PACIFIC TRAIL PIPELINES PROJECT
APPLICATION No. 4 TO AMEND ENVIRONMENTAL ASSESSMENT CERTIFICATE NO. E08-01

Amendment 4

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Prepared for:

BRITISH COLUMBIA
The Best Place on Earth

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SUMMARY

Pacific Trail Pipelines Management Inc. (PTP) is developing the Pacific Trail Pipelines Project (the Project or "PTP Project"). The approximately 472 km long pipeline will provide natural gas transmission service from Summit Lake to Kitimat, British Columbia. Potential environmental effects of the Project were identified in the Environmental Assessment Certificate (EAC) Application for the Kitimat – Summit Lake Natural Gas Pipeline Looping Project, October 2007 (2007 EAC Application). The Kitimat – Summit Lake Natural Gas Pipeline Looping Project is now called the PTP Project.

The original PTP Project EAC No. E08-01 (2008 EAC) was issued on June 26, 2008. PTP requested Amendment No. 1 for an increase in pipeline diameter from 36 inch to 42 inch, which was approved on April 10, 2012. Amendment No. 2, which was approved on August 9, 2012, was requested for a name change to PTP, the addition of a stockpile site and seven route amendments. Amendment No. 3, which was approved on July 31, 2013, requested amendments between kilometre maker (KM) 196.5 and the pipeline terminus in Kitimat. Amendment No. 3 included 54 route amendments, a change in the termination point and extra temporary workspaces including 9 multi-use sites and 5 stockpile sites.

PTP is requesting an additional amendment (No. 4) to EAC No. E08-01 pursuant to the British Columbia (BC) *Environmental Assessment Act,* to include the following amendments from KM 0.0 to KM 196.5. All of the proposed amendments are located outside of the study corridor (*i.e.*, the 100 m wide corridor studied in the approved 2008 EAC and Amendments 1, 2 and 3). Amendments in this application include the following.

- Pipeline route modifications to comply with landowner and tenure holder requests, to avoid potential geotechnical hazards, improve watercourse crossings and avoid or reduce adverse effects to wildlife, vegetation, aquatic and archaeological resources. The route modifications include:
  - 15 route refinements (route refinements are changes to the pipeline route that deviate from the 2007 EAC application's study corridor (100 m) by more than 100 m or that cross a different landform or land use type than the certified route. Any routing changes that affect major watercourse crossings are also considered to be a route refinement.); and
  - 12 minor route adjustments (minor route adjustments are small changes to the pipeline route associated with detailed engineering. These adjustments are located within 100 m of the study corridor, have similar landforms and land uses as the certified route, and do not require any changes at major watercourse crossings.).
- Clearing and potential grading of extra temporary workspace adjacent to the pipeline construction corridor to accommodate log storage during clearing, certain construction techniques (*e.g.*, horizontal directional drilling [HDD]), watercourse crossings, road crossings, pipeline crossings, sharp sidebends, difficult terrain or clearing of danger trees.
- Potential clearing and grading of a previously disturbed site near the pipeline corridor for a temporary stockpile site for uses such as a borrow pit, pipe and equipment storage as well as staging areas to reduce adverse environmental and social effects associated with increased traffic volumes during Project construction.
- Addition of a compressor station at Summit Lake.

This environmental effects assessment, like the effects assessment provided in the 2007 EAC Application, is a sustainability-based environmental assessment that considers five interconnected and interdependent "pillars" which are environment, economy, social, heritage, and health.

First Nations and Public Engagement

The proposed route changes are in the asserted traditional territory of the following First Nations and tribal organisations (based on the traditional territories used in the 2007 EAC Application):

- West Moberly First Nation;

- McLeod Lake Indian Band;
- Lheidli T'enneh Band;
- Carrier Sekani Tribal Council (on behalf of Nak'azdli Band, Saik'uz First Nation, Nadleh Whut'en Band, Stellat'en First Nation and Burns Lake Indian Band); and
- Nee Tahi Buhn First Nation.

PTP will engage First Nations to discuss these new amendments. PTP prepared a draft First Nation Engagement Plan that was submitted to the BC Environmental Assessment Office (BC EAO) in December 2013.

PTP has developed a program to notify members of the public whose interests may be affected by the amendments. A draft Public Consultation Plan was submitted to the BC EAO in December 2013. Individual tenure holders and landowners will continue to be contacted during 2013 and 2014.

Effects Assessment

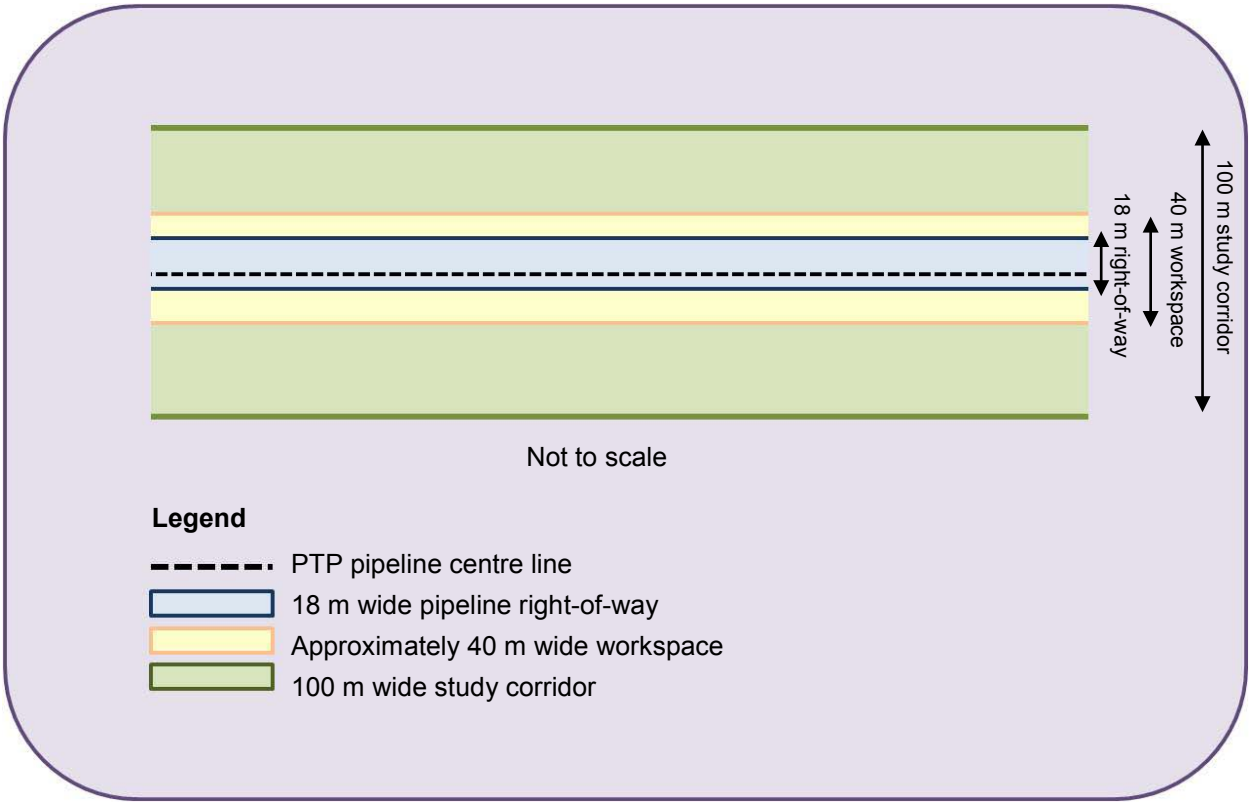
The methods used to assess the effects of the changes to the Project contained in this amendment application are similar to those used for the 2007 EAC Application (see Section 4 of this document).

Route Refinements and Minor Route Adjustments

The pipeline route changes are driven by numerous factors including meeting landowner or tenure holder requests, avoiding environmentally sensitive areas, improving watercourse crossings, constructability, avoiding geotechnical hazards and ensuring long-term pipeline integrity and safety.

A (100 m wide) study corridor was used for the Project in 2007 (see schematic drawing below). This study corridor contains the approximately 40 m wide construction corridor, which includes the 18 m wide statutory right-of-way and temporary workspace for pipeline construction. The proposed route amendments fall outside of the study corridor. Disciplines such as vegetation, wildlife, aquatics and socio-economics used a wider study corridor. The study corridors are further described in Section 4, Table 4.1.

Schematic Drawing of PTP Pipeline Route in the Study Corridor



Amendments to pipeline routing from the study corridor are defined below:

- **Route Refinements (RRs)** include changes to the pipeline route that deviate from the 2007 EAC Application's study corridor (100 m) by more than 100 m or that cross a different landform or land use type than the certified route. Any routing changes that affect major watercourse crossings are also considered to be a route refinement.

- **Minor Route Adjustments (MRAs)** include small changes to the pipeline route associated with detailed engineering. These adjustments are located within 100 m of the study corridor have similar landforms and land uses as the certified route, and do not require any changes at major watercourse crossings.

Most of the potential environmental effects identified in the 2007 EAC Application have not changed with the proposed route amendments. The proposed 15 route refinements and 12 minor route adjustments outlined in this application will not substantially change the Project footprint or the effects of the Project on the environment. The route amendments increase the overall length of the pipeline route by approximately 2.5 km. There are several environmental, geotechnical, land use, and constructability improvements expected in addition to ensuring long-term pipeline integrity and safety if the pipeline route amendments are certified.

The Scott and Fraser route refinements result in route length increases (of 0.7 km and 2.8 km, respectively) for the purpose of addressing landowner concerns. The South Tchesinkut route refinement reduces the route length by approximately 1.6 km while avoiding private lands.

A comparison of the expected effects of the 27 proposed route amendments relative to the certified route is provided in Tables 5.4 and 5.6. Fifteen route amendments have only beneficial and neutral effects on valued components compared to the certified route. Six of the route amendments have neutral effects

across all valued components. Five of the route amendments have a potential mitigable adverse effect that is countered by beneficial effects in other assessment categories. One route amendment is required to improve the location of a watercourse crossing, however, it results in neutral effects with one minor mitigable adverse effect (*i.e.*, alteration of archaeological and heritage resources).

For the amendments that were assessed to have a potential mitigable adverse effect on environment or heritage resources, these effects are offset by improvements in other assessment categories. For example, adverse effects on heritage values, such as removal of culturally modified trees, are balanced by beneficial environmental and economic effects, such as improvements to watercourse crossings and addressing landowner concerns.

A comparison between the certified route and the proposed route amendments is presented below and again in Tables 5.4 and 5.6. The baseline conditions, new potential effects and beneficial effects (or effects that were avoided as a result of the route amendments) were used in the comparison of the certified route to the proposed route amendments. This information is presented in Section 5.1 and summarised below.

An effects assessment of the route amendments was conducted. The following new potential residual effects were identified along portions of the amended route that did not occur along the same portion of the certified route:

- alteration of wetland habitat;
- clearing of riparian and floodplain forest and habitat features;
- clearing of mature and old coniferous forest;
- clearing of mature and old Douglas-fir forest;
- potential spread of invasive species to previously undisturbed area immediately after construction;
- loss or alteration of blue-listed plant community: mature black spruce, common horsetail and peat moss;
- permanent loss or alteration of archaeological and heritage resources within the Project footprint; and
- loss of a forest research plot.

The following beneficial effects were identified as a result of the proposed amendments:

- reduced potential of pipeline construction or operations impacting, or being impacted by, the high water table and decreased potential groundwater erosion; and potentially unstable slopes and soil erosion;
- improved creek crossings;
- improved highway and railway crossing;
- avoidance, or reduced amount, of private land crossed;
- avoidance of Agricultural Land Reserve (ALR) land crossed;
- reduced loss of maturing coniferous forest habitat and habitat features;
- reduced disturbance to wetlands;
- reduced effects on riparian habitat features including wildlife trees;

- reduced effects on moose and amphibian habitat;
- reduced effects on wildlife movement around Chinohchey Creek;
- avoidance of fish-bearing and nonfish-bearing watercourse crossings;
- reduced and avoided alteration of archaeological and heritage resources;
- avoidance of registered surface water points of diversion and their 200 m buffers;
- avoidance of water well locations and their 200 m buffers;
- avoidance of Visual Quality Objective (VQO) areas;
- reduced disruption of registered trapping tenure; and
- avoidance of the Ormond Lake Trail recreation site.

COMPARISON BETWEEN THE CERTIFIED ROUTE AND THE PROPOSED ROUTE AMENDMENTS

Proposed Amendment	Location	Rationale for Proposed Amendment	Assessment Category Comparison to Certified Project				
			Environmental	Social	Economy	Heritage	Health
Miller 1	KM 0.0 to KM 0.7	Minor route adjustment to improve constructability alignment through Miller Creek and the proposed Summit Lake Compressor Station site.	Neutral	Neutral	Neutral	Neutral	Neutral
Thorps 1	KM 2.0 to KM 2.8	Route refinement to remain adjacent to the Pacific Northern Gas (PNG) pipeline.	**Beneficial** – reduced clearing of mature coniferous forest habitat	Neutral	Neutral	Neutral	Neutral
Echo 1	KM 8.7 to KM 10.2	Route refinement to avoid a beaver dam pond and creek crossing as well as improve a creek crossing	**Beneficial** – improved creek crossings and reduced loss of maturing coniferous forest.	Neutral	Neutral	Neutral	Neutral
Salmon River Crossing No. 2	KM 20.4 to KM 21.9	Route refinement to improve Salmon River crossing and follow a forest service road (FSR).	Neutral	Neutral	Neutral	Neutral	Neutral
Salmon River Crossing No. 3	KM 30.8 to KM 33.3	Route refinement to avoid steep cut and fill on the river banks and ensure that the primary and contingency crossing methods can be accommodated.	Neutral	Neutral	Neutral	**Mitigable Adverse Effect** – alteration of protected archaeological and heritage resources and unprotected post-1846 culturally modified trees (CMTs).	Neutral
Crocker 1	KM 35.8 to KM 36.8	Route refinement to avoid wetland and improve crossing of Crocker Creek.	Neutral	Neutral	Neutral	Neutral	Neutral
Chief Lake FSR 1	KM 39.5 to KM 40.1	Minor route adjustment to improve the crossing of the FSR.	Neutral	Neutral	**Beneficial –** improved crossing of FSR.	Neutral	Neutral

Proposed Amendment	Location	Rationale for Proposed Amendment	Assessment Category Comparison to Certified Project				
			Environmental	Social	Economy	Heritage	Health
Shamrock	KM 54.5 to KM 54.8	Minor route adjustment to improve creek crossings when paralleling PNG.	**Beneficial** – improved creek crossings.	Neutral	Neutral	Neutral	Neutral
Scott	KM 56.3 to KM 71.6	Route refinement to avoid private land. The alignment is entirely on Crown land, avoiding all of the private land held by a family. The new alignment has fewer access roads to develop, crosses clear-cuts, improved crossing point of Chinohchey Creek and avoids a substantial amount of wet terrain encountered by the original PNG pipeline.	Neutral	**Beneficial** – avoidance of private land.	Neutral	Neutral	Neutral
East Stuart	KM 72.4 to KM 72.5	Minor route adjustment to improve creek crossing while paralleling the PNG pipeline.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral
Davidson 1	KM 75.1 to KM 76.5	Minor route adjustment to improve creek crossing and avoid encroaching wetland/swamp.	**Beneficial** – improved creek crossing and avoidance of encroachment on wetland habitat.	Neutral	Neutral	Neutral	Neutral
West Davidson	KM 77.8 to KM 78.4	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing and avoidance of wetland habitat feature.	Neutral	Neutral	Neutral	Neutral
Chico	KM 81.0 to KM 81.6	Minor route adjustment to avoid steep side hill cut alongside PNG pipeline.	Neutral	Neutral	Neutral	Neutral	Neutral
Breadalbane	KM 85.3 to KM 86.0	Route refinement to improve the creek crossing.	Neutral	Neutral	Neutral	Neutral	Neutral
New Road 51.5	KM 89.3 to KM 98.8	Route refinement around a steep creek crossing and to reduce grading.	**Beneficial** – improved creek crossing, reduced effect on riparian habitat features and maturing forest.	Neutral	Neutral	Neutral	Neutral
Rake	KM 96.5 to KM 96.6	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral
Wonder	KM 97.5 to KM 97.6	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral

Proposed Amendment	Location	Rationale for Proposed Amendment	Assessment Category Comparison to Certified Project				
			Environmental	Social	Economy	Heritage	Health
Fraser	KM 104.9 to KM 152.8	Route refinement to avoid private landowners and agricultural lands as requested by landowners.	**Mitigable Adverse Effect** – loss or alteration of plant community-at-risk but avoidance of five fish-bearing watercourses.	**Beneficial** – avoidance of private land, a recreation site, two VQOs as well as water wells and points of diversion and their 200 m buffers.	**Beneficial** – avoidance of ALR land, however, there is a loss of one forest research plot.	**Beneficial** – reduced alteration of protected archaeological and heritage resources and unprotected post-1846 historic resources.	Neutral
Stern Creek	KM 156.9 to KM 157.3	Route refinement to improve the creek crossing in difficult side hill terrain while paralleling the PNG pipeline.	**Beneficial** – reduced disturbance to wetlands and avoidance of disturbance to moose and migratory bird habitat. Improved creek crossing.	Neutral	Neutral	Neutral	Neutral
West Stern Creek	KM 157.5 to KM 157.5	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral
East Deserter Lake Road	KM 157.9 to KM 158.9	Route refinement to parallel an existing logging road and use a pre-existing footprint in side hill rock terrain.	Neutral	Neutral	Neutral	Neutral	Neutral
West Deserter Lake Road	KM 162.0 to KM 163.1	Minor route adjustment to the new high-grade FSR and improve constructability.	**Beneficial** – improved constructability.	Neutral	Neutral	**Mitigable Adverse Effect** – alteration of unprotected, post-1846 historic resource.	Neutral
Trois Ligne	KM 163.5 to KM 166.5	Route refinement to parallel the new high-grade FSR, improve highway and railway crossings, improve the Endako River crossing, to address landowner concerns, and improve the crossings of drainages and wet areas.	**Beneficial** – improved Endako River crossing and crossings of drainages and wetlands.	**Beneficial** – addressed landowner concerns.	Neutral	**Mitigable Adverse Effect** – increased alteration of unprotected post-1846 historic resources.	Neutral
McDowell	KM 170.1 to KM 172.0	Route refinement to avoid a large wetland.	**Beneficial** – avoidance of the Endako Marsh Lake complex; and reduced potential for adverse effects to wildlife habitat.	**Beneficial** – reduced private land crossed.	Neutral	Neutral	Neutral
Elliot	KM 173.9 to KM 176.5	Route refinement to stay upslope of a BC Hydro right-of-way and avoid as much of the BC Ministry of Transportation and Infrastructure (BC MoTI) gravel pit tenure as possible, as requested by BC MoTI.	Neutral	**Beneficial** – avoidance of water wells and their 200 m buffer.	**Beneficial -** addressed tenure holder concerns.	**Mitigable Adverse Effect** – alteration of unprotected post-1846 CMTs	Neutral

Proposed Amendment	Location	Rationale for Proposed Amendment	Assessment Category Comparison to Certified Project				
			Environmental	Social	Economy	Heritage	Health
West Sam Ross FSR	KM 177.3 to KM 177.4	Minor route adjustment to cross FSR at a minimum 70 degree angle.	Neutral	Neutral	**Beneficial** – improved FSR crossing.	Neutral	Neutral
South Tchesinkut	KM 182.8 to KM 193.8	Route refinement to avoid private land and reduce the amount of cultivated land crossed.	**Mitigable Adverse Effect –** increased potential effects to wildlife and wetland habitat as well as nonfish-bearing watercourses.	**Beneficial** – reduced private land crossed, and avoidance of water point of diversion and its 200 m buffer.	**Beneficial** – avoidance of ALR land.	**Beneficial** – avoidance of alteration of unprotected post-1846 historic resource.	Neutral

Notes: Neutral. No material change to the assessment of significant adverse effect.

Beneficial. The proposed amendment is expected to have a beneficial and advantageous effect compared to the certified route. (Note: Increased construction and material costs are considered to be beneficial to the local, regional, and national economy.)

Mitigable Adverse Effect. The proposed amendment may have an adverse effect compared to the certified Project, however, this effect can be mitigated.

Extra Temporary Workspace

Extra temporary workspace is defined as workspace required in addition to the approximately 40 m certified construction corridor described in the 2007 EAC Application. Extra temporary workspace within the (100 m) study corridor was assessed in the 2007 EAC Application. Therefore, this application will assess only the extra temporary workspace required outside of the study corridor. Extra temporary workspace generally extends outside the study corridor between 5 m and 20 m beyond the study corridor. A total area of approximately 35 ha of extra temporary workspace is required outside of the study corridor

The 2008 EAC anticipated the need for a construction corridor wider than approximately 40 m and describes instances where additional workspace may be required. As stated in Section 2.2 of Part A of the Assessment Report (BC EAO 2008): “During pipeline construction, a wider right-of-way will be required to accommodate ditch material, pipe and construction equipment, difficult terrain and unique construction activities (*e.g.,* HDD).”

The locations of extra temporary workspace have been selected to reduce adverse environmental effects while ensuring safety during construction. Where practical, extra temporary workspace will take advantage of existing disturbances and clearings. Extra temporary workspace will be located outside of the riparian reserve zones to comply with the *Oil and Gas Activities Act*.

The locations of extra temporary workspace are identified on the orthoimagery maps presented in Appendix A. Mitigation measures outlined in the 2007 EAC Application will be implemented to reduce or avoid adverse effects to identified features. Pre-construction surveys will be conducted by wildlife, vegetation, and aquatics professionals to identify and flag environmentally sensitive features prior to construction. Following construction, extra temporary workspace will be restored in accordance with the PTP Restoration Plan.

There are no material changes to the impacts, mitigation or residual effects identified in the 2007 EAC Application as a result of the extra temporary workspaces (PTP 2007).

Temporary Facilities (Stockpile Site)

During the advanced design work that has been conducted for the Project, one additional stockpile site has been identified. This temporary facility is required along the pipeline route for the purpose of storing pipe, equipment, and materials prior to transporting it to the right-of-way as well as for staging areas required during construction of the Project and as a borrow pit. The 2007 EAC Application anticipated the need for additional sites for temporary use. As stated in Section 4.4.6.3 of the 2007 EAC Application: “Other suitable previously disturbed sites may also be considered, such as current industrial sites (gravel pits, industrial yards, etc.).”

This additional temporary stockpile site along the pipeline route will reduce driving requirements within the Regional Study Area (RSA), which will in turn reduce potential wildlife encounters, and other safety risks associated with extra driving, particularly in areas of rough terrain.

An effects assessment of the temporary stockpile site was conducted. The following potential residual effects were identified:

- minor mixing of topsoil or root zone material with subsoil;
- minor and localised instabilities that may occur in fill materials and the alteration of local topography resulting from site grading;
- minor loss of topsoil or root zone material until a vegetated cover is established;
- increase in vehicle emissions in the Local Study Area (LSA) during construction;
- dust arising from construction traffic; and
- introduction of invasive species.

The identified potential residual effects of the temporary facilities were assessed to be less than significant.

Summit Lake Compressor Station

The original design proposed in the 2007 EAC Application was to transport natural gas from an LNG import facility at Kitimat to the Spectra Energy Transmission pipeline facilities at Summit Lake, the design called for the installation of a mid-point compressor station to enable the required throughput of natural gas. This compressor station was sited at the hydraulic mid-point of the pipeline south of Burns Lake and just east of Highway 97. Based on the current design, the PTP Project requires initiating compression at Summit Lake to move natural gas from Summit Lake to Kitimat.

An effects assessment of the proposed Summit Lake compressor station was conducted. The methods used to assess the effects of the changes to the compressor station contained in this amendment document are similar to those used for the original 2007 EAC Application. Air and noise studies are currently being conducted for the proposed compressor station. The results of the studies will be submitted to the BC EAO in January 2014. Additional effects to the following valued components may be identified based on the results of those studies: atmospheric environment as well as human health and safety.

The following residual effects were identified:

- minor mixing of topsoil or root zone material with subsoil;
- clearing of mature and old coniferous forest habitat;
- spread of invasive species to previously undisturbed areas immediately after construction;
- construction phase disruption of commercial wildlife and nature-based operations;
- construction phase increase in local and regional business activity;
- increase in local employment during construction of compressor station;
- purchase of goods and services from local communities during compressor station operation; and
- long-term payments to municipal and provincial bodies.

