AltaGas

Ridley Island Propane Export Terminal

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Environmental Evaluation Document

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EXECUTIVE SUMMARY

AltaGas Ltd. (AltaGas) is proposing to construct a propane export facility (the Project) on a site sub-leased from Ridley Terminals Inc. (RTI). The Project will be called the “Ridley Island Propane Export Facility”. The Project is located on British Columbia’s (BC) North Coast, 9 kilometers south of the City of Prince Rupert. The Project is on Ridley Island on federal port land administered by the Prince Rupert Port Authority (PRPA) that is leased to (RTI).

Ridley Island falls under the Port of Prince Rupert 2020 Land Use Management Plan (2010) that designates zoning for industrial and port terminal development, including the provision for dry and liquid bulk terminals. PRPA land is leased to RTI and supports a fully operational coal terminal built in 1983.

The Project will receive pressurized liquid propane via rail, which will be transferred to pressurized storage bullets. The propane will then be chilled, and transferred to refrigerated storage at near atmospheric pressure. The cooled propane will be transferred to Very Large Gas Carriers (VLGC), using new piping and loading arms to be constructed on the existing RTI coal jetty, for transport to Asia and other markets. The Project expects to offload approximately 50-60 rail cars per day, and to deliver by marine transport approximately 20-30 cargos of propane a year to market at full capacity.

The Project will provide significant economic benefits to Prince Rupert and the surrounding area. The Project will generate approximately 200-250 construction jobs, and will require approximately 40 full-time positions once the facility is in operation. Local businesses will have the opportunity to provide services in a broad range of areas related to construction and operation of the Project. The large capital investment and annual operating expenses associated with the Project will diversify economic activity at the Port of Prince Rupert, and will help support the long term economic stability of the region for future generations.

Regulatory Framework

Because the Project is located entirely on federal land and water, it requires an environmental assessment under Section 67 of CEAA 2012. The Project is not a designated project listed in the “Regulations Designating Physical Activities” (CEA Agency 2015) under the Canadian Environmental Assessment Act, 2012 (CEAA 2012).

In accordance with provisions of Section 67 of CEAA 2012, an Authority must not carry out a project or exercise a power to perform a duty or function that could permit the project to proceed. As a port authority constituted under the *Canada Marine Act*, PRPA is a Federal Authority for the Project. In addition, RTI is owned by the Crown and is therefore also a Federal Authority for the Project.

Consultation will also be required with Transport Canada to confirm compliance with the Navigation Protection Act for any improvements to the existing RTI jetty.

Since the Project is located entirely on federal land, a certificate under the *British Columbia Environmental Assessment Act* is not required.

Project Description

The Project is being built on a previously developed industrial site, designated and used for port related activities within RTI leased lands and PRPA jurisdiction. All new construction for the Project will take place on previously cleared sites and/or will build upon existing infrastructure.

The scope of the Project includes all physical works and activities associated with the construction, operation, and decommissioning of the Project. Project related physical works and activities are located on RTI lease lands within the federal lands administered by the PRPA.

Propane supply for the Project will come from natural gas processing facilities and petroleum refineries in BC and Alberta. The facility is being designed to run at an annual average of 3,226 tonnes/day with an expected annual capacity of 1,177,490 tonnes/year. Key Project Parameters are presented below:

Key Project Parameters

Inlet Product	**HD 5- Propane (>90% C3)**
Export Product	J-Spec Propane (>95% C3)
Energy Storage Capacity	2.66 Petajoule (PJ)
Expected Average Daily Capacity	3,226 tonnes/day
Annual Capacity	1,177,490 tonnes/year
Railcars per day	~ 50-60 railcars/day
Unloading Spots (two sides)	Up to 20 unloading racks, with a capacity to unload up to 40 railcars
Total Storage Capacity (Refrigerated Storage Tank and pressurized bullets)	98,000 cubic metres (m^3)
Power Supply	Approximately 15 Megawatts (MW). The facility will use gas driven compressors to supply a portion of the process refrigeration load. The remainder of the facility will be run off power from the BC Hydro grid. The facility will have sufficient on-site diesel emergency power generation for critical services.
Ship Handling Capabilities	230 metres (m) (Overall Length), 38.4m (Beam), 64,220 Deadweight Tonnes (DWT), 13.6 m (Summer Draft)
Ship turnaround time	40 hours
Number of carriers/year	Approximately 20-30 at full capacity
Operations	24/7/365 for rail handling, processing and ship loading

There are no pipelines in the Prince Rupert area that can be used to transport propane. As a result, all supply will be brought to the Project site by rail from the processing facilities in northeast BC and northern Alberta. AltaGas will make arrangements as required to develop a rail tank car fleet which will be moved by CN between gas processing facilities and the RTI site.

Propane facility operations consist of receiving pressurized propane by rail, offloading it to pressurized storage bullets, cooling it, and then storing it in an atmospheric, refrigerated tank until it is offloaded using the existing RTI jetty with new propane loading arms to a VLGC sized carrier for export. It is anticipated that carrier loading operations will occur approximately once every 15 to 20 days, which at full capacity results in approximately 20-30 carriers per year depending on customer demand, design plant capacity, and size of the carrier.

RTI will be responsible for all aspects of the Project associated with maintaining and operating the existing marine jetty. AltaGas will be responsible for retrofitting specific components of the jetty to accommodate propane export. No works below the high-water mark are planned.

Consultation

AltaGas is undertaking consultation and engagement with First Nations, and members of the public. AltaGas began consulting and engaging relevant stakeholders on the Project beginning in September 2015, prior to initiation of the environmental review process. Input received during consultation and engagement activities has been and continues to be considered in the development of this Environmental Evaluation Document and Project design considerations.

AltaGas recognizes the traditional territories of the potentially affected First Nations and initiated engagement early in Project development in order to meaningfully address and incorporate all concerns of the affected groups into Project design and assessment. The Project and associated activities fall within the traditional territories of the following groups:

- Lax Kw'alaams;
- Metlakatla;
- Kitselas;
- Kitsumkalum;
- Gitxaala; and
- Gitga'at.

AltaGas' objective of engagement with First Nations is to support positive, productive, and lasting relationships between AltaGas and the First Nations while ensuring that requirements of the First Nation Consultation Plan assigned to AltaGas are addressed meaningfully and completely.

Assessment Methodology

The methodology used in this assessment is consistent with the guidance detailed in the December, 2014 document *Projects on Federal Lands: Making a determination under section 67 of the CEAA 2012* and current best practices for environmental assessment, adapted as appropriate to this Project.

Because the Project is on a previous developed industrial site and within an industrially zoned area of PRPA, and RTI that has seen several large-scale and detailed environmental assessments recently conducted for nearby projects, the assessment largely uses available information for these environmental assessments.

Traditional ecological knowledge and resource use information received from First Nations through engagement have informed the effects assessment for related Project Valued Components (VCs), when available.

Field studies have been used to fill data gaps in existing data as necessary and are described herein, including a Phase II Environmental Site Assessment conducted by SNC-Lavalin in 2015.

Valued Components

The EED summarizes the process and methodologies used to identify and select VCs, for assessment. VCs are components of the bio-physical and socio-economic environments that are considered by AltaGas, public, aboriginal groups, government agencies, and other stakeholders involved in the assessment process to have scientific, ecological, economic, social, cultural, archaeological, or historical importance.

The table below summarizes the rationale for selection.

List of Selected Valued Components and their Sub-Components

Valued Component	Sub-Component	Rationale
MARINE RESOURCES	Marine habitats (including foreshore and shallow subtidal)	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
	Marine mammals	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
	Marine Species at Risk	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
	Marine Resource Use	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
FISH (marine and freshwater)	Commercial, Recreational, or Aboriginal(CRA) fish	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
	non-CRA fish	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
	Species at Risk - fish only	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
TERRESTRIAL RESOURCES	Vegetation Communities and Sensitive Ecosystems (including wetlands)	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
	Wildlife including migratory and non-migratory birds	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
	Species at Risk - wildlife and rare plants	Selected based on input from First Nations, agency experts, the public and professional opinion and experience related to similar projects.
HUMAN HEALTH	Human Health	Previous studies have identified these sub-components as important considerations for human health in the vicinity of Ridley Island.

List of Selected Intermediate Components and Their Sub-Components

Intermediate Component	Sub-Component	Rationale
TERRAIN	Soil Quality	Contaminated soil, terrain stability and the quality of seabed sediments have been identified in previous studies in the area as important to water quality and VCs for fish and marine resources.
	Terrain Stability	
	Seabed Sediment Quality	
WATER (marine and freshwater)	Groundwater Quality	The three sub-components are important considerations for the VCs for Fish and Marine Resources.
	Surface Water Quality	
	Marine Water Quality	
AIR QUALITY	Air Quality	Air quality, noise and lighting have been identified in previous studies in the area as important to human health considerations. These three components form sub-components for the VC Human Health to identify change that must be considered in relation to human health for workers and nearby receptors.
NOISE	Noise	
LIGHT	Light	

For each selected VC, the existing conditions within the AltaGas sub-lease site or identified marine water lot lease area or rail corridor within PRPA jurisdiction are described in sufficient detail to enable potential Project-VC interactions to be identified, understood and assessed.

Terrain Resources

Terrain Resources including surface soil quality, terrain stability, and seabed sediment quality at or near the AltaGas sub-lease site has been identified as an intermediate component (IC) because of its role as a potential pathway of effect to VCs (such as terrestrial habitat, human health) identified in the EED.

Soil and sediment contamination indicators were selected to measure and evaluate the interaction of the Project with Terrain Resources and its subcomponents, and were chosen to be relevant, practical, measurable, accurate, and predictable.

Potential interactions during the construction phase include the potential to disturb existing soil containing concentrations of regulated parameters greater than the applicable provincial standards and federal guidelines during excavation work, and the potential to introduce contaminants to soil through construction activities such as routine use, fuelling and maintenance of vehicles and equipment.

Potential interactions during operation that may have minor effects include spills of hazardous materials, fueling and maintenance of vehicles and equipment on site, erosion caused by rain and surface water drainage, flaring of ethane and methane, and suspension of seabed sediments by tugs and carriers during the berthing operations.

Potential interactions during decommissioning that may have minor effects on the terrain resources include spills of hazardous materials, fueling and maintenance of vehicles and equipment on site, erosion caused by rain and surface water drainage, during the decommissioning phase.

These adverse effects can be largely avoided by use of effective and established mitigation and Best Management Practices (BMPs).

With the implementation of effective and established mitigation measures and BMPs, as described in the above sections, residual effects from the Project on Terrain Resources are expected to be avoided or negligible as a result of regular construction, operations and decommissioning activities.

Water Quality

Water Quality including surface water quality, groundwater quality and marine water quality, at the sub-lease site and RTI marine berth area has been identified as an IC because environmental effects caused by the Project to water quality could have the potential to adversely affect other VCs (e.g., marine habitat).

Indicators were selected to measure and evaluate the interaction of the Project with the Water Quality and its subcomponents, and were chosen to be relevant, practical, measurable, responsive, accurate, and predictable. The indicators included groundwater contamination, surface water contamination, and marine water quality.

Available environmental information describing existing water quality within the Local Study Area (LSA) and Regional Study Area (RSA) was summarized from several recent and local environmental assessments and from publicly available government organization databases. As the Project is occurring on existing industrial land and uses an existing active marine jetty, and no construction is planned below the high water mark, there is very low potential for Project activities to interact with water resources; therefore, no new field studies were determined to be required and none were undertaken to gather additional water quality data for this assessment. Field investigations supplemented by information available from the BC Water Resource Atlas confirm that there are no natural water bodies or water courses remaining on the Project site.

PRPA has been conducting a baseline marine environmental water quality sampling since 2013. Marine waters in PRPA jurisdiction are monitored for oceanographic properties, heavy metals, polycyclic aromatic hydrocarbons, and bacteriological properties.

The primary concerns for potential adverse environmental effects caused during the construction phase are the potential to cause soil disturbances and thereby cause increased turbidity and sedimentation of surface water; the potential to introduce contaminants to groundwater through construction activities such as routine use, fuelling and maintenance of vehicles and equipment; and the potential to cause soil disturbances and thereby cause increased turbidity and sedimentation of marine water as a receptor of surface water run-off.

These adverse effects can be largely avoided by use of effective and established mitigation measures and management practices.

It is concluded that the Project will result only in minor adverse environmental effects on Water Quality. With the implementation of appropriate previously described mitigation measures no residual effect on the Water Quality IC is expected from the Project.

Marine Resources

The Marine Resources VC includes intertidal and shallow subtidal habitats, marine mammals, marine mammal species-at-risk, and marine resource use sub components, and were considered because of their importance to local communities, conservation concerns, and the potential to be adversely affected by Project activities.

Marine Resources was selected as a VC for the environmental effects assessment based on the following criteria: Ecological, aesthetic, and economic value, the importance to regulators First Nations, the scientific community, and the public, and protection under federal and provincial acts and regulations.

Available information describing existing marine resources within the LSA and RSA was summarized from several recent and local environmental assessments for proposed or approved projects and from public online government and non-governmental organization databases.

Because the Project will be constructed and decommissioned entirely within the AltaGas sub-lease site, effects on marine resources will not occur. Therefore, it is not anticipated that Project construction and decommissioning activities will affect marine resources and they will not be considered further in the assessment.

The potential interactions between the Project and the marine resource VC are anticipated to occur during the operation phase and to occur as a result of accidents and malfunctions during the berthing of LPG carriers and the transit of these carriers through waters within PRPA jurisdiction.

The potential adverse environmental effects of the Project on the Marine Resources VC are summarized in the EED and included the following:

- Disturbance to marine resources resulting from operational activities (e.g., berthing) that might potentially disrupt resting or foraging of marine species around the RTI jetty within the LSA;
- Disturbance of marine resources resulting from Liquefied Petroleum Gas (LPG) carrier movements within the RSA; and
- Collision with marine resources resulting from LPG carrier movements within the RSA.

Potential adverse effects on the Marine Resources VC during operations are expected to be negligible when the following effective and established mitigation measures directly related to berthing and mooring of LPG carriers at the RTI jetty are employed.

Based on the information presented in the EED, the small Project footprint on the existing RTI jetty, combined with no below high water mark construction, and intermittent LPG carrier usage of the RTI jetty, it is concluded that the Project will result in negligible effects on Marine Resources.

Fish

Freshwater and marine fish, including finfish, shellfish, and fish species-at-risk, were considered as a VC due to their importance to local communities, conservation concerns, and the potential for interactions with the Project. Given the history of previous disturbance to the sub-lease site, no freshwater fish or fish habitat are present, and were therefore not considered further in the effects assessment. The Fish VC includes marine CRA fish species (finfish and shellfish), non-CRA species (i.e., not fished but ecologically important), and marine fish species-at-risk.

No construction activity is proposed to occur below the HWM and thus effects on marine fish and marine species-at-risk are considered negligible. Therefore, it is not anticipated that Project construction and decommissioning activities will affect marine CRA fish or species-at-risk and they will not be considered further in the assessment of adverse environmental effects of Project construction activities on the Fish VC.

The potential adverse environmental effects of the Project on the Fish VC are restricted to the following:

- Direct fish mortality;
- Permanent alteration of fish habitat;

- Disturbance resulting from increased noise; and
- Detrimental effects on known or expected occurrence of marine species-at-risk.

There is a single potential interaction in the operations phase that was carried forward into the Fish VC effects assessment. This interaction was identified as berthing of LPG carriers at the RTI jetty and is associated with disturbance resulting from increased noise. All other potential interactions during the operations phase were categorized as having no interaction (N), no direct fish mortality, no permanent alteration of fish habitat, and no detrimental effects on known or expected occurrence of marine species-at-risk are anticipated to occur during that Project phase.

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project will not have any significant effects on marine CRA fish species, marine non-CRA fish species and/or marine fish species-at-risk. The effects that may occur are associated with marine accidents considered highly unlikely and the effects anticipated to be negligible.

Terrestrial Wildlife Resources

The Terrestrial Wildlife Resources VC considers both wildlife and vegetation (particularly vegetation communities and rare plants) with potential to interact with the Project. However, the existing condition of the AltaGas sub-lease site is devoid of vegetation as it has been cleared, graded, and compacted by previous industry activities. As such, the effects assessment is focussed on wildlife, and no further assessment of vegetation or plants will take place.

The Terrestrial Wildlife Resource VC is included in the Project EED because of its potential:

- Ecological, aesthetic, and economic value;
- Importance to regulators, the scientific community, the public and First Nations; and
- Protection under provincial, federal, and international law.

Development of the terrestrial wildlife resources baseline for the Project LSA primarily relied on information from environmental assessments for other projects proposed or approved in nearby areas. A site reconnaissance was conducted on October 28, 2015 to verify site conditions and assess the potential for Project effects on amphibians (specifically western toad mortality from road and rail traffic), birds (specifically loss of nesting habitat of migratory birds, raptors, and bird mortality from gas flaring), and mammals (specifically bat mortality from gas flaring) in the LSA.

The potential adverse environmental effects of the Project on the Terrestrial Wildlife Resources VC are generally considered within three main groupings:

- Habitat alteration and fragmentation; can include accidental habitat removal; maintenance of early season habitat; fragmentation of habitats by roads, railways or Project facilities; and introduction of silt or other deleterious substances to the environment.
- Disturbance or displacement; resulting from loud or visually-disturbing construction-related activities (e.g., excavation) that can disrupt dispersal, incubation, feeding young, territorial activities and foraging, in the proposed construction footprints as well as in adjacent habitats that are not directly affected by the Project.
- Mortality; increased road use can lead to an increase in vehicle-related wildlife mortality. Smaller, less mobile life-stages (juveniles/eggs) and species with very small home ranges may suffer direct mortality related to movement of construction equipment and accidental habitat removal. Larger wildlife is also at risk from mortality due to vehicle collisions.

The Project, once built, is unlikely to attract wildlife in general. Mitigation will focus on ensuring that the facilities remain unattractive or inaccessible to wildlife, minimizing mortality to any wildlife that does enter the Project footprint, and ensuring that all wastes and contaminants are contained and properly disposed of.

Based on the information presented in the above sections, the small Project footprint and the existing anthropogenic disturbance, it is concluded that the Project will result in negligible effects on Terrestrial Wildlife Resources. With the implementation of appropriate mitigation measures as described in the above sections, no residual effect on the Terrestrial Wildlife Resources VC is expected from the Project.

Air Quality

Air Quality is defined to be the quality of ambient air as defined through government-supported objectives and standards, as well as emissions into the ambient air that may directly or indirectly cause adverse human health or environmental effect. Air Quality was assessed as an IC because of the relevance to local community health and greenhouse gas (GHG) emissions, the potential of the Project to contribute adversely to existing air quality conditions and the potential to adversely affect other VCs.

The air quality study uses a local study area that covers a 625 km^2 area centered on the Project site, including Prince Rupert and Port Edward. The existing conditions included the current climate and air quality in the region beyond the study area, as well as the existing industrial emission sources at the Port of Prince Rupert.

Data sources were used to characterize the existing conditions for the LSA/RSA for: Ambient air quality and meteorological monitoring data and existing Port emissions over the most recent calendar year assessed.

A desktop study was completed to characterize the existing air quality and emissions in the region as well as the climate norms. In addition, the Project construction and operation emissions were characterized and a detailed air quality modelling exercise was performed to evaluate the maximum potential off-site air quality impacts that could result from the Project operations.

It is not anticipated that Project construction and decommissioning activities will affect the local air quality and, therefore, these activities will not be considered further in the assessment of adverse environmental effects. Project operations are the focus of this assessment. The Project emissions as well as the effects of these emissions on the ambient air quality in the LSA were addressed.

The potential adverse environmental effects of the Project on Air Quality are focussed on the following:

- Exceedance of the provincial AAQOs protective of human health in all public areas; and
- Identifying and limiting the release of GHGs to minimize contribution to climate change.

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project will not have any significant effects on air quality and GHGs/climate change.

Noise

This noise effects assessment was conducted to assess the potential effects or Project-related noise on humans. Noise effects are of particular concern for sensitive receptors, which includes homes, hospitals, and supported living facilities.

The LSA/RSA included the Project sub-lease site and a 2500 m buffer surrounding the area for determination of project noise effects on human health in Port Edward; the rail transportation corridor within PRPA jurisdiction; and the area within PRPA marine jurisdiction related to berthing and transit to and from the RTI wharf/berth.

It is anticipated that Project construction and decommissioning activities will have minor or negligible interaction with the local sound levels and, therefore, these activities will not be considered further in the assessment of adverse environmental effects. Construction noise changes can be managed through effective and well-established BMPs.

The potential adverse environmental effects identified relate to increased noise associated with Project operations. Increased operational noise can potentially impact nearby sensitive receptors at Port Edwards (e.g., residences, schools, supported living facilities, etc.), particularly during the night when people are sleeping. Operational noise is primarily associated with operation of stationary equipment such as compressors or condensers used to handle and move the LPG product.

The potential effects of noise produced by the operations phase of the project were assessed with a noise model. A simple noise model was developed and considered suitable due to the relatively flat topography of the area and the conservative assumptions used in the model.

Based on proposed mitigation measures, the facility is estimated to produce a sound pressure level of 40 A-weighted decibels (dBA) at 1.5 km from the facility, which complies with the BC OGC night time permissible sound level for a new facility. In addition, the change in the calculated percentage of high annoyed persons (%HA) does not exceed Health Canada's 6.5% guidance for the sensitive receptors in Port Edward.

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project may result in residual effects related to noise levels. The increase in noise levels may interact cumulatively with other Projects.

Light

Lighting refers to the lighting units as well as any associated components for focusing or directing light. Proper lighting is necessary at industrial facilities, for both safety and security. However, excessive light can be bothersome or disruptive to nearby human or wildlife populations. As such, a light assessment is included in the Project EED to confirm that the light changes due to the Project are properly managed.

The light assessment uses a LSA which includes the Project sub-lease site and a 2500 m buffer surrounding the area for determination of project light effects on human health in Port Edward; the rail transportation corridor within PRPA jurisdiction; and the area within PRPA marine jurisdiction related to berthing and transit to and from the RTI wharf/berth.

During construction, the light level will vary depending on the stage. Due to the topography of Ridley Island, headlights on mobile equipment are not expected to be visible from Port Edward except for a small amount of sky glow.

During operations, light sources will include building exterior and interior lighting, street lights and marine jetty lighting. As above, the topography of Ridley Island and the distance from the Project will limit visibility of light from the Project.

This light effects assessment indicated that light is not anticipated to exceed applicable thresholds with the recommended mitigation measures in place, the effects of altered light conditions are not expected on any receptor VCs. The assessment of light effects on human health is not considered further. As there are no residual effects on light there is no potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents.

Human Health

In general, the public and First Nations have expressed concerns regarding potential effects on human health associated with construction and operation of similar liquid petroleum gas facilities (e.g., related to diesel emissions and fugitive dust). Specific concerns relating to adverse effects on human health most often relate to changes in air quality, water quality, country foods, noise, and lighting.

The human health effects assessment considers potential changes in human health resulting from exposure to Project-related emissions for people either living or spending time within the LSA or RSA. This human health effects assessment evaluates the incremental human health risks that is attributable to the Project by comparing predicted conditions during construction, operation and decommissioning phases to existing baseline environmental conditions and where possible to thresholds established to protect human health.

Human Health was assessed as valued component because the Project has the potential to adversely affect human health through air inhalation and exposure to altered noise and lighting levels. The indicators used in the human health assessment included: NO_x, SO_2, CO, VOC, PM_{10}, PM_{25}, $NH_{3,}$ changes in levels of light trespass, glare and sky glow, and increase in sound levels.

The potential adverse environmental effects of the Project on the Human Health VC are generally considered within two main groupings: 1) Changes in human health resulting from the inhalation of CACs generated by the Project; and 2) Changes in human health resulting from exposure to altered light and noise conditions.

Since the light effects assessment indicated that light is not anticipated to exceed applicable thresholds with the recommended mitigation measures in place, the effects of altered light conditions on human health were not carried forward.

There are no potential interactions during the construction phase that were carried forward into human health effects assessment.

Several potential interactions were carried forward into human health effects assessment. These interactions are all associated with the Project emission sources and altered noise levels.

There are no potential interactions during the decommissioning phase that were carried forward into Air Quality effects assessment because adverse effects on ambient air quality or GHG emissions are expected to be negligible.

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project could have effects on human health related to increase in noise levels at or near permissible thresholds. An increase in noise levels has a direct effect on human health related to sleep interruption, community annoyance, and a decrease in community enjoyment.

Other effects that may occur are associated with accidents and unplanned events (especially in the marine transport activities) being considered highly unlikely and the effects anticipated to be negligible.

Project related noise levels would be low in magnitude, as the noise levels are expected to be mitigated at or lower than permissible noise levels. The noise increase would be at a local level, with only minor effects on closest sensitive receptors in Port Edward. The duration would be long term and frequent as the noise is associated with Project operations on a daily basis. The potential effects to humans would be entirely reversible, as the effects are only associated when noise-related activities are occurring. As the magnitude is low, and the potential to mitigate noise to a level at or below the permissible threshold is high, the potential adverse residual effect is not significant. The likelihood of this residual effect is likely, and the confidence based on available data, effective proven mitigation practices and model outputs is high.

As there are residual effects related to increase in noise levels with the potential to affect Human Health, there is a potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents of the Project.

Based on the results of the noise model, the proposed mitigation measures recommended for Project operations for the facility is estimated to produce a sound pressure level of 40 dBA at 1.5 km from the facility, which complies with the BC OGC night time permissible sound level for a new facility. In addition, the cumulative change in the calculated %HA does not exceed Health Canada’s 6.5% guidance for the sensitive receptors in Port Edward.

Accidents and Malfunctions

This section identifies and summarizes unplanned or unexpected incidents resulting from potential accidents and malfunctions that may be associated with the Project and effective and established standards and practices to mitigate effects on the bio-physical environment and human health.

Potential Project-related accidents or malfunctions are identified and evaluated based on existing, publicly available information, and the professional experience and judgment of Project team members, including professional engineers, technical experts, and industry stakeholders familiar with existing marine, road, and rail operations at RTI.

For the Project, three groups of potential accidents and malfunctions have been identified: accidents at land based facilities, marine based accidents and fuel spills from rail or vehicles. Each type of accident is described, in conjunction with facility specific mitigation, probability of occurrence, consequence and environmental and human health risks.

Because accident and malfunctions are unplanned or unexpected events that are unlikely to occur, associated environmental effects from the accident and malfunction events described herein are unlikely to occur.

The primary focus for accidents and malfunctions is the management of safe operations, through good systems for leak detection, good controls for responding to leaks, effective preventative maintenance programs and effective training of operations and maintenance staff.

The likelihood of land based accidents and malfunctions causing a significant effect on the biophysical resources in the local study areas for the respective resources are considered remote. The principal concern would be for marine birds and marine mammals in the extremely unlikely event of a spill.

There is a remote possibility of an accident causing a rupture of either a propane rail car or a propane storage tank on site. While there is a possibility of a propane leak resulting in human harm, casualties or even a fatality, this risk is considered extremely remote because there are industry proven effective and established mitigation measures as described previously.

No significant adverse residual effects are anticipated to result from the Project-related potential accidents and malfunctions, cumulative effects are therefore not considered further.

Conclusion

After consideration of the potential residual effects, and taking into account the ecological context of the site, the engineering design, and mitigation measures, AltaGas and its assessment team are confident that the Project can be constructed, operated, and decommissioned without significant adverse effects.

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Acronym List

Acronym	Definition
AAQO	Ambient Air Quality Objectives
ALA	AltaGas listing name on the Toronto Stock Exchange
AltaGas	AltaGas Ltd.
BC	British Columbia
BCWQG	British Columbia Approved Water Quality Guidelines
BCCSN	BC Cetacean Sightings Network
BCEAA	British Columbia *Environmental Assessment Act*
BCEAO	British Columbia Environmental Assessment Office
BCMCA	British Columbia Marine Conservation Analysis
BMP	Best Management Practices
BOG	Boil Off Gas
CAC	Criteria Air Contaminant
CALPUFF	California Puff
CCME	Canadian Council of Ministers of the Environment
CDC	Conservation Data Centre
CEA Agency	Canadian Environmental Assessment Agency
CEAA 2012	*Canadian Environmental Assessment Act*, 2012
CEMP	Construction Environmental Management Plan
CEPA	*Canadian Environmental Protection Act*
CEQG	Canadian Environmental Quality Guidelines
CIE	Commission on Illumination
CN	Canadian National Railway
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	Commercial, Recreational and Aboriginal
CSQG	Canadian Soil Quality Guideline
CSR	Contaminated Sites Regulation
CWQG	Canadian Water Quality Guideline
DFO	Fisheries and Oceans Canada
DNV	Det Norske Veritas
EA	Environmental Assessment
EED	Environmental Evaluation Document
EMA	*Environmental Management Act*

Acronym	Definition
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
ESA	Environmental Site Assessment
ESCP	Erosion and Sediment Control Plan
ESD	Emergency Shutdown Valve
FID	Final Investment Decision
FLNRO	BC Ministry of Forest, Lands, and Natural Resources Operations
GHG	Greenhouse Gas
GWQG	Groundwater Quality Guidelines
HEPH	Heavy Extractable Hydrocarbons
HWM	High Water Mark
HWR	Hazardous Waste Regulation
IBA	Important Bird Area
IC	Intermediate Component
IFMP	Integrated Fisheries Management Plan
IL	Industrial
ISQG	Interim Sediment Quality Guidelines
LEED	Leadership in Energy and Environmental Design
LEPH	Light Extractable Hydrocarbons
LFL	Lower Flammable Limit
LKB	Lax Kw'alaams Band
LNG	Liquefied Natural Gas
LPG	Liquefied Propane Gas
LSA	Local Study Area
MAML	Mobile Air quality Monitoring Laboratory
MBCA	*Migratory Birds Convention Act*
MFN	Metlakatla First Nation
MoE	BC Ministry of Environment and Climate Change
MWLAP	BC Ministry of Water Land Air Protection
NCWA	North Coast Watershed Atlas
NPA	*Navigation Protection Act*
OGC	Oil and Gas Commission

Acronym	Definition
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCRA	Pacific Coastal Resource Atlas
PEL	Probable Effects Level
PNCIMA	Pacific North Coast Integrated Management Area
PNG	Pacific Northern Gas
PNW	Pacific NorthWest
PRPA	Prince Rupert Port Authority
PSL	Permissible Sounds Levels
QRA	Quantitative Risk Assessment
RCA	Rockfish Conservations Area
RSA	Regional Study Area
RTI	Ridley Terminals Inc.
SARA	*Species At Risk Act*
SLM	Sound level meter
SNC-Lavalin	SNC-Lavalin Inc.
SPERP	Spill Prevention and Emergency Response Plan
SQCRD	Skeena-Queen Charlotte Regional District
TC	Transport Canada
TDG	Transportation of Dangerous Goods
VC	Valued Component
VLGC	Very Large Gas Carriers
WCMRC	Western Canada Marine Response Corporation
WMP	Wildlife Management Plan
WWF	Word Wildlife Fund

Units of Measurement

Unit	Definition
°C	Degrees Celsius
Bgs	Below ground surface
cd	Candela
dB	Decibels
dBA	A-weighted decibels
DWT	Dead Weight Tonnes
Ha	Hectares
Kg	Kilogram
kg/hr	Kilograms per hour
km	Kilometres
km^2	Square kilometres
kV	Kilovolts
Ldn	Day-night equivalent sound level
Ln	Night time sound level
M	Metre(s)
m/s	Metres per second
m^3	Cubic Metres
m^3/s	Cubic metres per second
$mag/arcsec^2$	magnitudes per square arc second
MMSCFD	Million standard cubic feet of gas per day
MW	Megawatts
PJ	Petajoule
USG/hr	U.S. Gallons per hour

1 PROJECT IDENTIFICATION

1.1 Project Overview

AltaGas Ltd. (AltaGas) is proposing to construct a propane export facility (the Project) on a site sub-leased from Ridley Terminals Inc. (RTI) located at 2110 Ridley Road, Prince Rupert, British Columbia (BC). The Project will be called the "Ridley Island Propane Export Facility".

The Project is located on BC's North Coast, 9 kilometers (km) south of the City of Prince Rupert. The Project is on Ridley Island on federal port land administered by the Prince Rupert Port Authority (PRPA) that is leased to RTI (Figure 1-1). The RTI site is accessible by road (Highway 16), rail (Canadian National Railway [CN]) and by marine cargo carriers using frequently used shipping routes accessing the Port of Prince Rupert.

At the northeastern portion of Ridley Island is the forested mountain of Kaien Island, which lies between the RTI and City of Prince Rupert to the north east of Ridley Island. Porpoise Harbour is connected to Chatham Sound, between Ridley and Lelu Islands, and to Wainright and Morse Basins to the east (see Figure 1-2).

Ridley Island falls under the Port of Prince Rupert 2020 Land Use Management Plan (2010) that designates zoning for industrial and port terminal development, including the provision for dry and liquid bulk terminals. PRPA land is leased to RTI and supports a fully operational coal terminal built in 1983. The entire RTI lease occupies an area of about 400 acres (including water lot lease areas). The Project is to be located on the southwest corner of the RTI lease area on a small 24 acre (9.7 hectares [ha]) parcel of land as shown in Figure 1-2. A close up aerial view of the Project area is provided in Figure 1-3.

The existing RTI terminal consists of a rail loop and rotary railcar dumper, coal stockyard and reclaimer system, berth with dual quadrant ship loading system, partially completed liquid sulphur storage and transfer system, storage and export system, and stormwater treatment system. The Project will be independent from the existing facilities at RTI. However, the Project will utilize common facilities (e.g., the jetty and rail yard) as necessary for construction and operation. The propane storage facility will be located on land sub-leased from RTI, whereas the shared infrastructure, including rail offloading structures and the jetty will be on RTI land.

The Project's sub-leased site is currently occupied by a partially completed sulphur export facility (Figure 1-4). Sulphur Corp of Canada started construction of the sulphur facility in 1999; however, the facility was never commissioned and hence was never used for storage, import or export of sulphur or any other product. The infrastructure that was built for the sulphur facility includes two above ground 15,000 tonne molten sulphur storage (API 650) tanks, piping and pipe racks, loading racks and pump house, as well as settling ponds used to address water runoff from the coal export facility located adjacent to the site. In order to construct the Project, the sulphur facility will be dismantled and removed.

