

Environmental Constraints Analysis and Cost Estimate

Prince Rupert Capacity Study

Prepared for:



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This report is based on facts and opinions contained within the referenced documents, including the results of any data collection programs carried out in relation to this report. We have attempted to identify and consider facts and documents relevant to the scope of work, accurate as of the time during which we conducted this analysis. However, the results, our opinions, or recommendations may change if new information becomes available or if information we have relied on is altered. We applied accepted professional practices and standards in developing and interpreting data. While we used accepted professional practices in interpreting data provided by PNG and Lauren Services Inc. or third party sources, we did not verify the accuracy of any such data. This document must be considered as a whole; selecting only portions of this report may result in a misleading view of the results, our opinions, or recommendations.

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1.0 Introduction

The Prince Rupert Capacity Study (PRCS) is a pre-FEED study initiated by Pacific Northern Gas Ltd. ("PNG") to expand their high pressure sweet natural gas supply infrastructure in northwest, BC. Four infrastructure segments between Terrace and Prince Rupert, BC have been initially identified which are presently limiting PNG's capacity to deliver gas to Ridley Island customers and are considered for expansion. The Prince Rupert Capacity Study ("PRCS") is being led by Lauren Services ("Lauren") to identify and scope the expansion opportunities along with engineering, environmental, and other technical requirements to be considered. The scope of the PRCS is presently limited to that which would be required to develop a Class 3 cost estimate for the FEED portion of the project.

Khtada Environmental Services LP ("Khtada") was retained to support the PRCS by conducting a desktop study and attend planning meetings with PNG, Lauren, and other contractors/consultants to broadly scope requirements. Khtada's scope specifically includes the following:

- Summarize in a desktop study environmental baseline information available for the four identified infrastructure segments;
- Identify permitting pathways required to obtain environmental regulatory approvals to move the segment(s) into the construction phase;
- Identify information required to make regulatory and permit submissions and scope the fieldwork required;
- Attend a routing meeting to communicate initial environmental constraints associated with each upgrade and option (February 21, 2018); and,
- Attend a risk identification and schedule workshop to identify individual segment risks and to review the schedule with the project team.

In this document, Khtada has also provided a Class 3 cost estimate to:

- Collect required environmental information to support regulatory applications;
- Support others in submission of Oil and Gas Commission (OGC) related permits and approvals; and,
- Prepare and submit applications for non-OGC related environmental permits.

1.1 Scope of Proposed System Expansion

The following four proposed system expansion options were contemplated and finalized at the Route Review Workshop (Table 1).

Table 1. Four proposed system expansion options

#	Segment Description	Notes
1	Compressor Station – R5	Upgrade the existing service site at "R5" south of Terrace to a compressor station. Current equipment at the site includes a scrubber, tank, sending/receiving barrels, and temporary buildings, and new equipment would include a compressor and one permanent building/structure.
2	Kitimat Lateral Connector (R5 to Terrace Junction)	Upgrade the existing 6" pipeline to a 10" or 12" pipeline along the current alignment from the R5 site to Terrace Junction southeast of Terrace (4.88 km length using existing ROW). This will facilitate transportation of product from the Kitimat Lateral to the Prince Rupert Lateral while avoiding constraints associated with the current alignment of the Terrace mainline.
3	Compressor Station – Salvus Camp	Upgrade the existing valve site at Salvus to a compressor station. Current equipment at the site includes sending/receiving barrels and a pipeline bypass and valve. New equipment would include a compressor and one permanent building/structure.
4	Galloway Station to Ridley Terminals – Pipeline Expansion	<p>Existing infrastructure at Galloway Station includes a BC Hydro metering station and a pipeline letdown station that feeds Prince Rupert. Existing pipeline would be expanded between Galloway Station and Ridley Terminals.</p> <p><u>Common Upgrade – (Option 4A)</u></p> <ul style="list-style-type: none"> Galloway Station to Galloway Rapids – 30" gas storage bottles to be removed or replaced; New regulator station take-off (if required) to be constructed. <p>Expansion options are divided into 2 sections:</p> <ul style="list-style-type: none"> 4B: North Option Route starting from Galloway Rapids and following the existing PNG alignment along Highway 16W and then the Ridley Island Road into Ridley Island and the RIPET. 4C South Option Route starting from Galloway Rapids and generally following the existing PNG alignment along the highway to the Wolf Creek Road. The new pipeline would follow the Wolf Creek road crossing to Watson Island and under Porpoise Harbour into Ridley Island and the RIPET.

