourse / Shoreline
- Municipality
- Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)

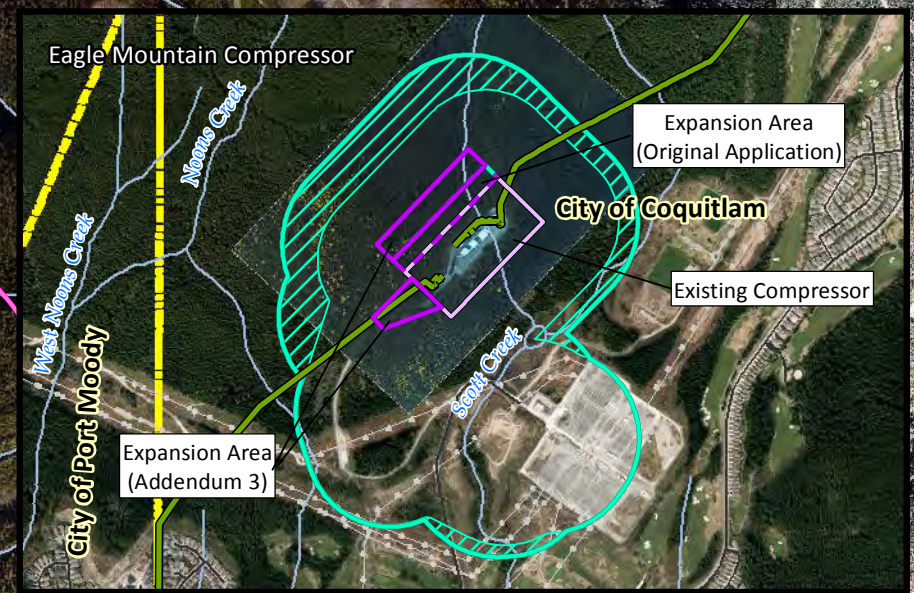
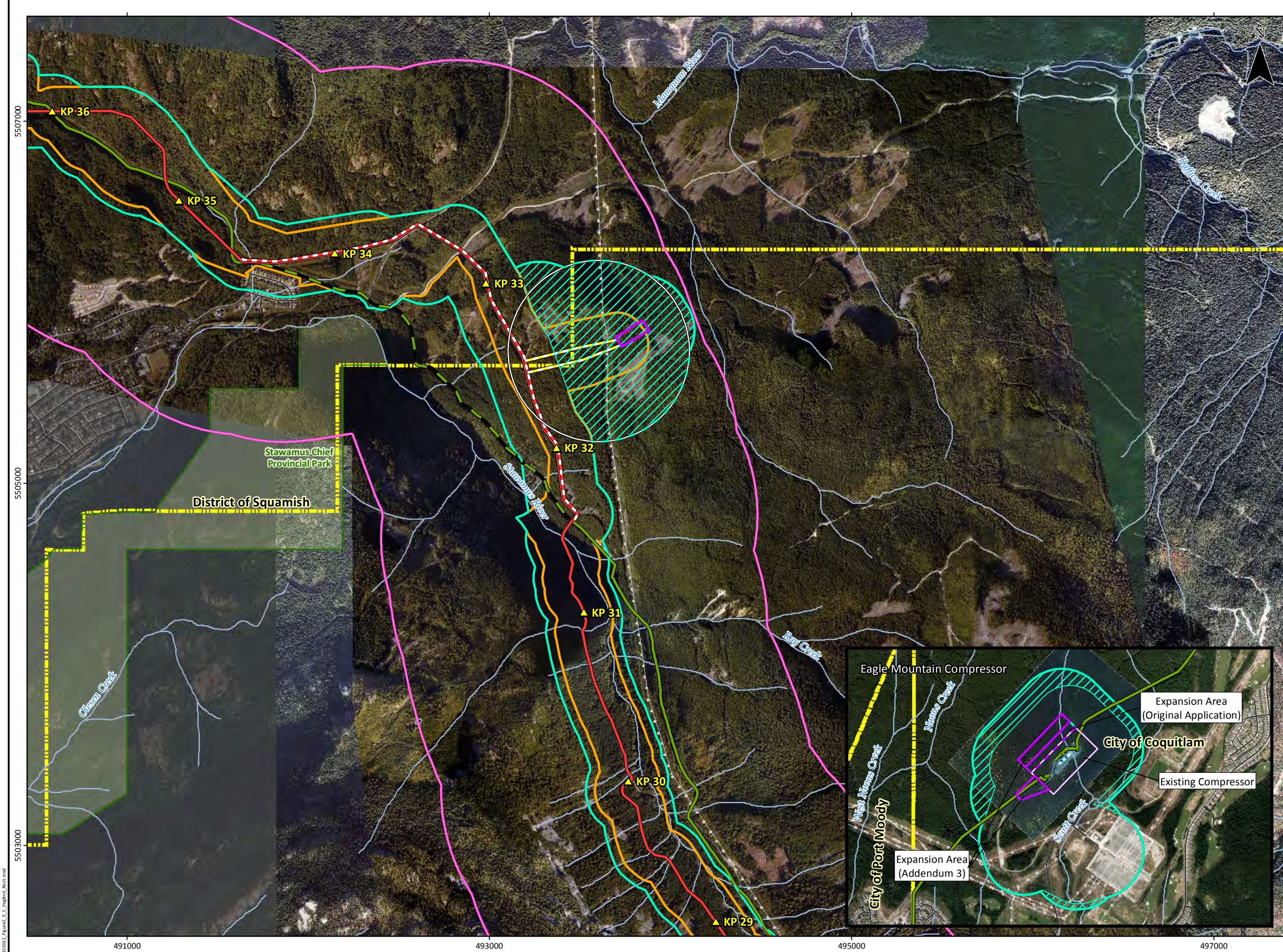


CH2M HILL Project Number 492434

NAD 1983. UTM Zone 10 North.
Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCAN 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LiDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

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2.5.2 Vegetation Effects Assessment

As noted in Table 2.5-1, there is expected to be a change in the existing conditions for the Eagle Mountain compressor station and Mount Mulligan compressor station, however, the conditions at these locations are comparable to the vegetation communities assessed in Section 8.0 of the Application (Volume 1, Part B). Therefore the proposed Addendum 3 changes do not result in any material change potential adverse effects, mitigation or residual adverse effects for the Vegetation VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 8.0 of the Application (Volume 1, Part B).

As a result, and the significance conclusions identified in the Application with respect to the Vegetation VC remain the same.

2.5.3 Vegetation Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Vegetation VC. The change in the existing conditions for the Vegetation VC does not change the assessment of the proposed Project’s contribution to cumulative effects on the Vegetation VC.

2.6 Wetlands

The assessment of potential adverse effects of the proposed Project on the Wetland Function VC is presented in Section 9.0 of the Application (Volume 1, Part B). The following subsections describe any change to the assessment of potential adverse effects on the Wetland Function VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.6.1 Existing Conditions

Table 2.6-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.6-1

CHANGES IN EXISTING CONDITIONS FOR THE WETLAND FUNCTION VALUED COMPONENT RELATED TO THE PROPOSED ADDENDUM 3 CHANGES

VC	Existing Conditions
Wetland Function	<p>Application Corridor Expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the Wetland Function VC for the Facility Siting Area. There are two wetlands located within the Facility Siting Area and one wetland in the preliminary Mount Mulligan construction footprint.</p> <p>The Application Corridor expansion and the Facility Siting Area for the Mount Mulligan compressor station extend the Wetlands LSA (refer to Figure 2.6-1 for spatial boundary extension). The existing conditions for the area beyond the LSA boundaries described in the Application and the other changes to the existing conditions for the Wetland Function VC are described in Table 2.6.2.</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Wetland Function VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Wetland Function VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Wetland Function VC.</p>

Application Corridor and Facility Siting Area

Table 2.6-2 provides a summary of the wetlands found in the Facility Siting Area.

TABLE 2.6-2



















EXISTING CONDITIONS FOR THE WETLAND LOCAL STUDY AREA

Wetland ID	Wetland Class	Centroid UTM Easting (10U)	Centroid UTM Northing (10U)	Wetland Functional Condition	Site Association	Wetland Riparian Class	Wetland Area (ha)
2Wet-6	Swamp	493661	5505716	Moderately-High Functional Condition	Ws02	N/A	0.15
2Wet-7	Swamp	493582	5505534	High Functional Condition	Ws54	N/A	0.09

There are two swamps located within the Facility Siting Area, one directly below the existing BC Hydro electrical transmission line and one approximately 50 m to the west. The preliminary Mount Mulligan compressor station construction footprint that is currently being evaluated is not crossed by these two swamps. The NPS 10" lateral pipeline has the potential to encounter the swamp located below the existing electrical transmission line. Pipeline construction is considered temporary disturbance, and mitigation to reduce potential adverse effects on wetlands is identified in the Application Environmental Management Plan (EMP) (Volume 3, Appendix 3A).

[Wetlands to provide new information obtained from site survey and EDI field visit]

**FIGURE 2.6-1
WETLAND STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post
-  Proposed NPS 24
-  FortisBC Pipeline Route
-  Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
-  Proposed NPS 10 to Compressor
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 Subject to Removal/Abandonment
-  Proposed Application Corridor
-  Proposed Compressor Siting Area
-  Wetland Local Study Area
-  Wetland LSA Expansion (Addendum 3)
-  Wetland Regional Study Area
-  Preliminary Mount Mulligan Compressor Station Footprint
-  Road
-  Electrical Transmission Line
-  Watercourse / Shoreline
-  Municipality
-  Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)

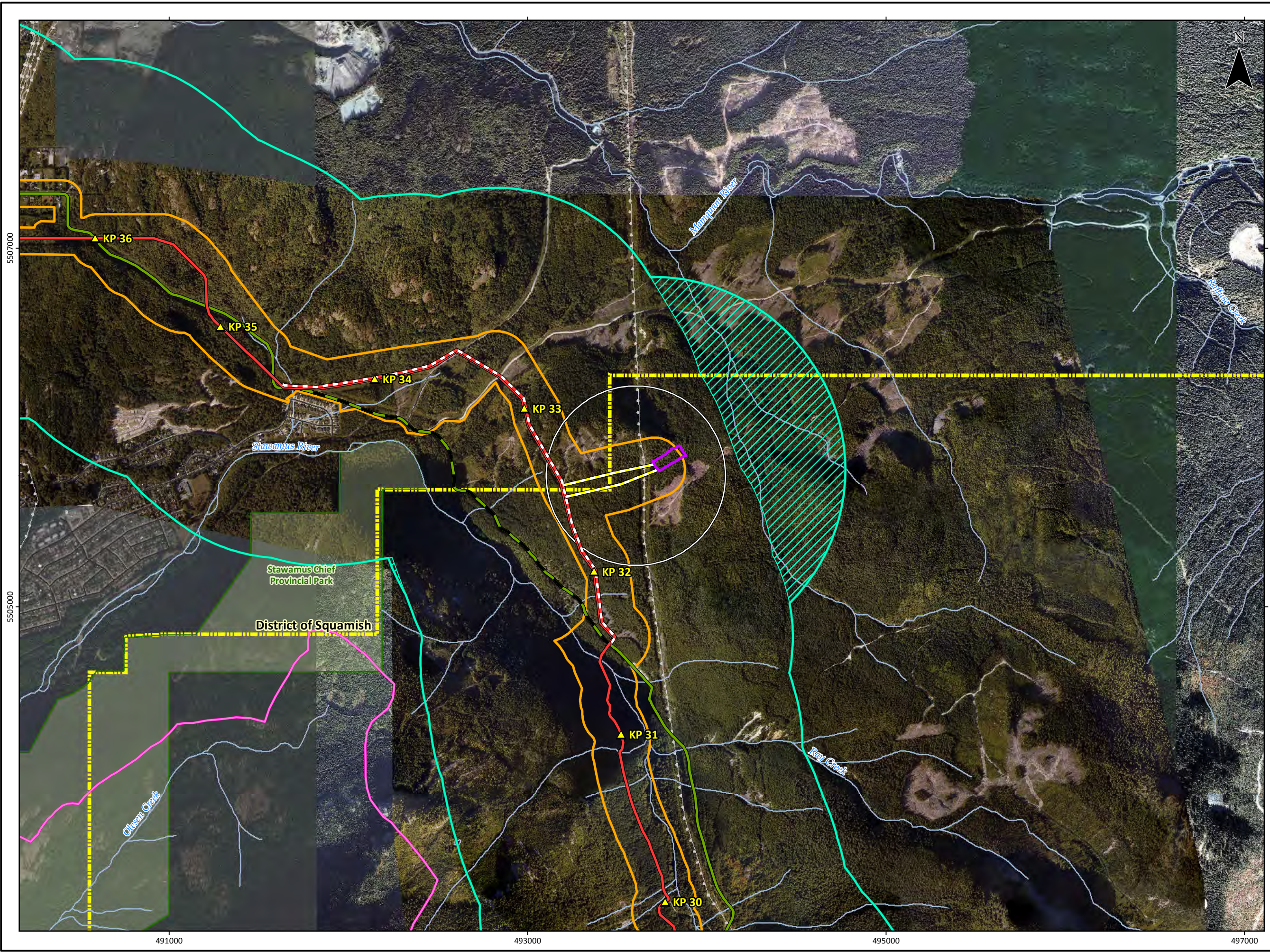


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2.6.2 Wetland Function Effects Assessment

The following new potential adverse effect identified for the Wetland VC in the Application would be added:

- loss or alteration of wetland function due to compressor station construction and operation.

Table 2.6-3 provides information on the new potential adverse effects to the Wetland Function VC as a result of the Mount Mulligan compressor station, including identification of potential residual adverse effect and mitigation measures.

TABLE 2.6-3

POTENTIAL ADVERSE EFFECTS, MITIGATION MEASURES AND RESIDUAL ADVERSE EFFECTS OF THE MOUNT MULLIGAN COMPRESSOR STATION ON WETLAND FUNCTION

Project Phase	Potential Adverse Effect	Project Component/ Location/Activity	Spatial Boundary	Key Recommendations/Mitigation	Potential Residual Adverse Effect(s)
Wetland Function					
Construction and Operations	Loss or alteration of wetland hydrological, habitat and biogeochemical function.	Mount Mulligan compressor station	Wetlands LSA	"No net loss" of wetland function will be addressed through offset planning, if deemed warranted by appropriate regulatory agencies following determination of loss of function through the wetlands PCM Program.	Loss or alteration of wetland hydrological, habitat and biogeochemical function due to the Mount Mulligan compressor station.

Table 2.6-4 characterizes the potential residual adverse effect to the Wetland Function VC as a result of the Mount Mulligan compressor station.

TABLE 2.6-4

ASSESSMENT OF POTENTIAL RESIDUAL ADVERSE EFFECTS ON THE WETLAND FUNCTION VALUED COMPONENT

Residual Adverse Effect	Criteria Rating	Effects Characterization Rationale
Wetland Function		
Loss or alteration of wetland hydrological, habitat and biogeochemical function due to the Mount Mulligan compressor station.	Spatial Boundary: Wetlands LSA	The spatial boundary for potential alteration of hydrologic, habitat and biogeochemical function is primarily within the area directly affected by construction (the Mount Mulligan compressor station footprint), and potential adverse effects in wetlands adjacent to the compressor station footprint are not expected to extend beyond the Wetland LSA.
	Duration: Short-term	Construction of the Mount Mulligan compressor station expected to occur in the construction phase.
	Frequency: Isolated to Periodic	Disturbance resulting from the proposed Project is expected to be isolated in the construction phase and periodic in the operations phase for maintenance.
	Reversibility: Medium to long-term	Potential adverse residual effects on hydrological, habitat and biogeochemical function are expected in the medium to long-term with implementation of proper mitigation. Recovery of plant communities and tree re-establishment is expected in the long-term.
	Magnitude: Medium	The effects of habitat, hydrological and biogeochemical alteration will be detectable within the construction phase and until natural flow patterns and vegetation are re-established following mitigation.
	Probability of Occurrence: High	The probability of adverse residual effects on wetland hydrological, habitat and biogeochemical function associated with the Mount Mulligan compressor station is likely.
	Confidence: Moderate	Determination based on good understanding of the effects of facility construction on wetland function, using both data pertinent to the proposed Project and data from outside the proposed Project.
Significance: Not significant	Contingent on the proper implementation of mitigation, the potential adverse residual effects of the proposed Project on wetland hydrological, habitat and biogeochemical function are not significant.	

Loss or Alteration of Wetland Hydrological, Habitat and Biogeochemical Function Due to the Mount Mulligan Compressor Station

During detailed compressor station design, the wetland areas will be avoided as far as practical, and the local surface and groundwater flows will be managed to preserve wetland function. Depending on the location of the disturbance, a slight reduction in wetland area does not result in an overall net loss of wetland function. As described in Section 9.0 of the Application (Volume 1 Part B), the potential adverse effect on the Wetland Function VC associated with the permanent facility is the loss of wetland hydrological, habitat and biogeochemical function, depending on the location of disturbance and the likelihood that wetland function will be compromised. The potential residual adverse effects on hydrologic flow (e.g., surface or groundwater flow) of wetlands as a result of the construction of the Mount Mulligan compressor station include wetland drainage, water diversion and water impoundment, which will be mitigated. The removal of wetland vegetation will result in a loss of habitat and associated losses of biogeochemical functions such as sediment control and carbon sequestration. If the function of the overall wetland has been compromised, the loss of wetland function will be mitigated, if warranted, through compensatory technical or economic mitigation in consultation with appropriate regulatory agencies.

As noted in Table 2.6-1, the Mount Mulligan compressor station does result in change to the existing conditions for the Wetland Function VC identified in Section 9.0 of the Application (Volume 1, Part B) and the changes lead to a new potential residual effect. The mitigation of “No net loss” of wetland function will be addressed through offset planning if deemed warranted by appropriate regulatory agencies. Therefore, the proposed material change to the assessment of potential adverse effects, mitigation or residual effects for the Wetlands Function VC as result of the Mount Mulligan compressor station does not change the significance conclusions identified in Section 9.0 of the Application (Volume 1, Part B).

2.6.3 Wetland Function Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Wetlands Function VC. Therefore the change in the existing conditions for the Wetlands Function VC does not change the assessment of the proposed Project’s contribution to cumulative change in the Wetland Function VC.

2.7 Wildlife and Wildlife Habitat

The assessment of potential adverse effects of the proposed Project on the Wildlife and Wildlife Habitat VC is presented in Section 10.0 of the Application (Volume 1, Part B). The following subsections describe any change to the assessment of potential adverse effects on the Wildlife and Wildlife Habitat VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.7.1 Existing Conditions


















The proposed Addendum 3 changes do not cross any provincially-designated identified wildlife areas or critical habitat for wildlife species that were not already included in the Application. Table 2.7-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.7-1

CHANGES IN EXISTING CONDITIONS FOR THE WILDLIFE AND WILDLIFE HABITAT VALUED COMPONENT RELATED TO THE PROPOSED ADDENDUM 3 CHANGES

VC	Existing Conditions
Wildlife and Wildlife Habitat	<p>Application Corridor Expansion and Facility Siting Area: There is no change in the existing conditions for the Wildlife and Wildlife Habitat VC. The existing conditions for the Facility Siting Area are comparable to the wildlife and wildlife habitat presented in Section 10.0 of the Application (Volume 1, Part B) and the wildlife habitat model results remain valid. The western part of the Facility Siting Area contains areas identified as critical nesting habitat for marbled murrelet by the Recovery Strategy for the Marbled Murrelet (<i>Brachyramphus marmoratus</i>) in Canada (Environment Canada 2014). The biophysical attributes of habitat necessary for marbled murrelet nesting may not be present in portions of these identified critical habitat polygons. Section 10.3.1 of the Application (Volume 1, Part B) provides further information on critical habitat for marbled murrelet.</p> <p>Locations where the marbled murrelet critical habitat areas occur within the Facility Siting Area would be investigated in the field, if necessary, during determination of the final Mount Mulligan compressor station location and the associated NPS 10" pipeline lateral, in order to evaluate the biophysical attributes of the habitat.</p> <p>The Application Corridor expansion and Facility Siting Area for the Mount Mulligan compressor station extends the Wildlife LSA assessed in Section 10.0 of the Application (Figure 2.7-1 for the locations of Wildlife LSA expansion). There is no change in existing conditions for the Wildlife and Wildlife Habitat VC at these LSA expansion locations.</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Wildlife and Wildlife Habitat VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Wildlife and Wildlife Habitat VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Wildlife and Wildlife Habitat VC.</p>

**FIGURE 2.7-1
WILDLIFE STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post
-  Proposed NPS 24
-  FortisBC Pipeline Route
-  Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
-  Proposed NPS 10 to Compressor
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 Subject to Removal/Abandonment
-  Proposed Application Corridor
-  Proposed Compressor Siting Area
-  Wildlife Local Study Area
-  Wildlife LSA Expansion (Addendum 3)
-  Preliminary Mount Mulligan Compressor Station Footprint
-  Road
-  Electrical Transmission Line
-  Watercourse / Shoreline
-  Municipality
-  Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)

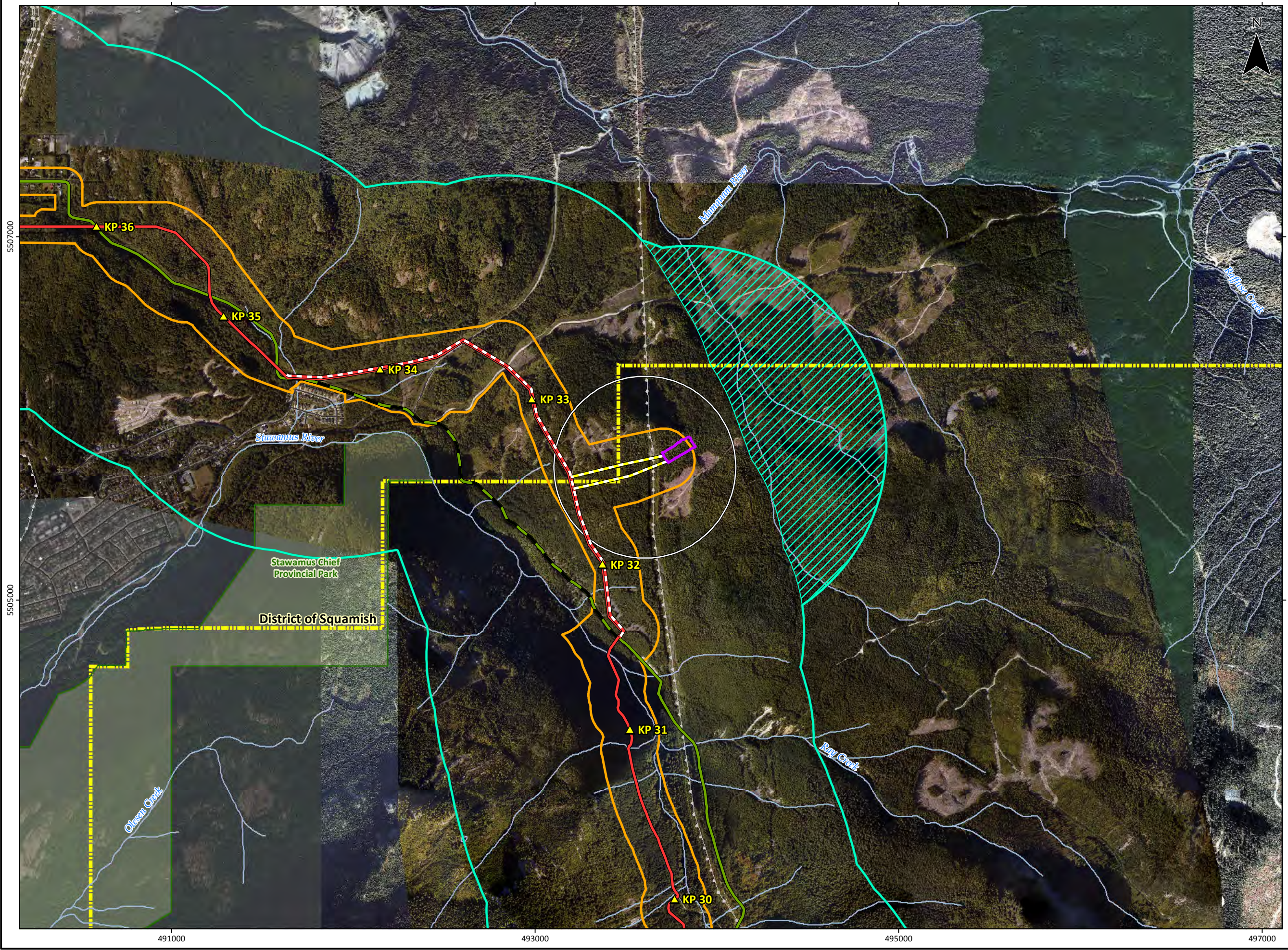


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2.7.2 Wildlife and Wildlife Habitat Effects Assessment

As noted in Table 2.7-1, there is no change in the existing conditions for the Wildlife and Wildlife Habitat VC for the proposed Addendum 3 changes since existing conditions are comparable to the wildlife and wildlife habitat assessed in the Application. Therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Wildlife and Wildlife Habitat VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 10.0 of the Application (Volume 1, Part B).

As a result, it is concluded that the significance conclusions identified in the Application with respect to the Wildlife and Wildlife Habitat VC remain the same.

2.7.3 Wildlife and Wildlife Habitat Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Wildlife and Wildlife Habitat VC since it was determined that there are no changes in the existing conditions or effects assessment for the Wildlife and Wildlife Habitat VC.

2.8 Economic Effects Assessment

The assessment of potential adverse effects of the proposed Project on the Economy VC and Employment and Labour Force VC is provided in Section 11.0 of the Application (Volume 1, Part B). The following subsections describe potential changes to the assessment of the potential adverse effects on the Economy VC and Employment and Labour Force VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.8.1 Existing Conditions

Table 2.8-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

**TABLE 2.8-1
 CHANGES IN EXISTING CONDITIONS FOR ECONOMIC
 VALUED COMPONENTS RELATED TO THE PROPOSED ADDENDUM 3 CHANGES**

VC	Existing Conditions
Economy	<p>Application Corridor Expansion and Facility Siting Area: There are no changes in the existing conditions for the Economy VC. The existing economic conditions for the Application Corridor expansion and the Facility Siting Area are included in the regional and local conditions presented in Section 11.0 of the Application (Volume 1, Part B).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Economy VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Economy VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Economy VC.</p>
Employment and Labour Force	<p>Application Corridor Expansion and Facility Siting Area: There are no changes in the existing conditions for the Employment and Labour Force VC. The existing economic conditions for the Application Corridor expansion and the Facility Siting Area are included in the regional and local conditions presented in Section 11.0 of the Application (Volume 1, Part B).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Employment and Labour Force VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Employment and Labour Force VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Employment and Labour Force VC.</p>

2.8.2 Economy Effects Assessment

As noted in Table 2.8-1, the proposed Addendum 3 changes do not result in a change in the existing conditions for the Economy VC. The economic conditions as a result of the proposed Addendum 3 changes are comparable to the economic conditions assessed in Section 11.0 of the Application (Volume 1, Part B).