The Project will receive pressurized liquid propane via rail, which will be transferred to pressurized storage bullets. The propane will then be chilled, and transferred to refrigerated storage at near atmospheric pressure. The cooled propane will be transferred to Very Large Gas Carriers (VLGC), using new piping and loading arms to be constructed on the existing RTI coal jetty, for transport to Asia and other markets. The Project will include 20 rail unloading racks located on the Project's sub-leased site, loading arms on the existing berth, gas generation, cooling equipment, and associated piping (all located on the Project's sub-leased site) which will allow for the Project's anticipated throughput of approximately 1.2 million tonnes of propane per annum. Final equipment types and sizes will be determined in the next phase of engineering as optimization of the Project design continues. The Project expects to offload approximately 50-60 rail cars per day, and it is expected that this would not increase rail traffic entering PRPA jurisdiction, as the Project would offset the maximum number of coal shipments from the facility and therefore the amount of rail traffic. The propane will then be delivered by marine transport, approximately 20-30 cargos of propane a year to market at full capacity.

The primary components associated with the Project are outlined below (also, see Figure 1-4):

- Modification to rail and switching on PRPA land leased to RTI which is designated for rail use.
- Rail tank car unloading facilities and associated equipment on the Project sub-lease site.
- Product storage including pressurized bullets and large full containment atmospheric storage tanks on the Project sub-lease site.
- Refrigeration and boil off gas (BOG) recovery systems on the Project sub-lease site.
- Ship loading infrastructure on RTI's existing coal export marine jetty.
- On-site utilities including power generation, connection to the grid, and distribution on the Project site.
- Safety systems including ground flare, fire and gas detection, spill response and fire suppression on AltaGas and shared facilities, including the rail yard, offloading arms, storage, piping, and jetty.
- Project control systems, ancillary support services and required buildings.

LEGEND

- Project Location
- Lands Administered by Prince Rupert Port Authority
- Marine Shipping Route
- Rail
- Highway

0 1.25 2.5 5 7.5 10 Kilometers

NOTES
1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.

REFERENCES
Bing Maps and MapPoint Web Service Copyright (c) 2010 Microsoft Corporation.
BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB) - data accessed through www.GeoBC.gov.bc.ca

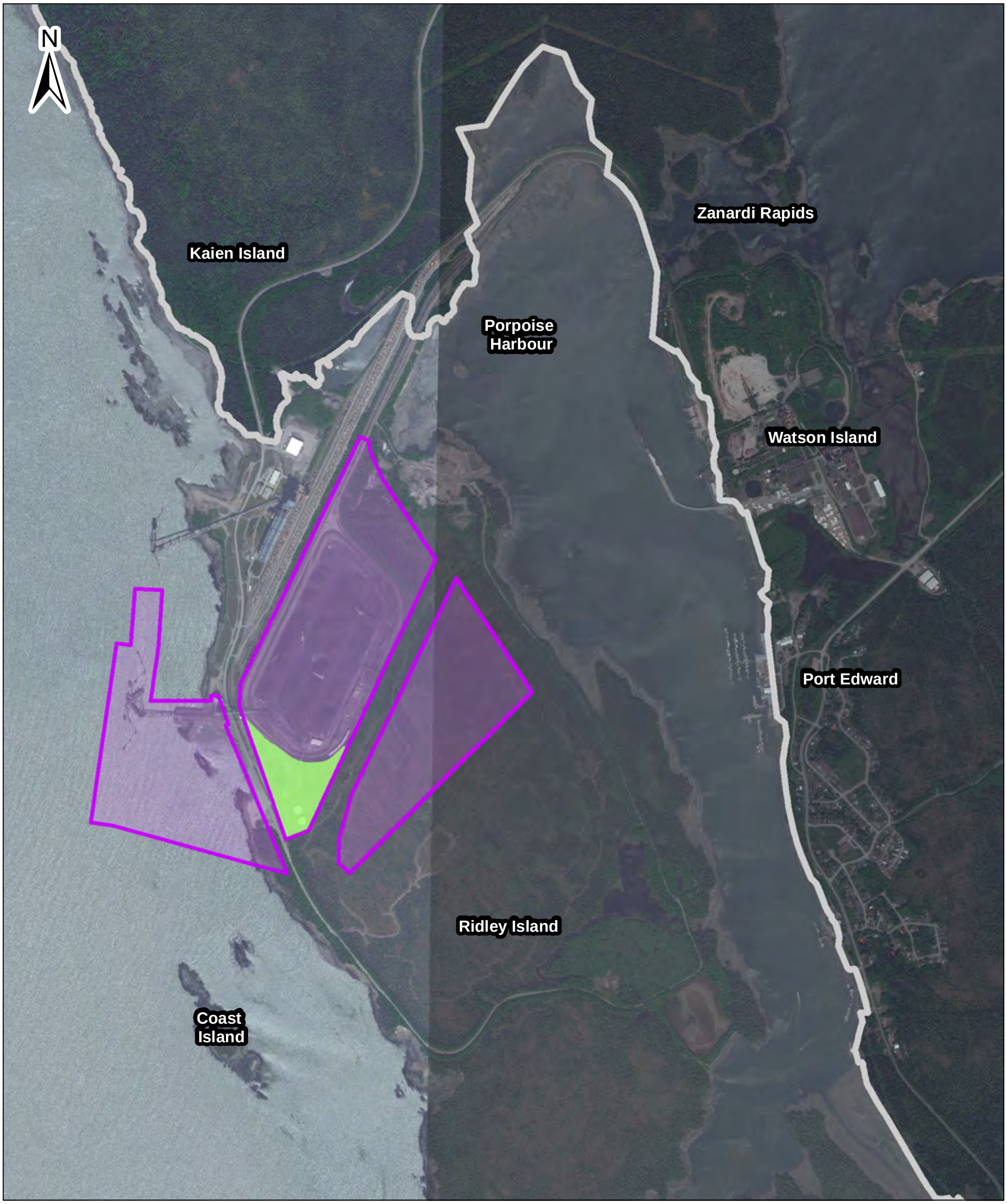
SNC • LAVALIN

CLIENT NAME: AltaGas Ltd.	PROJECT LOCATION: Ridley Terminals Inc., Ridley Island, Prince Rupert, BC

Figure 1-1: Project Location

BY: CJW	DATE: 2016/06/28	REF No: 630992-001	REV: 0
CHK'D: BB	SCALE: 1:100,000		

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\630992_001_ProjectLocation.mxd



LEGEND

- AltaGas Sub-Lease Land
- Ridley Terminals Inc. Lease Lands
- Lands Administered by Prince Rupert Port Authority

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS,

0 250 500 1,000 1,500 2,000 Meters

SNC • LAVALIN

CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal Ridely Island, Prince Rupert, BC

Figure 1-2: Land Tenure On Ridley Island

BY: SS	DATE: 2016/06/28	SCALE: 1:25,000	REF No: 630992-002	REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N			

MXD Path: P:\LOBIE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\630992_002_Project_Land_Tenure.mxd

Project Path:

LEGEND

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits:

SNC · LAVALIN

CLIENT NAME:
AltaGas Ltd.

PROJECT LOCATION:
Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 1-3: Aerial View of the Project Site

0 100 200 400 600 800 Meters

BY: ECH	DATE: 2016/06/28	SCALE: 1:9,912	REF No: 630992-004	REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N			

Project Path:

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\630992_004_AltaGas_Aerial.mxd

LEGEND

- Rail Roads
- AltaGas Sub-Lease Land

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits:

0 50 100 200 300 400 Meters

SNC · LAVALIN

CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal, Ridely Island, Prince Rupert, BC

Figure 1-4: Project Components

BY: SS	DATE: 2016/06/28	SCALE: 1:5,000	REF No: 630992-004	REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N			

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\630992_004_AltaGas_Project_Components.mxd

Project Path:

1.2 Project Justification

Just like the natural gas that is used to heat our homes, propane is a gas at room temperature and normal atmospheric pressure. The process to turn propane into a liquid for shipment is similar to converting natural gas into LNG, but is simpler and requires much less equipment and energy. Shippers convert propane into a liquid because it is much easier to transport liquids than gases. There are numerous propane export and import facilities around the world that have been operating safely and reliably for decades.

Propane has been produced and consumed in North America for decades, and has well-established, developed markets and infrastructure to support it. The United States has traditionally hosted both import and export facilities for propane, and became a net exporter of propane for the first time in 2012. Current export facilities are located at Ferndale, Washington (owned by an AltaGas affiliate) and Mont Belvieu, Texas, with a new facility at Marcus Hook, Pennsylvania. Most of Canada's propane exports currently go to the United States by pipeline, truck or rail. Propane facilities in BC consist mainly of rail and truck receipt terminals that serve as distribution centers to feed retail markets.

The largest source of propane in North America is the production of natural gas and oil refining. Changes in natural gas drilling technology coupled with higher prices for propane have resulted in a large increase in propane supplies in western Canada. Horizontal drilling has opened the development of natural gas trapped in what were previously inaccessible shale formations. Higher returns on investment from natural gas with a high propane content lead producers to focus their natural gas drilling on those formations that are also rich in propane and butane. Targeted drilling in BC and Alberta is expected to substantially increase the supply of propane and result in a surplus for the region. Current development fields and forecasts indicate a propane export facility is sustainable.

As detailed in 'Strategic Outcomes and Program Alignment Architecture: 2013-2014' Natural Resources Canada (2014) has several objectives related to energy development. These objectives include facilitating investment and capitalizing on the potential to stimulate jobs and growth through responsible resource development, while also maintaining strong environmental protection; to improve the alignment of federal and provincial regulatory processes and to ensure effective and meaningful consultation with First Nation people; to manage energy resources and infrastructure to contribute to the broader economy; and the development of new energy supply.

The propane export facility proposed by AltaGas is a good opportunity to pursue all of these goals. Creating new markets for Canadian propane will also help energy producers, and will play an important role in supporting their efforts to develop LNG export projects.

Supporting propane exports from BC is consistent with the mandate of BC's Ministry of Natural Gas Development as detailed in the 2013-2016 Revised Service Plan.

The major developed economies in eastern Asia are Japan, South Korea and China. These countries lack the resources to be self-sufficient in energy, and rely on imports from other countries to meet their energy demands. Roughly 80% of current demand for propane in Japan, South Korea and China is met from suppliers in the Middle East. A burgeoning supply surplus in North America has increased the interest of Asian buyers in sourcing propane from North America. Asian buyers are attracted to North American propane's lower prices, but also are interested in the supply diversity and lower political risk that would come with adding North American supply to their portfolio. An additional benefit of propane supply from western Canada would be reduced shipping time, distance and associated emissions.

The Project will provide significant economic benefits to Prince Rupert and the surrounding area. The Project will generate approximately 200-250 construction jobs, and will require approximately 40 full-time positions once the facility is in operation. Local businesses will have the opportunity to provide services in a broad range of areas related to construction and operation of the Project. The large capital investment and annual operating expenses associated with the Project will diversify economic activity at the Port of Prince Rupert, and will help support the long term economic stability of the region for future generations.

1.3 Proponent Information

AltaGas is a publicly traded North American energy infrastructure company with a focus in Canada and the United States. AltaGas owns and operates assets in natural gas, renewable energy and utilities and is listed on the Toronto Stock Exchange (ALA).

AltaGas has significant experience in North America developing and operating infrastructure assets in the natural gas, natural gas liquids (propane and butane) and power sectors. Currently AltaGas owns or has interest in six large natural gas processing facilities in BC and Alberta that produce propane. Two of these facilities have rail loading facilities.

In BC, AltaGas has over $1.6 billion in assets in the Province and recently constructed three run-of-river hydroelectric projects. All three run-of-river projects started as greenfield development projects in northern BC. AltaGas was the originator of the projects, moving them through initial development, permitting, construction, commissioning, and into operations. Additionally, AltaGas has recently completed the development and permitting and has begun the construction on a new 198 Million standard cubic feet of gas per day (MMSCFD) natural gas processing facility (the Townsend Facility) in northeast BC. AltaGas also developed the Bear Mountain Wind Power Project in northeast BC.

AltaGas has direct experience with handling, storing, and exporting propane through its responsibility for operating of the Ferndale Propane Export Facility (owned by an AltaGas affiliate) in Washington State. The Ferndale terminal has been operating safely for over 35 years without a major incident. It has the capability to handle exports and imports of up to approximately 2,500 tonnes a day and has facilities to handle and supply propane to the regional market for U.S. domestic consumption. The terminal has rail, truck and pipeline capability and is connected to the two local oil refineries offering gas balancing services. A photograph of the Ferndale facility is provided in Figure 1-5.

With its track record and experience in project development, construction and operation in BC, AltaGas is familiar with the regulatory regime and safety requirements under which extraction and gas transportation facilities are developed and operated.

AltaGas will leverage the experience it has gained from developing, constructing and operating projects throughout BC, to execute the Project in a commercially viable and environmentally sound manner, while considering the needs of PRPA, RTI, First Nations, and other stakeholders. AltaGas is a proven leader in developing working relationships with First Nations as evidenced by the positive working relationship created with the Tahltan Nation for the development and operation of the Northwest Hydroelectric Facilities.

Proponent Contact Information:

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Telephone: 604.623.4750 or 604.294.1828
Web: www.altagas.ca

Project Director:

Dan Woznow
Vice President Energy Exports
Email: dan.woznow@altagas.ca
Telephone: 604-623-4770

Figure 1-5: Aerial view looking west of Ferndale Propane Export Facility, Washington

1.4 Regulatory Context

The Project is not a designated project listed in the "Regulations Designating Physical Activities" (Canadian Environmental Assessment Agency [CEA Agency] 2015[1]) under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) (refer to section 1.4.1.1 below for further explanation). However, the Project is located entirely on federal land and water and therefore requires an environmental evaluation under Section 67 of CEAA 2012.

In accordance with provisions of Section 67 of CEAA 2012, a Federal Authority(s) must not make a decision about projects on federal lands unless the project is determined to be unlikely to cause significant adverse environmental effects or the Governor in Council (i.e., Cabinet) decides that those effects are justified under subsection 69(3) of CEAA 2012. Federal Authorities are required to consider the likelihood of significant adverse environmental effects before a project can proceed.

[1] Government of Canada. Regulations Designating Physical Activities. SOR/2012-147. CEA Agency 2015. Current to June, 2015.

Under Section 67 of CEAA 2012, PRPA, RTI, and Transport Canada (TC) – as Federal Authorities – have a responsibility to determine if the Project is likely to cause significant adverse environmental effects before allowing the Project to proceed. The Section 67 approval process is described further in Section 1.4.1.1 of this report.

Consultation will be required with Transport Canada to confirm compliance with the Navigation Protection Act for any improvements to the jetty. Consultation with Fisheries and Oceans Canada (DFO) will be required if commissioning or operating options are selected that may interact with the surrounding marine environment.

The regulatory process specified by the federal authorities, including the submission of this Environmental Evaluation Document (EED) by AltaGas, is consistent with current guidance for making a determination under section 67 of CEAA 2012, and the general approach to assessing effects adopted herein is consistent with practices expected when conducting an EA of a project pursuant to CEAA 2012.

RTI is the coordinator of the regulatory process by the federal authorities, which also include the PRPA and TC. The regulatory process consists of the following steps:

1) *Project Description*

- A Project Description was submitted for review by federal authorities, First Nations (i.e., Metlakatla First Nation, Lax Kw'alaams First Nation, Kitselas First Nation, Kitsumkalum First Nation, Gitxaala First Nation, and Gitga'at First Nation) and the public. A 30 day public engagement period was undertaken with open houses held in Port Edward and Prince Rupert. For more detail on the engagement and consultation carried out for the Project see Section 3.0, Consultation and Engagement.

2) *Environmental Effects Evaluation*

This step involved the following:

- a technical review by PRPA, RTI and federal authorities;
- incorporation of concerns arising from Project description engagement activities with the public, First Nations and federal authorities, these activities are described in Section 3; and
- consultation with First Nations.

3) *Determination*

A determination will be made by each Federal Authority in accordance with the requirements of Section 67 of CEAA 2012 and related guidance provided by the CEA Agency. If the project is determined unlikely to cause significant adverse effects, the Authorities may allow the project to proceed, taking into account mitigation measures determined through the environmental evaluation process.

If a Project is likely to cause significant adverse effects the authorities must not carry out the project or refer the project to the Governor in Council to determine if the significant effects are justifiable if the project were to proceed.

1.4.1 Environmental Permitting and Authorizations

The following provides an overview of notable environmental permits/authorizations anticipated to be required for the Project:

- CEAA 2012 Section 67 determination;
- Navigation Protection Act approval;
- Explosives Act Permit (if required); and
- Storm Water Management Plan approval from PRPA.

The PRPA project review process is running concurrently, and is contingent on a Section 67 approval.

The *Canadian Environmental Protection Act 1999* (*CEPA*) applies to activities undertaken by Crown Corporations on federal lands. In order to satisfy the requirements of the Act, the Project will adopt an appropriate set of environmental management plans (EMPs), including Spill Management Plans, which meet the requirements of the Act, and support the safe and environmentally sound operation of the facility.

1.4.1.1 Federal Authorizations

Canadian Environmental Assessment Act

The CEAA 2012 defines responsibilities and procedures for environmental assessment (EA) of projects involving the federal government, and establishes a process for determining environmental effects of projects. The CEAA 2012 "Regulations Designating Physical Activities" specifies thresholds for EAs that are overseen by the CEA Agency, the National Energy Board, and the Canadian Nuclear Safety Commission.

The following potential triggers were considered, as described in the Regulations Designating Physical Activities. As noted below, the Project is below the thresholds identified in the Regulations Designating Physical Activities.

Under Section 14(f) of the Regulations, designated projects that may be overseen by CEAA 2012 include "The construction, operation, decommissioning and abandonment, of a new liquefied petroleum gas (LPG) storage facility with a capacity of 100 000 m^3 or more". The storage capacity of the proposed LPG storage facility will not exceed 100,000 m^3 and will therefore not trigger an EA under CEAA 2012.

Section 24(c) of the Regulations, applicable to "the construction decommissioning, and abandonment of a new marine terminal designed to handle ships larger than 25,000 Dead Weight Tonnes (DWT) unless the terminal is located on lands that are routinely and have historically been used as a marine terminal or that are designed for such use in a land-use plan that has been the subject of public consultation", does not apply as the Project will be using RTI's existing marine terminal.

Section 25(a) of the Regulations, applicable to "the construction, operation, decommissioning and abandonment of a new railway line that requires a total of 32 kilometres (km) or more of new right of way" does not apply as the length of rail being built for the Project is less than 32 km.

Section 25(b) of the Regulations, applicable to "the construction, operation, decommissioning and abandonment of a new railway yard with seven or more yard tracks or a total track length of 20 km or more", does not apply as the Project is not constructing new yard, it is adding a few new tracks to an existing yard.

Section 2(a) of the Regulations, applicable to "the construction, operation, decommissioning and abandonment of a new fossil fuel-fired electrical generating facility with a production capacity of 200 Megawatt (MW) or more" does not apply as the generating capacity of the Project will be approximately 15 MW.

Section 46 of the Regulations, applicable to "the construction and operation of a new pipeline, other than an offshore pipeline, with a length of 40 km or more", does not apply as the length of piping required for the Project is under 40 km.

However, as the Project will be built on federal lands, Section 67 of CEAA 2012 will apply, whereby:

> "An authority must not carry out a project on federal lands, or exercise any power or perform any duty or function conferred on it under any Act of Parliament other than this Act that could permit a project to be carried out, in whole or in part, on federal lands, unless (a) the authority determines that the carrying out of the project is not likely to cause significant adverse environmental effects; or b) the authority determines that the carrying out of the project is likely to cause significant adverse environmental effects and the Governor in Council decides that those effects are justified in the circumstances under subsection 69(3)". 2012, c. 19, s. 52 "67", c. 31, s. 431(E).

Navigation Protection Act (NPA)

As administered by TC, in accordance with the NPA "it is prohibited to construct, place, alter, repair, rebuild, remove or decommission a work in, on, over, under any navigable water that is listed in the schedule". Since the Project is partly situated in the Pacific Ocean, and involves the modification of the existing RTI terminal facility, an NPA authorization may be required.

Fisheries Act Authorization

As administered by Fisheries and Oceans Canada (DFO), *Fisheries Act* authorization under paragraph 35 (2)(b) of the Act will be required if any of the proposed works, undertakings or activities of the Project are likely to result in impacts to fish or fish habitat that are part of or support commercial, recreational or Aboriginal (CRA) fisheries.

There are no proposed works under the high water mark (HWM) as part of the Project, and as such no *Fisheries Act* authorization is anticipated at this time. DFO will be consulted in the future if this changes.

Explosives Act

Site preparation activities will utilize explosives to level the grade of the sub-lease site. Blasting will be carried out by a licensed contractor and explosives will not be manufactured or stored on site. In the event that explosives will need to be manufactured or stored on site, *Explosives Act* permits will be obtained in advance of their use.

1.4.1.2 Provincial Authorizations

British Columbia Environment Assessment Act

Since the Project is located entirely on federal land, a certificate under the *British Columbia Environmental Assessment Act* (BCEAA) is not required for informational purposes, the Project also does not exceed criteria set by the provincial *Reviewable Projects Regulation*[2] that would trigger review under BCEAA.

The following criteria were considered:

- The Project is a new energy storage facility with the capability to store 2.66 Petajoule (PJ), which is less than the criteria of >3PJ of stored energy.
- The Project's approximately 15 MW gas driven compressor will be less than the criteria for a new facility with a rated nameplate capacity of >50 MW of electricity.
- The Project is not a transmission pipeline facility and as such does not meet those criteria for inclusion.
- New rail tracks within an existing railyard built for the Project will be less than the threshold of >20 continuous kilometres of developed track.

[2] Government of British Columbia, 2002. Environmental Assessment Act, Reviewable Project Regulation. B.C. Reg. 370/2002. Amendments to March 30, 2012.

2 PROJECT DESCRIPTION

2.1 Background

AltaGas submitted a Project Description to RTI and PRPA on January 20, 2016. Section 2 herein provides the description of the Project including updates to, and clarifications of, the original Project Description, to facilitate the review and the determination pursuant to Section 67 of the *CEAA 2012*.

2.2 Setting and Site Location

The Project is being built on a previously developed industrial site, designated and used for port related activities within RTI leased lands and PRPA jurisdiction. The Project fits within the objectives and land use plans described in the PRPA 2020 Land Use Management Plan which was reviewed by the public and First Nations in a consultation process, conducted during the winter and spring of 2012. All new construction for the Project will take place on previously cleared sites and/or will build upon existing infrastructure. In addition, technical and environmental information is publically available through the work done on recent EA processes (e.g., Pacific North West (PNW) Liquefied Natural Gas (LPG), Canpotex Potash Terminals, Prince Rupert LNG) in the immediate area, PRPA sustainability planning reports and implementation efforts, and known and proven strategies for mitigation of any expected environmental effects in the vicinity of Prince Rupert and from other propane export projects.

2.3 Scope of the Project

The scope of the Project includes all physical works and activities associated with the construction, operation, and decommissioning of the Project. Project related physical works and activities are located on RTI lease lands within the federal lands administered by the PRPA.

Propane supply for the Project will come from natural gas processing facilities and petroleum refineries in BC and Alberta. AltaGas will be relying on long-term contracts such that the operations team will be able to ensure a steady and reliable supply of propane to the Project that will meet customer specifications.

The facility is being designed to run at an annual average of 3,226 tonnes/day, with an expected annual capacity of 1,177,490 tonnes/year. To enhance reliability, the facility will add redundancy by incorporating two trains with a total capacity to handle a maximum 6,452 tonnes/day. The ability to occasionally process over the average 3,226 tonnes/day is being designed in to the facility in order to accommodate situations where trains are backed up due to unpredictable events that could close the railway temporarily. For the purposes of this environmental evaluation a conservative approach was adopted by considering the maximum potential throughput of the facility.

Key Project Parameters are presented in Table 2-1 below:

Table 2-1: Key Project Parameters

Inlet Product	**HD 5- Propane (>90% C3)**
Export Product	J-Spec Propane (>95% C3)
Energy Storage Capacity	2.66 PJ
Expected Average Daily Capacity	3,226 tonnes/day
Annual Capacity	1,177,490 tonnes/year
Railcars per day	~ 50-60 railcars/day
Unloading Spots (two sides)	20 unloading racks, with a capacity to unload up to 40 railcars
Total Storage Capacity (Refrigerated Storage Tank and pressurized bullets)	98,000 m^3
Power Supply	Approximately 15 MW. The facility will use gas driven compressors to supply a portion of the process refrigeration load. The remainder of the facility will be run off power from the BC Hydro grid. The facility will have sufficient on-site diesel emergency power generation for critical services.
Ship Handling Capabilities	230 m (Overall Length), 38.4m (Beam), 64,220 DWT (Deadweight Tonnes), 13.6 m (Summer Draft)
Ship turnaround time	40 hours
Number of carriers/year	Approximately 20-30 at full capacity
Operations	24/7/365 for rail handling, processing and ship loading

2.3.1 Project Components

The Project will include the following components (Section 1.1, Figure 1-4):

2.3.1.1 Project Facilities on PRPA Land

- Build out of an existing track (shared use with RTI).
- Construction of two new tracks.

2.3.1.2 *Project Facilities on RTI Lease Land*

- Construction of new rail tracks (arrival, departure, manifest, and bad order).
- Regraded existing rail sidings (shared use with RTI).
- Connection to one of RTI's existing 69 kilovolts (kV) substations, connecting with the BC Hydro grid.
- New natural gas line for connection to the Pacific Northern Gas (PNG) line.
- New buildings, including: administration, central control room, lab, operations, washrooms and sanitary waste disposal and maintenance buildings (shared use with RTI).
- Potential removal of the existing pellet shed and connected conveyor/tank.

2.3.1.3 *Project Facilities on the AltaGas sub-lease Site*

- Interconnecting Pipe racks.
- Rail tank car unloading equipment.
- Propane storage bullets.
- Propane dehydration equipment.
- Propane refrigeration equipment.
- BOG recovery system.
- Gas driven compressors.
- Electric driven compressors.
- Provisions (space) for a future de-ethanizer.
- Equipment cooling system (air).
- Refrigerated propane storage tank.
- Firewater tank.
- Fire monitors.
- Deluge system (integrated infrastructure).
- Ground flare.
- Storm water management facilities.
- Reconfiguration of the existing storm water outfall pipe (shared use with RTI).

- New vehicle access bridge (shared use with RTI).
- Operations control building.
- Vehicle parking.
- New access gates and security buildings.

2.3.1.4 Project Facilities on the Existing RTI Jetty

- Pipe rack along the existing trestle to support the liquid loading and vapour return lines.
- One liquid loading line (up to 24" OD) running the length of the trestle.
- One vapour return line (up to 12" OD) running the length of the trestle.
- Utility piping (nitrogen, water, instrument air).
- Loading arms on the center dolphin to offload propane to the VLGCs.
- Blower package for vapour return.
- Fire suppression equipment.

2.3.2 Project Activities

The Project includes the following activities:

2.3.2.1 Construction

- Site preparation, including blasting, rock crushing and regrading of the AltaGas sub-lease site. The site is brownfield and was previously cleared and therefore little to no clearing, grubbing, or stripping of overburden is required.
- Transportation of personnel and equipment will be provided by road, rail, and barge.
- Removal of the existing sulphur loading/storage/unloading facility. The sulphur facility was never commissioned and as such no hazardous substances are anticipated.
- Modification of existing settling ponds. Southernmost pond will be decommissioned and the northernmost will be re-configured and upgraded.
- Installation of utilities, including electrical power, natural gas, water, sewers, upgrade of existing site drainage, and fire protection.
- Construction of new rail tracks and switches for arrival, departure, manifest handling, and bad order.
- Re-grading of existing rail sidings on RTI lease land.

- Connection to the BC Hydro grid at via an existing RTI owned substation.
- Installation (via a barge) of piping and loading arms on the existing RTI jetty.
- Reinforcement of existing marine structures done by floating barge.
- Upgrade to existing jetty and Project sublease lighting. Lighting design upgrades will be finalized with final Project detailed design.
- Installation and hydrotesting of the refrigerated propane storage tank on the AltaGas sub-lease site.
- Installation of the propane refrigeration equipment on the AltaGas sub-lease site.
- Installation of a new vehicle access bridge to the RTI coal stockyard area from the AltaGas sub-lease site.
- A new at-grade turn-off to the bridge from the main road and access gate will be established approximately 340 m north of the existing turn-off.
- Approximately 250 construction jobs.

2.3.2.2 Operations

- Continuous operation capabilities (24 hours, 365 days a year).
- Periodic testing of the firewater and flare systems.
- Full-time employment for approximately 40 people.
- Receiving and unloading propane from CN trains accessing the site on existing rail tracks.
- Refrigerating propane.
- Storing propane (See additional information in Section 2.3.3: Receiving, Storing and Offloading Propane).
- Loading propane carriers for export (see additional information in Section 2.3.4: Marine Jetty: design, operations, and safety systems).

2.3.2.3 Decommissioning

- Removal of land-based above-ground infrastructure on the AltaGas sub-lease site.
- Decommissioning of infrastructure outside of the subleased area will be the responsibility of RTI.

2.3.3 Receiving, Storing and Offloading Propane

2.3.3.1 Transportation of Propane to Facility by Rail

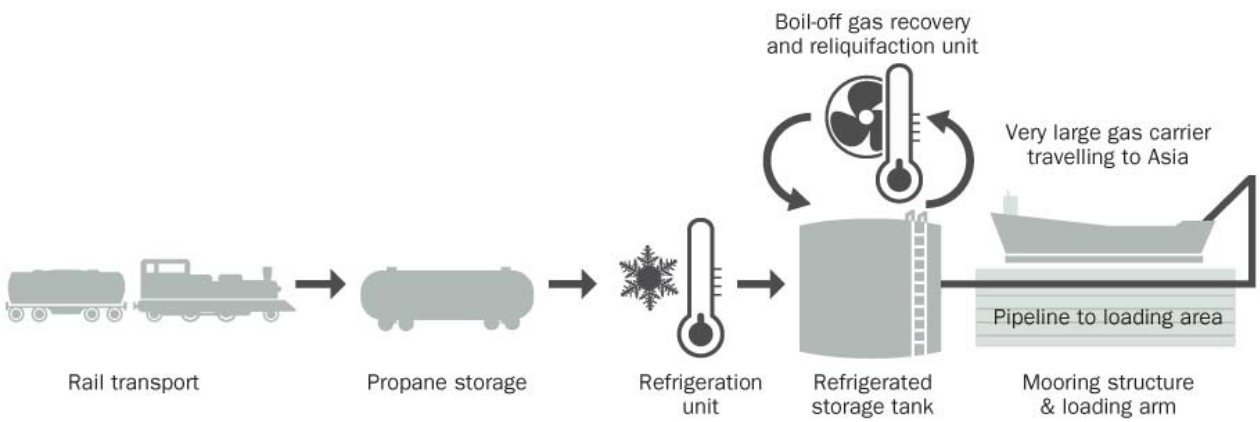
There are no pipelines in the Prince Rupert area that can be used to transport propane. As a result, all supply will be brought to the Project site by rail from the processing facilities in northeast BC and northern Alberta. Gas processing facilities located in northeast BC and Alberta, owned by AltaGas and other producers, are, or can be, connected to rail. Transport of propane to the Project site will be handled by manifest or unit trains operated by CN Rail. CN currently transports approximately 200 rail cars of propane per year through the Port of Prince Rupert, where they are loaded onto barges destined for Alaska.

Propane is regulated for transport under the federal Transportation of Dangerous Goods (TDG) Act and Regulations. AltaGas will make arrangements as required to develop a rail tank car fleet which will be moved by CN between gas processing facilities and the RTI site. Rail tank cars that carry propane are specifically designed and built for that purpose and are required to meet well established engineering codes and the requirements of Transport Canada and the US Department of Transport. DOT 112 tank cars will be used by the Project. These tank cars are designed and intended to ship propane at ambient temperatures, and as such they are capable of maintaining the pressure required to keep the propane in liquid form.

2.3.3.2 Propane Facility Operation

Propane facility operations consist of receiving pressurized propane by rail, offloading it to pressurized storage bullets, cooling it, and then storing it in an atmospheric, refrigerated tank until it is offloaded using the existing RTI jetty with new propane loading arms to a VLGC sized carrier for export. A simplified schematic outlining the operation of the facility is shown in Figure 2-1 below. Detailed process and instrumentation diagrams are being completed as part of the detailed design of the facility.

Figure 2-1: Propane Facility Operation



2.3.3.2.1 Unloading

Liquid propane will be unloaded from rail tank cars to storage vessels (commonly referred to as "bullets") on the AltaGas sub-lease site, which will hold and store the propane in advance of it being refrigerated for storage. Transfer from the rail tank cars will be done using specially designed unloading arms, which will be mounted on a centrally located unloading platform. The rail unloading location is illustrated in Figure 1-4, Section 1.1.

Unloading of rail cars will occur in several batches daily, 24 hours per day. Tracks will be installed on each side of the unloading platform. Each track will be capable of holding up to 20 rail cars. Each batch will unload up to 40 rail cars at a given time. It is anticipated that shuttling of the cars in and out of the unloading position will be accomplished by shunting engines owned and operated by AltaGas.

2.3.3.2.2 Refrigeration and Storage

The next step takes place in the refrigeration facility on the AltaGas sub-lease site and consists of removing residual water from the propane to meet export specifications and removal of potential hydrates. Once the propane is dehydrated it goes through the refrigeration process whereby it enters multiple heat exchangers, and is chilled to approximately -42 Degrees Celsius (°C). At this point, the propane will be at near atmospheric (low) pressure, and transferred to a storage tank, where it is stored until a carrier is ready for loading.

2.3.3.2.3 Boil-off Gas and Ground Flare

Although the storage tank is very well insulated, minor amounts of methane, ethane and propane (referred to as 'light ends') will steadily boil off from the effects of sun and ambient temperature. These light ends are used in the power section of facility with excess amounts being recompressed and used for cooling. The facility will have an enclosed ground flare which will be used to safely vent and combust flammable gases that arise from process upsets, or from periodic process venting associated with normal operations when pipes need to be opened for maintenance purposes. The flare will not emit a visible flame, nor will it emit radiant energy that will reach nearby properties.