2.0 Scoping of Constraints and Permitting Requirements

Environmental constraint scoping and determination of potential regulatory permits and application information was performed using a logical approach which follows generally accepted practices. Methods to obtain information relevant to the segment are presented below.

2.1 Environmental Constraint Scoping

Land development in BC may require specific permits, authorizations, or approvals from provincial and/or federal government agencies, depending on the nature and scope of the development and its potential to interact with species and habitat of significance. The PRCS involves contemplation of both re-development of existing infrastructure 'in-situ' and development of new infrastructure, both of which have the potential to affect aquatic and terrestrial resources and trigger regulatory referral requirements. Some regulatory requirements are risk-based, meaning the requirement is omitted for low-risk activities, and some regulatory requirements are simply triggered by proposing an activity.

To identify potential constraints, and ultimately determine regulatory requirements, available environmental background information was compiled by consulting provincial and federal

information databases and catalogues relevant for the area. The following web-based information resources were queried:

- SIWE – Species Inventory Web Explorer;
- BC Land and Resource Data Warehouse;
- Integrated Land and Resource Registry; and,
- iMAP BC Mapping Tool.

While not all aquatic and terrestrial resource information can be found online, the following spatial information was obtained from the resources above and considered in the constraints analysis:

- Mapped critical habitat for species of concern, and designated Wildlife Habitat Areas (WHAs);
- Approved Ungulate Winter Range (UWR);
- Old Growth Management Areas (OGMAs);
- Terrain Resource Information Mapping (TRIM) stream and lake layer, and topographic information;
- Fish data points (i.e. locations where fish have been captured or documented to occur, as available in the Fisheries Inventory Summary System of BC);
- Watercourse feature data points (i.e. falls or obstructions to fish passage);
- Provincial Parks; and,
- First Nations Reserve Lands.

2.1.1 Environmental Effects Scoping

Risk of causing environmental effects can be a driver for many regulatory permitting requirements. Potential environmental effects may occur if mitigation measures are not put in place. Table 2 provides a high-level scoping of potential environmental effects associated with pipeline and related infrastructure construction which was considered during the permitting scoping exercise.

Table 2. Environmental effects scoping

Activity	Potential Effects
General construction and use of industrial equipment	<ul style="list-style-type: none"> • Accidents and malfunctions of equipment resulting in spills of contaminants to soil or water. • Increased noise and emissions. • Introduction of wildlife attractants. • Introduction of invasive species.
Vegetation removal	<ul style="list-style-type: none"> • Erosion of exposed surfaces resulting in an increase in suspended sediment concentrations. • Change in habitat for avian and terrestrial wildlife. • Mortality or disturbance to wildlife (e.g., dens) and nesting birds. • Removal of rare and endangered ecosystems and plants.
Pipeline installation including materials management	<ul style="list-style-type: none"> • Erosion of exposed surfaces resulting in an increase in suspended sediment concentration. • Excavation in developed industrial lands and within contaminated soils. • Use of chemical that could spill or leach resulting in spills of contaminants to soil or water.

Watercourse crossings including road and pipeline	<ul style="list-style-type: none"> • Change or alteration in fish habitat. • Mortality of fish during instream works. • Disturbance to of stream banks and increase in suspended sediment concentration. • Removal of riparian vegetation resulting in loss of cover and habitat complexity. • Use of chemicals that could change water chemistry (e.g., pH).
Pipeline commissioning	<ul style="list-style-type: none"> • Discharge of hydrostatic test water and discharge of contaminants to soil or water. • Introduction of invasive species during reclamation.

2.2 Mitigation Measures

PNG's environmental management system includes detailed mitigation measures associated with operation and maintenance of their pipeline transmission and distribution infrastructure titled *Environmental Standards, Practices, and Procedures* (ESPP). To a large extent, the mitigation measures referenced in the document are considered sufficient to avoid environmental impacts. It has been assumed that these measures will be considered during the permitting scoping and environmental assessment phases of the project. Where standard measures identified in the ESPP are not expected to be considered sufficient by regulatory agencies, a Construction Environmental Management Plan ("CEMP") may be required. It is noted in this estimate when this may be required.