Cumulative Effects

A detailed cumulative effects assessment (CEA) was completed in 2007 to evaluate changes to the environment that are caused by the Project in combination with other past, present and reasonably foreseeable future human actions. The results of this CEA, presented in Section 8 of the 2007 EAC Application, will not be changed by the addition of 15 route refinements and 12 minor route adjustments. The proposed amendments are located within the RSA of that CEA, described in Section 4, Table 4.1. The amendments will result in a marginal increase in pipeline right-of-way from KM 0 to KM 196.5 (approximately 2.5 km or 1.2%). However, the amendments are proposed to meet landowner or tenure holder requests, reduce impact to environmentally sensitive areas, improve constructability, avoid geotechnical hazards, and ensure long-term pipeline integrity and safety, which will reduce potential adverse effects located within the RSA compared to the certified Project.

The 2007 CEA for the Project concluded that the most important adverse terrestrial, aquatic and social cumulative effects in the RSA are habitat alteration associated with mountain pine beetle infestation, salvage logging and forest conversion for agricultural, residential, transportation and industrial uses. Incremental increases due to the Project, as originally proposed, and considering all the amendments applied for, will contribute to regional and sub-regional cumulative effects risk, however, these Project-specific effects are comparatively small in extent.

A CEA of the temporary facility site was conducted for the LSA of each site. Residual effects identified from the use of the temporary facilities for the Project were combined with past, present and potential future disturbances in the LSA of each site to identify potential cumulative effects. Mitigation measures were proposed to reduce or avoid potential effects. The following potential residual cumulative effects were identified:

- increase in vehicle emissions in the medium-term;
- increase in dust arising from construction traffic in the medium-term; and
- spread of invasive plant species.

All identified potential residual cumulative effects were assessed to be less than significant as described in Section 7.4.

A CEA of the Summit Lake compressor station is currently underway. Results of the effects assessment will be submitted to the BC EAO December 2013.

Conclusion

The majority of environmental effects identified in the 2007 EAC Application will not change as a result of the proposed amendments. No significant adverse effects were identified as related to the proposed amendments. Furthermore, it is anticipated that the proposed route amendments will result in fewer adverse effects to land use, watercourses, wildlife habitat, and geotechnical conditions than the certified route, if they are approved.

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LIST OF ABBREVIATIONS

ALR	Agricultural Land Reserve
BC	British Columbia
BC EAO	British Columbia Environmental Assessment Office
BC MoFR	British Columbia Ministry of Forests and Range (2007 acronym)
BC MoFLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
BC MoTI	British Columbia Ministry of Transportation and Infrastructure
BEC	Biogeoclimatic Ecosystem Classification
BVLD	Bulkley Valley Lake District
CEA	cumulative effects assessment
CEAA	*Canadian Environmental Assessment Act*
CMT	culturally modified tree
EAC	Environmental Assessment Certificate
EMP	Environmental Management Plan
ETWS	extra temporary workspace
FSR	Forest Service Road
HCA	*Heritage Conservation Act*
HDD	horizontal directional drill
KM	kilometre mark
LNG	liquefied natural gas
LRMP	Land and Resource Management Plan
LSA	Local Study Area
MRA	minor route adjustment
OCP	Official Community Plan
OGC	Oil and Gas Commission
PNG	Pacific Northern Gas
PTP	Pacific Trail Pipelines
RR	route refinement
RSA	Regional Study Area
SBS	Sub-boreal Spruce
SBSmk	Sub-boreal Spruce moist cool biogeoclimatic zone
SCADA	System Control and Data Acquisition
VQO	Visual Quality Objective

GLOSSARY OF TERMS

Baseline condition	A baseline condition is the current state of an environmental setting for a particular component of the Project. This environmental reference point will aid in determining potential environmental effects and will be used when comparing future environmental conditions and potential project effects.
Compressor station	A facility that pressurises natural gas to facilitate throughput in a pipeline.
Cumulative effects	The *Canadian Environmental Assessment Act (CEAA)* defines cumulative effects as changes to the environment caused by an action, including projects or activities, combined with human actions of the past, present, and future.
Environmental effect	The *CEAA* defines it in respect of a project: • any change that the Project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*; and • any effect of any change referred to in the paragraph above on: – health and socio-economic conditions; – physical and cultural heritage; – the current use of lands and resources for traditional purposes by aboriginal persons; – any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; or • any change to the Project that may be caused by the environment, whether any such change or effect occurs within or outside Canada.
Extra temporary workspace	Extra workspace outside of the approximately 40 m construction corridor to accommodate difficult terrain, watercourse crossings, log storage during clearing, or certain construction techniques.
Kilometre mark	Location reference points spaced approximately 1 km apart. KMs follow the flow of the product, with KMs increasing from Summit Lake to Kitimat.
Local Study Area	The LSA consists of a 1 km buffer centred on the pipeline right-of-way (*i.e.,* 1 km on either side of the pipeline) and a 1 km buffer surrounding multi-use and stockpile sites. The LSA captures most direct and indirect effects of Project activities and facilities. This is the zone of influence within which plants (50 m), animals (500 m) and humans (500-800 m) are most likely to be affected by Project construction and operation. The width of the LSA may vary somewhat depending on the specific resource in question. For example, wildlife studies will expand to a 50 km buffer, where necessary, to ensure potential effects on elements such as grizzly bear movement are captured or a larger downstream area may be studied at major river crossings to assist with mitigation/compensation planning.
Material change	A change to the assessment criteria ratings (*i.e.,* spatial context, duration, frequency, reversibility, magnitude and probablility of occurrence) used to make a determination of significance.
Mature forest	KM 0 to KM 196.5 is located within the Sub-Boreal Spruce Biogeoclimatic Ecosystem Classification (BEC) vegetation zone. Within this vegetation zone “mature” forest is defined as 100 to 140 years old (Westland Resource Group Inc. [Westland] 2007, Ministry of Agriculture and Lands 2007).
Maturing forest	Maturing forest is below the age category for “mature” and has some features of a mature forest, such as self thinning (coarse woody debris starting to build up) and multi-height canopy starting to form.
Mitigation	The *CEAA* defines mitigation as the elimination, reduction or control of the adverse environmental effects of the Project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.
Modified	Modified is one of the five levels used to define a VQO, as defined in the Visual Impact Assessment Guidebook (BC Ministry of Forests 2001). Modified indicates that landscape alteration activities are visually dominant, but have characteristics that appear natural.
Multi-use site	A land area used for multiple purposes that can include storing pipe and equipment or as a camp to provide temporary accommodation for pipeline construction crews.
Non-classified drainage	A watercourse with a continuous channel less than 100m in length.

Old forest	KM 0 to KM 196.5 is located within the Sub-Boreal Spruce BEC vegetation zone. Within this vegetation zone "old" forest is defined as greater than 140 years old (Westland 2007, Ministry of Agriculture and Lands 2007).
Old Growth Management Area	Defined areas that contain, or are managed to attain, specific structural old-growth attributes and that are delineated and mapped as fixed areas (BC Forest Practices Board 2012).
Partial Retention	Partial Retention is one of five levels used to define a VQO, as defined in the Visual Impact Assessment Guidebook (BC Ministry of Forests 2001). Partial Retention indicates that the landscape alteration activities are visible, but remain subordinate.
Pipeline	In the case of PTP, a line that is used for the transmission of natural gas.
Preservation	Preservation is one of five levels used to define a VQO, as defined in the Visual Impact Assessment Guidebook (BC Ministry of Forests 2001). A Preservation VQO indicates that the objective is to have no visual activities.
Project	*CEAA* definition: In relation to physical work, any proposed construction, operation, modification, decommissioning, abandonment or other undertaking in relation to that physical work, or any proposed physical activity not relating to a physical work that is prescribed or is within a class of physical activities that is prescribed pursuant to regulations made under paragraph 59(b).
Project footprint	The Project footprint study area is made up of the area directly disturbed by clearing, construction and clean-up activities, including associated physical works and activities (*i.e.,* permanent right-of-way, temporary workspace, temporary access routes, temporary stockpile sites, temporary staging areas, construction work camp, off-load areas, borrow pits, and facility sites).
Proponent	*CEAA* definition: In respect of a project, means the person, body, federal authority, or government that proposes the Project.
Protected archaeological and heritage resources	Cultural materials which pre-date A.D. 1846 are protected by the *Heritage Conservation Act* of BC.
Regional Study Area	The RSA includes relevant portions of the Traditional Territories of affected First Nations as well as local communities most likely to experience socio-economic effects of the Project (*e.g.,* Kitimat, Terrace, Houston, Burns Lake, Fraser Lake, Vanderhoof, Summit Lake, and Prince George). The RSA for the CEA is approximately 15 km on both sides of the pipeline centre line (total width 30 km). For the socio-community topics, the RSA will include municipalities where Project effects on employment, services, housing, and infrastructure might be felt *(e.g.,* Prince George, Vanderhoof, Fraser Lake, Burns Lake, Smithers, Terrace, and Kitimat).
Residual effects	Residual effects remain after mitigation is applied.
Right-of-way	Land in which the pipeline owner has permanent, however, limited rights to construct, operate and maintain the pipeline.
Riparian	Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water.
Significant residual effect	A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.
Species at risk	An Extirpated, Endangered, or Threatened Species or a species of special concern as per the *Species at Risk Act.*
Stockpile site	A land area used for storing pipe and construction materials.
Study corridor	The 100 m wide corridor studied in the 2007 EAC Application (and approved in 2008 EAC), and 2011 and 2012 EAC Amendment Applications (approved in Amendments 1, 2 and 3).
Temporary workspace	Land where the pipeline owner has obtained a limited right of use for pipeline construction purposes and where the right will expire after a specified period of time, or by a specific date.
Topsoil	Uppermost layer of soil, containing the highest concentration of organic matter and microorganisms.
Unprotected archaeological and heritage resources	Cultural materials that post-date the year 1846, the arbitrary cut-off for full protection under the Act. Most CMT features, as well as historic camps and cabin remains are not protected under the current BC *Heritage Conservation Act.* These resources are also referred to as historic.
Viewshed	An area of land, water, and other environmental elements that is visible from a fixed vantage point.

Visual Quality Objective	A VQO, as defined in the Visual Impact Assessment Guidebook (BC Ministry of Forests 2001), is a resource management objective that reflects the desired level of visual quality based on the physical characteristics and social concern in the area. The objectives are established by the district manager, or are contained in a higher-level plan.
Wetland	Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activities that are adapted to a wet environment (National Wetlands Working Group definition).
Wetland riparian classifications	Wetlands have five riparian classes based on whether the wetland is a simple wetland or wetland complex, wetland size, and biogeoclimatic unit in which the wetland occurs. W1 to W4 are simple wetlands while W5 is a wetland complex (BC Ministry of Forests 1995)
Wildlife tree	A standing live or dead tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife.

1.0 INTRODUCTION AND PURPOSE

Pacific Trail Pipelines Management Inc. (PTP) is requesting an amendment to the Environmental Assessment Certificate (EAC) No. E08-01 pursuant to the British Columbia (BC) *Environmental Assessment Act* to include the following amendments, which are located outside of the study corridor, from kilometre marker (KM) 0.0 to KM 196.5 (the Project). The study corridor is defined as the 100 m wide corridor studied in the EAC Application (2007 EAC Application) as well as 2011 and 2012 Amendment Applications (Amendments 1, 2 and 3) (see Figure 3). Amendments in this application include the following.

- Pipeline route modifications are proposed to meet landowner or tenure holder requests; avoid environmentally sensitive areas; avoid geotechnical hazards; improve constructability; and ensure long-term pipeline integrity and safety. The route modifications include 15 route refinements and 12 minor route adjustments (see Section 2.1).
- Clearing and potential grading of extra temporary workspace (ETWS) adjacent to the pipeline construction corridor to accommodate log storage during clearing, certain construction techniques (*e.g.*, horizontal directional drill [HDD]), watercourse crossings, road crossings, pipeline crossings, sharp sidebends, clearing of danger trees or difficult terrain.
- Clearing and potential grading of previously disturbed site near the pipeline corridor for temporary uses such as pipe and equipment storage, borrow pits and staging areas to reduce adverse environmental and social effects associated with increased traffic volumes during Project construction. One new temporary stockpile site is proposed in this application.
- Addition of a compressor station at Summit Lake.

An overview of the Project area is provided in Figure 1.

This environmental assessment, similar to the effects assessment contained in the 2007 EAC Application, is a sustainability-based environmental assessment that considers the following five interconnected and interdependent “pillars” identified by the BC Environmental Assessment Office (BC EAO): environment, economy, social, heritage and health.

The following sections of the Application for an EAC Amendment provide a description of the proposed amendments and how they differ from the certified Project. This report also includes an assessment of valued components during the construction, operations and decommissioning phases of the Project. Potential environmental effects of the Project were identified in the 2007 EAC Application. The effects assessment in this application identifies new potential effects that were not identified on the certified route. Potential effects that are unchanged from the 2007 EAC Application are not identified. A full assessment for the new temporary facility is provided.

This application is presented in 9 sections. Section 2 contains a description of the proposed amendments. The Project commitments contained in the 2008 EAC are reviewed in light of the proposed amendments in Section 3. Section 4 contains the Environmental Assessment methods. An assessment of the potential effects, residual effects and cumulative effects of the route amendments are presented in Section 5. An assessment of the effects of ETWS is provided in Section 6. Section 7 provides an assessment of the effects of the stockpile site. An effects assessment of the Summit Lake Compressor Station is provided in Section 8. References are provided in Section 9. A set of 1:20,000 orthoimagery maps that identify the locations of the proposed amendments and a watercourse crossing table are provided in the appendices at the end of this application.


NISAGA'A MEMORIAL LAVA BED
SEVEN SISTERS
Skeena Stikine Forest District
Bulkley River
BABINE MOUNTAINS
GRANISLE
Fort St. James Forest District
Kalum Forest District
SMITHERS
TELKWA
Babine Lake
RUBYROCK LAKE
CARP LAKE
Prince George Forest District
TERRACE
FORT ST. JAMES
SUTHERLAND RIVER
Stuart Lake
SUMMIT LAKE
KM 0.0
KM 025
KM 050
KM 075
KM 100
KM 125
KM 150
KM 175
KM 200
KM 225
KM 250
KM 275
KM 300
KM 325
KM 350
KM 375
KM 400
KM 425
KM 450
KM 464
TAZDLI WYIEZ BIN / BURNIE-SHEA
HOUSTON
BURNS LAKE
BURNIE RIVER P.A.
Section 1 and 2
KM 0 - KM 196.5
KITIMAT
ATNA RIVER
MORICE LAKE
FRASER LAKE
VANDERHOOF
STUART RIVER LOWER
Francois Lake
Nadina Forest District
Skeena Forest Region
Omineca Forest Region
Vanderhoof Forest District
PRINCE GEORGE
Nechako River
Omineca
Ootsa Lake
TWEEDSMUIR
Chilako River
Skeena
ENTIAKO
TWEEDSMUIR
North Island - Central Coast Forest District
Quesnel Forest District
QUESNEL
Cariboo
Cariboo Forest Region
FRASER
Figure 1
Location of the PTP Project
PACIFIC TRAIL PIPELINES
Certified PTP Pipeline Route
Proposed PTP Pipeline Route
Community
Road
Railway
Watercourse
Waterbody
Parks and Protected Areas
City/Town Municipal Boundary
Ministry of Environment Regions
Ministry of Forests, Lands and Natural Resource Operations
Forest Regions
Forest Districts
Base mapping: Government of British Columbia; Geopolitical Boundaries: Government of British Columbia 2011; Parks and Protected Areas: Government of British Columbia, 2013;
Pipeline Route Information, Proposed: Pacific Trail Pipelines, Nov. 13 and Dec. 5, 2012; Apr. 10, 2013.
KM Markers: Pacific Trail Pipelines, May 2011.
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.
tera ENVIRONMENTAL CONSULTANTS
SCALE 1: 1,700,000
0 15 30 60
Kilometres
(All Locations Approximate)
N
November 2013
Projection: BC Albers
W8323_PTP_pol_bnd.mxd

2.0 PROPOSED AMENDMENTS

PTP proposes a number of amendments to its EAC including changes to the pipeline route, the addition of ETWS for constructing the Project, and an additional stockpile site to be used for staging and stockpiling materials, and a borrow pit. These amendments and their potential for adverse effects are assessed in this amendment application.

2.1 Route Refinements and Minor Route Adjustments

Proposed amendments to the pipeline route have resulted from PTP's detailed constructability assessments, which were completed from 2011 to 2013. These investigations identified the proposed amendments to avoid environmentally sensitive areas, avoid geotechnical hazards, improve constructability and ensure long-term pipeline integrity and safety. Route changes also resulted from feedback received from First Nations, landowners, tenure holders and the public during various PTP-led engagement programs.

Amendments to the pipeline route are defined as being located outside of the study corridor centred on the certified pipeline centre line. The route amendments are classified into two categories.

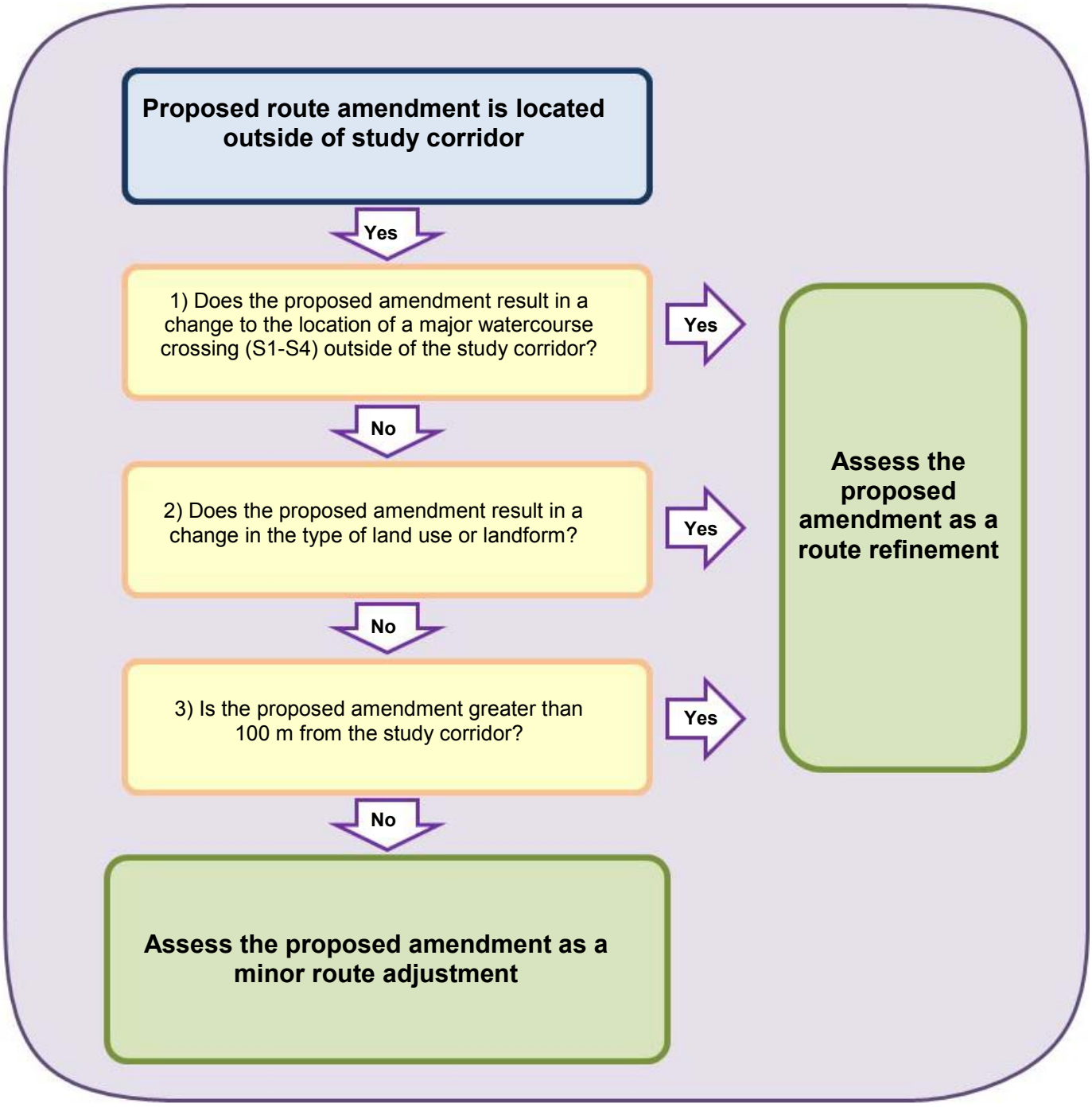
- **Route Refinements (RRs)** include changes to the pipeline route that deviate from the study corridor by more than 100 m or that cross a different landform or land use type than the certified route. Any routing changes that move the location of a major watercourse crossing to outside the study corridor are also considered to be a route refinement.

- **Minor Route Adjustments (MRAs)** include small changes to the pipeline route associated with detailed engineering. These adjustments are located within 100 m of the study corridor, have similar landforms and land uses as the certified route, and do not move a major watercourse crossing to outside of the study corridor.

A flow diagram used to determine whether a pipeline route is considered to be a route refinement or a minor route adjustment is presented in Figure 2.

The route refinements increase the route length by approximately 2.5 km and the length difference for minor route adjustments is negligible (*i.e.*, less than 0.1 km difference), resulting in an increase to the overall route length by approximately 2.5 km.

Figure 2 Flow Diagram of the PTP Route Amendment Classification and Decision Criteria



2.2 Extra Temporary Workspace

ETWS is needed to accommodate log storage during clearing, watercourse crossings, certain construction techniques (*e.g.,* HDD), road crossings, pipeline crossings, sharp sidebends, clearing of danger trees and difficult terrain. The ETWS will be located adjacent to and additional to the approximately 40 m wide construction corridor or Project footprint, as described in the 2007 EAC Application. Work space, in addition to the approximately 40 m construction corridor, was anticipated in the 2008 EAC, however, areas located outside the study corridor were not assessed.

2.3 Stockpile Site

During the detailed design work that has been conducted for the Project from 2011 to 2013, one additional temporary stockpile site has been identified. This temporary site is required for the purpose of storing pipe, equipment and materials prior to transporting it to the right-of-way, as staging areas, and borrow pits during pipeline construction. Additional temporary sites along the route substantially reduce driving requirements and the safety risks associated with extra driving, particularly in areas of rough and extreme terrain. During public and stakeholder engagement sessions, PTP repeatedly heard concerns regarding increased traffic associated with Project construction.

2.4 Compressor Station

PTP is requesting the addition of a compressor station at Summit Lake. The project description provided in Section 8 provides details of the proposed changes to support the environmental assessment of the reconfigured site and facility.

The original design proposed in the 2007 EAC Application was to transport natural gas from a Liquefied Natural Gas (LNG) import facility at Kitimat to the Spectra Energy Transmission pipeline facilities at Summit Lake, the design called for the installation of a mid-point compressor station to enable the required throughput of natural gas. This compressor station was sited at the hydraulic mid-point of the pipeline south of Burns Lake and just east of Highway 97. Based on the current design, the PTP Project requires initiating compression at Summit Lake to move natural gas from Summit Lake to Kitimat.

3.0 IMPLICATIONS FOR PROJECT COMMITMENTS IN THE ENVIRONMENTAL ASSESSMENT CERTIFICATE

A total of 539 specific commitments have been made by PTP for various phases of the Project. Compliance with these commitments is a condition of the EAC. The proposed amendments do not change or diminish PTP's Project-related commitments.

The minor route adjustments identified in this application are generally small realignments that are needed to improve constructability, whereas most of the proposed route refinements contained in this application have been identified in response to Project commitments contained in the 2007 EAC Application. For example, PTP made the following commitment to resolve private landowner concerns:

> *"...PTP commits to consult with private landowners to determine and resolve any concerns associated with clearing, construction, and restoration activities."* (EAC Commitment No. 8.37)

The proposed route refinements would meet several other EAC commitments, including the following:

> *"...PTP commits to undertake additional terrain stability investigations and geotechnical work as part of the project design following certification. Should areas of instability be identified, they will be subject to further geotechnical investigations, which may lead to engineering design solutions or local route adjustments"* (EAC Commitment No. 1.2 and No. 3.68).