The Mount Mulligan compressor station is situated farther from local businesses that have the potential to be adversely affected by noise, dust, increased traffic and disruption of access during Project construction. However, the Project construction activities for the pipeline are still required in the District of Squamish. Therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Economy VC during the construction,

operations, and decommissioning or abandonment phases of the proposed Project presented in Section 11.0 of the Application (Volume 1, Part B).

As a result, it is concluded that the significance conclusions identified in the Application with respect to the Economy VC remain the same.

2.8.3 Economy Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Economy VC. There is no change in the existing conditions for the Economy VC and no change in the assessment of the proposed Project's contribution to cumulative change in the Economy VC.

2.8.4 Employment and Labour Force Effects Assessment

As noted in Table 2.8-1, the proposed Addendum 3 changes do not result in a change in the existing conditions for the Employment and Labour Force VC. The Facility Siting Area is in the Economy RSA as assessed in Section 11.0 of the Application (Volume 1, Part B). No material change is expected with respect to labour force capacity, requirements sourcing, training, or composition. Therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Employment and Labour Force VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 11.0 of the Application (Volume 1, Part B).

As a result, it is concluded that the significance conclusions identified in the Application with respect to the Employment and Labour Force VC remain the same.

2.8.5 Employment and Labour Force Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Employment and Labour Force VC. There is no change in the existing conditions and no change in the assessment of the proposed Project's contribution to cumulative change in Employment and Labour Force VC.

2.9 Community and Regional Infrastructure and Services Effects Assessment

The assessment of potential adverse effects of the proposed Project on the Community Utilities and Services VC, Transportation Infrastructure VC and Community VC is provided in Sections 12.0 of the Application (Volume 1, Part B). The following subsections describe potential changes to the assessment of the potential adverse effects on the Community Utilities and Services, Transportation Infrastructure and Community VCs that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.9.1 Existing Conditions

Table 2.9-1 provides a summary of changes to existing conditions for Community and Regional Infrastructure and Services VCs associated with the proposed Addendum 3 changes.

TABLE 2.9-1

**CHANGES IN EXISTING CONDITIONS FOR COMMUNITY
 AND TRANSPORTATION INFRASTRUCTURE AND COMMUNITY
 VALUED COMPONENTS RELATED TO THE PROPOSED ADDENDUM 3 CHANGES**

VC	Existing Conditions
Community Utilities and Services	<p>Application Corridor Expansion and Facility Siting Area: There are no changes in the existing conditions for the Community Utilities and Services VC or the Community VC. The change related to the Transportation VC relates to the change of construction traffic patterns from Highway 99 near Squamish to the Mamquam FSR for transporting workers and equipment to the proposed Mount Mulligan compressor station. However, the conditions are comparable to the transportation conditions presented in Section 11.0 of the Application (Volume 1, Part B) for the Transportation Infrastructure VC.</p> <p>The Application Corridor expansion and Facility Siting Area extends the Community and Regional Infrastructure and Services LSA assessed in Section 12.0 of the Application (Figure 2.9-1).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Community Utilities and Services VC, Transportation Infrastructure VC or the Community VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Community Utilities and Services VC, Transportation Infrastructure VC or the Community VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Community Utilities and Services VC, Transportation Infrastructure VC or the Community VC.</p>
Transportation Infrastructure	
Community	

**FIGURE 2.9-1
COMMUNITY AND REGIONAL
INFRASTRUCTURE AND SERVICES
STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

- Kilometre Post
- Proposed NPS 24
FortisBC Pipeline Route
- Proposed NPS 24 and NPS 10
Parallel FortisBC Pipeline Route
- Proposed NPS 10 to Compressor
- Existing NPS 10 FortisBC Pipeline
- Existing NPS 10 Subject to
Removal/Abandonment
- Proposed Application Corridor
- Proposed Compressor Siting Area
- Community and Regional
Infrastructure and Services
Local Study Area
- Community and Regional
Infrastructure and Services
LSA Expansion (Addendum 3)
- Preliminary Mount Mulligan
Compressor Station Footprint
- Road
- Electrical Transmission Line
- Watercourse / Shoreline
- Municipality
- Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)

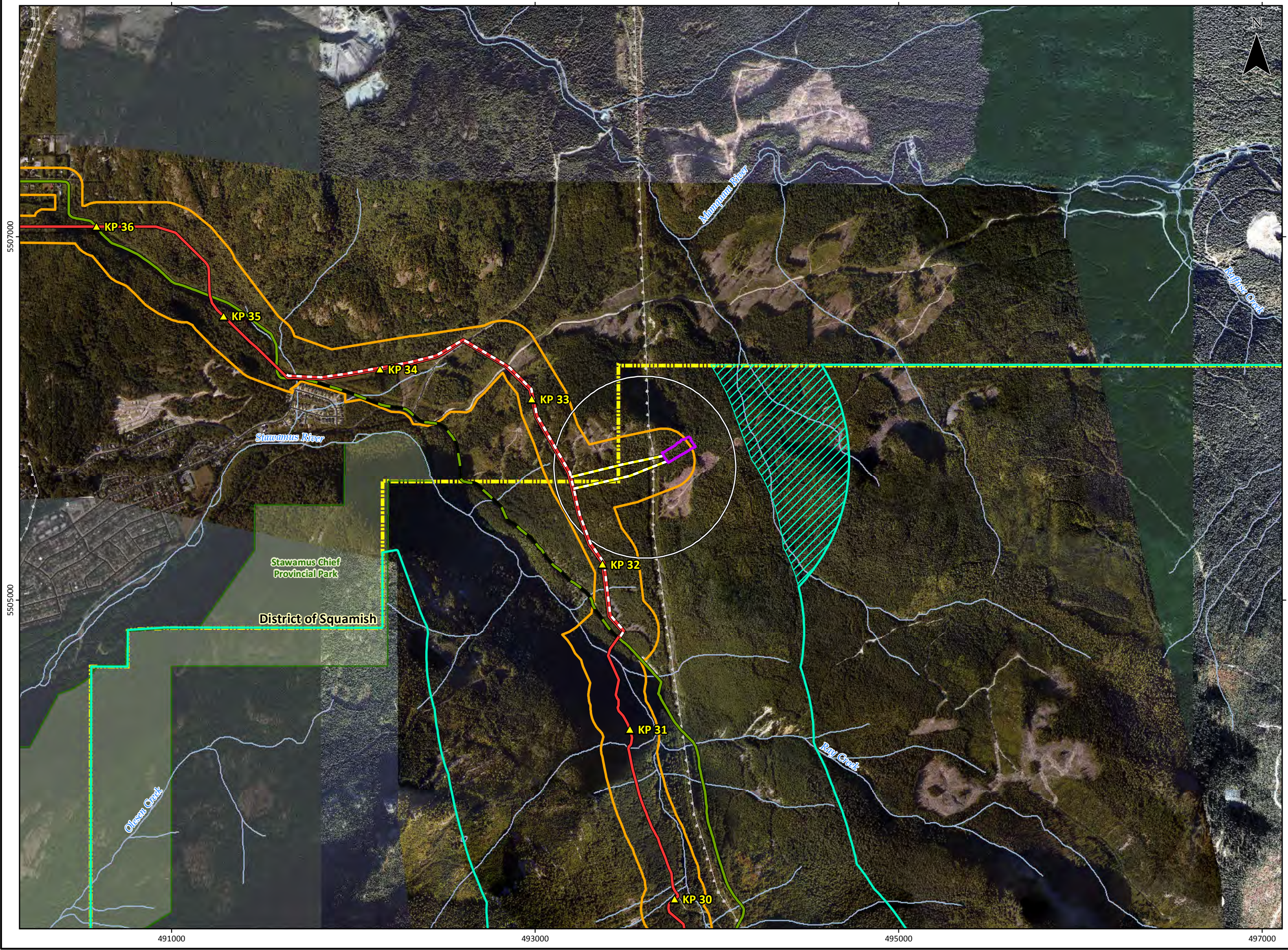


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2.9.2 Community Utilities and Services Effects Assessment

As noted in Table 2.9-1, the proposed Addendum 3 changes do not result in a change in the existing conditions for the Community Utilities and Services VC. The conditions at these locations are comparable to the area assessed in Section 12.0 of the Application (Volume 1, Part B) and, therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Community Utilities and Services VC.

As a result, it is concluded that the significance conclusions identified in the Application with respect to the Community Utilities and Services VC remain the same.

2.9.3 Community Utilities and Services Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of the potential cumulative adverse effect the Community Utilities and Services VC. As a result, it is concluded that the significance conclusions identified in the Application with respect to the Community Utilities and Services VC remain the same.

2.9.4 Transportation Infrastructure Effects Assessment

As noted in Table 2.9-1, there is expected to be a change in the existing conditions for the Transportation Infrastructure VC however, no additional active roads would be crossed and the regional transportation infrastructure is included in the Community and Regional Infrastructure and Services RSA and the conditions are comparable to the transportation infrastructure assessed in Section 12.0 of the Application (Volume 1, Part B). With the implementation of mitigation measures, including the Traffic Control Management Plan in Section 6.8 of the Application (Volume 3, Appendix 3A), the proposed Addendum 3 changes do not result in any material change potential adverse effects, mitigation or residual adverse effects for the Transportation Infrastructure VC during the construction, operations, and decommissioning or abandonment phases of the Project.

As a result, it is concluded that the significance conclusions identified in the Application with respect to the Transportation Infrastructure VC remain the same.

2.9.5 Transportation Infrastructure Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Transportation Infrastructure VC. The change in the existing conditions for the Transportation Infrastructure VC does not change the assessment of since it was determined that there are no changes in the existing conditions or effects assessment the proposed Project's contribution to cumulative effects on the Transportation Infrastructure VC.

2.9.6 Community Effects Assessment

As noted in Table 2.9-1, the proposed Addendum 3 changes do not result in a change in the existing conditions for the Community VC. The compressor station and other changes at Mount Mulligan are located in the Community and Regional Infrastructure and Services RSA as assessed in Section 12.0 of the Application (Volume 1, Part B). Therefore, no material change is expected with respect to the assessment of potential adverse effects, mitigation or residual effects for the Community VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 12.0 of the Application (Volume 1, Part B).

As a result, it is concluded that the potential adverse effects, mitigation and significance conclusions identified in the Application with respect to the Community VC remain the same.

2.9.7 Community Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Community VC. There is no material change in the existing conditions for the Community VC does not change in the assessment of the proposed Project's contribution to cumulative effects on the Community VC.

2.10 Land and Resources

The assessment of potential adverse effects of the proposed Project on the Land and Resources Use VC is provided in Section 13.0 of the Application (Volume 1, Part B). The following subsections describe any potential changes to the assessment of the potential adverse effects on the Land and Resources Use VC that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.10.1 Existing Conditions

Table 2.10-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.10-1

CHANGES IN EXISTING CONDITIONS FOR LAND AND RESOURCES USE VALUED COMPONENT RELATED TO THE PROPOSED ADDENDUM 3 CHANGES

VC	Existing Conditions
Land and Resources Use	<p>Application Corridor expansion and Facility Siting Area: There is expected to be a change in the existing conditions for the Land and Resources Use VC related to the Mount Mulligan compressor station.</p> <p>The Application Corridor expansion and Facility Siting Area for the Mount Mulligan compressor station extends the Land and Resources LSA assessed in Section 13.0 of the Application (Figure 2.10).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Land and Resources Use VC.</p> <p>Port Mellon upgrade removal: There is no change in existing conditions for the Land and Resources Use VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Land and Resources Use VC.</p>

Application Corridor Expansion and Facility Siting Area

The eastern portion of the Facility Siting Area is located on Crown land outside of the District of Squamish municipal boundary, in Electoral Area “D” of the Squamish Lillooet Regional District. The western portion of the Facility Siting area is located within the District of Squamish.

The Application Corridor expansion for the Mount Mulligan compressor station extends the Land and Resources LSA assessed in Section 13.0 of the Application. The Land and Resources RSA remains the same (refer to Figure 2.10-1 for the locations of Land and Resources LSA expansion). Specific changes to existing conditions with respect to key indicators including: human habitation; consistency with land use plans; visual aesthetics; recreational use; recreational hunting, fishing and gathering; commercial recreation and tourism; forestry; mineral and subsurface resources and linear infrastructure are described in Table 2.10-2. These and other key indicators are also described in detail for the Land and Resources Use RSA in Section 13.0 of the Application (Volume 1, Part B).

TABLE 2.10-2

CHANGES IN THE EXISTING CONDITIONS FOR THE LAND AND RESOURCES USE VALUED COMPONENT RELATED TO THE APPLICATION CORRIDOR EXPANSION AND FACILITY SITING AREA

Existing Condition	Variations in the Existing Conditions
Human habitation	<p>The Mount Mulligan Facility Siting Area is located farther from residential areas in the District of Squamish. The nearest residence from the proposed Mount Mulligan compressor station is located in Valleycliffe at a distance of approximately 1,800 m to the west, in contrast to approximately 500 m for the Squamish Industrial Park location assessed in the Application. Construction traffic would use the Mamquam FSR that is adjacent to the Valleycliffe area.</p>

TABLE 2.10-2 Cont'd

Existing Condition	Variations in the Existing Conditions
Consistency with land use plans	<p>Changes to applicable land use plans are as follows.</p> <ul style="list-style-type: none"> • The District of Squamish Official Community Plan (OCP) would apply to the western portion of the Mount Mulligan Facility Siting Area • The eastern portion of the Facility Siting Area is subject to the Squamish Lillooet Regional District Electoral Area "D" OCP. The Application Corridor expansion (<i>i.e.</i>, the NPS 10 supply line to the station) overlaps with areas zoned for Community Watershed Protection and Resource Management in Schedule B of SLRD Electoral Area D OCP Bylaw No. 1135 – 2013. The Community Watershed designation is described in Section 15.4.1 of the Application (Volume 1, Part B). The Resource Management designation is discussed in Section 2.10.2 of this addendum. • The Facility Siting Area is zoned for Resource Use under SLRD Electoral Area D Zoning Bylaw No. 540. Current allowable uses do not include a compressor station. A zoning amendment would be required, which would be addressed during the detailed Project design and permitting phase. • The Facility Siting Area is in an area designated as "Non-settlement" in the SLRD Regional Growth Strategy. The designation allows for some industrial uses. <p>The Facility Siting Area is located in the Squamish District Sustainable Resource Management Plan - Mamquam Landscape Unit area and the East Howe Landscape Unit area. No legal or non-legal OGMAs are crossed by the proposed changes to the Project.</p>
Visual aesthetics	<p>The Facility Siting Area is located at the base of Mount Mulligan, in a backcountry area. Portions of the Facility Siting Area are visible in the distance from the Squamish Chief (3rd peak) and the Sea to Sky Gondola and viewing platforms. The site partially overlaps with recently harvested cutblocks and is adjacent to a BC Hydro transmission line. The potential effects of the proposed Project on visual aesthetics were previously described in Section 13.0 of the Application (Volume 1, Part B). Updated visual modeling of the Mount Mulligan compressor station is provided in Appendix E.</p>
Recreational use Recreational hunting, fishing and gathering Commercial recreation and tourism	<p>The Facility Siting Area is located at the base of Mount Mulligan, east of the District of Squamish. The area is visible in the distance from the Squamish Chief (3rd peak) and the Sea to Sky Gondola and viewing platforms. The site will partially overlap with recently harvested cutblocks and is adjacent to a BC Hydro transmission line. The potential effects of the proposed Project on visual aesthetics were previously described in Section 13.0 of the Application (Volume 1, Part B). Updated visual modeling of the Mount Mulligan compressor station is provided in Appendix E.</p>
Forestry	<p>The Facility Siting Area overlaps with a woodlot (Woodlot Licence #W0028). Clearing and timber harvesting would be required for construction of the compressor station and NPS 10 pipeline expansion (including temporary work space and road upgrades). The timber volume that would be permanently removed from the woodlot area is expected to be below the 5% allowable reduction.</p>
Mineral and subsurface resources	<p>The Facility Siting Area overlaps with a conditional registration mineral reserve held by Westcoast Energy Inc.</p>
Linear infrastructure	<p>The Application Corridor expansion crosses a BC Hydro electrical transmission line located approximately 465 m to the east of KP 32.5.</p>

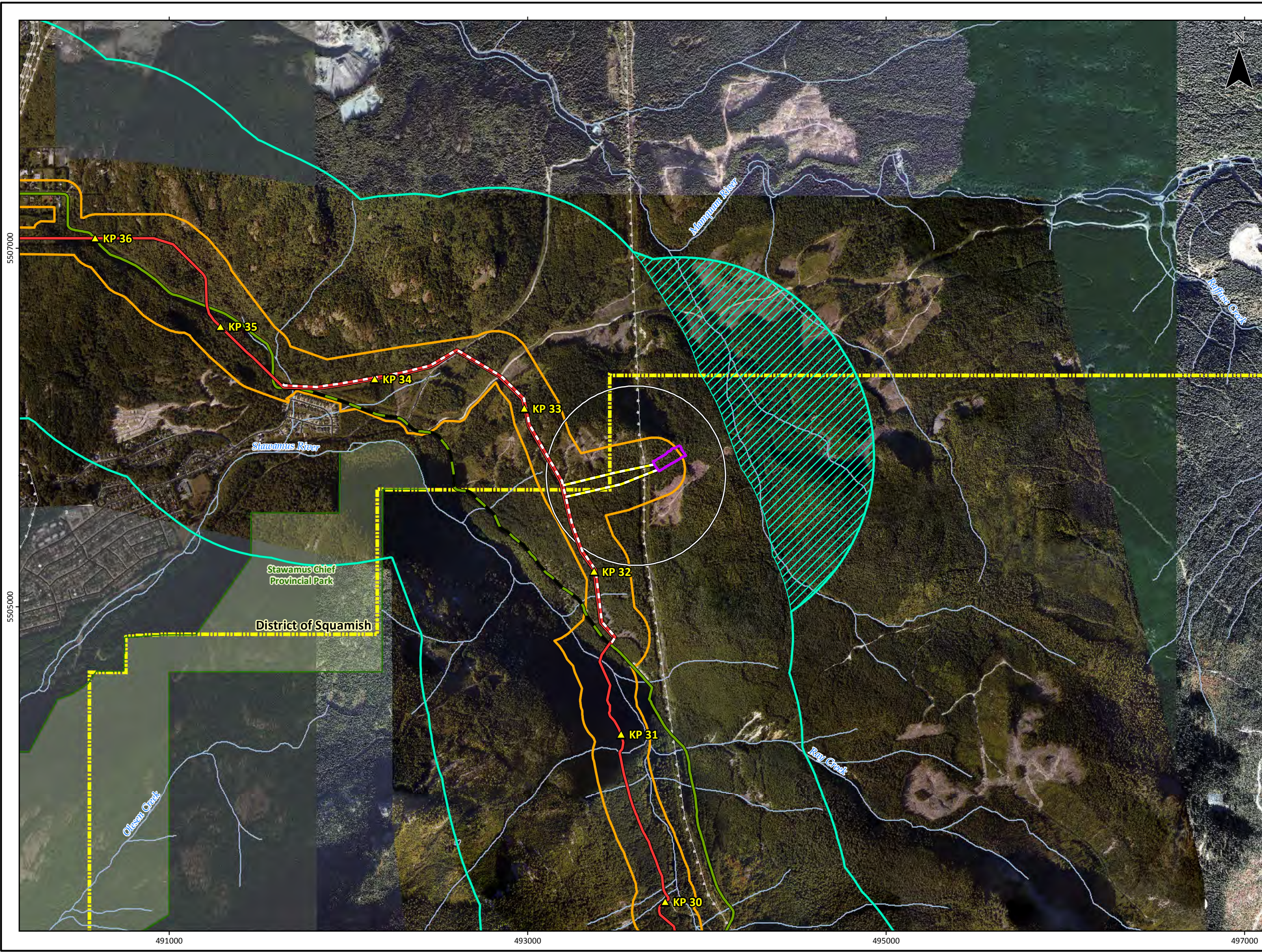


FIGURE 2.10-1
LAND AND RESOURCES
STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3

- Kilometre Post
- Proposed NPS 24 FortisBC Pipeline Route
- Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
- Proposed NPS 10 to Compressor
- Existing NPS 10 FortisBC Pipeline
- Existing NPS 10 Subject to Removal/Abandonment
- Proposed Application Corridor
- Proposed Compressor Siting Area
- Land and Resources Local Study Area
- Land and Resources LSA Expansion (Addendum 3)
- Preliminary Mount Mulligan Compressor Station Footprint
- Road
- Electrical Transmission Line
- Watercourse / Shoreline
- Municipality
- Park/Protected Area

SCALE: 1:20,000
 0 200 400 600 800 metres
 (All Locations Approximate)



CH2M HILL Project Number 492434

NAD 1983. UTM Zone 10 North.
 Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCan 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LiDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

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2.10.2 Land and Resources Use Effects Assessment

The existing conditions in Table 2.10-2 for the proposed Addendum 3 changes differ from those described in the Application since the preliminary Mount Mulligan compressor station site is located outside of the District of Squamish. The preliminary site of the Mount Mulligan compressor station is inconsistent with land use zoning for “Resource Use” under the Electoral Area D Zoning Bylaw. However, there is no material change to the assessment of the potential residual effect “Inconsistency with land use planning objectives”, because any zoning amendments or permitting requirements would be addressed during the detailed planning and permitting phase of the Project.

The existing conditions for visual aesthetics for the proposed Addendum 3 changes differ from those described in the Application. The Facility Siting Area is located in a backcountry area east of the District of Squamish, and is visible in the distance from areas which experience high recreational use, including the Squamish Chief (3rd peak) and the Sea to Sky Gondola and viewing platforms. However, the site is located in a woodlot and will partially overlap with recently harvested cutblocks. The area is also adjacent to a BC Hydro transmission line. The distance from viewing observer viewpoints and the level of previous disturbance contribute to a reduced visual effect. In addition, the area is naturally screened by topography and vegetation. Details of the updated visual modeling of the Mount Mulligan compressor station are provided in Appendix E. The potential effects of the proposed Project on visual aesthetics were previously described in Section 13.0 of the Application (Volume 1, Part B).

The preliminary Mount Mulligan compression station site is within the Land and Resources LSA assessed in the Application. Conditions for the Land and Resource Use VC at the site are generally comparable to the land and resource use existing conditions that informed Section 13.0 of the Application. The potential effects of construction and operation of the pipeline component of the proposed Project in the area have previously been evaluated (Volume 1, Part B); further, the significance evaluations of the identified residual adverse effects have been reviewed with respect to the Addendum 3 changes, and are considered to be robust. Therefore, the proposed Addendum 3 changes do not result in any material change to the potential adverse effects, mitigation or residual adverse effects for the Land and Resources Use VC.

As a result, it is concluded that the potential adverse effects, mitigation and significance conclusions identified in the Application with respect to the Land and Resources Use VC remain the same

2.10.3 Land and Resources Use Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Land and Resources Use VC. The proposed changes are not expected to influence the cumulative effects assessment and consequently the Land and Resources RSA has not been expanded. The change in the existing conditions for the Land and Resources Use VC does not change the assessment of the proposed Project’s contribution to cumulative effects on the Land and Resources Use VC.

2.11 Heritage Effects Assessment

The assessment of potential adverse effects of the proposed Project on the Heritage Resources VC is provided in Section 14.0 of the Application (Volume 1, Part B). The following subsections describe any change to the assessment of potential adverse effects on the Heritage Resources VC that may result from the proposed Addendum 3 changes described in Section 1.1 of this Addendum.

2.11.1 Existing Conditions

Table 2.11-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.11-1

**CHANGES IN EXISTING CONDITIONS FOR HERITAGE RESOURCES
 VALUED COMPONENT RELATED TO THE PROPOSED ADDENDUM 3 CHANGES**

VC	Existing Conditions
Heritage Resources	<p>Application Corridor Expansion and Facility Siting Area: There is no change in the existing conditions for the Heritage Resources VC. During construction, all surface disturbance would occur within the Heritage Resources RSA assessed in the Application. No known archaeological or heritage sites have been identified in the Facility Siting Area or Application Corridor expansion. Field assessment of the Mount Mulligan compressor station and NPS 10" lateral pipeline disturbance area would be conducted prior to construction as part of the Project Archaeological Impact Assessment in compliance with all Permit conditions under the BC <i>Heritage Resources Act</i>. The Application Corridor expansion and Facility Siting Area for the Mount Mulligan compressor station extends the Heritage Resources LSA (<i>i.e.</i>, the Project Footprint) assessed in Section 15.0 of the Application (Figure 2.4-1 for the locations of Heritage LSA expansion).</p> <p>Eagle Mountain Footprint: There is no change in existing conditions for the Heritage Resources VC.</p> <p>Port Mellon Upgrade Removal: There is no change in existing conditions for the Heritage Resources VC.</p> <p>Abandonment of NPS 10: There is no change in existing conditions for the Heritage Resources VC.</p>

2.11.2 Heritage Resources Effects Assessment

As noted in Table 2.11-1, the proposed Addendum 3 changes do result in a change in the existing conditions for the Heritage Resources VC, however, the conditions at these locations are comparable to the area assessed in Section 14.0 of the Application (Volume 1, Part B) and, therefore, the proposed Addendum 3 changes do not result in any material change to the assessment of potential adverse effects, mitigation or residual effects for the Heritage Resources during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 14.0 of the Application (Volume 1, Part B).

As a result, it is concluded that the significance conclusions identified in the Application with respect to the Heritage Resources VC remain the same.