2.3 Permitting Scoping

Referencing the information from environmental constraint scoping, Khtada has provided an initial evaluation of the federal and provincial requirements that maybe triggered based on the combined scope of all segments and options (Table 3). The list below is refined in the subsequent sections for each option but focused on permits that are applicable (Yes) and permits likely required (Likely) in Section 3. The below exercise assumes that PNG's ESPP will be incorporated into design, planning and construction.

Table 3. Regulatory permit scoping

Agency	Permit/Authorization/Approval	Applicable	Permit Trigger
Federal			
CEAA	Canadian Environmental Assessment Act Project Approval	No	Projects involving construction of a new pipeline >40 km or interfere with a Migratory Bird Sanctuary
DFO	Request for Review under the Fisheries Act	Likely	Watercourse crossings that cause serious harm to fish species of commercial, recreation and aboriginal (CRA) importance may require review.
DFO	Fisheries Act Authorization	Unlikely	DFO review may trigger an Authorization under Section 35(2)(b). However, Khtada is of the opinion negative effects can be mitigated to the extent practical to avoid an Authorization.
DFO	Fisheries Act Scientific Fish Collection	Yes	Is required for fish inventories and salvage (re-location) during construction.
DFO/EC	Species at Risk Act Permit to affect a listed species or its critical habitat	Unlikely	Projects that cross federal land are required to protect critical habitat of listed species. Assessment is required to confirm presence of species and potential impacts.
EC	Migratory Bird Convention Act Permit to destroy or disturb migratory bird nests	Unlikely	Mitigation will include clearing trees outside nesting period and surveys during construction to confirm absence. Assessment required to confirm.
TC	Navigation Protection Act Notice of Works	Likely	Pipelines buried under the bed of Navigable Waters and pipelines attached to existing works are considered

Agency	Permit/Authorization/Approval	Applicable	Permit Trigger
			Minor Works and may not require referral. Pipelines placed on the marine floor may require Notice of Works.
TC	Navigation Protection Act Approval of Works	Unlikely	Pipelines crossing Navigable Waters not meeting the conditions under Minor Works will require approval.
Provincial			
EAO	BC Environmental Assessment Act Environmental Assessment Certificate	No	The project involved modifications of pipelines <114mm in diameters and <60 km long, and therefore not a reviewable project.
OGC	Land Act Investigative Use Permit (≤2 year)	Likely	Geotechnical or other investigation that result in a disturbance to land, soil and vegetation, or involve previously leased land require permission.
OGC	Land Act Licence of Occupation	Likely	Use of crown land where minimal improvement is proposed (e.g. drag sections).
OGC	Land Act Right-of-Way and Easement	Likely	Use of crown land for new pipeline right-of-way.
ECC	Open Burning Smoke Control Regulation Burning Permit	Unlikely	Majority of alignment incorporates existing cleared corridors. Cleared vegetation is likely not suited for burning.
MOTI	Transportation Act	Likely	Permission to construct on a highway or railway ROW from the Ministry of Transportation and Infrastructure may be required for current access from Highway 16.
FLNRORD	Wildlife Act Permits; fish and amphibian	Yes	Required for fish and amphibian inventory for evaluating fish and amphibian habitat characteristics. Salvage/relocation may be required during in-stream construction.
ECC	Hazardous Waste Regulation; Hazardous Waste Transport License Hazardous Waste Storage License	No	Not expected provided all waste discharges meet BC water quality guidelines and stored wastes will no exceed regulated amounts.
EMPR	Mines Act Approval of gravel extraction	No	No local quarries and borrow area planned as part of construction.
OGC	Forest Act Occupant / Master Licence to Cut	Likely	Required for harvesting merchantable timber from tenured lands.
OGC	Oil and Gas Activities Act Pipeline or Facility Activities Permit	Yes	For new (or amendment to) pipeline or facilities. Instream works approvals may be included within the activities permits.
OGC	Heritage Conservation Act Heritage Inspection Permit	Likely	Required for any archeological impact assessment that will require ground altering activities.
OGC	Heritage Conservation Act Archaeological Site Alternation Permit	Unlikely	Would be required if the Archaeological Survey identifies archeological protected features will be affected by construction
OGC	Water Sustainability Act Approval for Short Term Use of Water (Temporary water withdrawal Permit)	Likely	Small quantities for investigation purposes may be authorized by the IUP. Permit will be required if water withdrawal from a watercourse is proposed.
OGC	Water Sustainability Act Notification/Approval of Changes In and About a Stream	See Oil and Gas Activities Permit	For instream and riparian, roads and pipeline activities, Included in the Oil and Gas Activities Permit.