2.3.3.2.4 Carrier Loading

VLGCs specially designed to handle refrigerated propane will be brought to the RTI facility to be loaded with product for export. VLGCs that call at the facility will be owned and operated by third party companies that are specialists in the safe transport of propane. New piping and loading arms will be built on the existing RTI jetty to deliver propane from the facility to the carriers. Electric motor driven pumps will transfer the chilled propane along the pipes from the unpressurized storage tank to the carrier. It is anticipated that carrier loading operations will occur approximately once every 15 to 20 days, which at full capacity results in approximately 20-30 carriers per year depending on customer demand, design plant capacity, and size of the carrier. Loading will take approximately 40 hours, and will be completed in accordance with RTI and PRPA's terminal rules and regulations (see Section 2.3.4).

The number of carriers calling at the terminal will be limited by a maximum number of permitted vessels that can call at the RTI terminal annually. Additionally, there is a practical limit (i.e. there are only so many vessels that can arrive, load and depart in a given year). The AltaGas carriers will displace the number of coal carriers that are permitted to call at the terminals and therefore no increase in ship calls at RTI will occur.

2.3.3.2.5 Power Supply

AltaGas estimates that approximately 15 MW will be required for on-site power of the facility. The facility will use gas driven compressors to supply a portion of the process refrigeration load. The gas driven compressors will be supplied by a mixture of pipeline quality natural gas and light hydrocarbons (methane, ethane and propane) that are evaporated from the incoming propane stream during the refrigeration process that would otherwise need to be combusted in a flare. The remainder of the facility will be run off grid power from one of RTI's existing 69kV substations connected to the BC Hydro grid. The facility will have sufficient on-site diesel emergency power generation for critical services.

The use of the gas driven compressors is necessary, as the saturated gases (light ends) from the propane in the rail cars (minor amounts of ethane and methane) must be removed in order to meet export specifications of the purchaser. The use of the removed ethane and methane in gas driven compression is an efficient use of what would otherwise be a waste stream.

In order to maximize site safety, critical process equipment and emergency systems will be powered by a back-up emergency diesel generator. The diesel generator will only start up in emergency scenarios when grid power from BC Hydro is unavailable, through ATS switch gear.

2.3.3.3 Shipping of Propane to Market by Carrier

Shipping and shipping-related activities will be handled by third party owners and operators. Shipping of propane will displace coal shipping (which has historically occurred at the proposed location) resulting in no net increase in ship traffic at the RTI terminal.

The global propane industry is served by a large fleet of propane-specific carriers, which are generally smaller than the coal ships that currently call at the RTI facility. The current fleet of 144 carriers worldwide has an average draft of 11.6 meters (m), a maximum draft of 13.6 m, and 100 of the carriers have draft of 12 m or less. These carriers are similar in size to those already calling at RTI's coal terminal. Propane carriers typically have a beam of 36 m and length of 230 m and carry approximately 40,000 tonnes. Carrier scheduling is planned well ahead of actual loading. AltaGas and RTI will confirm physical acceptability of the carrier after reviewing the documents associated with the carrier. In addition to the physical aspect, AltaGas will also review the record of maintenance, accident reports, on board inspection reports, and any certificates by major oil and gas companies based on a 'SIRE report'[3]. Selecting reliable buyers who provide sound carriers in a timely manner is an important requirement of the Project.

Detailed maintenance and operation procedures (including those for emergency situations) will be developed for the carrier loading operations for the Project. At present, AltaGas can confirm that a Nitrogen leak test will be performed at the connection point of manifold prior to loading propane onto a carrier. Should a leak or other deficiency be found during the loading of propane onto the carrier, operators would immediately stop the loading operation and disconnect the manifold. Operators would then ask the carrier to leave the berth immediately and fix the deficiency at a safe area within PRPA jurisdiction. After fixing the deficiency, the carrier would be allowed to berth again and retested.

[3] The Ship Inspection Report Programme (SIRE) is a carrier risk assessment tool – a large database of up-to-date information about carriers and barges. It is an industry-wide system established 21 years ago and is used by the Oil Companies International Marine Forum (OCIMF) member companies and registered recipients.

2.3.3.4 Daily Operations

Normal operations will consist of trains arriving and then departing on CN every day. Initial total deliveries will likely be 15–20 railcars per day, with anticipated growth to approximately 50-60 railcars per day within 12–18 months of the start of operations.

The Project will be designed to accommodate the maximum daily number of rail tank cars that could potentially be delivered by CN. Direct labour is required only for connecting the rail tank cars to the high pressure storage, and connecting the low pressure storage to the carrier. All other operations will be managed according to established safety protocols like those used at the Ferndale facility, from a control room operated by AltaGas personnel and located on the AltaGas sub-leased land.

2.3.4 Marine Jetty: Project Facilities Design, Operations, and Safety Systems

RTI will be responsible for all aspects of the Project associated with maintaining and operating the existing marine jetty. AltaGas will be responsible for retrofitting specific components of the jetty to accommodate propane export. No works below the high-water mark are planned.

RTI has advised AltaGas that they are currently updating their "Terminal Rules and Regulations" document as well as producing a "Port Information Booklet" specific to the handling of propane at the marine jetty. These documents detail the mandatory procedures and regulations, as well as general information for the carrier to follow prior to arrival and while moored at the jetty. Details will be specific to the following:

- Carrier acceptance (vetting).
- Pilotage.
- Tug assistance.
- Carrier berthing.
- Carrier mooring.
- Limiting environmental operating conditions.
- Cargo transfer.
- Product safety specifications.
- Communications.
- Fire protection.
- Carrier and terminal security.
- Carrier access.

- Carrier repair and provisioning.
- Spill prevention[4].
- Emergency response.

The following sections provide a brief description of the marine related safety systems and operational measures that will be adopted for the Project.

2.3.4.1 Carrier Vetting

As part of RTI's operational procedures, all carriers will be vetted and required to meet RTI's safety and environmental standards and the terminal's rules and regulations prior to arrival at the terminal. Carrier vetting procedures are currently being developed from regional and global best practices and will be provided to PRPA six months prior to the in-service date.

2.3.4.2 Pilotage Requirements

Pilotage and escort requirements will be in accordance with the Prince Rupert Port Authority's "Harbour Practices and Procedures" and the Canada Shipping Act, the federal Pilotage Act, and the Pacific Pilotage Requirements. Simulation training for the Project is being undertaken with the Pacific Pilots, and AltaGas will continue to work with pilots to ensure the Project is operated safely.

2.3.4.3 Escort Requirements

RTI intends to comply with tug escort requirements that are defined in the PRPA's "Harbour Practices and Procedures" guidance and will be determined in consultation with the Pacific Pilotage Authority, TC, PRPA, and the Canadian Coast Guard.

2.3.4.4 Carrier Berthing Operations

Harbour tugs will be required to meet the carrier at the direction of the Pilot and Master to assist the carrier in safely berthing and mooring at the marine terminal.

A docking aid system will be installed at the existing jetty to assist the pilots and terminal operators in carrier berthing. The system will monitor and display the carrier's approach speed, distance and angle with respect to the berthing dolphins. The system improves the safety of the berthing operation and reduces the risk of abnormal berthing events by allowing the Pilot to manage the carrier's speed and approach vector in order to verify that the approach procedure is within the specified terminal limits.

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[4] There are no bunkering facilities located at Prince Rupert. No bunkering will take place as part of the Project.

Inbound carriers arriving in a ballasted condition will normally berth with their port sides to the loading platform allowing for the bow of the carrier to be head on into the prevailing current and wind direction.

Although the existing jetty is designed to allow for berthing of carriers much larger than those that will be calling at the Project (up to 250,000 DWT), modifications and upgrades to the existing fender system are anticipated.

2.3.4.5 Carrier Mooring Operations

The existing mooring points are expected to be sufficient for safe mooring of the carriers calling at facility for the Project. Mooring lines will be secured to quick release hooks. The number and placement of the mooring lines will be determined for each size of carrier during the detailed engineering phase of the Project.

2.3.4.6 Maximum Operating Conditions

Operational safety limits will be established to cover visibility, wind and sea conditions. The preliminary limiting operating criteria are as follows:

- Berthing maximum wind speed: 20 m/s (40 knots)
- Loading/unloading shutdown maximum wind speed: 25 m/s (50 knots)
- Loading/unloading arm disconnect maximum wind speed: 30 m/s (60 knots)
- Carrier to vacate berth: 32.4 m/s (63 knots)
- Maximum current: 2.5 knots
- Minimum visibility: 1.0 km

The above are estimated limiting criteria and are considered preliminary at the time of writing. The limiting operating criteria are subject to change pending detailed operational and mooring analyses to be conducted during the detailed design of the Project.

Meteorological and oceanographic sensors will be installed to monitor: wind speed and direction, current speed and direction, visibility, tidal changes, and wave height and direction. Real-time data from the sensors will be transmitted to the control room for display and logging.

2.3.4.7 Cargo Transfer

The Project will include the piping, valves, fire protection, carrier access, and control systems required to safely transfer the cargo and crew between the shore, the jetty, and the carrier. All loading equipment on the jetty will be controlled by a central control room located on RTI lease land on Ridley Island. Topside equipment and systems can be categorized into cargo transfer systems, safety and security systems, emergency response systems, carrier services, and control systems.

The cargo transfer system includes marine loading arms, manifolds, pipelines, booster pumps and valves. All cargo pipelines and hoses connecting the carrier to the marine terminal will conform to industry standards. The actual connection between the carrier and the marine terminal for the purpose of transferring propane will be made with the use of marine loading arms.

The loading arms are supplied with product via piping running along the jetty from the onshore storage tank. There will be two new pipelines built for the propane transport from the facility to the loading arms: one liquid loading line (up to 24” OD), and one vapour return line (up to 12” OD).

A safety zone and rules for its implementation will be established at the berth face for vessel loading based on the results of a risk assessment and in conjunction with RTI, PRPA, Transport +Canada and the Harbour Master.

2.3.4.8 Dredging

Dredging will not be required for the Project.

2.3.4.9 Emergency Response Requirements

AltaGas will work with RTI and PRPA to understand and manage all existing land-based Emergency Response Plans (ERPs). The plans will be established after detailed engineering is complete and prior to construction and/or operation.

RTI will be managing all marine emergency response requirements and will continue to comply with all ERP requirements that have already been established for the facility. The ERP will be modified as necessary to address propane specific response plans.

2.4 Schedule

Project approval is anticipated in Q3 2016. Detailed engineering and design are planned to be completed and executed in mid-2016 which will be followed by construction starting after all approvals are obtained, potentially as early as Q3 2016 through to 2018 (approximately 24-28 months). Therefore, subject to obtaining the necessary regulatory approvals and required consultation, the proposed propane export facility could be commissioned and start operations as early as late 2018.

2.5 Environmental and Socio-Economic Background

The Project is proposed on a site characterized by a history of industrial development and use. Environmental and socio-economic information has been gathered over the course of the last several decades, resulting in a substantial amount of available data for the site and adjacent areas. Development began at Ridley Island when an access road was constructed in 1982 connecting the island with Highway 16 north of Port Edward, BC. RTI was constructed after the completion of this access road and has been operating on Ridley Island since 1984. The Project site will be located on existing industrial zoned land at the southwest end of the terminal.

2.5.1 Biophysical Setting

The Project site experiences precipitation patterns consistent with a maritime climate and is located in a temperate rainforest region. This climate is characterized by high annual rainfall, peaking in the fall and winter months, and moderate temperature ranges from 3 ˚C to 13 ˚C.

The Project site is on low-lying, rolling terrain with a maximum elevation of approximately 35 m at a point south of the RTI facilities (Dillon 2004). There are no natural water courses on the Project site. Surface runoff is gathered in drainage ditches and two existing settlement ponds on the RTI sub-lease site. More detail regarding the water and sediment of the project area can be found in the baseline sections for the Terrain Intermediate Component (IC) (Section 5) and the Water Quality IC (Section 6).

The western shoreline of Ridley Island is a steep, rocky intertidal zone composed primarily of bedrock, boulder and cobble (WorleyParsons 2012). The intertidal zone supports a diverse community of marine biota from exposure to high wave action. Available mapping data indicates that the Prince Rupert marine area includes important foraging, resting, and migrating areas for humpback whales, northern resident killer whales, and Steller sea lion (DFO 2016b).

More detail on the marine setting can be found in the baseline sections of the Fish Valued Component (VC) (Section 7) and the Marine Resources VC (Section 6).

The Project site has no vegetation cover due to recent ground disturbance and previously constructed sulphur facility and therefore has limited wildlife values at present. More detail on the wildlife and terrestrial resources found in and near the Project area is described in Section 9, Terrestrial Resources.

2.5.2 Socio-Economic Setting

2.5.2.1 Local Community

The Project is situated within the Skeena-Queen Charlotte Regional District (SQCRD) on the north coast of BC. The main urban centre is the City of Prince Rupert, and there are a number other small villages and towns located along the coastline, on adjacent islands and on the islands of Haida Gwaii. Over the last 10 years, the SQCRD has experienced a decrease in population in the order of 21%, and at the same time its economy has been facing substantial restructuring with decreasing reliance on more traditional sectors such as fishing and forestry. While on a community-level basis there tends to be relatively high levels of labour market participation. The District Municipality of Port Edward is the closest community to the Project site, located approximately 2.5 km east and across Porpoise Bay. The population is estimated at 544 residents. The town has an elementary school and community centre offering recreational services. Public, emergency and medical services are based out of Prince Rupert located 15 km north of Port Edward.

2.5.2.2 Emergency and Health Services

There are existing emergency and health services, based primarily in Prince Rupert. These services include those of the Canadian Coast Guard's Marine Traffic Services, Pacific Pilotage Authority, BC Coast Pilots, SMIT Marine and PRPA, provincial ambulance, fire and policing, as well as resources available from tenants of PRPA.

2.5.2.3 Economy

The main economic activities in Port Edward and Prince Rupert are the Port of Prince Rupert, and Ridley Terminals, industry, fishing, forestry and recreation within the community.

The fisheries active in the area around Project site depend upon several species mentioned in Section 6, in addition to Dungeness crab (Cancer magister). Chatham Sound located west of Ridley Island is a known location for sport fishing. More information on CRA fisheries is addressed in Marine Resources (Section 7).

Tourism is playing an increasing role in the regional economy, capitalizing on the area’s high level of natural beauty and the abundance of eco-adventure opportunities.

PRPA and the tenants on port lands are also an important part of the economy of the Prince Rupert and Port Edwards area. Currently there are several proposals for new port facilities, with particular attention given to LNG facilities.

2.5.2.4 Work Force and Employment

Since the late 1990's, the SQCRD, including the City of Prince Rupert and the District of Port Edward and surrounding areas, have experienced industrial closures in the resource sector and a general decline in shipments of coal out of its port facilities. A relatively high unemployment rate was recorded for the Prince Rupert Census Metropolitan Area, which includes Port Edward, compared to the province as a whole.

The economic situation in northwest BC has shown considerable improvement over the past four years as new major industrial projects have been proposed, or are under construction, including, hydro transmission lines, pipelines, LNG facilities, mines, and container ports. While some projects are underway, others await environmental approvals and final decisions by their investors. These initiatives are expected to be a major driver of new development and employment activity in the region.

2.5.2.5 Land Use

The Project site is located on land used for industrial and transportation activities. The land is designated by PRPA for port use in the "2020 Land Use Management Plan" for the lands under their jurisdiction (available: http://www.rupertport.com/documents/prpa-land-use-management-plan/pdf). All of the land on which the Project will be located is disturbed and currently used for industrial and port related activities. Rail transportation will be on lands already used for rail transport, both on PRPA and RTI lease lands, and on CN lands. Activities on marine areas will be on structures already existing and shipping will use waters already designated for vessel movements.

2.5.2.6 Current Use of Land for Traditional Purposes

First Nation persons may currently use resources for traditional purposes in the marine areas that would be traversed by marine carriers using existing terminal facilities. More information on the effects of the Project on current traditional uses by First Nation groups can be found in Section 14, First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes.

2.5.3 Upstream Emissions

Greenhouse Gas (GHG) emissions associated with upstream activities are expected to come from emissions associated with rail transport. Propane is a byproduct of natural gas and oil production; thus the value chain for propane commences when it is extracted from the natural gas or oil. However, accounting for emissions upstream of rail transportation from the Project would result in double-counting as those emissions are associated with the natural gas and oil value chains, and are therefore, excluded from this estimate.

For the purposes of this analysis, the methodology described in GHG emissions for transport or mobile sources, version 2.6 (May 2015) was adopted. It was assumed that the distance travelled by the trains is 1,400 km and that 18,000 tonnes reflects a conservative estimate of the weight of a unit train of propane (100 cars; DOT112 with 120 m^3 propane in winter). Annual upstream GHG emissions for the daily transport of a unit train of propane between Edmonton and Prince Rupert were estimated to be 160,117 metric tonnes of CO2e per year. The upstream GHG emissions analysis related to the Project was conducted outside of the requirements of the Section 67 process.

3 CONSULTATION AND ENGAGEMENT

AltaGas is undertaking consultation and engagement with First Nations, and members of the public. AltaGas began consulting and engaging relevant stakeholders on the Project beginning in September 2015, prior to initiation of the environmental review process.

With the submission of the Project Description to RTI, PRPA and TC, the identified federal authorities, the Project officially commenced the regulatory process on April 20, 2016. Since this time, AltaGas has conducted and participated in various consultation and engagement activities with respect to the Project.

Engagement and consultation activities were designed to obtain stakeholder expertise, local experience, and traditional and community knowledge. Input received during consultation and engagement activities has been and continues to be considered in the development of this EED and Project design considerations.

This section involves a summary of sources engaged regarding the Project's potential to cause adverse environmental effects. The scope and results of the consultation with the public and engagement with First Nations, provincial agencies, and federal authorities, which was completed up to submission of the EED, is provided in this section.

3.1 *Public Consultation*

This section describes consultation activities undertaken with members of the public and how the concerns of the public were recorded.

3.1.1 Scope of Consultation

AltaGas is committed to ongoing consultation with the public with respect to the Project. To date AltaGas has consulted with the following public stakeholders:

- Port Edward Mayor and Council
- Prince Rupert Mayor and Council
- Community of Port Edward
- Community of Prince Rupert
- PRPA Community Information Forum

Consultation activities carried out to date are detailed in Table 3-1.

Table 3-1: Summary of Consultation Activities to Date

Date	Activity	Stakeholder
February 3, 2016	Meeting	Mayor and City Manager of Prince Rupert
February 18, 2016	Meeting	Mayor and Chief Administrative Officer of Port Edward
February 24, 2016	Presentation	PRPA Community Information Forum
March 22, 2016	Presentation	District of Port Edward
April 11, 2016	Presentation	City of Prince Rupert
April 20 – May 20, 2016	30 Day Public Comment Period	General Public
May 10, 2016	Open House	Community of Port Edward
May 11, 2016	Open House	Community of Prince Rupert

- Distribution of Project Description document through:
  - Printed copies at the District of Port Edward Municipal Office, Prince Rupert City Hall, Prince Rupert Public Library and PRPA
  - Digital copy posted to dedicated Project page on AltaGas website
- Notification of the open houses was provided by:
  - Direct mail notification to all households in Port Edward
  - Two weeks advertising notice in the Northern View
  - Advertisement in the May edition of N2N magazine
  - On dedicated Project page on AltaGas website
- Concerns of the public were recorded during meetings, received via on-line submission to the AltaGas website, and submitted on comment cards during open houses.

3.1.2 Summary of Issues

Issues of public concern identified through consultation are summarized in Table 3-2.

Table 3-2: Summary of Public Comments and Concerns Related to the Project

Comment/Question from Public	Response
What is the overall cost of the project?	$400 to $500 million.
How many jobs will be created?	AltaGas expects that the facility will create approximately 40 to 50 permanent jobs and an additional 200 to 250 jobs during construction.
When do you anticipate making a decision to proceed with the project?	AltaGas is hoping to complete the regulatory process by the end of 2016. Once a regulatory determination is made, then AltaGas will proceed with a final investment decision. If the decision is positive, we anticipate proceeding with construction in 2017 and beginning operation in 2018.
Will you be hosting an Open House in Port Edward?	Yes. And we will host open houses in Prince Rupert as well.
Will you work with the community to reduce the impact of noise from train whistles?	AltaGas recognizes and appreciates the importance of reducing the amount of noise from train whistles, and is committed to working with community members as part of a local solution to this problem.
Where will your construction workers be residing while working on your project?	AltaGas is committed to ensuring that current community members are not displaced by construction works working on the proposed project. AltaGas is currently evaluating whether there is sufficient lodging available in the broader community, or whether a camp will be required.
Will you be expanding your project?	AltaGas' focus is on the proposed propane export terminal project as outlined in the Project Description. The present site is a brownfield site, and there is no additional room available on this site to accommodate expansion.
Where will the propane for your project be sourced from?	Propane will be sourced from natural gas producers in British Columbia and Alberta.
How much power will your project require?	AltaGas will require approximately 15 megawatts (MW) of power to operate the facility. We plan to access this power through the existing power grid and through the use of propane at the site.
Will you be flaring?	There will be an enclosed ground flare that will only be used in the event of a need to depressurize in an emergency.
Will your project produce odour from propane?	The project is not expected to result in any odor, as the propane that is shipped to the facility will not be infused with mercaptan.
How safe are the rail cars that will be handling propane?	CTC/DOT 112 rail cars specifically used for transporting propane will be used in compliance with Transport Canada regulations. These cars have thicker tanks and improved puncture resistance as well as thermal protection compared to previous designs. Currently there are approximately 200 propane cars per year that travel along the Canadian National Railway (CN) rail line to Prince Rupert.
How will you be able to tell if there is a leak at your facility?	The export terminal will be designed with inherent safety systems and processes. Emergency detection, shut down and isolations systems will be integral to the operating design. AltaGas operates the Ferndale Propane Export Facility which has a stellar safety record and has operated for 15 years without a safety incident.

Comment/Question from Public	Response
What happens if there is a train derailment?	Propane is non-toxic. In the event of a leak or spill, propane will dissipate. CTC/DOT 112 rail cars specifically used for transporting propane will be used in compliance with Transport Canada regulations. These cars have thicker tanks and improved puncture resistance as well as thermal protection compared to previous designs. Currently there are approximately 200 propane cars per year that travel along the Canadian National Railway (CN) rail line to Prince Rupert. AltaGas is working with CN to develop an emergency response plan. We will look to increase emergency response capacity along the rail corridor route and will apply, along with CN, for an Emergency Response Assistance Plan (ERAP) through Transport Canada.
Is the local fire department capable of responding to any propane-related rail incident?	CN is committed to providing ongoing engagement with first responders across its network in the communities where they operate. Local responders have access to real time information on the type of dangerous goods transported through their community with the AskRail mobile application.

3.2 First Nation Engagement

All matters of First Nation engagement will be discussed in Section 14.

3.3 Regulatory Engagement

Engagement with individual governmental agencies has occurred as part of the ongoing environmental review process and will continue into the project implementation phase. The objective of this engagement was to determine the coordination of the environmental review and develop information sharing processes to facilitate discussion related to undertaking the environmental review assessment for specific subject areas.

This section summarizes the scope of the engagement with regulators and issues raised during the process.

3.3.1 Scope of Engagement

AltaGas has engaged with the following regulatory bodies and federal authorities:

- RTI
- PRPA
- TC
- Canadian Environmental Assessment Agency

- BC Environmental Assessment Office (BC EAO)
- BC Oil and Gas Commission (OGC)

AltaGas initiated Project and regulatory-related meetings with provincial and federal regulators include:

- Project overview and environmental review process planning meeting with RTI and PRPA on January 15, 2016.
- Project and federal regulatory overview meeting with various BC Government ministries on March 8, 2016 including BC OGC, Major Projects, Ministries of Environment, Natural Gas, Aboriginal Relations and Transportation.
- Weekly communication and issues management meeting with RTI and PRPA.
- On-going collaboration with RTI and PRPA in creation of a Project Terms of Reference document.
- Provided Project Description to CEAA and received written confirmation May 24, 2016 that the Project is not described in the Regulations Designating Physical Activities under CEAA 2012 and that Section 67 of CEAA 2012 is the required and appropriate environmental review process for the Project.

4 ASSESSMENT METHODOLOGY

The methodology used in this assessment is consistent with the guidance detailed in the December, 2014 document *Projects on Federal Lands: Making a determination under section 67 of the CEAA 2012* and current best practices for EA, adapted as appropriate to this Project. This includes establishing the existing conditions of the study areas as the baseline, identifying VCs, characterization of project effects and interactions, identification of effects associated with accidents and malfunctions, residual effects determined after applying effective and established mitigation, and assessment of cumulative effects, if required.

Because the Project is on a previous developed industrial site and within an industrially zoned area of PRPA, and RTI that has seen several large-scale and detailed EAs recently conducted for nearby projects, the assessment largely uses available information for several key existing EAs, including but not limited to:

- Proposed Prince Rupert LNG Facility – Application Information Requirements for an Environmental Assessment Certificate. 2014.
- Environmental Impact Statement and Environmental Assessment for Pacific NorthWest LNG. 2014.
- Environmental Impact Statement – Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor. 2011.
- Environmental Assessment Document – Sulphur Forming, Handling and Storage Facility, Ridley Island, BC. 2007 C, February 2007.
- Phase II Environmental Site Assessment, Ridley Island, Prince Rupert, BC. Dillon Consulting Ltd for Transport Canada (for RTI), March 31, 2004.
- Sulphur Export Terminal at Ridley Terminals, Ridley Island, Prince Rupert – Environmental Appraisal Document. Sulphur Corp of Canada, March 1999.

Field studies have been used to fill data gaps in existing data as necessary and are described herein, including a Phase II Environmental Site Assessment conducted by SNC-Lavalin in 2015.

Traditional ecological knowledge and resource use information received from First Nation groups through engagement have informed the effects assessment for related Project VCs, when available. Project-related effects on current use of land and resources for traditional purposes are presented in Section 14. For more details of this process refer to Section 14.

The approach used in this EED is consistent with the requirements for an assessment under Section 67 of the *CEAA 2012,* ensuring that the primary effort and analysis of the environmental assessment is focused on the components of the Project most likely to yield residual adverse effects.

4.1 Selection of Valued Components

The EED summarizes the process and methodologies used to identify and select the VCs for assessment. VCs are components of the bio-physical and socio-economic environments that are considered by AltaGas, public, aboriginal groups, government agencies, and other stakeholders involved in the assessment process to have scientific, ecological, economic, social, cultural, archaeological, or historical importance (CEA Agency) 2014 and 2015; BC EAO 2013). Intermediate Components are studied and analyzed in order to assess project effects on Valued Components. In some cases a component of the biophysical or socio-economic environment is not identified as a VC, but may comprise one step of a pathway along which a project effect travels.

The following process was used to select the VCs:

1) Issues scoping (including: a literature review, public, First Nation, and regulatory agency engagement);
2) Evaluation of candidate VCs; and
3) Selection of final VCs, including identification of indicators for assessment.

VCs were selected to be **relevant** to the Project, **representative** of the important features of the bio-physical and socio-economic environments likely to be affected by the Project, **responsive** to the potential effects of the project, **concise** (so the nature of the project-VC interaction can be understood, while avoiding overlapping or redundant analysis), and taken together, **complete** to enable a full understanding of the important potential environmental, economic, social, heritage, and health effects of a Project (BCEAO 2013).

4.1.1 Issues and Scoping

Although the Project will be developed on a previously developed industrial site, the assessment considered the issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas.

The list of issues deemed important to consider in the selection of VCs included Soil Quality, Terrain Stability, Air Quality, Noise and Vibration, and Light (Visual), Seabed Sediment Quality, Groundwater Quality, Surface Water Quality, Marine Water Quality, Marine habitats (including foreshore and shallow subtidal), Marine mammals, Marine Species at Risk, Marine Resource Use, CRA fish, non-CRA fish, Species at Risk, Vegetation Communities and Sensitive Ecosystems (including wetlands), Wildlife including migratory and non migratory birds, and Species at Risk (wildlife and rare plants), and use by First Nations for traditional purposes.

In identifying VCs based on the issues described above, the following questions have been considered:

- Can the effects of the Project on the VC be measured and monitored?
- Is the candidate VC better represented by another VC?
- Can the potential effects on the candidate VC be considered within the assessment of another VC?
- Is information about the candidate VC needed to support the assessment of potential effects on another VC?

These questions are intended to appropriately focus the assessment of effects of greatest importance.

Where issues or potential VCs are better understood as a pathway of effect to another VC, they have been identified as ICs. ICs are studied and analyzed in order to assess project effects on VCs. An IC is a component of the biophysical or socio-economic environment not identified as a VC, but may comprise one step of a pathway along which a project effect travels.

4.1.2 Selected Valued Components and Intermediate Components

The VCs and ICs shown in Tables 4-1 and 4-2 respectively were selected for assessment in the EED. The tables summarize the rationale for selection.

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Table 4-1: List of Selected Valued Components and Their Sub-Components

VALUED COMPONENT	SUB-COMPONENT	Rationale
MARINE RESOURCES	Marine habitats (including foreshore and shallow subtidal)	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
	Marine mammals	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
	Marine Species at Risk	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
	Marine Resource Use	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
FISH (marine and freshwater)	Commercial, Recreational, or Aboriginal (CRA) fish	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
	non-CRA fish	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
	Species at Risk - fish only	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
TERRESTRIAL RESOURCES	Vegetation Communities and Sensitive Ecosystems (including wetlands)	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
	Wildlife including migratory and non-migratory birds	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
	Species at Risk - wildlife and rare plants	Selected based on issues important to the setting, reflecting a number of recent environmental assessments on Ridley Island and adjacent areas and feedback gathered through initial engagement on the Project Description.
HUMAN HEALTH	Human Health	Previous studies have identified these sub-components as important considerations for human health in the vicinity of Ridley Island.

Table 4-2: List of Selected Intermediate Components and Their Sub-Components

INTERMEDIATE COMPONENT	SUB-COMPONENT	Rationale
TERRAIN	Soil Quality	Contaminated soil, terrain stability and the quality of seabed sediments have been identified in previous studies in the area as important to water quality and VCs for fish and marine resources.
	Terrain Stability	
	Seabed Sediment Quality	
WATER (marine and freshwater)	Groundwater Quality	The three sub-components are important considerations for the VCs for Fish and Marine Resources.
	Surface Water Quality	
	Marine Water Quality	
AIR QUALITY	Air Quality	Air quality, noise and lighting have been identified in previous studies in the area as important to human health considerations. These three components form sub-components for the VC Human Health to identify change that must be considered in relation to human health for workers and nearby receptors.
NOISE	Noise	
LIGHT	Light	

4.2 *Assessment Boundaries*

The spatial and temporal boundaries for the Project are summarized below.

4.2.1 Spatial Boundaries

The spatial boundaries of the EED assessment for all VCs reflect the following:

1) The AltaGas sub-lease site and within a 500 m buffer surrounding the sub-lease site;
2) The rail transportation corridor within PRPA/RTI jurisdiction;
3) The area within PRPA marine jurisdiction; and
4) Consideration has been given to the effects of the Project on the nearest community, Port Edwards, for effects on air quality, noise, and light emanating from the above stated boundaries.

Each VC assessment section will detail spatial boundaries specific to the VC being assessed.

4.2.2 Temporal Boundaries

The potential effects specific to the Project are based on the three main phases of the Project:

- Short-term - Construction Phase (25-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

4.3 Baseline Conditions of Valued Components

For each selected VC, the existing conditions within the AltaGas sub-lease site or identified marine water lot lease area or rail corridor within PRPA jurisdiction are described in sufficient detail to enable potential Project-VC interactions to be identified, understood and assessed. The following information is included for each selected VC:

- Documentation of the methods and data sources used to compile information on existing conditions, including any standards or guidelines followed. Existing conditions at the site have been well documented by existing and proposed projects in the area, and the EED will reference those existing reports wherever possible;
- A description of baseline conditions within the study area in sufficient detail to enable potential Project-VC interactions to be identified, understood, and assessed. The description of baseline conditions will be appropriate to an existing industrial site;
- Reference to natural and/or human-caused trends that may alter the environmental, economic, social, heritage, and health setting, irrespective of the changes that may occur as a result of the Project or other project and/or activities in the area; and
- An explanation of whether and how other past and present projects and activities in the study area have affected or are affecting each VC.

4.4 Identification of Project Effects

The principle steps in the assessment for each VC are outlined below.

4.4.1 Project Interactions

A project interaction table identifies all Project-related construction, operation and decommissioning activities as outlined in Section 2.3.2 was provided for each VC. The table is a tool used to identify and communicate the interactions between Project construction, operation, or decommissioning activities and the sub components of each VC (Table 4-1). All potential interactions with Project VCs and potential accidents, malfunctions or unplanned events are identified and discussed in Section 15, Accidents and Malfunctions.

4.4.2 Mitigation Measures

The *CEAA 2012* defines a mitigation measure as a "Measure for the elimination, reduction or control of adverse environmental effects". The assessment provides a:

- Description of effective and established mitigation measures incorporated into the Project;
- Description of effective and established mitigation assumed or proposed to be implemented, including consideration of best management practices, ERPs, and other general practices; and
- Risk-based approach, as described in CEA Agency (2014) will be used in the assessment, should it be necessary, whereby effort and analysis increases with any increase in the number of likely adverse environmental effects for which effective and established mitigation measures are not available.

For each VC, prior to preparation of the characterization table, the effective and established mitigation is summarized in Table 4-3 (italicized text is for illustrative purposes). Mitigation codes are used as unique identifiers of proposed mitigation measures and aid in readers' interpretation and understanding of the effects assessment discussion presented within each assessment section.

Table 4-3: Example Summary of Potential Adverse Environmental Effects and Mitigation

Phase	Description of Potential Effect	Mitigation	Mitigation code	Residual Effect (Y/N)
OM-4	Alienation or disorientation of birds from light or blasting noise disturbance	Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	T1-M1	Y
		Minimizing the use of artificial lighting wherever possible	T1-M2	
		Using work area lights that have shades designed to direct light down where it is needed for operations and minimize light directed sky-ward	T1-M3	

4.4.3 Assessment of Residual Effects

The potential residual effects are characterized for each VC using the metrics summarized in Table 4-4 as required pursuant to Section 67 in the *CEAA 2012*. Ultimately, the Project-VC interactions identified with the potential for significant adverse effects are clearly described in sufficient detail to enable a non-technical reviewer to understand the cause, type, and nature of the potential effects.

The characterization and assessment of potential residual Project effects are summarized in Table 4-4. The characterization is developed using professional judgement, discussion with federal authorities, input made available from potentially affected First Nation groups, previously documented interactions, considers the likelihood of occurrence, the level of consequence, and the significance of the residual effect.