2.11.3 Heritage Resources Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Heritage Resources VC. There is no material change in the existing conditions for the Heritage Resources VC does not change in the assessment of the proposed Project's contribution to cumulative effects on the Heritage Resources VC.

2.12 Health Effects Assessment

The assessment of potential adverse effects of the proposed Project on Human Health and Ecological Health VCs is provided in Section 15.0 (Volume 1, Part B) of the Application. The following subsections described any change to the assessment of potential adverse effects on the Human Health and Ecological Health VCs that may result from the proposed Addendum 3 changes as described in Section 1.1 of this Addendum.

2.12.1 Existing Conditions

Table 2.12-1 provides a summary of changes to existing conditions associated with the proposed Addendum 3 changes.

TABLE 2.12-1

CHANGES IN EXISTING CONDITIONS FOR HEALTH VALUED COMPONENTS RELATED TO THE PROPOSED ADDENDUM 3 CHANGES

VC	Existing Conditions
Human Health	Application Corridor expansion and Facility Siting Area: There is expected to be a change to the existing conditions for the Human Health and Ecological Health VC due to the Mount Mulligan compressor station.
Ecological Health	The Application Corridor expansion and facility siting area for the Mount Mulligan compressor station extends the Health LSA (Figure 2.12-1). The Health LSA considers the extensions as described in the Acoustic LSA (Section 2.2 of this Addendum); the Surface Water LSA and the Groundwater LSA (Section 2.3), and the Land and Resources LSA (Section 2.10).
	Eagle Mountain Footprint: There is no change in existing conditions for the Human Health and Ecological Health VCs.
	Port Mellon upgrade removal: The Health LSA and RSA is reduced as a result of proposed Addendum 3 changes, constituting a removal of the study area around the Port Mellon compressor station. The existing conditions at Port Mellon do not apply to this Addendum.
	Abandonment of NPS 10: There is no change in existing conditions for the Human Health and Ecological Health VCs.

Application Corridor Expansion and Facility Siting Area

The eastern portion of the Facility Siting Area is located on Crown land outside of the District of Squamish municipal boundary, in Electoral Area “D” of the Squamish Lillooet Regional District. The western portion of the Facility Siting area is located within the District of Squamish.

















Specific changes to existing conditions with respect to the key indicators of noise and drinking water quality are described in Table 2.12-2. More detail on existing conditions is provided in the Health RSA in Section 15.0 of the Application (Volume 1, Part B).

TABLE 2.12-2

CHANGES IN THE EXISTING CONDITIONS FOR THE HEALTH VALUED COMPONENTS RELATED TO THE APPLICATION CORRIDOR EXPANSION AND FACILITY SITING AREA

Existing Condition	Variations in the Existing Conditions
Noise	The existing acoustic environment in the East Valleycliffe area (<i>i.e.</i> , nearest receptor site) consists of vehicle traffic (cars and ATVs), the Stawamus River, wildlife/foilage and infrequent aircraft flyovers.
Drinking water quality	The Application corridor expansion overlaps with approximately 9 ha of a designated community watershed (Stawamus River). No registered groundwater wells or points of diversion were identified as overlapping with the Application Corridor expansion and Facility Siting Area.

**FIGURE 2.12-1
HEALTH STUDY AREA
BOUNDARY EXPANSION
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post
-  Proposed NPS 24 FortisBC Pipeline Route
-  Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
-  Proposed NPS 10 to Compressor
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 Subject to Removal/Abandonment
-  Proposed Application Corridor
-  Proposed Compressor Siting Area
-  Health Local Study Area
-  Health LSA Expansion (Addendum 3)
-  Preliminary Mount Mulligan Compressor Station Footprint
-  Road
-  Electrical Transmission Line
-  Watercourse / Shoreline
-  Municipality
-  Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)

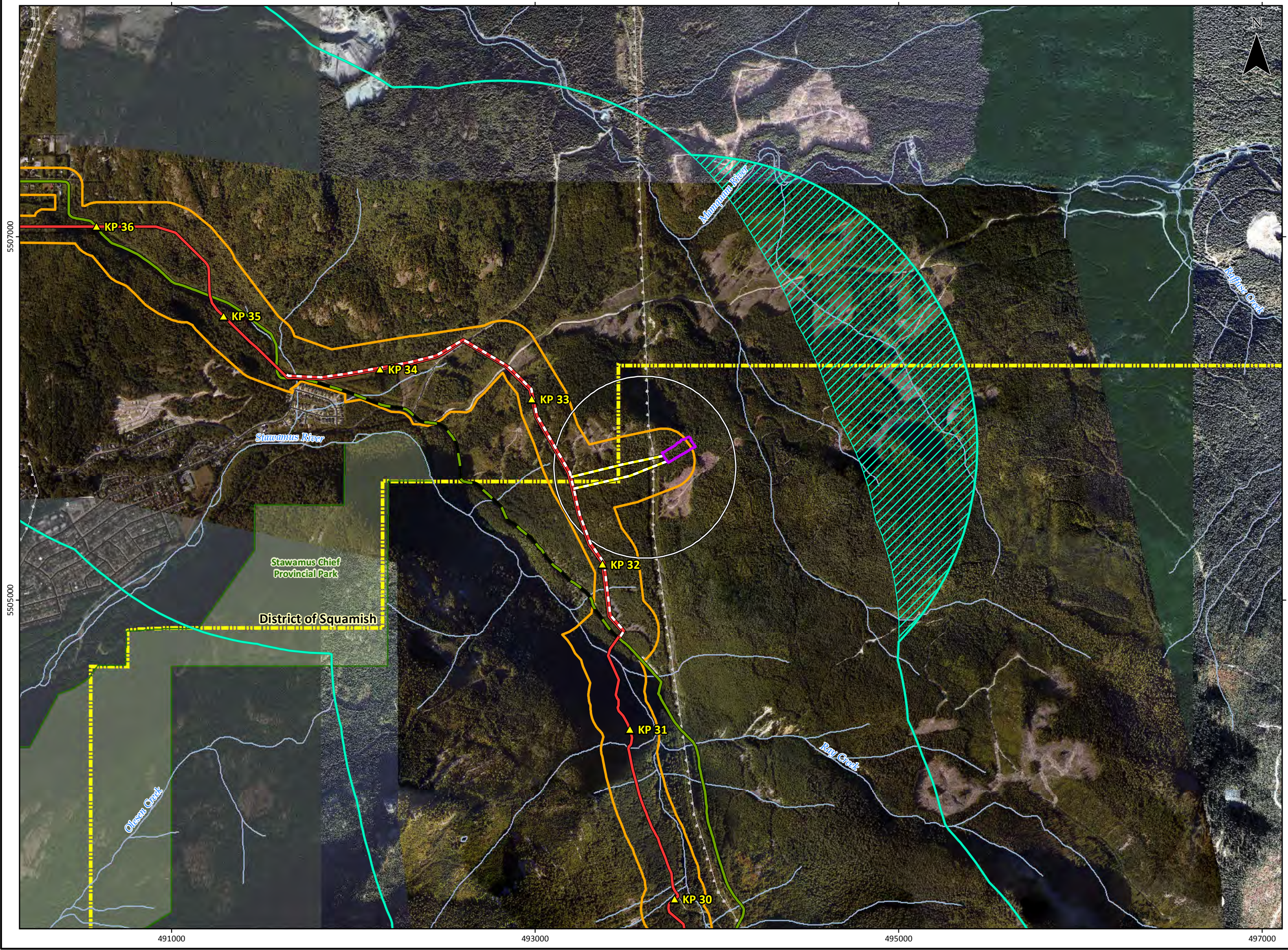


CH2M HILL Project Number 492434

NAD 1983, UTM Zone 10 North.
Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCan 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LiDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

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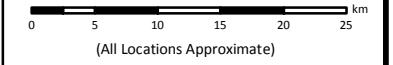
FIGURE 2.12-2

**HEALTH
STUDY AREA BOUNDARY
REDUCTION**

**EAGLE MOUNTAIN-WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

-  Kilometre Post (5 km)
-  Compressor Station
-  Proposed NPS 24
-  FortisBC Pipeline Route
-  Existing NPS 10 FortisBC Pipeline
-  Health Local Study Area (LSA)
-  Health Regional Study Area (RSA)
-  Health RSA Reduction (Addendum 3)
-  Highway
-  Road
-  Railway
-  Watercourse
-  Waterbody
-  Municipality
-  Regional District
-  Park/Protected Area
-  First Nations Reserve

SCALE: 1:600,000



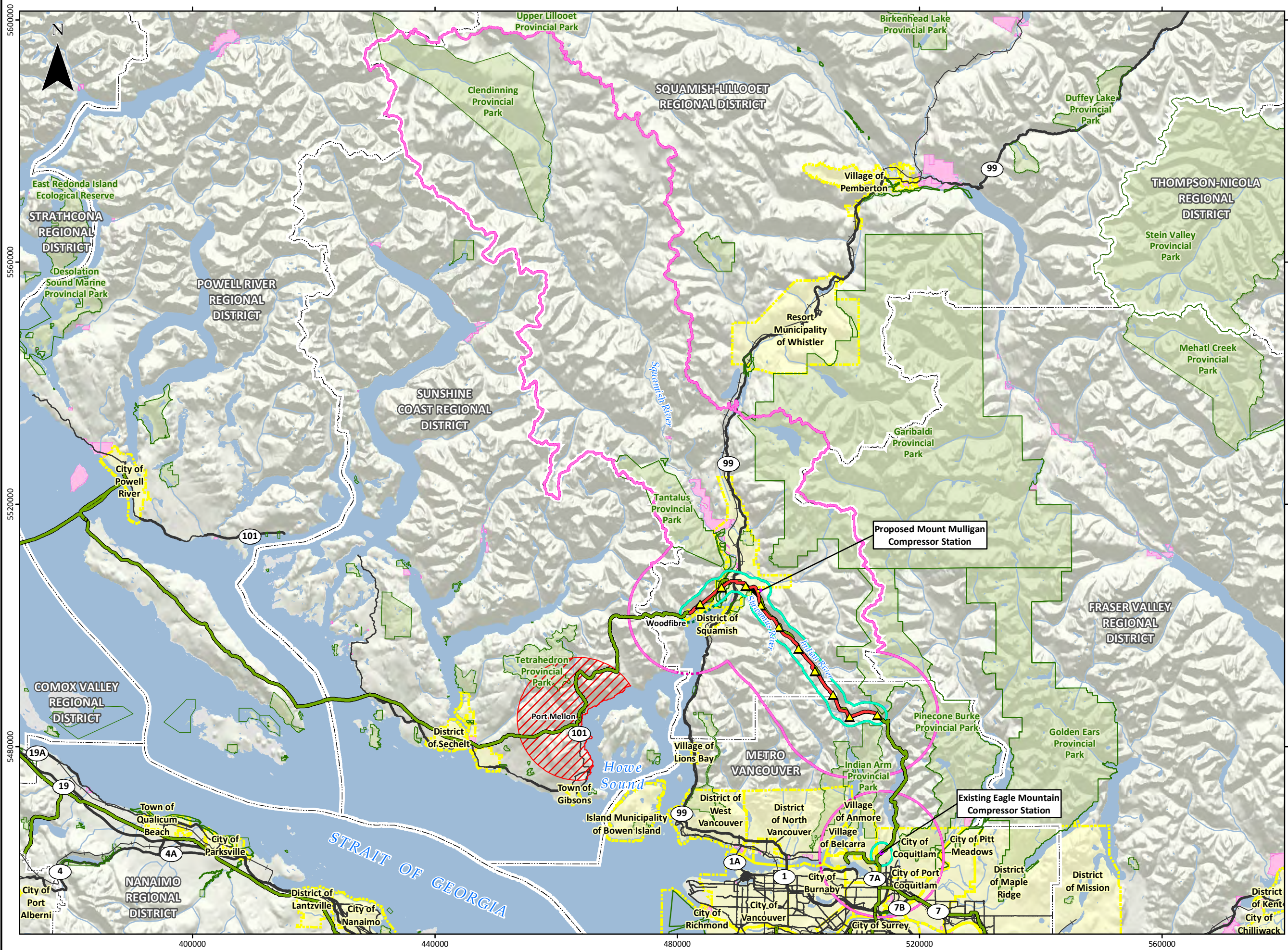
CH2M HILL Project Number 492434

UTM Zone 10 North, NAD 1983.

Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Compressor Stations: UPI 07-23-2014, FortisBC 08-04-2015; Roads: NRCAN 2014; Railways: USNIMA 2000; Hydrography: NRCAN 2009, ESRI 2005, USNIMA 2000 and BC MFLNRO 2008; Municipal Boundaries, Regional Districts: BC MFLNRO 2007; Parks, Wildlife Management Areas: BC MFLNRO 2008; First Nations Reserves: Government of Canada 2015; Hillshade: TERA Environmental Consultants 2008.

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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2.12.2 Human Health Effects Assessment

The Application corridor expansion associated with the Addendum 3 changes overlaps with a designated community watershed: namely, the Stawamus River. The Stawamus River and the Mamquam River to the north are back-up surface water sources to supply the District of Squamish in emergency situations only. The Stawamus River watershed is crossed by the Project Footprint and is considered in the evaluation of the potential adverse effect on drinking water quality (Table 15.5-1, Volume 1, Part B). No residual adverse effects were identified in the Application and none are expected with the proposed Addendum 3 changes.

Noise associated with the Mount Mulligan compressor station is likely to increase during operations due to the installation of gas turbine compressors, which are generally louder than electric compressor units. Electric compression was proposed for the Squamish compressor station site assessed in the Application. However, the results of acoustic modeling for the relocated compressor station found that the components proposed to be installed at the Mount Mulligan compressor station with expected engineering measures are predicted to produce sound levels below the permissible sound level recommended by the BC OGC. The percentage of highly annoyed persons (%HA) at the closest receptor sites (*i.e.*, existing dwellings) did not exceed the Health Canada threshold of 6.5% (refer to Section 2.2.2 of this addendum).

The air quality analysis for the proposed Addendum 3 changes found that air quality concentrations of contaminants generated by the gas turbines and other emission sources at the Mount Mulligan compressor station would be low and fully compliant with the BC Ambient Air Quality Objectives (AAQOs; refer to Section 2.2.4 of this addendum).

With the implementation of measures to reduce noise and air emissions described in the Application (refer to Section 5.1 of Volume 3, Appendix 3A), there is no material change to the potential residual effects of noise or air emissions. As a result, it is concluded that the potential adverse effects, mitigation and determination of significance identified in the Application with respect to the Human Health VC remain the same.

2.12.3 Human Health Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Human Health VC. The change in the existing conditions for the Human Health VC does not change in the assessment of the proposed Project's contribution to cumulative effects on the Human Health VC.

2.12.4 Ecological Health Effects Assessment

As noted in Table 2.12-1, there is expected to be a change to the conditions for the Ecological Health VC, since the siting of the Mount Mulligan compressor station and other Addendum 3 changes may affect hunting, fishing or gathering areas for country foods. Although it is possible that country foods locations are present in or near the facility siting area (*e.g.*, in the Stawamus Creek Síiyamín ta Skwxwú7mesh site, which is in the Health RSA in the Application), the conditions at this location have been assessed with respect to proximity of the proposed pipeline construction and operation in Section 15.0 of the Application (Volume 1, Part B). Therefore, no material change is expected with respect to the potential adverse effects, mitigation or residual adverse effects for the Ecological Health VC during the construction, operations, and decommissioning or abandonment phases of the proposed Project previously assessed in Section 15.0 of the Application (Volume 1, Part B).

As a result, it is concluded that the potential adverse effects, mitigation and significance conclusions identified in the Application with respect to the Ecological Health VC remain the same.

2.12.5 Ecological Health Cumulative Effects Assessment

The proposed Addendum 3 changes do not result in any material change to the assessment of potential cumulative adverse effects on the Ecological Health VC. The change in the existing conditions for the Ecological Health VC does not change in the assessment of the proposed Project's contribution to cumulative effects on the Ecological Health VC.

2.13 Accidents or Malfunctions

The assessment of risks and consequences associated with potential accidents or malfunctions were presented in Section 16.0 of the Application (Volume 1, Part B). The proposed Addendum 3 changes do not result in any additional hazards or risks and do not result in the need for any additional proposed mitigation during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 16.0 of the Application (Volume 1, Part B).

2.14 Effects of the Environment on the Project

The assessment of risks and consequences associated with potential effects of the environment on the proposed Project were presented in Section 17.0 (Volume 1, Part B), of the Application. The proposed Addendum 3 changes do not result in any material change to the risks identified or to the proposed mitigation during the construction, operations, and decommissioning or abandonment phases of the proposed Project presented in Section 17.0 of the Application (Volume 1, Part B). Consequently, it is concluded that the risks and mitigation identified in the Application remain the same.

3.0 ABORIGINAL GROUPS INFORMATION REQUIREMENTS

This section describes the potential adverse effects of the proposed Addendum 3 changes on Aboriginal Interests. As described in Volume 1, Part C, Section 19.0 of the Application, the four Aboriginal groups whose Aboriginal Interests may be affected by the proposed Project are:

- Tsleil-Waututh Nation;
- Squamish Nation;
- Kwikwetlem First Nation; and
- Musqueam Nation.

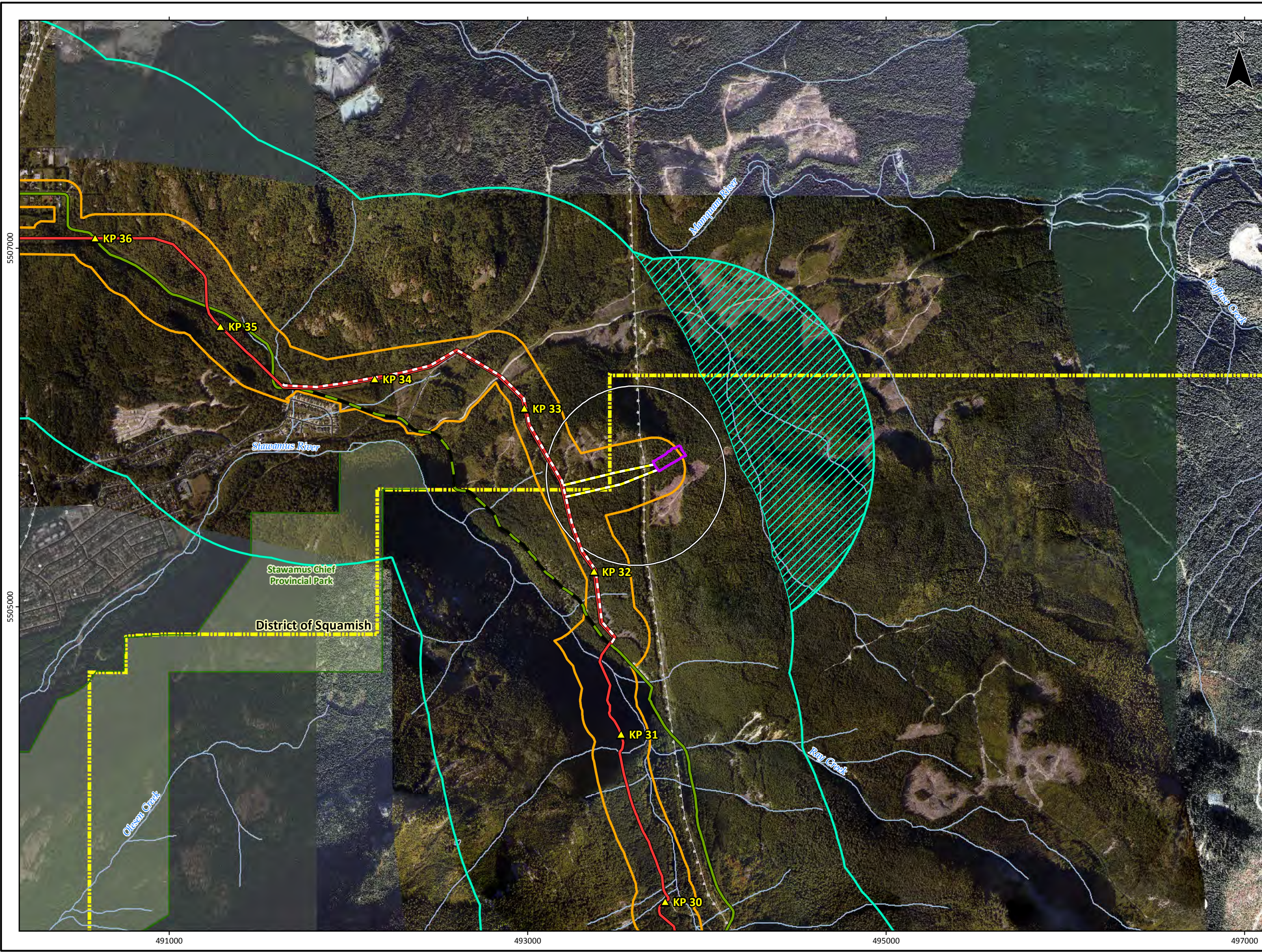
These groups are either directly affected or have expressed a specific interest in the planning, construction or operations of the proposed Project within the areas of the Addendum 3.

Although the Application Information Requirements do not require that Musqueam Nation be included in Part C of the Application, due to the interest they expressed in the proposed Project and its potential adverse effects on watercourses and fishing, an assessment of the adverse effects of the proposed Project on their ability to fish was included in the following sections of Volume 1, Part C of the Application: Section 18.0 Background and Consultation; Section 19.0 Aboriginal Interests; and Section 21.0 Summary of Aboriginal Interests. Accordingly, Musqueam Nation has been included in this Addendum to the Application.

Over the last year, at the request of Squamish Nation, FortisBC and Squamish Nation negotiated FortisBC's involvement in a parallel assessment process led by the Squamish Nation, the Squamish Nation Process. Specifics of the process are confidential, as are discussions and the consultations themselves. It is for this reason that information from the Squamish Nation was not included in this Addendum to the Application.

FortisBC would consult with the four Aboriginal groups about the proposed Addendum 3 changes through the Working Group process and as per the consultation procedures outlined in the Aboriginal Consultation Plan 2 Regarding the Addenda.

As described in Section 19.0 of the Application (Volume 1, Part C), FortisBC has assumed that Aboriginal groups continue to use land and resources within the Aboriginal Interests LSA for subsistence or cultural purposes, which may include use in and around the area of the proposed Addendum 3 changes. The Aboriginal Interests LSA includes the LSA boundaries of the VCs that interact with Aboriginal Interests including: ARD; Acoustic Environment; Air Quality, Surface Water; Fish and Fish Habitat; Vegetation; Wetland; Wildlife and Wildlife Habitat; Transportation Infrastructure; Land and Resources Use; Heritage Resources; and Ecological Health. Refer to the following sections of this Addendum for the details on the LSA changes for the following VCs that in turn change the Aboriginal Interests LSA: ARD (Section 2.1.6); Acoustic Environment (Section 2.2.2); Air Quality (Section 2.2.4); Surface Water (Section 2.3.2); Vegetation (Section 2.5.2); Wetlands (Section 2.6.2); Wildlife and Wildlife Habitat (Section 2.7.2); Transportation Infrastructure (Section 2.9.4); Land and Resources Use (Section 2.10.2); Heritage Resources (Section 2.11.2); and Ecological Health (Section 2.12.4). Figure 3.0-1 illustrates the expansion to the Aboriginal Interests LSA.



**FIGURE 3.0-1
ABORIGINAL INTEREST
STUDY AREA
BOUNDARY EXPANSION**
**EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT
ADDENDUM NO. 3**

- Kilometre Post
- Proposed NPS 24 FortisBC Pipeline Route
- Proposed NPS 24 and NPS 10 Parallel FortisBC Pipeline Route
- Proposed NPS 10 to Compressor
- Existing NPS 10 FortisBC Pipeline
- Existing NPS 10 Subject to Removal/Abandonment
- Proposed Application Corridor
- Proposed Compressor Siting Area
- Aboriginal Interest Local Study Area
- Aboriginal Interest LSA Expansion (Addendum 3)
- Preliminary Mount Mulligan Compressor Station Footprint
- Road
- Electrical Transmission Line
- Watercourse / Shoreline
- Municipality
- Park/Protected Area

SCALE: 1:20,000
0 200 400 600 800 metres
(All Locations Approximate)



CH2M HILL Project Number 492434

NAD 1983. UTM Zone 10 North.
Proposed Pipeline Route, Kilometre Posts: Universal Pegasus International (UPI) 08-21-2014 (Route 1017); Existing Pipeline: FortisBC 2012; Addendum 3 Route: FortisBC 08-05-2015; Pipeline Application Corridor: CH2M 08-06-2015 (Revision 12); LSA and RSA: CH2M 08-06-2015; Compressor Station Site: FortisBC 08-04-2015; Electrical Transmission Line: BC Hydro 09-29-2014; Roads: BC MFLNRO 2012; Watercourses: BC FLNRO 2004; Hydrography Text: NRCan 2007-2011; Municipal Boundaries: BC MFLNRO 2007; Parks, Protected Areas, Wildlife Management Areas: BC MFLNRO 2008; LiDAR Imagery: Atlantic Group 2013; Base Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, 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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The following subsections describe the potential adverse effects of the proposed Addendum 3 changes on Aboriginal Interests. Note that the Musqueam effects assessment focuses on disruption of subsistence fishing activities and alteration of subsistence fishing resources.

3.1 Tsleil-Waututh Nation

The Aboriginal Interests LSA boundary has been expanded to include the Application Corridor expansion and Facility Siting Area for Mount Mulligan compressor station (Figure 3.0-1). The following proposed Addendum 3 changes are located within the boundaries of the Tsleil-Waututh Consultation Area:

- inclusion of a compressor station as associated components at the base of Mount Mulligan near KP 32.5 (now referred to as the Mount Mulligan compressor station and the Facility Siting Area), as a potential alternative for the Squamish compressor station proposed in the Application;
- an Application Corridor expansion to accommodate the Mount Mulligan compressor station and Facility Siting Area, the existing FortisBC pipeline (NPS 10”) pipeline suction and discharge laterals to the Mount Mulligan compressor station; and
- small increase to the footprint of the Eagle Mountain compressor station to accommodate a shift in workspace.

It is not known to FortisBC if all the past and present use areas identified in the Application are in the Aboriginal Interests LSA, or if they are in or near the area of the proposed Addendum 3 changes, however, Tsleil-Waututh Nation has concentrated its discussions with FortisBC around the work avoidance zones. Since the submission of the Application, Tsleil-Waututh Nation has completed a Project-specific Traditional Ecological Knowledge study. This study did not provide additional use sites, or information on the past and present use sites described in the Application.