> *"...PTP commits to examine alternative methods or locations for a stream crossing if unsuitable soils (e.g., marine clays) are encountered at the crossing site."* (EAC Commitment No. 3.24)

> *"...PTP commits to minimise the removal of vegetation and the disturbance of soil adjacent to wetlands and to conduct grading adjacent to wetlands away from the wetland to extent practical to reduce the risk of sediment and other material entering the wetland"* (EAC Commitment No. 4.46 and 4.30).

> *"...PTP commits to minimise clearing in mature and old forest habitats."* (EAC Commitment No. 4.74; No. 4.56, 5.22 and 5.25 are similar commitments)

> *"...PTP commits to reduce clearing in mature and old riparian, mature and old floodplain, and mature and adjacent old coniferous forests, whenever practical, in order to mitigate effects on fisher."* (EAC Commitment No. 5.33)

The EAC commitment type met by each of the route refinements is provided in Table 3.1.

TABLE 3.1

MATRIX OF ROUTE REFINEMENTS AND COMMITMENTS ADDRESSED

Name	Location	Commitment type				
		Terrain Stability and Geotechnical Concerns	Improve Watercourse Crossings, Alignment, and HDD Feasibility	Wetland Protection	Reduce Clearing of Mature and Old Forest Habitats or Riparian Areas	Landowner Requests or Land Use Issues
Thorps 1	KM 2.0 to KM 2.8				X	
Echo 1	KM 8.7 to KM 10.2		X	X		
Salmon River Crossing No. 2	KM 20.4 to KM 21.9		X			
Salmon River Crossing No. 3	KM 30.8 to KM 33.3	X	X			
Crocker 1	KM 35.8 to KM 36.8		X	X		
Scott	KM 56.3 to KM 71.6					X
Breadalbane	KM 85.3 to KM 86.0		X			
New Road 51.5	KM 89.3 to KM 89.8	X	X			
Fraser	KM 104.9 to KM 152.8					X

TABLE 3.1 Cont'd

Name	Location	Commitment type				
		Terrain Stability and Geotechnical Concerns	Improve Watercourse Crossings, Alignment, and HDD Feasibility	Wetland Protection	Reduce Clearing of Mature and Old Forest Habitats or Riparian Areas	Landowner Requests or Land Use Issues
Stern Creek	KM 156.9 to KM 157.3	X	X			
East Deserter Lake Road	KM 157.9 to KM 158.9	X				
Trois Ligne	KM 163.5 to KM 166.5		X	X		X
McDowell	KM 170.1 to KM 172.0			X		
Elliot	KM 173.9 to KM 176.5					X
South Tchesinkut	KM 182.8 to KM 193.8					X

4.0 METHODS OF ENVIRONMENTAL ASSESSMENT

This amendment application considers each proposed change to the 2008 certified Project as well as the 2011 and 2012 certified amendments and identifies and analyses potential adverse effects resulting from clearing, construction, restoration, operations, maintenance, decommissioning and abandonment that are different from the effects assessed for the certified Project. For each potential effect, appropriate mitigation measures are described and potential residual effects that remain after mitigation are identified.

The methods used to assess the effects of the changes to the Project description contained in this amendment document are similar to those used to complete the impact assessment included in the 2007 EAC Application. However, in 2013, the BC EAO added "context" in relation to sensitivity and resilience as an assessment criteria for the significance of residual effects. The assessment criteria used for the evaluation of significance for this assessment are outlined in Table 4.1.

The proposed amendments have been assessed to determine whether or not there is a material change to the approved Project. For the purposes of this assessment, "material change" has been defined as a change to the assessment criteria ratings (*i.e.,* spatial context, duration, frequency, reversibility, magnitude and probablility of occurrence) used to make a determination of significance (Table 4.1).

A sustainability-based five pillar effects assessment was conducted to determine if the proposed amendments are beneficial, neutral, or adverse when compared to the 2008 certified Project as well as the 2011 and 2012 certified amendments. Valued components are divided into environmental, social, economic, heritage, and health categories for evaluation. Table 4.2 presents the five pillar approach. A summary of expected effects of the requested amendments, evaluated by valued component category (*i.e.*, the five pillars), is presented in Tables 5.4 and 5.6.

A 100 m wide study corridor was used for the Project in 2007, which includes an 18 m wide statutory right-of-way within an approximately 40 m wide construction corridor (Figure 3). Disciplines such as vegetation, wildlife, aquatics, and socio-economics studied a wider area (Table 4.1).

TABLE 4.1

ASSESSMENT CRITERIA USED FOR THE EVALUATION OF SIGNIFICANCE OF ENVIRONMENTAL EFFECTS

Assessment Criteria		Definition
Spatial Context – Location of Effect		
Project footprint		The Project footprint is the land area directly disturbed by assessment, construction, and clean-up activities, including associated physical works and activities (*i.e.,* permanent right-of-way, temporary construction workspace, temporary access route, temporary stockpile site, temporary staging area, facility sites).
Local		The Local Study Area (LSA) is defined as a 1 km buffer centred on the pipeline right-of-way (*i.e.,* 1 km on either side of the pipeline). The LSA captures most direct and indirect effects of Project activities and facilities. This is the zone of influence within which plants (50 m), animals (500 m) and humans (500-800 m) are most likely to be affected by Project construction and operation. The width of the LSA may vary somewhat depending on the specific resource in question. The LSA for the stockpile site and compressor station is a 1 km buffer from the edge of the sites.
Regional		The Regional Study Area (RSA) is broad enough to include those communities in the study region that may be affected economically (*e.g.,* jobs, accommodation) or socially (*e.g.,* hospitals, police).
Temporal Context – of the Event and Residual Effect		
Duration (interval of the event causing the residual effect)	Immediate	Event duration is limited to less than or equal to 2 days.
	Short-term	Event duration is longer than 2 days but less than or equal to 1 year.
	Medium-term	Event duration is longer than 1 year but less than or equal to 5 years.
	Long-term	Event duration extends longer than 5 years.

TABLE 4.1 Cont'd

Assessment Criteria		Definition
Frequency (how often would the event that caused the residual effect is anticipated to occur)	Accidental	Event occurs rarely over assessment period and does not occur under normal conditions.
	Isolated	Event is confined to a specific period (*e.g.,* construction period; less than or equal to <10% of the assessment period).
	Occasional	Event occurs intermittently and sporadically (*e.g.,* animal mortalities on road ways, and ground disturbance from unscheduled maintenance; estimated 10-15% of the assessment period).
	Periodic	Event occurs intermittently but repeatedly over the construction and operations period (*e.g.,* mowing during routine maintenance activities; routine aerial patrols; estimated >15% but <80% of the assessment period).
	Continuous	Event occurs continually over the assessment period (*e.g.,* noise at compressor station; estimated >80% of the assessment period).
Reversibility (period of time over which the residual effect extends)	Immediate	Residual effect is alleviated in less than or equal to 2 days.
	Short-term	Greater than 2 days but less than or equal to 1 year to reverse residual effect.
	Medium-term	Greater than 1 year but less than or equal to 5 years to reverse residual effect.
	Long-term	Greater than 5 years to reverse residual effect.
	Permanent	Residual effect is irreversible.
Magnitude – of the Residual Effect[1]		
Negligible		Residual effect is not detectable.
Low		Potential residual effect is detectable but well below established or derived environmental standards or thresholds.
Medium		Potential residual effect is detectable but in established or derived environmental and/or regulatory standards or thresholds.
High		Potential residual effect is beyond established or derived environmental standards or thresholds, or management plans for the indicator are being considered.
Probability of Occurrence – Likelihood of Residual Effect Happening		
High		Is expected to occur.
Low		Is not expected to occur.
Level of Confidence – Degree of Certainty Related to Significance Evaluation		
Low		Determination of significance based on incomplete understanding of cause-effect relationships and or incomplete data pertinent to the Project area.
Moderate		Determination of significance based on good understanding of cause-effect relationships using data from outside the Project area or incompletely understood cause-effect relationships using data pertinent to the Project area.
High		Determination of significance based on good understanding of cause-effect relationships and data pertinent to the Project area.
Context – of the Residual Effect		
Context refers to the extent a valued component has previously been affected, either naturally or anthropogenically, and to the sensitivity and resiliency of the area to current activities, as well as how these characterisations could change with respect to the Project. In this application, context in regards to residual effects will be examined by determining the sensitivity and resilience of baseline conditions of areas affected by the Project, and by determining if changes could potentially occur from Project activities.		
Significance – of the Residual Effect[2]		
Significant		A high probability of occurrence of a residual effect that cannot be avoided or mitigated, having a combination of characteristics that render it unacceptable to the public, regulators, other interests, or that exceeds standards or contravenes legal requirements.
Less than significant		All other impacts.

Notes: 1 In consideration of magnitude, there are no environmental standards, guidelines, or objectives for many of the construction/operation issues under evaluation. Therefore, the determination of magnitude of the residual effect often entails professional judgment and an historical consideration of the assessment of magnitude made by regulators, land authorities, lessees, other stakeholders, and the assessment team to adverse effects.

2 Significant Residual Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated.

PTP will make a determination of impact significance, however, it is understood that the BC EAO has the responsibility of determining significance under the BC *Environmental Assessment Act*.

Figure 3 Schematic Drawing of PTP Pipeline Route in the Study Corridor

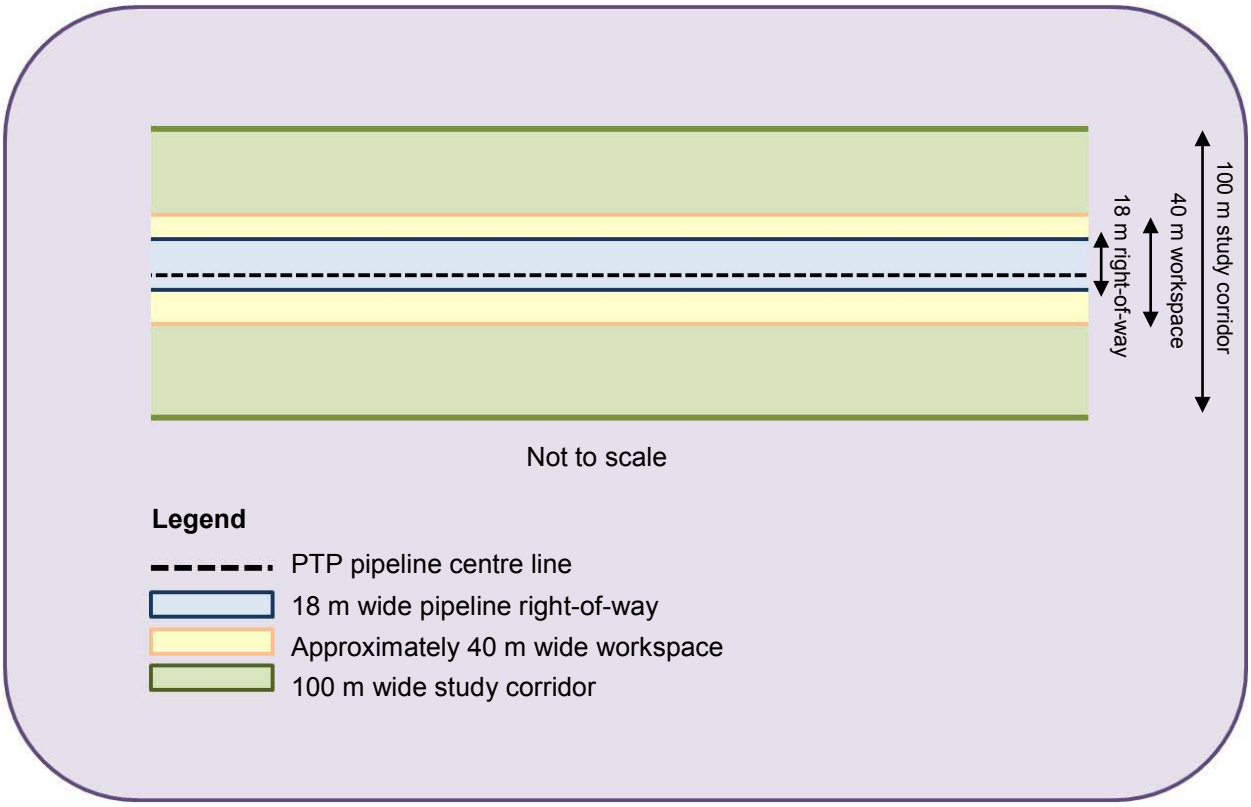


TABLE 4.2

THE FIVE PILLARS OF IMPACT EFFECTS ASSESSMENT

Environmental	Social	Economic	Heritage	Health
Valued Ecosystem Components	Valued Social Components	Valued Economic Components	Valued Archaeological and Heritage Component	Valued Health and Safety Component
• Geophysical environment • Atmospheric environment • Aquatic environment • Terrestrial environment (vegetation, wildlife, and wildlife habitat) • Species and ecosystems at risk	• First Nations community and land use • Navigable waters • Aesthetics and viewsheds • Community and regional infrastructure and services • Land and resource use*	• Land and resource use* • Employment and economy	• Archaeological and heritage resources	• Human health and safety

Note: * Land and resource use can be considered both a social and economic impact depending on the specific circumstances.

5.0 ENVIRONMENTAL ASSESSMENT OF PIPELINE ROUTE AMENDMENTS

The pipeline route amendments addressed in this application occur within KM 0.0 to KM 196.5, as shown on Maps 01 to 31 in Appendix A. The area is located in the Interior Plateau of British Columbia with elevations ranging between approximately 800 m and 1,500 m above sea level. The area is generally characterised by flat and gently rolling terrain with numerous wetlands, rivers and lakes. An assessment of 15 route refinements and 12 minor route amendments is provided in this section.

5.1 Route Refinements

A summary of the location, net change in length from the certified route, First Nation traditional territories crossed (based on the traditional territories used in the 2007 EAC Application) and rationale for the route refinements is provided in Table 5.1. As presented in Table 3.1 (Matrix of Route Refinements and Commitments Addressed), most route refinements are proposed to improve watercourse crossings, avoid wetlands and address landowner and tenure holder concerns. The Scott and Fraser route refinements result in route length increases (of 0.7 km and 2.8 km, respectively) in order to address landowner concerns. The South Tchesinkut route refinement reduces the route length by approximately 1.6 km while avoiding private lands.

The following section provides a summary of the differences in baseline conditions between each proposed route refinement and the certified route in relation to each valued component (see Table 4.2). There are several valued components where there is no change in baseline conditions and, therefore, no discussion of that component is provided. In addition to discussing the differences, this section will also present the rationale for the proposed route refinements. Potential effects associated with each route refinement are also listed. References to the location of mitigation measures in the 2007 EAC Application for the potential effects are presented in Table 5.2.

TABLE 5.1

SUMMARY OF ROUTE REFINEMENTS

Name	Location	Net Length Difference from Certified Centre Line (m)	First Nation Traditional Territory*	Rationale
Thorps 1	KM 2.0 to KM 2.8	-29	McLeod Lake Indian Band, West Moberly First Nations	Route refinement to remain adjacent to the Pacific Northern Gas (PNG) pipeline.
Echo 1	KM 8.7 to KM 10.2	-35	McLeod Lake Indian Band, West Moberly First Nations	Route refinement to avoid wetlands and a creek crossing as well as improve a creek crossing.
Salmon River Crossing No. 2	KM 20.4 to KM 21.9	+81	Lheidli-T'enneh First Nation, Carrier Sekani Tribal Council (Nak'azdli Band)	Route refinement to improve Salmon River crossing and follow a Forest Service Road (FSR).
Salmon River Crossing No. 3	KM 30.8 to KM 33.3	+153	Lheidli T'enneh First Nation, Carrier Sekani Tribal Council (Nak'azdli Band)	Route refinement to avoid steep cut and fill on the river banks and ensure that the primary and contingency crossing methods can be accommodated.
Crocker 1	KM 35.8 to KM 36.8	+22	Lheidli T'enneh First Nation, Carrier Sekani Tribal Council (Nak'azdli Band)	Route refinement to avoid wetland and improve crossing of Crocker Creek.
Scott	KM 56.3 to KM 71.6	+705	Lheidli T'enneh First Nation, Carrier Sekani Tribal Council (Nak'azdli Band)	Route refinement to avoid private land. The alignment is entirely on Crown land, avoiding all of the private land held by a family. The new alignment has fewer access roads to develop, crosses clear-cuts, improved crossing point of Chinohchey Creek and avoids a substantial amount of wet terrain encountered by the original PNG pipeline.
Breadalbane	KM 85.3 to KM 86.0	-28	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation, Nadleh Whut'en Band)	Route refinement to improve the creek crossing.
New Road 51.5	KM 89.3 to KM 89.8	-75	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation, Nadleh Whut'en Band)	Route refinement around a steep creek crossing and to reduce grading.

TABLE 5.1 Cont'd

Name	Location	Length Difference from Certified Centre Line (m)	First Nation Traditional Territory*	Rationale
Fraser	KM 104.9 to KM 152.8	+2,780	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation, Nadleh Whut'en Band, Stellat'en First Nation)	Route refinement to avoid private lands and agricultural properties, as requested by the landowners.
Stern Creek	KM 156.9 to KM 157.3	+27	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation)	Route refinement to improve the creek crossing in difficult side hill terrain while paralleling the PNG pipeline.
East Deserter Lake Road	KM 157.9 to KM 158.9	-46	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation)	Route refinement to parallel an existing logging road and use a pre-existing footprint in side hill rock terrain.
Trois Ligne	KM 163.5 to KM 166.5	+355	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation), Nee Tahi Buhn Band	Route refinement to parallel the new high-grade FSR, improve highway and railway crossings, improve the Endako River crossing, address landowner concerns, and improve the crossings of drainages and wet areas.
McDowell	KM 170.1 to KM 172.0	+104	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation, Burns Lake Band), Nee Tahi Buhn Band	Route refinement to avoid a large wetland.
Elliot	KM 173.9 to KM 176.5	+14	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation, Burns Lake Band), Nee Tahi Buhn Band	Route refinement to stay upslope of a BC Hydro right-of-way and avoid as much of the BC Ministry of Transportation and Infrastructure (BC MoTI) gravel pit tenure as possible, as requested by BC MoTI.
South Tchesinkut	KM 182.8 to KM 193.8	-1,565	Carrier Sekani Tribal Council (Stellat'en First Nation, Burns Lake Band), Nee Tahi Buhn Band	Route refinement to avoid private land and reduce the amount of cultivated land crossed.

Note: * As per 2007 EAC Application.

Thorps 1 (KM 2.0 to KM 2.8)

The rationale for the proposed “Thorps 1” route refinement is to move the alignment adjacent to the existing PNG right-of-way rather than an access road. This route refinement is approximately 30 m shorter than the certified route. The move results in a decrease in the area of new cut and decreases the distance through peat soil and a high water table by 60 m. No material change was identified for the other valued components.

There are no new potential effects associated with this route refinement.

Potential benefits associated with this route refinement include:

- reduced potential for pipeline construction or operations impacting, or being impacted by, the high water table and decreased potential groundwater erosion; and
- reduced clearing of mature coniferous forest habitat features as a result of a shorter alignment.

Echo 1 (KM 8.7 to KM 10.2)

The rationale for the proposed “Echo 1” route refinement is to avoid a beaver dam pond and a creek crossing as well as improving another creek crossing. The refinement shortens the overall route by approximately 35 m.

The proposed route refinement avoids crossing a beaver dam pond and decreases workspace that would be located in riparian habitat as well as mature coniferous forest habitat. The proposed alignment crosses two clear-cuts. Within one clear-cut (near KM 10) there is a strip of maturing forest that buffers a creek. In addition, single mature (80 to 140 year old) Douglas-fir trees remain in the clear-cuts.

There are no new potential effects associated with this route refinement. Potential benefits associated with this route refinement include reduced loss of maturing coniferous forest.

Salmon River Crossing No. 2 (KM 20.4 to KM 21.9)

The rationale for the proposed "Salmon River Crossing No. 2" route refinement is to improve the Salmon River crossing and follow a FSR. This alignment is approximately 80 m longer than the certified route.

The proposed route refinement is approximately 120 m farther from the unstable slopes on the west and east approach slopes to the Salmon River. The proposed alignment avoids mature cottonwood and mixed riparian habitat with high wildlife value located on the east bank. It also decreases the line of sight, which is beneficial to prey species. The proposed alignment crosses several different vegetation features than does the certified route, including: two swamps (wetland riparian classifications W4 and W5); a cutblock; a young regenerating coniferous forest; and an old hybrid spruce tree patch located on the west bank of the river.

The proposed route alignment crosses 20 m more Agricultural Land Reserve (ALR) land than does the certified route.

There are no new potential effects associated with this route refinement.

A potential benefit associated with this route refinement includes a reduced possibility of pipeline construction or operations impacting, or being impacted by potentially unstable slopes and soil erosion on both approach slopes to the Salmon River.

Salmon River Crossing No. 3 (KM 30.8 to KM 33.3)

The rationale for the proposed "Salmon River Crossing No. 3" route refinement is to avoid a steep cut and fill on the river banks and to ensure that the primary and contingency crossing methods are accommodated. This alignment is approximately 155 m longer than the certified route.

The proposed route refinement avoids potentially unstable slopes on the right bank of the Salmon River. Avoiding the unstable slopes will also avoid cliff nesting migratory birds. New vegetation features on the proposed alignment include a large, disturbed wetland complex (W5) and a swamp (W5) in the floodplain channels.

The Salmon River Crossing No. 3 route refinement will avoid one nonfish-bearing (S6) watercourse crossing.

The proposed alignment crosses a lithic scatter that is protected under the *Heritage Conservation Act* (*HCA*) as well as six historic culturally modified trees (CMTs) that are not protected under the *HCA* (post-1846).

New potential effects associated with this route refinement include:

- in the case of an HDD failure and implementation of an open cut pipeline installation method, loss of old cottonwood trees may result;
- alteration or disturbance to wetlands located in floodplain channels; and
- alteration of archaeological and heritage resources.

Potential benefits associated with this route refinement include:

- reduced potential of pipeline construction or operations impacting, or being impacted by, potentially unstable slopes and soil erosion on the right (south) approach slope to the Salmon River;
- reduced loss of maturing coniferous forest;

- avoidance of cliff-nesting migratory bird habitat; and
- avoidance of one nonfish-bearing watercourse crossing.

Crocker 1 (KM 35.8 to KM 36.8)

The rationale for the proposed "Crocker 1" route refinement is to avoid a wetland and improve the crossing of Crocker Creek. This alignment is approximately 20 m longer than the certified route.

The proposed route refinement avoids an area of groundwater discharge and the potentially unstable slope on the left (north) bank of Crocker Creek. On the east side of the creek a wide floodplain area used by moose is avoided by the new alignment. Old Douglas-fir will be cleared on the west side of the creek. The proposed Crocker 1 route refinement will cross one additional nonfish-bearing (S6) watercourse.

A new potential effect associated with this route refinement includes the potential loss of old Douglas-fir trees.

Potential benefits associated with this route refinement include:

- reduced potential of pipeline construction or operations impacting, or being impacted by, potentially unstable slopes and soil erosion on the left (north) approach slope to Crocker Creek; and
- benefit to moose habitat by avoiding floodplain area.

Scott (KM 56.3 to KM 71.6)

The rationale for the proposed "Scott" route refinement is to avoid private land. It also requires the development of fewer access roads and improves the crossing of Chinohchey Creek. This alignment is approximately 705 m longer than the certified route.

At the time of submitting this amendment application, no terrain mapping, LiDAR data or geophysical field reconnaissance along the proposed Scott route refinement was available. Based on the information that is available for the certified route, the Scott route refinement may avoid the potentially unstable slopes on the east and west approach slopes of Steep Creek 4 at KM 57 and slopes in the vicinity of Chinohchey Creek, near KM 62 and KM 64.

The proposed alignment results in a reduced amount of new cut. This alignment exhibits upland characteristics, is mostly cleared and relatively dry. The proposed alignment locates the Chinohchey Creek crossing in an area that has previously been disturbed. Most of the proposed alignment is through recent clear-cuts and young regenerating forests that include mixed, maturing forest patches and retention areas. One forested swamp (W4) is crossed.

The proposed alignment crosses three additional fish-bearing watercourses and one additional nonfish-bearing watercourse.