2.4 Environmental Assessment Information Requirements

Environmental Assessments (EAs) provide an integrated process for identifying and evaluating potential adverse environmental effects that may occur during the development of a project. Khtada believes the scope of information collected during an EA is driven by the application requirements for applicable permits, authorizations, and approvals required by law and regulation and adapted to ensure sufficient information is collected about a sensitive species or feature based on its unique ecological needs.

When developing the information requirements, Khtada recognizes two levels of assessment detail:

- **Environmental Overview Assessment** provides a desktop-level review of environmental sensitivities with potential to occur in the study area. A focus is given to species and ecosystems with specific regulatory protections. Field assessments are performed to confirm findings and evaluate potential for project activities to interact with the sensitivity. An Environmental Overview Assessment contains generally enough detail to describe sensitivities to an extent where standard environmental best management practices can effectively mitigate effects. The Environmental Overview Assessment can be completed following conceptual design and does not include any fish/wildlife sampling.
- **Detailed Environmental Effects Assessment** is completed following approximately 50% detailed design. The detailed assessment includes components of the overview assessment while also considering the potential for specific aspects of the project to impact environmental sensitivities. To evaluate this, rare and endangered species, fish, amphibians, water quality and soil are sampled and inventoried. Habitat suitability is evaluated at the site level as opposed to the landscape level. The detailed assessment evaluates specific mitigation required to meet regulatory requirements.

3.0 R5 Compressor Station

3.1 Environmental Constraints

Based on a review of the baseline information, the following environmental constraints were noted:

- Construction will occur within the existing PNG R5 tenure;
- No clearing is required for construction;
- There is one mapped watercourse north of R5 area that flows into Sockeye Creek. No information on fish or amphibian presence was obtained although high mapped gradients suggest the watercourse is likely non-fish bearing.
- Potential for songbird nesting in existing infrastructure

3.2 Permitting Scoping

Pending the results of the field assessment, the following permits may be required prior to construction:

- *Oil and Gas Activities Act* – Facilities Activity Permit (or an amendment to the existing permit).

3.3 EA Information Requirements

It is expected that an Environmental Overview Assessment would be sufficient in identifying and describing potential environmental effects associated with development of a compressor station at the R5 site.

4.0 Kitimat Lateral Connector (R5 to Terrace Junction)

4.1 Environmental Constraints

Based on a review of the baseline information, the following environmental constraints were noted:

- The pipeline will follow the existing alignment of PNG's decommissioned 6" line, however may have to be widened to support construction (e.g. drag sections). Additional clearing is likely required.
- One freshwater stream crossing is required on an unnamed tributary to Thornhill Creek. No information on fish or amphibian habitat was available although mapped gradients suggest the stream is potentially fish bearing and provides potential habitat for amphibians.
- A majority of construction will occur within the existing and cleared ROW. Construction outside the existing ROW may interact with potential breeding bird habitat.

4.2 Permitting Scoping

Pending the results of the field assessment, the following permits may be required prior to construction:

- *Oil and Gas Activities Act* – Pipeline Activity Permit (or an amendment to the existing permit).
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 11 for changes in and around a stream dependent upon the results of the watercourse survey. The Pipeline Activity Permit may include the Section 11 requirements.
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 10 Approval for Short Term Use of Water (temporary water withdrawal permit) should an onsite source of water be required.
- *Oil and Gas Activities Act (Land Act)* – License of Occupation or ROW for widening and construction footprints.
- *Oil and Gas Activities Act (Forest Act)* - Occupant License to Cut likely required depending upon scope of clearing and quality of timber.
- *Wildlife Act* – Scientific Fish Collection Permit (salvage) and Amphibian Salvage Permit potentially required for salvages related to the watercourse crossing. Avoiding instream works would negate the need for this permit.
- *Fisheries Act* – Scientific Licence for fish collection is potentially required for salvages related to the watercourse crossing containing anadromous fish.