Although FortisBC has no specific information regarding Tsleil-Waututh Nation’s potential Aboriginal Interests in the area of the proposed Addendum 3 changes, the proposed changes are within the Aboriginal Interests LSA. The assessment of potential adverse effects of the proposed Project on Tsleil-Waututh Nation’s Aboriginal Interests is presented in Section 19.5 of the Application (Volume 1, Part C). Existing conditions and potential adverse effects on Tsleil-Waututh Nation’s Aboriginal Interests of hunting, fishing, trapping, vegetation gathering, use of habitation sites, use of trails and travelways, use of sacred areas and use of gathering places for the proposed Addendum 3 changes are comparable to those presented in Section 19 of the Application (Volume 1, Part C). It is anticipated that the proposed Addendum 3 changes would have no discernable effects on the subsistence or cultural Aboriginal rights and do not change the characterization and assessment of potential adverse effects on Tsleil-Waututh Nation’s Aboriginal Interests presented in the Application.

3.2 Squamish Nation

All of the proposed Addendum 3 changes identified in Section 1.1 of this Addendum, are within the boundaries of the asserted traditional territory of Squamish Nation. The Aboriginal Interests LSA boundary has been expanded to include the Application Corridor expansion and Facility Siting Area for the Mount Mulligan compressor station (Figure 3.0-1). As noted in Section 3.0 of this Addendum, the Squamish Nation Process precludes the inclusion of information regarding the Squamish Nation in this Addendum.

3.3 Kwikwetlem First Nation

The proposed Addendum 3 change of a small increase to the footprint of the Eagle Mountain compressor station to accommodate a shift in workspace, is located within the boundaries of the Kwikwetlem First Nation Area of Interest.

The additional proposed Addendum 3 changes identified in Section 1 are not within the boundaries of the Kwikwetlem First Nation Area of Interest, however, are within the spatial boundaries of the Aboriginal Interests LSA and may be of interest to Kwikwetlem First Nation. The Aboriginal Interests LSA boundary has been expanded to include the Application Corridor expansion and Facility Siting Area for the Mount Mulligan compressor station (Figure 3.0-1).

Although FortisBC has no specific information regarding Kwikwetlem First Nation's potential Aboriginal Interests in the proposed Addendum 3 changes, the proposed changes are within the Aboriginal Interests LSA. The assessment of potential adverse effects of the proposed Project on Kwikwetlem First Nation's Aboriginal Interests is presented in Section 19.7 of the Application (Volume 1, Part C). Existing conditions and potential adverse effects on Kwikwetlem First Nation's Aboriginal Interests for proposed Addendum 3 changes are comparable to those presented in Section 19 of the Application (Volume 1, Part C). Therefore, the proposed Addendum 3 changes do not change the characterization and assessment of potential adverse effects on Kwikwetlem First Nation's Aboriginal Interests presented in the Application.

3.4 Musqueam Nation

The proposed Addendum 3 change of a small increase to the footprint of the Eagle Mountain compressor station to accommodate a shift in workspace, is located within the boundaries of the asserted traditional territory of Musqueam Nation.

The additional proposed Addendum 3 changes identified in Section 1 are not within the boundaries of the asserted traditional territory of Musqueam Nation, however, are within the spatial boundaries of the Aboriginal Interests LSA and proposed Addendum 3 changes may be of interest to Musqueam Nation. The Aboriginal Interests LSA boundary has been expanded to include the Application Corridor expansion and Facility Siting Area of the Mount Mulligan compressor station (Figure 3.0-1).

Although FortisBC has no specific information regarding Musqueam Nation's potential Aboriginal Interests in the area of the proposed Addendum 3 changes, the proposed changes are within the Aboriginal Interests LSA. The assessment of potential adverse effects of the proposed Project on Musqueam Nation's Aboriginal Interests is presented in Section 19.8 of the Application (Volume 1, Part C). Existing conditions and potential adverse effects on Musqueam Nation's Aboriginal interests for the proposed Addendum 3 changes are comparable to those presented in Section 19 of the Application (Volume 1, Part C). Therefore, the proposed Addendum 3 changes station do not change the characterization and assessment of potential adverse effects on Musqueam Nation's Aboriginal Interests presented in the Application.

4.0 PUBLIC CONSULTATION

Input received from the Working Group, District of Squamish and the public has demonstrated that there are concerns regarding the location of the compressor station in Squamish as described in the Application. These concerns include the proximity of the compressor station to residents, businesses and recreational opportunities, visual aesthetics and noise. FortisBC is proposing a new location at the base of Mount Mulligan near approximately KP 32.5. The Mount Mulligan compression station site is located in a Facility Siting Area that includes areas on Crown land well as potential sites within the District of Squamish boundaries.

FortisBC will participate in the BC EAO hosted open house for Addendum 2 and Addendum 3 planned for early October, 2015. FortisBC will brief local municipalities and local media prior to the open house including a mail drop in the Valleycliffe neighbourhood.

This Addendum to the Application regarding the proposed Addendum 3 changes will be made available to the public on the BC EAO website for the proposed Project.

5.0 ENVIRONMENTAL MANAGEMENT PLAN AND FOLLOW-UP PROGRAMS

Volume 1, Part E of the Application provides information on the practices and programs FortisBC has developed to ensure environment management measures and commitments made in the Application are implemented throughout all phases of the proposed Project. A summary of the Environmental Management Plan, FortisBC's Emergency Response Plan and contingency plans was included in Section 23.0 of the Application, while environmental monitoring during construction, post-construction monitoring, and compliance reporting was included in Section 24.0 of the Application. An EMP for the proposed Project was presented in Volume 3, Appendix 3A of the Application. No changes to Volume 1, Part E of the Application are warranted as a result of the proposed Addendum 3 changes.

6.0 CONCLUSIONS

Overall, the potential residual adverse effects identified in the Application have not changed as a result of the proposed Addendum 3 changes. Table 6.0-1 provides information on new potential adverse effects for the Air Quality VC and the Wetland Function VC as presented in Section 2.0 of this Addendum.

TABLE 6.0-1

**SUMMARY OF NEW POTENTIAL ADVERSE EFFECTS,
RESIDUAL ADVERSE EFFECTS AND CONCLUSION**

VC	Potential Adverse Effect	Potential Residual Adverse Effect	Significance Conclusion
Air Quality	CACs during operations due to combustion sources	Elevated concentrations of CACs during operations due to combustion sources	Not significant
Wetland Function	Loss or alteration of wetland hydrological, habitat and biogeochemical function.	Loss or alteration of wetland hydrological, habitat and biogeochemical function due to the Mount Mulligan compressor station.	Not significant

There are no changes to the assessment of potential cumulative effects as a result of the proposed Addendum 3 changes. No significant adverse effects were identified related to the proposed Addendum 3 changes.

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APPENDIX A
GEOTECHNICAL MEMO



Memo

To: Art Kanzaki (FortisBC)

From: Nick Ekman (Amec Foster Wheeler)

cc: Gary Abbott (FortisBC)
Thea Mitchell (CH2M)
Colin Martin (Solaris-MCI)

Date: September 8, 2015

Re. Geotechnical Summary for the Proposed Mount Mulligan Compressor Station

This memo has been prepared to provide information to support Addendum No. 3 (Addendum) to the Environmental Assessment Certificate Application (the Application) that was filed with the British Columbia (BC) Environmental Assessment Office (EAO) for the proposed Eagle Mountain – Woodfibre Gas Pipeline Project (the proposed Project) on January 12, 2015.

FortisBC is applying to include a compressor station at the base of Mount Mulligan near KP 32.5 (now referred to as the Mount Mulligan compressor station) as a potential alternative for the Squamish compressor station proposed in the Application, and the removal of the Port Mellon compressor station upgrades from the Application due to an optimization of the compression design.

This memo provides supplementary background geotechnical and site reconnaissance information specific to Addendum 3 in addition to information previously provided in the Terrain Technical Report (Volume 2, Appendix 1B of the Application), and should be read in conjunction with the Terrain Technical Report. Information is provided on geotechnical aspects and recommendations to mitigate the potential interactions of the Mount Mulligan compressor station on the Terrain Integrity Valued Component (VC) (see Section 2.1 of Addendum 3), as well as terrain on the Mount Mulligan compressor station. Information is also provided as a geotechnical summary in Table 1.

Background:

The proposed Mount Mulligan compressor station is located on the eastern slopes of the Stawamus River valley, approximately 4.5 km upstream of the Hwy 99 bridge crossing of the Stawamus River. A 1 km in diameter siting area (referred to as the Facility Siting Area) has been identified in which the Mount Mulligan compressor station would be located. The Facility Siting Area is located on a slight break in slope overlooking the Stawamus River valley to the west, and

the Mamquam River valley to the north. Elevations at the extents of the Facility Siting Area range from approximately 300 to 660 masl. Access to the preliminary Mount Mulligan compressor station site is available via existing cutblock access and forest service roads to the east and west. An existing BC Hydro 500kV transmission line bisects the proposed Facility Siting Area.

Ground reconnaissance of the Facility Siting Area was conducted on July 17th and August 5th, 2015. The purpose of the ground reconnaissance was to review preliminary siting options, and to identify the Facility Siting Area for the Mount Mulligan compressor station. Figure 1 (as produced by CH2M Hill) below, shows the Facility Siting Area and a preliminary Mount Mulligan compressor station footprint.

The proposed Facility Siting Area is approximately 79 ha in area. It is anticipated that the Mount Mulligan compressor station would require development of approximately 4 ha and would be located somewhere within the Facility Siting Area.

Topography:

Based on site reconnaissance and review of bare earth terrain models, overall slopes below the Facility Siting Area are moderate to moderately steep towards the west, and steep to the north. Above the site to the southeast, the slopes are moderate to moderately steep overall. Within the Facility Siting Area, the terrain is hummocky to ridged and bedrock-controlled, with gentle to flat-lying hollows between ridges. The ridges and knobs on the western portion of the site become very steep with vertical bluffs up to 8 m high. A large bedrock knob protrudes near the center of the Facility Siting Area. Immediately north of the bedrock knob, subvertical cliffs up to about 120 m high descend towards the Mamquam River valley. A northeast-southwest trending hollow occurs through the center of the Facility Siting Area between the bedrock knob and the slopes above the site to the south. The preliminary Mount Mulligan compressor station is located within this hollow.

Surficial Geology:

Terrain mapping previously completed for the Application indicates the majority of the Facility Siting Area is underlain by blankets and mantles of moraine (glacial till) deposits overlying bedrock, with lesser extents of colluvial materials overlying bedrock. Rockfall mass movement processes are also identified along the northern and western boundaries of the Facility Siting Area.

Cemented, angular sand layers, and cobble to boulder-sized granular materials exposed in cutslopes were observed during site reconnaissance along an existing lower cutblock access road immediately northeast of the preliminary Mount Mulligan compressor station. This suggests pockets of glaciofluvial or other meltwater-related sediments identified in terrain mapping at the base of the valley slope to the northeast may extend further west than indicated and underlie the eastern extents of the northeast-southwest trending hollow; however, detailed surficial mapping of the Facility Siting Area was beyond the scope of the reconnaissance.

Bedrock Geology:

Review of bedrock geology mapping completed by Bostock 1963¹ indicates the area is underlain by Cretaceous or earlier Coast Plutonic Rocks consisting of mesocratic and melanocratic rocks: quartz diorite, diorite, granodiorite; minor hornblende gabbro and leucocratic rocks. The upper slopes of the southeastern portion of the Facility Siting Area is identified as Jurassic and Cretaceous Gambier Group rocks consisting of tuff, breccia, agglomerate, andesite, argillite, chert, greywacke, quartzite, conglomerate; minor schist, granulite, lime-silicate rock, and scarn.

Previous screening assessments indicate the Gambier Group rocks are associated with increased Metal Leaching and Acid Rock Drainage (ML/ARD) potential. While the Gambier Group rocks are mapped over a small percentage within the Facility Siting Area, the location of contacts between rocks units are anticipated to vary given the scale of the mapping, such that Gambier Group rocks may occur more frequently and over a larger area within the Facility Siting Area. Localized

¹ Bostock, H H. Geology, Squamish, Vancouver, West Half, British Columbia. Scale 1: 253,440. Geological Survey of Canada, Preliminary Map 42-1963, 1963.

weathering and oxidation of sulphides (pyrite and sphalerite), was observed within existing rock cuts along the switchback access road downslope and to the west of the Facility Siting Area.

Discussion:

Based on a review of existing background information from bare earth topography, terrain and hazard mapping, geology mapping and results of the overview site reconnaissance, the general Facility Siting Area as shown on Figure 1 appears feasible for siting of the preliminary Mount Mulligan compressor station at a concept level from a geotechnical perspective. Additional detail regarding potential interactions between the proposed Project on terrain, and the terrain on the proposed Project are included in Table 1.

Further geotechnical evaluation will be required as part of the ongoing site selection and engineering design of the Mount Mulligan compressor station layout and components. The scope of further geotechnical evaluation is anticipated to include, but not be limited to:

- field mapping of surficial and bedrock geology;
- detailed site specific hazard assessment (seismic, terrain hazards);
- subsurface characterization (geophysical survey, drilling investigation); and
- additional geotechnical engineering design (provision of cut and fill slope angles, site grading, drainage and material requirements, machine foundation, blasting and rock cut design recommendations as required).

CLOSURE

Recommendations presented herein are based on a geotechnical evaluation of available information as outlined above. If conditions other than those reported are noted during subsequent phases of the proposed Project, Amec Foster Wheeler should be notified and be given the opportunity to review and revise the current recommendations, if necessary. Recommendations presented herein may not be valid if an adequate level of review or inspection is not provided during construction.

This memo has been prepared for the exclusive use of FortisBC for specific application to the area within this memo. Any use of which a third party makes of this memo, or any reliance on or decisions made based on it, are the responsibility of such third parties. Amec Foster Wheeler accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this memo. It has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

Respectfully submitted,

**Amec Foster Wheeler Environment & Infrastructure,
a Division of Amec Foster Wheeler Americas Limited**

Reviewed by:

Original paper copies signed and sealed by
Nick Ekman, M.Eng., P.Eng.

Original paper copies signed by
Dan Hughes-Games, P.Eng.

Nick Ekman, M.Eng., P.Eng.
Senior Geotechnical Engineer

Dan Hughes-Games, P.Eng.
Senior Geotechnical Engineer

List of Attachments: Table 1 Geotechnical Summary for the Proposed Mount Mulligan
Compressor Station Facility

Notes:

1. This table provides geotechnical mitigation measures to mitigate the potential interactions of the Mount Mulligan compressor station on the Terrain Integrity Valued Component (VC) as well as the terrain on the proposed changes.
2. The methodology and other important information is provided in the Terrain Technical Report (see Volume 2, Appendix 1B of the Application). This report is to be read in conjunction with the Terrain Technical Report.
3. The Kilometre Post (KP) stations are based on the Route 1013 pipeline alignment, and are approximate only.
4. This table is not intended for construction. The general configuration including dimensions provided by CH2M is preliminary, subject to further feasibility study and site investigation.
5. All parameters including depths and types of bedrock, soil conditions and inferred conditions shown in the table are interpreted and may vary from actual conditions.
6. Not all geohazard conditions are discussed in this table. The geohazard polygons and notes in Appendix C of the Terrain Technical Report (see Volume 2, Appendix 1B of the Application) should be referenced in conjunction with this table to identify areas where various mitigation measures may be required and to identify the conditions and reasons for those measures.
7. Mitigation measures presented in this table are based primarily on application of general and specific Best Management Practices (BMPs), which are outlined in Table A1 in Appendix A1 of the Terrain Technical Report. Where applicable, additional considerations and measures may be noted. The mitigations are preliminary and are subject to revision as additional information becomes available.
8. FortisBC commits, if the proposed Project does proceed to construction, that all BMPs and engineering recommendations will be implemented as appropriate.

KP Station	Terrain Description	Geotechnical Comments	Potential Interactions and Mitigations
Approx. 32.5	<p>Mount Mulligan Compressor Station</p> <ul style="list-style-type: none"> The Facility Siting Area is located on a hillslope overlooking the Stawamus and Mamquam river valleys. The preliminary Mount Mulligan compressor station is located on a gentle to flat-lying hollow between bedrock-controlled slopes. Moderate to moderately steep slopes descend to the west, and ascend to the southeast, with steep, subvertical slopes to the north. The bedrock-controlled western portions of the Facility Siting Area are hummocky to ridged, with bluffs up to 8 m high. Subvertical bedrock cliffs up to 120 m high occur immediately north of a bedrock knob in the central portion of the facility siting area. <p>Surficial Geology</p> <ul style="list-style-type: none"> Surficial soils consist primarily of blankets and mantles of glacial till overlying bedrock, with lesser extents of colluvial materials overlying bedrock. Glaciofluvial or other meltwater-related granular materials were observed in soil cuts northeast of the preliminary Mount Mulligan compressor station along an existing cutblock access road. Alluvium in the form of fluvial and debris flow deposits were observed at small watercourse crossing approximately 175 m east of the Facility Siting Area. <p>Bedrock Geology</p> <ul style="list-style-type: none"> Coast Plutonic Rocks consisting of mesocratic and melanocratic rocks: quartz diorite, diorite, granodiorite; minor hornblende gabbro and leucocratic rocks, and Jurassic and Cretaceous Gambier Group rocks consisting of tuff, breccia, agglomerate, andesite, argillite, chert, greywacke, quartzite, conglomerate; minor schist, granulite, lime-silicate rock, and scarn. (Bostock, 1963). 	<ul style="list-style-type: none"> The Mount Mulligan compressor station may require rock excavation and/or blasting depending on final location. Cut slope design will need to accommodate variability in rock strength and structure. Redirection or improper surface drainage control within the Facility Siting Area and downslope could potentially cause terrain instability. Intersection with Gambier Group rocks may increase potential for adverse ARD. Localized weathering and oxidation of sulphides (pyrite and sphalerite), was observed within existing rock cuts along the switchback access road downslope and to the west of the Facility Siting Area. Groundwater seepage through granular materials overlying shallow hummocky bedrock may be encountered within excavations. <p>Slide area at KP 32.8 (SM 0586) has resulted in partial loss of the right-of-way grade on the existing FortisBC pipeline.</p>	<p>Potential Interactions of the Mount Mulligan Compressor Station on Terrain:</p> <ul style="list-style-type: none"> Grading and blasting of rock cuts could decrease local stability. Alteration of natural drainage patterns could cause instability and increase potential for sediment delivery to streams or downslope access roads. Increased soil exposure could increase surface sediment generation. Exposure/disturbance of bedrock containing sulphide mineralization may increase potential for adverse ARD. <p>Potential Interactions of the Terrain on the Mount Mulligan Compressor Station:</p> <p>SM 0586</p> <ul style="list-style-type: none"> Slope movement or retrogression of the slide area could impact adjacent compressor station infrastructure. <p>RF 0332 and Subvertical cliffs</p> <ul style="list-style-type: none"> Rockfall shadow is within proposed Facility Siting Area. Rockfall could impact downslope compressor station infrastructure. Retrogression of the cliff face toward the centre of Facility Siting Area could impact surrounding compressor station infrastructure. <p>Mitigation:</p> <p>All General BMPs plus BMPs for:</p> <ul style="list-style-type: none"> Controlled blasting Shallow to moderately deep seated slides Rockfall Acid Rock Drainage <p>Special Considerations:</p> <ul style="list-style-type: none"> Adequate setback of Mount Mulligan compressor station from potentially unstable slopes, rockfall areas and cliff faces in the northern portion of the Facility Siting Area will be required. Further geotechnical assessment will be required as part of the final site selection and engineering design of the Mount Mulligan compressor station location and components.

Bostock, H. H., 1963. Geology, Squamish, Vancouver, West Half, British Columbia. Scale 1: 253,440. Geological Survey of Canada, Preliminary Map 42-1963.

APPENDIX B
ACOUSTIC ENVIRONMENT MEMO

Acoustic Environment

PREPARED FOR: Art Kanzaki (FortisBC Energy Inc.)
PREPARED BY: John Lindner, M.Sc. (SNC-Lavalin)
DATE: August 21, 2015
PROJECT NUMBER: 492434
APPROVED BY: Claude Chamberland, Eng. (SNC-Lavalin)

This memo has been prepared to provide the information to support Addendum 3 (the Addendum) to the Environmental Assessment Certificate Application (the Application) that was filed with the British Columbia (BC) Environmental Assessment Office (EAO) for the proposed Eagle Mountain – Woodfibre Gas Pipeline Project (the proposed Project) filed on January 12, 2015. Specifically, the memo describes an acoustics assessment for the proposed Mount Mulligan compressor station.

1.0 Introduction and background

FortisBC is applying to include a compressor station at the base of Mount Mulligan near KP 32.5 (now referred to as the Mount Mulligan compressor station) as a potential alternative for the Squamish compressor station proposed in the Application. Section 1.1 of the Addendum provides information on the changes to the Project description including the Mount Mulligan compressor station.

1.2 Mount Mulligan compressor station construction

The design of the Mount Mulligan compressor station includes the installation of three 4,700 HP gas turbine driven units. It differs from the Squamish compressor station design described in Section 1.0 in the Application (Volume 1, Part A) which included the installation of two 16,600 HP electric motor driven units. The Mount Mulligan compressor station design will require one gas turbine unit to operate for three months of the year, two gas turbine units to operate for seven months of the year and all three units to operate for up to two months of the year to accommodate seasonal loads on the existing FortisBC pipeline system. Therefore, it is expected over the course of the year at least one compressor unit will be operating 98% of the year (98% station run-time).

The Mount Mulligan compressor station design will incorporate numerous autonomous safety monitoring devices that will automatically shut-down the station and isolate itself from the pipeline in abnormal conditions. The Mount Mulligan compressor station will also be equipped with discharge gas cooling and other auxiliary equipment, including high pressure yard piping, isolation valves, control and gas systems, storage facilities and offices.

1.3 Objectives

The objectives of this study are to:

- characterize the existing Acoustic Environment within the Acoustic Environment local study area (LSA) and Acoustic Environment regional study area (RSA) around the proposed Mount Mulligan compressor station;
- describe the noise related to the proposed Mount Mulligan compressor station operations;
- model the distribution and levels of noise emanating from the proposed Mount Mulligan compressor station operations; and

- compare the proposed Mount Mulligan compressor station sound level contributions with existing sources, background sound levels and regulatory standards and objectives.

Construction noise from the proposed Mount Mulligan compressor station is comparable to the proposed Squamish compressor station construction noise evaluated in Section 5.2.1 of Rev 1 of the Acoustic Environmental Technical Data Report (TDR-1) prepared by SNC-Lavalin Inc. (SNC-Lavalin) contained in the Application (Volume 2) and is not repeated in this report.

The results of this study do not identify residual environmental or socio-economic effects nor provide conclusions regarding significance. Section 5.0 of the Application (Volume 1, Part B) provides potential effects, mitigation and significance conclusions.

1.4 Regulatory Standards and Objectives

The regulatory standards and objectives followed in this study are the same as in Section 1.3 of TDR-1; a summary is provided below.

1.4.1 BC Oil and Gas Commission Noise Control Best Practices Guideline

The BC Oil and Gas Commission (OGC) sets Permissible Sound Levels (PSLs) for activities under its jurisdiction. The 2009 BC OGC Noise Control Best Practices Guideline (Guideline) sets PSLs during operation, but does not set limits for temporary or construction noise. In addition to calculating the PSL, operators are required to identify all facility noise sources and their sound pressure levels; and, to estimate the noise levels received at the nearest or most likely affected dwelling using a noise model. Noise levels at dwellings are compared with the calculated PSL to determine compliance with the PSL. All assumptions and methodology used in the modelling of noise and PSL estimates must also be presented in the noise impact assessment.

The minimum PSL in the Guideline is 40 dBA Leq; dBA is decibels measured using the A sound filter that measures mid-frequencies most effectively similar to the human ear, and Leq is the equivalent steady sound level of noise averaged over time. The PSL may be adjusted for proximity to transportation noise sources and higher population density following specific procedures in the Guideline.

1.4.2 Health Canada Useful Information for Environment Assessments

Although not a regulation, Health Canada's 2010 *Useful Information for Environmental Assessments* provides guidance for conducting environmental assessments. Health Canada does not have any enforceable noise guidelines or thresholds, so it draws on various internationally recognised acoustic standards in reference to noise assessments and makes a series of recommendations (listed in Section 1.3.1.1 of TDR-1). As it relates to this study, for event durations of greater than one year, such as operational noise, where predicted noise levels are in the range of 45 dB to 75 dB, Health Canada advises the evaluation of health impact endpoints based on the percentage of those likely to become highly annoyed. Health Canada proposes mitigation when that percentage changes by more than 6.5% or when the combination of baseline and predicted noise levels exceed 75 dB.

1.4.3 District of Squamish Noise Regulation Bylaw No. 2312 (2014)

The District of Squamish Noise Regulation Bylaw No. 2312 (2014) makes it an offence for construction noise to be made from construction activity during the following hours:

- before 0700 or after 2100 on any day other than Saturday, Sunday or a statutory holiday; or;
- before 0800 or after 1900 on Saturdays, Sundays or statutory holidays.

1.5 Spatial Boundaries for Acoustic Environment

The spatial boundaries for this study were calculated following the same methodologies as in TDR-1:

- The local study area (LSA) is an area extending 1.5 km from the Project Footprint in each direction. This distance is the maximum potential extent from a facility fence line where permissible sound levels must be met, according to the BC OGC Guideline.
- The Acoustic Environment regional study area (RSA) is an area extending 5 km from the proposed Project Footprint in each direction, and included any other residences that may be affected. This area was set to account for potential adverse cumulative effects occurring due to the existence of other developments and activities.

2.0 Methods

2.1 Sensitive receptors

Sensitive noise receptors are locations where humans live and can include residential homes, seniors' homes, hospitals, daycares and hotels. The identification of sensitive noise receptors was conducted using geographic information for land use, zoning and building locations, as well as satellite imagery. Sensitive receptor locations were confirmed during the field monitoring program. The sensitive receptors around Mount Mulligan compressor station are shown in Figure 2.1-1. The majority of the sensitive receptors are residences; Table 2.1-1 describes the nearest receptor to the proposed Mount Mulligan compressor station.