The Scott route refinement is located entirely on Crown land, whereas the certified route crossed 8.5 km private land. There is one additional mineral tenure along the proposed alignment.

New potential effects associated with this route refinement include a loss of mature and old Douglas-fir trees in retention areas.

Potential benefits associated with this route refinement include:

- avoidance of private lands;
- reduced loss of mature coniferous forest;
- reduced effects on moose and amphibian habitat; and

- reduced effects on wildlife movement around Chinohchey Creek.

Breadalbane (KM 85.3 to KM 86.0)

The rationale for the proposed "Breadalbane" route refinement is to improve a creek crossing, which results in a reduction of the length of the route by approximately 30 m.

The new alignment decreases the disturbance to mature coniferous forest habitat and increases the buffer between the right-of-way and Breadalbane Lake. A W4 marsh with open water pools is located within the workspace on the east side of the proposed alignment.

There are no new potential effects associated with this route refinement.

A potential benefit associated with this route refinement includes an improved creek crossing.

New Road 51.5 (KM 89.3 to KM 89.8)

The rationale for the proposed "New Road 51.5" route refinement is to avoid a steep creek crossing and reduce grading. The proposed alignment is approximately 75 m shorter than the certified route.

The proposed route refinement parallels the PNG right-of-way, crossing young regenerating forest. The proposed alignment avoids crossing wetland habitat near the confluence of two creeks. This alignment avoids one nonfish-bearing (S6) watercourse.

New potential effects associated with this route refinement include:

- potential spread of invasive plants due to weeds currently present on the adjacent PNG right-of-way.

Potential benefits associated with this route refinement include:

- reduced effect on riparian habitat features including wildlife trees;
- reduced loss of maturing forest; and
- avoidance of one nonfish-bearing watercourse.

Fraser (KM 104.9 to KM 152.8)

The rationale for the proposed "Fraser" route refinement, which is 2.8 km longer than the certified route, is primarily to avoid private and agricultural lands, as requested by the landowners. Additional rationale for the route refinement includes the avoidance of environmental features and compliance with government and community requests. Portions of the route refinement improve creek crossings, avoid wet areas, parallel a new logging road, and avoid steep side hill and rock terrain. Other portions of the route refinement avoid a future gravel pit on a BC MoTI tenure near KM 127 and satisfy the Fraser Lake community request to relocate the pipeline farther away from the PNG pipeline.

The proposed route refinement avoids several potentially unstable gullies and slopes at KM 118.8, KM 120.2, around Kluk Creek (KM 121 to KM 122), Steep Creek 3A (KM 123.6), KM 138.3 and Steep Creek 3 gully (KM 139.2). Approximately 100 m of terrain with a high water table is traversed from KM 127 to KM 138.1. At the time of submitting this amendment application no terrain mapping, LiDAR data or geophysical field reconnaissance was available along a portion of the proposed route refinement from KM 139.8 to KM 152.8. However, based on the information available for the certified route in this area, the Fraser route refinement may also avoid the potentially unstable slopes associated with Steep Creek 2 (KM 142.6) and in the vicinity of Steep Creek 1 (KM 143 to KM 144.5).

The proposed Fraser route refinement avoids agricultural land. In avoiding the agricultural land, the proposed alignment crosses more maturing and mature coniferous forests with Douglas-fir and subalpine fir, several clear-cuts, regenerating forests, and new mature riparian habitat around Nine Mile Creek than

the certified route. The Fraser route refinement crosses six additional wetlands, including swamps and marshes, that each have W5 riparian classifications.

The proposed route encounters a provincially blue-listed bog community (from approximately KM 127.6 to KM 127.9) of mature black spruce, common horsetail and peat moss. Changes in hydrology and a loss of tree cover, that will increase light availability and temperature, will alter species composition. PTP proposed another route option, which only encountered the edge of this blue-listed bog community, however, the proposed route crossed a BC MoTI tenure for which permission was denied by BC MoTI.

The proposed alignment avoids five fish-bearing watercourses and two nonfish-bearing watercourses.

The Fraser route refinement crosses one additional protected trail. However, the route refinement crosses one fewer protected lithic scatter, avoids one protected grave marker and one legacy status CMT, crosses one fewer historic trap, approximately 800 fewer historic CMTs, and avoids one heritage trail and three unprotected, historic cabin/homesteads.

Four additional forest research plots are crossed by the Fraser route refinement. However, only one plot (plot 66-1-1G, at UTM 10 392467E 5997199N) is of concern to BC Ministry of Forests, Lands and Natural Resource Operations (BC MoFLNRO). The alignment crosses 23.6 km less ALR land, avoids the Ormond Lake Trail recreation site, crosses two fewer Crown land notations, avoids water wells and points of diversion by more than 200 m, and avoids two Visual Quality Objectives (VQOs) (one Modified and one Partial Retention).

New potential effects associated with this route refinement include:

- alteration to a mature wetland plant community-at-risk (provincially blue-listed bog community of mature black spruce, common horsetail and peat moss); and
- loss of one forest research plot.

Potential benefits associated with this route refinement include:

- avoidance of private lands;
- avoidance of ALR land;
- reduced potential of pipeline construction or operations impacting or being impacted by potentially unstable slopes, gullies and soil erosion;
- avoidance of five fish-bearing watercourses and two nonfish-bearing watercourses;
- reduced number of identified archaeological and heritage resources as well as historic features;
- avoidance of registered surface water points of diversion and their 200 m buffers; avoidance of water well locations and their 200 m buffers;
- avoidance of two VQO areas; and
- avoidance of the Ormond Lake Trail recreation site.

Stern Creek (KM 156.9 to KM 157.3)

The rationale for the proposed “Stern Creek” route refinement is to improve the creek crossing in difficult side hill terrain while paralleling the PNG pipeline. This alignment is approximately 25 m longer than the certified route.

The proposed route refinement avoids crossing the south end of a W4 wetland, which provides high value habitat for moose and nesting migratory birds.

No new potential effects have been identified for this route refinement.

Potential benefits associated with this route refinement include:

- reduced disturbance to a wetland; and
- avoidance of disturbance to high value moose and nesting migratory bird habitat.

East Deserter Lake Road (KM 157.9 to KM 158.9)

The rationale for the "East Deserter Lake Road" route refinement is to parallel an existing logging road and use an existing footprint in a side hill rock terrain. This route refinement is approximately 45 m shorter than the certified route.

The new alignment parallels a forestry service road and crosses clear-cut and retention areas that were not crossed by the certified route, which crossed young second growth clear-cut forest.

No new potential effects are associated with this route refinement.

The associated benefit with the proposed refinement is reduced disturbance and improved geotechnical conditions resulting from paralleling an existing linear disturbance in side hill rock terrain.

Trois Ligne (KM 163.5 to KM 166.5)

The rationale for the proposed "Trois Ligne" route refinement is to parallel the new high-grade FSR, address landowner concerns, improve highway and railway crossings, improve the Endako River crossing, and improve the crossings of drainages and wet areas.

The proposed alignment now crosses an historic, unprotected, cabin/homestead and six additional historic, unprotected CMTs.

The proposed alignment crosses 0.4 km more private land than the certified route.

There are no new potential effects associated with this route refinement.

Potential benefits associated with this route refinement include:

- addressed private landowner issues;
- improved watercourse crossing; and
- improved highway and railway crossing.

McDowell (KM 170.1 to KM 172.0)

The rationale for the proposed "McDowell" route refinement is to avoid Endako Marsh Lake complex. This route refinement would lengthen the route by approximately 105 m.

The proposed route refinement avoids encroaching on the Endako Marsh Lake complex, which is an important habitat for moose, amphibians, migratory birds, raptors and a variety of mammal species.

The proposed alignment crosses 0.5 km more Crown land and 0.3 km less private land. There is one additional registered trapping tenure along the proposed alignment.

There are no new potential effects associated with this route refinement.

Potential benefits associated with this route refinement include:

- avoidance of the Endako Marsh Lake complex;
- reduced potential for adverse effects to important wildlife habitat; and

- reduced amount of private land crossed.

Elliot (KM 173.9 to KM 176.5)

The rationale for the proposed "Elliot" route refinement is to stay upslope of the BC Hydro right-of-way and reduce potential effect to the BC MoTI gravel pit tenure, as requested by BC MoTI. This alignment would lengthen the route by approximately 15 m.

The proposed alignment crosses eight new historic, unprotected, CMTs located at two sites.

The proposed alignment crosses 80 m more Crown land and 70 m less private land. The proposed alignment would result in the route being over 200 m away from three water wells, whereas the certified route was within the 200 m buffer of the wells.

There are no new potential effects associated with this route refinement.

Potential benefits associated with this route refinement include:

- reduced amount of private land crossed; and
- avoidance of water well locations including their 200 m buffers.

South Tchesinkut (KM 182.8 to KM 193.8)

The rationale for the proposed "South Tchesinkut" route refinement is to avoid private land and reduce the amount of cultivated land crossed. This route refinement would shorten the route by approximately 1.6 km.

At the time of submitting this amendment application, no terrain mapping, LiDAR data or geophysical field reconnaissance along the South Tchesinkut route refinement was available. Based on the information available for the certified route, the South Tchesinkut route refinement traverses potentially unstable slopes located at KM 184.8 and at KM 190.7.

The proposed route refinement crosses Tchesinkut Creek in an area with fewer wildlife habitat features than the certified route. However, the alignment parallels the creek wildlife movement corridor in some areas. The proposed alignment also crosses recent clear-cuts and four wetlands (one W3, two W4 and one W5). The proposed route crosses six additional nonfish-bearing (S6) watercourses. The proposed alignment avoids crossing an historic cabin/homestead.

The proposed alignment crosses 0.4 km less Crown land and 1.2 km less private land. This alignment avoids 5.1 km of ALR land. A forest research plot and aggregate pits are avoided by the proposed alignment. The alignment also avoids one grazing lease, one registered trapping tenure and one Crown land notation. The proposed alignment is over 200 m away from registered surface water points of diversion.

There are no new potential effects associated with this route refinement.

Potential benefits associated with this route refinement include:

- reduced amount of private land crossed;
- reduced ALR land crossed;
- avoided an historic resource;
- reduced interruption of registered trapping tenure; and
- avoidance of registered surface water points of diversion and their 200 m buffers.

5.1.1 Summary of New Potential Effects and Mitigation Measures for the Route Refinements

A summary of new potential effects, associated mitigation measures and residual effects for each valued component identified on the route refinements is provided in Table 5.2.

TABLE 5.2

NEW POTENTIAL EFFECTS SUMMARY AND MITIGATION MEASURES FOR THE ROUTE REFINEMENTS

Potential Effect	Location	Mitigation Measures	Potential Residual Effects
Valued Component: Geophysical Environment			
The route refinements have not resulted in any material change to the impacts, mitigation or residual effects for the clearing, construction and restoration, operations and maintenance, and decommissioning and abandonment identified in Tables 7.2-1 to 7.2-3, and Section 7.2.1.3 of the 2007 EAC Application (PTP 2007).			
Valued Component: Atmospheric Environment			
The route refinements have not resulted in any material change to the impacts, mitigation or residual effects for the clearing, construction and restoration, operations and maintenance, and decommissioning and abandonment identified in Tables 7.2-4, 7.2-5, 7.2-8 and 7.2-9 and Section 7.2.2.3 of the 2007 EAC Application (PTP 2007).			
Valued Component: Aquatic Environment			
A net gain of four nonfish-bearing watercourses and a net loss of two fish-bearing watercourses have been identified due to the route refinements. This is not considered a material change to the impacts, mitigation or residual effects for the clearing, construction and restoration, operations and maintenance, and decommissioning and abandonment identified in Tables 7.2-10 to 7.2-12 and Section 7.2.3.3 of the 2007 EAC Application (PTP 2007).			
Valued Component: Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation			
Alteration of wetland habitat	Salmon River Crossing No. 3 (KM 30.8 to KM 33.3)	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007). Additional mitigation measures, not identified in 2007, include the following: • Schedule construction to occur during dry or frozen ground conditions.	Wetland habitat will be altered.
Alteration of wetland hydrologic function and wetland water quality	Salmon River Crossing No. 3 (KM 30.8 to KM 33.3)	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007).	With the implementation of mitigation measures, no residual effects have been identified.
Alteration of mature and old riparian and floodplain forest	In the case of an HDD failure: Salmon River Crossing No. 3 (KM 30.8 to KM 33.3) Fraser (KM 104.9 to KM 152.8)	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007).	Clearing of riparian and floodplain forest and habitat features.
Alteration or loss of mature to old Douglas-fir forest	Crocker 1 (KM 35.8 to KM 36.8); Scott (KM 56.3 to KM 71.6)	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007).	Clearing of mature and old Douglas-fir forest.
Spread of invasive plants	New Road 51.5 (KM 89.3 to KM 89.8)	• PTP will implement the mitigation measures for the "introduction, and acceleration of the spread of invasive plants" identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007).	Spread of invasive species to previously undisturbed area immediately after construction.
Valued Component: Species and Ecosystems at Risk			
Loss or alteration of blue-listed plant community: mature black spruce, common horsetail and peat moss	Fraser KM 127.6 to KM 127.9	• PTP will implement the mitigation measures identified for the "loss or alteration of rare plants and rare plant communities" in Table 7.2-17 of the 2007 EAC Application (PTP 2007).	Loss or alteration of blue-listed plant community: mature black spruce, common horsetail and peat moss.

TABLE 5.2 Cont'd

Potential Effect	Location	Mitigation Measures	Potential Residual Effects
Valued Component: Archaeological and Heritage Resources			
Alteration to archaeological and heritage resources	Salmon River Crossing No. 3 (KM 30.8 to KM 33.3); Fraser (KM 104.9 to KM 152.8); Trois Ligne (KM 163.5 to KM 166.5); Elliot (KM 173.9 to KM 176.5)	• PTP will implement the mitigation measures identified in Table 7.2-21 of the 2007 EAC Application (PTP 2007)	Permanent loss or alteration of archaeological and heritage resources within the Project footprint.
Valued Component: First Nations Community and Land Use			
The route refinements have not resulted in any material change to the impacts, mitigation or residual effects for clearing, construction and restoration; operations and maintenance; and decommissioning and abandonment identified in Tables 7.2-23 to 7.2-26 and Section 7.2.7.3 of the 2007 EAC Application (PTP 2007).			
Valued Component: Land and Resource Use			
Loss of forest research plot	Fraser (KM 104.9 to KM 152.8)	Additional mitigation measures, not identified in 2007, include the following: • Based on discussions with BC MoFLNRO from October 30 to November 1, 2013, PTP has been given permission to cross the forest research plot. BC MoFLNRO has requested that PTP engage a Ministry-approved inventory consultant for a full detailed review of the site to address BC MoFLNRO's concerns.	Loss of forest research plot.
Valued Component: Community and regional infrastructure services			
The route refinements have not resulted in any material change to the impacts, mitigation or residual effects for clearing, construction and restoration, operations and maintenance, and decommissioning and abandonment identified in Tables 7.2-31 to 7.2-32 Section 7.2.9.2 and Section 7.2.9.3 of the 2007 EAC Application (PTP 2007).			
Valued Component: Employment and Economy			
The route refinements have not resulted in any material change to the impacts, mitigation or residual effects for clearing, construction and restoration; operations and maintenance; and decommissioning and abandonment identified in Tables 7.2-33 to 7.2-36 and Section 7.2.10.3 of the 2007 EAC Application (PTP 2007).			
Valued Component: Human Health and Safety			
The route refinements have not resulted in any material change to the impacts, mitigation or residual effects for clearing, construction and restoration; operations and maintenance; and decommissioning and abandonment identified in Tables 7.2-37 to 7.2-40 and Section 7.2.11.3 of the 2007 EAC Application (PTP 2007).			
Valued Component: Navigable Waters			
The route refinements have not resulted in any material change to the impacts, mitigation or residual effects for clearing, construction and restoration, operations and maintenance, and decommissioning and abandonment identified in Table 7.2-41 and Section 7.2.12 of the 2007 EAC Application (PTP 2007).			
Valued Component: Aesthetics and Viewsheds			
Several new Partial Retention VQO areas have been identified along the route refinements but have not resulted in any material change to the impacts, mitigation or residual effects for clearing, construction and restoration; operations and maintenance; and decommissioning and abandonment identified in Tables 7.2-42 to 7.2-44 and Section 7.2.13.3 of the 2007 EAC Application (PTP 2007).			

An assessment of the significance of the identified residual effects is provided in Table 5.3. The determination of significance has not changed from the 2007 EAC Application.

TABLE 5.3

SIGNIFICANCE OF RESIDUAL EFFECTS FOR THE ROUTE REFINEMENTS

Potential Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Valued Component : Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation								
Wetland habitat will be altered.	Project footprint on Salmon River Crossing No. 3	Medium-term	Isolated	Medium-term	Low	High	High	Less than significant

TABLE 5.3 Cont'd

Potential Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Clearing of riparian and floodplain forest and habitat features.	Project footprint on Salmon River Crossing No. 3 and Fraser	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Clearing of mature and old Douglas-fir forest.	Project footprint on Crocker 1 and Scott	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Spread of invasive species to previously undisturbed areas immediately after construction.	Project footprint to LSA on New Road 51.5	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Valued Component : Species and Ecosystems at Risk								
Loss of blue-listed plant community: mature black spruce, common horsetail and peat moss.	Project footprint on Fraser	Long-term	Isolated	Long-term	Medium	High	High	Less than significant
Valued Component : Archaeological and Heritage Resources								
Permanent loss or alteration of archaeological and heritage resources within the Project footprint.	Project footprint on Salmon River Crossing No. 3, Fraser, Trois Ligne, Elliot	Long-term	Isolated	Permanent	Low	High	High	Less than significant
Valued Component : Socio-economic Components								
Loss of forest research plot.	Project footprint on Fraser	Long-term	Isolated	Permanent	Medium	High	High	Less than significant

Context Discussion in Relation to the Significance of Residual Effects

In 2013 the BC EAO added "context" in relation to sensitivity and resilience as an assessment criteria for the significance of residual effects. This information is not easily presented in a table (as in Table 5.3 where the other criteria for the significance of residual effects are assessed). A discussion of context for each of the identified residual effects is presented in the text that follows.

Wetland Habitat will be Altered

Sensitivity of the function of wetland habitats and habitat features varies among wetland types and is dependent on the vegetation, hydrology, reliance of local wildlife species on the particular feature or habitat attributes (*e.g.* rarity and importance to different life stages or seasonal survival rates), and the nature and timing of disturbance. Resilience is anticipated to be greater for shrub or sedge dominated wetlands as opposed to treed wetlands, and sensitivity is anticipated to decrease when construction activities are completed under frozen conditions as opposed to non-frozen conditions. Additionally, treed wetland habitats with limited buffer vegetation due to existing adjacent disturbance, such as roads and clear-cuts, are anticipated to be less resilient to project activities.

Clearing of Riparian and Floodplain Forest and Habitat Features

Sensitivity of the function of riparian and floodplain forest habitat and habitat features varies depending on the riparian vegetation and the reliance of local wildlife species on the particular riparian habitat, riparian habitat attributes (*e.g.*, rarity and importance to different life stages), the nature and timing of disturbance, and the age and type of vegetation community. Due to the active channel and existing disturbance (*e.g.*, forest harvest and agricultural lands) in and adjacent to the riparian area on the West side of Salmon River Crossing No. 3, the riparian and floodplain habitat is more sensitive and less resilient than riparian and floodplain habitat and habitat features associated with less active ephemeral drainages. Resilience is also anticipated to be greater for riparian area with vegetation communities that recover more rapidly such as shrub and willow dominated plant communities, while resilience is anticipated to be lower in riparian communities that have a longer recovery period such as later seral stage communities.

Clearing of Mature and Old Coniferous Forest

Sensitivity of mature and old coniferous forest habitat and habitat features varies among ecosystem type, patch size, reliance of local wildlife species on the particular habitat (*e.g.,* rarity and importance at the landscape level), and the nature and timing of disturbance. Areas of mature and old coniferous forest in the amended project corridor are fragmented due to historic and current forest harvest and road construction, which increases susceptibility to wind throw thereby increasing sensitivity and decreasing resilience of the patch. Wildlife use of old and mature conifer forest is also reliant on patch size and the level of fragmentation. Resilience is anticipated to be greater for larger patches of old coniferous forest habitat.

Clearing Of Mature and Old Douglas-Fir Forest

Sensitivity of mature and old Douglas-fir forest habitat is reliant on patch size, rarity and importance at the landscape level, and the nature and timing of disturbance. Mature and old coniferous forest contain living trees with cavities and root masses acceptable for nesting birds, and medium and small mammals. Due to forest harvest, mature and old Douglas-fir forests in the Project corridor are fragmented due to historic and current forest harvest and road construction, which increases susceptibility to wind throw thereby increasing sensitivity and decreasing resilience of the patch. Wildlife use of old and mature Douglas-fir forest is also reliant on patch size and the level of fragmentation. Resilience is anticipated to be greater for larger patches of mature and old Douglas-fir forest habitat in relatively unfragmented landscapes, while resilience is anticipated to be less for small patches in primarily clear-cut landscapes.

Spread of Invasive Species to Previously Undisturbed Areas Immediately After Construction

The sensitivity of previously undisturbed areas to the introduction of invasive species varies among locations and depends on the ecosystem type, existing nearby occurrences of invasive species, and nature and timing of Project activities. The resilience of previously undisturbed areas to invasive species is expected to be greater for areas with little to no nearby occurrences of invasive species and for areas with fast recovery of native vegetation, while resilience is anticipated to be lower in areas with nearby occurrences of invasive species and slower recovery of native vegetation.

Loss of Blue-Listed Plant Community: Mature Black Spruce; Common Horsetail; and Peat Moss

Sensitivity of the black spruce, common horsetail and peat moss plant community to project activities is high due to the potential alteration of local hydrology, vegetation clearing, and increased light penetration to the understory. Resilience of this plant community is anticipated to be low due to the small patch size and existing adjacent disturbance including roads and clear-cuts.

Permanent Loss or Alteration of Archaeological and Heritage Resources within the Project Footprint

The sensitivity of archaeological and heritage resources to permanent loss or alteration due to Project activities is assessed based on two factors: the loss of, or impacts to, the physical site; and the significance of the resource.

All archaeological sites and heritage resources within the Project corridor are subject to permanent loss or alteration. Therefore, all archaeological and heritage resources are highly sensitive to alteration or loss according to the first criteria.

Assessing the second criteria of sensitivity is much more subjective and is, therefore, based on professional judgment along with the consideration of information collected in the field. The significance of an archaeological or heritage resource is assessed from ethnic/cultural, scientific, public and economic perspectives. Therefore, site sensitivity will vary depending on the significance assessment from each of these perspectives. The sensitivity of the resources, will also factor in the current integrity of the sites, which may have already been impacted by previous development activities such as logging and road construction.

Archaeological and heritage resources are not resilient to change as they are a non-renewable, non-sustainable resource and their loss or disturbance due to Project activities will be permanent.

Although the physical sites located within the Project footprint will be impacted during the clearing and construction phases of development, the implementation of a mitigation strategy and preservation by record will assist in offsetting this loss and will contribute to the lasting archaeological record.

Loss of Forest Research Plot

Forest research plots were put in place by the BC MoFLNRO in a wide range of stand conditions and growth trajectories to gather data for growth and yield models. The forest research plots are important sites that allow the province to gather natural stand measurement over time (BC MoFLNRO 2013).

The context, sensitivity and resilience of the forest research program to the loss of one forest research plot impacted by the proposed Fraser route variant will depend on the value of the data provided by each site. PTP has been given permission to cross the forest research plot by the BC MoFLNRO and will pay for a full detailed review on the site by a Ministry-approved inventory consultant. This detailed review will provide PTP and BC MoFLNRO with an understanding of how this research plot fit into the greater context of the provincial forest research program.

5.1.2 Assessment Category Comparison of the Proposed Route Refinements to the Certified Route

A comparison of the expected effects of the proposed route refinements relative to the certified route is provided in Table 5.4. Six route refinements have both beneficial and neutral effects on valued components. Four of the route refinements have neutral effects across all valued components. One route refinement, Salmon River Crossing No. 3, will improve the location of a watercourse crossing; however, results in neutral effects with one minor mitigable adverse effect (*i.e.*, impact to protected lithic scatter and loss of historic, unprotected, CMTs). Four of the route refinements have a mitigable adverse effect that is countered by beneficial effects in at least one other assessment categories.