4.3 EA Information Requirements

In general, environmental sensitivities associated with the Kitimat Lateral Connector are low and effects easily mitigated through implementation of PNG's ESPPs. A fish and amphibian assessment

will be required to confirm this low risk. An Environmental Assessment Overview is anticipated to be sufficient to document potential interactions and effects.

5.0 Compressor Station – Salvus Camp

5.1 Environmental Constraints

Based on a review of the baseline information, the following environmental constraints were noted:

- Segment involves an upgrade to an existing valve site. As such, minimal clearing should be required.
- Segment will occur within identified Moose Ungulate Winter Range (UWR) and near identified critical nesting habitat for Marbled Murrelet;
- A wetland providing potential fish and amphibian habitat is located within 50 m of the valve site.
- The area contains large deciduous and coniferous trees that provide potential mammal denning and raptor nesting habitat.
- The area is within 200 m from Skeena River and located within 200-year floodplain, although separated from the Skeena River by CN Rail tracks and Highway 16.
- A rare plant, White Adders Mouth Orchid, has been identified in the area.
- The segment will occur within a rare ecosystem – Black Cottonwood - red alder, salmonberry and Sitka Spruce – very wet hyper maritime.

5.2 Permitting Scoping

Pending the results of the environmental assessment, the following permits may be required prior to construction:

- *Oil and Gas Activities Act* – Facility Activity Permit (or an amendment to the existing permit).
- *Oil and Gas Activities Act* – License of Occupation or other tenure for additional lands.
- *Transportation Act* – Permission to construct on a highway or railway ROW from the Ministry of Transportation and Infrastructure may be required for current access from Highway 16.
- *Species at Risk Act* – Permit to affect critical habitat of Species at Risk from Environment Canada. This permit should not be required with appropriate mitigation.
- *Fisheries Act* – Scientific Licence for fish collection is potentially required for salvages related to the watercourse crossing containing anadromous fish.

5.3 EA Information Requirements

Environmental sensitivities associated with the Salvus Compressor Station are moderate to high and potential interactions are present of regulatory concern. A Detailed Environmental Effects

Assessment would be required to document potential interactions with rare plant and ecosystems, fish, amphibian, mammals and raptors. A CEMP providing site specific mitigation measures would be required to address the level of environmental sensitivity observed on the site.

6.0 Galloway Station to Ridley Terminals

6.1 4A – Common Option: Galloway Station to Galloway Rapids

6.1.1 Environmental Constraints

Based on a review of the baseline information, the following environmental constraints were noted:

- The pipeline will generally follow the existing ROW and parallel others' ROWs. A majority of the footprint has been previously disturbed.
- Minimal mature vegetation clearing is required due to the current level of development. However, mature vegetation is located within close proximity to the alignment which may provide mammal denning and raptor nesting habitat.
- Three mapped watercourse crossings. No information on fish or amphibian presence was available although mapped gradients between 10 and 15% and small watershed area suggests they are likely non-fish bearing.
- Segment is within 50 m of the marine environment and uncontrolled released from construction areas may affect marine species including Species and Risk Act listed species.
- Critical habitat for nesting Marbled Murrelet is located across and upslope of Highway 16.

6.1.2 Permitting Scoping

Pending the results of the environmental assessment, the following permits may be required prior to construction:

- *Oil and Gas Activities Act* – Pipeline Activity Permit (or an amendment to the existing permit).
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 11 for changes in and around a stream dependent upon the results of the watercourse survey. The Pipeline Activity Permit may include the Section 11 requirements.
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 10 Approval for Short Term Use of Water (temporary water withdrawal permit) although onsite sources are likely unsuitable.

A DFO Request for Review and Environment Canada Permit to affect critical habitat of a listed species is likely not required with implementation of mitigation measures to avoid harm.