Table 2.1-1. Nearest sensitive receptors to the proposed Mount Mulligan compressor station .

Facility	Distance to nearest sensitive receptor (m)	Approximate number of sensitive receptors in local study area	Classification of nearest receptors	Comments
Mount Mulligan	1740	0	Single family residences in urban subdivision	Sensitive receptors are located west of the proposed compressor station

2.2 Determination of permissible sound level

The permissible sound level (PSL) was set for the proposed Mount Mulligan compressor station following the BC OGC Guideline (see Section 1.4.1). As shown in Table 2.1-1, the nearest sensitive receptor is more than 1.5 km from the facility fence line so the night time (2200 – 0700) PSL for the proposed Mount Mulligan compressor station is 40 dBA Leq at a distance of 1.5 km.

MEMORANDUM

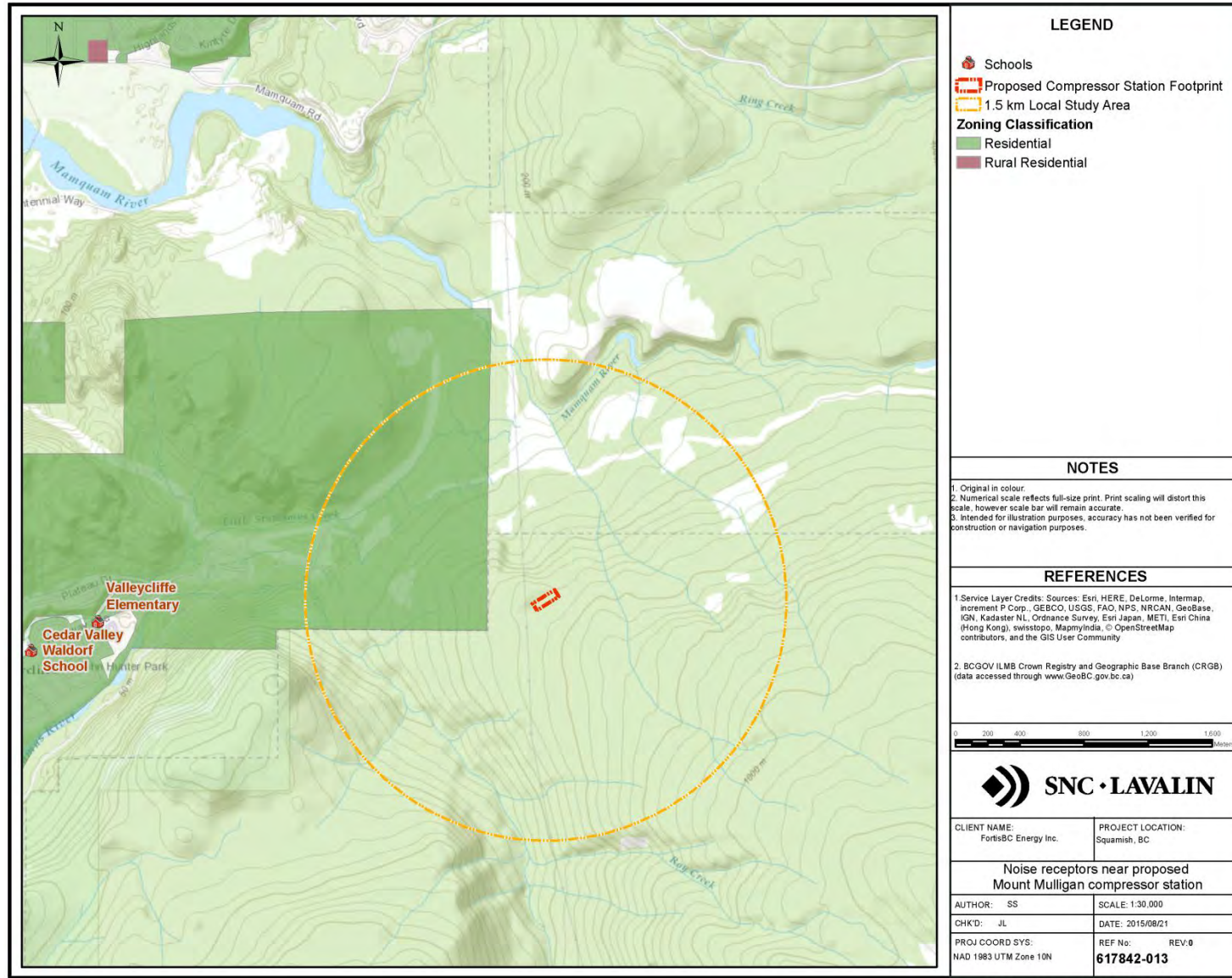


Figure 2.1-1. Location of sensitive receptors around the proposed Mount Mulligan compressor station.

2.3 Sound level monitoring

Monitoring of sound level parameters at three locations (Sites 13 to 15) was conducted in July 2015, near the proposed Mount Mulligan compressor station. The monitoring equipment used for the monitoring program is summarized in Table 2.3-1.

Table 2.3-1. Noise monitoring equipment used during field program

Facility	Sound level meter (SLM)	Averaging period	Monitoring period	Audio recordings
Mount Mulligan	2 Larson & Davis LxT1L SLMs	5 secs	24 hours at long-term sites, 5 mins at short-term sites	All stored on Roland R-05

The continuous audio data stored on the Roland R-05 recorders provided a time-stamped audible record of the noise events during the SLM measurements. The shorter readings with the LxT1L were sufficient to characterize the Acoustic Environment because there were a limited number of noise sources so the background levels were stable. The SLMs were field calibrated with a Larson & Davis CAL200 calibrator at the beginning and end of each set of measurements; calibrations were accurate to within +/- 0.5 dBA. SLMs are also calibrated by an independent laboratory every 12 months. The microphone of the SLM was mounted on a tripod approximately 1.5 m above the ground, the average height of a person.

The monitoring locations were selected with the following considerations (where possible):

- near to dwellings and/or sensitive receptors;
- at least 3 m from sound reflecting objects such as walls, fences, etc.;
- away from air conditioning units, heat pumps, water features, etc; and
- towards the proposed compressor station.

The monitoring dates were selected to ensure suitable meteorological conditions:

- wind speed did not exceed 20 km/h;
- lack of precipitation and dry roads; and
- temperature above -10 degrees C.

Appendix A summarizes the weather conditions in Squamish during the measurements, based on a nearby Environment Canada monitoring station. The conditions were suitable for noise monitoring.

Table 2.3-2 lists the noise monitoring locations and the specific sampling dates. Selected photographs of the monitoring sites are included in Appendix B. A map of the monitoring sites is shown in Figure 2.3-1.

Table 2.3-2. Noise monitoring locations.

Facility	Monitoring site*	Monitoring date	UTM Easting**	UTM Northing**	Distance to compressor (m)	Description
Mount Mulligan	13	July 28, 2015 (all day)	492007	5506144	1810	Gravel access road northeast of residences along Cherry Drive
	14	July 28, 2015 (all day)	491908	5505957	1740	Path at south end of Cherry Drive, south of residences along road
	15	July 29, 2015 (14:40 – 14:45)	492900	5505932	840	Aboriginal cultural site nearest to compressor station; included at request of Squamish First Nation

* Sites 1 – 12 were identified in TDR-1.

** WGS84 Datum, Zone 10.

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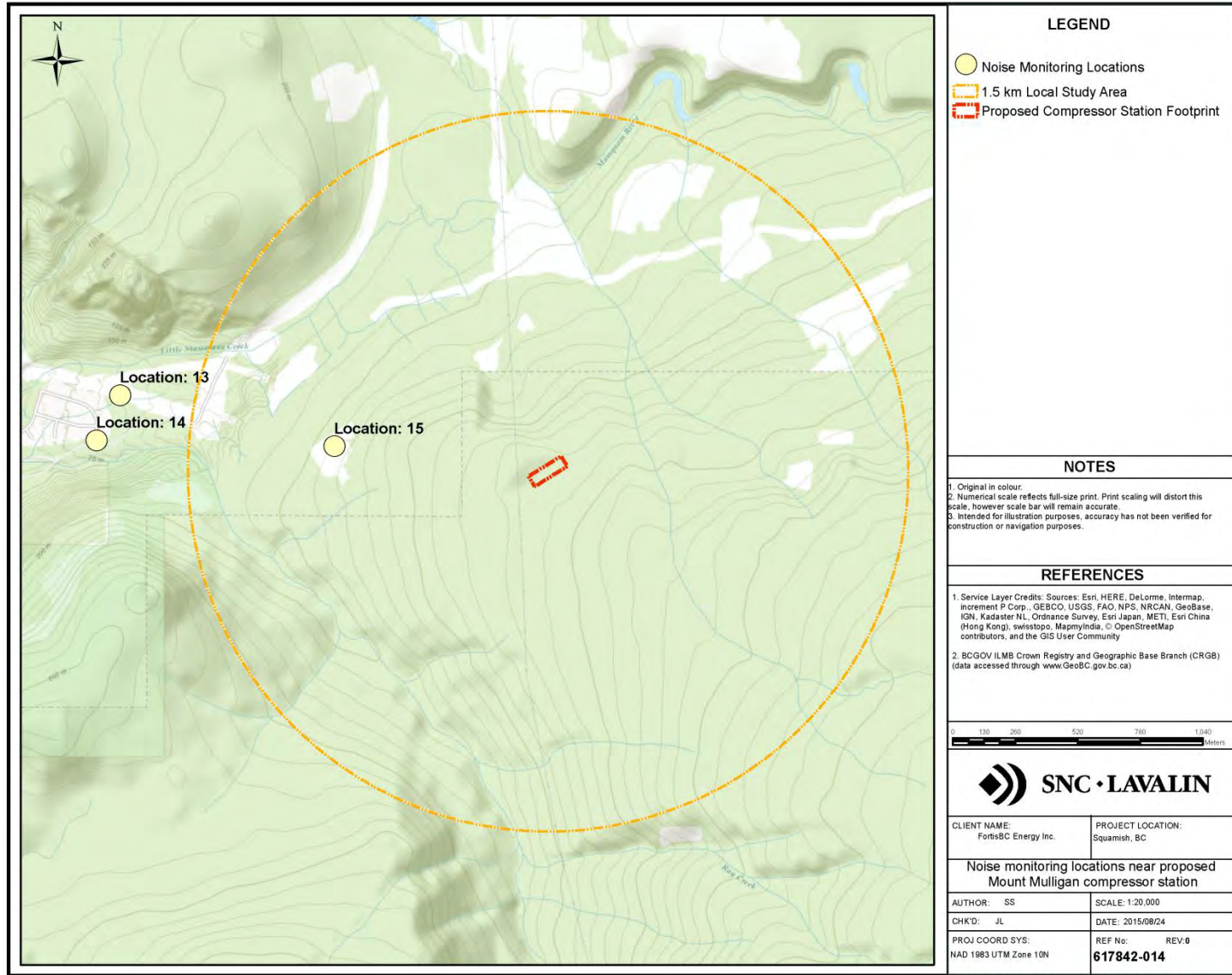


Figure 2.3-1. Noise monitoring locations near proposed Mount Mulligan compressor station.

2.4 Acoustic modelling

Acoustic modelling assessed whether the operational phase of the proposed Mount Mulligan compressor station is likely to cause an exceedence of the PSL at 1.5 km from the property fence line.

Some noise generating equipment, such as gas turbine drive compressors, will be located inside insulated buildings. The major outdoor sources of noise from facility operations are the gas cooler fans, gas turbine combustion air intake and exhaust, electric generator exhaust and cooler fans, exposed sections of pipe, and ventilation fans. The locations of the major sources of noise at the proposed Mount Mulligan compressor station are shown in Figure 2.4-1.

The noise levels of the major noise sources are shown in Table 2.4-1. They were derived from sound power level profiles provided by FortisBC, engineering estimates based on the characteristics of the noise source (type, power, flow, etc.) and from SNC-Lavalin’s in-house database for similar equipment.

Table 2.4-1. Sound power levels of proposed compressor station equipment.

Facility	Area	Equipment description	Quantity	Sound emission level (dBA)*
Mount Mulligan	Inside	Compressors kid (turbine driven), unenclosed	3	Lw: 124 dBA, manufacturer data
		Electrical generator, unenclosed	1	Lw: 115 dBA, estimated from manufacturer sound level
	Outside	Gas after coolers	3	Lw: 105 dBA, estimated from capacity rating
		Turbine lube oil coolers	3	Lw: 100 dBA, estimated from capacity rating
		Turbine exhaust with silencer	3	Lw: 112 dBA, manufacturer data
		Piping, insulated (1.5" wool & aluminum cladding)	3	Lw: 81 dBA, estimated from manufacturer sound level
		Electrical generator exhaust, with silencer	1	Lw: 103 dBA, estimated from manufacturer sound level
		Electrical generator cooler	1	Lw: 97 dBA, estimated from capacity rating
		Building ventilation fans	10	Lw: 95 dBA, estimated from similar equipment

Note: Lw corresponds to sound pressure level (*i.e.*, the intrinsic sound level of a source).

The acoustics model was developed with the following assumptions:

- compressor stations operate continuously, 24 hours per day, and 7 days a week;
- all equipment operates under normal conditions;
- standby or spare equipment is not operating;
- doors and windows of enclosures and buildings at proposed compressor station are closed; and
- emergency situations and process upsets are excluded from normal operation.

The operating conditions considered in the modelling are representative of the normal continuous operation of the compressor station. It is applicable to the day time and night time operation of the facility.

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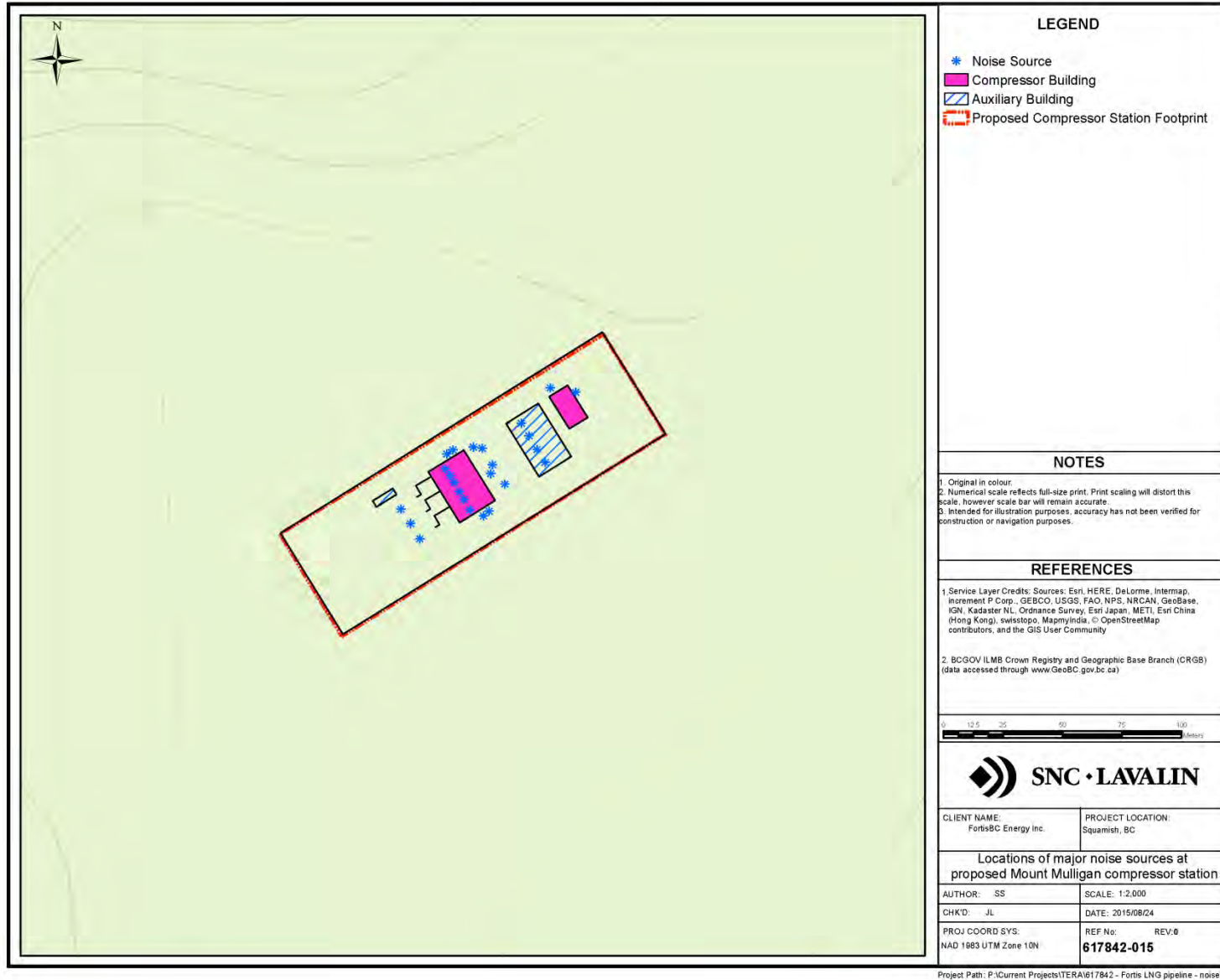


Figure 2.4-1. Locations of major noise sources at proposed Mount Mulligan compressor station.

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Noise was modelled accordingly to the International Standards Organization (ISO) 9613-2 methodology using SoundPLAN® software, version 7.3. The SoundPLAN® software, developed by Braunstein + Berndt GmbH, was first released in 1986 and is widely used for noise evaluations. It is a proven software platform providing accurate calculation and control features.

The ISO 9613-2 methodology calculates the attenuation of sound when propagating in free field, in order to forecast the sound pressure level at a given distance from various noise sources, under meteorological conditions favourable to the propagation of the sound toward the receiver. These conditions consist of a downwind propagation or moderate temperature inversion propagation, as commonly happens at night. The methodology takes into account geometric spreading due to distance, atmospheric attenuation, ground and barrier effects, reflection from surfaces, and propagation through dwellings, vegetation and industrial sites. It is applicable to most situations concerning industrial noise.

Noise levels of the facility were calculated for specific receptors and for a grid to produce a noise contour map. The results are representative of the continuous equivalent sound pressure level (Leq) using the A filter, also noted as LAeq (dBA).

Table 2.4-2 shows the modelling parameters used in the acoustic model.

Table 2.4-2. Acoustic modelling parameters.

Model parameter	Model setting
Temperature (degrees C)	10
Relative humidity (%)	70
Wind speed	Downwind (1 to 5km/h) from the source toward the receptor
Noise source types	Point sources, line sources and area sources for building envelope
Noise source data	Table 2.4-1
Noise propagation calculation standard	ISO 9613-2
Ground attenuation	Project footprint: reflective (0.0), Rest of LSA: average (0.6)
Terrain parameters	Topographic data: 5m interval, forest neglected
Orders of reflections	3

In addition, acoustic modelling was conducted assuming the following engineering measures will be implemented:

- The compressor building wall and ceiling shall have a minimum transmission loss (TL ASTM E90) as follows:

Frequency (Hz)	63	125	250	500	1k	2k	4k
TL (dB) - Wall & ceiling	9	15	20	26	28	38	43

- The compressor building will be constructed to have less than 0.1% open area. Any large openings (0.1 m² or larger) shall have appropriate silencing, equivalent to the building transmission loss. All doors shall be designed to reduce transmission of sound to the environment.

3.0 Results

3.1 Sound level monitoring

The primary noise sources monitored in the Mount Mulligan area were cars and all-terrain vehicles, the Stawamus River, wildlife, foliage, and infrequent aircraft flyovers.

Noise monitoring results are provided in Appendix C: Figures C-1 and C-2 show the noise monitoring results around the proposed Mount Mulligan compressor station. The spikes in the sound levels are primarily caused by vehicle traffic and aircraft flyovers. Several features in the noise levels should be noted:

- Noise measurements between 2200 and 2230 at Sites 13 and 14 were removed because of noise generated by the SNC-Lavalin technician; and
- The higher noise background at Site 14 (relative to Site 13) was from the nearby Stawamus River.

Table 3.1-1 summarizes the average day time (0700 to 2200) and night time (2200 to 0700) sound levels of the three monitoring sites near Mount Mulligan.

Table 3.1-1. Noise monitoring results near Mount Mulligan.

Date	Sound level metric*	Site 13 (dBA)	Site 14 (dBA)	Site 15 (dBA)
July 28, 2015	Ld	48	51	-
	Ln	32	44	-
	Ldn	47	52	-
	LAF90	31	43	-
	Leq	-	-	38

* Legend: Ld = Leq measured during day time hours (0700-2200); Ln = Leq measured during night time hours (2200-0700); Ldn = day-night equivalent level is the 24-hr Leq where Ln is increased by 10 dBA to account for greater sensitivity to noise at night; LAF90 = Sound level that is equalled or exceeded for 90% of the 24-hr measurement time period.

3.2 Acoustic modelling

The sound levels at the Mount Mulligan receptor sites due to the proposed compressor station are presented in Figure 3.2-1 and Table 3.2-1. Each contour in Figure 3.2-1 corresponds to a line of constant predicted sound level (in 5 dBA increments). In general, the sound level contours decrease with distance from the noise sources. Variations in the sound level contours are due to the relative location and orientation of the noise sources, ground attenuation and terrain effects.

Table 3.2-1. Predicted sound levels at receptor location due to proposed Mount Mulligan compressor station.

Receptor site	Predicted facility sound level Leq (dBA)	Permissible sound level Leq (dBA)	BC OGC compliant?	Ambient sound level, Ldn (dBA)	Cumulative sound level*, Ldn (dBA)	Increase in highly annoyed persons (%)
1.5 km from facility	38	40	Yes	-	-	-
13	29	-	-	46	47	0.1
14	29	-	-	53	52	0.0

* Cumulative sound level = Addition of predicted facility sound level and ambient sound level, summed logarithmically.

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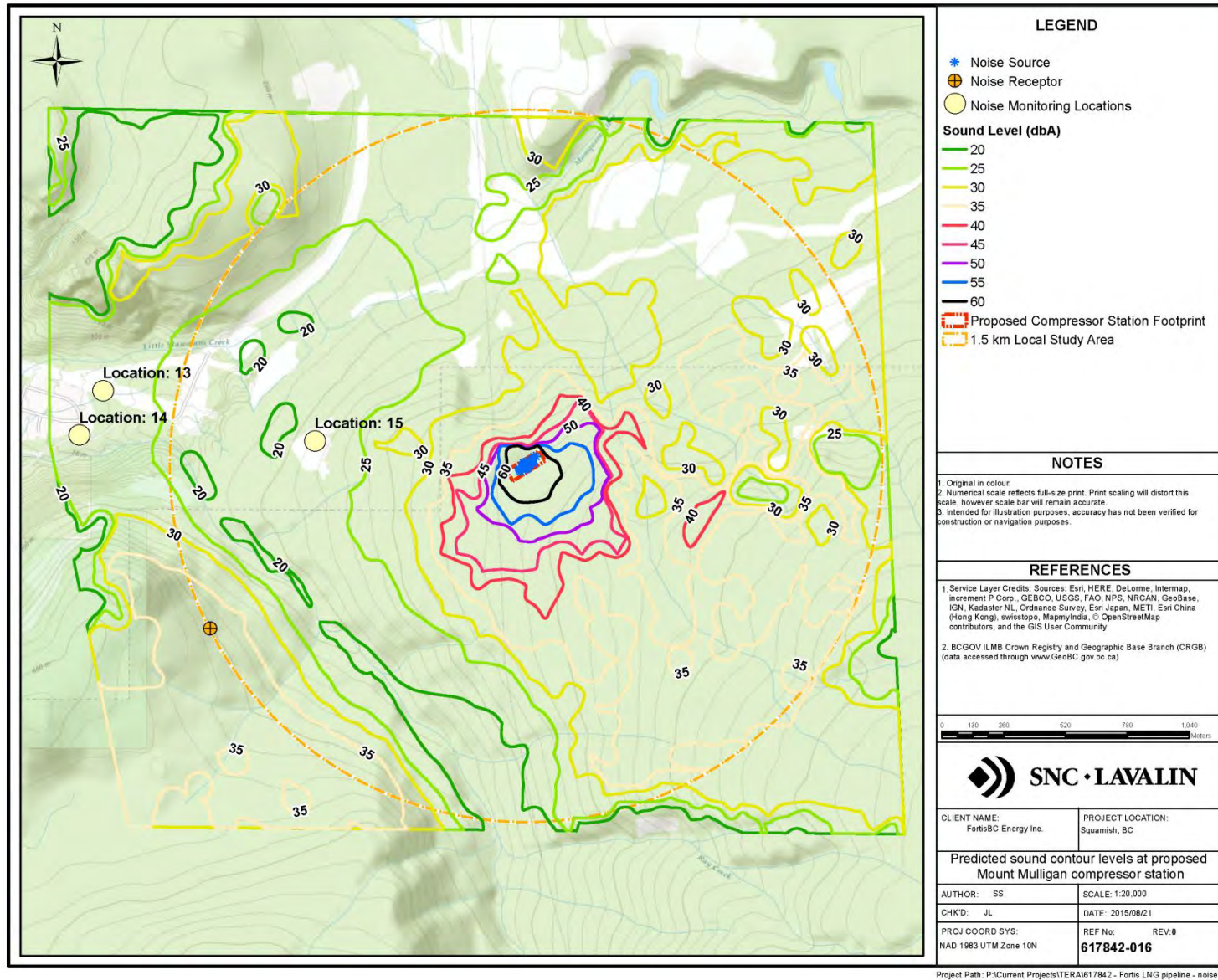


Figure 2.4-1. Predicted sound contour levels due to proposed Mount Mulligan compressor station.

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In Table 3.2-1, BC OGC noise limit compliance is only determined for a single location 1.5 km from the fence line of proposed Mount Mulligan compressor station, at the location where the predicted sound level is at a maximum. The cumulative sound level and the increase in highly annoyed persons (%HA) are listed for receptor sites 13 and 14 since they represent the closest dwellings to the proposed Mount Mulligan compressor station; the predicted facility sound level for Sites 13 and 14 are not compared to the BC OGC permissible sound level because they are further than 1.5 km from the fence line of the proposed Mount Mulligan compressor station.