Table 4-4: Criteria for the Characterization of Residual Effects

Criteria	Description	Definitions
Magnitude	Expected size or severity of the effect	Defined on a VC specific basis – see individual VC assessment sections for definition
Extent	Spatial scale over which the residual effect is expected to occur	• Site-specific; • Local; • Regional; and • Out of scope. Definitions may vary by VC
Duration	Length of time over which the residual effect is expected to persist	Definitions vary by VC, taking into account VC-specific temporal cases: • short term; • long term; and • permanent.
Frequency	How often the residual effect is expected to occur	Definitions vary by VC, taking into account VC-specific temporal cases: • infrequent; • frequent; and • continuous.
Reversibility	Whether or not the residual effect can be reversed once the physical work or activity causing the effect ceases	• fully reversible; • partially reversible; and • irreversible.
Ecological Context	Sensitivity and resilience of the VC to Project related change.	Defined on a VC specific basis and draws on the Existing Conditions.
Level of Effect	The significance of the residual effect	Level of Effect will be defined specific to each VC. The Level of Effect will be classified as: • Not significant; or • Significant.
Likelihood	Whether or not a residual effect is likely to occur	• High, medium, or low probability.
Confidence	Level of certainty associated with the significance & likelihood predictions	• High, moderate, or low level of confidence, with explanation of why.

4.4.4 Determination of Significance

Each VC provides the basis used for determination of significance in a tabular format. The determination will identify the threshold for distinguishing between “Significant” and “Not Significant”.

Table 4-5: Example Table for Characterization and Assessment of Residual Effects

Potential Residual Effect	Project Activity or Physical Works	Project Phase	Mitigation Code	Residual Environmental Effects Characterization[1]				Significance Determination			
				Magnitude	Geographic Extent	Duration	Frequency	Reversible	Level of Effect	Likelihood	Confidence

Notes:

Project Phase:	C = Construction (includes pre-construction and final design), O&M = Operations and maintenance, D = Decommissioning;
Magnitude:	NM = Negligible, LM = Low magnitude, MM = Moderate magnitude, HM = High magnitude
Geographic Extent:	Project site: S, Local: L or Regional: R
Duration:	LT = Long term, MT = Moderate term, ST = Short term, TT = Transient term
Frequency:	CF = Continuous, FF = Frequent, UF = Uncommon, RF = Rare
Reversibility:	R = Reversible, I = Irreversible, C = Change but may fluctuate from positive to adverse for the duration
Level of Effect:	NS: Not Significant, S = Significant
Likelihood:	C: Certain, L: Likely, UL: Unlikely
Confidence:	L: Low, M: medium or H: High

4.5 Cumulative Effects Assessment

The cumulative effects assessment identifies those residual effects from this Project that are considered likely to interact with similar effects in the same time frame with those of past, existing, or foreseeable physical activities in the vicinity of PRPA jurisdiction. A list of all other projects and activities considered in the Cumulative Effects Assessment is provided in Section 4.5.1 and 4.5.2.

In order to consider cumulative environmental effects the following criteria have been considered:

- there must be an environmental effect of the Project;
- the environmental effect must be demonstrated to operate cumulatively with the environmental effects from other projects or activities;
- it must be known that the other projects or activities have been or will be carried out (not hypothetical); and
- the cumulative environmental effect must be likely to occur.

Potential cumulative environmental effects are subject to an assessment using the assessment methods described in Section 4.4.

The resulting assessment of interactions between this Project and another project in PRPA jurisdiction is summarized, and identifies any significant residual cumulative effects identified.

4.5.1 Scope of the Cumulative Effects Assessment

The scope of the CEA was defined by:

- Project components, due to the diverse spatial and technical aspects of the Project;
- Human activity, past, present, or future, that can be measured or reasonably expected to occur and result in effects that are additive to potential effects of the Project;
- Key indicator resources and/or environmental components that could be affected the spatial scope of the assessment; and
- The temporal scope of the Project.

4.5.2 Project Inclusion List

The CEAA states that the level of effort directed to the assessment of cumulative environmental effects should be appropriate to the nature of the project under assessment, its potential effects, and the environmental setting. The CEA that was completed considered the following development categories for other projects and/or actions (other than the project under assessment):

- Certain: the action will proceed or there is a high probability that the action will proceed; and
- Reasonably foreseeable: the action may proceed, but there is some uncertainty about this conclusion.

In both cases, the categorization of a project or activity as either ‘certain‘ or ‘reasonably foreseeable‘ was based on currently available information.

Past or present project would only be considered where the information available about the existing environment did not incorporate effects from the project.

For this CEA, other certain projects or actions included past and ongoing activities as evidenced by existing disturbance areas and facilities, current land use tenures and activities, and traditional knowledge and use. Other reasonably foreseeable projects or actions included projects that have been discussed publicly by their proponents and/or have entered a formal project approval or permitting process.

For reference purposes the current operational projects within PRPA jurisdiction are below.

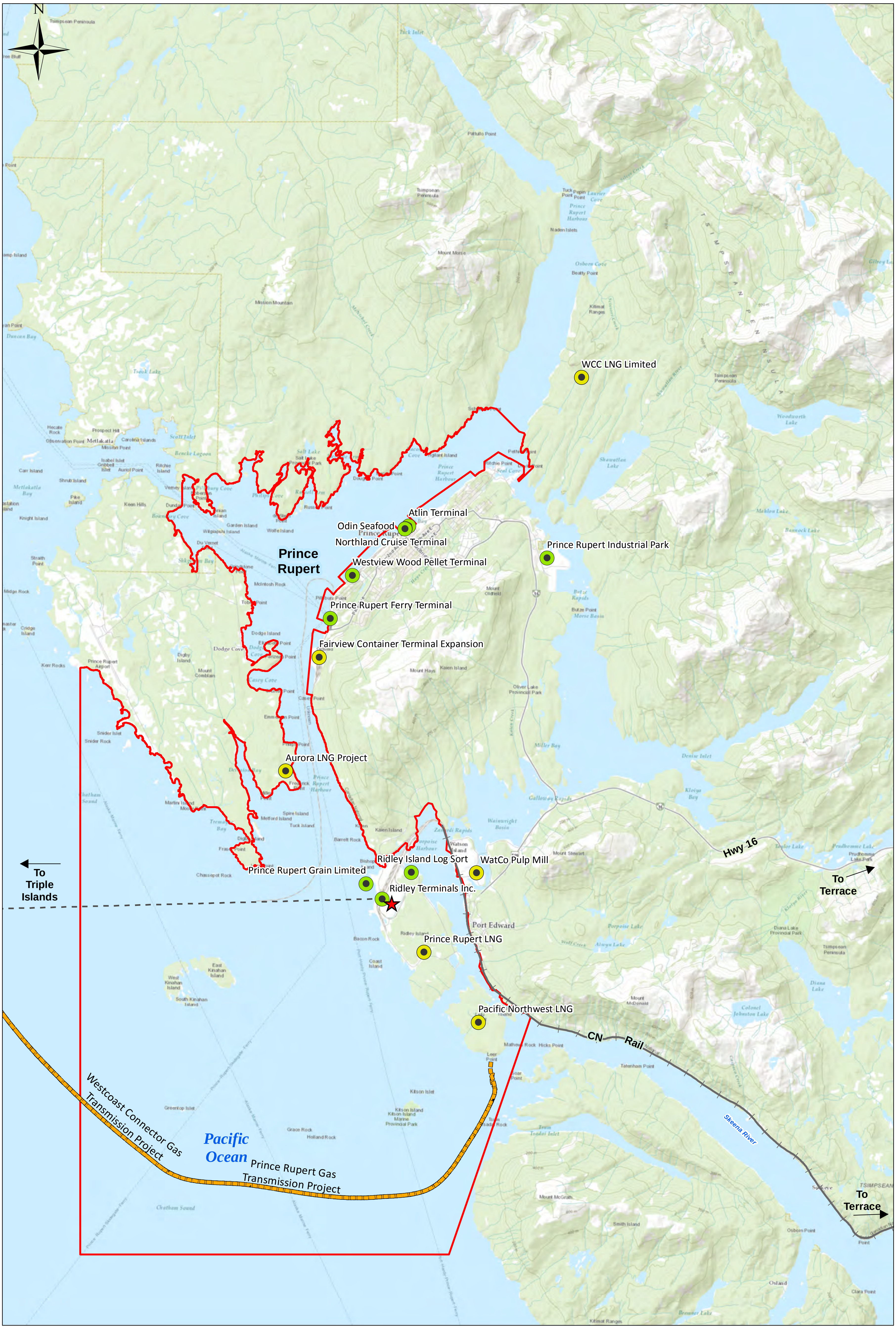
- Atlin Terminal
- Fairview Container Terminal Phase I
- Northland Cruise Terminal
- Odin Seafood
- Prince Rupert Ferry Terminal
- Prince Rupert Grain Limited
- Prince Rupert Industrial Park
- Ridley Island Log Sort
- Ridley Terminals Inc.
- Westview Wood Pellet Terminal

Other certain or reasonably foreseeable projects that were considered in the assessment, including potential cumulative interactions and relevant VCs, are summarized in Table 4-6 and illustrated on Figure 4-1. Other projects that were considered included those located within the PRPA jurisdiction, as well as those located outside the PRPA jurisdiction with associated shipping activities overlapping with the Project's shipping lanes. Additionally, reasonably foreseeable projects, with the potential to act cumulatively with the Project, were also considered.

Table 4-6: Reasonably Foreseeable Projects within PRPA Jurisdiction

Project/Activity	Status	Potential Effects of Project / Activity	VCs Potentially Affected by Cumulative Effects
Reasonably Foreseeable Projects within the PRPA jurisdiction			
Aurora LNG Project	Pre-application	• Emissions from construction and operation of the proposed Aurora LNG Project • Construction and operation of the Aurora marine facility may result in residual effects to fish and fish habitat, marine mammals • Increase in vessel numbers increases the potential for interaction with marine mammals and fish (direct mortalities and acoustic disturbances) • Effects on birds due to noise and light from Aurora LNG and the Project	• Marine resources • Fish • Human Health
Fairview Container Terminal Phase II	Certificate Issued - In the permitting phase	• Emissions from vessel and locomotive traffic • Accidents and Malfunctions	• Human Health
Pacific NorthWest LNG Project	Certificate Issued by the BCEAO CEA Agency Approval	• Emissions from construction and operation • Construction and operation of the Pacific NorthWest LNG marine facility may result in residual effects to fish and fish habitat, marine mammals • Increase in vessel numbers increases the potential for interaction with marine mammals and fish (direct mortalities and acoustic disturbances) • Effects on birds due to noise and light from Pacific Northwest LNG and the Project	• Marine resources • Fish • Human Health
Prince Rupert LNG Project	Pre-application Project appears to be on hold and therefore uncertain or unlikely to proceed in the reasonably near future	• Emissions from construction and operation • Construction and operation of the Prince Rupert LNG marine facility may result in residual effects to fish and fish habitat, marine mammals, and may interact cumulatively with the Project • Dredging and disposal activities may overlap with those of the Project • Acoustic disturbance from pile driving	• Water • Marine resources • Fish • Human Health

Project/Activity	Status	Potential Effects of Project / Activity	VCs Potentially Affected by Cumulative Effects
		• Increase in vessel numbers increases the potential for interaction with marine mammals and fish (direct mortalities and acoustic disturbances) • Effects on birds due to noise and light from Prince Rupert LNG and the Project	
Watson Island Development Corporation Bulk Export Facility	Pre-application Project status unclear	• Vegetation clearing and disturbance associated with this project may act cumulatively with the Project	• Terrestrial resources
WCC LNG Project	Pre-application	• Emissions from construction and operation • Construction and operation of the Pacific WCC LNG marine facility may result in residual effects to fish and fish habitat, marine mammals • Increase in vessel numbers increases the potential for interaction with marine mammals and fish (direct mortalities and acoustic disturbances) • Effects on birds due to noise and light	• Marine resources • Fish
Activities in Area			
Fishing	Ongoing	Considers recreational use of waters in Project vicinity to fish	Fish and Marine Resources
Hunting	Ongoing	Considers recreational use of lands and waters in Project vicinity to hunt and trap	Terrestrial
Recreation /Tourism	Ongoing	Considers recreational activities or sports carried out in the water or lands in Project vicinity	Fish and Marine Resources Terrestrial



LEGEND

Project Location

Other Project Locations

Current

Proposed

Proposed Gas Pipelines

Jurisdiction of Prince Rupert Port Authority

Highway

Marine Shipping Route

Rail

NOTES
1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.

REFERENCES
Bing Maps and MapPoint Web Service Copyright (c) 2010 Microsoft Corporation.
BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB) - data accessed through www.GeoBC.gov.bc.ca

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CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminals Inc., Ridley Island, Prince Rupert, BC

Past, Present and Reasonably Forseeable Projects

BY:	ECH	DATE:	2016/10/12	REF No: 633752-00X	REV: 0
CHK'D:	MB	SCALE:	1:100,000		

0 1.25 2.5 5 7.5 10 Kilometers

MXD Path: P:\LOB\EIAM-BC\GIS_Directory\Projects\AltaGas Ridley Terminal\MXD\633752_00X_Past Present and Reasonably Forseeable Projects.mxd

4.6 Accidents and Malfunctions

Section 15 provides details of the accidents and malfunction scenarios to be assessed, relevant regulatory and procedural plans and procedures in place to mitigate risk of potential accidents, as well presents an assessment of potential effects on Project VCs related to the identified accidents and malfunctions using the same assessment methodology presented within this section.

4.7 Summary of Residual Effects and Mitigation for the Project

The effects of the Project and associated effective and established mitigation measures are summarized in tabular form using Table 4-7.

Table 4-7: Example Table for Summary of Mitigation by Effect and VC

Phase	Summary of Potential Effect	Mitigation Measures	Unique ID Number
Effect or VC (e.g., Terrestrial Resources - Wildlife)			
		•	
		•	
Effect or VC (e.g., Marine Mammals)			
		•	

4.8 Follow-up Strategy

Based on the CEAA 2012 definition of a "follow-up program" as a program for verifying the accuracy of the environmental assessment of a designated project, and determining the effectiveness of any mitigation measures, Table 4-8 is used to summarize the EMPs (and related monitoring where required) by Project phase (e.g., construction, operation and decommissioning).

Table 4-8: Example Table for Summary of all EMPs and Related Proposed Monitoring Programs Associated with your VC

Environmental Management Plan	Monitoring Plan*
Construction Environmental Management Plan (CEMP)	
Operation Environmental Management Plan	
Decommissioning Environmental Management Plans	

*Details of any proposed monitoring programs will be determined in discussion with RTI and PRPA.

5 TERRAIN RESOURCES

This section presents the assessment of the Intermediate Component (IC) Terrain Resources.

5.1 Context and Boundaries

Terrain Resources including surface soil quality, terrain stability, and seabed sediment quality at or near the AltaGas sub-lease site has been identified as an IC because of its role as a potential pathway of effect to VCs (such as terrestrial habitat, human health) identified in the Environmental Effects Determination (EED).

5.1.1 Overview and Regulatory Setting

Soil and seabed sediments are assessed to interpret and understand environmental quality with consideration to human health and environmental protection. The AltaGas sub-lease Site is under federal jurisdiction. Accordingly, the following federal guidelines are applicable to soil present at the AltaGas sub-lease site and sediments present in the RTI water lot:

- *Canadian Environmental Quality Guidelines* (CEQG), Canadian Council of Ministers of the Environment (CCME), Winnipeg Manitoba, including updates to 2015.
  - Interim Sediment Quality Guidelines (ISQGs)
  - Sediment Probable Effects Level (PEL)
  - Canadian Soil Quality Guidelines (CSQGs)
- *Canada Wide Standards for Petroleum Hydrocarbons in Soil*, Canadian Council of Ministers of the Environment (CCME), Winnipeg, Manitoba, January 1, 2008.

The land use at the AltaGas sub-lease Site is designated as 'Industrial' (IL) according to CEQG. The CSQG are guidelines for the protection of environmental and human health. The ISQG and PEL are guidelines for the protection of aquatic life that live in or on aquatic sediments. The ISQG are thresholds below which adverse effects to aquatic life are not expected. The PEL guidelines are thresholds above which adverse effects to aquatic life are expected.

5.1.2 Selection of Intermediate Component

- Terrain Resources were selected as an IC because they are a measurable metric by which we can assess a stressor along a pathway of effect that ultimately could lead to effects of a biophysical VC.

5.1.2.1 Sub Components

Sub-components for the Terrain Resources IC were selected to structure and focus the assessment of effects of the Project based on their relevance to the Project and their representativeness of the features of the natural environment potentially affected by the Project.

The sub-components selected include: soil quality, terrain stability and seabed sediment quality. The rationale for the selection of these sub-is summarized with in Table 5-1.

Table 5-1: Sub-components of the Terrain Resources IC

Sub-component	Rationale for Selection
Surface Soil Quality	Interaction with Project construction activities such as excavations and site preparation and Project operations such as site grading and maintenance.
Terrain Stability	Interaction with Project construction activities such as blasting of bedrock and levelling of development areas.
Seabed Sediment Quality	Interaction with Project activities such as carrier traffic.

5.1.2.2 Indicators

Indicators were selected to measure and evaluate the interaction of the Project with Terrain Resources and its subcomponents, and were chosen to be relevant, practical, measurable, accurate, and predictable. The indicators are summarized in Table 5-2.

Table 5-2: Indicators for Terrain Resources

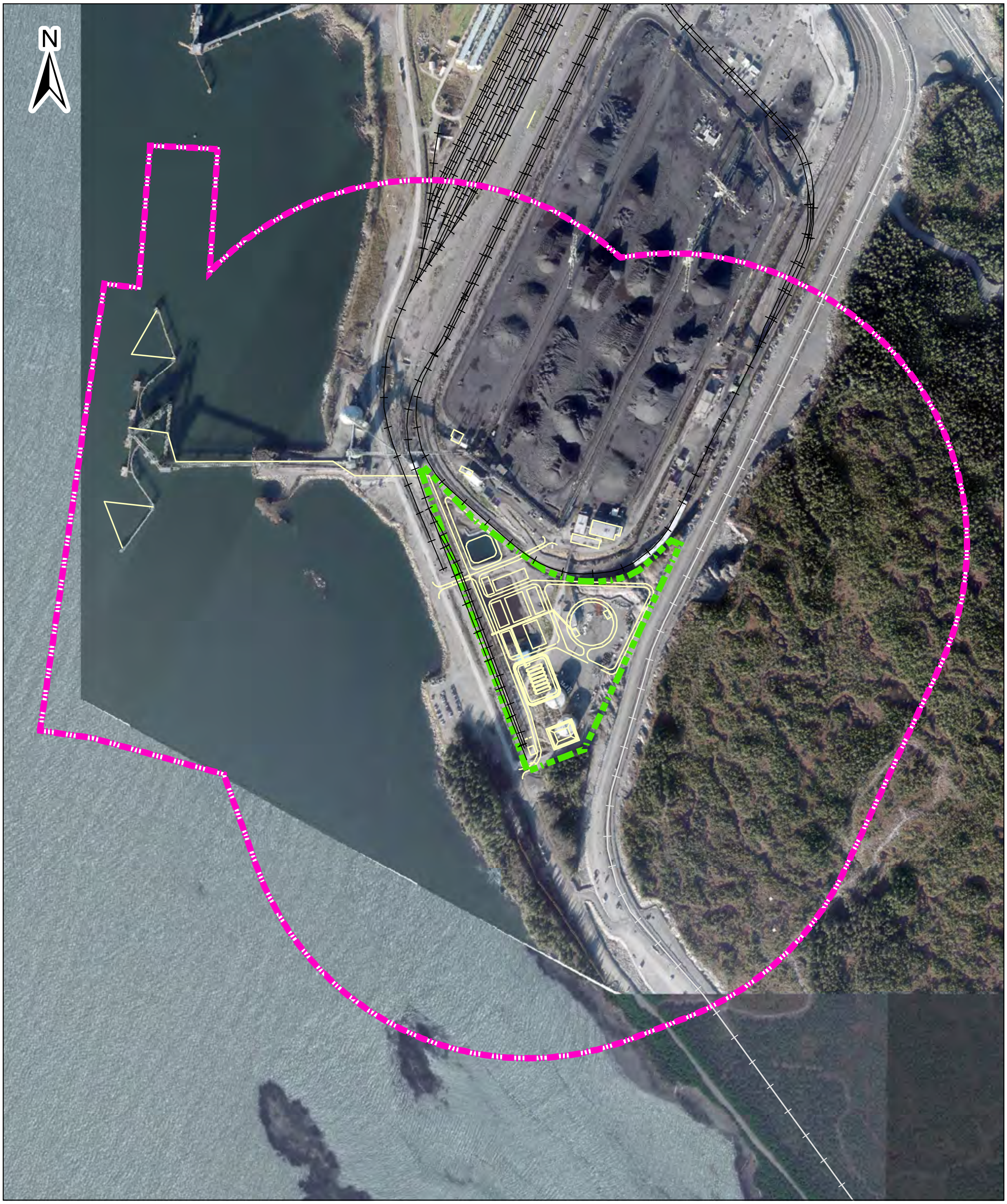
Indicator	Direct or Indirect Linkage	Rationale
Soil Contamination	Direct	The presence of environmental contaminants at concentrations greater than the applicable federal guidelines is a practical, measurable and relevant indicator of effects on soil quality.
Sediment Contamination	Direct	The presence of environmental contaminants at concentrations greater than the applicable federal guidelines is a practical, measurable and relevant indicator of effects on seabed sediment quality.

5.1.3 Assessment Boundaries

5.1.3.1 Spatial

The Local Study Area (LSA) is the AltaGas sub-lease site (9.7 ha) buffered by 500 m and the RTI water lot area (Figure 5-1).

The Regional Study Area (RSA) is defined as Ridley Island and RTI water lots and the surrounding seabed sediments (Figure 5-2). The RSA provides context for potential regional Project effects on terrain resources.



LEGEND

- New Railway
- Railway
- Project Components
- AltaGas Sub-Lease Site
- Terrain Local Study Area

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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CLIENT NAME: AltaGas Ltd.

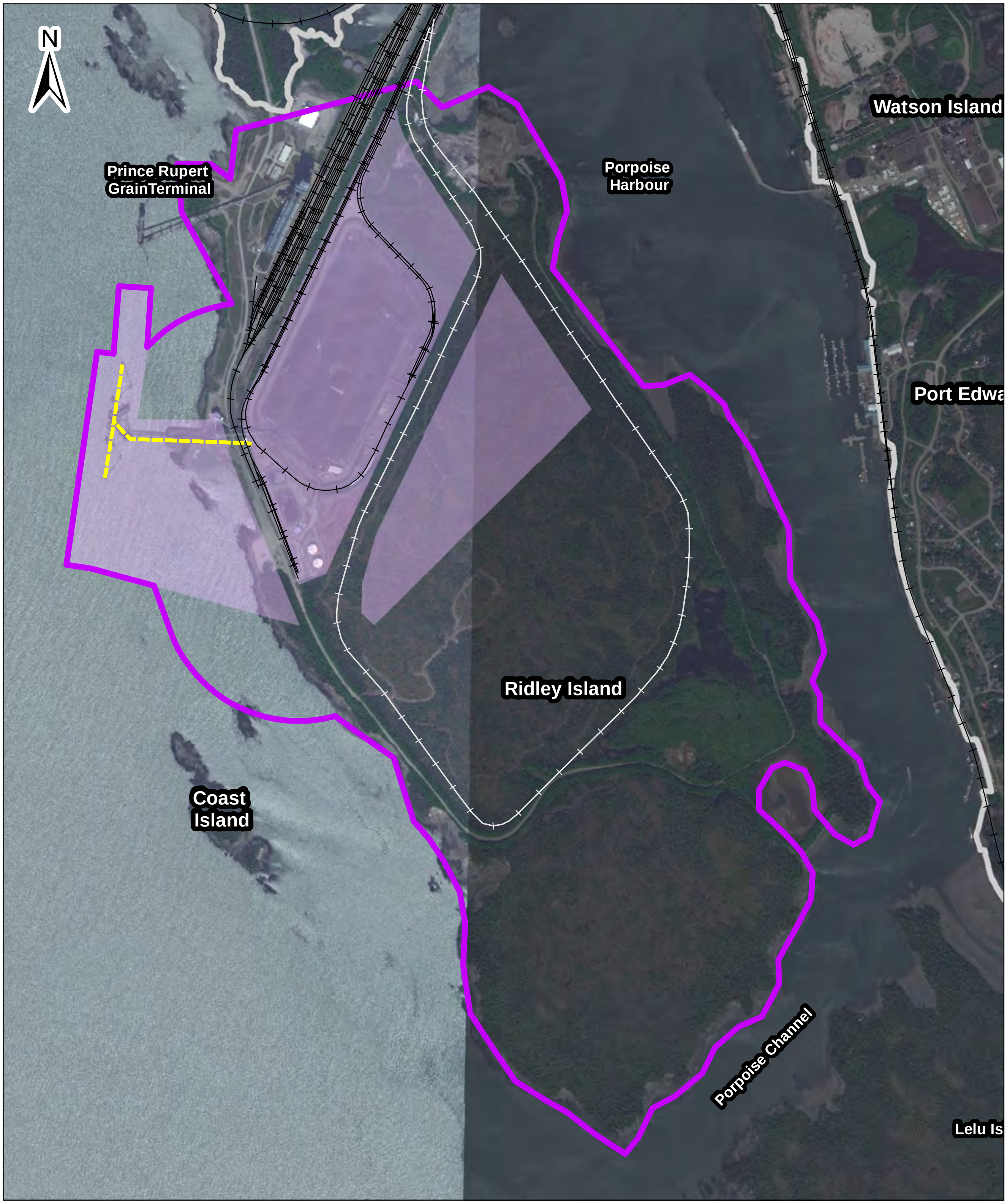
PROJECT LOCATION: Ridley Terminal, Ridely Island, Prince Rupert, BC

Figure 5-1: Terrain Local Study Area

0 100 200 400 600 800 Meters

BY: SS	DATE: 2016/09/22	SCALE: 1:10,000	REF No: 633752-107_001	REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N			

MXD Path: P:\LOB\EIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_107_001_AltaGas_Terrain_LSA.mxd



LEGEND

- New Railway
- Railway
- Jetty
- Terrain Regional Study Area (RSA)
- Prince Rupert Port Authority Jurisdiction
- Ridley Terminals Inc. Lease Lands

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS,

SNC·LAVALIN

CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal Ridely Island, Prince Rupert, BC

Figure 5-2: Terrain Regional Study Area

0 220 440 880 1,320 1,760 Meters

BY: SS	DATE: 2016/10/12	SCALE: 1:21,000	REF No:	REV: 0
CHK'D: CR	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-1087-002	

MXD Path: P:\LOB\EIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_107_002_AltaGas_Terrain_RSA.mxd

Project Path:

5.1.3.2 Temporal

The potential effects specific to the Project are based on the three main phases:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

5.2 Existing Conditions

The following describes the existing conditions of the LSA and RSA. The existing conditions have been adopted as the baseline by which potential Project-related changes to the IC and subcomponents were measured.

5.2.1 Data Sources

Environmental information describing existing terrain resources within the LSA and RSA was summarized from several recent and local environmental assessments and from publicly available government and non-governmental organization databases as listed in Section 5.2.1.1. The site and surrounding area are well understood from previous studies conducted at the Project-site, undertaken in support of current and historic industrial development on Ridley Island. In addition, AltaGas conducted Phase 1 and a Phase 2 Environmental Site Assessments on the Project site in 2015. As a result there is sufficient analytical data pertaining to soil and sediment quality available for the assessment. Relevant findings from available documents were incorporated into this study.

5.2.1.1 Data Sources Used in the Assessment

- Soil and Ocean Sediment Sampling Program at Ridley Terminals Prince Rupert, B.C. 42p. Tera Planning Ltd. (Tera). 1998.
- Phase II Environmental Site Assessment, Ridley Island, Prince Rupert, B.C. 340p. Dillon Consulting Ltd. (Dillon). 2004.
- Environmental Impact Statement, Canpotex Potash Export Terminal and Ridley Island Road, Rail and Utility Corridor, Ridley Island, Prince Rupert, B.C. 555p. Stantec (Stantec). 2011.
- Environmental Impairment Liability Insurance Risk Assessment, Ridley Terminals Inc, Ridley Island, Prince Rupert, B.C. 74p. Premier Environmental Services Inc. (Premier). 2004.
- Assessment of Potential Cross-Contamination of Coal/Petroleum Coke and Sulphur Stockpiles. 14p. Keystone Environmental Ltd. (Keystone). 2007.

- Ridley Terminals Inc. Project Description, Stockpile Expansion Project, 76p. Ridley Terminals Inc. (RTI). 2013.
- Limited Phase II Environmental Site Assessment, Ridley Terminal Inc. Coal and Petroleum Coke Storage/Transfer Facility, Ridley Island, Prince Rupert, BC – DRAFT, SNC-Lavalin Inc. (SNC-Lavalin). 2015.
- Limited Phase I Environmental Site Assessment, Ridley Terminal Inc. Coal and Petroleum Coke Storage / Transfer Facility, Ridley Island, Prince Rupert, BC – DRAFT, SNC-Lavalin Inc. 2016.
- Mapping and Assessing Terrain Stability Guidebook, 2nd Edition, Forest and Range Practices Act, 43 p., Forest and Range Practices Act of British Columbia .2004.

5.2.1.2 *Desktop and or Field Studies Conducted*

The following online databases and resources were reviewed for this assessment:

- iMapBC (DataBC 2016);
- Geological Survey of Canada, GEOSCAN Database, mapsheet 1557a; and
- Geological Survey of Canada, GEOSCAN Database, mapsheet 1472a.

5.2.2 Description of Existing Conditions

5.2.2.1 *Surficial Soil Quality and Terrain Stability*

Pre-development surficial geological conditions at the sub-lease site are described by the Geological Survey of Canada as an organic veneer consisting of peat and muck (humisol) extending from surface to maximum depth of 1.0 m below ground surface taking on the form of underlying surfaces generally with a slope of less than 15 degrees. This surface layer is underlain by a glaciomarine veneer consisting of silt and clay, with localized drop stones, to a maximum thickness of 1.0 m taking on the form of underlying bedrock surfaces generally with a slope of less than 20 degrees. Beneath the organic and glaciomarine veneers lies hummocky rolling bedrock terrain (GEOSCAN 1557a).

The bedrock at the sub-lease site is predominantly comprised of gneiss and schist formations (Tera 1996) and is described by the Geological Survey of Canada as weathered schist with muscovite, biotite, garnet and amphibole (GEOSCAN 1472a). The bedrock is extensively faulted and fractured as a result of the natural geologic activity coupled with localized blasting during construction of the RTI facility (Premier 2004).

Due to disturbances to soil caused during previous phases of development, little to no natural soil cover remains on the sub-lease site. Soil currently present at the AltaGas sub-lease AltaGas sub-lease site consists of imported sand and gravel fill and/or blast rock extending from surface to underlying bedrock with depths ranging from 0.2 m to 7.5 m below ground surface (bgs). The site is generally flat with an average elevation of 18 m above sea level with an estimated one to three degree slope leading to an elevation gain of approximately 5 m in the eastern portion of the property at the location of the existing storage tanks (SNC-Lavalin 2015).

A portion of the AltaGas sub-lease site, adjacent to the RTI marine jetty, is reclaimed shoreline. One borehole advanced as part of SNC-Lavalin's Phase II Environmental Site Assessment (ESA) encountered marine sediments at a depth of approximately 10 m below ground surface in the area of the reclaimed shoreline (SNC-Lavalin 2016). The marine sediments were observed to be overlain by disturbed-fill material (SNC-Lavalin 2016) consisting of large boulders, sand and gravel. The shoreline where the existing RTI marine jetty is located is a steep, rocky intertidal zone composed primarily of bedrock, boulder and cobble (WorleyParsons 2012).

Seismic activity reported along the coast of northwestern BC is a result of movements across several major tectonic boundaries. The area is prone to seismic activity and several earthquakes have been measured and reported in the area with the strongest recorded earthquake on record occurring in October of 2012, off the coast of Haida Gwaii, with a magnitude of 7.7 (NRCAN 2016). Subduction and shield grinding along these plates produce pressure buildup and releases of energy resulting in ongoing earthquakes in the region (RTI 2013).

Fugitive coal dust is mitigated at the RTI stockyard by hydration of stockpiles using a spray tower (Premier 2004). A 2007 study completed by Keystone determined that the sub-lease site has not been significantly impacted by fugitive coal and petroleum coke dust (Keystone 2007).

A desktop terrain stability assessment was conducted in accordance with the Forest and Range Practices Act of British Columbia Act (FLNRO 2004) and with the use of online resources available through DataBC's iMapBC tool supported by surficial and bedrock geology maps made available by the Geological Survey of Canada. The terrain stability of the AltaGas sub-lease site is classified in a range of I to III which is defined as stable with low-risk of stability issues (FLNRO 2004).

5.2.2.2 Seabed Sediment Quality

Marine sediments within the water lot area of the AltaGas sub-lease site and RTI marine berth are described as fine benthic silt with a greyish-brown colour deposited from discharge from the nearby Skeena River (Tera 1996). Also identified in the areas immediately to the east and west of the existing marine berth are sediments described as dark grey to black soft clayey silt with the presence of fine sand and shell fragments (WorleyParsons 2013). Coal fragments were observed in marine seabed sediments in close proximity to the RTI marine berth however benthic invertebrate communities did not appear to be impacted and it was suspected that contaminants associated with the coal particles (particularly PAHs) were not bioavailable (Dillon 2004).

Seabed sediment quality in the area of the RTI marine berth has been assessed by three different programs:

A limited seabed sediment sampling program was conducted by Tera in 1998 and nine seabed sediment samples were collected and were subsequently analyzed by ASL Analytical Service Laboratories Ltd. for concentrations of regulated metals and light and heavy extractable hydrocarbons (LEPH and HEPH). All sample results were compared to applicable provincial standards and federal guidelines in current use at the time and no exceedances were reported (Tera 1998).

A 2004 seabed sediment sampling program conducted by Dillon included the collection of 19 sediment samples from the RTI marine berth area and the area beneath the outfall of Settlement Pond #1. Laboratory results were compared to federal guidelines and several samples were reported as having concentrations of metals, including copper, zinc and lead, in exceedance of applicable guidelines. Several samples were also reported as having concentrations of PAH constituents in excess of applicable federal guidelines (Dillon 2004).