6.1.3 EA Information Requirements

Environmental sensitivities associated with the Galloway Station to Galloway Rapids Segment are low to moderate and potential interactions of regulatory concern area limited. A Detailed Environmental Effects Assessment would be required to document environmental sensitivities and

fish present in the watercourses. A CEMP providing site species mitigation measures would be required to address the level of environmental sensitivity observed on the site.

6.2 4B- North Option Route from Galloway Rapids to RIPET

6.2.1 Environmental Constraints

Based on a review of the baseline information, the following environmental constraints were noted:

- The pipeline generally follows the existing PNG and others' ROW. A majority of the footprint has been previously disturbed, limiting interactions with rare plant and ecosystems and wildlife.
- 13 mapped watercourses are crossed by the pipeline of which five are confirmed fish bearing based on historical data. Based on mapped gradient, the remaining eight stream area likely fish bearing.
- Based on historical data, Chinook Salmon, Dolly Varden and Cutthroat Trout may be present and are considered species of CRA importance. Sculpin and Stickleback are also present.
- The pipeline will cross Galloway Rapids and potentially interact with marine species including Species and Risk Act listed species. The risk is reduced with an aerial crossing or crossing attached to the highway bridge.

6.2.2 Permitting Scoping

Pending the results of the environmental assessment, the following permits may be required prior to construction:

- *Oil and Gas Activities Act* – Pipeline Activity Permit (or an amendment to the existing permit).
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 11 for changes in and around a stream dependent upon the results of the watercourse survey. The Pipeline Activity Permit may include the Section 11 requirements.
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 10 Approval for Short Term Use of Water (temporary water withdrawal permit) although onsite sources are likely unsuitable.
- *Oil and Gas Activities Act (Land Act)* – License of Occupation or ROW for widening and construction footprints.
- *Fisheries Act* - Request for Review by DFO for watercourse crossing containing fish unless self assessment of the selected crossing methods determined a review is not required.
- *Navigation Protection Act* – Notice of Work or Approval of works depending upon the selected option and navigation clearances for crossing Galloway Rapids.

Given the level of previous disturbance, an *Oil and Gas Activities Act (Forest Act)* Occupant License to Cut is not likely required depending upon scope of clearing and quality of timber. The

pipeline will enter Federal Land (the Port of Prince Rupert) and may be subject to the Canadian Port Authority Environmental Assessment Regulation.

6.2.3 EA Information Requirements

Given the number of watercourse crossings containing and likely containing fish and the proximity to identified critical habitat for a listed species, environmental sensitivities associated with the north option are considered moderate. A Detailed Environmental Effects Assessment would be required to document environmental sensitivities and fish present in the watercourses. A CEMP providing site specific mitigation measures would be required to address the level of environmental sensitivity observed on the site.

6.3 **4C- South Option Route from Galloway Rapids to RIPET**

6.3.1 Environmental Constraints

Based on a review of the baseline information, the following environmental constraints were noted:

- The pipeline will follow the existing PNG and others' ROW however may have to be widened to support construction. Additional clearing maybe required.
- Eight mapped watercourses will be crossed and potentially one wetland. No publicly available historical information was obtained for these watercourses. Based on mapped gradients, six of the crossings may contain fish species of CRA concern and present.
- Work will occur within 50 m of the marine environment and involve two marine crossings; Wolf Creek Estuary and Porpoise Harbour. Construction has the potential to interact with marine species including Species and Risk Act listed species.
- Work will occur within Watson Island and cross former pulp mill lands increasing the risk of prior soil contamination.
- The pipeline will enter Federal Land (the Port of Prince Rupert) and maybe subject to the Canadian Port Authority Environmental Assessment Regulation.

6.3.2 Permitting Scoping

Pending the results of the environmental assessment, the following permits may be required prior to construction:

- *Oil and Gas Activities Act* – Pipeline Activity Permit (or an amendment to the existing permit).
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 11 for changes in and around a stream dependent upon the results of watercourse surveys. The Pipeline Activity Permit may include the Section 11 requirements.
- *Oil and Gas Activities Act (Water Sustainability Act)*- Section 10 Approval for Short Term Use of Water (temporary water withdrawal permit) although onsite sources are likely unsuitable.