TABLE 5.4

COMPARISON OF THE PROPOSED ROUTE REFINEMENTS TO THE CERTIFIED ROUTE

Proposed Route Refinement	Location	Rationale for Proposed Route Refinement	Assessment Category Comparison to Certified Route				
			Environmental	Social	Economy	Heritage	Health
Thorps 1	KM 2.0 to KM 2.8	Route refinement to remain adjacent to the PNG pipeline.	**Beneficial** – reduced clearing of mature coniferous forest habitat	Neutral	Neutral	Neutral	Neutral
Echo 1	KM 8.7 to KM 10.2	Route refinement to avoid a beaver dam pond and creek crossing as well as improve a creek crossing.	**Beneficial** – improved creek crossings and reduced loss of maturing coniferous forest.	Neutral	Neutral	Neutral	Neutral
Salmon River Crossing No. 2	KM 20.4 to KM 21.9	Route refinement to improve Salmon River crossing and follow an FSR.	Neutral	Neutral	Neutral	Neutral	Neutral
Salmon River Crossing No. 3	KM 30.8 to KM 33.3	Route refinement to avoid steep cut and fill on the river banks and ensure that the primary and contingency crossing methods can be accommodated.	Neutral	Neutral	Neutral	**Mitigable Adverse Effect** – alteration of protected archaeological and heritage resources and unprotected post-1846 CMTs.	Neutral
Crocker 1	KM 35.8 to KM 36.8	Route refinement to avoid wetland and improve crossing of Crocker Creek.	Neutral	Neutral	Neutral	Neutral	Neutral

TABLE 5.4 Cont'd

Proposed Route Refinement	Location	Rationale for Proposed Route Refinement	Assessment Category Comparison to Certified Route				
			Environmental	Social	Economy	Heritage	Health
Scott	KM 56.3 to KM 71.6	Route refinement to avoid private land. The alignment is entirely on Crown land, avoiding all of the private land held by a family. The new alignment has fewer access roads to develop, crosses clear-cuts, improved crossing point of Chinohchey Creek and avoids a substantial amount of wet terrain encountered by the original PNG pipeline.	Neutral	**Beneficial** – avoidance of private land.	Neutral	Neutral	Neutral
Breadalbane	KM 85.3 to KM 86.0	Route refinement to improve the creek crossing.	Neutral	Neutral	Neutral	Neutral	Neutral
New Road 51.5	KM 89.3 to KM 89.8	Route refinement around a steep creek crossing and to reduce grading.	**Beneficial** – improved creek crossing, reduced effect on riparian habitat features and maturing forest.	Neutral	Neutral	Neutral	Neutral
Fraser	KM 104.9 to KM 152.8	Route refinement to avoid private landowners and agricultural lands as requested by the landowners.	**Mitigable Adverse Effect** – loss or alteration of plant community-at-risk but avoidance of five fish-bearing watercourses.	**Beneficial** – avoidance of private land, a recreation site, two VQOs as well as water wells and points of diversion and their 200 m buffers.	**Beneficial** – avoidance of ALR land, however, there is a loss of one forest research plot.	**Beneficial** – reduced alteration of protected archaeological and heritage resources and unprotected post-1846 historic resources.	Neutral
Stern Creek	KM 156.9 to KM 157.3	Route refinement to improve the creek crossing in difficult side hill terrain while paralleling the PNG pipeline.	**Beneficial** – reduced disturbance to wetlands and avoidance of disturbance to moose and migratory bird habitat. Improved creek crossing.	Neutral	Neutral	Neutral	Neutral
East Deserter Lake Road	KM 157.9 to KM 158.9	Route refinement to parallel an existing logging road and use a pre-existing footprint in side hill rock terrain	Neutral	Neutral	Neutral	Neutral	Neutral
Trois Ligne	KM 163.5 to KM 166.5	Route refinement to parallel the new high-grade FSR, improve highway and railway crossings, improve the Endako River crossing, to address landowner concerns, and improve the crossings of drainages and wet areas.	**Beneficial** – improved Endako River crossing and crossings of drainages and wetlands.	**Beneficial** – addressed landowner concerns.	Neutral	**Mitigable Adverse Effect** – increased alteration of unprotected post-1846 historic resources.	Neutral

TABLE 5.4 Cont'd

Proposed Route Refinement	Location	Rationale for Proposed Route Refinement	Assessment Category Comparison to Certified Route				
			Environmental	Social	Economy	Heritage	Health
McDowell	KM 170.1 to KM 172.0	Route refinement to avoid a large wetland.	**Beneficial** – avoidance of the Endako Marsh Lake complex; and reduced potential for adverse effects to wildlife habitat.	**Beneficial** – reduced private land crossed.	Neutral	Neutral	Neutral
Elliot	KM 173.9 to KM 176.5	Route refinement to stay upslope of a BC Hydro right-of-way and avoid as much of the BC MoTI gravel pit tenure as possible, as requested by BC MoTI.	Neutral	**Beneficial** – avoidance of water wells and their 200 m buffer.	**Beneficial -** addressed tenure holder concerns.	**Mitigable Adverse Effect** – alteration of unprotected post-1846 CMTs	Neutral
South Tchesinkut	KM 182.8 to KM 193.8	Route refinement to avoid private land and reduce the amount of cultivated land crossed.	**Mitigable Adverse Effect –** increased potential effects to wildlife and wetland habitat as well as nonfish-bearing watercourses.	**Beneficial** – reduced private land crossed, and avoidance of water point of diversion and its 200 m buffer.	**Beneficial** – avoidance of ALR land.	**Beneficial** – avoidance of alteration of unprotected post-1846 historic resource.	Neutral

Notes: Neutral. No material change to the assessment of significant adverse effect.

Beneficial. The proposed amendment is expected to have a beneficial and advantageous effect compared to the certified route. (Note: Increased construction and material costs are considered to be beneficial to the local, regional, and national economy.)

Mitigable Adverse Effect. The proposed amendment may have an adverse effect compared to the certified route, however, this effect can be mitigated.

5.2 Minor Route Adjustments

An assessment of the effects of the 12 minor route adjustments in the Project area is provided in Table 5.5. All minor route adjustments are less than 100 m from the study corridor (see Figure 2). Minor route adjustments are proposed in order to improve creek crossings and constructability.

A comparison of the expected effects of the proposed minor route adjustments to the certified route is provided in Table 5.6. Ten of the minor route adjustments were found to have a beneficial effect in at least one assessment category, one of which also has mitigable adverse effects. Two minor route adjustments were found to have neutral effects in all assessment categories.

TABLE 5.5

SUMMARY OF MINOR ROUTE ADJUSTMENTS

Name	Location	Length Difference from Certified Centre Line (m)	Maximum Offset Distance of Proposed Centre Line from Certified Study Corridor (m)	First Nation Traditional Territory*	Rationale	Effects Assessment
Miller 1	KM 0.0 to KM 0.7	+37	32	McLeod Lake Indian Band, West Moberly First Nations	Minor route adjustment to improve constructability alignment across Miller Creek and the proposed Summit Lake Compressor Station site.	No material change to the assessment of significant adverse effects.
Chief Lake FSR 1	KM 39.5 to KM 40.1	+3	10	Lheidli T'enneh First Nation, Carrier Sekani Tribal Council (Nak'azdli Band)	Minor route adjustment to improve the crossing of the FSR.	No material change to the assessment of significant adverse effects.
Shamrock	KM 54.5 to KM 54.8	-2	N/A (Centre line inside study corridor)	Lheidli T'enneh First Nation, Carrier Sekani Tribal Council (Nak'azdli Band)	Minor route adjustment to improve creek crossings when paralleling the PNG pipeline.	No material change to the assessment of significant adverse effects.
East Stuart	KM 72.4 to KM 72.5	-1	N/A (Centre line inside study corridor)	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation)	Minor route adjustment to improve creek crossing while paralleling the PNG pipeline.	No material change to the assessment of significant adverse effects.
Davidson 1	KM 75.1 to KM 76.5	-22	42	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation)	Minor route adjustment to improve creek crossing and avoid encroaching wetland/swamp.	No material change to the assessment of significant adverse effects.
West Davidson	KM 77.8 to KM 78.4	-26	59	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation)	Minor route adjustment to improve creek crossing.	No material change to the assessment of significant adverse effects.
Chico	KM 81.0 to KM 81.6	-4	40	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation)	Minor route adjustment to avoid steep side hill alongside the PNG pipeline.	No material change to the assessment of significant adverse effects.
Rake	KM 96.5 to KM 96.6	+1	N/A (Centre line inside study corridor)	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation, Nadleh Whut'en Band)	Minor route adjustment to improve creek crossing.	No material change to the assessment of significant adverse effects.
Wonder	KM 97.5 to KM 97.6	+7	N/A (Centre line inside study corridor)	Carrier Sekani Tribal Council (Nak'azdli Band, Saik'uz First Nation, Nadleh Whut'en Band)	Minor route adjustment to improve creek crossing.	No material change to the assessment of significant adverse effects.
West Stern Creek	KM 157.5 to KM 157.5	+1	N/A (Centre line inside study corridor)	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation)	Minor route adjustment to improve creek crossing.	No material change to the assessment of significant adverse effects.
West Deserter Lake Road	KM 162.0 to KM 163.1	-7	47	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation)	Minor route adjustment to parallel the new high-grade FSR and improve constructability.	No material change to the assessment of significant adverse effects.
West Sam Ross FSR	KM 177.3 to KM 177.4	+4	N/A (Centre line inside study corridor)	Carrier Sekani Tribal Council (Nadleh Whut'en Band, Stellat'en First Nation, Burns Lake Band), Nee Tahi Buhn Band	Minor route adjustment to cross FSR at a minimum 70 degree angle.	No material change to the assessment of significant adverse effects.

Note: * As per 2007 EAC Application.

TABLE 5.6

COMPARISON OF THE PROPOSED MINOR ROUTE ADJUSTMENTS TO THE CERTIFIED ROUTE

Proposed Minor Route Adjustment	Location	Rationale for Proposed Minor Route Adjustment	Assessment Category Comparison to Certified Route				
			Environmental	Social	Economy	Heritage	Health
Miller 1	KM 0.0 to KM 0.7	Minor route adjustment to improve constructability alignment through Miller Creek and the proposed Summit Lake Compressor Station site.	Neutral	Neutral	Neutral	Neutral	Neutral
Chief Lake FSR 1	KM 39.5 to KM 40.1	Minor route adjustment to improve the crossing of the FSR.	Neutral	Neutral	**Beneficial** – improved crossing of FSR.	Neutral	Neutral
Shamrock	KM 54.5 to KM 54.8	Minor route adjustment to improve creek crossings when paralleling PNG.	**Beneficial** – improved creek crossings.	Neutral	Neutral	Neutral	Neutral
East Stuart	KM 72.4 to KM 72.5	Minor route adjustment to improve creek crossing while paralleling the PNG pipeline.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral
Davidson 1	KM 75.1 to KM 76.5	Minor route adjustment to improve creek crossing and avoid encroaching wetland/swamp.	**Beneficial** – improved creek crossing and avoidance of encroachment on wetland habitat.	Neutral	Neutral	Neutral	Neutral
West Davidson	KM 77.8 to KM 78.4	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing and avoidance of wetland habitat feature.	Neutral	Neutral	Neutral	Neutral
Chico	KM 81.0 to KM 81.6	Minor route adjustment to avoid steep side hill cut alongside PNG pipeline.	Neutral	Neutral	Neutral	Neutral	Neutral
Rake	KM 96.5 to KM 96.6	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral
Wonder	KM 97.5 to KM 97.6	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral
West Stern Creek	KM 157.5 to KM 157.5	Minor route adjustment to improve creek crossing.	**Beneficial** – improved creek crossing.	Neutral	Neutral	Neutral	Neutral
West Deserter Lake Road	KM 162.0 to KM 163.1	Minor route adjustment to the new high-grade FSR and improve constructability.	**Beneficial** – improved constructability.	Neutral	Neutral	**Mitigable Adverse Effect** – alteration of unprotected post-1846 historic resource.	Neutral
West Sam Ross FSR	KM 177.3 to KM 177.4	Minor route adjustment to cross FSR at a minimum 70 degree angle.	Neutral	Neutral	**Beneficial** – improved FSR crossing.	Neutral	Neutral

Notes: Neutral. No material change to the assessment of significant adverse effect.

Beneficial. The proposed amendment is expected to have a beneficial and advantageous effect compared to the certified route. (Note: Increased construction and material costs are considered to be beneficial to the local, regional, and national economy.)

Mitigable Adverse Effect. The proposed amendment may have an adverse effect compared to the certified route, however, this effect can be mitigated.

5.3 Cumulative Effects Assessment for Route Refinements and Minor Route Adjustments

A cumulative effects assessment (CEA) was completed to evaluate changes to the environment that are caused by the Project in combination with other past, present and future human actions. It is recognised that the combined effects of unrelated individual projects or activities could result in aggregate effects that may be different in nature or extent from the effects of the individual activities. The proposed route amendments are location adjustments to the certified Project, therefore, activities that have occurred in the Project area since 2007 are not considered relevant for evaluating changes to the CEA.

The results of this CEA, presented in Section 8 of the 2007 EAC Application, will not be changed by the addition of 15 route refinements, 12 minor route adjustments. The proposed amendments are located within the RSA of the 2007 CEA. The route amendments will result in a marginal increase in the pipeline right-of-way length (approximately 2.5 km, or 1.2% of the route from KM 0 to KM 196.5). However, the amendments are proposed to meet landowner and tenure holder requests, avoid environmental features, improve constructability and ensure long-term pipeline integrity and safety. As a result, the proposed amendments reduce potential adverse effects within the RSA compared to the certified Project.

It is noteworthy that the 2007 CEA fulfilled the requirements of Section 16(1) (2) of the *Canadian Environmental Assessment Act* and was used to provide the basis for the BC EAO and federal responsible authorities to prepare the 2008 BC Environmental Assessment Report and the Canadian Environmental Assessment Agency screening report.

The 2007 CEA for the Project concluded that the most important adverse terrestrial, aquatic, and social cumulative effects in the RSA are habitat alteration associated with mountain pine beetle infestation, salvage logging, and forest conversion for agricultural, residential, transportation, and industrial uses. Incremental increases due to the Project, as originally proposed, and considering the amendments applied for, will contribute to regional and subregional cumulative effects risk. However, these Project-specific effects are comparatively minimal in extent.

6.0 ENVIRONMENTAL ASSESSMENT OF EXTRA TEMPORARY WORKSPACE

The locations of ETWS have been identified by detailed design surveys that were conducted from 2011 to 2013. Temporary workspace is defined as being located within the approximately 40 m certified construction corridor while ETWS is land required in addition to the construction corridor. The extent of ETWS requirements varies depending on the type of construction activity. Construction activities and challenges that require ETWS include: log storage during clearing, construction in difficult areas, such as rugged terrain or bends in the pipeline; road, pipeline and watercourse crossings; certain construction techniques, such as HDD crossings. The nature or location of these activities requires extra space for safety, material storage, extra equipment and pipeline assembly.

The 2008 EAC anticipated the need for a construction corridor wider than approximately 40 m and describes instances where additional workspace may be required. As stated in Section 2.2 of Part A of the Assessment Report (BC EAO 2008): "*...During pipeline construction, a wider right-of-way will be required to accommodate ditch material, pipe and construction equipment, difficult terrain and unique construction activities (e.g., HDD)*."

ETWS generally extends between 5 m and 20 m beyond the (100 m) study corridor. Watercourse crossings sometimes require an area of more than 100 m near the crossing location for watercourse crossing pipe preparation (*i.e.*, to weld, coat and pre-test, if required). ETWS within the study corridor was assessed in the 2007 EAC Application. During Oil and Gas Commission (OGC) permitting, PTP will apply for an additional 5% of ETWS to be located within the study corridor. Therefore, this application only assesses the ETWS required outside of the study corridor from KM 0.0 to KM 196.5. A total area of approximately 35 ha of ETWS is required outside of the study corridor.

Detailed field investigations of the ETWS were conducted during 2013 to identify potential effects on the environment. The locations of ETWS were shifted, where practical, to avoid sensitive environmental features, such as riparian areas. The locations of ETWS have been chosen to reduce the impact to valued components. Where practical, workspace will take advantage of existing disturbances and clearings. Environmental features that were identified in the ETWS during field investigations included the following features:

- wildlife tree patches;
- wetlands;
- wildlife trails;
- mature and old coniferous trees, including Douglas-fir trees;
- mature and old deciduous trees, including old black cottonwood trees;
- rock outcrop; and
- recent clear-cuts.

The locations of ETWS are identified on the orthomaps presented in Appendix A. There is no material change to the impacts, mitigation or residual effects identified in the 2007 EAC Application for the pipeline (PTP 2007). Mitigation measures outlined in the 2007 EAC Application will be implemented to reduce or avoid adverse effects to identified features. Pre-construction surveys will be conducted by wildlife, vegetation, and aquatics professionals to identify and flag features prior to construction. Following construction, ETWS will be restored in accordance with the PTP Restoration Plan (TERA Environmental Consultants [TERA] 2013a).

6.1 Cumulative Effects Assessment for Extra Temporary Workspace

A CEA was completed to evaluate changes to the environment that are caused by the Project in combination with other past, present and future human actions. The results of this CEA, presented in

Section 8 of the 2007 EAC Application, will not be changed by the addition of ETWS. The proposed ETWS is located within the RSA of the 2007 CEA. The need for ETWS beyond the approximately 40 m construction corridor was considered in the 2008 EAC and described instances where additional workspace may be required. As stated in Section 2.2 of Part A of the EAO Assessment Report (BC EAO 2008): "*...During pipeline construction, a wider right-of-way will be required to accommodate ditch material, pipe and construction equipment, difficult terrain and unique construction activities* (*e.g.,* HDD)."

It is noteworthy that the 2007 CEA fulfilled the requirements of Section 16(1) (2) of the *Canadian Environmental Assessment Act* and was used to provide the basis for the BC EAO and federal responsible authorities to prepare the 2008 BC Environmental Assessment Report and the Canadian Environmental Assessment Agency screening report.

The 2007 CEA for the Project concluded that the most important adverse terrestrial, aquatic, and social cumulative effects in the RSA are habitat alteration associated with mountain pine beetle infestation, salvage logging, and forest conversion for agricultural, residential, transportation, and industrial uses. Incremental increases due to the Project, as originally proposed, and considering the amendments applied for, will contribute to regional and subregional cumulative effects risk. However, these Project-specific effects are comparatively minimal in extent.

7.0 ENVIRONMENTAL ASSESSMENT OF TEMPORARY FACILITY

In addition to the right-of-way required for the construction of the Project, land will be required on a temporary basis for construction camps, staging and equipment/pipe stockpile sites (*i.e.*, temporary facilities). The 2007 EAC Application anticipated the need for additional sites for temporary use. As stated in Section 4.4.6.3 of the 2007 EAC Application:

> *"...Other suitable previously disturbed sites may also be considered, such as current industrial sites (gravel pits, industrial yards, etc.)."*

In addition, PTP made the following EAC commitments regarding temporary facilities:

> *"...PTP commits to locate storage areas, construction camps, and temporary facilities in disturbed areas or other areas acceptable to the BC MOFR to minimise forest impacts, particularly on non-pine timber supply." (EAC Commitment No. 8.25)*
>
> *"...PTP commits to ensure temporary sites are replanted with appropriate tree species to restore the productive forest, as directed by BC MOFR. Communicate with BC MOFR to discuss hauling restrictions for beetle-killed wood. Discuss mitigation measures with forest tenure holders for demonstrated economic losses." (EAC Commitment No. 8.26)*
>
> *"...PTP commits to deactivate and restore temporary access routes and sites required to construct the Project once Project construction is complete." (EAC Commitment No. 8.9)*

A complete effects assessment was prepared for the Tchesinkut Creek stockpile site, which is an additional element to the Project. The newly identified temporary facility required for the Project including the proposed use of the facility and a justification for the location of the facility is described in Section 7.1. Section 7.2 provides the baseline conditions, potential effects, mitigation measures and residual effects from or during clearing, construction and restoration of the temporary facility. Section 7.3 provides additional mitigation measures for temporary facility outlined in the EMP (TERA 2013b). Section 7.4 provides a summary of the potential effects, mitigation measures and residual effects and an assessment of the significance of residual effects.

A map of the proposed temporary facility study site is provided in Appendix A. The study site has been identified for the purposes of an environmental assessment and is the anticipated location for the site. The exact site boundaries will be determined during OGC permitting but will be located within the LSA.

7.1 Description of Temporary Facility

The pipe is expected to be delivered by rail to existing rail sidings in the vicinity of the Project for off loading and movement to temporary stockpile sites prior to being transported to the right-of-way. The 2008 EAC included approval of pipe stockpile sites along the right-of-way near the following locations: KM 167; KM 238; and KM 380 (in addition to the three multi-use sites that were approved for pipe and material storage at KM 228, KM 335 and KM 380). The 2012 EAC Amendment included approval of a stockpile site near KM 426. The 2013 EAC Amendment No. 3 received approval for stockpile sites near KM 211, KM 274, KM 436, KM 447 and KM 449 (in addition to nine multi-use sites near KM 238, KM 293, KM 332, KM 352, KM 353, KM 365, KM 377, KM 386 and KM 400).

PTP is applying for one new stockpile site located near KM 193 (Tchesinkut Creek (see Map No. 31 in Appendix A). The proposed Tchesinkut Creek stockpile study site is approximately 1 ha in size and is located in close proximity to the Tchesinkut Creek crossing. The proposed site will be used as a stockpile site, borrow pit and a staging area for the Tchesinkut Creek crossing. The site will be restored after clearing and construction of the Project are complete. The location of the study site, the distance from the pipeline route, the First Nations traditional territory within which the site is located, and justification for why the site is needed are presented in Table 7.1.

The site will be in operation during the clearing, construction and restoration phase of the Project from 2014 to the end of 2019.

Where the land is not graded and prepared for the use of stockpiling pipe, site preparation work will require:

- the land area to be cleared, topsoil and duff pushed off to an area for later use, the surface graded to level conditions to the extent practical, drained if needed (via the development of surface ditches), and if the soils are unsuitable for the pipe stockpiles and vehicles, the area will be surfaced with aggregate material;
- temporary access roads to the site and within the site that may necessitate some form of upgrading to make them suitable for construction traffic, as required;
- installation of double-lined tanks and/or other secondary containment techniques for fuel storage; and
- restoration and rehabilitation of the site to as near the original state as possible, including replanting with trees, if that is the desired end land use by the Crown.

TABLE 7.1

SUMMARY OF STOCKPILE SITE AMENDMENT

Site	Approximate Location	Proposed Use	Distance from Route (m)	First Nation Traditional Territory*	Rationale
Tchesinkut Creek stockpile site	KM 193	Staging area, stockpile site and borrow pit	Adjacent	Carrier Sekani Tribal Council (Stellat'en First Nation, Burns Lake Band), Nee Tahi Buhn Band	New site in an existing clearing: site required to accommodate multiple construction requirements, including construction of the Tchesinkut Creek crossing.

Note: * As per 2007 EAC Application.

7.2 Baseline Conditions of the Temporary Facility

The 2013 baseline conditions of the Tchesinkut Creek stockpile site are presented in this section. A desktop review and field studies were completed for the temporary stockpile study site during the summer of 2013.

Geophysical Environment

The proposed study site is located within a 4 m to 5 m high north-south trending bedrock-cored ridge overlain by a mantle (0.1 m to > 1 m thick) of glaciofluvial sand and gravel. Bedrock is anticipated within 1 m of ground surface and the overlying soils may be susceptible to surface water erosion. The Tchesinkut Creek valley flanks the east, south and west sides of this ridge. The site should be well-drained and relatively impermeable due to the rock at surface. No potential geohazards associated with this site were identified.

Atmospheric Environment

The baseline information for the atmospheric environment associated with the study site is consistent with the information provided in the 2007 EAC Application (PTP 2007).

The Tchesinkut Creek stockpile site is located in the Central Interior Ecoprovince and the Bulkley Valley Lake District (BVLD) airshed. The Central Interior Ecoprovince lies east of the Coast and Mountain Ecoprovince and is characterised by a flat topography and distinct seasons. Situated on the leeward side of the Coast Mountains, the climate in this area is characterised by colder winters, warmer summers and a rainy season during the late spring and early summer months. The most common air pollutants in the BVLD airshed are fine particulates (BVLD Airshed Management Society 2006 in PTP 2007).