The predicted facility sound levels with expected engineering measures are lower than the PSL and compliant with the BC OGC noise limits. Furthermore, the change in the calculated percentage of highly annoyed persons (%HA) does not exceed 6.5% at any existing dwelling. Considering these results, additional engineering controls are not recommended.

For reference, the predicted facility sound level at Site 15 was also estimated at 23 dBA. This sound level is lower than Sites 13 and 14 because of terrain effects, even though it is closer to the proposed compressor station. If the 38 dBA measured at Site 15 on March 29 is representative of the sound level at the site at all times, the cumulative sound level (*i.e.*, with the predicted facility sound level) would be 38 dBA. This was not included in Table 3.2-1 because no dwelling exists at that location so Site 15 is not subject to any regulatory noise limits or guidance.

4.0 Closure

The key findings of the acoustic assessment for the proposed Mount Mulligan compressor station are as follows:

- the existing Acoustic Environment in the Acoustic Environment LSA and RSA of the proposed Mount Mulligan compressor station consists of vehicle traffic, the Stawamus River, wildlife, foliage and aircraft flyovers;
- the permissible sound level at 1.5 km from the proposed Mount Mulligan compressor station is 40 dBA at night; and
- the components proposed to be installed at the Mount Mulligan compressor station with expected engineering measures are predicted to produce sound levels below the permissible sound level recommended by the BC OGC and the change in the calculated %HA at existing dwellings does not exceed Health Canada guidelines.

Appendix A: Meteorological conditions during noise monitoring

Table A-1. Meteorological conditions during noise monitoring on July 28, 2015*

Hour of day	Precipitation (mm)	Wind speed (km/h)	Temperature (degrees C)
00 (midnight)	None		13.6
01	None	0	12.8
02	None	3	12.0
03	None		11.3
04	None	5	11.1
05	None	0	10.7
06	None	5	11.4
07	None		14.5
08	None		17.4
09	None	16	19.5
10	None	17	21.1
11	None	17	22.2
12 (noon)	None	15	23.5
13	None	16	24.0
14	None	17	24.8
15	None	16	25.7
16	None	17	25.4
17	None	17	24.5
18	None	16	23.8
19	None	17	21.7
20	None	5	19.1
21	None	6	17.5
22	None	4	16.4
23	None	0	15.3

* Source: Environment Canada "Squamish Airport" station (2015).

Appendix B: Selected field photographs



Figure B-1. Noise monitoring site 13 looking west toward backyard of 38624 Cherry Drive, Squamish.



Figure B-2. Noise monitoring site 14 looking north toward Cherry Drive, Squamish.



Figure B-3. Noise monitoring site 15 looking west toward Squamish.

Appendix C: Noise monitoring results

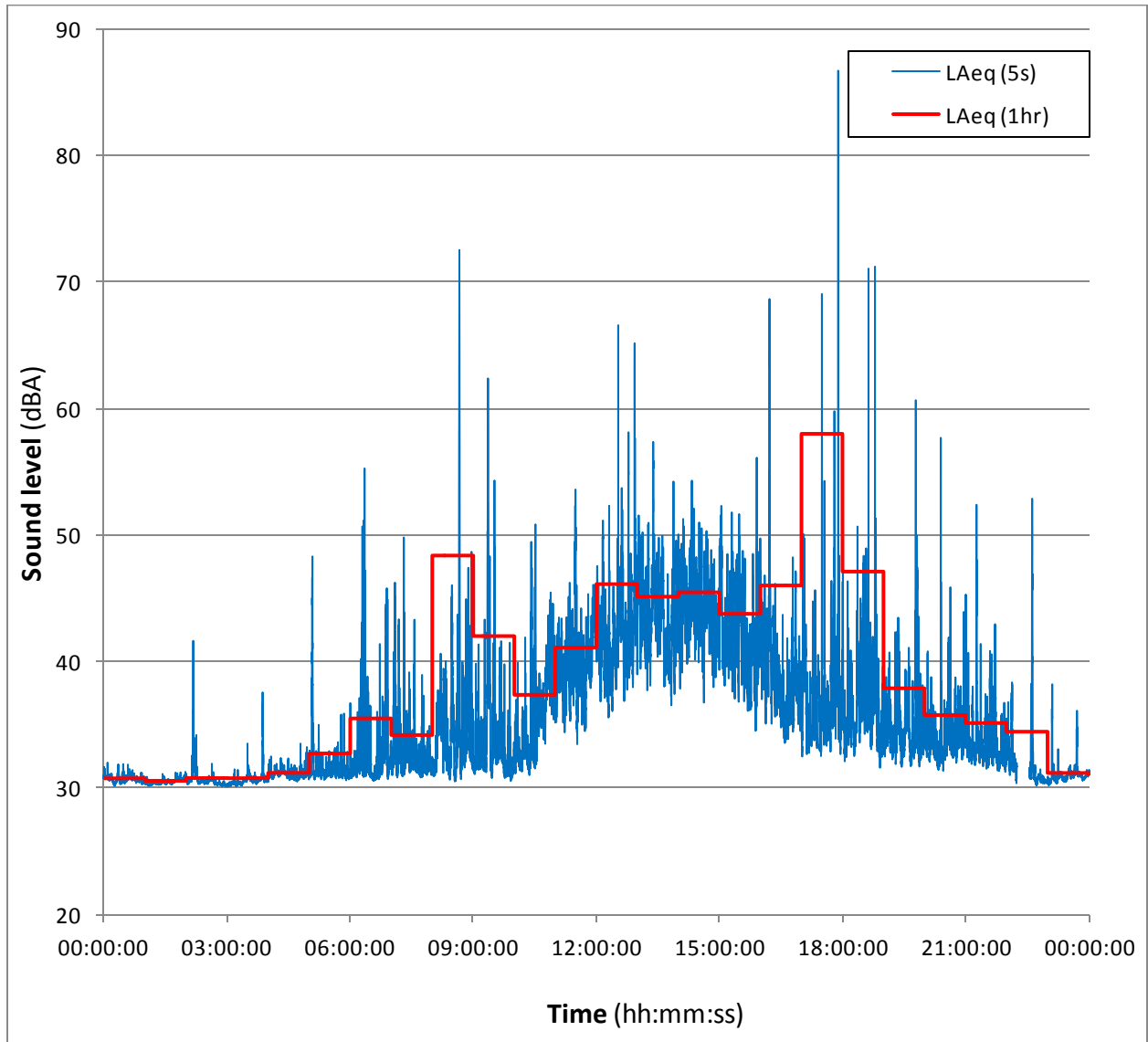


Figure C-1. Noise monitoring results at Site 13 near proposed Mount Mulligan compressor station on July 28, 2015.

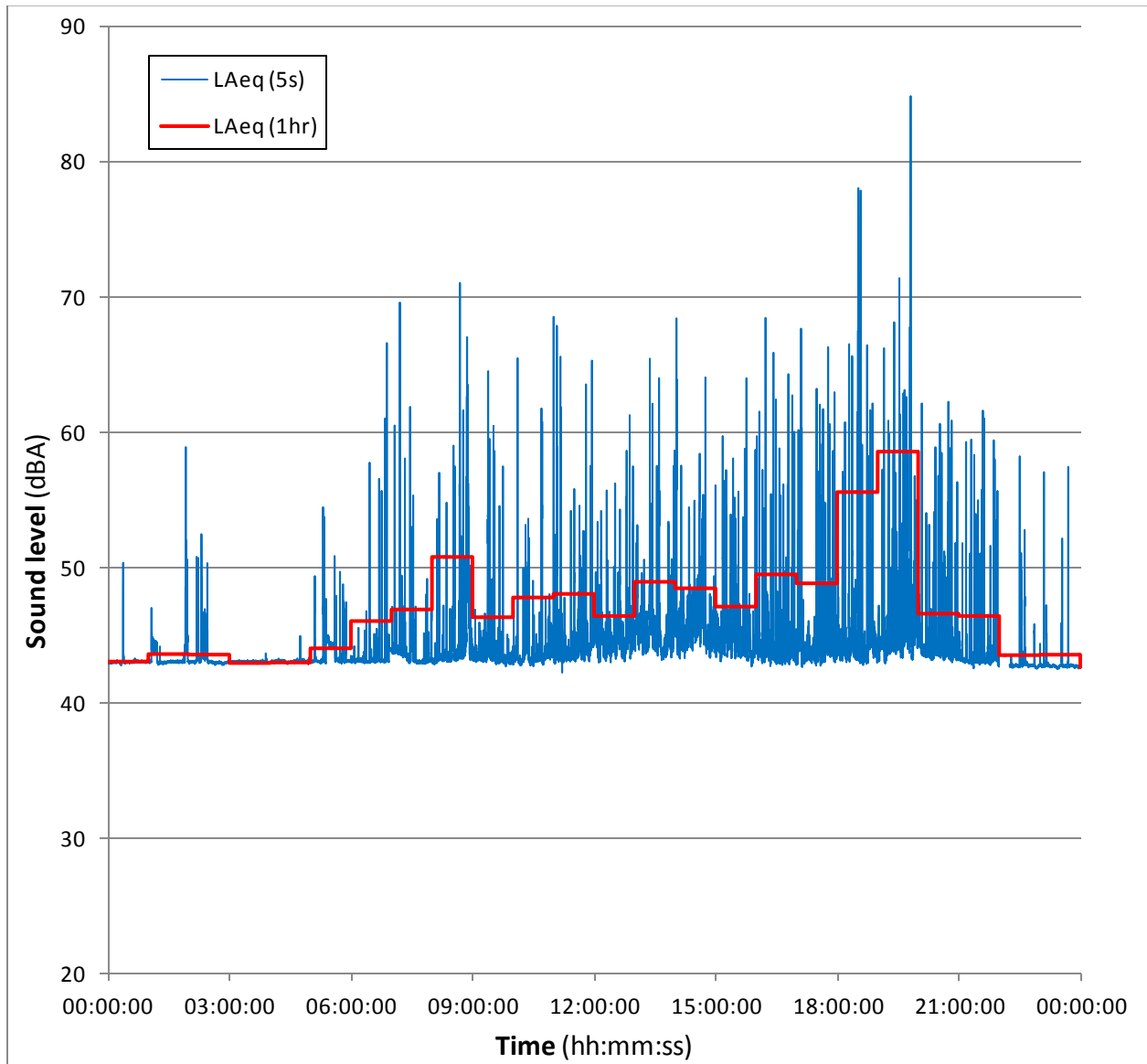


Figure C-2. Noise monitoring results at Site 14 near proposed Mount Mulligan compressor station on July 28, 2015.

APPENDIX C
AIR QUALITY MEMO



August 27, 2015

TO: Art Kanzaki, FortisBC Energy Inc. **DATE:** August 27, 2015
C.C.: Thea Mitchell, CH2M Hill
FROM: Bryan McEwen (SNC-Lavalin)
SUBJECT: FortisBC Mount Mulligan Compressor Station Air Quality Analysis

INTRODUCTION AND BACKGROUND

On January 12, 2015, FortisBC Energy Inc. (FortisBC) filed an Environmental Assessment Certificate Application (Application) with the British Columbia (BC) Environmental Assessment Office (EAO) for the proposed Eagle Mountain – Woodfibre Gas Pipeline Project (proposed Project). FortisBC is applying to include a compressor station at the base of Mount Mulligan near KP 32.5 (the Mount Mulligan compressor station) as a potential alternative for the Squamish compressor station proposed in the Application. Section 1.1 of the Addendum provides information on the changes to the Project description including the Mount Mulligan compressor station.

This memo provides an air quality analysis of the preliminary Mount Mulligan compressor station site, assuming the use of gas turbines, rather than the electrical motor driven compressors initially proposed for the Squamish compressor station. As such, the analysis includes an emission inventory of criteria air contaminants (CACs) and a dispersion model to predict the maximum potential off-site concentrations of CACs to test for compliance with the applicable provincial and federal air quality guidelines and standards in effect.

The CACs assessed include: nitrogen oxides (NO_x), sulphur dioxide (SO₂), carbon monoxide (CO), suspended particulate matter of aerodynamic diameter 10 microns and less (PM₁₀) and suspended particulate matter of aerodynamic diameter 2.5 microns and less (PM_{2.5}), NO_x (both NO and NO₂) is emitted from combustion sources although it is only NO₂ that is considered a priority substance with applicable ambient objectives.

Description of Proposed Mount Mulligan Compressor Station

FortisBC considered a number of factors when evaluating compressor station siting options for the proposed Project. The process of selecting compressor station locations involves collaborating with experts from various disciplines, including land, environment, engineering, and construction planning, and considering input from regulatory agencies, Aboriginal groups, and the public. Information on the compressor station site selection criteria used by FortisBC is provided in Section 1.5 of the Application (Volume 1, Part A).



A schematic of the preliminary Mount Mulligan compressor station site as well as the emission sources and surrounding buildings is shown in Figure 1. The following emission sources were characterized for the air quality assessment (expected maximum usage in brackets):

- three combustion turbines, Solar Turbines Incorporated Centaur 40 C16 units, each of nominal capacity 4,700 hp. Maximum rate of 46.6 GJ/hr (44.2 MMBTU/hr) at full output,
- two 590 kW gas engine electric generators (GE Waukesha Series) -- one unit used at any time up to full (590 kW) capacity,
- and two 2.5 MMBTU/hr gas fired heating boilers -- one unit used at any given time up to full (2.5 MMBTU/hr) capacity.

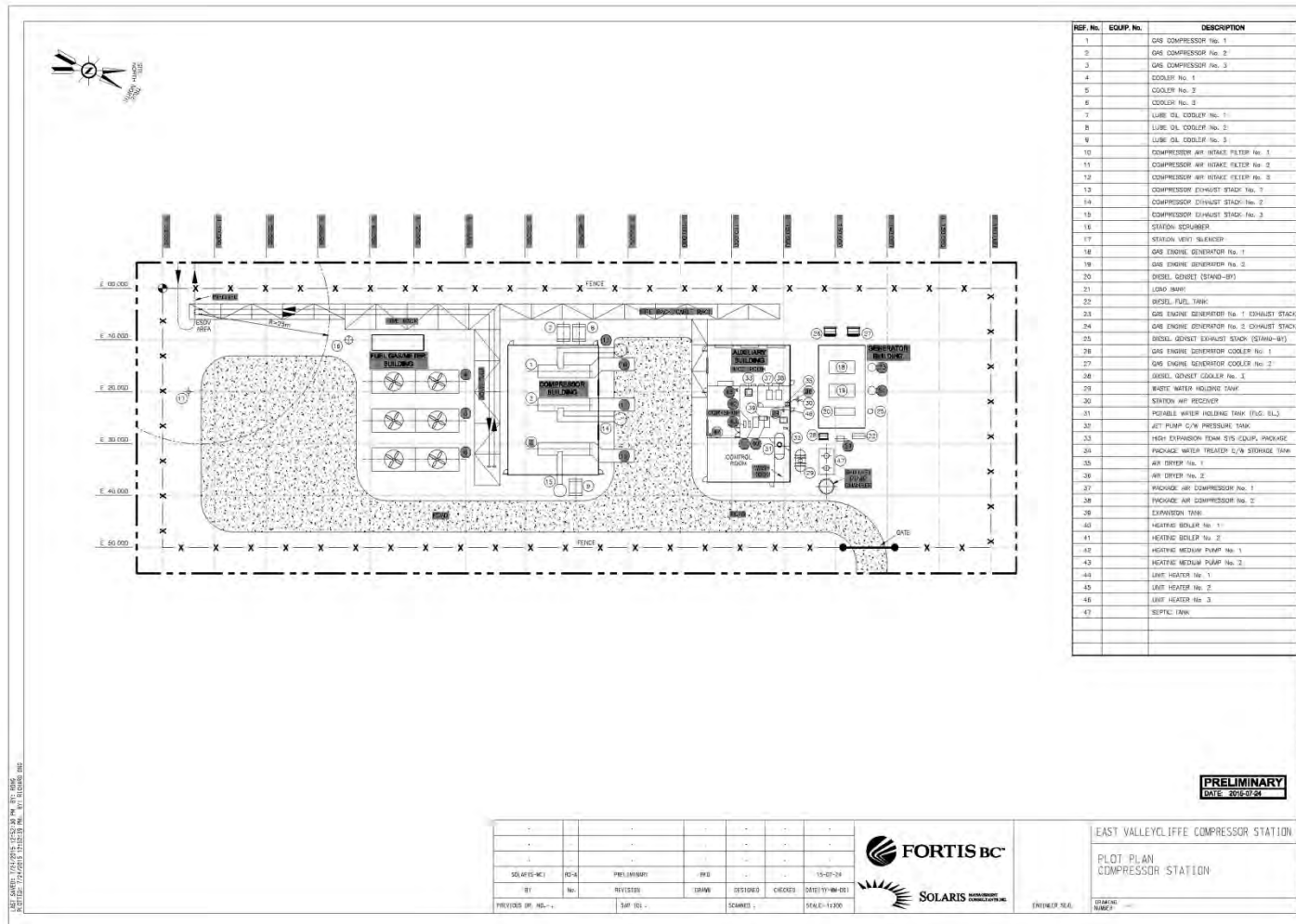


Figure 1: Preliminary Mount Mulligan Compressor Station Site Layout



AIR DISPERSION MODEL

The California Puff (CALPUFF) model, version 6.42 was used to complete the dispersion simulation over a period of one year. The year 2012 was used to coincide with a mesoscale meteorological dataset developed for the BC Ministry of Environment (BC MoE). The Weather Research and Forecasting (WRF) model fields were purchased for the region through an agreement with the data provider set up by the BC MoE. These fields were used with the CALPUFF meteorological processor (CALMET, V 6.4.0) in 'no obs' mode meaning that no additional meteorological data were used for the meteorological simulation.

Meteorological Simulation

Other assignments needed for the meteorological simulation were made consistent with the BC MoE Dispersion Modelling Guidelines¹. The relevant model settings are summarised in Attachment 1. Figure 2 provides a representation of the terrain heights in the model, as well as the location of the Mount Mulligan compressor station and the Squamish Airport, which has a meteorological (met) station. Figure 5, showing the land use categories used in the model, is provided in Attachment 1.

¹ http://www.bcairquality.ca/reports/pdfs/air_disp_model_08.pdf

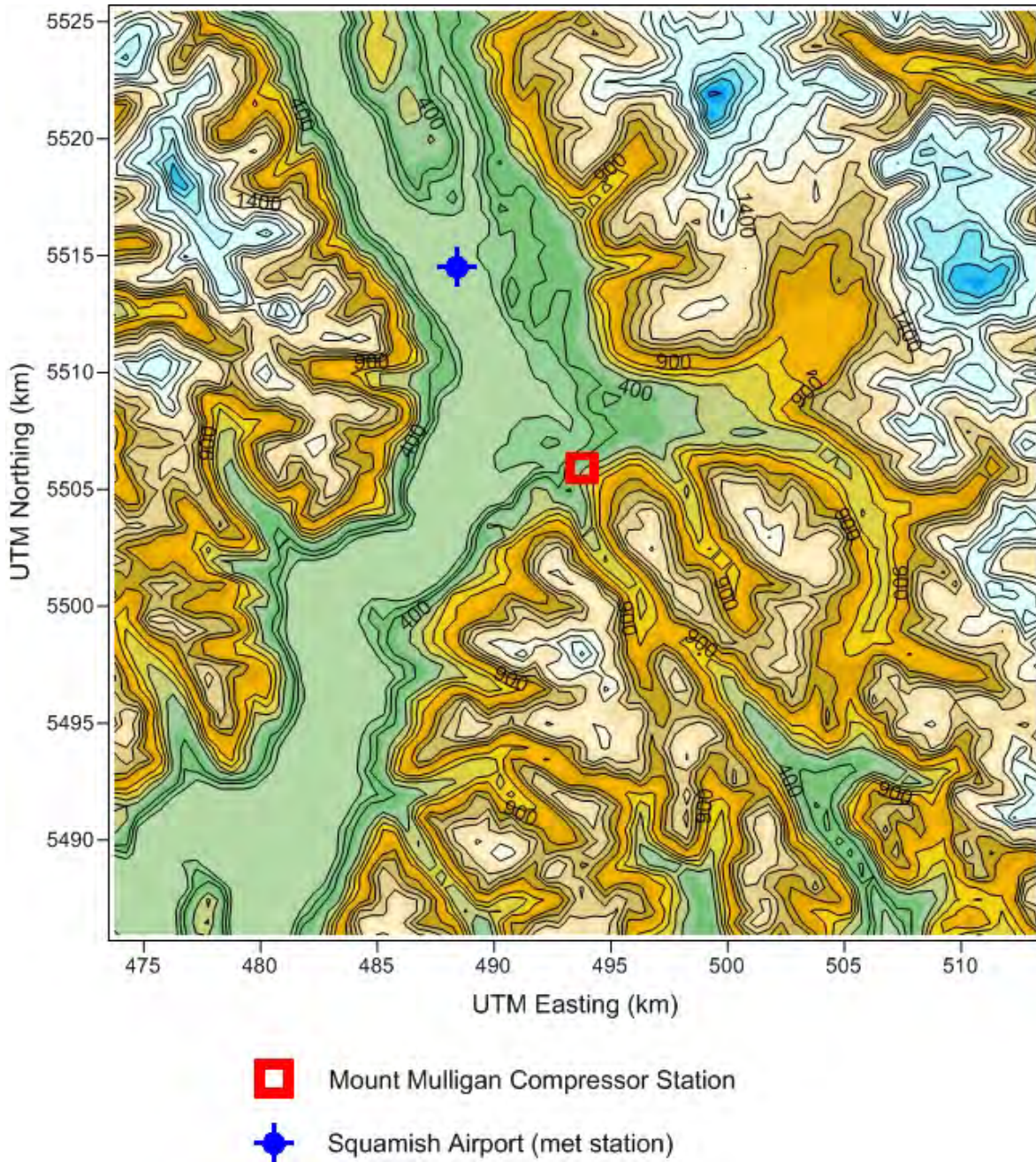


Figure 2: Model Domain showing Terrain Heights



Surface wind data were extracted from the model output to view the wind flow at the preliminary Mount Mulligan compressor station site and compared to the surface wind data at the Squamish Airport. The Squamish Airport winds are shown to be highly bi-directional, due to the valley orientation in the area. Simulated winds at Mount Mulligan compressor station site are different in that they are dominated by south-easterly flow with smaller contributions from the south, south-west and east sectors.

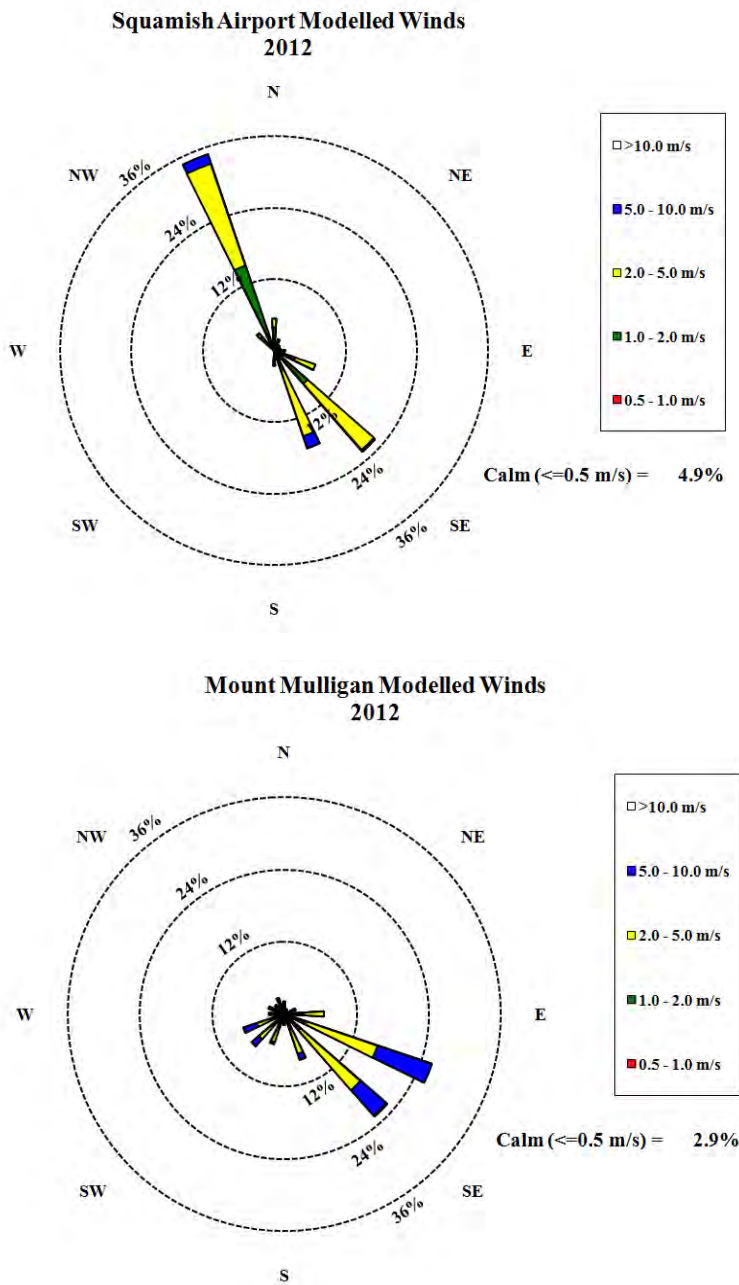


Figure 3: CALMET Modelled Surface Winds at Squamish Airport and Mount Mulligan Compressor Station



Air Quality Simulation

Additional source processing was completed to represent building downwash for the sources modelled. Building dimensions from the facility plans (Figure 1) were used with the US EPA Building Profile Input Program (BPIP) to determine the building parameters used for each source in the CALPUFF model input file. Additional CALPUFF settings were made, consistent with the BC MoE Dispersion Modelling Guidelines, as summarised in Attachment 1.

Supplier emission criteria such as stack height and exhaust temperature are identified in Table 1.

Table 1: Specified and Estimated Source Data

Measure	Turbine	Generator	Boiler
Power Rating (MMBTU/hr)	n/a ¹	1.8	2.5
stack height (m)	16.7	4.2	11.0
stack diameter (m)	1.2	0.8	0.4
exit V (m/s)	22.0	20.0	15.0
exit T (°C)	560.0	450.0	400.0

estimated value

Notes: ¹ see further discussion provided after Table 2

Additional source criteria required for atmospheric modelling were either available from the site plans or estimated as necessary. The following assumptions were used for the estimations:

- stack height of boiler conservatively estimated at 1 m above the height of auxiliary building,
- stack diameter for the generator assumed to be equal to the equipment exhaust connecting flange and the diameter for the boiler conservatively estimated at half this value,
- exit velocity for the generator and boiler conservatively based on similar equipment and SNC-Lavalin professional judgment.