- *Oil and Gas Activities Act (Land Act)* – License of Occupation or ROW for widening and construction footprints.
- *Fisheries Act* - Request for Review by DFO for watercourse crossings containing fish unless self assessment of the selected crossing methods determined a review is not required.
- *Navigation Protection Act* – Notice of Work or Approval of works depending upon the selected option a for crossing Porpoise Harbour and the Wolf Creek Estuary.

Given the level of previous disturbance, an *Oil and Gas Activities Act (Forest Act)* Occupant License to Cut is unlikely to be required depending upon scope of clearing and quality of timber. The pipeline will enter Federal Land (the Port of Prince Rupert) and may be subject to the Canadian Port Authority Environmental Assessment Regulation.

6.3.3 EA Information Requirements

Given the number of watercourse crossings both freshwater and marine likely containing fish and listed species, environmental sensitivities associated with the north option are moderate. A Detailed Environmental Effects Assessment would be required to document environmental sensitivities and fish present in the watercourses. A CEMP providing site specific mitigation measures would be required to address the level of environmental sensitivity observed on the site.

7.0 Cost Estimate

When developing this cost estimate, Khtada assumed the following for all locations and phases:

- Includes all staff fees and disbursements related to environmental assessments, permitting and supporting detailed design;
- Does not include costs associated with the construction phase of the segment.
- Includes all truck, accommodation and travel costs.
- Includes all field gear rental; camera, fish and wildlife sampling gear, water quality meters, underwater camera, etc.;
- Includes all miscellaneous consumables;
- Include time incurred for communications with the team provided meetings are either by phone, email or located in the Terrace area.
- Includes a 5% administration charge that may be levied on subcontractors and 10% on all direct expenses.
- Assumes segment infrastructure can be redesigned or relocated to avoid major permitting-related fish and wildlife habitat offsetting and compensation requirements.
- Excludes applicable taxes.

This cost estimate is based on the preliminary alignment options and anticipated construction extents provided by Lauren Services during the initial scoping and route review workshop phases. Changes made to the proposed alignment(s) may affect the actual project cost, and specific operational or safety requirements not identified in this cost estimate may affect the overall environmental risk assessment and project cost. In addition, this cost estimate is based on the regulatory environment current to the date this report was produced, notwithstanding changes to government, policy, permit requirements, land use and ownership, and the outcomes of public and First Nations consultation processes. Lastly, it was assumed that PNG's ESPP can be followed to the greatest extent possible during the work, limiting agency review of proposed activities and lengthy timelines and costs.

7.1 R5 Compressor Station Cost Estimate

The below table provide an estimate of costs based on the scope identified above.

Table 4. R5 Compressor Station Cost Estimate

Task	Activity	Cost Estimate
R5 Compressor Station Total		\$3,350
Environmental Overview Assessment		\$3,350
	Field assessment to confirm desktop study results	\$1,700
	Mitigation planning	\$1,650
Permit Applications		\$0
	None identified	\$0

7.2 Kitimat Lateral Connector (R5 to Terrace Junction) Cost Estimate

The below table provides an estimate of costs based on the scope above. In developing of this estimate is assume that all activities in and around watercourses can be complete to avoid effects to fish and amphibians, including potential sediment releases.

Table 5. R5 to Terrace Junction Cost Estimate

Task	Activity	Cost Estimate
R5 to Terrace Connector Total		\$8,475
Environmental Overview Assessment		\$7,575
	Fish and Fish Habitat Assessment	\$1,700
	Amphibian Assessment	\$1,700
	Breeding bird and raptor assessment	\$1,700
	Mitigation planning	\$2,475
Permit Applications		\$900
	OGC permitting support	\$450
	Fish and amphibian salvage permit application	\$450

7.3 Salvus Compressor Station Cost Estimate

The below table provides an estimate of costs based on the scope identified above. In developing of this estimate is assume that all activities in and around watercourses can be complete to avoid all effects to rare plants, terrestrial species, fish and amphibians.