A comprehensive seabed sediment sampling program was conducted by WorleyParsons in 2013 and 85 seabed sediment samples were collected and subsequently analyzed by Maxxam Analytics Inc. for concentrations of PAHs, regulated metals, and Polychlorinated Biphenyl's (PCBs) and by AGAT Laboratories for concentrations of dioxins and furans. Laboratory sample results were compared to applicable provincial standards and federal guidelines. Dioxins and furans were detected in seabed sediments; however, all reported concentrations were less than the standards and guidelines in use for the protection of marine life. Concentrations of arsenic and copper were reported in excess of the federal guidelines but less than the provincial standards in all 85 samples. Concentrations of zinc were reported above the federal guidelines but less than the provincial standards in 16 of the 85 samples. Additionally, the BC *Contaminated Sites Regulation* (CSR) identifies elevated concentrations of arsenic, copper and zinc as background conditions within Region 6 (Skeena) and therefore the metals results reported for the seabed sediment samples are considered to be indicative of regional background sediment quality. Concentrations of several PAH constituents were reported above the provincial standards and federal guidelines in 40 of the 85 marine seabed sediment samples analyzed (WorleyParsons 2013).

5.3 Assessment of Potential Adverse Environmental Effects

This section identifies potential interactions between terrain resources and Project components or activities and the potential for adverse environmental effects for which a reasonably direct causal link can be demonstrated.

5.3.1 Potential Interactions of the Project

As described in Section 4, Potential interactions between Project activities occurring in the LSA and RSA and the three sub-components of the Terrain Resources VC are described in Table 5-3. Interactions were described as follows:

- N = no interaction
- M = minor interaction
- CF = interaction to be considered further in the environmental evaluation

Minor interactions and their associated well-known mitigations are described below in Section 5.3.2, however, are not considered further in the characterization of residual effects. Any interactions designated as CF are assessed in more detail in Section 5.3.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Table 5-3: Project Interaction Table

Project Activities and Physical Works		Subcomponents Potentially Affected		
		Surface Soil Quality	Terrain Stability	Seabed Sediment Quality
Construction Activity				
C-1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	M	N	N
C-2	Site blasting which may involve explosives manufactured off site.	M	M	N
C-3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered because the sulphur storage facilities were never used).	N	N	N
C-4	Relocation and reconstruction of existing settling ponds, involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sub-lease Site.	M	M	N
C-5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	M	M	N
C-6	Construction of rail tracks.	M	M	N
C-7	Re-grading of existing sidings on RTI lease land.	M	M	N
C-8	Connection to BC Hydro grid on PRPA lands.	M	N	N
C-9	Upgrade to Existing Jetty: Installation of piping and loading arms.	N	N	N
C-10	Installation and hydrotesting of refrigerated storage tanks and equipment.	N	N	N
C-11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	M	M	N
C-12	Installation of a new vehicle At-Grade road crossing to RTI coal stockyard area.	M	M	N
C-13	Local transport of material and personnel to and from the site and PRPA lands.	N	N	N

Project Activities and Physical Works		Subcomponents Potentially Affected		
		Surface Soil Quality	Terrain Stability	Seabed Sediment Quality
Operation and Maintenance				
O-1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	M	N	N
O-2	Gas powered compression, supplemented with BC Hydro power to provide approximately 15 MW.	N	N	N
O-3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring several times a year and otherwise only in the case of emergencies.	M	N	N
O-4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	N	N	N
O-5	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	N	N	N
O-6	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12-18 months.	N	N	N
O-7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	N	N	N
O-8	Refrigerating and storing propane; propane is passed through a heat exchanger where it is chilled to approximately -42˚C and transferred to a refrigerated storage tank.	N	N	N
O-9	Propane delivery to the carrier via new piping driven by electric pumps. Loading will occur once every 15 to 20 days and take approximately 40 hours. (i.e., 20-30 carriers per year).	N	N	N
O-10	Berthing of liquefied gas carriers at the RTI berth facility. Carriers will be met by tug escorts upon approach to the berth and will utilize a docking aid system.	N	N	M
O-11	LPG carrier movements in PRPA navigational jurisdiction.	N	N	M
Decommissioning				
D-1	Removal of land-based above-ground infrastructure on sub-lease Site.	M	N	N
Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor interaction with well-known mitigation measures enacted and are not considered further in the environmental evaluation; and CF = interaction to be considered further in the environmental evaluation.				

5.3.2 Assessment of Potential Effects

Potential adverse environmental effects associated with each interaction identified as minor or carry forward in Table 5-4 are described in detail below. Minor adverse environmental effects can be mitigated with routine measures including careful planning, design and use of management practices applied during all Project phases; these measures are discussed in Section 5.3.3.

5.3.2.1 Assessment of Minor Interactions

The assessment of minor interactions or groups of interactions, relating to each phase of development and the potential adverse environmental effects and associated mitigation measures are described in detail below.

5.3.2.1.1 Construction Phase

The primary concerns for potential adverse environmental effects caused during the construction phase are:

a) The potential to disturb existing soil containing concentrations of environmental contaminants greater than the applicable federal guidelines during excavation work required for completion of the construction phase; and

b) The potential to introduce contaminants to soil through construction activities such as routine use, fuelling and maintenance of vehicles and equipment.

These adverse effects can be largely avoided by use of effective and established mitigation measures management practices presented in Section 5.3.3.

The principle adverse effects described above are expanded in greater detail below as they relate to specific interactions expected to occur during the construction phase:

C-1 Site grading with the use of heavy machinery and the application of gravel has the potential to adversely affect surface soil quality at the AltaGas sub-lease site. Existing soil quality data shows that environmental contaminants exist in surficial soils and contaminants could be spread and mobilized during grading activities thereby causing cross-contamination. Additionally, imported fill material could inadvertently introduce new contaminants to the Project site if not obtained from a source of known quality.

C-2 Blasting activities have the potential to adversely affect surface soil quality at the AltaGas sub-lease site. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and preparations for blasting and blasting activities themselves could cause contaminants to be mobilized.

C-4 Relocation of existing settling ponds will require mechanical excavation and handling of soil. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during relocation activities. Due to the presence of shallow bedrock across the sub-lease site it is expected that blasting would be required to relocate settling ponds. Additionally, imported fill material could inadvertently introduce new contaminants to the Project site if not obtained from a source of known quality.

C-5 Installation of utilities such as electrical, natural gas, sewer, fire protection and storm water management systems will require mechanical excavation and handling of soil. Existing soil quality data shows that contaminants in applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during relocation activities. Due to the presence of shallow bedrock across the sub-lease site blasting will be required to complete the installation of new utilities (refer to C-2 above).

C-6 and C-7 Construction of new rail tracks and re-grading and upgrades to existing rail tracks will require mechanical excavation and handling of soil. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during construction activities. Due to the presence of shallow bedrock across the sub-lease site blasting will be required to complete the installation of new tracks.

C-8 Construction activities required to connect the sub-lease site to the existing BC Hydro electrical grid on PRPA lands will require mechanical soil handling. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during construction activities.

C-11 and C-12 Removal of the existing overhead rail crossing and replacement with level-ground rail crossing on RTI leased lands will require mechanical excavation and handling of soil. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during relocation activities. Due to the presence of shallow bedrock across the sub-lease site blasting will be required to reach the desired grade specifications identified in the AltaGas design.

5.3.2.2 Operations Phase

Primary concerns that may have minor effects on the Terrain Resources IC include spills of hazardous materials, fueling and maintenance of vehicles and equipment on site, erosion caused by rain and surface water drainage, flaring of ethane and methane, and suspension of seabed sediments by tugs and carriers during the berthing operations.

These adverse effects can be largely avoided by use of effective and established mitigation and BMPs.

The principle adverse effects described above are expanded in greater detail below as they relate to specific interactions expected to occur during the operations phase:

O-1 The use, fuelling and maintenance of vehicles and equipment during Project operation has the potential to cause minor adverse effects to surface soil quality and seabed sediment quality through introduction of contaminants.

O-3 Flaring of ethane and methane by-products could introduce combustion related contaminants, such as PAHs, to a localized area around the flare and thereby have the potential to cause adverse effects to soil quality.

O-10 and O-11 Carrier vessels and associated tugs manoeuvring to and from the RTI jetty could cause suspension of seabed sediments leading to increased turbidity and mobilization of any contaminants contained within sediments.

5.3.2.3 *Decommissioning*

Primary concerns that may have minor effects on the terrain resources include spills of hazardous materials, fueling and maintenance of vehicles and equipment on site, erosion caused by rain and surface water drainage, during the decommissioning phase.

These adverse effects can be largely avoided by use of effective and established mitigation and BMPs.

The principle adverse effects described above are expanded in greater detail below as they relate to specific interactions expected to occur during the decommissioning phase:

D-1 The removal of land-based above-ground infrastructure on the sub-lease site will require the use of vehicles and equipment. Erosion of soil and subsequent sediment control issues may also occur during this phase as soil disturbances are likely to occur.

5.3.3 Mitigation Measures

Mitigation measures for the potential adverse environmental effects of the Project on the Terrain Resources IC are outlined below for construction, operation and decommissioning phases. As mitigation measures often overlap for multiple Project activities and can be specific to individual sub-components, mitigation measures have been provided by Project phase to reduce repetition. A summary of potential adverse environmental effects and mitigation measures for the Terrain Resources (by Project phase) is provided in Table 5-4.

5.3.3.1 Construction Phase

Mitigation measures proposed for the construction phase to minimize and reduce adverse effects to soil quality, terrain stability and seabed sediment quality include:

- M1 - Use of qualified Environmental Monitor(s) during the construction phase.
- M2 - Confirmation of the environmental quality of existing soil in areas where Project construction requirements could disturb soil. Collection of representative soil samples in areas where soil characterization has not yet been completed. Any soil to be disposed of off-site will require sampling for landfill acceptance.
- M3 - Management and handling of all excavated soil in accordance with federal regulations to prevent migration of contaminants.
- M4 - Selection of a suitable disposal facility for off-site disposal of any contaminated soil generated during excavation work in the construction phase of the Project.
- M5 - Confirmation of the environmental quality of any imported soil required for leveling and grading work at the Project Site to prevent inadvertent introduction of contaminants to the Site.
- M6 - Development and implementation of a Construction Environmental Management Plan (CEMP) suitable for use during the construction phase.
- M7 - Development and implementation of Spill Prevention and Emergency Response Plan (SPERP) to address handling of hazardous materials including fuel and lubricants used during the construction phase to protect soil quality and seabed sediment quality.
- M8 - Development and implementation of an Erosion and Sediment Control Plan (ESCP).

5.3.3.2 Operations Phase

Mitigation measures that are recommended for use during routine operation and maintenance of the facility and associated infrastructure to minimize and reduce adverse effects to surface soil quality, terrain stability and seabed sediment quality include:

- M9 - Inclusion of best management practices in an EMP to address soil and erosion control, hazardous material handling, fuelling and maintenance of vehicles and equipment and waste handling to protect soil quality and seabed sediment quality.
- M10 - Development and implementation of a SPERP to protect soil quality and seabed sediment quality during the operations phase.

- M11 - Development and implementation of berthing procedures to minimize suspension and mobilization of seabed sediments, including:
  - i.e., Carrier berthing – Harbour tugs will be required to meet the carrier at the direction of the Pilot and Master to assist the carrier in safely berthing and mooring at the RTI jetty.
  - Docking – A docking aid system will be installed at the existing jetty to assist the pilots and terminal operators in carrier berthing. The system will monitor and display the carrier's approach speed, distance and angle with respect to the berthing dolphins. The system improves the safety of the berthing operation and reduces the risk of abnormal berthing events by allowing the Pilot to manage the carrier's speed and approach vector in order to verify that the approach procedure is within the specified terminal limits.
  - Ballast – Inbound carriers arriving in a ballasted condition will normally berth with their port sides to the loading platform allowing for the bow of the carrier to be head on into the prevailing current and wind direction.
  - Carrier mooring – The existing mooring points are expected to be sufficient for safe mooring of the carriers calling at facility for the Project. Mooring lines will be secured to quick release hooks. The number and placement of the mooring lines will be determined for each size of carrier during the detailed engineering phase of the Project.
  - Limiting environmental operating conditions – Operational safety limits will be established to cover visibility, wind and sea conditions. The preliminary limiting environmental operating criteria are as follows:
    - Berthing maximum wind speed: 20 m/s (40 knots)
    - Loading/unloading shutdown maximum wind speed: 25 m/s (50 knots)
    - Loading/unloading arm disconnect maximum wind speed: 30 m/s (60 knots)
    - Carrier to vacate berth: 32.4 m/s (63 knots)
    - Maximum current: 2.5 knots
    - Minimum visibility: 1.0 km

5.3.3.3 *Decommissioning*

Decommissioning work will include many of the same activities as construction and operation and maintenance. As such, it is anticipated that similar mitigation measures should be applied. Mitigation measures anticipated for use during decommissioning work are listed below, subject to finalizing decommissioning plans:

- M12 - Use of qualified Environmental Monitors during the decommissioning phase.
- M13 - Development and Implementation of a CEMP suitable for use during the decommissioning phase.
- M14 - Development and implementation of a SPERP suitable for the decommissioning phase.
- M15 - Development and implementation of an ESCP suitable for use during the decommissioning phase.

5.3.3.4 *Summary of Potential Adverse Effects and Mitigation*

A summary of potential adverse effects and recommended mitigation measures is provided in Table 5-4.

Table 5-4: Summary of Potential Adverse Environmental Effects and Mitigation

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
Construction (all)	Adverse effects to soil quality and seabed sediment quality caused during construction phase	Use of Environmental Monitor to ensure adherence to mitigation measures outlined in CEMP, SPERP and ESCP	T1-M1	N
Construction (C-1, C-4, C-5, C-6, C-7, C-8, C-11, C-12)	Adverse effects to soil quality from disturbance of existing contaminants and introduction of contaminants from imported fill or routine use of vehicles and equipment	Disturbances to surficial soils should follow established procedures for identifying existing contamination, removal and disposal of any contaminated soil and procedures to prevent contamination from migrating to unaffected areas	T1-M2 T1-M3 T1-M4 T1-M5	N
		CEMP to include specifications for fuel handling and vehicle and equipment maintenance	T1-M6	
		SPERP to provide specifications to reduce potential for adverse effects to soil quality and seabed sediments	T1-M7 T3-M7	
Construction (C-2, C-4, C-5, C-6, C-7, C-11, C-12)	Adverse effects to soil quality and terrain stability resulting from erosion occurring during construction activities	ESCP to provide mitigation measures to reduce sedimentation and erosion caused during construction activities	T1-M8 T2-M8	N
Operation (O-1)	Adverse effects to surface soil quality and seabed sediment quality from use of vehicles and equipment at the work site	Use of CEMP and SPERP during fuelling and maintenance of vehicles and equipment to prevent adverse effects to soil quality and seabed sediment quality	T1-M9 T3-M9 T1-M10 T3-M10	N
Operation (O-3)	Adverse effects to surface soil quality from use of flare	Routine monitoring of performance and operation of flare to reduce potential for accumulation of contaminants that may cause adverse effects to soil quality	T1-M10	N
Operation (O-10, O-11)	Adverse effects to seabed sediment quality through suspension of seabed sediments caused by carrier vessels and tug traffic	Use of berthing procedures and established navigation routes to minimize potential for suspension and mobilization of seabed sediments	T3-M11	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
Decommission (all)	Adverse effects to soil quality, terrain stability and seabed sediment quality	Use of Environmental Monitor to ensure adherence to mitigation measures outlined in CEMP, SPERP and ESCP	T1-M12 T2-M12 T3-M12	N
Decommissioning (D-1)	Adverse effects to surface soil quality and seabed sediment quality from use of vehicles and mobile equipment and adverse effects to soil quality and terrain stability caused by	Use of CEMP and SPERP during decommissioning activities to prevent adverse effects to soil quality and seabed sediment quality during fuelling and maintenance of vehicles and equipment	T1-M12 T3-M12 T1-M13 T3-M13	N
	erosion occurring during construction activities	ESCP to provide mitigation measures to reduce sedimentation and erosion caused during decommissioning phase	T1-M15 T2-M15	

5.3.4 Residual Effects

Based on the assessment presented in the above sections, it is concluded that the Project will result in no residual effects. With the implementation of effective and established mitigation measures and best management practices, as described in the above sections, residual effects from the Project on the Terrain Resources IC are expected to be avoided or negligible as a result of regular construction, operations and decommissioning activities.

5.3.5 Cumulative Effects

As there are no residual effects on Terrain resources there is no potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents.

6 WATER QUALITY

This section presents the assessment of the Intermediate Component (IC) Water Quality.

6.1 Context and Boundaries

Water Quality including surface water quality, groundwater quality and marine water quality, at the sub-lease site and RTI marine berth area has been identified as an IC because environmental effects caused by the Project to water quality could have the potential to adversely affect other VCs (e.g., marine habitat) have been identified.

6.1.1 Overview and Regulatory Setting

Freshwater and marine water quality on federal land are assessed and managed through federal regulations that outline specific standards and guidelines used to interpret and understand environmental quality with consideration to human health and environmental protection. The Altagas sub-lease Site is situated on federal port lands. The following federal guidelines and are considered applicable at the AltaGas sub-lease Site:

- *Canadian Environmental Quality Guidelines (CEQG), Canadian Council of Ministers of the Environment (CCME), Winnipeg Manitoba,* including updates to February 2014 – which include:
  - *Canadian Water Quality Guidelines (CWQG)*
  - *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites* (FGQG). Environment Canada, 2015, Version 3, November 2015; and
  - *Canadian Drinking Water Quality Guidelines* (CDWQG). Health Canada, 2014, October 2014.

The CWQG provide criteria for the protection of freshwater and marine life from anthropogenic activities that have the potential to introduce contaminants to the natural environment through chemical inputs and changes to physical conditions. Based on definitions contained in the CEQG, the land use at the AltaGas sub-lease site is defined as “Industrial” (IL) and as such CWQG is applicable. When assessing surface water in federal marine and freshwater environments, the generic numerical CWQG are used to determine thresholds for acceptable levels of contamination at a site for comparison to laboratory analytical data. The CEQG does not provide guidelines for the assessment of potable groundwater. Drinking water and potential drinking water sources are assessed using the Health Canada Guidelines for Canadian Drinking Water.

The interim FGQG were developed to assist federal custodians in assessing, remediating/risk managing federal contaminated sites funded under the Federal Contaminated Sites Action Plan (FCSAP). The FGQG are intended to be used as interim guidance until Canadian Council of Ministers of the Environment (CCME) groundwater guidelines are adopted. A draft protocol for the derivation of guidelines was issued by CCME for public comment in 2010, and was reissued in 2015.

Provision 36 of the *Fisheries Act*, as administered by the Environment and Climate Change Canada, identifies regulations for the purpose of controlling the input of deleterious substances to a water body which could thereby result in destruction of habitat. In addition to the input of deleterious substances described in the *Fisheries Act*, Fisheries and Oceans Canada, under Section 35, also prohibits any work or undertaking that would cause serious harm to fish and fish habitat.

6.1.2 Selection of Intermediate Component

The Water Quality IC was selected to describe changes in water quality related to the Project that have the potential to affect other VCs.

Potential effects on Water Quality associated with the Project were assessed in order to determine if changes related to the Project would result in adverse effects on other VCs.

6.1.2.1 Sub Components

Sub-components were selected to structure and focus the assessment and have been chosen based on their relevance to the Project and their representativeness of the features of the natural environment that are likely to be affected by the Project. Together they enable a comprehensive understanding of the important potential environmental effects of the Project on Water Quality.

The sub-components selected for assessment as part of the Water Quality are groundwater quality, surface water quality and marine water quality. The sub-components are summarized with respective rationale for selection in Table 6-1.

Table 6-1: Sub-components of Water Quality

Sub-component	Rationale for Selection
Groundwater Quality	Interaction with Project construction activities such as excavations and site preparation. Disturbances to existing groundwater monitoring wells or introduction of contaminants to groundwater through existing groundwater monitoring wells.
Surface Water Quality	Interaction with Project construction activities such as relocation of existing settlement ponds, drainage ditches and stormwater management systems.
Marine Water Quality	Interaction with Project activities such as movement of vessels at the RTI marine jetty and discharge of stormwater and surface water runoff from the AltaGas sub-lease Site.

6.1.2.2 Indicators

Indicators were selected to measure and evaluate the interaction of the Project with the Water Quality and its subcomponents, and were chosen to be relevant, practical, measurable, responsive, accurate, and predictable. The indicators are summarized in Table 6-2.

Table 6-2: Indicators for Water Quality

Indicator	Direct or Indirect Linkage	Rationale
Groundwater Contamination	Direct	The presence of environmental contaminants at concentrations greater than the applicable federal guidelines is a practical, measurable and relevant indicator of effects on groundwater quality.
Surface Water Contamination	Direct	The presence of environmental contaminants at concentrations greater than the applicable federal guidelines is a practical, measurable and relevant indicator of effects on surface water quality.
Marine Water Quality	Direct	The presence of environmental contaminants at concentrations greater than the applicable federal guidelines is a practical, measurable and relevant indicator of effects on marine water quality.

6.1.3 Assessment Boundaries

6.1.3.1 Spatial

The spatial boundaries for the Water Quality assessment are summarized in Table 6-3. The Local Study Area (LSA) is defined as the AltaGas sub-lease Site (measuring approximately 9.7 hectares [ha]) and a perimeter buffer of 500 m and the LSA also includes the RTI water lot area (Figure 6-1).

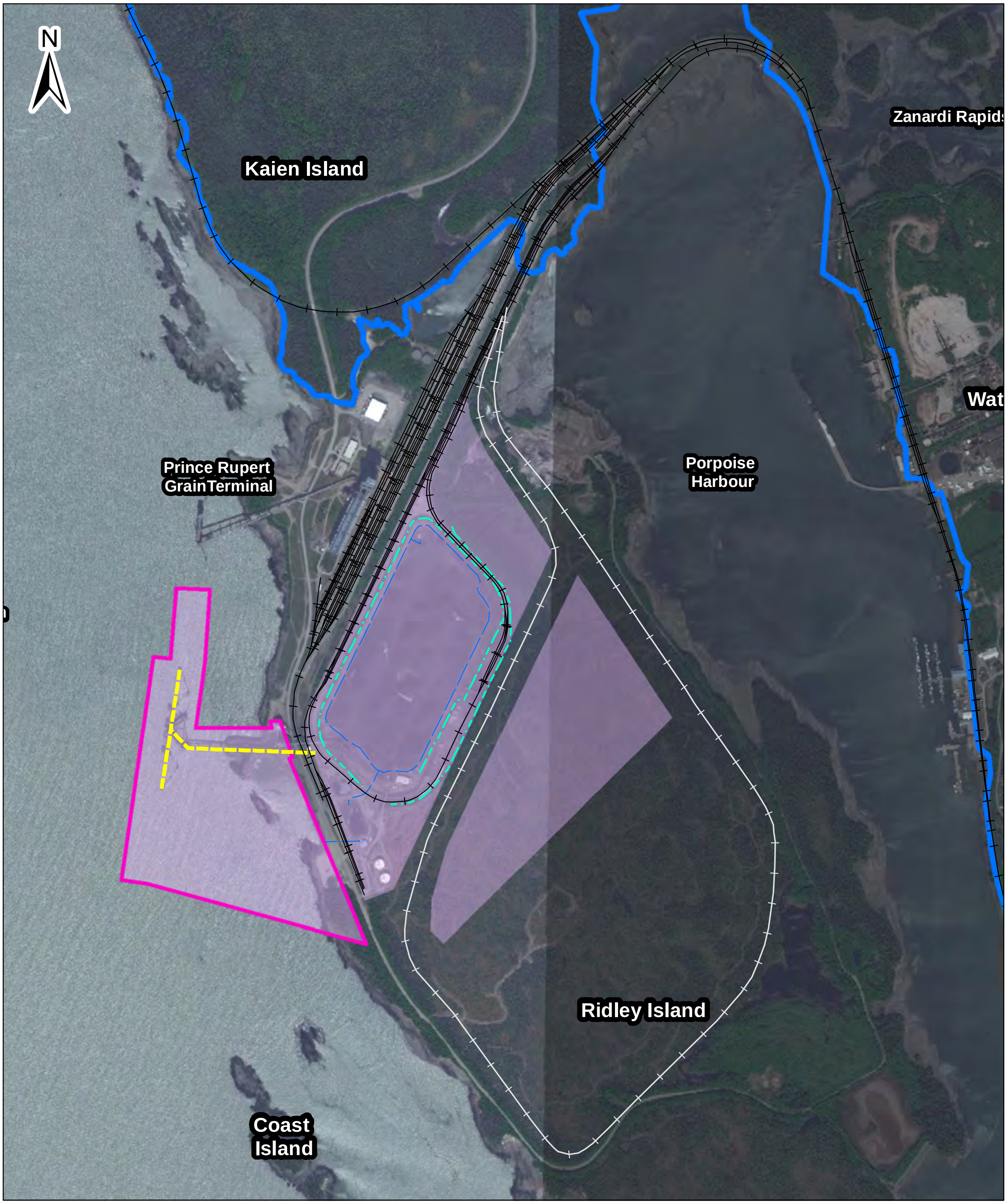
The Regional Study Area (RSA) is defined as Ridley Island and the PRPA marine navigational jurisdiction (Figure 6-2). The RSA is approximately 15,880 ha in area and includes:

- The rail transportation corridor within PRPA/RTI jurisdiction from the AltaGas sub-lease site.
- The area within PRPA marine jurisdiction beyond the LSA related to berthing and seaward from the RTI wharf/berth.

Although much of Ridley Island is currently undeveloped, future land use on the island is planned through major port-oriented industrial operations, based on the PRPA's Land Use Management Plan (AECOM 2010).

Table 6-3: Spatial Boundaries for Water Quality

Spatial Extent	Description
Local Study Area (LSA)	AltaGas sub-lease Site buffered by 500 m
Regional Study Area (RSA)	Ridley Island and PRPA marine jurisdiction



LEGEND

- New Railway Track
- Railway Tracks
- Jetty
- Drainage Ditch
- Perimeter Drainage
- Water Local Study Area (LSA)
- Water Regional Study Area (RSA)
- Ridley Terminals Inc. Lease Lands

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS,

SNC · LAVALIN

CLIENT NAME:
AltaGas Ltd.

PROJECT LOCATION:
Ridley Terminal
Ridely Island, Prince Rupert, BC

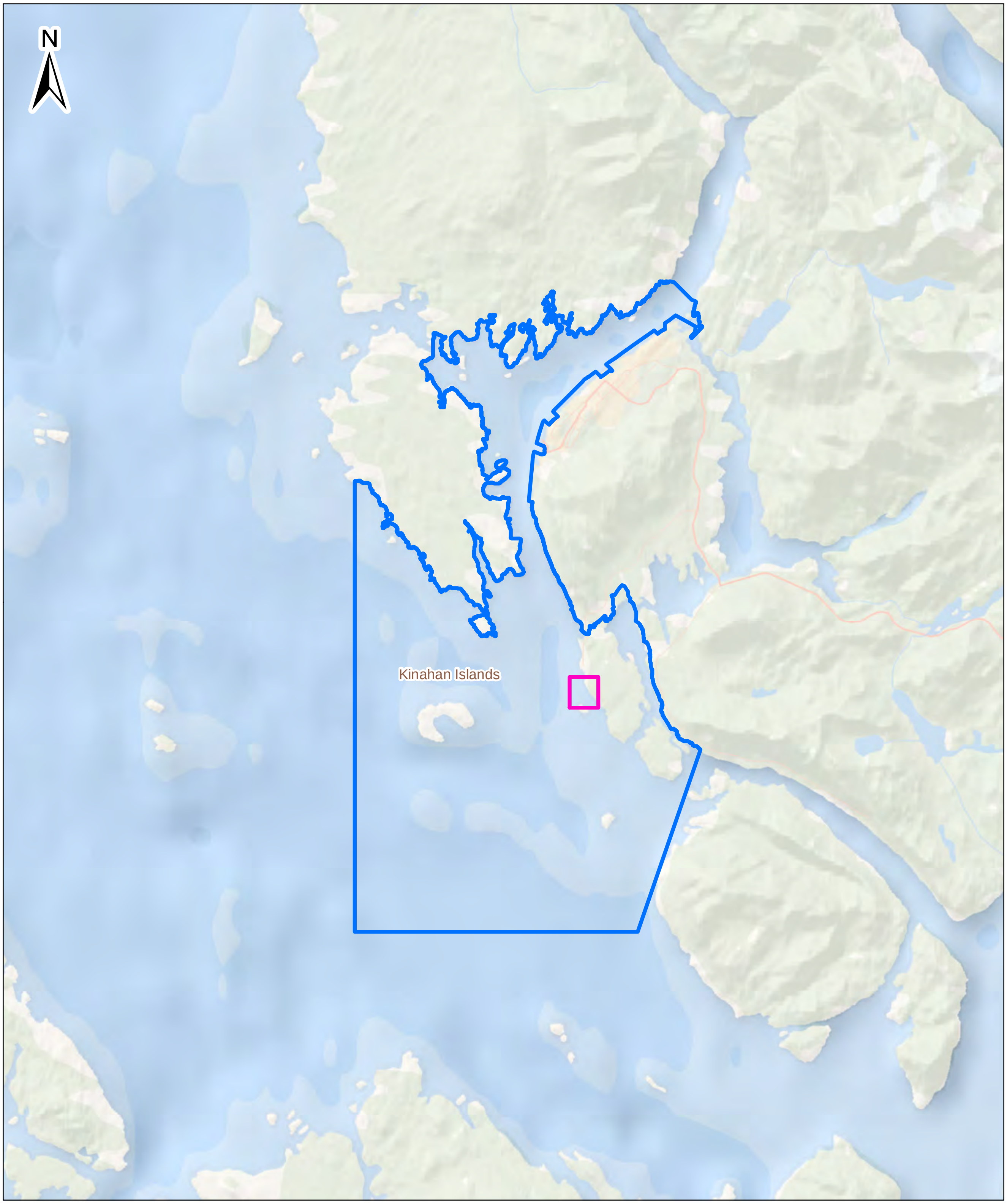
Figure 6-1: Water Local Study Area

0 205 410 820 1,230 1,640
Meters

BY: SS	DATE: 2016/06/28	SCALE: 1:20,000	REF No: REV: 0
CHK'D: CR	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-108-001

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_108_001_AltaGas_Water_LSA.mxd

Project Path:



LEGEND

Water Local Study Area
Water Regional Study Area

0 2,050 4,100 8,200 12,300 16,400 Meters

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

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CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 6-2: Water Regional Study Area

BY: SS	DATE: 2016/06/28	SCALE: 1:200,000	REF No: 633752-108-002 REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N		

MXD Path: P:\LOB\EIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_108_002_AltaGas_Water_RSA.mxd

Project Path: \\Sli2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\

6.1.3.2 Temporal

The potential effects specific to the Project are based on the three main phases:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

6.2 Existing Conditions

This section describes the existing conditions of the LSA and RSA as it relates to the IC and the sub components. The existing conditions form the baseline by which potential Project-related changes to the IC and subcomponents can be measured.

6.2.1 Data Sources

Available environmental information describing existing water quality within the LSA and RSA was summarized from several recent and local environmental assessments and from publicly available government organization databases. As the Project is occurring on existing industrial land and uses an existing active marine jetty, and no construction is planned below the high water mark (HWM), there is very low potential for Project activities to interact with water resources; therefore, no new field studies were determined to be required and none were undertaken to gather additional water quality data for this assessment. Several environmental assessments with a focus on groundwater, surface water and marine water quality have been completed on the sub-lease site and adjacent RTI leased lands and PRPA lands through the various phases of historic industrial development. Relevant findings from available documents were incorporated into this study. The information sources are detailed in the next section.

6.2.1.1 Data Sources Used in the Assessment

- Phase II Environmental Site Assessment, Ridley Island, Prince Rupert, B.C. 340p. Dillon Consulting Ltd. (Dillon). 2004.
- Discharge Cove – Historical Effluent Outfall. 6p. Prince Rupert Port Authority (PRPA). 2011.
- Environmental Impact Statement, Canpotex Potash Export Terminal and Ridley Island Road, Rail and Utility Corridor, Ridley Island, Prince Rupert, B.C. 555p. Stantec (Stantec). 2011.

- Environmental Impairment Liability Insurance Risk Assessment, Ridley Terminals Inc, Ridley Island, Prince Rupert, B.C. 74p. Premier Environmental Services Inc. (Premier). 2004.
- Ridley Terminals Inc. Project Description, Stockpile Expansion Project, 76p. Ridley Terminals Inc. (RTI). 2013.
- Ridley Terminals Inc. Environmental Assessment Decision Summary, 60p. Ridley Terminals Inc. (RTI). 2011.
- Ridley Terminals Inc. Project Description, 107p. Worley Parsons Canada (WorleyParsons). 2013.
- Baseline Marine Environmental Water Quality Sampling Program 2013 Annual Report. 67p. SNC-Lavalin Inc. 2014.
- Limited Phase I Environmental Site Assessment, Ridley Terminal Inc. Coal and Petroleum Coke Storage / Transfer Facility, Ridley Island, Prince Rupert, BC – DRAFT, SNC-Lavalin Inc. 2016.
- Limited Phase II Environmental Site Assessment, Ridley Terminal Inc. Coal and Petroleum Coke Storage/Transfer Facility, Ridley Island, Prince Rupert, BC – DRAFT, SNC-Lavalin Inc. 2015.

6.2.1.2 *Desktop and or Field Studies Conducted*

The following online databases and resources were reviewed in the desktop study:

- iMapBC (DataBC 2016); and
- BC Water Resource Atlas (DataBC 2016).

6.2.2 Description of Existing Conditions

All new construction will take place on the previously cleared industrial site and will utilize existing RTI marine infrastructure. No new construction will occur below the natural HWM in the marine water lot lease area. The RTI jetty has a berth-side depth of 22 m (low tide) and is capable of handling vessels of 250,000 DWT; gas carriers are about 65,000 DWT (AltaGas 2015). The RTI jetty will not require any in water works modification.