Aquatic Environment

There are no classified drainages or watercourses that cross the study site. However, a number of aquatic features, including streams, occur outside the footprint, within the LSA of this site.

Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation

The study site is located in an area that was clear-cut approximately 5 years ago. Reforestation activities have been completed since the area was harvested. Limited wildlife, wildlife habitat or vegetation features are present.

Species or Ecosystems at Risk

No species or ecosystems at risk were identified at this site.

Archaeological and Heritage Resources

There are no protected archaeological sites or heritage resources identified at this site.

First Nations Community and Land Use

The site is located within the traditional territory of the following First Nations and Tribal Organisations.

- Carrier Sekani Tribal Council (Stellat'en First Nation, Burns Lake Band); and
- Nee Tahi Buhn First Nation.

The First Nations community profiles and land uses are consistent with those provided in the 2007 EAC Application.

The study site is not located on or adjacent to areas of importance identified in the Traditional Use Studies of the Carrier Sekani Tribal Council or the Nee Tahi Buhn First Nation (Carrier Sekani Tribal Council 2007, Nee Tahi Buhn 2007). Tchesinkut Creek is located in the LSA of the study site. The Carrier Sekani Tribal Council Traditional Use Study indicates that the Carrier Sekani Tribal Council has an interest in Tchesinkut Creek because the creek supports Endako River Chinook and other fish populations important to First Nations fisheries (Carrier Sekani Tribal Council 2007).

The site and LSA do not cross a First Nations Reserve.

Land and Resource Use

The site is located within the boundaries of the Lakes District Land and Resource Management Plan (LRMP) and the Lakes North Sustainable Resource Management Plan.

The study site crosses the following land and resource use value components:

- approximately 1 ha of Crown land;
- one forest tenure held by Burns Lake Community Forest Limited;
- two grazing leases (No. RAN076039, RAN072662);
- one guide outfitting tenure (No. 601012);
- one registered trapping tenure (No. TR0604T024); and
- one oil and gas pipeline Crown land notation.

The 2007 EAC Application provides additional information regarding the land and resource use value components mentioned above.

Community and Regional Infrastructure and Services

The site is located in the Bulkley-Nechako Regional District. The closest municipalities to the site are the villages of Burns Lake and Fraser Lake. The infrastructure and services of the Bulkley-Nechako Regional District and Burns Lake and Fraser Lake are consistent with that provided in the 2007 EAC Application.

Employment and Economy

The information on employment and economy in the area is consistent with that provided in the 2007 EAC Application.

Human Health and Safety

The information on human health and safety in the area is consistent with that provided in the 2007 EAC Application.

Navigable Waters Considerations

There are no navigable waters considerations for the site or the LSA of the site.

Aesthetics and Viewsheds

The site is located in the Lakes District LRMP boundary. No visual management areas were identified within the study site. A significant visual area identified in the Lakes District LRMP is crossed by the LSA. In addition, there are two Partial Retention VQOs crossed by the LSA, one of which is also crossed by the study site.

7.3 Effects Assessment

The potential effects and mitigation measures of the Tchesinkut Creek stockpile study site on each valued component are provided in this section. Information from the 2007 EAC Application and the field studies was used to complete the effects assessment. The potential effects listed here are summarised in Table 7.2.

The site will not be used during maintenance and operation, nor during decommissioning and abandonment phases of the Project, therefore, the assessment provided only applies to the clearing, construction and restoration phase.

7.3.1 Potential Effects

Geophysical Environment

The potential effects of clearing, construction and restoration of the site on the geophysical environment include:

- lowering of soil capability caused by soil mixing;
- rock blasting; and
- surface water erosion.

Potential effect: Lowering of soil capability caused by soil mixing

Topsoil and duff removal will be conducted at the Tchesinkut Creek stockpile site and admixing of topsoil and root zone material with subsoil may occur.

Topsoil conservation is necessary to preserve the capability of the soil to sustain favourable growing conditions for tree species, shrubs and groundcover. It is necessary to ensure that the topsoil resource is not mixed with subsoil materials. Topsoil often contains the necessary nutrient content, organic matter, pH and water holding characteristics necessary to foster and sustain plant growth. Subsoil materials in the Project area are often of high pH (calcareous), low in nutrients and organic matter and of excessive coarse fragment content (*i.e.,* gravely and stony).

PTP will implement the mitigation measures outlined in Table 7.2-1 of the 2007 EAC Application (PTP 2007) to reduce soil mixing.

The following residual effect has been identified: minor mixing of topsoil or root zone material with subsoil.

Potential Effect: Rock blasting

Bedrock is anticipated within 1 m of the ground surface at the Tchesinkut Creek study site. Where intact and unrippable bedrock is encountered within approximately 2 m of the ground surface, it may be necessary to blast the bedrock in order for it to be excavated.

PTP will implement the mitigation measures outlined in Table 7.2-1 of the 2007 EAC Application (PTP 2007) to reduce effects from rock blasting. The following residual effects have been identified: minor and localised instabilities that may occur in fill materials and the alteration of local topography resulting from site grading.

Potential Effect: Loss of topsoil or root zone material through wind and water erosion.

Grading the Tchesinkut Creek study site will result in the exposure and storage of loose, unvegetated, sandy textured soils that may be lost to wind and water erosion. The result of this loss will be a reduction in the amount of this valuable material available for restoration of the site as well as potential sedimentation into adjacent waterbodies.

PTP will implement the mitigation measures outlined in Table 7.2-1 of the 2007 EAC Application (PTP 2007) to reduce surface water erosion.

The following residual effect has been identified: potential minor loss of topsoil or root zone material until vegetated cover is established.

Atmospheric Environment

The potential effects of clearing, construction and restoration of the study site on the atmospheric environment are consistent with some of the effects listed for the Project in the 2007 EAC Application, including:

- greenhouse gas emissions;
- emissions from construction equipment;
- dust from construction traffic and blasting; and
- smoke from slash burning.

Potential Effect: Greenhouse gas emissions

Sources of greenhouse gas emissions associated with the clearing, construction, and restoration of the Tchesinkut Creek stockpile study site are consistent with those listed in the 2007 EAC Application, including:

- combustion of fossil fuels associated with the transport of equipment and material to the site;
- combustion of fossil fuels associated with construction activities; and
- emissions associated with the temporary clearing of site vegetation and changes to land-use and vegetative cover.

PTP will implement the mitigation measures outlined in Table 7.2-4 of the 2007 EAC Application (PTP 2007).

The site is located in an existing disturbance. This will reduce the amount of greenhouse gas emissions associated with clearing of vegetation.

No residual effect has been identified.

Potential Effect: Emissions from construction equipment

The operation of heavy equipment (*e.g.,* earth movers, excavation equipment, and grading equipment) at the Tchesinkut Creek stockpile study site will result in air emissions such as carbon monoxide, sulphur dioxide, nitrogen oxides and volatile organic compounds. There will also be air emissions associated with the exhaust of trucks transporting materials and crews to and from the site.

PTP will implement the mitigation measures outlined in Table 7.2-4 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: increase in vehicle emissions.

Potential Effect: Dust from construction traffic and blasting

Blasting, excavation and grading activities during clearing and construction at the Tchesinkut Creek stockpile study site and vehicle traffic driving to and from the Tchesinkut Creek stockpile study site on unpaved access roads will result in fugitive dust emissions.

PTP will implement the mitigation measures outlined in Table 7.2-4 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: increase in dust arising from construction traffic.

Potential Effect: Smoke from open burning

Land clearing at the Tchesinkut Creek stockpile study site will result in the removal of vegetation. Some of this material may be disposed of by open burning.

PTP will implement the mitigation measures outlined in Table 7.2-4 of the 2007 EAC Application (PTP 2007).

The potential effect of open burning will be limited to areas in proximity to human receptors (*i.e.,* permanent residences and public facilities), therefore, the effect will be temporary and localised.

No residual effect has been identified.

Aquatic Environment

There are no classified drainages or watercourses adjacent to or crossing the study site, therefore, there are no anticipated potential effects of clearing, construction and restoration of the site on this valued component.

Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation

The potential effects of clearing, construction and restoration of the study site on the terrestrial environment include spread of invasive plants.

Potential Effect: Spread of invasive plants

Activities associated with the clearing, construction and restoration of the Tchesinkut Creek stockpile study site could cause the spread of invasive plants.

PTP will implement the mitigation measures outlined in Table 7.2-13 of the 2007 EAC Application (PTP 2007).

The following potential residual effect has been identified: spread of invasive plants.

Species and Ecosystems at Risk

No species and ecosystems at risk were identified at the study site, therefore, there are no anticipated potential effects of clearing, construction and restoration of the site on this valued component.

Archaeological and Heritage Resources

No archaeological and heritage resources were identified at the study site, therefore, there are no anticipated potential effects of clearing, construction and restoration of the site on this valued component.

Socio-economic Valued Components

The effects assessment presented in the 2007 EAC Application for the socio-economic valued components has not changed as a result of the addition of the Tchesinkut stockpile site.

7.3.2 Significance of Residual Effects

The residual effects of the clearing, construction and restoration of the Tchesinkut Creek stockpile site are presented in this section. Information from the 2007 EAC Application and the field studies was used to complete the effects assessment. The assessment of the significance of residual effects is presented in Table 7.4. In all cases, the significance of the residual effects is assessed to be less than significant.

Geophysical Environment

The potential residual effects of clearing, construction and restoration of the study site on the geophysical environment include:

- minor mixing of topsoil or root zone material with subsoil;
- minor and localised instabilities that may occur in fill materials and the alteration of local topography resulting from site grading; and
- minor loss of topsoil or root zone material until a vegetated cover is established.

Residual Effect: Minor mixing of topsoil or root zone material with subsoil

Where topsoil or root zone material is stripped off the site and stored for later use during the restoration phase of the Project, there is the potential that not all material can be salvaged and some minor mixing of material with excavated subsoil may occur.

The evaluation of the significance of the residual effect was completed with a high level of confidence. The location of the residual effect will be limited to the site footprint. There is a high probability that potential mixing will be isolated to clearing, construction and restoration of the site, resulting in medium-term duration. The residual effect is considered to be reversible in the medium-term and of low magnitude.

PTP has determined that the context of the site in relation to the residual effect may change as a result of Project activities. The site is a bedrock-cored ridge overlain by a mantle of glaciofluvial sand and gravel. The site is currently not sensitive and is resistant to mixing of topsoil or root zone material with subsoil. The sensitivity of the site to soil mixing will increase as a result of Project activities as well as decrease the site's resilience.

The residual effect is considered to be less than significant.

Residual Effect: Minor and localised instabilities that may occur in fill materials and the alteration of local topography resulting from site grading

Blasting of intact bedrock for purposes of grading the site and excavating the site may temporarily destabilise adjacent fill materials. Excavation and grading will also alter the local topography in the site.

Evaluation of the significance of the residual effect was completed with a high level of confidence. The location of the residual effect will be limited to the site footprint. There is a high probability that potential minor and localised instabilities may occur in fill materials and alteration of local topography will result from site grading. The residual effect will be isolated to the excavation and grading of the site. Site grading will take less than a year to complete, therefore, the duration will be short-term. While the alteration of local topography will be permanent, instabilities that may occur in the fill material are considered reversible in the short-term. The residual effect is considered to be of low magnitude.

PTP has determined that the context of the site in relation to the residual effect will be changed as a result of the project activities. The site is located on an area of undisturbed bedrock, therefore, the sensitivity of the site to alterations of local topography and localised instabilities in fill material are low and resilience is high. The Project will require blasting and grading on the site, resulting in the alteration of topography and potential minor localised fill material instabilities. As a result, the sensitivity of the site to this residual effect will increase and the resilience will decrease.

The residual effect is considered to be less than significant.

Residual Effect: Potential for minor loss of topsoil or root zone material until a vegetated cover is established

Minor loss of topsoil and root zone material may occur where materials are windrowed or stockpiled for later use.

Evaluation of the significance of the residual effect was completed with a high level of confidence. The location of the residual effect will be limited to the site footprint. It is probable that potential minor loss of topsoil or root zone material may occur until a vegetated cover is established. The residual effect will likely be isolated to areas where materials are windrowed or stockpiled. It is expected that minor loss of topsoil or root zone associated with Project activities will be of medium-term duration. The residual effect is considered to be reversible in the medium-term and of low magnitude.

PTP has determined that the context of the site in relation to the residual effect will change as a result of project activities. The current sensitivity of the site to topsoil and root zone material loss is low and its resilience is relatively high because the site has been replanted sometime in the last five years and a vegetation cover is re-establishing on the site. As a result of the Project activities and subsequent loss of vegetation at windrowed and stockpile areas, the sensitivity will be higher and resilience will be lower in relation to minor loss of topsoil or root zone material. The site will be maintained in a similar state throughout clearing and construction and will be revegetated post construction, at which point the sensitivity and resilience ratings will return to present levels.

The residual effect is considered to be less than significant.

Atmospheric Environment

The residual effects of clearing, construction and restoration of the study site on the atmospheric environment include:

- increase in vehicle emissions; and
- increase in dust arising from construction traffic.

Residual Effect: Increase in vehicle emissions

Although emissions arising from construction equipment will occur at the study site, the residual effect of an increase in vehicle emissions will be noticeable only in areas near human receptors (*e.g.,* permanent residences and public facilities). The evaluation of the significance of the residual effect was completed with a high level of confidence. The location of the residual effect will be limited to the site footprint and LSA. There is a high probability that vehicle emissions will be isolated to clearing, construction and restoration of the site, resulting in medium-term duration. The residual effect is considered to be reversible in the medium-term and of low magnitude.

PTP has determined that the context of the emission levels at the site and in the LSA in relation to this residual effect will only be affected during clearing, construction and restoration of the site. It is expected that emission levels will return to present conditions following restoration.

There are no human receptors near the site, therefore, the residual effect is considered to be less than significant.

Residual Effect: Increase in dust arising from construction traffic

Fugitive dust emissions are transient in nature and are dependent on many factors, such as the moisture in the soil, the level of activity at a particular location, and meteorological conditions at the time of construction activities.

The increase in dust arising from construction traffic has been identified as a cumulative effect and is assessed further in Section 8.

Aquatic Environment

No classified drainages or watercourses are encountered by the study site, therefore, there are no anticipated residual effects of clearing, construction and restoration of the site on this valued component.

Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation

The residual effect of clearing, construction and restoration of the study site on the terrestrial environment includes the spread of invasive plants.

Residual Effect: Spread of invasive plants

Activities associated with clearing, construction and restoration of the site may cause the spread of invasive plants.

The spread of invasive plants has been identified as a cumulative effect and is assessed further in Section 8.

Species and Ecosystems at Risk

No species and ecosystems at risk were identified at the study site, therefore, there are no anticipated residual effects of clearing, construction and restoration of the site on this valued component.

Archaeological and Heritage Resources

No archaeological and heritage resources were identified at the study site, therefore, there are no anticipated residual effects of clearing, construction and restoration of the site on this valued component.

Socio-economic Components

There are no residual effects identified for the socio-economic value components associated with the study site.

7.3.3 Summary of Effects and Mitigation Measures for the Temporary Facility

A summary of the potential effects, mitigation measures and residual effects presented above is provided in Table 7.2.

TABLE 7.2

POTENTIAL EFFECTS SUMMARY AND MITIGATION MEASURES FOR THE TEMPORARY FACILITY

Potential Effect	Location	Mitigation Measures	Potential Residual Effect
Valued Component: Geophysical Environment			
Lowering of soil capability caused by soil mixing	Project footprint	• PTP will implement the mitigation measures identified in Table 7.2-1 of the 2007 EAC Application (PTP 2007).	Minor mixing of topsoil or root zone material with subsoil.
Rock blasting	Project footprint	• PTP will implement the mitigation measures identified in Table 7.2-1 of the 2007 EAC Application (PTP 2007).	Minor and localised instabilities that may occur in fill materials and the alteration of local topography resulting from site grading.
Loss of topsoil or root zone material through wind and water erosion	Project footprint	• PTP will implement the mitigation measures identified in Table 7.2-1 of the 2007 EAC Application (PTP 2007).	Minor loss of topsoil or root zone material until vegetated cover is established.
Valued Component: Atmospheric Environment			
Greenhouse gas emissions	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-4 of the 2007 EAC Application (PTP 2007).	No residual effect.
Emissions from construction equipment	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-4 of the 2007 EAC Application (PTP 2007).	Increase in vehicle emissions.
Dust from construction traffic and blasting	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-4 of the 2007 EAC Application (PTP 2007).	Increase in dust arising from construction traffic.
Smoke from open burning	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-4 of the 2007 EAC Application (PTP 2007).	No residual effect.
Valued Component: Aquatic Environment			
No potential effect identified.	N/A	None	None
Valued Component: Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation			
Spread of invasive plants	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007).	Spread of invasive plants.
Valued Component: Species and Ecosystems at Risk			
No potential effect identified.	N/A	None	None
Valued Component: Archaeological and Heritage Resources			
No potential effect identified.	N/A	None	None
Socio-Economic Valued Components			
The effects assessment presented in the 2007 EAC Application for the socio-economic valued components has not changed as a result of the addition of the Tchesinkut stockpile site.			

Where a residual effect, may interact with effects of other past, present or reasonably foreseeable projects/activities it is assessed as a cumulative effect in Section 7.5. Table 7.3 indicates the residual effects that have a potential cumulative effect and are therefore omitted from the assessment in Table 7.4.

TABLE 7.3

IDENTIFICATION OF RESIDUAL EFFECTS WITH POTENTIAL CUMULATIVE EFFECTS

Residual Effect	Potential Cumulative Effect
Valued Component: Geophysical Environment	
Minor mixing of topsoil or root zone material with subsoil	No
Minor and localised instabilities that may occur in fill materials and the alteration of local topography resulting from site grading	No
Minor loss of topsoil or root zone material can be expected until a vegetated cover is established	No
Valued Component: Atmospheric Environment	
Increase in vehicle emissions	No
Increase in dust arising from construction traffic	Yes
Valued Component: Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation	
Spread of invasive plants	Yes

Residual effects with no cumulative effect are assessed for significance in Table 7.4.

TABLE 7.4

SIGNIFICANCE OF POTENTIAL RESIDUAL EFFECTS FOR THE TEMPORARY FACILITY

Potential Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Valued Component: Geophysical Environment								
Minor mixing of topsoil or root zone material with subsoil	Project footprint	Short-term	Isolated	Medium-term	Low	High	High	Less than significant
Minor and localised instabilities that may occur in fill materials and the alteration of local topography resulting from site grading	Project footprint	Short-term	Isolated	Minor and localised instabilities in fill material: Short-term Alteration of local topography: Permanent	Low	High	High	Less than significant
Minor loss of topsoil or root zone material until a vegetated cover is established	Project footprint	Medium-term	Isolated	Medium-term	Low	High	High	Less than significant
Valued Component: Atmospheric Environment								
Increase in vehicle emissions	Project footprint/LSA	Medium-term	Isolated	Medium-term	Low	High	High	Less than significant

7.4 Cumulative Effects Assessment of the Temporary Facility

The temporary stockpile site included in this amendment application was not assessed in the 2007 EAC Application. As an additional project element, a new CEA of the stockpile site is presented in this section.

Activities related to temporary stockpile sites located in previously undisturbed wilderness areas have a greater potential to result in adverse cumulative effects including increased wildlife-vehicle collision due to increased concentration of vehicle traffic in the LSA and the presence of wildlife movement corridors or important seasonal wildlife habitats. To reduce the potential for adverse cumulative effects, the site is located on previously cleared land.

Past, present and reasonably foreseeable projects or developments in the LSA, constituting a 1 km area around the site (see Map 31 in Appendix A) are provided in Table 7.5. Reasonably foreseeable projects are those that are in the public domain or information that has been passed along to PTP as part of the stakeholder consultation program.

TABLE 7.5

PAST, PRESENT AND REASONABLY FORESEEABLE PROJECTS, ACTIVITIES OR DEVELOPMENTS IN THE LOCAL STUDY AREA OF THE TEMPORARY FACILITY

Site	Approximate Location	Description of Past Disturbances	Description of Current Condition	Potential Future Developments
Tchesinkut Creek Stockpile Site	KM 193.4	• Forest harvesting activities within stockpile study site five years ago with subsequent associated reforestation activities. • Forestry logging road construction (spur and branch roads) and subsequent maintenance.	The stockpile site is located in an existing clear-cut last harvested approximately five years ago. Active infrastructure in the LSA includes: • typical patch-clear-cut logging blocks; • forestry roads and spurs; and • silviculture activities.	• New harvest cutblocks in LSA. • Ongoing road maintenance. • New road and access bridge development to access cutblocks in LSA. • Ongoing silviculture. • Other pipeline projects.

The potential cumulative effect that may occur in the LSA as a result of the interaction of the residual effects (identified in Section 7) with past, present or reasonably foreseeable projects/activities (Table 7.5) is presented in Table 7.6.

TABLE 7.6

IDENTIFICATION OF POTENTIAL CUMULATIVE EFFECTS BASED ON THE INTERACTION OF POTENTIAL RESIDUAL EFFECTS WITH PAST, PRESENT AND REASONABLY FORESEEABLE PROJECTS, ACTIVITIES OR DEVELOPMENTS IN THE LOCAL STUDY AREA OF THE TEMPORARY FACILITY

Potential Residual Effect	Location	Interactions With Past Projects/Activities	Interaction With Present Projects/Activities	Interaction With Future Projects/Activities	Potential Cumulative Effect
Valued Component: Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation					
Spread of invasive species immediately after construction	LSA	Previous disturbance may have resulted in the introduction of invasive species in the local area.	None. PTP is implementing a stringent Invasive Species Management Plan to reduce the risk of invasive species introduction.	Future projects in the area may further increase the potential for spread of invasive plant species.	Introduction of invasive plant species.
Valued Component: Atmospheric Environment					
Increase in dust arising from construction traffic	Project footprint/LSA	None. Project activities will only affect dust levels at the site footprint and LSA during the clearing, construction and restoration phase.	During the clearing, construction and restoration phase of the project, project activities at the site and in the LSA will interact with other project and activities in the area to result in an increase in dust levels.	Increases in dust levels caused by Project activities in the site and LSA will be limited to the clearing, construction and restoration phase. Therefore, dust level increases as a result of the Project will only interact with dust levels caused by future projects until restoration is complete.	Increase in dust arising from construction traffic in the medium-term.

Additional mitigation measures that the Project will implement to manage the risk of the potential cumulative effect on the LSA are described in Table 7.7.

TABLE 7.7

MITIGATION FOR POTENTIAL CUMULATIVE EFFECTS AND IDENTIFICATION OF RESIDUAL CUMULATIVE EFFECTS

Potential Cumulative Effect	Additional Mitigation Measures	Residual Cumulative Effect
Valued Component: Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation		
Spread of invasive plant plants	No additional mitigation measures beyond those included in the Project EMP.	Spread of invasive plants.
Valued Component: Atmospheric Environment		
Increase in dust arising from construction traffic in the medium-term	No additional mitigation measures beyond those included in the Project EMP.	Increase in dust arising from construction traffic in the medium-term.

The residual cumulative effects that will persist after mitigation measures are implemented are assessed in Table 7.8.

TABLE 7.8

CUMULATIVE EFFECTS ASSESSMENT OF TEMPORARY FACILITIES

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Valued Component: Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation								
Spread of invasive plants	Project footprint/LSA	Long-term	Occasional	Medium-term	Low	High	Moderate	Less than significant
Valued Component: Atmospheric Environment								
Increase in dust arising from construction traffic in the medium-term	Project footprint/LSA	Medium-term	Isolated	Medium-term	Low	High	High	Less than significant

Context Discussion in Relation to the Significance of Residual Effects

A discussion of context, in relation to sensitivity and resilience, for each of the identified residual effects for the temporary facilities is presented in the text that follows.

Spread of Invasive Species Immediately After Construction

PTP has determined that the context of the site may change as a result of Project activities and interactions with past, present and future activities in the area. The site has previously been disturbed by logging activities and subsequently replanted. As a result of previous disturbances, the site is already sensitive to invasive species, though the re-establishing vegetation helps to increase the site's current resilience to invasion. Project activities are likely to introduce further disturbance to the site and may facilitate the introduction of invasive species from other Project areas, thereby increasing the sensitivity of the site to this residual effect. Implementation of the Invasive Plant Management Plan in the EMP could reduce the sensitivity of the site to the introduction and spread of invasive species (TERA 2013b). Restoration of the site and the implementation of the Post-Construction Monitoring Program could increase the resilience of the site against invasive species. However, future projects may cause subsequent disturbance to the site or may introduce invasive plant species which will affect the resilience of the site against invasive species after PTP has completed restoration activities.