Table 6. Salvus Compressor Cost Estimate

Task	Activity	Cost Estimate
Salvus Compressor Station Total		\$12,250
Detailed Environmental Assessment		\$10,975
	Vegetation and Rare Plant survey	\$1,700
	Fish and amphibian survey	\$1,700
	Raptor survey	\$1,700
	Marbled Murrelet and breeding bird survey	\$1,700
	Wildlife suitability survey; UWR and mammal denning	\$1,700
	Effects Assessment and mitigation planning	\$2,475
Permit Applications		\$1,275
	OGC permitting support	\$825
	Fish and amphibian salvage permit application	\$450

7.4 Galloway Station to Galloway Rapids Cost Estimate

The below table provides an estimate of costs based on the scope identified above. In developing of this estimate is assume that all activities in and around watercourses can be complete to avoid all effects to rare plants, terrestrial species, fish and amphibians.

Table 7. Galloway Station to Galloway Rapids Cost Estimate

Task	Activity	Cost Estimate
Galloway Station to Galloway Rapids Segment Total		\$15,150
Detailed Environmental Assessment		\$13,050
	Rare Plant and invasive plant survey	\$1,950
	Fish and amphibian survey	\$1,950
	Raptor survey	\$1,950
	Marbled Murrelet and breeding bird survey	\$1,950
	Wildlife suitability survey	\$1,950
	Effects Assessment, mitigation planning and CEMP	\$3,300
Permit Applications		\$2,100
	OGC permitting support	\$825
	DFO Request for Review	\$825
	Fish and amphibian salvage permit application	\$450

7.5 Galloway Rapids to RIPET (North Option) Cost Estimate

The below table provide an estimate of costs based on the scope identified above. In developing of this estimate is assume that all activities can be complete to avoid effects to rare plants, terrestrial species, fish and amphibians.

Table 8. Galloway Rapids to RIPET (North Option) Cost Estimate

Task	Activity	Cost Estimate
Galloway Rapids to RIPET (North Option) Total		\$32,025
Detailed Environmental Assessment		\$25,800
	Rare Plant and invasive plant survey	\$3,900
	Fish and amphibian survey	\$5,850
	Raptor survey	\$1,950
	Marbled Murrelet and breeding bird survey	\$3,900
	Wildlife suitability survey	\$1,950
	Effects assessment, mitigation planning and CEMP	\$8,250
Permit Applications		\$6,225
	OGC permitting support	\$1,650
	DFO Review	\$1,650
	TC NPA – Notice of Work	\$825
	PRPA – Environmental Assessment Screening	\$1,650
	Fish and amphibian salvage permit application	\$450

7.6 Galloway Rapids to RIPET (South Option) Cost Estimate

The following table summarizes the baseline information and environmental constraints identified during the desktop review and identifies the level of assessment required to support the environmental permits (likely) required. In developing of this estimate is assume that all activities can be complete to avoid all effects to rare plants, terrestrial species, fish, amphibians and marine species.

Table 9. Galloway Rapids to RIPET (South Option) Cost Estimate

Task	Activity	Cost Estimate
Galloway Station to Galloway Rapids Segment Total		\$36,710
Detailed Environmental Assessment		\$29,660
	Rare Plant and invasive plant survey	\$1,950
	Fish and amphibian survey	\$5,830
	Marine Assessment	\$5,830
	Raptor survey	\$1,950
	Marbled Murrelet and breeding bird survey	\$3,900
	Wildlife suitability survey	\$1,950
	Effects assessment, mitigation planning and CEMP	\$8,250
Permit Applications		\$7,050
	OGC permitting support	\$1,650
	DFO Review /Authorization	\$1,650
	TC NPA – Approval	\$1,650
	PRPA – Environmental Assessment Screening	\$1,650
	Fish and amphibian salvage permit application	\$450

7.7 Summary of Costs

Based on the above information, the costs to provide environmental assessment and permitting services, based on the qualifications provided in this estimate are:

- R5 Compressor Station - **\$3,350**
- R5 to Terrace Junction - **\$8,475**
- Salvus Compressor Station - **\$12,250**
- Galloway Station to Galloway Rapids - **\$15,150**
- Galloway Rapids to RIPET:
 - North Option Galloway Rapids to RIPET - **\$32,025**
 - South Option Galloway Rapids to RIPET - **\$36,710**

APPENDIX 1

FIGURES