The majority of the sub-lease site is currently developed for industrial use with the presence of several structures including above ground storage tanks, above ground product piping systems, a product handling rail corridor, underground utility infrastructure, industrial support buildings and two man-made surface water management ponds. The larger of the two ponds is in active use by RTI for management of surface water that is directed from the coal stockyard and other actively used areas of their leased lands (RTI 2013). Since 2004, numerous groundwater monitoring wells have been installed across the RTI leased lands for the purpose of assessing and monitoring groundwater quality with respect to known and suspected areas of environmental concern. In 2015 several new groundwater monitoring wells were installed in the AltaGas sub-lease site (SNC-Lavalin 2016).

6.2.2.1 Groundwater Quality

Information available through the British Columbia Water Resource Atlas indicates there is no groundwater aquifers present on Ridley Island (DataBC 2016). The closest water well to the sub-lease site is approximately 2.8 km to the east, adjacent to the District of Port Edward, and was drilled and installed in 2005 for commercial purposes. The groundwater quality at the sub-lease site and RTI lease area has been assessed by two previous environmental assessments and relevant results are summarized below.

Dillon Consulting Limited (Dillon) was retained by Transport Canada to conduct a Phase I and Phase II ESA of the RTI lease and adjacent RTI water lot area in 2003 and 2004. A total of 16 groundwater monitoring wells were installed on the RTI lease by Dillon during the Phase II ESA. In 2015 SNC-Lavalin Inc. conducted a limited Phase I and Phase II Environmental Site Assessment at the AltaGas sub-lease site. SNC-Lavalin did not locate any existing groundwater monitoring wells on the AltaGas sub-lease site and subsequently installed four new groundwater monitoring wells to facilitate the collection of groundwater samples for assessment of groundwater quality.

The soil stratigraphy at the AltaGas sub-lease site is primarily comprised of sand and blast-rock fill material overlying bedrock. The depth to the water table within the surficial material (fill/blast rock layer) ranges from 0.5 to 2.0 m bgs and generally flows toward the drainage ditches (Dillon 2004). Groundwater within the underlying bedrock has been encountered at depths ranging from 1.0 m to 16.6 m bgs.

The existing RTI rail-car dumper structure requires dewatering of underground facilities and as such has created a hydraulic cone of depression (Dillon 2004) in the direct vicinity. The rail-car dumper is located to the north of the sub-lease site.

Several factors including the natural contours of the bedrock, the varying depths of overburden fill material, dewatering of the underground rail-car dumper structures and proximity to the marine environment and tidal forces create a complex hydrogeological regime at the site.

Petroleum hydrocarbons have been reported in groundwater in RTI lease lands. Previous ESA studies established groundwater monitoring wells; however, several have been disturbed during subsequent construction around the RTI property. None of the groundwater wells are on the Project site. The 2004 Dillon Phase II ESA indicates that two groundwater wells located on the RTI lease area had detectable concentrations of hydrocarbons including polycyclic aromatic hydrocarbons (PAHs) and LEPH and HEPH less than the applicable BC CSR standards.

The SNC-Lavalin Phase II ESA indicated that one groundwater monitoring well on the AltaGas sub-lease site had detectable concentrations of toluene greater than the applicable CCME CEQG three groundwater monitoring wells had concentrations of metals greater than the applicable CCME CEQG. One groundwater monitoring well on the AltaGas sub-lease site was found to contain concentrations of magnesium and sodium greater than the provincial drinking water standards.

6.2.2.2 Surface Water Quality

Field investigations supplemented by information available from the BC Water Resource Atlas confirm that there are no natural water bodies or water courses remaining on the Project site.

The RTI coal stockyard area is surrounded by a perimeter drainage ditch system that collects surface water runoff from the coal stockyard. The perimeter ditches drain to two settlement ponds located on the RTI lease area. Settlement Pond #1 is on the AltaGas sub-lease site and collects water from the southern portion of the RTI lease area and Settlement Pond #2 is located to the north of the RTI coal stockyard and collects surface water from the northern portion of the drainage ditch system. Settlement Pond #1 drains to Chatham Sound through a manually controlled weir system. No flocculants are used in Settlement Pond #1 and water from the pond is also used for dust suppression on RTI lease roads as necessary during dry conditions (SNC-Lavalin 2015). Water from Settlement Pond #2 is discharged to ground surface between the RTI coal stockyard and Porpoise Harbour. In 2004 Dillon collected one surface water sample from water contained within Settlement Pond #1 and analytical results indicated that concentrations of aluminum, arsenic, cadmium, copper and iron were in exceedance of the CCME marine aquatic life guidelines. Concentrations of hydrocarbons and PAHs in the surface water contained within Settlement Pond #1 were determined to be less than the applicable CCME marine aquatic life guidelines at the time of the 2004 sampling event (Dillon 2004). As surface water contained within Settlement Pond #2 discharges to the north of the RTI lease area and there is no anticipated interaction with project. Water quality of Settlement Pond #2 is not considered to be relevant to this EED.

6.2.2.3 Marine Water Quality

Marine waters surrounding Ridley Island vary in their exposure to tides and currents. The western side of Ridley Island is subject to strong tidal currents from Brown Passage. The eastern side of Ridley Island is separated from the mainland and Port Edward by a narrow straight and Porpoise Harbour where fresh water inflows mix with strong-tides to create brackish estuarine habitat along the rail corridor leading to Ridley Island (RTI 2011). Effluent from the former Canadian

Cellulose facility, which was located on nearby Watson Island, historically transported effluent by pipeline and for discharge into Discharge Cove located at the north end of Ridley Island and reportedly caused impairment to marine resources (PRPA 2011). The RTI marine berth area lies within the Pacific North Coast Integrated Management Area (PNCIMA) as defined by DFO as supporting sustainable development of Canada's oceans with a focus on maintaining environmental, social and cultural values through a precautionary approach (Worley Parsons 2013). The marine water quality adjacent to Ridley Island is known to be affected by the freshwater discharge of the Skeena River. The mean annual discharge of the Skeena River is 910 cubic metres per second (m^3/s) (de Groot 2005) with a maximum recorded discharge 10,194 m^3/s occurring in June of 1936 (de Groot 2005). The Skeena River is prone to major seasonal fluctuations in discharge and contributes to corresponding fluctuations in marine water quality as freshet and inland rainfall affect water levels and total discharge of the river system. Salinity concentrations have been observed to decrease in the spring and fall during higher recorded discharge events (Stantec 2011). The delta of the Skeena River is considered to be the second largest in BC and the sediment plume from the delta has been observed to extend approximately 30 km into Chatham Sound (Stantec 2011).

RTI is authorized to discharge effluent from Settlement Pond #1 to the marine environment in accordance with permit PE-06698. Permit PE-06698 was issued by the British Columbia Ministry of Environment in September of 1984 and re-issued with amendments in 2000. The permit identifies several conditions, including a maximum effluent discharge rate of 50,000 m^3/month as well as chemical and physical characteristics (i.e., pH, total suspended solids, oil and grease and acute lethality) that the discharge water must meet. Annual summary reports from 2008 to 2015 were reviewed and the reports show that concentrations of total suspended solids exceeded the permit criteria (200 mg/L) on three occasions during this time period (218 mg/L March 10, 2011, 320 mg/L September 22, 2011 and 250 mg/L December 14, 2012). All other tested parameters have been reported to meet the required criteria for all quarterly sampling events. In addition to the chemical and physical parameters identified in the permit, samples collected at six month intervals have also been analyzed for concentrations of PAHs. Laboratory analytical results show that detectable concentrations of PAHs are present in the majority of the effluent samples. Reports for the sampling events conducted prior to 2008 were not available for review. Results of these sampling events are considered to be applicable as discharged effluent may be a point source of contaminants within the marine portion of the LSA and RSA.

The PRPA has been conducting a baseline marine environmental water quality sampling since 2013. Marine waters in PRPA jurisdiction are monitored for oceanographic properties, heavy metals, polycyclic aromatic hydrocarbons, and bacteriological properties. Four of the 26 monitoring stations lie in Chatham Sound, immediately west of Ridley Island, have been sampled seasonally at multiple depths since 2013. Analytical results of samples collected from the stations adjacent to

Ridley Island have generally been below applicable guidelines with the exception of boron which has regularly been reported at concentrations above the applicable guidelines. Copper concentrations were reported to exceed applicable guidelines at stations adjacent to Ridley Island in one sampling event in 2013. (SNC-Lavalin 2013 to 2016).

6.3 Assessment of Potential Adverse Environmental Effects

This Section will include a description of all physical works and activities associated with Project components and the potential for adverse environmental effects for which a reasonably direct causal link can be demonstrated between some aspect of the Project and the Water Quality IC and associated sub-components.

6.3.1 Potential Interactions of the Project

Potential interactions between Project activities occurring in the LSA and RSA and the three sub-components of the Water Quality IC are described in Table 6-4. Interactions were described as follows:

- N = no interaction
- M = minor interaction
- CF = interaction to be considered further in the assessment

A minor interaction (M) results in an adverse effect that will be eliminated or reduced to negligible by using proven and effective mitigation measures or best management practices (CEAA 2014 – Projects on federal lands).

An interaction is carried forward (CF) because there is meaningful level of uncertainty that the effect may exceed acceptable levels or standards without implementation of project-specific mitigations and may result in residual adverse effects. Any interactions designated as CF are assessed in more detail in Section 6.3.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Table 6-4: Project Interaction Table

Project Activities and Physical Works		IC Subcomponents Potentially Affected		
		Groundwater Quality (WQ1)	Surface Water Quality (WQ2)	Marine Water Quality (WQ3)
Construction Activity				
C-1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	N	M	N
C-2	Site blasting which may involve explosives manufactured off site.	M	N	N
C-3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	N	N	N
C-4	Relocation and reconstruction of existing settling ponds, involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sub-lease Site.	M	M	M
C-5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	N	M	N
C-6	Construction of rail tracks.	N	M	N
C-7	Re-grading of existing sidings on RTI lease land.	N	M	N
C-8	Connection to BC Hydro grid on PRPA lands.	N	M	N
C-9	Upgrade to Existing Jetty: Installation of piping and loading arms.	N	N	N
C-10	Installation and hydrotesting of refrigerated storage tanks and equipment.	N	N	M
C-11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	N	M	N
C-12	Installation of a new vehicle At-Grade road crossing to RTI coal stockyard area.	N	M	N
C-13	Local transport of material and personnel to and from the site and PRPA lands.	N	M	N

Project Activities and Physical Works		IC Subcomponents Potentially Affected: Groundwater Quality (WQ1)	Surface Water Quality (WQ2)	Marine Water Quality (WQ3)
Operations and Maintenance				
O-1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	N	M	N
O-2	Gas powered compression, supplemented with BC Hydro power to provide approximately 15 MW.	N	N	N
O-3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring twice a year and otherwise only in the case of emergencies and process upsets.	M	M	N
O-4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	N	N	N
O-5	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	N	N	N
O-6	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12 - 18 months.	N	N	N
O-7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	N	N	N
O-8	Refrigerating and storing propane; propane is passed through a heat exchanger where it is chilled to approximately -42˚C and transferred to a refrigerated storage tank.	N	N	N
O-9	Propane delivery to the carrier via new piping driven by electric pumps. Loading will occur once every 15 to 20 days and take approximately 40 hours (i.e., 20-30 carriers per year).	N	N	N
O-10	Berthing of liquefied gas carriers at the RTI berth facility. Carriers will be met by tug escorts upon approach to the berth and will utilize a docking aid system.	N	N	M
O-11	LPG carrier movements in PRPA navigational jurisdiction.	N	N	M
Decommissioning				
D-1	Removal of land-based above-ground infrastructure on sub-lease Site.	N	M	N

Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor interaction with well-known mitigation measures enacted and are not considered further in the environmental evaluation; and CF = interaction to be considered further in the environmental evaluation

6.3.2 Assessment of Potential Effects

Minor adverse environmental effects can be mitigated with routine measures including careful planning, design and management practices as described in Section 6.3.3.

6.3.2.1 Assessment of Minor Interactions

The assessment of minor interactions or groups of interactions, relating to each phase of development and the potential adverse environmental effects and associated mitigation measures are described in detail below.

6.3.2.1.1 Construction Phase

The primary concerns for potential adverse environmental effects caused during the construction phase are:

a) the potential to cause soil disturbances and thereby cause increased turbidity and sedimentation of surface water;

b) the potential to introduce contaminants to groundwater through construction activities such as routine use, fuelling and maintenance of vehicles and equipment; and

c) the potential to cause soil disturbances and thereby cause increased turbidity and sedimentation of marine water as a receptor of surface water run-off.

These adverse effects can be largely avoided by use of effective and established mitigation measures and management practices described in Section 6.3.3.

The principle adverse effects described above are expanded in greater detail below as they relate to specific interactions expected to occur during the construction phase:

C-1 – Site grading with the use of heavy machinery and the application of gravel has the potential to adversely affect surface water quality at the AltaGas sub-lease site. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and contaminants could be spread and mobilized during grading activities thereby causing introduction of contaminants to surface water. Additionally, imported fill material could inadvertently introduce new contaminants to the Project site if not obtained from a source of known quality. Disturbance to surficial soil has the potential to cause sedimentation and increased turbidity in surface water, however, adequate area exists to isolate the work sites and prevent sediment discharge and sediment-laden water discharge to the receiving environment.

C-2 – Blasting activities have the potential to adversely affect groundwater quality at the AltaGas sub-lease site. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and preparations for blasting and blasting activities themselves could cause contaminants to be mobilized.

C-4 – Relocation of existing settling ponds will require discharge of existing surface water contained in the ponds and mechanical excavation and handling of soil to infill existing ponds and create new ponds. Water currently in the ponds will be discharged to the marine environment in a manner consistent with applicable standards and/or permits. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during relocation activities. Due to the presence of shallow bedrock across the AltaGas sub-lease site it is expected that blasting would be required to relocate settling ponds. Additionally, imported fill material could inadvertently introduce new contaminants to the Project site if not obtained from a source of known quality. Disturbance to surficial soil has the potential to cause sedimentation and increased turbidity in surface water and discharge to Chatham Sound has the potential to cause periods of increased turbidity to marine water. Groundwater quality could be affected during pond decommissioning if liner integrity is compromised before surface water is managed.

C-5 – Installation of utilities such as electrical, natural gas, sewer, fire protection and storm water management systems will require mechanical excavation and handling of soil. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during relocation activities. Due to the presence of shallow bedrock across the AltaGas sub-lease site it is possible that blasting would be required to complete the installation of new utilities. Disturbance to surficial soil has the potential to cause sedimentation and increased turbidity in surface water.

C-6 and C-7 – Construction of new rail tracks and re-grading and upgrades to existing rail tracks will require mechanical excavation and handling of soil. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during construction activities. Due to the presence of shallow bedrock across the AltaGas sub-lease site it is possible that blasting would be required to complete the installation of new tracks. Disturbance to surficial soil has the potential to cause sedimentation and increased turbidity in surface water.

C-8 – Construction activities required to connect the AltaGas sub-lease site to the existing BC Hydro electrical grid on PRPA lands will require mechanical soil handling. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during construction activities. Disturbance to surficial soil has the potential to cause sedimentation and increased turbidity in surface water.

C-10 – A hydro-test is a way in which storage tanks, including LPG tanks, are tested for strength and leaks. Hydro-testing is performed to ensure there are no construction defects and prove the safety and integrity of a tank. The test involves filling the tank with fresh or sea water. The vapour space at the top above the water is then pressurized to a specified amount that is slightly more than atmospheric pressure.

The temperature of water used in the hydro-testing will be about 7-15 C ambient and the test duration is up to 24 hours. Water temperature won't change significantly during the test so it will be returned to the ocean at the test temperature or within a couple degrees. If sea water is used, surface screened seawater will be used as-is with no treatment planned. It is estimated that the time to fill the tank with water will be 5-15 days and a similar amount of time required to drain the tank. The inner tank is cleaned before testing but there could still be small particulates dislodged from the surface of the inner tank when it is filled and emptied. As such, the water will pass through screens to collect suspended solids, before being discharged to the ocean. As hydro-test water will be discharged to the marine environment, a minor interaction was identified; however, potential effects would be negligible and easily avoided through proper waste water management practices. Similar to the LPG storage tank, piping and small tanks will be hydro-tested. If the hydro-tests are performed when there are no risks of freezing (5 C or above for an extended period) there will be no additives used in the water. After hydro-testing, the water will be disposed of into the PRPA stormwater system as-is. In the event that freezing is a concern during testing, methanol is added to the water. In that case, post-test water will be collected and disposed of at an approved treatment facility.C-11 and C-12 – Removal of the existing overhead rail crossing and replacement with level-ground rail crossing on RTI leased lands will require mechanical excavation and handling of soil. Existing soil quality data shows that contaminants in exceedance of applicable federal guidelines exist in surficial soils and these contaminants could be mobilized during relocation activities. Due to the presence of shallow bedrock across the AltaGas sub-lease site it is possible that blasting would be required to reach the desired grade specifications identified in the AltaGas design. Disturbance to surficial soil has the potential to cause sedimentation and increased turbidity in surface water.

6.3.2.2 Operations Phase

Primary concerns that may have minor effects on water quality include spills of hazardous materials, fueling and maintenance of vehicles and equipment on site, erosion caused by rain and surface water drainage, flaring of ethane and methane, and suspension of seabed sediments by tugs and carriers during the berthing operations.

These adverse effects can be largely avoided by use of effective and established mitigation and management practices as described in Section 6.3.3.

The principle adverse effects described above are expanded in greater detail below as they relate to specific interactions expected to occur during the operations phase:

O-1 – The use, fuelling and maintenance of vehicles and equipment used during Project operation has the potential to cause minor adverse effects to groundwater quality, surface water quality and marine water quality through introduction of new contaminants.

O-3 – Flaring of ethane and methane by-products could introduce emission related contaminants to a localized area around the flare and thereby have the potential to cause adverse effects to groundwater quality, surface water quality and marine water quality through introduction of new contaminants.

O-10 – Berthing of liquefied gas carriers at the RTI berthing facility could cause suspension of marine sediments thereby adversely affecting marine water quality.

O-11 – Liquefied gas carrier movements in PRPA navigation jurisdiction could cause suspension of marine sediments thereby adversely affecting marine water quality.

6.3.2.3 Decommissioning

Primary concerns that may have minor effects on the water quality include spills of hazardous materials, fueling and maintenance of vehicles and equipment on site, erosion caused by rain and surface water drainage, during the decommissioning phase.

These adverse effects can be largely avoided by use of effective and established mitigation and management practices as described in Section 6.3.3.

The principle adverse effects described above are expanded in greater detail below as they relate to specific interactions expected to occur during the decommissioning phase:

D-1 The removal of land-based above-ground infrastructure on the sub-lease site will require the use of vehicles and equipment. Erosion of soil and subsequent sediment control issues may also occur during this phase as soil disturbances are likely to occur.

6.3.3 Mitigation Measures

Mitigation measures for the potential adverse environmental effects of the Project on the Water Quality IC are outlined below for construction, operation and decommissioning phases. As mitigation measures often overlap for multiple Project activities and can be specific to individual sub-components, mitigation measures have been provided by Project phase to reduce repetition. A summary of potential adverse environmental effects and mitigation measures for the Water Resources IC (by Project phase) is provided in Table 6-5.

6.3.3.1 Construction Activity

Mitigation measures that are recommended for use during the construction activities to minimize and reduce adverse effects to groundwater quality, surface water quality and marine water quality include:

- M1 – Use of qualified Environmental Monitor(s) during the construction phase.
- M2 – Confirmation of the environmental quality of existing soil, surface water and groundwater in areas where disturbances will be required to accommodate Project construction requirements.
- M3 – Management and handling of all excavated soil in accordance applicable regulations and guidelines to prevent migration of contaminants to surface water and groundwater.
- M4 – Confirmation of the environmental quality of any imported soil required for leveling and grading work at the Project Site to prevent inadvertent introduction of contaminants to the Site and contamination of surface water and groundwater.
- M5 – Development and implementation of a Construction Environmental Management Plan (CEMP) suitable for use during the construction phase.
- M6 – Development and implementation of Spill Prevention and Emergency Response Plan (SPERP) to address handling of hazardous materials including fuel and lubricants used during the construction phase to protect water quality.
- M7 – Development and implementation of an Erosion and Sediment Control Plan (ESCP) to protect surface water quality and marine water quality.
- M8 – Verification that water within settlement ponds on AltaGas sub-lease site meets existing discharge criteria prior to discharge to marine environment. Discharge in a manner that does not cause increase in turbidity in marine water.
- M9 – Prior to hydrotesting, tanks will be cleaned. Hydrotest waters will be, run through a screen to capture debris and tested prior to release to the marine environment.

6.3.3.2 Operation and Maintenance

Mitigation measures that are recommended for use during routine operation and maintenance of the facility and associated infrastructure s to minimize and reduce adverse effects to groundwater quality, surface water quality and marine water quality include:

- M10 – Implementation of routine environmental monitoring programs to ensure that operations are not causing adverse environmental effects to groundwater quality, surface water quality and marine water quality.

- M11 – EMPs to address soil and erosion control, hazardous material handling, fuelling and maintenance of vehicles and equipment and waste handling to protect groundwater quality, surface water quality and marine water quality.
- M12 – Use of stormwater management system.
- M13 – Development and implementation of a SPERP to protect groundwater quality, surface water quality and marine water quality during the operations phase.
- M14 – Development and implementation of berthing procedures to minimize suspension and mobilization of seabed sediments and increase in turbidity of marine water.
  - i.e. Carrier berthing – Harbour tugs will be required to meet the carrier at the direction of the Pilot and Master to assist the carrier in safely berthing and mooring at the RTI jetty.
  - Docking – A docking aid system will be installed at the existing jetty to assist the pilots and terminal operators in carrier berthing. The system will monitor and display the carrier's approach speed, distance and angle with respect to the berthing dolphins. The system improves the safety of the berthing operation and reduces the risk of abnormal berthing events by allowing the Pilot to manage the carrier's speed and approach vector in order to verify that the approach procedure is within the specified terminal limits.
  - Ballast – Inbound carriers arriving in a ballasted condition will normally berth with their port sides to the loading platform allowing for the bow of the carrier to be head on into the prevailing current and wind direction.
  - Carrier mooring – The existing mooring points are expected to be sufficient for safe mooring of the carriers calling at facility for the Project. Mooring lines will be secured to quick release hooks. The number and placement of the mooring lines will be determined for each size of carrier during the detailed engineering phase of the Project.
  - Limiting environmental operating conditions – Operational safety limits will be established to cover visibility, wind and sea conditions. The preliminary limiting environmental operating criteria are as follows:
    - Berthing maximum wind speed: 20 m/s (40 knots)
    - Loading/unloading shutdown maximum wind speed: 25 m/s (50 knots)
    - Loading/unloading arm disconnect maximum wind speed: 30 m/s (60 knots)
    - Carrier to vacate berth: 32.4 m/s (63 knots)
    - Maximum current: 2.5 knots
    - Minimum visibility: 1.0 km

- M15 – Vessels to travel along established navigational routes when travelling within PRPA navigational jurisdiction.

6.3.3.3 Decommissioning

Decommissioning work will include many of the same activities as construction and operation and maintenance. As such, it is anticipated that similar mitigation measures should be applied. Appropriate mitigation measures recommended for use decommissioning work are listed below:

- M16 – Use of qualified Environmental Monitors during the decommissioning phase.
- M17 – Development and Implementation of a CEMP suitable for use during the decommissioning phase.
- M18 – Development and implementation of a SPERP suitable for the decommissioning phase.
- M19 – Development and implementation of an ESCP suitable for use during the decommissioning phase.

A summary of potential adverse effects and recommended mitigation measures is provided in Table 6-5.

Table 6-5: Summary of Potential Adverse Environmental Effects and Mitigation

Activity	Description of Potential Effect	Mitigation	Mitigation code	Residual Effect (Y/N)
Construction *(all)*	General	Use of a qualified environmental monitor during all construction activities	WQ1-M1 WQ2-M1 WQ3-M1	N
Construction *(C-1, C-2, C-4, C-5, C-6, C-7, C-8, C-10, C-11, C-12, C-13)*	Adverse effects to surface water and groundwater quality from disturbance of existing contaminants in soil and materials and introduction of new contaminants from imported fill or use of vehicles and equipment	Disturbances to surficial soils should follow established procedures for identifying contamination, removing contaminated material and procedures to prevent contamination moving off the site	WQ2-M2 WQ2-M3 WQ2-M4	N
		Construction Environmental Management Plan	WQ1-M5 WQ2-M5 WQ3-M5	
		Spill Prevention and Emergency Response Plan	WQ1-M6 WQ2-M6	
		Erosion and Sediment Control Plan	WQ2-M7	
	Adverse effects to marine water quality caused by drainage and relocation of existing settlement ponds	Characterization of chemical quality of water contained within existing settlement ponds and controlled discharge to avoid increase in turbidity in marine water	WQ3-M8 WQ3-M9	
Operations *(all)*	General	Adherence to environmental monitoring programs	WQ1-M10 WQ2-M10 WQ3-M10	N
Operation *(O-1, O-3)*	Adverse effects to groundwater quality, surface quality and marine water quality from routine operations, wastewater and stormwater management and general use of vehicles and equipment at the work site	Environmental Management Plan	WQ1-M10 WQ2-M10	N
		Use of wastewater and stormwater management systems	WQ2-M11	
		Spill Prevention and Emergency Response Plan	WQ1-M12 WQ2-M12 WQ3-M12	

Activity	Description of Potential Effect	Mitigation	Mitigation code	Residual Effect (Y/N)
Operation *(O-10, O-11)*	Adverse effects to marine water quality caused by vessel traffic in RTI waterlot and PRPA navigational jurisdiction	Follow berthing procedures when operating vessels in RTI waterlot	WQ3-M13	N
		Follow established navigational routes within PRPA navigational jurisdiction	WQ3-M14	
Decommissioning *(all)*	General	Use of a qualified environmental monitor during all sensitive decommissioning activities	WQ1-M15 WQ2-M15 WQ3-M15	N
Decommissioning *(D-1)*	Adverse effects to surface water quality from use of vehicles and mobile equipment at the work site	Construction Environmental Management Plan	WQ2-M16	N
		Spill Prevention and Emergency Response Plan	WQ2-M17	
		Erosion and Sediment Control Plan	WQ2-M18	

6.3.4 Residual Effects

Based on the information presented in the above sections, it is concluded that the Project will result only in minor adverse environmental effects on Water Quality. With the implementation of appropriate previously described mitigation measures no residual effect on the Water Quality IC is expected from the Project.

6.3.5 Cumulative Effects

As there are no residual effects on Water Quality there is no potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents.

7 MARINE RESOURCES

This section presents the effects assessment for the Marine Resources Valued Component (VC).

7.1 Context and Boundaries

The Marine Resources VC includes intertidal and shallow subtidal habitats, marine mammals, marine species-at-risk, and marine resource use sub components, and were considered because of their importance to local communities, conservation concerns, and the potential to be adversely affected by Project activities.

7.1.1 Overview and Regulatory Setting

Three Federal Acts and regulations apply to potential adverse environmental effects of the Project on the Marine Resources VC. Each is briefly discussed below.

7.1.1.1 Federal

Fisheries Act

The *Fisheries Act* applies to Project activities that may cause serious harm to fish that are part of, or support commercial, recreational or Aboriginal (CRA) fisheries (s.35), and deposition of deleterious substances into waters containing fish (s.36). Marine finfish and shellfish are considered in the Fish VC. Marine mammals are also subject to the *Marine Mammal Regulations* under the *Fisheries Act*, which states that no person shall disturb or attempt to kill a marine mammal except when fishing for marine mammals under the authority of these Regulations.

Species at Risk Act

Marine mammals may be federally protected under the *Species at Risk Act* (SARA). Protection of taxa listed under the SARA applies to extirpated, endangered, or threatened aquatic taxa such as marine mammals. The SARA contains prohibitions that make it an offence to kill, harm, possess, collect, buy, sell or trade an individual of a taxon listed in Schedule 1 of the SARA as endangered, threatened, or extirpated.

Navigation Protection Act

According to the *Navigation Protection Act*, it is "prohibited to construct, place, alter, repair, rebuild, remove or decommission a work in, on, over, under, through, or across any navigable water that is listed in the schedule except in accordance with this *Act* or any other federal act." The *Navigation Protection Act* is intended to safeguard the public right to navigation. Hence, marine navigation, fishing, and other marine resource use activities may potentially be affected during the construction, operation and/or decommissioning phases of the Project.

7.1.1.2 Provincial

Marine species that are considered to be at risk in BC are also identified and ranked by the BC Conservation Data Centre (CDC). In BC, species and ecological communities are assigned to one of three lists, based on their provincial Conservation Status Rank. Red-listed species and ecological communities are Extirpated, Endangered, or Threatened in BC. Blue-listed species and ecological communities are of Special Concern (formerly referred to as Vulnerable) and Yellow-listed species and ecological communities are secure. Extirpated elements no longer exist in the wild in BC, but do occur elsewhere. Endangered elements are facing imminent extirpation or extinction. Threatened elements are likely to become endangered if limiting factors are not reversed” (BC MoE 2015).

7.1.2 Selection of Valued Component

Marine Resources was selected as a VC for the environmental effects assessment based on the following criteria:

- Ecological, aesthetic, and economic value.
- Importance to regulators First Nations, the scientific community, and the public.
- Protection under federal and provincial acts and regulations.

The marine subcomponents were selected to predict and measure potential Project-related adverse environmental effects on the Marine Resource VC to structure and focus the assessment on their relevance to the Project and their importance to assessing the VC. Combined, the information concerning these sub components provides a thorough understanding of the potential environmental effects of the Project on Marine Resources. The Marine Resource subcomponents are summarized in Table 7-1.

Table 7-1: Subcomponents of Marine Resources

Subcomponent	Rationale for Selection
Marine habitats including intertidal and subtidal habitats	Potential for interaction with Project infrastructure such as additional lighting on the existing Ridley Terminals Inc. (RTI) marine jetty.
Marine mammals	Potential for interaction with Project activities such as increased gas carrier traffic.
Marine mammals species-at-risk	Potential for interaction with Project activities such as increased gas carrier traffic.
Marine resource use	Potential for interaction with Project activities such as increased gas carrier traffic and marine resource use within Prince Rupert Port Authority (PRPA) marine jurisdiction.

7.1.2.1 Indicators and Linkages

Indicators were selected to qualitatively measure and evaluate change resulting from the interaction of the Project with the Marine Resources VC and its sub components. The selected indicators are considered to be relevant, practical, measurable, responsive, accurate, and predictable. Indicators of change in the Marine Resources VC effects assessment are described in Table 7-2.

Table 7-2: Indicators for Marine Resources

Indicator	Direct or Indirect	Rationale
Occurrence and relative abundance of marine species-at-risk	Direct	Legislative obligation; data available
Surface area of marine habitat permanently altered or destroyed	Direct	Legislative obligation; data available
Occurrence and relative abundance of marine mammals	Indirect	Legislative obligation; data available
Marine commercial and recreational vessel use	Indirect	Qualitative description of the potential interaction between LPG carriers and existing local vessel traffic; data available

Other VC assessments in this application were used to support and/or inform the Marine Resource VC assessment, including:

- Water IC – Freshwater and Marine water quality subcomponent.
- Terrain IC – marine sediment quality subcomponent.
- Fish VC – marine fish and species-at-risk subcomponent.

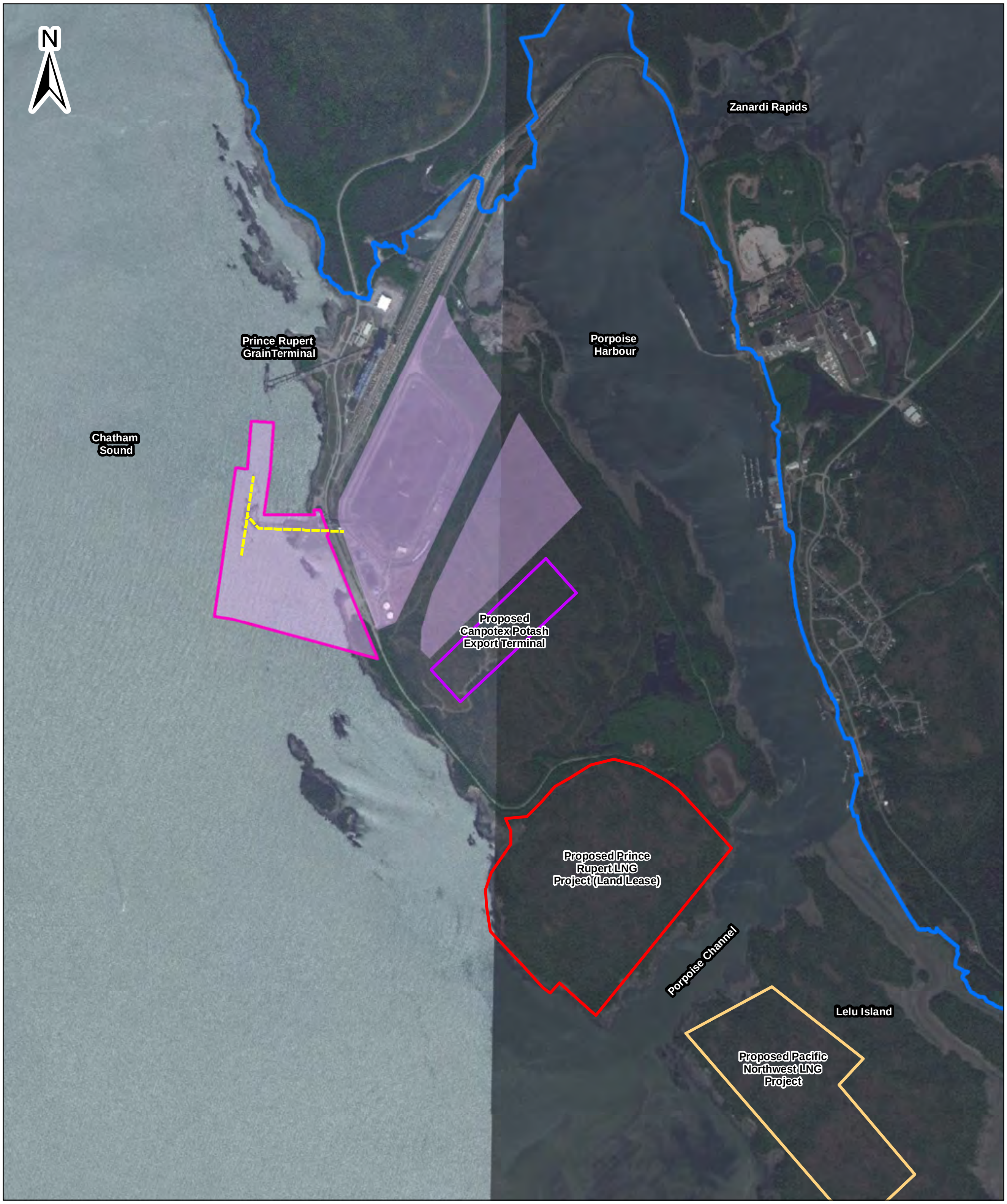
7.1.3 Assessment Boundaries

7.1.3.1 Spatial

The spatial boundaries selected for the Marine Resources VC effects assessment are summarized in Table 7-3 and shown on Figure 7-1 and Figure 7-2. The Local Study Area (LSA) encompasses about 48 ha and includes the RTI water lot sub-lease area adjacent to the RTI jetty. The Regional Study Area (RSA) encompasses about 15, 880 ha and provides context for the marine resources of the LSA within the marine jurisdiction of the PRPA.