Increase in Dust Arising From Construction Traffic in the Medium-Term

PTP has determined that the context of the dust levels at the site and in the LSA in relation to this residual effect will only be affected during clearing, construction and restoration of the site. It is expected that dust levels will return to present conditions following restoration. Increases in dust levels caused by the PTP Project will not interact with past emissions caused by previous projects or activities or with future emission levels caused by projects or activities that occur in the LSA or at the site after the restoration phase.

Conclusion

There are no significant adverse cumulative effects associated with the stockpile site.

8.0 ENVIRONMENTAL ASSESSMENT OF COMPRESSOR STATION

The proposed Summit Lake compressor station siting area is located within Unit 40, Block A, Group 93-J-7 (UTM: 6014868N 524719E), approximately 400 m south of the existing PNG Summit Lake compressor station and near Miller Creek. The Village of Summit Lake is approximately 1 km west of the proposed site. The proposed compressor station siting area is approximately 45 ha. The disturbance footprint for facility equipment and soil storage during construction is anticipated to be approximately 35 ha. The remaining area will provide sufficient space for reconfiguration of the site based on final design or potential future expansion, as well as buffering construction and operation activities from the adjacent environment.

The following section provides a description of the components and operations of the proposed Summit Lake Compressor Station. The environmental baseline condition and potential effects for each valued component are also identified. Mitigation measures for the potential effects are presented in Table 8.1. Residual effects are identified in Table 8.2.

Most potential environmental effects identified in the 2007 EAC Application for the Burns Lake Compressor Station are similar to the potential effects of the proposed Summit Lake Compressor Station.

A map of the proposed compressor station siting area is provided in Appendix A. The proposed siting area has been identified for the purposes of an environmental assessment and the compressor site will be located within the proposed siting area; the exact site boundaries will be determined during OGC permitting.

8.1 Description of Compressor Station

The proposed Summit Lake compressor station will compress gas to facilitate its flow through the PTP pipeline. PTP is currently in the detailed design phase for the proposed compressor station and will make a decision about the compression trains, other onsite equipment and buildings, and compressor power source during this phase.

8.1.1 Project Phases

Construction

The following activities will occur as part of the site preparation and construction:

- surveying - staking boundaries;
- clearing and grubbing where applicable - trees, brush and vegetation will be cleared from the site; merchantable timber will be processed to mill specifications; and large stumps and rocks will be removed from the site;
- duff/topsoil salvage – topsoil will be stripped and stockpiled;
- grading and site preparation – after topsoil salvage, grading will be undertaken to level the site and a gravel surface may be placed over traffic areas;
- facility construction and installation – civil and foundations work, installation of buildings, structures, equipment, piping, and control systems; and
- clean-up/reclamation - removal of waste, grading, restoration of topsoil, and erosion control measures.

During construction, various surface control measures may be implemented such as:

- containment around specific equipment that uses hydrocarbon or other liquids;
- catchment basins for surface runoff from the site; and

- liquid collection tanks to temporarily store liquids discharged from piping and vessels on site.

The actual methodology used will be determined during the detailed design phase of the proposed compressor station.

A Site Grading and Drainage Management Plan will be included in the final design of the proposed compressor station, in order to address potential seasonal surface water and groundwater flows in and out of small wet depressions and minor drainages on the site.

Restoration

Reclamation of disturbed portions of the proposed compressor station site will begin following completion of building activities.

Waste or debris generated at the site will be removed regularly and disposed of in compliance with local regulations.

A fence will be installed around the site. Areas within the proposed compressor station site that are not required for ongoing operations and maintenance will be specifically managed in order to revert applicable areas to a natural vegetative state where feasible and within safety standards.

Operations

The proposed compressor station is anticipated to be operational in 2018. The following activities are associated with operations:

- vegetation maintenance – removal of invasive weeds at site boundaries; and
- routine inspections and maintenance of equipment and facilities.

PTP will monitor and control its pipeline and compressor operations 24 hours per day, 365 days per year from a control centre. Pressures, flows, and compressor operating parameters will be continuously monitored. The Project facilities will be designed with instrumentation and electrical equipment connected to a System Control and Data Acquisition system.

Approved permanent sanitary waste facilities will be constructed at the proposed compressor station in accordance with applicable regulations. The Project is currently designed to include removal of waste from the sewage holding tank, which will be trucked out for disposal. Potable water required for the office will be trucked to the site. Water used for cleaning equipment will be collected and trucked from the site for proper disposal.

Decommissioning

The anticipated lifetime of the proposed compressor station is approximately 30 years, minimum. At the end of its useful life, if it is decided to abandon the proposed compressor station, PTP will decommission the facility in accordance with regulations at the time of decommissioning.

8.1.2 Required Permits/Approvals

The proposed compressor station development is further subject to a number of additional regulatory permits and approvals including:

- re-zoning approval under the *Local Governments Act* (as previously described in Section 3.5);
- compliance with the *HCA* (as administered under provisions of the *Oil and Gas Activities Act* by the OGC);

- occupation of Crown land under the *Land Act* (as administered under provisions of the *Oil and Gas Activities Act* by the OGC);
- cutting permit approval under the *Forest Act* (as administered under provisions of the *Oil and Gas Activities Act* by the OGC); and
- Facility Permit approval under the *Oil and Gas Activities Act* via review by the OGC.

Operation of the facility will require additional regulatory permits and approvals including:

- Waste Discharge Regulation approval under the *Environmental Management Act* via review by the Ministry of Environment (and the OGC); and
- compliance with the BC Noise Control Best Practices Guideline as administered by the OGC.

8.2 Baseline Conditions of the Compressor Station

The baseline conditions of the proposed Summit Lake compressor station are presented below. The information is a compilation of 2006 Terrestrial Ecosystem Mapping data, 2011 and 2013 field studies, as well as a follow-up (2013) desktop review of areas outside of the 2011 assessed site. Baseline conditions for the atmospheric environment will be provided to the BC EAO in January 2014 following the completion of detailed air and noise investigations.

Geophysical Environment

The geophysical environment description is based on a review of 2011 BGC Engineering 1;20,000 scale terrain mapping and ground-based field reconnaissance, 2013 BGC Engineering geology mapping near the pipeline crossing of the Highway 97, and 2013 BGC Engineering geotechnical drilling (of 11 holes, 15 m to 20 m deep) of a portion of the site.

The proposed compressor station siting area is located on terrain that is generally well-drained. Several wetlands containing soft organic soils and a high water table are present however the soils are mostly compact, dense, silty sands and gravels extending several metres in depth. Surface water and groundwater flows in and out of several small wet depressions and minor drainages on the site. Glaciolacustrine silts are present in the southern portion of the proposed site and are likely unsuitable for construction. The area is level to gently sloping with slopes ranging from 0-26% and elevation of the site varies from 715-750 m. No geohazards were identified that could affect the construction and operation of the proposed compressor station.

Atmospheric Environment

Air and noise studies are currently being conducted for the proposed Summit Lake compressor station site. The results of those studies will be submitted to the BC EAO in January 2014.

Aquatic Environment

The aquatic environment description is based on a combination of a desktop review and field investigation conducted on the site. There are no classified watercourses or waterbodies that interact with the proposed Summit Lake compressor station siting area. The location of the northwest corner of the proposed compressor station site is in close proximity to Miller Creek, an S3 fish-bearing watercourse. This corner of the site will be setback outside the 20 m Riparian Reserve Zone. One non-classified drainage was identified within the centre of the proposed compressor station site. Appropriate measures to carry surface runoff from the site will be implemented. Field surveys identified small wetlands to the northeast and southeast of the proposed Summit Lake compressor station siting area, which will be avoided during construction.

Terrestrial Environment: Wildlife and Wildlife Habitat; Vegetation

The terrestrial environment description is based on 2006 Terrestrial Ecosystem Mapping data, desktop review and field investigation conducted on the east end of the proposed siting area in 2013.

The proposed Summit Lake Compressor Station site and LSA are located in the Sub-boreal Spruce moist cool biogeoclimatic subzone (SBSmk1). The SBSmk1 is characterised by gently rolling terrain, frequent stand initiating events, severe, snowy winters, and relatively short warm, wet, summers. Wetlands are common, especially swamps and marshes in low-lying areas. Forest stands are predominately coniferous and consist of hybrid white spruce, lodgepole pine and subalpine-fir with some interior Douglas fir, paper birch, and trembling aspen components. Wildlife in Sub-boreal Spruce zone are adapted to avoid or survive deep snow conditions and the Sub-boreal Spruce zone is heavily populated by moose, deer, bear, and small mammals. Wetlands in the Sub-boreal Spruce zone provide habitat for ungulates and migratory birds including waterfowl and songbirds.

The LSA overlaps with coniferous forest habitat, Summit Lake, Huble Lake and wetland complexes. Old coniferous forest habitats provide thermal cover and security habitat for wildlife, and snow interception during the sever winters. Old coniferous forests in the LSA are preferred breeding habitat for some species of songbirds, and provide habitat for fisher, marten, ermine, red-backed vole, red squirrel, and northern flying squirrel. The LSA crosses the Summit Lake to Crocker River Wildlife Movement Corridor used by Moose, deer and bear. Summit Lake provides habitat for aquatic fur bearers such as beaver and river otter and a waterfowl breeding area and known breeding site for Wood Duck.

Most of the proposed Summit Lake compressor station footprint occurs in open canopy mature and old moist (SBSmk1/01), very moist (SBSmk1/07) and wet (SBSmk1/09) coniferous forest. Pools of standing water and small watercourses occur in the wet forest. A small area at the west end of the site has been harvested and is dominated by shrubs and young lodgepole pine. The forested areas include old forest habitat features including multi-storied canopy, coarse woody debris, and wildlife trees. Old coniferous forest is uncommon on the landscape and the site footprint may occasionally provide refuge habitat for old growth dependent species. The north end of the site is wet and the northern boundaries of the site overlap with wetland habitat along the existing PNG right-of-way, wetland habitat associated with a tributary to Miller Creek, and riparian habitat adjacent to Miller Creek. Existing disturbance includes the existing PNG right-of-way and maintenance buffer for Highway 97.

The proposed compressor station site does not encounter Wildlife Habitat Areas, Old Growth Management Areas, Parks, Protected Areas, or Ungulate Winter Ranges. No seasonal ranges that support critical periods of the life history of wildlife have been identified for the site.

Species or Ecosystems at Risk

The British Columbia Conservation Data Centre occurrence data was searched for plant and wildlife species-at-risk and ecosystems-at-risk and none were identified in the proposed compressor station siting area. No rare plants, rare plant communities or wildlife species-at-risk were identified during field investigations conducted in the summers of 2011 and 2013. There is a potential for fisher and grizzly bear to use the site sporadically.

Archaeological and Heritage Resources

Archaeological potential has been assessed as low through desktop review as well as a field assessment (for a portion of the site). No archaeological sites or heritage resources are known to be present within the proposed compressor station siting area and further archaeological assessment is not considered necessary.

First Nations Community and Land Use

The proposed compressor station siting area is located within the traditional territories of the McLeod Lake Indian Band and the West Moberly First Nations based on the First Nations traditional territories used in the 2007 EAC Amendment Application.

The First Nations community profiles and land uses are consistent with those provided in the 2007 EAC Application. The Traditional Use Studies prepared for the Project indicate that First Nations may hunt and gather berries near the proposed Summit Lake compressor station site.

The proposed compressor station siting area and LSA do not cross a First Nations Reserve.

Land and Resource Use

The proposed compressor station siting area and LSA are located in the General zone of the Prince George LRMP. The proposed compressor station is consistent with the land use designation in the Prince George LRMP. The site is also contained in Electoral Area G - Crooked River-Parsnip in the Regional District of Fraser-Fort George. The Area G Official Community Plan (OCP) designates the area as "agricultural/resource". An application for rezoning to comply with the Area G OCP was submitted on December 14, 2011. The proposed compressor station site is situated on forested land. No Old Growth Management Areas or Parks and Protected Areas overlap the site.

The proposed compressor station siting area crosses the following land and resource use value components:

- approximately 45 ha Crown Land (100% of the site);
- one guide outfitting tenure (No. 701164);
- one registered trapping tenure (No. TR0716T006); and
- two PNG pipelines.

In addition to the value components listed above, the LSA encounters the following:

- the village of Summit Lake;
- Highway 97;
- one rail line;
- two Crown land notation (one Use, Recreation and Enjoyment of the Public Reserve and another for a local regional park);
- one active registered surface water point of diversion (however none are located within 200 m of the proposed siting area); and
- two water wells, both of which are greater than 200 m from the proposed siting area.

The 2007 EAC Application provides additional information regarding the land and resource use value components mentioned above.

Community and Regional Infrastructure and Services

The site is located in the Fraser-Fort George Regional District. The Village of Summit Lake is located approximately 1 km to the west of the proposed compressor station siting area. The infrastructure and services of the Fraser-Fort George Regional District and Summit Lake are consistent with that provided in the 2007 EAC Application.

Employment and Economy

The information on employment and economy in the area is consistent with that provided in the 2007 EAC Application.

Human Health and Safety

Noise and air studies are currently being conducted for the proposed Summit Lake compressor station site. The results of these investigations will be submitted to the BC EAO in December 2013.

Navigable Waters Considerations

No navigable waters would be affected by the construction and operation of the proposed compressor station.

Aesthetics and Viewsheds

A review of provincially identified viewpoints and VQO areas was conducted. Two Partial Retention VQO areas were identified in the proposed compressor station siting area and six additional Partial Retention areas and one Preservation VQO area were identified in the LSA. There are no viewpoints identified in the proposed siting area, however, there are eight within the LSA.

8.3 Effects Assessment of the Compressor Station

The potential effects and associated mitigation measures for each valued component are provided in this section for the proposed Summit Lake Compressor Station siting area. Information from the 2007 EAC Application, 2011 and 2013 field studies and 2013 desktop studies was used to complete the effects assessment. The potential effects listed here are presented in Section 8.3.1 and summarised with the mitigation measures in Table 8.1. Residual effects are presented Section 8.3.2 and a summary of the assessment of significance is presented in Table 8.2.

The assessment covers the potential effects that may occur during the entire life span of the proposed compressor station including clearing, construction and restoration, operation and maintenance, and decommissioning and abandonment.

8.3.1 Potential Effects

Geophysical Environment

Potential effect: Lowering of soil capability caused by soil mixing

Topsoil and duff removal will be conducted at the proposed Summit Lake compressor station site and admixing of topsoil and root zone material with subsoil may occur.

Topsoil conservation is necessary to preserve the capability of the soil to sustain favourable growing conditions for tree species, shrubs and groundcover. It is necessary to ensure that the topsoil resource is not mixed with subsoil materials. Topsoil often contains the necessary nutrient content, organic matter, pH and water holding characteristics necessary to foster and sustain plant growth. Subsoil materials in the Project area are often of high pH (calcareous), low in nutrients and organic matter and of excessive coarse fragment content (*i.e.,* gravely and stony).

PTP will implement the mitigation measures outlined in Table 7.2-1 of the 2007 EAC Application (PTP 2007) to reduce soil mixing.

The following residual effect has been identified: minor mixing of topsoil or root zone material with subsoil.

Potential Effect: Loss of topsoil or root zone material through wind and water erosion.

Grading and storage of loose, unvegetated soils may result in a loss of sandy textured soils to wind and water erosion. The result of this loss will be a reduction in the amount of this valuable material available for restoration of the site as well as potential sedimentation into adjacent waterbodies.

PTP will implement the mitigation measures outlined in Table 7.2-1 of the 2007 EAC Application (PTP 2007) to reduce surface water erosion.

The following residual effect has been identified: potential minor loss of topsoil or root zone material until vegetated cover is established.

Atmospheric Environment

Detailed air and noise studies are currently being conducted for the proposed Summit Lake compressor station site. The results of the investigations will be submitted to the BC EAO in January 2014.

Aquatic Environment

There are no classified drainages or watercourses crossing the proposed siting area. Miller Creek is a fish-bearing watercourse that is adjacent to the northwest edge of the proposed compressor station siting area. However, the proposed compressor station will be located outside the 20 m Riparian Reserve Zone of the watercourse. Therefore, there are no anticipated potential effects of the site on this valued component.

Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation

The potential effects of clearing, construction and restoration of the proposed compressor station siting area on the terrestrial environment include:

- sensory disturbances to wildlife;
- loss or alteration of old forest and old forest habitat features;
- alteration of wetland or riparian habitat; and
- spread of invasive plants.

Potential Effect: Sensory disturbances to wildlife

Clearing, construction and restoration activities have the potential to result in sensory disturbances to wildlife at the proposed compressor station site. Sensory disturbances often result in wildlife leaving and avoiding areas with construction activities. Consequences of sensory disturbances are most severe during important life cycle events, or in important seasonal ranges, when the animals are already energetically stressed. No seasonal ranges that support critical periods of the life history of wildlife have been identified on the proposed compressor station site.

PTP will implement the mitigation measures outlined in Table 7.2-13 of the 2007 EAC Application (PTP 2007).

No residual effect has been identified.

Potential Effect: Loss or alteration of old coniferous forest and old forest habitat features

Mature and old stands of hybrid white spruce, lodgepole pine, and subalpine-fir with some interior Douglas fir occur in the proposed compressor station siting area. Old forest habitat features including wildlife trees occur in the forested areas of the site. Forest harvesting is occurring or is planned for many of the mature and old forest stands in the region. Clearing of mature and old coniferous forest vegetation and old forest habitat features will occur during the construction phase of the project.

PTP will implement the mitigation measures outlined in Section 7.2.4 and Table 7.2-13 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: approximately 20 ha of mature and old coniferous forest habitat will be cleared for the Project.

Potential Effect: Alteration of wetland or riparian habitat

The proposed compressor station siting area overlaps with wetland habitats at the northern end of the site and the northwest corner of the site encroaches on riparian vegetation associated with riparian management area of Miller Creek. Wetland and riparian ecosystems aid in maintaining water quality and provide important feeding, cover, and nesting habitat for a variety of wildlife species. The features and the

function of the wetlands and riparian areas may be altered by clearing, construction or restoration activities.

PTP will implement the mitigation measures outlined in Table 7.2-13 of the 2007 EAC Application (PTP 2007).

No residual effect has been identified.

Potential Effect: Spread of invasive plants

Activities associated with the clearing, construction and restoration of the site may cause the spread of invasive plants. The proposed compressor station site will be fenced and the portions of the site not used for buildings and above-ground piping infrastructure will be gravelled. Vegetation within the compound will be controlled, and invasive plants will be managed through the PTP EMP.

PTP will implement the mitigation measures outlined in Table 7.2-13 of the 2007 EAC Application (PTP 2007).

The following potential residual effect has been identified: spread of invasive plants.

Species and Ecosystems at Risk

No species and ecosystems at risk were identified at the study site, therefore, there are no anticipated potential effects.

Archaeological and Heritage Resources

No archaeological and heritage resources were identified at the study site, therefore, there are no anticipated potential effects.

First Nations Community and Land Use

The potential effects of clearing, construction and restoration of the proposed compressor station siting area on First Nations community and land use include:

- disruption of seasonal harvesting activities by First Nations; and
- temporary disruption of seasonal First Nation hunting activity near the compressor station.

Potential Effect: Disruption of seasonal harvesting activities by First Nations

Hunting, fishing, berry picking and plant and material gathering are important seasonal activities for the First Nations people in the LSA. The primary hunting season is the late summer and fall in most areas. The primary fishing season is the early spring to late fall. Berry picking activity is concentrated in late summer and early fall. Plant and material gathering takes place in all seasons of the year. The Project may introduce noise along the route during the construction phase that may affect harvesting activities. The area affected is small in relation to the total area of First Nation's traditional territories available for seasonal harvesting activities. Permanent disturbances to seasonal harvesting activities due to the operation of the compressor station are expected to be negligible and, as such, operational phase residual effects have not been identified.

PTP will implement the mitigation measures outlined in Table 7.2-23 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: construction phase disruption of traditional use activities.

Land and Resource Use

Potential Effect: Construction phase disruption of commercial wildlife and other nature-based operations

Construction of the proposed compressor station may temporarily disrupt wildlife and nature-based commercial operations on the one registered trapline and one guide-outfitting territory located within the LSA of the proposed compressor station. The area affected is small in relation to the total area of available to the one registered trapper and one guide outfitter. Permanent disturbances to nature-based commercial operations from the operation of the compressor station are expected to be negligible and, as such, operational phase residual effects have not been identified.

PTP will implement the mitigation measures outlined in Table 7.2-27 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: construction phase disruption of commercial wildlife and nature-based operations.

Community and Regional Infrastructure Services

No potential effects have been identified.

Employment and Economy

The potential effects of clearing, construction and restoration of the proposed compressor station siting area on employment and economy include:

- increased project and employee spending in communities in the RSA;
- increase in local employment for the construction of the compressor station;
- increased employment and requirement for goods and services during operation of the compressor station; and
- increased tax revenues to municipal and provincial governments during operation of the compressor station.

Potential Effect: Increased project and employee spending in communities in the RSA

Construction of the Project will require access to supplies and services that could be available through local suppliers. The Project effects will primarily occur during the construction phase.

PTP will implement the mitigation measures outlined in Table 7.2-33 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: construction phase increase in local and regional business activity.

Potential Effect: Increase in local employment for the construction of the compressor station

Construction of this facility may require local workers to augment the specialized workforce.

PTP will implement the mitigation measures outlined in Table 7.2-33 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: increase in local employment during construction of permanent facilities.

Potential Effect: Increased employment and requirement for goods and services

Most of the employment generated by the construction of the proposed compressor station will occur during the clearing, construction and restoration phases. The operation of the compressor station is not

expected to require additional employees over the life of the Project. Operational crews may be stationed at key locations along the pipeline route. The compressor station may require the purchase of goods and services from local communities periodically during the operations and maintenance phases of the Project.

PTP will implement the mitigation measures outlined in Table 7.2-35 of the 2007 EAC Application (PTP 2007).

The following residual effect has been identified: purchase of goods and services from local communities.

Potential Effect: Increased tax revenues to municipal and provincial governments

The proposed compressor station will cross provincial and local government jurisdictions. PTP will implement the mitigation measure outlined in Table 7.2-35 of the 2007 EAC Application to pay taxes to municipal and provincial government bodies (PTP 2007).

The following residual effect has been identified: long-term payments to municipal and provincial bodies.

Human Health and Safety

Noise and air studies are currently being conducted for the proposed Summit Lake compressor station site. The results of these investigations will be submitted to the BC EAO in December 2013.

Navigable Waters

No navigable waters are crossed by the site, therefore, there are no anticipated potential effects on this valued component.

Aesthetics and Viewsheds

Potential Effect: Visual disturbance of viewpoints and visual quality

There are two Partial Retention VQO areas located within the proposed compressor station siting area as well as six additional Partial Retention VQO areas and one Preservation VQO area located within the LSA. There are no viewpoints located within the proposed compressor station siting area, however, there are eight located within the LSA. The compressor station siting area is adjacent to Highway 97, depending on the placement of the compressor station within the siting area, it may be visible from the highway. The visual quality of the area has already been affected by transmission lines, an existing compressor station, timber harvesting activities and logging roads. Use visual management strategies described in Section 7.2.13 of the 2007 EAC Application (PTP 2007) and the Restoration Plan (TERA 2013a), such as vegetation replanting, to further reduce any long-term disruption of viewscapes. Potential visual effects are anticipated to be minimal.

No residual effect has been identified.

8.3.2 Significance of Residual Effects

The residual effects of the clearing, construction and restoration of the proposed Summit Lake compressor station site are presented in this section. The assessment of the significance of residual effects is presented in Table 8.5 of Section 8.5. In all cases, the significance of the residual effects is assessed to be less than significant.

Geophysical Environment

Residual Effect: Minor mixing of topsoil or root zone material with subsoil

Where topsoil or root zone material is stripped off the site and stored for later use during the restoration phase of the Project, there is the potential that not all material can be salvaged and some minor mixing of material with excavated subsoil may occur.