CAC emission rates at the specified loadings are identified in Table 2. Volatile Organic Compounds (VOCs) estimates are included in the emission estimates but are not modelled since there are no regulatory ambient objectives or standards for VOCs. Consistent with the Application Air Quality Technical Report², additional CAC emission rates were calculated with the US EPA AP-42 Ch 3.1 (Stationary Gas Turbines) data³ and a more representative source of data for PM_{2.5}⁴. The gas engine and gas boiler rates were also calculated with AP-42 factors (ch 3.2 and ch 1.4 respectively).

² SNC-Lavalin, 2014. Air Quality Technical Report for the Eagle Mountain –Woodfibre Gas Pipeline Project. November 5.

³ <http://www.epa.gov/ttnchie1/ap42>

⁴ Innovative Environmental Solutions, 2012. Fine Particulate Emissions from Natural Gas-Fired Combustion Sources: Alternative PM2.5 Emission Factors. Prepared for the Canadian Energy Partnership for Environmental Innovation (CEPEI), October.

**Table 2: Maximum Source Emission Rates for Mount Mulligan Dispersion Modelling (all values in g/s)**

Source	NO _x	SO ₂	CO	VOC	PM	PM ₁₀	PM _{2.5}
turbine1	5.40E-01	1.57E-03	6.58E-01	1.17E-02	3.67E-02	3.67E-02	2.59E-03
turbine2	5.40E-01	1.57E-03	6.58E-01	1.17E-02	3.67E-02	3.67E-02	2.59E-03
turbine3	5.40E-01	1.57E-03	6.58E-01	1.17E-02	3.67E-02	3.67E-02	2.59E-03
generator 1	4.44E-01	1.31E-04	2.78E-01	2.68E-02	1.08E-02	1.08E-02	1.08E-02
generator 2	4.44E-01	1.31E-04	2.78E-01	2.68E-02	1.08E-02	1.08E-02	1.08E-02
boiler 1	3.08E-02	1.85E-04	2.59E-02	1.69E-03	2.34E-03	2.34E-03	2.34E-03
boiler 2	3.08E-02	1.85E-04	2.59E-02	1.69E-03	2.34E-03	2.34E-03	2.34E-03

Since the emission rates for the gas turbines are most substantial to the model, several different operating scenarios were considered to develop the maximum rates. At an elevation of 533 m above sea level and an operating temperature of -20°C, the gas turbines would develop 4,325 hp and an actual gas exhaust flow rate of 144,210 m³/hr⁵. The NO_x and CO emission limits applicable to the gas turbines (25 and 50 ppm at 15% O₂ respectively) lead to the emission rates shown in Table 2. These full capacity rates are higher than the rates that would occur during other ambient conditions (and higher than necessary to run the station during maximum demand).

While usage of the gas turbines is expected to substantially fluctuate by season (depending on gas demand), only one electric generator and one boiler are expected to be used at any time. The other electric generator and boiler are used for back up purposes. For this reason, the 'Maximum Emissions Scenario' modelled includes three gas turbines, one electric generator and one boiler, all operating at maximum capacity for the compressor station.

Modelling Results

Table 3 provides a summary of the maximum model air quality predictions for the Mount Mulligan compressor station, over different averaging periods of interest. These averaging periods were selected to determine compliance with applicable BC Ambient Air Quality Objectives (AAQOs)⁶. The BC AAQOs identified in Table 3 are the most stringent values in each case (e.g., 'Level A' where applicable). The BC AAQOs are more stringent than applicable federal objectives and standards, which aren't shown.

⁵ Emissions data provided by Solar Turbines Incorporated.

⁶ <http://www.bcairquality.ca/reports/pdfs/agotable.pdf>

**Table 3: Maximum Off-site Predicted Air Quality Concentrations for Mount Mulligan compressor station**

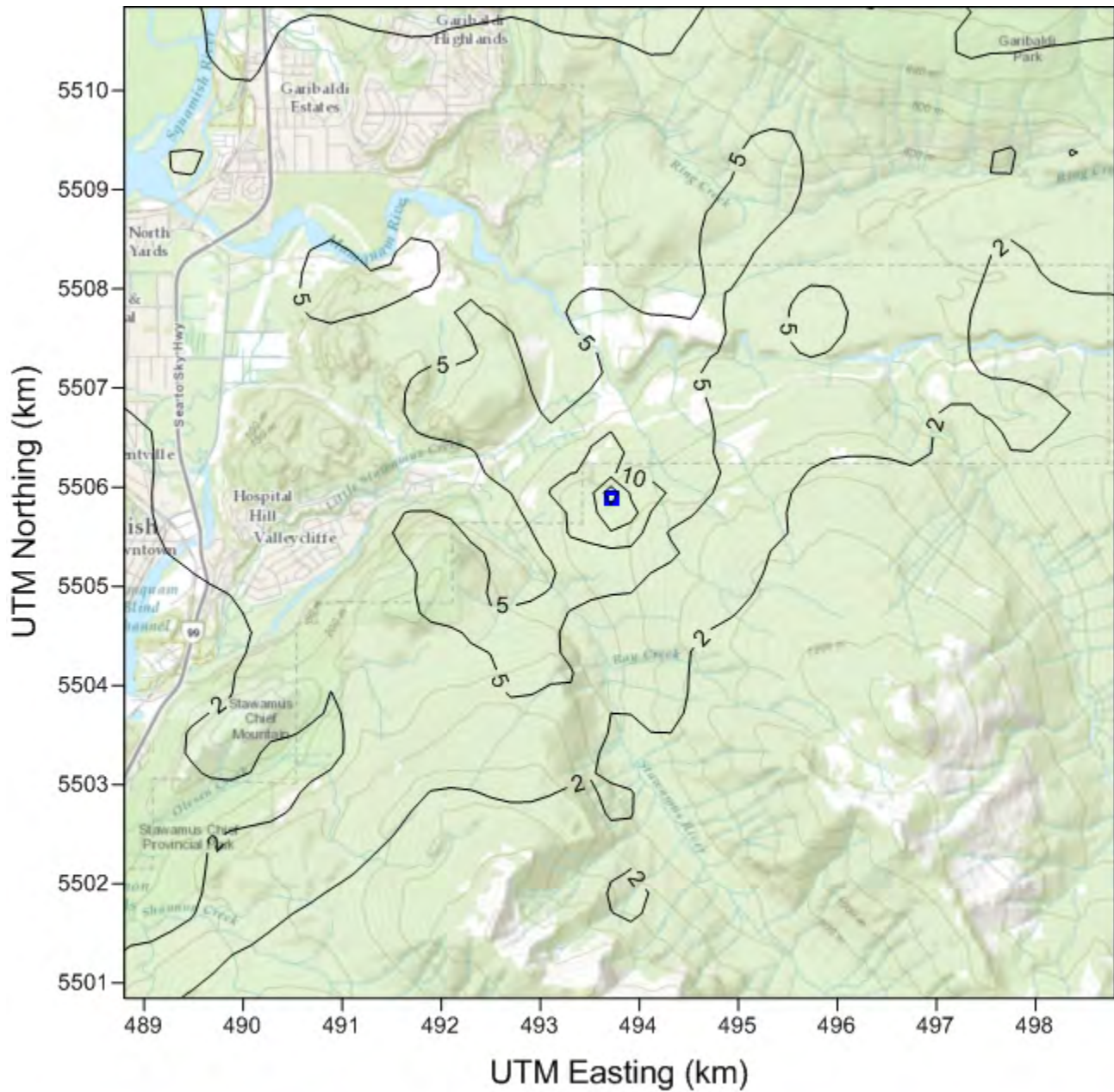
Air Contaminant	Predicted Ambient Concentrations				BC AAQOs			
	($\mu\text{g}/\text{m}^3$)				($\mu\text{g}/\text{m}^3$)			
	1-hour	8-hour	24-hour	Annual	1-hour	8-hour	24-hour	Annual
NO ₂ *	110	-	-	14.8	188	-	-	60
CO	221	147	-	-	14,300	5,500	-	-
SO ₂ **	0.4	-	-	-	200	-	-	-
PM _{2.5}	-	-	0.6	0.13	-	-	25	8
PM ₁₀	-	-	4.5	-	-	-	50	-

Notes:

- * 1-hour concentrations are 98th percentile of daily maximum levels over a year
- ** 1-hour concentrations are 99th percentile of daily maximum levels over a year
- '-' no ambient objective for the time period indicated

The predicted off-site impacts are low and fully compliant with the BC AAQOs. NO₂ predictions are made assuming 100% conversion of emitted NO_x to NO₂ and therefore are considered to be higher than would be expected with the facility operating. The '100% conversion' method of NO_x to NO₂ is identified as the preferred conversion scheme in the BC Modelling Guidelines. Only if this method implies exceedences of the ambient objectives should more refined conversion schemes be used.

Figure 4 provides a visualization of the maximum 1-hour NO₂ predictions near the Mount Mulligan compressor station site on a 10 km by 10 km map. The maximum predictions occur very near the Mount Mulligan compressor station fenceline and are expected to be caused by building downwash. Within approximately 100 m from the compressor station, the predicted concentrations drop to much lower levels. 1-hour concentrations of the other air contaminants are expected to follow a similar spatial distribution but are not shown here due to their very low levels.




 Mount Mulligan compressor station

Figure 4: Maximum Predicted 1-hour NO₂ Concentrations near Mount Mulligan compressor station (Maximum Emissions Scenario)



August 27, 2015

CONCLUSION

A one year air quality simulation was completed to identify the Maximum Emissions-Scenario air quality concentrations associated with the preliminary Mount Mulligan compressor station site location, assuming gas turbines and additional gas-fired equipment necessary to operate the facility. The Maximum Emissions Scenario modelled is higher than the actual maximum operations conditions expected over a calendar year. The modelling results indicate that there are no expected exceedances of any provincial criteria. Since the federal objectives/standards are equal to or higher than the provincial objectives, there are no expected exceedances of any federal air quality criteria. No adverse air quality conditions are expected for the Mount Mulligan compressor station site.

Sincerely,

A handwritten signature in black ink that reads "Bryan mcewen".

Bryan McEwen (Program Manager, SNC-Lavalin)

Office: 604-515-5101

Cell: 604-970-9547

Email: bryan.mcewen@snclavalin.com

Attachment 1

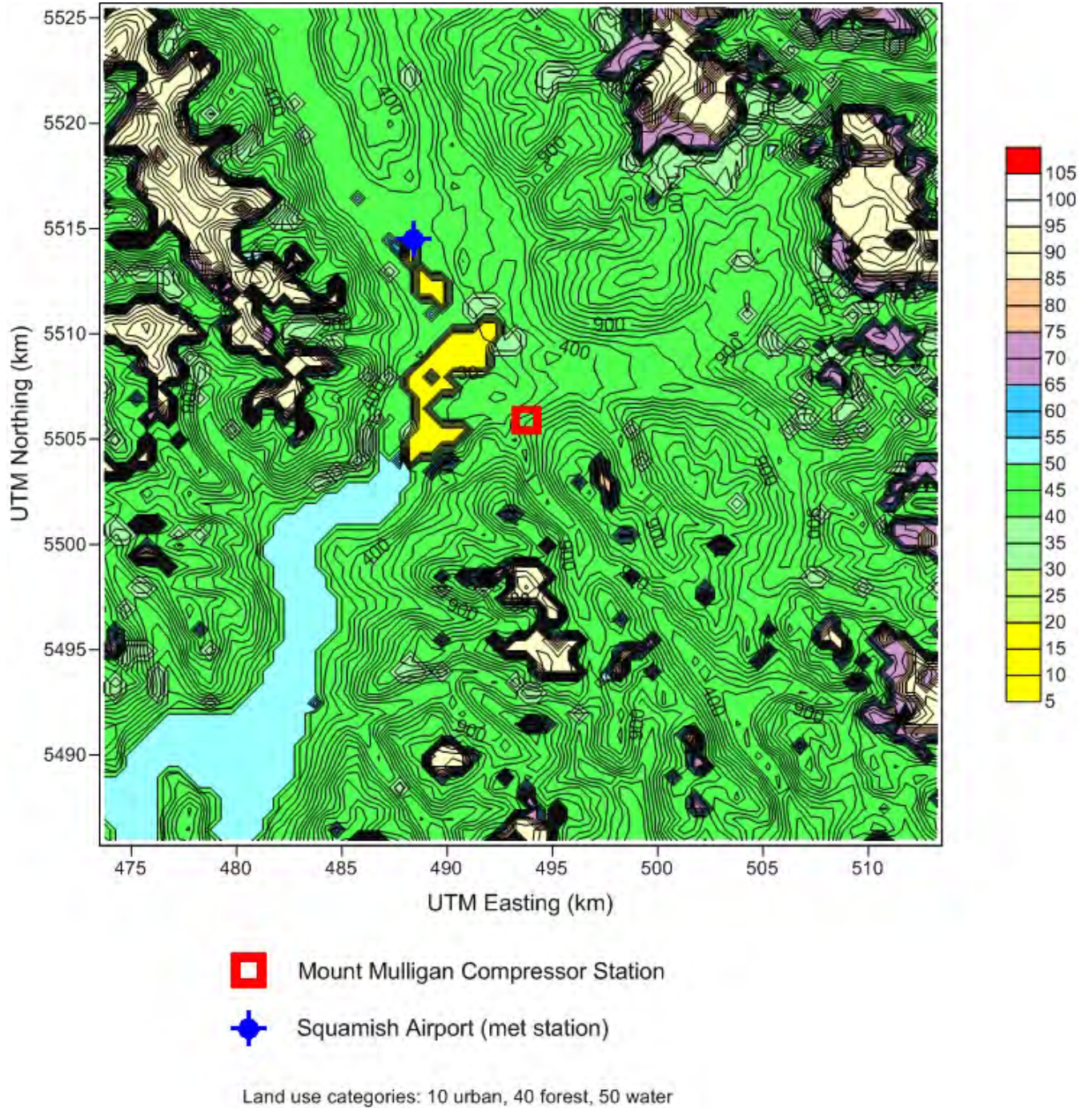


Figure 5: Land Use used in Dispersion Model

Table A1. CALMET Model Control Input File Options (default settings not shown unless significant)

Option	Parameter	Guideline Value*	Value Used Here	Comments/Justification
Extrapolate calm winds aloft?	ICALM	0 or 1	0	No effect, since station winds not used
Layer-dependent biases.	BIAS	Varies	{all zeroes}	No effect, since station winds not used
Minimum distance between upper air station and surface station for which extrapolation of surface winds will be allowed.	RMIN2	-1	-1	No effect
Gridded prognostic wind field model output fields.	IProg	2, 4, or 14	14	Used as initial guess field
Timestep (seconds) of the prognostic model input data.	ISTEPPGS	—	3600	Default.
Maximum radius of influence over land of the surface layer.	RMAX1	Varies	30	No effect since WRF no obs used
Maximum radius of influence over land aloft.	RMAX2	Varies	30	No effect since WRF no obs used
Maximum radius of influence over water.	RMAX3	Varies	50	No effect since WRF no obs used
Minimum radius of influence used in the wind field interpolation.	RMIN	0.1	0.1	Default. In units of km.
Radius of influence of terrain features.	TERRAD	Varies	5	No default exists. In units of km.
Distance from a surface station at which the station observations and the first-guess field are equally weighted.	R1	Varies	3	No effect since WRF no obs used
Distance from an upper station at which the observation and the first-guess field are equally weighted.	R2	Varies	5	No effect since WRF no obs used
Relative weighting of the prognostic wind field data.	RProg	Varies	0	No effect since WRF no obs used
Initial guess field wind components.	IDIOPT3	0	0	Default.
Upper air station to use for domain-scale winds.	IUPWND	-1	-1	Default.
Bottom and top of layer through which the initial guess winds are computed.	{ZUPWND(1), ZUPWND(2)}	{1, 1000}	{1, 1000}	Defaults.
Use of lake breeze module.	LLBREZE	—	F	Default.
Number of lake breeze regions.	NBOX	—	0	Set to zero since LLBREZE is set to F.
Maximum search radius in averaging process.	MNMDAV	—	10	Non-default. In units of grid cells.

*Values enclosed in black, dark grey, or light grey correspond to the MoE guidance of “do not touch”, “recommended default”, or “expert judgement required to determine”, respectively (*Guidelines for Air Quality Dispersion Modelling in British Columbia, 2008*).

Table A2. CALPUFF Model Control Input File Options (default settings not shown unless significant)

Option	Parameter	Guideline Value*	Value Used Here	Comments/Justification
Method used to simulate building downwash?	MBDW	2	2	
Stack-tip downwash?	MTIP	1	1	Default value.
Chemical transformation scheme.	MCHEM	1	0	No chemistry modelled
Wet removal modelled?	MWET	1	0	No removal modelled
Dry deposition modelled?	MDRY	1	0	No removal modelled
Methods used to compute dispersion coefficients.	MDISP	2 or 3	2	Dispersion coefficients computed from internally calculated sigma v, sigma w using micrometeorological variables.
Sigma measurements used?	MTURBVW	(3)	3	Default value.
Back-up method used to compute dispersion when measured turbulence data are missing.	MDISP2	(2)	3	PG dispersion coefficients for rural areas
Partial plume penetration of elevated inversion?	MPARTL	1	1	Default value.
Probability distribution function used for dispersion under convective conditions?	MPDF	0 or 1	1	PDF used

*Values enclosed in black, dark grey, or light grey correspond to the MoE guidance of “do not touch”, “recommended default”, or “expert judgement required to determine”, respectively (*Guidelines for Air Quality Dispersion Modelling in British Columbia, 2008*).

APPENDIX D
GREENHOUSE GAS EMISSION MEMO

Addendum No. 3 - Greenhouse Gas Emissions

PREPARED FOR: Art Kanzaki
(Project Director, FortisBC Energy Inc.)

PREPARED BY: Channy Shen, M.Sc. (Environmental Scientist, CH2M)
Darryl Chartrand, Ph.D. (Environmental Scientist, CH2M)

DATE: August 26, 2015

PROJECT NUMBER: 492434

APPROVED BY: Tara Lindsay B.Sc., A.Ag., MCIP, RPP (Regulatory Lead, CH2M)

This memo has been prepared to provide information to support Addendum No. 3 (Addendum) to the Environmental Assessment Certificate Application (the Application) that was filed with the British Columbia (BC) Environmental Assessment Office (EAO) for the proposed Eagle Mountain – Woodfibre Gas Pipeline Project (the proposed Project) on January 12, 2015.

Introduction and Background

FortisBC is applying for the following changes (proposed changes) to the Application as described in Section 1.1 of the Addendum: the inclusion of a compressor station at the base of Mount Mulligan near KP 32.5 (the Mount Mulligan compressor station) as a potential alternative for the Squamish compressor station proposed in the Application, and the removal of the Port Mellon compressor station upgrades from the Application due to a optimization of the compression design.

This memo provides the updated Greenhouse Gas (GHG) emission inventory that reflects the proposed changes using the GHG quantification methods described in the GHG Technical Report (Volume 2 of the Application). Construction and operation GHG emissions were investigated for the proposed changes, and the GHG impacts of the Addendum on the proposed Project was assessed.

Qualification of Greenhouse Gas Emissions

Construction

Overall construction phase GHG emissions for the proposed Project include emissions from short-term construction vehicles and equipment; marine traffic; land clearing; one-time pipeline venting, etc. The proposed changes will result in a decrease of GHG emissions from elimination of power line and substation construction for the Squamish compressor station as described in the Section 1.3 Application (Volume 1, Part A) and an increase of GHG emission due to the land clearing for the Mount Mulligan compressor station. Overall, there will be a total of 3.08 kt GHG emissions decrease during construction phase as a result of the Addendum changes. The sub-sections below provide information on the GHG emissions for vehicles and equipment and land clearing for the proposed changes.

GHG Emission Decrease - Vehicles and Equipment

Table 1 summarizes the details of the expected GHG emissions decrease due to avoidance of the electrical transmission line and substation construction for Squamish compressor station.

Table 1. Summary of GHG Emissions Reduction from Avoiding Construction of Electrical Transmission Lines and Substations for Squamish Station – On/Off-Road Vehicles and Equipment

GHG Emissions from Electrical Transmission Line and Substation Construction - Squamish Station

Activity	GHG Emissions Reduction (kt)			
	CO ₂	CH ₄ ²	N ₂ O ²	GHG (CO ₂ e)
On-Road Vehicles and Equipment	0.06	1.27E-06	2.19E-07	0.06
Off-Road Vehicles and Equipment	3.9	2.20E-04	1.62E-03	4.39
Total Construction Equipment and On/Off-Road Vehicle GHG Emissions Reduction	3.96	2.21E-04	1.62E-03	4.45

GHG Emissions Increase - Land Clearing

A small increase in GHG emissions is expected due to required land clearing for the proposed Mount Mulligan compressor station site and for the corridor expansion to accommodate the NPS 10" pipeline suction and discharge laterals to the Mount Mulligan compressor station. The total expected area to be cleared is estimated to be approximately 3.08 ha, in which 1.02 ha are the footprint of the compressor station and 2.06 ha are the footprint of the corridor expansion.

Table 2 provides a summary of total cleared areas under the Addendum by species, land clearing GHG emission factors and the results of GHG emission calculations for the Mount Mulligan compressor station.

Table 2. Summary of Mount Mulligan Compressor Station Land Clearing and Associated GHG Emissions

Top 5 Tree Species	Species Area (%)	Area (ha)
Amabilis Fir	10%	0.31
Douglas-Fir	20%	0.62
Red Alder	10%	0.31
Western Hemlock	30%	0.92
Western Redcedar	30%	0.92
Total Clearing Area by Tree Species¹	100%	3.08

GHG Emission Source	Emission Factor (EF) ²	GHG Emissions (kt)
	(Average t CO ₂ e/ha)	(Emission Factor*3.08 ha)
Wood Burning in Construction Year	526	1.62
Wood Decay in Construction Year	190	0.59
Uprooting Plus Burning	360	0.55 ³
Uprooting Plus Decay during the Year of Construction	182	0.28
Post-Construction Decay in 19 Years	360 ⁴	1.11
Total GHG Emissions from all Sources in 20 Years		4.15

Notes:

- 1 Calculated by addition of Vegetation Resources Inventory (VRI) data (area in ha) by species including lead, second, third, fourth, fifth, etc.; potentially causing overlap of polygons (i.e., duplication of areas calculated).

- 2 Emission factors are taken from the Dymond calculator (Dymond 2014) for South Coast component with 27% of harvested carbon assumed stored.
- 3 Based on professional judgment of assessment team, it was identified that only half of uprooted tree residues will be burned and the second half will be used for mulching or left on-site (i.e., decay, therefore only half of 1.02 ha was multiplied by emissions factor of 360 and 182).
- 4 Sum of emission factors in 19 years.

Operation

Removal of Port Mellon Compressor Station Upgrades

Direct GHG Emissions Decrease – Port Mellon Compressor Station

The removal of the Port Mellon Compressor Station upgrades leads to a reduction of operational GHG emissions for compressor stations. Table 3 provides a summary of the reduction in GHG emissions related to the removal of Port Mellon upgrades from the Application.

Table 3. Summary of GHG Emission Reduction Related to Removal of Port Mellon Upgrades

Combustion Source	Avoided Hours of Operation per Year	Avoided Fuel Consumption (scm/year)
Solar C33 C50 6000 HP Gas Turbine	4,292	5,570,915
Annual CO ₂ Emissions from Gas Turbine Combustion (t/y)		10,716.4
Annual CH ₄ Emissions from Gas Turbine Combustion (t/y)		10.6
Annual N ₂ O Emissions from Gas Turbine Combustion (t/y)		0.28
Total GHG (CO ₂ e) Emissions Reduction from Combustion Sources (kt/y)		11.065
Natural Gas Release Source	Avoided Natural Gas Release (scm/y)	Avoided Natural Gas Release (t/y)
Dry Gas Seal Leaks	5,599	3.3
Station Blowdowns/Unit Blowdowns/Unit Start-Ups	7,002.7	4.1
New Compressor Equipment Leaks	1,406	0.8
Total Natural Gas Venting from Blow-Downs and Leaks	14,008	8.2
Annual CH ₄ Emissions from Natural Gas Release Sources (t/y)		7.4
Annual CO ₂ Emissions from Natural Gas Release Sources (t/y)		0.1
Total GHG (CO ₂ e) Emissions Reduction from Natural Gas Release Sources (kt/y)		0.186
Total GHG (CO₂e) Emissions Reduction from Removal of Port Mellon Upgrades (kt/y)		11.25

Changes from Squamish Compressor Station to Mount Mulligan Compressor Station

Direct GHG Emissions Increase - Mount Mulligan Compressor Station

For the Mount Mulligan Compressor Station, the proposed gas turbine driven units, gas fired heating boilers and gas engine electric generators will replace the electric motor driven compressor units and auxiliary equipment as described for the Squamish compressor station in the Application. This change will lead to a reduction in indirect GHG emissions due to a reduction in electricity consumption.

However, there will be an increase in the direct combustion GHG emissions. GHG emission source estimates based on the actual performance requirements for the Mount Mulligan compressor station during normal operations includes:

- Three gas turbine driven turbines, Solar Turbines Incorporated Centaur 40 C16 units, each of nominal capacity 4,700 hp
 - Based on operational experience and hydraulic simulation software on horsepower requirements, it is not anticipated that operations will require all or any of the three units at maximum power/load for the majority of the year
 - A conservative estimate of operating hours are defaults to the high end, thus increasing annual fuel usage estimates
- Two 590 kW gas engine electric generators (GE Waukesha Series)
 - Only one generator will operate at a time (one is back-up)
 - One compressor running – 275 kW (or 45%) load on generator (200 kW station load plus 50-100 kW load bank)
 - Two compressors running – 325 kW (or 55%) load on one generator
 - Three compressors running – 450 kW (or 80%) load on one generator
 - Fuel flow data on various loads were from the generator datasheet for this project
- Two 2.5 MMBTU/hour gas fired heating boilers
 - Only one boiler will operate at a time (one is back-up). Based on operational experience, operation hours are estimated to be 25% of the year or 2190 hours
 - Assumed 80% boiler efficiency

Direct GHG Emissions from Stationary Combustion Sources

Tables 4, 5 and 6 provides a summary of the unit rating, fuel consumption, operation hours and emission factors used in GHG emission estimates for compressor gas turbines, , gas fired heating boilers and gas engine electric generators, respectively, for Mount Mulligan compressor station. The calculated direct GHG emissions from each combustion source category and total Mount Mulligan Compressor Station combustion GHG emissions are provided in Table 7.