Table 7-3: Spatial Boundaries for Marine Resources Effects Assessment

Spatial Extent	Description
Local Study Area (LSA) for Marine Resources	Ridley Terminals Inc. (RTI) water lot boundary
Regional Study Area (RSA) for Marine Resources	Prince Rupert Port Authority (PRPA) marine navigational boundary



LEGEND

- Jetty
- Marine Local Study Area (LSA)
- Marine Regional Study Area (RSA)
- Ridley Terminals Inc. Lease Lands
- Proposed Canpotex Potash Export Terminal
- Proposed Pacific Northwest LNG Project
- Proposed Prince Rupert LNG Project

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS,

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CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal, Ridely Island, Prince Rupert, BC

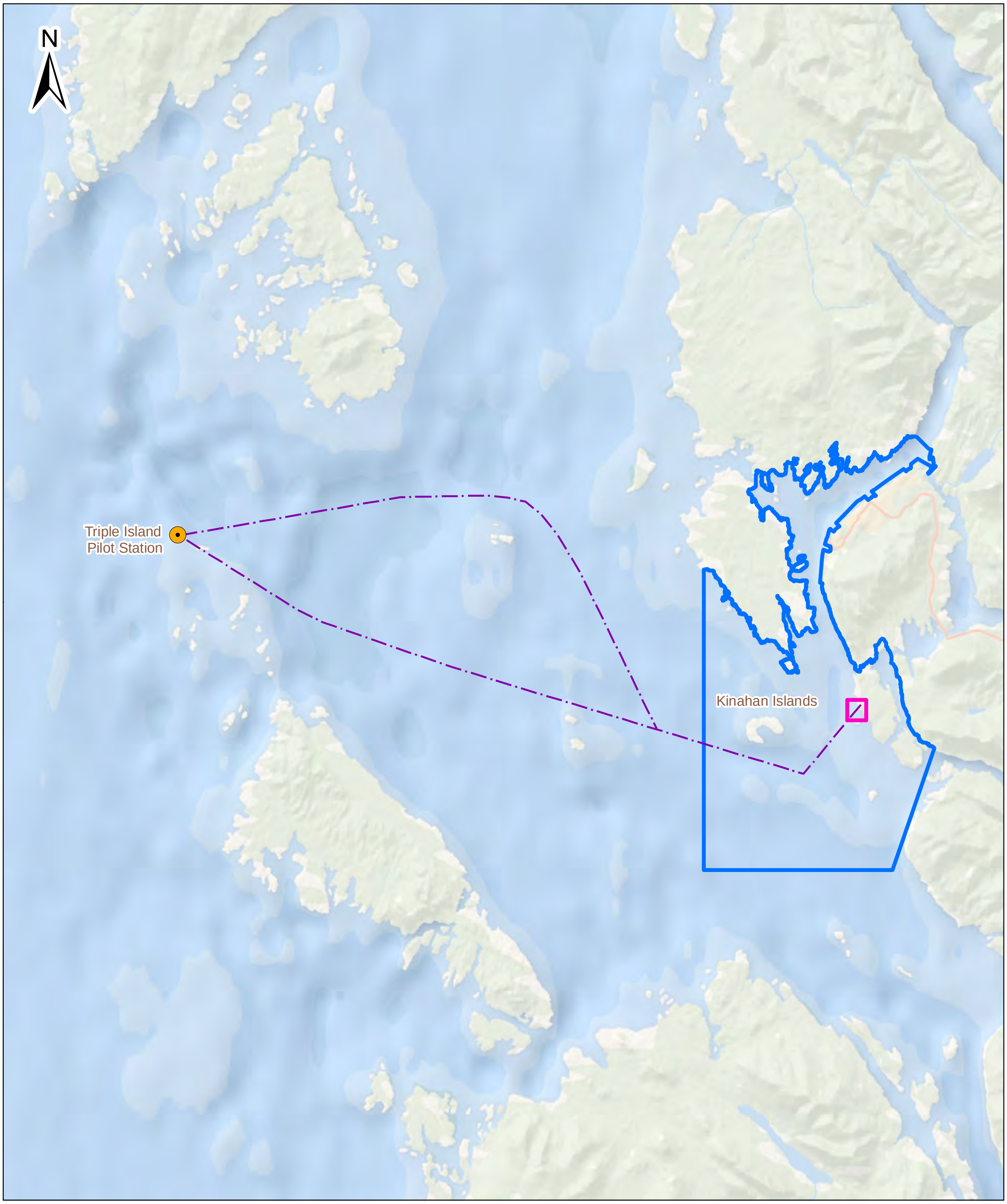
Figure 7-1: Marine Local Study Area

0 312.5 625 1,250 1,875 2,500 Meters

BY: SS	DATE: 2016/07/15	SCALE: 1:30,000	REF No: REV: 0
CHK'D: CR	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-103-001

MXD Path: P:\LOBIEIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_103_001_AltaGas_Marine_LSA.mxd

Project Path:



LEGEND

BC_Geoname
Triple Island Pilot Station
Deep draft routes identified in the Sailing Direction PAC205
Marine Local Study Area
Marine Regional Study Area

0 3,125 6,250 12,500 18,750 25,000 Meters

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

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CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 7-2: Marine Regional Study Area

BY: SS	DATE: 2016/07/15	SCALE: 1:300,000	REF No: REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-103-002

MXD Path: P:\LOB\EIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_103_002_AltaGas_Marine_RSA.mxd

Project Path: \\Sli2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\

7.1.3.2 Temporal

Potential adverse effects resulting from the Project were assessed for the main Project temporal phases, including:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

7.2 Existing Conditions

This section describes the existing conditions of the LSA and RSA as it relates to the VC and the sub components. The existing conditions form the baseline by which potential effects to the VC and subcomponents can be measured.

7.2.1 Data Sources Used in Assessment

Available information describing existing marine resources within the LSA and RSA was summarized from several recent and local environmental assessments for proposed or approved projects and from public online government and non-governmental organization databases. As the Project is occurring on existing industrial land and uses an existing active marine jetty, and no construction is planned below the HWM, there is very low potential for Project activities to interact with marine resources; therefore, no new field studies were undertaken for this assessment.

The following studies were reviewed for the Marine Resource VC effects assessment:

- Pacific Northwest LNG Draft Environmental Assessment Report. 2016.
- Prince Rupert LNG Proposed Liquefied Natural Gas Facility Application Information Requirements for an Environmental Assessment Certificate Application (AECOM 2014).
- Addendum to the Environmental Impact Statement – Marine Resources. 143p. Pacific Northwest LNG (PNW LNG). Stantec. 2014.
- *Ridley Terminals Incorporated Habitat Baseline Study.* 209p. WorleyParsons Ltd. (WorleyParsons). 2013 (EA not completed – studies used for reference herein).
- Prince Rupert Marine Risk Assessment. Navigational Risk Assessment Report produced for Prince Rupert Port Authority. 122p. Det Norske Veritas (DNV). 2013.
- Fairview Terminal Phase II Expansion Project Comprehensive Study Report. Canadian Environmental Assessment Agency. 2012.

- Final report: Identification and mapping of fish habitat within and around Prince Rupert Harbour. World Wildlife Fund (WWF). 2011.
- Environmental Impact Statement, Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor. 555p. Stantec Ltd. (Stantec). 2011.
- Environmental assessment document for sulphur forming, handling and storage facility, Ridley Island, BC. 251p. ICEC Terminals Inc. Keystone Environmental Ltd. (Keystone Environmental). 2007.

The following online databases and resources were reviewed in the desktop study:

- BC Ministry of Environment (BC MoE) Species and Ecosystem Explorer (MoE 2015).
- Fisheries and Oceans Canada (DFO) Mapster V3.1 (DFO 2016).
- BC Marine Conservation Analysis (BCMCA) Atlas (http://bcmca.ca/maps-data/atlas/).
- BC Cetacean Sightings Network (BCCSN 2016).

7.2.2 Description of Existing Baseline Conditions

The Project will be built on an existing industrial site sub-lease site within RTI lease land and PRPA jurisdiction (AltaGas 2015). Ridley Island falls under the Port of Prince Rupert 2020 Land Use Management Plan (AECOM 2011) that designates zoning for industrial and port terminal development, including the provision for dry and liquid bulk terminals. All new construction will take place on a previously cleared industrial site and will build upon existing RTI marine infrastructure. No new construction will occur below the natural high water mark or in the marine water lot lease area. The RTI jetty has a berth-side depth of 22 m at low tide and is capable of handling vessels of 250,000 DWT. LPG carriers are about 65,000 DWT (AltaGas 2015) and therefore the RTI jetty will not require any in water works modification.

The total number of commercial vessel calls at the RTI jetty from 2005 until 2015 ranged from 54 in 2015 to 130 in 2010, with an average of 89 vessels per year (Table 7-4). Projected total number of vessel calls for 2016 and 2017 is 33 on average, excluding the anticipated 20 to 30 additional Project carriers.

Vessel types by size calling at RTI include:

- Handymax: 40,000 to 50,000 DWT
- Supramax: 50,000 to 60,000DWT
- Panamax: 50,000 to 80,000 DWT
- Capesize (includes Baby Cape): Largest bulk carriers, 80,000 to 175,000 DWT

Table 7-4: Number and Type of Commercial Vessels Calling at the RTI Jetty Since 2006

Year	Total Vessel Calls at RTI Jetty by Vessel Type					
	Handymax	Supramax	Panamax	Baby Cape	Cape	Total
2006	24	4	23	5	2	**58**
2007	15	5	35	8	14	**77**
2008	18	8	35	6	14	**81**
2009	24	11	35	2	9	**81**
2010	22	16	57	7	28	**130**
2011	5	2	53	13	29	**102**
2012	1	0	57	9	47	**114**
2013	0	0	62	11	46	**119**
2014	1	0	47	1	25	**74**
2015	0	0	41	2	11	**54**
2016	0	0	30	0	3	**33**
2017	0	0	33	0	0	**33**

Note: 2016 and 2017 are projected numbers provided by RTI.

7.2.2.1 Marine Habitats

Regional oceanographic conditions and processes have a large influence on the distribution and abundance of marine resources including marine habitats, fish and marine mammals. Within the RSA and LSA water column properties during the period of high annual biological production from mid-May to the end of August, such as salinity and water temperature, are mainly influenced by oceanographic properties in Chatham Sound to the west and the Skeena River outflow from the southeast. This results from the seaward discharge of freshwater which acts in concert with westward wind-driven ocean currents from Chatham Sound, causing a major flushing of surface brackish water towards the west and a strong intrusion of cold, saline oceanic water at depth; a classic estuarine circulation (SNC-Lavalin 2014). With a decline in freshwater discharge in late summer and early autumn, the outflow of brackish water through Chatham Sound slows and the increase in westerly winds in autumn result in a net inflow of high salinity surface waters into the RSA. By early winter, coastal circulation becomes dominated by winds until the early spring snow-melt resumes.

Information on intertidal and subtidal marine habitats in the LSA was available from several environmental assessments conducted for other proposed large-scale, nearby projects, as well as for the proposed RTI project (WorleyParsons 2013). The section below briefly summarizes baseline information for marine intertidal and subtidal habitats based on these assessments.

The industrial history of the Ridley Island means that most of the shoreline is characterized by upland fill and large rip-rap to reduce erosion from the westerly exposure to Chatham Sound winds. In addition, infilling and grading is common in the upland areas (WorleyParsons 2013). This industrial activity has resulted in a shoreline with little exposed natural bedrock and limited marine riparian vegetation (MRV).

MRV is recognized as a dynamic ecotone extending both landward and seaward from the high water level of marine shorelines. It is usually defined to occur at the land-water interface at the higher high water large tide or high water mark. In practice, the MRV zone is usually best determined in the field from the spatial extent of vegetation and driftwood. MRV includes numerous species of grasses, sedges, shrubs, herbs, and trees found at or near HWM. Since many plants along the shoreline (except for halophytes) are limited by the presence of salt water, their seaward growth is restricted. The MRV zone along marine shorelines serves a variety of critical ecological and social functions. For example, MRV provides wildlife habitat and nutrient and leaf litter input; enhances feeding conditions of young salmon; and enhances upper foreshore habitat complexity.

During the summer of 2010, the World Wildlife Fund (WWF) (2011) updated and ground-truthed foreshore habitat data for the Prince Rupert Harbour area, originally collected in 1999. A simple three-class system based on qualitative estimates of habitat value represented by the vegetation and substrate type was applied to the field observations. Within the Project LSA the shoreline northward to the Prince Rupert Grain Inc. Terminal was classified as low habitat value, while the shoreline from the LSA southward towards the Coast Islands was classified as moderate habitat value.

In the spring of 2013, WorleyParsons conducted a desktop and field survey of the intertidal and shallow subtidal areas in the LSA to characterize habitats for a proposed expansion of the RTI marine loading facility. WorleyParsons (2013) employed transect surveys to document intertidal habitats in the LSA. The observed intertidal algal and faunal communities in the LSA were characteristic of an area moderately exposed to wave energy from Chatham sound winds and swell. Riprap was the dominant substrate type throughout the intertidal zone of the LSA and four distinct algal habitat bands were identified:

- Un-vegetated boulder and splash-zone species such as barnacles in the upper intertidal.
- Rockweed (*Fucus gardneri*) dominated the mid-intertidal.
- Red algae (*Microcladia* sp.) and sea lettuce (*Ulva* sp.) with more mobile invertebrates such as chitons, whelks, and sea stars dominated the mid to lower intertidal.
- A narrow band of kelp (*Laminaria* and *Alaria*) in the lower intertidal of the LSA. The width of the kelp band was limited in deep waters by the presence of silt and mud substrates.

No marine species-at-risk or sensitive habitats were identified in the intertidal or subtidal surveys of the LSA (WorleyParsons 2013).

7.2.2.1.1 Subtidal Habitats

Subtidal habitat in the majority of the RSA to the west of the Project LSA is <40 m deep with a mud seabed. There is a relatively deep water channel to the south of the Kinahan Islands that serves as the main marine traffic route to the Port of Prince Rupert for large commercial vessels (DNV 2013).

Subtidal habitats in the LSA were described by WorleyParsons (2013) from a subtidal sea bed underwater video survey which extended seaward about 500 m from the current LSA shoreline to a maximum depth of about 27 m. Raw underwater video was reviewed and classified using standard methods and included records of substrate class, marine algae, and fauna. Visibility during the underwater video survey was <1 m due to the high turbidity generated by the Skeena River discharge.

In the LSA, several patches of bull kelp (*Nereocystis luetkeana*) were observed on hard surfaces such as cobble, rocks, and bedrock. Subtidal algal flora declined rapidly with depth because the deeper subtidal substrates were dominated by silt and mud with small amounts of shell, wood, and organic debris. Twenty-nine invertebrate fauna taxa were identified from the underwater video with polychaetes, bivalves, and mud shrimp prevalent throughout the subtidal area of the LSA. Dungeness Crabs (*Metacarcinus magister*) were moderately abundant in the southern portion of the LSA, as were flatfish including English Sole (*Parophyrs vetulus*) and Starry Flounder (*Platichthys stellatus*). Marine fish resources are considered further in the Fish VC section of this assessment.

7.2.2.2 Marine Mammals

In the RSA, baseline information on marine mammal occurrence, distribution, and relative abundance was obtained from desktop review of several recent environmental assessments conducted for nearby industrial projects (e.g., Pacific NorthWest LNG), published government reports, and the BC Cetacean Sightings Network (BCCSN). A list of the marine mammals most likely to be observed in the RSA is provided in Table 7-5.

Table 7-5: Marine Mammals Most Likely to be Observed in the RSA (from BCSCN 2002-2015)

Common Baleen Whales	Scientific Name
Baleen Whales	
Humpback Whale	*M. novaeangliae*
Toothed Whales	
Harbour Porpoise	*P. phocoena*
Killer Whale (northern resident or transient)	*O. orca*
Pinnipeds	
Harbour Seal	*P. vitulina richardsi*

The Pacific North Coast Integrated Management Area (PNCIMA) is one of five large federal ocean management areas in Canada and covers an area of approximately 102,000 km^2 (DFO 2011). The LSA and RSA fall within PNCIMA, and DFO (2007, 2016) has identified functional habitat use for Humpback Whales (*Megaptera novaeangliae*, known concentrations), Northern Resident Killer Whales (*Orcinus orca*, important habitat), and Steller Sea Lions (*Eumetopias jubatus*, haul outs). DFO (2007) indicate that whales and Steller Sea Lions are 'destination migrants' in that such species will migrate into the PNCIMA region to feed, typically from the spring to autumn.

The marine mammals observed in the RSA (Figure 7-2) can be divided into three main groups: baleen whales, toothed whales, and pinnipeds. Information on the most commonly observed baleen whales in the RSA was obtained from mapping completed by the BCCSN from 1961-2015 (see maps listed in Stantec 2014 and Figure 7-3). The majority of sightings in the RSA included Humpback whales primarily south and west of the Kinahan Islands, and a few Grey Whale (*Eschrichtius robustus*) sightings also to the south of the Kinahan Islands. Humpback Whales are known to exhibit site-fidelity to foraging areas. The whales increase in numbers from early summer to autumn in regional waters surrounding the RSA, likely in response to seasonal increases in prey (Stantec 2014). Note however, that the RSA itself is not considered a 'hot-spot' for Humpback Whales, and that regions west of Triple Island and in Work Channel are the closest areas where high whale density would be a predicted to have a high encounter rate (Ford et al. 2009).

The most frequently observed toothed whales in the RSA (Figure 7-3) include the SARA-listed Special Concern Harbour Porpoise (*Phocoena phocoena*); SARA-listed Northern Resident Killer Whales, and occasionally Dall's Porpoise (*Phocoenoides dalli*). Harbour Porpoise sightings typically occur within 20 km of shore along most of the BC coast, and they can travel up to 100 km per day and thus likely move quickly through the RSA when present. Harbour Porpoises have been observed year-round in the vicinity of Ridley Island, particularly in Porpoise Harbour and between Ridley and Kinahan Islands (Stantec 2011; Figure 7-3). Chatham Sound has been identified as an important foraging area for the Northern Resident Killer Whale from early spring and summer and is mainly related to the Chinook (*Oncorhynchus tshawytscha*) and Chum Salmon (*O. keta*) runs of the Skeena (Ford 2006). Relatively few sightings of Northern Resident Killer Whales have occurred in the RSA compared to regions further west around Dundas, Stephens, and Porcher Islands.

The most frequently observed pinnipeds in the RSA include Harbour Seals (*Phoca vitulina richardsi*). The RSA and surrounding area is also considered an important area for the SARA-listed Special Concern Loughlin's Northern (Steller) Sea Lions. No major sea lion haul-outs or rookeries occur within the RSA; however, sea lions are highly mobile during non-breeding season and may transit through the RSA.

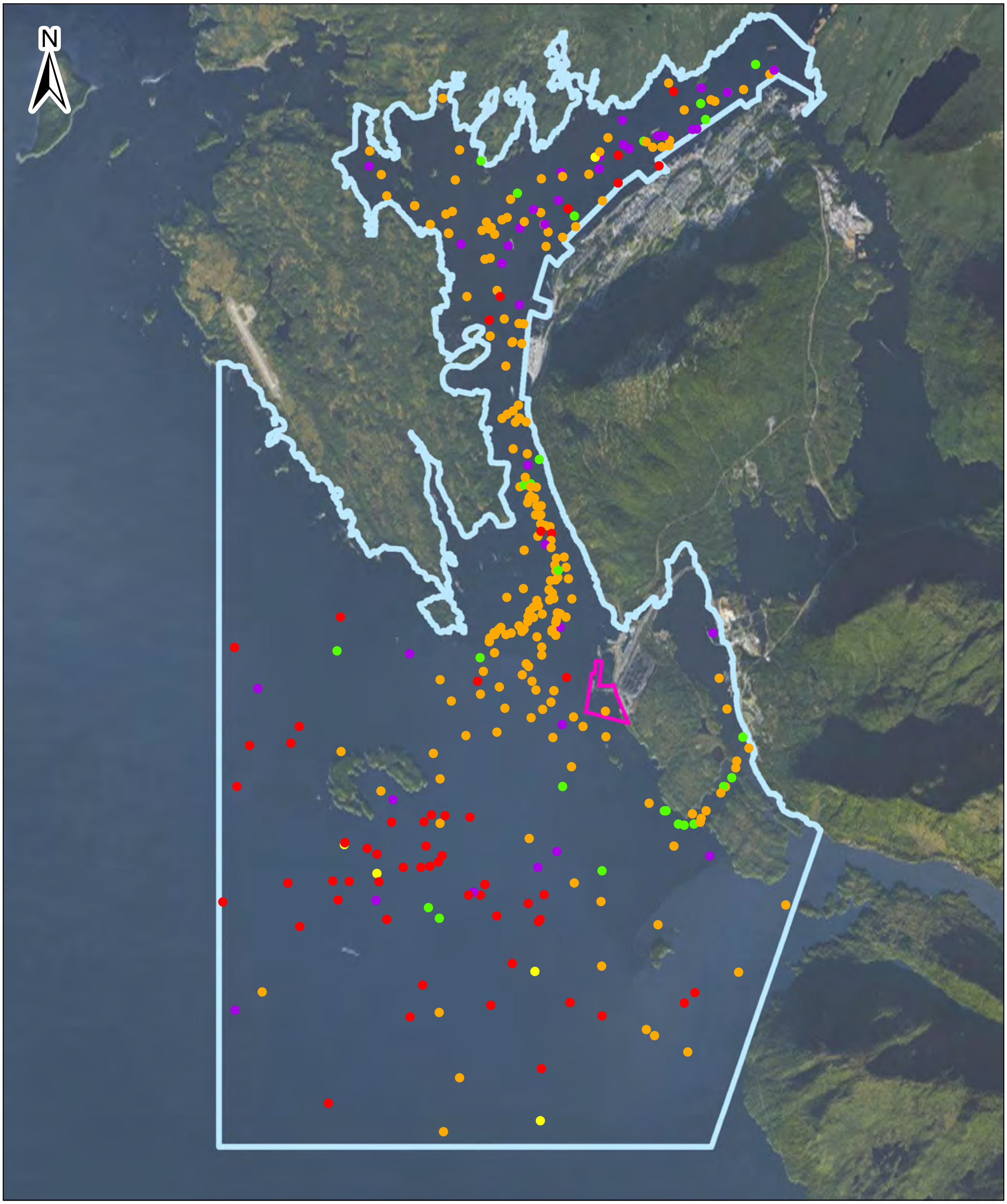
During marine mammal surveys completed by AECOM (2014) observations of Humpback Whales, Harbour Porpoise, Harbour Seals, and Steller Sea Lions were reported in the Project RSA. Dall's Porpoise, Pacific White-sided Dolphin (*Lagenorhynchus obliquidens*); Harbour Seal are also common in the area. The BCCSN sightings (2002 to 2015) also indicate that humpback whales, killer whale and harbour porpoises are most frequently observed in the RSA; most humpback whale sightings occurring south of the Kinihan Islands.

7.2.2.3 Marine Species-at-Risk (other than fish)

Table 7-6 summarizes the marine species-at-risk potentially occurring in the RSA. Several of the marine mammals observed in the Prince Rupert harbour area are federally listed under Schedule 1 of SARA and are considered species of conservation concern. Killer whales (northern resident and transient populations) are listed as Threatened, and are also provincially red-listed. Humpback Whales are federal species of Special Concern, and provincially blue-listed. Steller Sea Lions, Grey Whales, Harbour Porpoise, and sea otters (*Enhydra lutris*) are also listed as special concern under SARA, and are provincially blue-listed species. Sea otters are also protected under the BC Wildlife Act. Stantec (2014b) indicates that the Prince Rupert area is likely beyond the northern range of sea otters.

Table 7-6: Marine Species-at-Risk Potentially Occurring in the RSA

Common Name	Scientific Name	Conservation Status
Baleen Whales		
Grey Whale	*E. robustus*	• Special Concern – SARA Schedule 1 • BC blue-listed
Humpback Whale	*M. novaeangliae*	• Special Concern – SARA Schedule 1 • BC blue-listed
Toothed Whales		
Harbour Porpoise	*P. phocoena*	• Special Concern – SARA Schedule 1 • BC blue-listed
Killer Whale (northern resident)	*O. orca*	• Threatened - SARA Schedule 1 • BC red-listed
Killer Whale (transient)	*O. orca*	• Threatened - SARA Schedule 1 • BC red-listed
Pinnipeds		
Steller Sea Lion	*E. jubatus*	• Special Concern – SARA Schedule 1 • BC blue-listed
Other		
Sea Otter	*E. lutris*	• Special Concern – SARA Schedule 1 • BC blue-listed
Leatherback Turtle	*Dermochelys coriacea*	• Endangered – SARA Schedule 1 • BC red-listed
Northern Abalone	*Haliotis kamtschatkana*	• Endangered – SARA Schedule 1 • BC red-listed



LEGEND

- Marine Local Study Area (LSA)
- Marine Regional Study Area (RSA)

Mammal Obeservations

- Misc Toothed Whales
- Other Baleen Whales
- Harbour Porpoise
- Humpback Whale
- Killer Whale

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

Reference:
1.Sightings data from the B.C. Cetacean Sightings Network.2013. Vancouver Aquarium Marine Science Centre and Fisheries and Oceans Canada. Data not corrected for effort. Used with permission.
2.Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS, NPS

SNC • LAVALIN

CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 7-3: Marine Mammals

0 1,200 2,400 4,800 7,200 9,600 Meters

BY: SS	DATE: 2016/07/15	SCALE: 1:115,000	REF No: 633752-103-003	REV: 0
CHK'D: CR	PROJ COORD SYS: NAD 1983 UTM Zone 9N			

MXD Path: P:\LOBIE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_103_003_AltaGas_Marine_Mammals.mxd

7.2.2.4 Marine Resource Use

The two potential effects considered in this Marine Resources VC effects assessment are:

- Reduction in access to and reduction in numbers of fish that support CRA fisheries.
- Interference with the navigation of existing marine resource users.

Project effects may originate from the potential for accidents and malfunctions (see Section 15, Accidents and Malfunctions). The sections below provide baseline information for three main marine resource uses in the RSA (PRPA navigational) waters:

- Commercial marine vessel traffic (associated with the PRPA and Port Edward Harbour Authority)
- Commercial and recreational fishing
- Recreational boating

7.2.2.4.1 Commercial Vessel Traffic

The following commercial facilities are part of the Port of Prince Rupert and contribute marine traffic to the RSA: Fairview Container Terminal, Westview, Ridley Terminals (coal, petroleum coke, dry bulks, and liquid bulks); Pinnacle Pellets (wood pellets); Prince Rupert Grain Terminal; Northland Cruise Terminal; the BC Ferries Terminal; the Alaska Marine Highway Terminal; and the Atlin Terminal (small cruise ships) (AtlaGas 2015). The Canpotex Potash Terminal and several LNG facilities with marine terminals have been proposed for the region and could result in a large increase in vessel traffic in the next decade (Stantec 2014).

DNV (2013) reported on the mix of commercial vessels movements tracked by PRPA in 2012 and indicated that about 885 vessel movements per year could be attributed to the following:

- BC Ferries – 443
- Container vessels – 130
- Grain bulk carriers – 112
- Coal/wood pellet carriers – 107
- Log bulk carriers – 32
- Tugs and barges (with or without tows of logs, general cargo, containers, bulk, oil and other) – 31
- Cruise ships – 25
- Tankers – 5

7.2.2.4.2 Commercial and Recreational Fishing Vessels

Major commercial fisheries that have occurred historically, and may operate present-day, within the RSA include Dungeness Crab (trap), Humpback (*Pandalus hypsinotus)* [historical], Pink (*P. borealis)*, and Side-stripe Shrimp (*Pandalopsis dispar*) (trawl), and salmon (seine and gillnet) (BCMCA Atlas 2016). Other minor fisheries that could occur in the RSA include Green Sea Urchin (*Strongylocentrotus droebachiensis)*, Tanner Crab (*Chionoecetes bairdi)*, Eulachon (*Thaleichthys pacificus)*, and Pacific Herring (*Clupea pallasii*) (DFO 2016).

Recreational fishing in small boats (<10 m length) most frequently occurs for Pacific Salmon, Pacific Halibut (*Hippoglossus stenolepis)*, rockfish, and Dungeness Crabs (BCMCA 2016). Stantec (2014a) also reported that five First Nation communities (Metlakala, Lax Kw'alaams, Gitxaala, Kitselas, and Kisumkalum First Nations) depend on several marine species for food, social or ceremonial purposes including Pacific Salmon, Pacific Halibut, Pacific Herring, Eulachon, shellfish, and bivalves. The effects of the Project on current and traditional use of land and resources are discussed in Section 14.

Fishing can occur throughout the RSA throughout the year (depending on the species) but fishers must abide by rules set forth by the PRPA, including no fishing with nets in the inner harbour, no unattended nets, no trap fishing in the inner harbour within 100 m of any berth, jetty, or structure used by watercraft, or within designated aircraft landing zones. Crabbing will not be permitted in the harbour at any location that could constitute a hazard to navigation or to the safety of persons (PRPA 2008). Recreational and subsistence fisheries can obtain permits from the PRPA to fish within the inner harbour as long as they don't interfere with navigation (Stantec 2011).

Commercial and recreational marine users do not transit through the LSA because of the existing RTI jetty. Vessel traffic camera monitoring data collected by PRPA in 2013 (Stantec 2014) indicate that the Coast Islands, just south of the Project LSA, had no recorded recreational, fishing or commercial vessel counts. In comparison, about 1,000 vessels transited through Flora Bank, and about 5,000 vessels were counted in Porpoise Channel primarily in July and August. Most recreational and commercial vessels leaving Port Edward via Porpoise Channel head northwest towards the Kinahan Islands and generally do not follow the western shoreline of Ridley Island past the Coast Islands and towards the RTI jetty.

7.2.2.4.3 Recreational Vessel Traffic

In addition to PRPA, Port Edward Harbour Authority serves small craft harbours in each of the small vessel marinas in Prince Rupert and Port Edward (Fairview Harbour, Porpoise Harbour, Rushbrook Harbour, and Cow Bay Harbour). There are several other types of marine facilities within Prince Rupert and Port Edward including marinas, yacht clubs, public wharves, and coastal ecotourism and fishing lodges.

Recreational activities in the area include recreational boating (powered and self-propelled) and tourism activities associated with the nearby Kitson Island Marine Provincial Park located approximately 5 km south of the Project site. The Kitson Island Marine Provincial Park located at the mouth of the Skeena River was established in 1993 and is managed under a Collaborative Management Agreement between BC Parks and the Metlakatla and Lax Kw'alaams First Nations (AECOM 2011). Further, it was identified in AECOM (2011) that the PRPA will not consider development of this Island or of other nearby areas within its jurisdiction that can be demonstrated as having a deleterious effect on the environmental value of Kitson Island.

Four Coast Guard Stations (CGS) (with up to 90 staff) are located in the North Coast. One of these stations is located in Prince Rupert at the Seal Cove Seaplane Base. The Prince Rupert Canadian Coast Guard Station offers services to assist maritime safety (DFO 2007).

7.3 Assessment of Potential Adverse Environmental Effects

The Project will be constructed and decommissioned entirely within the AltaGas sub-lease site, effects on marine resources will not occur. Further, no construction activity is proposed to occur below the high water mark (HWM) and thus effects on marine fish and marine species-at-risk are expected to be negligible. In the context of this effects assessment, a negligible effect is defined as changes/effects that are sufficiently small that they are difficult to measure and/or do not differentiate from baseline conditions. Therefore, it is not anticipated that Project construction and decommissioning activities will affect marine resources and they will not be considered further in the assessment of adverse environmental effects of Project construction activities on the Marine Resources VC.

The potential interactions between the Project and the marine resource VC are anticipated to occur during the operation phase and to occur as a result of accidents and malfunctions during the berthing of LPG carriers and the transit of these carriers through waters within PRPA jurisdiction.

7.3.1 Potential Interactions of the Project

Potential interactions between Project activities occurring in the LSA and RSA and the four subcomponents of the Marine VC are described in Table 7-7.

Project-VC interactions were categorized as follows:

- N = no interaction;
- M = minor interaction; and
- CF = interaction to be considered further in the environmental evaluation.

A minor interaction (M) results in an adverse effect that will be eliminated or reduced to negligible by using effective and established mitigation measures or best management practices.