The evaluation of the significance of the residual effect was completed with a high level of confidence. The location of the residual effect will be limited to the site footprint. There is a high probability that

potential mixing will be isolated to clearing, construction and restoration of the site, resulting in medium-term duration. The residual effect is considered to be reversible in the medium-term and of low magnitude.

PTP has determined that the context of the site in relation to the residual effect may change as a result of Project activities. The site is currently not sensitive and is resistant to mixing of topsoil or root zone material with subsoil. The sensitivity of the site to soil mixing will increase as a result of Project activities as well as decrease the site's resilience.

The residual effect is considered to be less than significant.

Residual Effect: Potential for minor loss of topsoil or root zone material until a vegetated cover is established

Minor loss of topsoil and root zone material may occur where materials are windrowed or stockpiled for later use.

Evaluation of the significance of the residual effect was completed with a high level of confidence. The location of the residual effect will be limited to the site footprint. It is probable that potential minor loss of topsoil or root zone material may occur until a vegetated cover is established. The residual effect will likely be isolated to areas where materials are windrowed or stockpiled. It is expected that minor loss of topsoil or root zone associated with Project activities will be of medium-term duration. The residual effect is considered to be reversible in the medium-term and of low magnitude.

PTP has determined that the context of the site in relation to the residual effect may change as a result of Project activities. The site is currently forested and, therefore, is not sensitive to the loss of topsoil and root zone material. The sensitivity of the site to loss of topsoil or root zone material will increase as a result of Project activities as well as decrease the site's resilience.

The residual effect is considered to be less than significant.

Atmospheric Environment

Detailed air and noise studies are currently being conducted for the proposed Summit Lake compressor station site. The results of the investigations will be submitted to the BC EAO in January 2014.

Aquatic Environment

There were no residual effects identified for the aquatic environment.

Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation

Residual Effect: Clearing of mature and old coniferous forest and old forest habitat features

Approximately 20 ha of mature and old coniferous forest habitat will be cleared for the construction of the proposed compressor station.

Sensitivity of mature and old coniferous forest habitat and habitat features varies among ecosystem type, patch size, reliance of local wildlife species on the particular habitat (*e.g.,* rarity and importance at the landscape level), and the nature and timing of disturbance. Areas of mature and old coniferous forest in the area are fragmented due to historic and current forest harvest and road construction, which increases susceptibility to wind throw thereby increasing sensitivity and decreasing resilience of the patch. Wildlife use of old and mature conifer forest is also reliant on patch size and the level of fragmentation. Resilience is anticipated to be greater for larger patches of old coniferous forest habitat.

The residual effect of clearing mature and old coniferous forest is localized on the Project footprint, and is considered reversible in the long-term and of low magnitude.

The residual effect is considered to be less than significant.

Species and Ecosystems at Risk

There were no residual effects identified for species and ecosystems at risk.

Archaeological and Heritage Resources

There were no residual effects identified for archaeological and heritage resources.

First Nations Community and Land Use

Residual Effect: Construction phase disruption of traditional use activities

Traditional activities such as hunting, fishing, berry picking, and plant and material-gathering require seasonal access to lands and waters crossed by the Project. Disruption will occur to these seasonal activities due to alterations in access along the Project. First Nations will be provided with information about construction schedules, locations and access restrictions, to avoid conflicts with traditional use activities. While effort will be made by the proponent to reduce the effects on First Nations members, it is possible that traditional use activities could be temporarily disrupted during clearing and construction phases.

Context was not assessed for this residual effect since is not considered an appropriate factor for the characterization of First Nations community and land use effects.

The location of the residual effect will be limited to the proposed compressor station siting area and LSA. There is a high probability that construction phase disruption to traditional use activities will be of occasional frequency and of medium-term duration. The residual effect is considered to be reversible in the medium-term and of medium magnitude.

The residual effect is considered to be less than significant.

Land and Resource Use

Residual Effect: Construction phase disruption of commercial wildlife and nature-based operations

The trapping and guided hunting operations in the proposed compressor station LSA require seasonal access to land and rivers crossed by or near the proposed compressor station. Seasonal access disruptions may occur as a result of the construction of the proposed compressor station. Medium-term effects in some locations will be related to improved access. While some operators view additional access as a positive benefit, others are concerned about an increase in unregulated hunting activity.

Construction of the proposed compressor station will elevate noise levels in the active construction zone and along access roads used to reach the Project construction area. PTP will contact commercial wildlife, and other nature-based operations prior to construction to advise them of project scheduling, and enable them to shift operations during the Project construction phase.

Commercial nature-based operations may be temporarily disrupted during the construction and restoration phases as a result of access disruptions or delays, and noise disturbance. PTP will discuss mitigation and possibly compensation with trappers and guided hunting and fishing operators that can demonstrate economic loss associated with Project activities based on an economic analysis including historical data.

Context was not assessed for this residual effect since is not considered an appropriate factor for the characterization of land and resource use effects.

The location of the residual effect will be limited to the proposed compressor station siting area and LSA. There is a high probability that construction phase disruption of commercial wildlife and nature-based operations will be of occasional frequency and of medium-term duration. The residual effect is considered to be reversible in the medium-term and of low magnitude.

The residual effect is considered to be less than significant.

Employment and Economy

Residual Effect: Construction phase increase in local and regional business activity

The Project will require access to local goods and services during the Project clearing, construction, and restoration phase.

Context was not assessed for this residual effect since it is not considered an appropriate factor for the characterization of beneficial economic or employment effects.

The residual effect is considered to be reversible in the medium-term, beneficial and of medium magnitude.

The residual effect is considered to be less than significant.

Residual Effect: Increase in local employment during construction of compressor station

Opportunities for local employment will exist during Project clearing, construction, and restoration.

Context was not assessed for this residual effect since it is not considered an appropriate factor for the characterization of beneficial economic or employment effects.

The residual effect is considered to be reversible in the medium-term, beneficial and of low magnitude.

The residual effect is considered to be less than significant.

Residual Effect: Purchase of goods and services from local communities

Context was not assessed for this residual effect since it is not considered an appropriate factor for the characterisation of beneficial economic or employment effects.

The requirement for goods and services will vary over time. The residual effect is considered beneficial, long-term and low in magnitude.

The residual effect is considered to be less than significant.

Residual Effect: Long-term payment to municipal and provincial bodies

PTP will pay levies and taxes through the operations phase of the proposed compressor station.

Context was not assessed for this residual effect since it is not considered an appropriate factor for the characterization of beneficial economic or employment effects.

The residual effect will be beneficial, long-term and medium magnitude.

The residual effect is less than significant.

Human Health and Safety

Detailed air and noise studies are currently being conducted for the proposed Summit Lake compressor station site. The results of the investigations will be submitted to the BC EAO in December 2013.

Navigable Waters

No navigable waters are crossed by the site, therefore, there are no anticipated potential effects on this valued component.

Aesthetics and Viewsheds

There were no residual effects identified for aesthetics and viewsheds.

8.3.3 Summary of Effects and Mitigation Measures for the Compressor Station Site

A summary of the new or increased potential effects, associated mitigation measures and residual effects for each valued component identified for the proposed compressor station are provided in Table 8.2.

TABLE 8.1

EFFECTS SUMMARY AND MITIGATION MEASURES FOR THE PROPOSED COMPRESSOR STATION

Potential Effect	Location	Mitigation Measures	Residual Effects
Valued Component : Geophysical Environment			
Lowering of soil capability caused by soil mixing	Project footprint	• PTP will implement the mitigation measures identified in Table 7.2-1 of the 2007 EAC Application (PTP 2007).	Minor mixing of topsoil or root zone material with subsoil.
Loss of topsoil or root zone material through wind and water erosion	Project footprint	• PTP will implement the mitigation measures identified in Table 7.2-1 of the 2007 EAC Application (PTP 2007).	Minor loss of topsoil or root zone material until vegetated cover is established.
Valued Component : Atmospheric Environment			
Air and noise studies for the proposed Summit Lake compressor station are currently underway. The results of these investigations will be submitted to the BC EAO in January 2014.			
Valued Component : Aquatic Environment			
No potential effect has been identified	N/A	None	None
Valued Component : Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation			
Loss or alteration of old coniferous forest and old forest habitat features	Project footprint	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007).	Clearing of mature and old coniferous forest habitat.
Sensory disturbance of wildlife during important life cycle events	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007). Additional mitigation includes the following: • In areas where clearing activities have not been completed prior to the bird nesting period, a breeding bird survey shall be undertaken by a qualified avian biologist prior to initiating activities, using Environment Canada guidance for industry standards.	No residual effect has been identified.
Spread of invasive plants	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-13 of the 2007 EAC Application (PTP 2007).	Spread of invasive plants.
Valued Component : Species and Ecosystems at Risk			
No potential effect has been identified	N/A	None	None
Valued Component : Archaeological and Heritage Resources			
No potential effect has been identified	N/A	None	None
Valued Component : First Nations Community and Land Use			
Disruption of seasonal harvesting activities by First Nations (hunting, camps, berries)	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-23 of the 2007 EAC Application (PTP 2007).	Construction phase disruption of traditional use activities.
Valued Component : Land and Resource Use			
Construction phase disruption of commercial wildlife and other nature-based operations	Project footprint/LSA	• PTP will implement the mitigation measures identified in Table 7.2-27 of the 2007 EAC Application (PTP 2007).	Construction phase disruption of commercial fish, wildlife, and nature-based operations.
Valued Component : Community and Regional Infrastructure and Services			
No potential effect has been identified	N/A	None	None

TABLE 8.1 Cont'd

Potential Effect	Location	Mitigation Measures	Residual Effects
Valued Component : Employment and Economy			
Increased Project and employee spending in communities in the RSA	RSA	• PTP will implement the mitigation measures identified in Table 7.2-33 of the 2007 EAC Application (PTP 2007).	Construction phase increase in local and regional business activity.
Project construction will increase employment in communities in the RSA	RSA	• PTP will implement the mitigation measures identified in Table 7.2-33 of the 2007 EAC Application (PTP 2007).	Increase in local employment during construction of compressor station.
Increased employment and requirement for goods and services	RSA	• None identified.	Purchase of goods and services from local communities.
Increased tax revenues to municipal and provincial governments	RSA	• PTP will implement the mitigation measures identified in Table 7.2-35 of the 2007 EAC Application (PTP 2007).	Long-term payments to municipal and provincial bodies.
Valued Component : Human Health and Safety			
Air and noise studies for the proposed Summit Lake compressor station are currently underway. The results of these investigations in relation to Human Health and Safety will be submitted to the BC EAO in December 2013.			
Valued Component : Navigable Waters			
No potential effect has been identified	N/A	None	None
Valued Component : Aesthetics and Viewsheds			
Visual disturbance of viewpoints and visual quality	Project footprint/LSA	• The selected site is surrounded by forest, which will mitigate the visibility of the compressor station. • Implement the Restoration Plan. • Light will not be directed above the horizontal plane unless required for health and safety.	No residual effect identified.

An assessment of the significance of the identified residual effects is provided in Table 8.2. The determination of significance has not changed from the 2007 EAC Application.

TABLE 8.2

SIGNIFICANCE OF POTENTIAL RESIDUAL EFFECTS FOR THE PROPOSED COMPRESSOR STATION

Potential Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Valued Component: Geophysical Environment								
Minor mixing of topsoil or root zone material with subsoil	Compressor station footprint	Short-term	Isolated	Medium-term	Low	High	High	Less than significant
Minor loss of topsoil or root zone material until a vegetated cover is established	Compressor station footprint	Medium-term	Isolated	Medium-term	Low	High	High	Less than significant
Valued Component : Atmospheric Environment								
Air and noise studies for the proposed Summit Lake compressor station are currently underway. The results of these investigations will be submitted to the BC EAO in January 2014.								
Valued Component : Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation								
Clearing of mature and old coniferous forest habitat.	Compressor station footprint	Short-term	Isolated	Long-term	Low	High	High	Less than significant

TABLE 8.2 Cont'd

Potential Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Spread of invasive plants	Compressor station footprint to LSA	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Valued Component : First Nations Community and Land Use								
Construction phase disruption of traditional use activities	Compressor station footprint to LSA	Medium-term	Occasional	Medium-term	Low	High	Moderate	Less than significant
Valued Component : Land and Resource Use								
Construction phase disruption of commercial wildlife and nature-based operations	Compressor station footprint to LSA	Medium-term	Occasional	Medium-term	Low	High	Moderate	Less than significant
Valued Component : Employment and Economy								
Construction phase increase in local and regional business activity	RSA	Medium-term	Isolated	Medium-term	Medium, beneficial	High	High	Less than significant
Increase in local employment during construction of compressor station	RSA	Medium-term	Isolated	Medium-term	Low, beneficial	Moderate	Moderate	Less than significant
Purchase of goods and services from local communities	RSA	Long-term	Periodic	Long-term	Low, beneficial	High	High	Less than significant
Long-term payments to municipal and provincial bodies	RSA	Long-term	Periodic	Long-term	Medium, beneficial	High	High	Less than significant

8.4 Cumulative Effects Assessment of the Compressor Station

A CEA of the proposed Summit Lake compressor station site will be submitted in December 2013 following the completion of air and noise investigations at the proposed Summit Lake compressor station site.

9.0 REFERENCES

9.1 Literature Cited

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9.2 GIS Data and Mapping References

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APPENDIX A

ORTHOIMAGERY MAPSET

To be included as a separate document (map book)

APPENDIX B

WATERCOURSE CROSSING TABLE

Watercourse ID on Proposed Route	Watercourse ID on Certified Route	KM (May 2011)	Watercourse Name	Provincial Classification	Zone	Easting	Northing	Distance from Original Crossing (m)	Upstream or Downstream Shift	2013 Primary Crossing Method	2013 Contingency Crossing Method	Navigability	Sensitivity	Net Change in Habitat Potential
Salmon River														
12	12	20.8	Salmon River	S1	10	506474	6009373	101.10	U	Trenchless with Monitoring	Isolate with Fish Salvage and Monitoring or Open Cut	Yes	High	No Change
RA 13	13	21.7	Unnamed Channel	S3	10	505606	6009185	124.35	U	Open Cut if Dry or Frozen to Bottom	Isolate with Fish Salvage and Monitoring	No	High	No Change
RA 20N	20N	31.6	Salmon River	S1	10	496534	6006304	594.85	D	Trenchless with Monitoring	Isolate with Fish Salvage and Monitoring or Open Cut	Yes	High	Decrease
Crocker 1														
RA 22Na	Not previously crossed.	36.05	Unnamed Channel	S6	10	491978	6005689	*	*	Open Cut with Sediment Control	Isolate if Flowing	No	Low	*
RA 23N	23N	36.3	Crocker Creek	S2	10	491913	6005628	242.92	D	Isolate with Fish Salvage and Monitoring	Open Cut if Dry or Frozen to Bottom	No	Moderate	Increase
Scott														
VAR_1-1	32	56.5	Unnamed Channel	S6	10	472428	6003747	631.53	U	Open Cut with Sediment Control	Isolate if Flowing	No	Low	Decrease
VAR_1-2	32	56.5	Unnamed Channel	S6	10	472416	6003769	639.36	U	Open Cut with Sediment Control	Isolate if Flowing	No	Low	Decrease
VAR_1-3	35N	58.3	Chinohchey Creek	S2	10	470782	6004463	5,877.692	U	Isolate with Fish Salvage and Monitoring	Open Cut if Dry or Frozen to Bottom	No	Low	Decrease
VAR_1-7	Not previously crossed.	59.2	Unnamed Tributary to Chinohchey Creek	S4	10	469766	6005266	*	*	Open Cut if Dry or Frozen to Bottom	Isolate with Fish Salvage and Monitoring if Flowing	No	Low	*
VAR_1-8	Not previously crossed.	59.8	NCD	S6	10	469202	6005426	*	*	Open Cut if Dry or Frozen to Bottom	Isolate if Flowing	No	Low	*
VAR_1-9	Not previously crossed.	61.1	Unnamed Channel	S3	10	467940	6005542	*	*	Open Cut if Dry or Frozen to Bottom	Isolate with Fish Salvage and Monitoring if Flowing	No	Low	*
VAR_1-12	Not previously crossed.	64	Gravel Creek	S2	10	465420	6005081	*	*	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	Low	*
VAR_1-16	Not previously crossed.	67.5	Unnamed Channel	S6	10	461802	6004378	*	*	Open Cut if Dry or Frozen to Bottom	Isolate if Flowing	No	Low	*
VAR_1-18	40	68.6	Unnamed Channel	S6	10	460969	6004253	1,028.995	U	Open Cut if Dry or Frozen to Bottom	Isolate if Flowing	No	Low	Decrease
VAR_1-20	42	70.1	Unnamed Channel	S6	10	459290	6003848	1,149.518	U	Open Cut if Dry or Frozen to Bottom	Isolate if Flowing	No	Low	No Change
Breadalbane														
53N	RA 53N	85.7	Breadalbane Creek	S3	10	444769	6000905	136.19	D	Isolate with Fish Salvage and Monitoring	Open Cut if Dry or Frozen to Bottom	No	Moderate	Increase
New Road 51.5 (Road 51.5)														
RA 59	RA 59	89.5	Unnamed Channel	S6	10	441090	6001331	83.59	U	Open Cut if Dry or Frozen to Bottom	Isolate if Flowing	No	Low	No Change
61	61	89.7	Unnamed channel	S3	10	440790	6001326	238.24	U	Isolate with Fish Salvage and Monitoring	Open Cut if Dry or Frozen to Bottom	No	Moderate	No Change
Fraser														
RA 73	73	105.4	Clear Creek	S3	10	425836	5998756	243.65	D	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	High	Increase
RA 84b	Not previously crossed.	117.3	Unnamed Wetland	W1	10	413948	6001815	*	*	Open Cut if Frozen to Bottom	Isolate	No	Low	*
RA 85 2013	85	119.2	Unnamed Channel	S5	10	412397	6001846	5,713.27	U	Isolate if flowing	Open Cut if Dry or Frozen to Bottom	No	Low	Decrease (S3 to S6)
RA 84z	Not previously crossed.	119.3	Unnamed Channel	S6	10	412255	6001849	*	*	Isolate if flowing	Open Cut if Dry or Frozen to Bottom	No	Low	*

Watercourse ID on Proposed Route	Watercourse ID on Certified Route	KM (May 2011)	Watercourse Name	Provincial Classification	Zone	Easting	Northing	Distance from Original Crossing (m)	Upstream or Downstream Shift	2013 Primary Crossing Method	2013 Contingency Crossing Method	Navigability	Sensitivity	Net Change in Habitat Potential
RA 93 2013	93	121.2	Kluk Creek	S3	10	410418	6001339	3,098.51	U	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	Moderate	No Change
RA 94 2013	94	122.2	Unnamed Channel	S3	10	409405	6001247	3,467.32	U	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	Moderate	Decrease
RA 94a	Not previously crossed.	123.9	Unnamed Channel	S6	10	407705	6001538	*	*	Isolate if flowing	Open Cut if Dry or Frozen to Bottom	No	Low	*
RA 94c	Not previously crossed.	125.5	Unnamed Channel	S6	10	406976	6001280	*	*	Isolate if flowing	Open Cut if Dry or Frozen to Bottom	No	Low	*
RA 99a	Not previously crossed.	127	Unnamed Channel	S5	10	404534	6001637	*	*	Isolate if flowing	Open Cut if Dry or Frozen to Bottom	No	Low	*
VAR_2-1	Not previously crossed.	127	Swamp	Swamp	10	404197	6001213	*	*	Open Cut	Open Cut	Unknown	Low	*
RA 100 2013	100	128	Nine Mile Creek	S2	10	403769	6000797	2,205.656	U	Existing	Clear Span Bridge	No	High	Decrease
RA 104 2013	104	133	Tatsutnai Creek	S2	10	398554	5999340	2,992.92	U	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	Low	Decrease
RA 108 2013	108	135.6	Dog Creek	S4	10	396129	5997731	563.19	U	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	Moderate	Decrease
110	110	137.5	Unnamed Wetland	W4	10	394535	5997236	65.00	U	Open Cut with Sediment Control	Open Cut with Sediment Control	No	Low	No Change
VAR_3-3	112	139.5	Unnamed Channel	S6	10	393043	5997238	366.48	U	Open Cut if Dry	Isolate if Flowing	No	Low	No Change
VAR_3-4	113	141.3	Unnamed Channel	S6	10	390982	5997477	71.89	D	Open Cut if Dry	Isolate if Flowing	No	Low	No Change
VAR_3-7	115	142.6	Unnamed Channel	S6	10	389905	5998528	1,045.17	U	Open Cut if Dry	Isolate if Flowing	No	Low	Decrease
VAR_3-8	Not previously crossed.	142.7	Unnamed Channel	S6	10	389848	5998576	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
VAR_3-12	119	143.9	Unnamed Channel	S6	10	388927	5998806	1600	U	Open Cut if Dry	Isolate if Flowing	No	Low	No Change
VAR_3-20	126N	148.2	Ormond Creek	S2	10	384508	5997665	1,379.972	U	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	Moderate	Increase
Stern Creek														
RA 133	133	157.1	Stern Creek	S2	10	376023	5996359	84.75	D	Isolate with Fish Salvage and Monitoring	Isolate with Fish Salvage and Monitoring	No	Moderate	Decrease
Trois Ligne														
140Nd	Not previously crossed.	163.75	Unnamed Wetland	W1	10	369843	5993794	*	*	Open Cut if Dry	Isolate if Flowing	Unknown	Low	*
RA 141	141	164.6	Endako River	S1	10	369351	5993688	196.58	D	Isolation with salvage and monitoring	Trenchless with Monitoring	Yes	Moderate	Decrease
RA 141b 2012	RA 141b	166	Unnamed Channel	S5	10	367955	5994164	306.78	D	Open Cut if Dry	Isolate if Flowing	No	Low	No Change
McDowell														
142	142	170.2	Unnamed Channel	S6	10	363934	5994040	27.83	no stream	Open Cut if Dry	Isolate if Flowing	No	Low	No Change
RA 142a	142a	170.4	Unnamed Channel	S6	10	363697	5994015	102.40	U	Isolate if flowing	Isolate if flowing	No	Low	Decrease (S4 to S6)
RA 143zz	143zz	170.9	Unnamed Channel	S4	10	363217	5993940	626.16	U	Isolate with Fish Salvage and Monitoring	Open Cut if Dry or Frozen to Bottom	No	Low	Increase
Elliot														
144aa	Not previously crossed.	174.46	Unnamed Wetland	Wetland	10	359883	5995293	*	*	Open Cut if Dry	Isolate if Flowing	Unknown	Low	*
145	145	176.1	Unnamed Channel	S2	10	358336	5995665	25.16	U	Isolate with Fish Salvage and Monitoring	Open Cut if Dry	No	High	No Change

Watercourse ID on Proposed Route	Watercourse ID on Certified Route	KM (May 2011)	Watercourse Name	Provincial Classification	Zone	Easting	Northing	Distance from Original Crossing (m)	Upstream or Downstream Shift	2013 Primary Crossing Method	2013 Contingency Crossing Method	Navigability	Sensitivity	Net Change in Habitat Potential
South														
RA 149a	Not previously crossed.	183.7	Unnamed Channel	S6	10	350919	5996075	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
RA 149c	Not previously crossed.	184.8	Unnamed Channel	S6	10	349769	5995967	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
RA 149d	Not previously crossed.	185.9	Unnamed Channel	S6	10	348687	5996036	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
RA 149e	Not previously crossed.	186	Unnamed Channel	S6	10	348601	5996033	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
RA 149g	Not previously crossed.	188.7	Unnamed Channel	S3	10	346023	5996479	*	*	Isolate with Fish Salvage and Monitoring if Flowing	Open Cut if Dry	No	Moderate	*
RA 149h	Not previously crossed.	189.8	Unnamed Channel	S6	10	344919	5996510	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
RA 149i	Not previously crossed.	190.7	Unnamed Channel	S6	10	344070	5996552	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
RA 149k	Not previously crossed.	192	Unnamed Channel	S6	10	342744	5996501	*	*	Open Cut if Dry	Isolate if Flowing	No	Low	*
RA 149m	149	193.2	Tchesinkut Creek	S2	10	341613	5996355	17,298.69	U	Isolate with Fish Salvage and Monitoring	Isolate if flowing	Yes	High	Decrease

Note: * Not applicable. The watercourse was not crossed on the certified route.