Table 4. Gas Driven Turbines and Associated Direct GHG Emissions - Mount Mulligan Compressor Station

Site	Compressor		Turbine		Hours of Operation (hours/year) ²	Fuel Consumption (scm/year)
	Unit Number	Make and Model	Make and Model	HP		
Mount Mulligan Compressor Station	No. 1	Solar C16-7	Centaur 40	4,700	8,760	7,767,310
	No. 2	Solar C16-7	Centaur 40	4,700	5,088	4,386,279
	No. 3	Solar C16-7	Centaur 40	4,700	1,488	1,404,515
Associated Direct GHG Emissions From Gas Turbine Driven Units						
Applied Average Low Heat Value (LHV) and EFs			Annual GHG Emissions (t/year)			
CO ₂ EF (t/GJ)	0.05	CO ₂	23,756.3			
CH ₄ EF (t/GJ)	0.00004958	CH ₄	23.6			
N ₂ O EF (t/GJ)	0.000001305	N ₂ O	0.6			
Average LHV (GJ/scm)	0.0350437	Total Gas Turbine GHG¹		24,530.0		

Source: WCI (2011)

Notes:

- 1 When calculating total GHG, individual GWPs were applied (i.e., 1 for CO₂, 25 for CH₄ and 298 for N₂O).
- 2 Compressor operating hours are based on the most demanded performance requirements and are very conservative.

Table 5. Gas Fired Heating Boilers and Associated Direct GHG Emissions - Mount Mulligan Compressor Station

Site	Boilers				Hours of Operation (hours/year) ²	Fuel Flow (GJ/year)
	Unit Number	Rated Capacity (MMBTU/hour)	Thermal Efficiency (%)	Heat Input (MMBTU/hour)		
Mount Mulligan Compressor Station	No. 1	2.5	80%	3.13	2,190	7,221
	No. 2	2.5	80%	3.13	Back-Up	Back-Up
Associated Direct GHG Emissions From Boilers						
Applied Average Low Heat Value (LHV) and EFs				Annual GHG Emissions (t/year)		
CO ₂ EF (t/GJ)	0.05	CO ₂	361.0			
CH ₄ EF (t/GJ)	0.00004958	CH ₄	0.4			
N ₂ O EF (t/GJ)	0.000001305	N ₂ O	0.009			
Average LHV (GJ/scm)	0.0350437	Total Boiler GHG¹		372.8		

Source: WCI (2011)

Notes:

- 1 When calculating total GHG, individual GWPs were applied (i.e., 1 for CO₂, 25 for CH₄ and 298 for N₂O).
- 2 Only one boiler unit will operate at a time, the second unit is back-up, and planned to operate 25% of the year on the high end (i.e., 24 hours x 365 days x 25% = 2190 hours).

Table 6. Gas Engine Electric Generators and Associated Direct GHG Emissions - Mount Mulligan Compressor Station

Site	Generators				Hours of Operation (hours/year) ³	Fuel Consumption (scm/year)
	Unit Number	Rated Capacity (kW/hour)	Operation Load (%)	Fuel Flow ² (scfm)		
Mount Mulligan Compressor Station	No. 1	590	76%	90	1,488	227,532
	No. 1	590	55%	67	3,600	409,801
	No. 1	590	47%	62	3,672	386,804
	No. 2	590	back-up		Back-Up	Back-Up
Associated Direct GHG Emissions From Generators						
Applied Average Low Heat Value (LHV) and EFs				Annual GHG Emissions (t/year)		
CO ₂ EF (t/GJ)	0.05	CO ₂	1,794.5			
CH ₄ EF (t/GJ)	0.00004958	CH ₄	1.8			
N ₂ O EF (t/GJ)	0.000001305	N ₂ O	0.0			
Average LHV (GJ/scm)	0.0350437	Total Generator GHG¹		1,852.9		

Source: WCI (2011)

Notes:

- 1 When calculating total GHG, individual GWPs were applied (i.e., 1 for CO₂, 25 for CH₄ and 298 for N₂O).
- 2 Fuel flow from supplier's generator datasheets.
- 3 Only one generator will operate at a time (one is back-up). The generator will run on 47% load (275 kW) when one compressor is running, on 55% load (325kW) when two compressor is running, and on 76% load (450 kW) when three compressor is running.

Table 7. Mount Mulligan Compressor Station Direct GHG Emissions from Combustion Sources

Combustion Sources	GHG (CO ₂ e) Emissions (kt/y)
Gas Turbines	24.53
Gas Fired Heating Boilers	0.37
Gas Engine Electric Generators	1.85
Total Stationary Combustion GHG Emissions	26.76

Indirect GHG Emissions Decrease - Squamish Compressor Station

The relocation of the Squamish Compressor Station to the Mount Milligan site and the replacement of electric motor driven compressor units with gas turbine compressor units at the Mount Mulligan compressor station will result in reductions of indirect GHG emissions due to reduced electrical consumption. Table 8 below summarizes the expected reductions of indirect GHG emissions from this change.

Table 8. Summary of GHG Emission Reduction Due to Removal of EMD Compressor Turbines

EMD Turbine Number	HP	Avoided Operation Hours (hours/year)	Avoided Electricity Demand (KWh) ¹	Avoided GHG Emissions ² (tCO ₂ e/year)
Compressor Electricity Demand and Indirect GHG Emissions				
Squamish EMD Compressor Turbine No. 1	16500	4292.4	14,559	12,498
Squamish EMD Compressor Turbine No. 2	16500	4292.4	15,469	13,280
Auxiliary Equipment Electricity Demand and Indirect GHG Emissions				
High pressure Gas Cooler Motors at V2		8584.8	298	512
Cathodic Protection System		8584.8	< 0.042	< 0.073
Custody Transfer Station		8584.8	< 35.42	< 62
Total Reduction of Indirect GHG Emissions (CO₂ekt/y):				26.29³

Notes:

- 1 Electricity demand for compressors takes into account efficiencies of respective compressor models defined by Solar Turbines (Solar Turbines 2014) for ideal conditions.
- 2 Single emission factor for indirect GHG emissions was provided by CAS (Guzman pers. comm.).
- 3 Reduction from operation of cathodic protection system and Custody transfer station were not included.

Total Greenhouse Gas Emissions Changes for the Addendum

Tables 9 and 10 summarized the net changes in construction and operation GHG emissions due to the Addendum changes, respectively.

Table 9. Changes in Construction GHG Emissions Related to the Addendum Changes

Affected Construction GHG Emission Sources	Construction GHG Emissions (in kt ¹)		Net Change in Construction GHG Emissions ²
	Squamish Compressor Station	Mount Mulligan Compressor Station	
Vehicles and Equipment	-4.45	0	-4.45
Land Clearing	0	4.15	4.15
Overall Net Change in GHG Emissions			-0.30

Notes:

- 1 kt = kilotonnes of CO₂ equivalent.
- 2 Negative values indicate a reduction of emissions.

Table 10. Changes in Operation GHG Emissions Related to the Addendum Changes

Affected Operation GHG Emission Sources	Operation GHG Emissions (in kt/yr ¹)			Net Change in Operation GHG Emissions ²
	Squamish Compressor Station	Port Mellon Compressor Station	Mount Mulligan Compressor Station	
Compressor Station Operation	-26.29	-11.25	26.76	-10.79

Notes:

- 1 kt/yr = kilotonnes of CO₂ equivalent per year.
- 2 Negative values indicate a reduction of emissions.

Conclusion

Since proposed changes will lead to 0.10% decrease of the proposed Project construction GHG emissions and 8.85% decrease of the operation GHG emissions, the Addendum will result in less contribution of GHG to Federal, Provincial GHG emission levels. Therefore, the Addendum will not change the GHG assessment conclusions stated in the original Application.

References

Dymond, C. 2014. Deforestation emission for BC by region. Microsoft Excel® tool.

Western Climate Initiative. 2011. Final Essential Requirements of Mandatory Reporting. 2011 Amendments for Harmonization of Reporting in Canadian Jurisdictions. Website: http://www.westernclimateinitiative.org/dmdocuments/Final_Essential_Requirements_of_Mandatory_Reporting_Second_Update_December_21_2011.323.pdf. Accessed: August 2015.

APPENDIX E
VISUAL AESTHETICS MEMO

Addendum No. 3 - Visual Aesthetics

PREPARED FOR: Art Kanzaki (FortisBC Energy Inc.)

PREPARED BY: Natalie Schell, M.Phil., B.Sc. (Socio-Economic Planner, CH2M)
Nina Barton, M.R.M. (Socio-Economic Marine Specialist, CH2M)
Ted Baksa, B.Sc., GISP (GIS Lead, CH2M)

DATE: August 21, 2015

PROJECT NUMBER: 492434

APPROVED BY: Tara Lindsay, B.Sc., A.Ag., MCIP, RPP (Regulatory Lead, CH2M)

This memo has been prepared to provide the information to support Addendum No. 3 (Addendum) to the Environmental Assessment Certificate Application (the Application) that was filed with the British Columbia (BC) Environmental Assessment Office (EAO) for the proposed Eagle Mountain – Woodfibre Gas Pipeline Project (the proposed Project) January 12, 2015.

Existing Visual Conditions

FortisBC is applying to include a compressor station at the base of Mount Mulligan near KP 32.5 (referred to as the Mount Mulligan compressor station) as a potential alternative for the Squamish compressor station proposed in the Application as well as discharge laterals (NPS 10" laterals) to the Mount Mulligan compressor station as described in Section 1.1 of the Addendum.

The preliminary Mount Mulligan compressor station site and a portion of the NPS 10" laterals are located in the Sea to Sky Land and Resource Management Plan (LRMP) area. The Sea to Sky LRMP states that the potential loss of visual landscape quality due to resource development activities is a concern, especially from viewing perspectives including communities and main travel corridors (Government of BC 2008). The LRMP also identifies the Frontcountry Area as a visually sensitive area (Government of BC 2008). The Frontcountry Area follows the main transportation corridors in the LRMP area, including the Sea to Sky Highway (Highway 99), the District of Squamish and the surrounding area, and the west coast of Howe Sound, across from Highway 99 (Government of BC 2008). The Mount Mulligan compressor station is located in the Frontcountry Area. The LRMP states that since this area is heavily used for public and recreational use and it is the gateway through which all visitors to the area pass through, it is essential that the aesthetic quality be maintained (Government of BC 2008). As a result, the LRMP encourages all resource users and developers to consider visual management as an important feature of their development planning (Government of BC 2008).

The Mount Mulligan compressor station and the NPS 10" laterals are also located in the Woodlot Licence W0028 (Forest Tenure Holder: Allan Woods), but is not located in an area with an established visual quality objective (VQO) (BC Ministry of Forests 2008, Government of BC 2013).

Potential Landscape Changes

Visual studies were conducted on four observer viewpoints (OVs) in Squamish and the surrounding area to determine potential visual effects of the Mount Mulligan compressor station and the NPS 10 laterals. The following OVs were visited on August 5 and 6, 2015:

- OV1: The Stawamus Chief (Peak 3)
















- OV2: The Sea to Sky Gondola (The Chief Overlook Viewing Platform)
- OV3: Valleycliffe neighborhood
- OV4: Highway 99 pedestrian bridge


The location of each OV is presented in Figure 1.

FIGURE 1

OBSERVER VIEWPOINT LOCATIONS

EAGLE MOUNTAIN-WOODFIBRE GAS PIPELINE PROJECT ADDENDUM NO.3

-  Kilometre Post
-  Observer Viewpoint (OV)
-  Proposed NPS 24 FortisBC Pipeline Route
-  Proposed NPS 10 FortisBC Pipeline
-  Existing NPS 10 FortisBC Pipeline
-  Existing NPS 10 Subject to Removal/Abandonment
-  Compressor Station
-  Road
-  Highway
-  Railway
-  Watercourse
-  Waterbody
-  Municipality
-  Park/Protected Area
-  First Nations Reserve

SCALE: 1:60,000

 (All Locations Approximate)

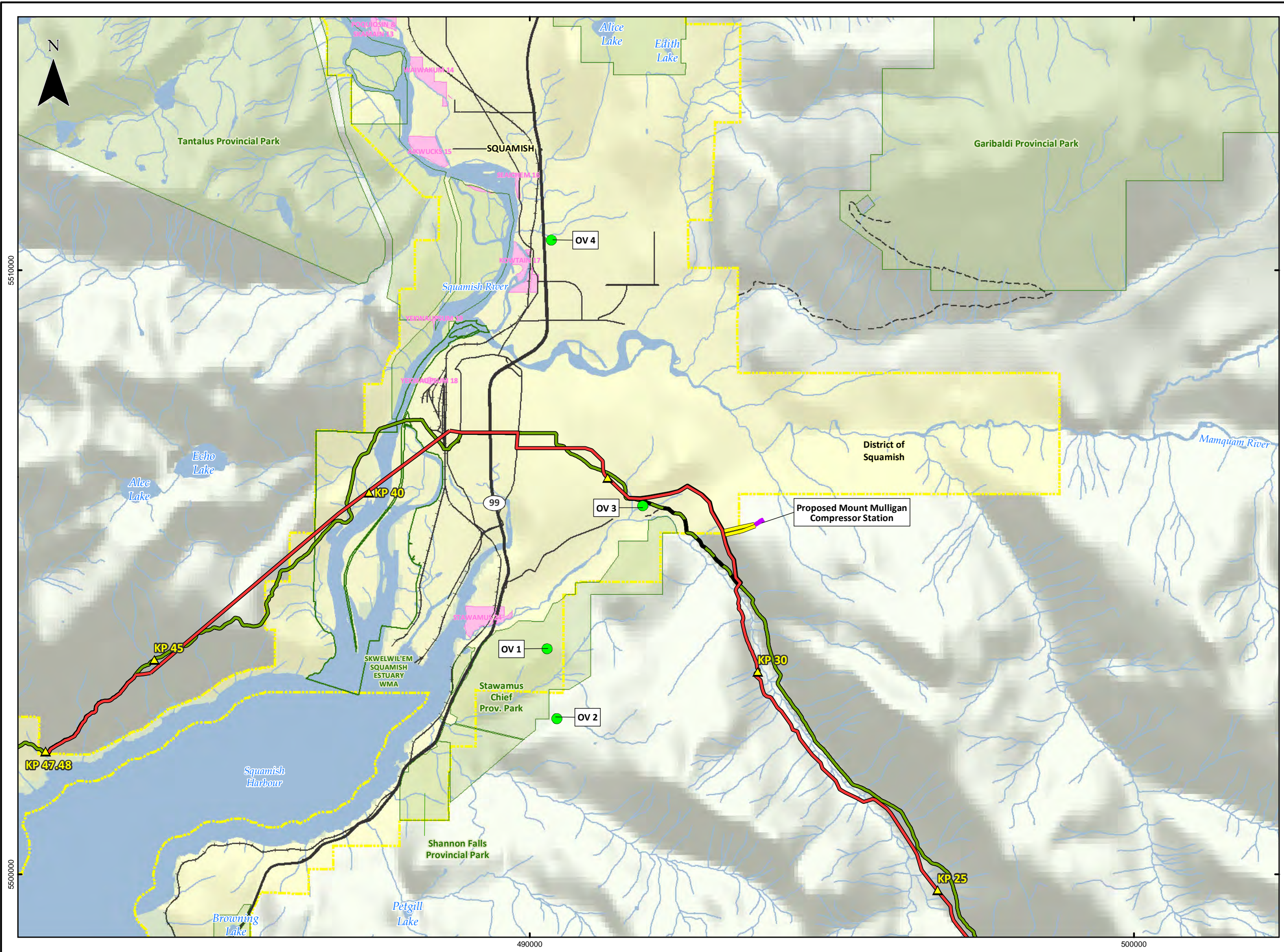


CH2M HILL Project Number 492434

UTM Zone 10 North, NAD 1983.
 Proposed Pipeline 1017, Kilometre Posts 1017: Universal Pegasus International (UPI) 08-21-2014; NPS 10 Proposed and Abandoned Pipeline: FortisBC 08-06-2015; Supply Lines: Digitized from FortisBC 04-29-2015; Existing Pipeline: FortisBC 2012; Preliminary Mount Mulligan Compressor Station Footprint: FortisBC 08-04-2015; Roads: NRCAN 2014; Railways: NRCAN 2012; Hydrography: NRCAN 2009, BC MFNRO 2008; Parks, Wildlife Management Areas: BC MFNRO 2008; First Nation Reserves: Government of Canada 2015; Hillshade: TERA Environmental Consultants 2008.

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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Of the four OV's, OV1 (Stawamus Chief) and OV2 (the Sea to Sky Gondola) were chosen for visual modeling due to their popularity as tourist viewpoints and the direct sight line to the Mount Mulligan compressor station. The models provide a simulation of the proposed Mount Mulligan compressor station and the NPS 10" laterals on the landscape (Figures 2 and 3). Although the Mount Mulligan compressor station site and will not be visible in OV3 and OV4, photos are provided in Figures 4 and 5 with an arrow indicating where the Mount Mulligan compressor station is located relative to the two viewpoint. The NPS 10" laterals are only indicated on figures where they are visible.

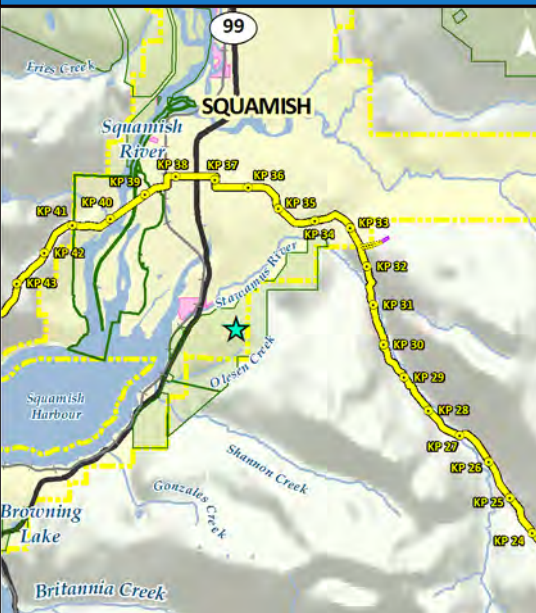
Figure 2
Visualization from the
Stawamus Chief

Project Number: 492434
Date: August 21, 2015

LOCATION MAP AND VIEWPOINT



REGIONAL MAP



BEFORE PROJECT



AFTER PROJECT

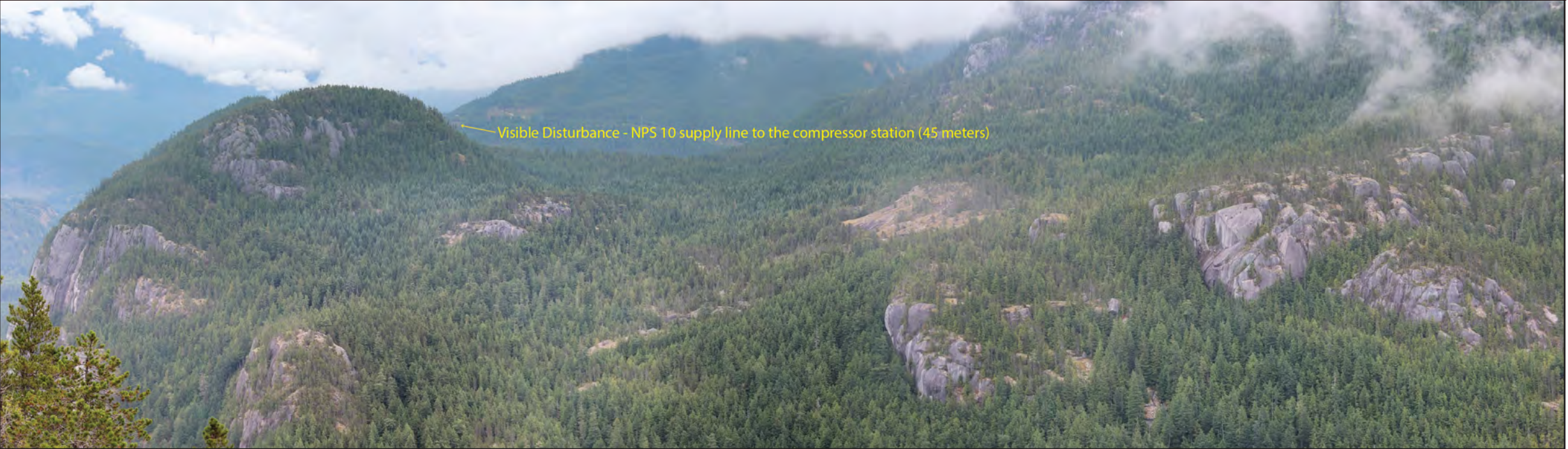
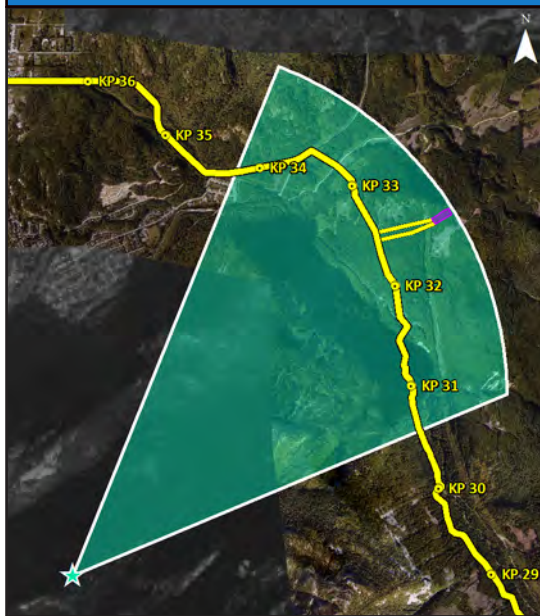


Figure 3
Visualization from the
The Sea to Sky Gondola

Project Number: 492434
Date: August 21, 215

LOCATION MAP AND VIEWPOINT



REGIONAL MAP



BEFORE PROJECT



AFTER PROJECT

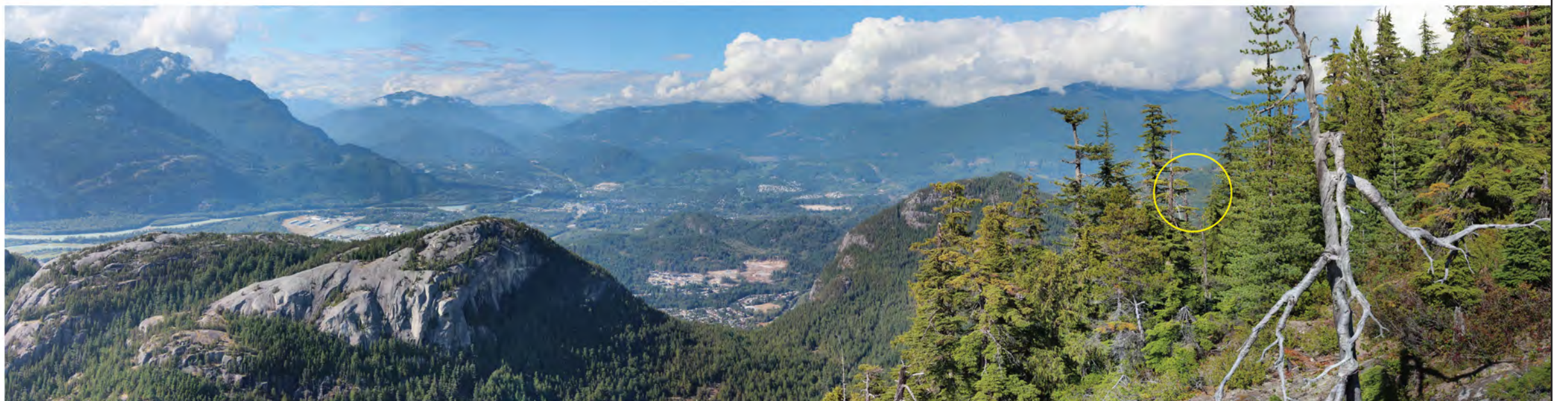




Figure 4. The Proposed Mount Mulligan Compressor Station from OV3: Valleycliffe Neighbourhood
The arrow indicates where the Mount Mulligan Compressor Station will be located, but not visible from this OV



Figure 5. The Proposed Mount Mulligan Compressor Station from OV4: Highway 99 Pedestrian Bridge
The arrow indicates where the Mount Mulligan Compressor Station will be located, but not visible from this OV

Discussion

The two models Figure 2 and 3 provide a visual simulation of the proposed Mount Mulligan compressor station and NPS 10" laterals on the landscape. Trees will be cleared to accommodate the facility, and will include a compressor station, a VDF building, a substation, pipe rack and fencing. The maximum height of the facility is anticipated to be approximately 16 m in height. If trees (approximately 30 m in height) remain to act as a visible barrier, the facility will not be seen from either OV1 or OV2. However, the lateral NPS 10" lateral pipeline right-of-way will be visible. As vegetation is re-established, the right-of-way will become less visible.

It is anticipated that the proposed Mount Mulligan compressor station and NPS 10" lateral right-of-way will not be visible from OV3 and OV4 due to the topography of the landscape and existing trees acting as a visual barrier.

References

British Columbia Ministry of Forests. 2008. Recreational Visual Quality Objectives (digital file). Victoria, BC. Available: apps.gov.bc.ca/pub/dwds/home.so. Acquired: February 2013. Last Update Check: February 20, 2013.

Government of British Columbia. 2008. Sea-to-Sky Land and Resource Management Plan. BC Integrated Land Management Bureau, Coast Region, Surrey, BC. xiv + 186 pp.

Government of British Columbia. 2013. iMapBC 2.0 (Web Map Application). Victoria, BC. Website: <http://maps.gov.bc.ca/ess/sv/imapbc>. Accessed: October 2014.