All Project-VC interactions categorized as CF in Table 7-7 are assessed in more detail below (in Section 7.3.2) since there is reasonable level of uncertainty that there may be an effect and whether the effect may exceed acceptable levels or standards without implementation of project-specific mitigations and may result in residual adverse effects.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Table 7-7: Project Interactions with the Marine Resources VC

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Marine Habitat	Marine Mammals	Marine Species-at-Risk	Marine Resource Use
Construction Activity					
C-1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	N	N	N	N
C-2	Site blasting which may involve explosives manufactured off site.	N	N	N	N
C-3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	N	N	N	N
C-4	Relocation and reconstruction of existing settling ponds. Involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sublease within RTI lease land.	N	N	N	N
C-5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	N	N	N	N
C-6	Construction of tracks.	N	N	N	N
C-7	Re-grading of existing sidings on RTI lease land.	N	N	N	N
C-8	Connection to BC Hydro grid on PRPA lands.	N	N	N	N
C-9	Upgrade to Existing Jetty: Installation of piping and loading arms.	N	N	N	N
C-10	Installation and hydrotesting of refrigerated storage tanks and equipment.	M	M	M	M
C-11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	N	N	N	N
C-12	Installation of a new vehicle access bridge to RTI coal stockyard area.	N	N	N	N
C-13	Local transport of materiel and personnel to and from the site and PRPA lands.	N	N	N	N

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Marine Habitat	Marine Mammals	Marine Species-at-Risk	Marine Resource Use
Operation and Maintenance					
O-1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	N	N	N	N
O-2	Gas powered compression, supplemented with BC Hydro power to provide approximately 15 MW.	N	N	N	N
O-3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring twice a year and otherwise only in the case of emergencies.	N	N	N	N
O-4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	N	N	N	N
O-5	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	N	N	N	N
O-6	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12 - 18 months.	N	N	N	N
O-7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	N	N	N	N
O-8	Refrigerating and storing propane. Propane is passed through a heat exchanger where it is chilled to approximately -42 C and transferred to a refrigerated storage tank.	N	N	N	N
O-9	Propane delivery to the carrier via new piping driven by electric pumps. Loading will occur once every 15 to 20 days and take approximately 40 hours.	CF	N	N	N
O-10	Berthing of LPG carriers at the RTI jetty.	CF	M	M	M
O-11	LPG carrier movements in PRPA navigational jurisdiction.	N	CF	CF	CF
Decommissioning					
D-1	Removal of land-based above-ground infrastructure on sub-lease site.	N	N	N	N
Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor interactions mitigated with well-known industry standards and best management practices that result in negligible effects and are not considered further in the environmental evaluation; and CF = interaction to be considered further in the EE.					

7.3.2 Assessment of Potential Effects

The potential adverse environmental effects of the Project on the Marine Resources VC are summarized in Table 7-7 and are restricted to the following:

- Disturbance to marine resources resulting from operational activities (e.g., berthing) that might potentially disrupt resting or foraging of marine species around the RTI jetty within the LSA;
- Disturbance of marine resources resulting from LPG carrier movements within the RSA; and
- Collision with marine resources resulting from LPG carrier movements within the RSA.

The potential adverse environmental effects associated with these potential interactions are assessed below.

7.3.2.1 Construction Phase

No interactions during the construction phase were carried forward into the Marine Resources VC effects assessment. A minor interaction with hydrotesting may occur and is discussed below (Refer to Section 6, Water Quality for a detail regarding the hydrotesting activity).

C-10 – Hydrotesting is expected to have no adverse residual affects to marine resources as the hydrotesting waters will be returned to the marine environment, clean and of adequate temperature as not to affect any resources that may be in the vicinity of the discharge at the time of release. It is expected that waters used in hydrotesting of LNG storage tanks will be relatively benign and appropriate mitigation measures will be applied before discharge into the marine environment and thus will not result in any adverse environmental affects to Marine Resources.

For works proposed on the Jetty, no interaction was identified because all work will be done using a floating barge. The barge will be connected to the jetty and therefore no interaction with anchors and the seabed or piles driven to keep in place. The barge will be temporary and thus low likelihood of detectable effect from shading. It was assumed that the barge would be considered a vessel to the jetty. There will be no discharge of waste water, it will not be aground, and best practices for its use would be followed.

7.3.2.2 Operations Phase

There are three potential interactions during the operations phase that were carried forward into the Marine Resources VC effects assessment. These interactions were identified as Operations (O-9): Propane delivery to the carrier via new piping driven by electric pumps. Loading will occur once every 15 to 20 days and take approximately 40 hours; Operations (O-10): Berthing of LPG carriers at the RTI jetty once every 15 to 20 days; and Operations (O-11): LPG carrier short term (1-2 hours) transit through PRPA navigational jurisdiction.

All other potential interactions identified in Table 7-7 during the operations phase were categorized as having no interaction (N), therefore no effect on marine resources resulting from these other interactions is anticipated to occur during the operations phase.

7.3.2.2.1 Disturbance of Marine Resources Around the Jetty

The operations phase activity (O-10): Berthing of LPG carriers at the RTI jetty has the potential to result in disturbance to Marine Resources. During normal operations, propane will be piped from on-land storage facilities to a berthed gas carrier at the RTI jetty. The propane supply loading arm located along the jetty will require additional lighting for safety reasons (AltaGas 2016). The RTI jetty currently has lighting and the additional lighting due to new Project related activities is expected to have a negligible effect on marine resources in the LSA since:

- New lighting will represent a small increase in existing lighting.
- New lighting is comparable to the existing lighting on the jetty.
- Additional lighting will be used during two night-time periods while one gas carrier is loaded every 15-20 days.
- No marine species-at-risk have been noted to occur around the jetty or within the LSA, and majority of the species diversity observed was found in the lower intertidal and shallow subtidal portions of the LSA and is unlikely to be affected by the temporary use of additional lighting.
- Light affects related to the Project are detailed in Section 12, Light.

Berthing of LPG carriers at the RTI jetty may result in increased disturbance to local marine resources in the LSA due to increased underwater noise or increased water column turbidity from carrier or tug propeller wash. Cetaceans and pinnipeds rely on underwater sounds to communicate, orient, navigate, socialize, locate and detect mates, avoid predators, and capture prey (WWF 2013). The potential effect of anthropogenic ship-based sources of underwater noise on marine mammals includes modification of behavioral responses, communication masking, auditory injury, temporary habitat displacement or reduced forage fishing or disrupted social behaviours (DFO 2015b).

The interaction between the berthing of a gas carrier and marine resources in the LSA was identified as negligible for the following reasons.

- The RTI jetty has a berth-side depth of 22 m (low tide) and is capable of handling vessels of 250,000 DWT; LPG carriers are about 65,000 DWT (AltaGas 2016).
- The Jetty has been used by RTI as a bulk coal carrier loading facility for more than three decades. Minor modifications (described in Section 2.3.1.4) are required to the RTI jetty to handle the Project's LPG carriers (AltaGas 2016).
- It is anticipated that one gas carrier will be in berth at the RTI jetty every 15 to 20 days, and remain at berth for about 40 hours. Given the low frequency of vessel occurrence and short duration within the RSA/LSA underwater noise generated from one LNG carrier every 15-20 days on local marine mammals is considered transient.

Prop-wash from the two support tugs and gas carrier during berthing is anticipated to have a negligible effect on marine resource habitat because of the natural deep depth of the berth and because no dredging is required at the berth. The past three-decades of use of the jetty by RTI coal bulk carriers does not appear to have resulted in increased turbidity based on results of nearby water quality monitoring.

Underwater noise generated from support tugs manoeuvring the gas carrier into position is expected to occur for less than an hour in duration every 15-20 days, and will only result in temporary avoidance of the area by marine fish or mammals, if present.

Finally, interactions between marine mammals and the berthing of a gas carrier at the RTI jetty are considered negligible because:

- Very few historical observations of marine mammals or marine mammal species-at-risk have been made within the LSA (Figure 7-3); and
- LPG carriers will arrive once every 15-20 days and take about an hour to berth.

Overall, the effect on marine resources resulting from LPG carriers at the RTI berth during operations is considered negligible and can be mitigated through effective and established mitigation applied to carrier movements as described in Section 7.3.3.

7.3.2.2.2 Disturbance of marine resources during carrier transit

LPG carriers may interact with marine mammals through temporary behavioral disturbance due to vessel movements and the accompanying underwater noise that has the potential to disrupt cetacean life processes such as communication, resting and foraging (DFO 2015a).

Stantec (2014) used a sound propagation model to map underwater sound levels generated by a LNG carrier (that would be almost 2.5 times larger than any proposed LPG carrier) with an escort tug moving over deep water between Ridley Island and the Triple Island Pilot station. The sound pressure level distance (95% radii) that exceeded the 120 decibels (dB) marine mammal behaviour disturbance criteria (threshold; NOAA 2015) for continuous sound was 15 km during berthing and 7-8 km while transiting at 12 knots to Triple Island Pilot station with one escort tug (Stantec 2014). For the purposes of this assessment it was assumed that a similar or lower underwater noise distance radii could be generated with a LPG carrier and one escort tug, since vessels over about 100 m have similar sound generating properties (e.g., WWF 2011). Although the vessels are generating a wide spatial sound profile, the LPG carriers are transiting from the RTI jetty through PRPA marine jurisdiction in less than an hour. Hence, marine mammals that might occur in the RSA at the time of transit or berthing of LPG carriers would be temporarily exposed to underwater noise that exceeds the behaviour disturbance criteria for about a few hours every 15-20 days (one arrival and one departure). As the number of LPG carrier movements will be noticeably less than the maximum number of vessel movements over the last 10 years, many fewer movements than those associated with proposed LNG carriers, and less than the maximum allowed in PRPA waters, the effect of underwater noise on marine mammals is considered negligible.

7.3.2.3 Decommissioning

There are no potential interactions during the decommissioning phase that were carried forward into the Marine Resources VC effects assessment; therefore, no disturbance of marine resources around the jetty is expected.

7.3.3 Mitigation Measures

Mitigation measures for the potential adverse environmental effects of the Project on the Marine Resources VC are outlined below for construction, operation and decommissioning phases. As mitigation measures often overlap for multiple Project activities and can be specific to individual VC sub-components, mitigation measures have been provided by Project phase and VC rather than Project activity to reduce repetition.

7.3.3.1 Construction Phase

Potential adverse effects on the Marine Resources VC during construction are expected to be negligible; however, the effective and established mitigations shown below should be implemented on the upland portion of the site during construction to further avoid or minimize potential adverse effects on Marine Resources VC subcomponents that are present in the LSA, as.

- M-1: Ensure that equipment and vehicles are in good repair and are not leaking fluids.

- M-2: Develop a spill response plan and having spill kits in all vehicles.
- M-3: Apply best practices to construction including containment of construction and hazardous wastes.
- M-4: Prevent sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.
- M-5: Ensure that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.
- M-6: Conduct refuelling and servicing of equipment at least 30 m from any water body.
- M-7: Use work area lights that have shades designed to direct light down where it is needed for construction and minimize light directed sky-ward.

7.3.3.2 Operations Phase

Potential adverse effects on the Marine Resources VC during operations are expected to be negligible when the following effective and established mitigation measures directly related to berthing and mooring of LPG carriers at the RTI jetty are employed:

- M-8: Reducing potential effects from berthing of LPG carriers at the RTI jetty will require the use of the vessel management procedures and standards and practices from the RTI "Terminal Rules and Regulations" and the PRPA Port Information Guide (2015).
- M-9: Mandatory jetty procedures – RTI has advised AltaGas that they will update the "Terminal Rules and Regulations" document as well as producing a "Port Information Booklet" specific to the handling of propane at the marine jetty if the Project proceeds. These documents will provide mandatory procedures and regulations, as well as general information for the LPG carrier to follow prior to arrival and while moored at the berth.
- M-8 and M-9 are expected to effectively mitigate the potential adverse effects during operations, and the following mitigation practices identified here will also help to avoid or mitigate the effects of the Project on the fish present in the LSA and/or RSA:
  - A: Tug assistance – RTI intends to comply with tug escort requirements that are defined in the PRPA's "Harbour Practices and Procedures" guidance. Detailed tug requirements will be determined in consultation with the Pacific Pilotage Authority, Transport Canada, and the Canadian Coast Guard once berthing studies and navigation simulations are completed.
  - B: Carrier berthing – Harbour tugs will be required to meet the carrier at the direction of the Pilot and Master to assist the carrier in safely berthing and mooring at the RTI jetty.

- C: Docking – A docking aid system will be installed at the existing jetty to assist the pilots and terminal operators in carrier berthing. The system will monitor and display the carrier's approach speed, distance and angle with respect to the berthing dolphins. The system improves the safety of the berthing operation and reduces the risk of abnormal berthing events by allowing the Pilot to manage the carrier's speed and approach vector in order to verify that the approach procedure is within the specified terminal limits.
- D: Ballast – Inbound carriers arriving in a ballasted condition will normally berth with their port sides to the loading platform allowing for the bow of the carrier to be head on into the prevailing current and wind direction.
- E: Carrier mooring – The existing mooring points are expected to be sufficient for safe mooring of the carriers calling at facility for the Project. Mooring lines will be secured to quick release hooks. The number and placement of the mooring lines will be determined for each size of carrier during the detailed engineering phase of the Project.
- F: Limiting environmental operating conditions – Operational safety limits will be established to cover visibility, wind and sea conditions. The preliminary limiting environmental operating criteria are as follows:
  - Berthing maximum wind speed: 20 m/s (40 knots)
  - Loading/unloading shutdown maximum wind speed: 25 m/s (50 knots)
  - Loading/unloading arm disconnect maximum wind speed: 30 m/s (60 knots)
  - Carrier to vacate berth: 32.4 m/s (63 knots)
  - Maximum current: 2.5 knots
  - Minimum visibility: 1.0 km
- G: Meteorological and oceanographic sensors will be installed to monitor: wind speed and direction, current speed and direction, visibility, tidal changes, and wave height and direction. Real-time data from the sensors will be transmitted to the control room for display and logging.
- H: Cargo transfer – All loading equipment on the jetty will be controlled by a central control room located on RTI lease land on Ridley Island. Topside equipment and systems can be categorized into cargo transfer systems, safety and security systems, emergency response systems, carrier services, and control systems. The cargo transfer system includes marine loading arms, manifolds, pipelines, booster pumps and valves. All cargo pipelines and hoses connecting the carrier to the marine terminal will conform to industry standards.

- I: Safety zone – A safety zone at the berth face will be established around the facility for safety purposes in consultation with RTI, PRPA and Transport Canada.
- J: Emergency response – AltaGas will work with RTI to establish and manage all land-based ERPs to avoid the discharge of contaminants from land based activities to the marine environment. The plans will be established after detailed engineering is complete and prior to construction and/or operation.
- K: Pilotage – Pilotage requirements will be in accordance with the PRPA's "Harbour Practices and Procedures", the Canada Shipping Act, the federal Pilotage Act, and the Pacific Pilotage Requirements.
- L: Marine communications – The minor interaction between LPG carrier vessels and marine mammals in the RSA will be mitigated and reduce to negligible using well-known and established vessel management practices as outlined in the PRPA Port Information Guide (2015).
- M: Carrier speed – Carrier transit speed will be determined by the Pilot and Harbour Master to account for safe navigation, reduced collision with other vessels, and reduced interaction with marine mammals.

7.3.3.3 Decommissioning Phase

Providing that all effective and established mitigations identified for the upland portion of the site during construction are implemented during decommissioning (to avoid or minimize potential adverse effects on Marine Resources VC subcomponents that are present in the LSA), potential adverse effects on the Marine Resources VC during decommissioning are expected to be negligible.

7.3.3.4 Accidents, Malfunctions and Unplanned Events

Potential adverse effects on the Marine Resources VC associated with accidents, malfunctions and unplanned events are expected to be negligible as long as the effective and established mitigations for an LPG carrier accident at the wharf, an LPG accident in transit in PRPA waters and a LPG carrier collisions with other vessels identified in Section 15 are followed.

7.3.3.5 Summary of Potential Adverse Effects and Mitigation

A summary of potential adverse effects and recommended mitigation measures is provided in Table 7-8.

Table 7-8: Summary of Potential Adverse Environmental Effects and Mitigation

Phase/Activity	Description of Potential Adverse Effect	Recommended Mitigation	Mitigation Code	Residual Effect (Y/N)
Construction/ C1-C13	No direct effects identified.	• Standard and well known mitigations used during construction on land when adjacent to water.	M-1 to M-7	N
Operations/ OM-9, OM-10, and OM-11	Disturbance of marine resources around the jetty. Disturbance of marine resources during carrier transit. Potential collision during carrier transit.	• Vessel management procedures.	M-8	N
		• Mandatory jetty procedures.	M-9	
Decommissioning/ D1	No direct effects identified.	• Standard and well known mitigations used during decommissioning on land when adjacent to or over the water.	M-1 to M-7	N

7.3.4 Characterization of Residual Effects and their Significance

Based on the information presented in the above sections, the small Project footprint on the existing RTI jetty, combined with no below high water mark construction, and intermittent LPG carrier usage of the RTI jetty, it is concluded that the Project will result in negligible effects on Marine Resources. With the implementation of effective and established mitigation measures identified in Section 7.3.3, it is anticipated that the Project will not have any significant effects on the Marine Resources VC, and residual adverse effects will be negligible.

In the absence of residual effects on the Marine Resource VC a characterization and determination of significance for the Marine Resource VC is not required.

7.4 Cumulative Effects

As there are no residual effects on Marine Resources there is no potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents.

7.5 Follow-up Strategy

Environmental Management Plans identified for the Marine Resources VC will be implemented to verify the effectiveness of the mitigation measures to address concerns for the possible effects of accidents and malfunction during the operations phase of the Project. Table 7-9 provides a summary of the EMPs and related monitoring programs.

Table 7-9: Summary of all EMPs and Related Monitoring Programs Associated with the Marine Resources VC

Environmental Management Plan	Proposed Monitoring Plan*
Construction Environmental Management Plan	
Spill and Emergency Response Plan	Aquatic Monitoring to support the effectiveness of the plan if required at the time of an accident
Water Quality Management Plan	Aquatic Monitoring to support the effectiveness of the plan if required at the time of an accident
Operation Environmental Management Plan	
Water Quality Management Plan	Aquatic Monitoring to support the effectiveness of the plan if required at the time of an accident
Spill and Emergency Response Plan	Aquatic Monitoring to support the effectiveness of the plan if required at the time of an accident
Marine Mammal Monitoring Plan	Marine mammal monitoring in collaboration with PRPA
Decommissioning Environmental Management Plans	
Water Quality Management Plan	Aquatic Monitoring to support the effectiveness of the plan if required

*Details of any proposed monitoring programs will be determined in discussion with RTI and PRPA.

8 FISH

This Section presents the assessment of the Fish Valued Component (VC).

8.1 Context

Freshwater and marine fish, including finfish, shellfish, and fish species-at-risk, were considered as a VC due to their importance to local communities, conservation concerns, and the potential for interactions with the Project.

Ridley Island is included in the PRPA land use management plan and is zoned for industrial use and port terminal development (AECOM 2011). The AltaGas sub-lease site on Ridley Island is an existing industrial site, and was originally cleared in the 1980s and then again in 2010, grubbed in 2011 and graded in 2012 (Stantec 2011; WorleyParsons 2013a). The sub-lease site is currently occupied by a partially completed sulphur export facility that will be decommissioned and removed (AltaGas 2016).

There are no natural water courses on the sub-lease site, and surface run-off originating onsite is gathered in drainage ditches and a settling pond. A manually controlled weir system is used to drain the settling pond into the foreshore of Chatham Sound (AltaGas 2016). Given the history of previous disturbance to the sub-lease site, no freshwater fish or fish habitat are present (WorleyParsons 2013a), and are therefore not considered further in this effects assessment.

8.1.1 Overview and Regulatory Setting

8.1.1.1 Federal

8.1.1.1.1 Fisheries Act

The main section of the Canada *Fisheries Act* (2012) that applies to the Fish VC effects assessment is Section 35 and the Fisheries Protection Program, which require that “no person shall carry on any work, undertaking, or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal (CRA) fishery, or to fish that support such a fishery. The *Fisheries Act* defines serious harm to fish “as the death of fish or any permanent alteration to, or destruction of, fish habitat”, and where habitat includes both the biotic and abiotic components of aquatic systems that are used by the fish species under consideration. Under the *Fisheries Act*, “fish” are defined as all fish, shellfish, crustaceans and marine animals, and their eggs, spawn, spat and juvenile stages of fish, shellfish, crustaceans and marine animals. “Fish habitat” is defined as the spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes. Marine mammals and habitats that are protected under the *Fisheries Act* are addressed in the Marine Resources VC effects assessment (Section 7.0).

8.1.1.1.2 Species At-Risk Act

Species of conservation concern are afforded legal protection under the *Species at-risk Act* (SARA). SARA is a federal commitment to prevent “at-risk” wildlife species from becoming extinct and to implement the necessary actions to secure their recovery and conservation. SARA provides a legal framework for the protection of wildlife and conservation of biological diversity in Canada.

8.1.1.2 Provincial

Fish species that are considered to be at-risk in BC are also identified and ranked by the BC Conservation Data Centre (BC CDC). In BC, at-risk species and ecological communities are assigned to one of three lists, based on their provincial Conservation Status Rank. Red-listed species and ecological communities are Extirpated, Endangered, or Threatened in BC. Blue-listed species and ecological communities are of Special Concern (formerly Vulnerable) and Yellow-listed species and ecological communities are secure. Extirpated elements no longer exist in the wild in BC, but do occur elsewhere. Endangered elements are facing either imminent extirpation or extinction. Threatened elements are likely to become endangered if limiting factors are not reversed” (MoE 2016).

8.1.2 Selection of Valued Component

The Fish VC includes marine CRA fish species (finfish and shellfish), non-CRA species (i.e., not fished but ecologically important), and marine fish species-at-risk. Freshwater CRA species, freshwater non-CRA species and freshwater species-at-risk were not included as subcomponents of the Fish VC as there are no freshwater CRA or non-CRA or species at risk on the sub-lease site and there is no potential for Project-VC interactions with these potential freshwater subcomponents (as documented in Section 8.3.1 (8-8)). The fish species included in the effects assessment are described throughout Section 8.2. Table 8-1 summarizes the subcomponents of the Fish VC and the rationale for selection.

8.1.2.1 Sub Components

Sub components of the VC were selected to structure and focus the assessment and have been chosen based on their relevance to the Project and their importance to assessing this VC. Together they enable a comprehensive understanding of the important potential environmental effects of the Project on fish.

The sub-components selected for assessment as part of the Fish VC are listed in Table 8-1.

Table 8-1: Subcomponents of the Fish VC

Subcomponent	Rationale for Selection
Marine CRA species	Potential for interactions with Project operations; accidents and malfunctions; importance to local communities.
Marine non-CRA species	Potential for interactions with Project operations; accidents and malfunctions; importance to ecological communities.
Marine species-at-risk	Potential for interactions with Project operations; accidents and malfunctions; importance to local communities; conservation concern.

8.1.2.2 Indicators

Indicators were selected to qualitatively measure and evaluate change resulting from the interaction of the Project with the Fish VC and its sub components. The selected indicators are considered to be relevant, practical, measurable, responsive, accurate, and predictable. Indicators of change in the Fish VC effects assessment are described in Table 8-2.

Table 8-2: Indicators for the Fish VC

Indicator	Direct or Indirect	Rationale
Likelihood of direct fish mortality.	Direct	Direct measure of *Fisheries Act* serious harm.
Area of fish habitat permanently altered.	Direct	Direct measure of *Fisheries Act* serious harm.
Timing, duration, and frequency of Project activities that may indirectly increase noise disturbance.	Indirect	Change in fish or species-at-risk behaviour due to project disturbance can reduce access to habitats important for completing life stages.

Other relevant VCs (and subcomponents) considered in this document that support and inform the Fish effects assessment include the Marine Resources VC, Water Quality IC (water quality subcomponent) and Terrain IC (sediment quality subcomponent).

Potential environmental effects resulting from storm water and waste water runoff into the marine receiving waters were considered within the Water Quality IC assessment. In general, all storm water and waste water will be discharged into the marine environment and interactions are considered negligible as water quality will meet the existing requirements identified in the waste discharge permit previously issued to RTI pursuant to the Provincial *Environment Management Act*.

8.1.3 Assessment Boundaries

8.1.3.1 Spatial

The spatial boundaries selected for the Fish VC effects assessment are summarized in Table 8-3. The Local Study Area (LSA) is about 48 ha and includes the water lot sub-lease area adjacent to the RTI jetty (Figure 8-1). The Regional Study Area (RSA) provides context for the marine fish resources of the LSA within the marine jurisdiction of the PRPA (Figure 8-2).

Table 8-3: Spatial Boundaries for the Fish VC

Spatial Extent	Description
Local Study Area (LSA) for marine CRA and non-CRA fish species and species-at-risk	Ridley Terminals Inc. (RTI) water lot boundary
Regional Study Area (RSA) for marine CRA and non-CRA fish species and species-at-risk	Prince Rupert Port Authority (PRPA) marine navigational boundary

LEGEND

- Jetty
- Fisheries Local Study Area (LSA)
- Fisheries Regional Study Area (RSA)
- Ridley Terminals Inc. Lease Lands
- Proposed Canpotex Potash Export Terminal
- Proposed Pacific Northwest LNG Project
- Proposed Prince Rupert LNG Project

0 312.5 625 1,250 1,875 2,500 Meters

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS,

SNC • LAVALIN

CLIENT NAME: AltaGas Ltd.

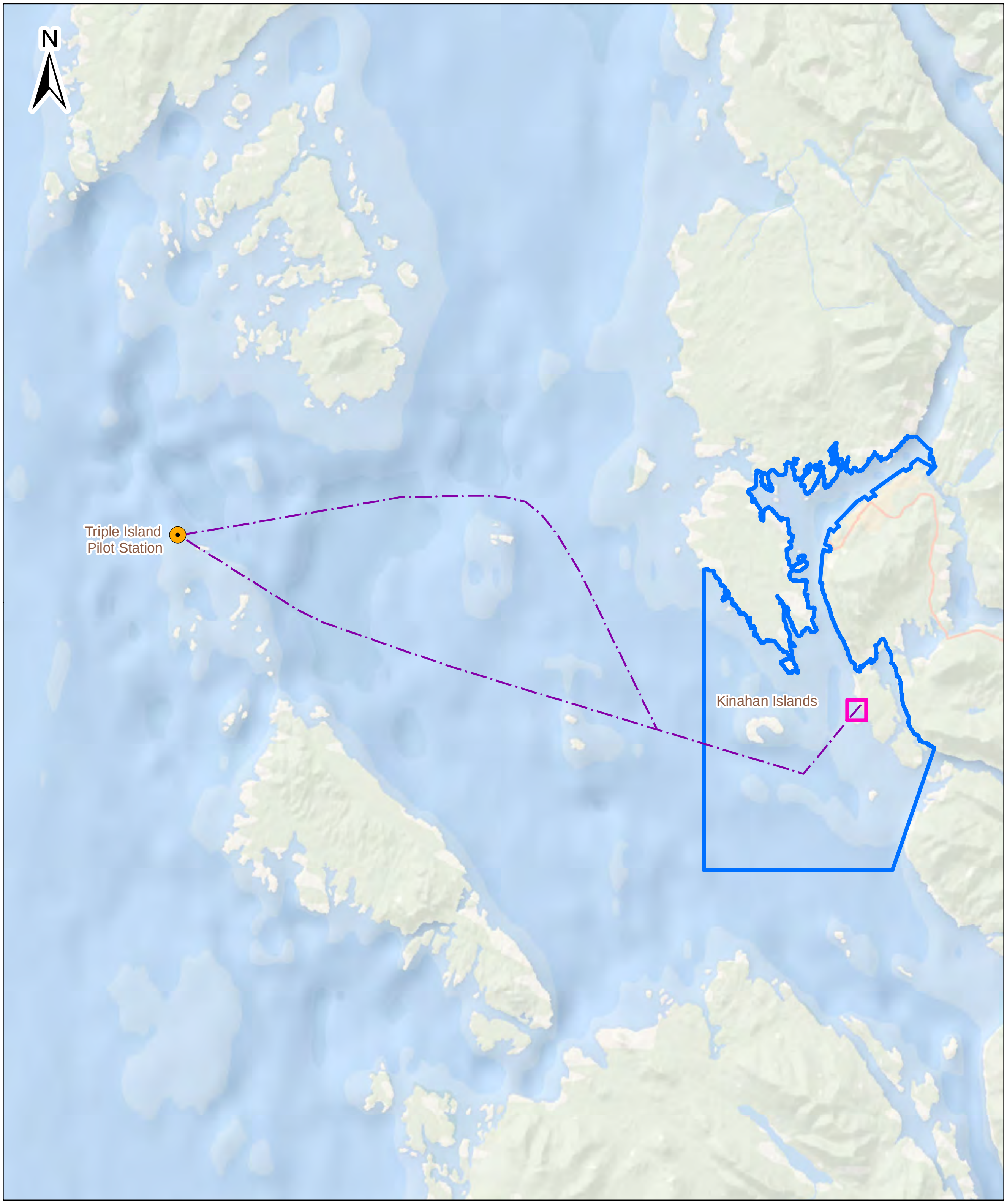
PROJECT LOCATION: Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 8-1: Fisheries Local Study Area

BY: SS	DATE: 2016/06/28	SCALE: 1:30,000	REF No: REV: 0
CHK'D: CR	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-106-001

MXD Path: P:\LOBIEIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_106_001_AltaGas_Fisheries_LSA.mxd

Project Path:



LEGEND

- Triple Island Pilot
- Deep draft routes identified in the Sailing Direction PAC205
- Fisheries Local Study Area
- Fisheries Regional Study Area

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

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CLIENT NAME: AltaGas Ltd.	PROJECT LOCATION: Ridley Terminal Ridely Island, Prince Rupert, BC

Figure 8-2: Fisheries Regional Study Area

0 3,125 6,250 12,500 18,750 25,000 Meters

BY: SS	DATE: 2016/06/28	SCALE: 1:300,000	REF No: REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-106-002

MXD Path: P:\LOB\EIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_106_002_AltaGas_Fisheries_RSA.mxd

Project Path: \\Sli2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\

8.1.3.2 Temporal

Potential adverse effects resulting from the Project were assessed for the main Project temporal phases, including:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

8.2 Existing Conditions

This section describes the existing conditions of the LSA and RSA as it relates to the VC and the sub components. The existing conditions form the baseline by which potential effects to the VC and subcomponents can be measured.

8.2.1 Methods and Data Sources

Information from several recent and local environmental assessments and from public online government and non-governmental organization databases describing existing marine fish and habitat within the LSA and RSA were summarized in this section. No new field studies were conducted due to the minimal Project-related activities performed below the HWM and because of the adequate current existing information.

The following studies were reviewed for the Fish VC effects assessment:

- Sulphur Export Terminal at Ridley Terminals, Ridley Island, Prince Rupert - Environmental Appraisal Document. March 3, 1999. Sulphur Corp of Canada (Sulphur Corp). 1999.
- Comprehensive Study Report - Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor. CEAA. 2012.
- Draft - Habitat Baseline Study. October 22, 2013. WorleyParsons Ltd. (Worley Parsons). 2013a.
- Prince Rupert Marine Risk Assessment – Navigational Risk Assessment Report. February 29, 2012. Det Norske Veritas (DNV). 2013.
- Environmental Impact Statement and Environmental Assessment Certificate Application. Section 13: Marine Resources. Stantec Consulting Ltd. (Stantec) 2014a.
- Application Information Requirements for and Environmental Impact Assessment Certification Application. BG Group. 2014.

- Pacific Northwest LNG – Appendix M – Technical Data Report – Marine Resources. Stantec. 2014b.

The following online databases and resources were also reviewed in support of baseline data generation for this assessment:

- iMap Online Mapping Application (DataBC 2016);
- BC Ministry of Environment (MoE) Species and Ecosystem Explorer (MoE 2016);
- Pacific Coastal Resource Atlas (PCRA) (2016);
- North Coast Watershed Atlas (NCWA) (2015);
- Fisheries and Oceans Canada (DFO) Herring Spawn and Catch Records (DFO 2016a);
- DFO Mapster V3.1 (DFO 2016b);
- DFO Rockfish Conservations Areas (RCA) (DFO 2016c);
- DFO Shellfish Contamination in the Pacific Region (DFO 2016d); and
- Federal SARA Registry (GoC 2016).

8.2.2 Description of Baseline Conditions

The Project will be built on an existing industrial brown field sub-lease site within RTI lease land and PRPA jurisdiction (AltaGas 2016). Ridley Island falls under the Port of Prince Rupert 2020 Land Use Management Plan (AECOM 2011) that designates zoning for industrial and port terminal development, including the provision for dry and liquid bulk terminals. All new construction will take place on the previously cleared brown field site and will build upon existing RTI marine infrastructure. No new construction will occur below the natural high water mark or in the marine water lot lease area. The RTI jetty has a berth-side depth of 22 m at low tide and is capable of handling vessels of 250,000 DWT. LPG carriers are about 65,000 DWT (AltaGas 2016) and therefore the RTI jetty will not require any in water works modification.

The total number of commercial vessel calls at the RTI jetty from 2005 until 2015 ranged from 54 in 2015 to 130 in 2010, with an average of 89 vessels per year (Table 8-4). Projected total number of vessel calls for 2016 and 2017 is 33 on average (see Table 8-4), excluding the anticipated 20 to 30 additional Project carriers.

Table 8-4: Number and Type of Commercial Vessels Calling at the RTI Jetty Since 2006

Year	Total Vessel Calls at RTI Jetty by Vessel Type					
	Handymax	Supramax	Panamax	Baby Cape	Cape	Total
2006	24	4	23	5	2	**58**
2007	15	5	35	8	14	**77**
2008	18	8	35	6	14	**81**
2009	24	11	35	2	9	**81**
2010	22	16	57	7	28	**130**
2011	5	2	53	13	29	**102**
2012	1	0	57	9	47	**114**
2013	0	0	62	11	46	**119**
2014	1	0	47	1	25	**74**
2015	0	0	41	2	11	**54**
2016	0	0	30	0	3	**33**
2017	0	0	33	0	0	**33**

Note: 2016 and 2017 are projected numbers provided by RTI.

8.2.2.1 Marine Commercial, Recreational, or Aboriginal Fisheries Fish

Stantec (2014a) noted that fish species with commercial, recreational, or cultural value that were likely present in both the LSA and RSA were Pacific salmon (*Oncorhynchus* species), Pacific Herring (*Clupea pallasii*), Eulachon (*Thaleichthys pacificus*), Dungeness Crab (*Metacarcinus magister*), and several species of shrimp.

WorleyParsons (2013b) reported results from intertidal transect surveys and boat-based underwater video surveys conducted in spring 2013 at the RTI facilities. The field surveys documented marine fauna using intertidal and subtidal habitats in the LSA. Raw underwater video was reviewed and classified using standard methods to generate records of substrate class, marine algae, and fauna. Four major habitats categorized by algal communities and substrates were identified in the upper to lower intertidal zone: unvegetated boulder, Fucus on boulders, red algae band on smaller rocks, and a lower intertidal band of kelp on boulders. Subtidal habitat beyond the narrow kelp band was mainly mud and silt with scattered organic debris with small amounts of bedrock in the southern portion of the LSA (see the Marine Resource VC effects assessment for further details).

The marine CRA fish species observed during the WorleyParsons (2013b) surveys included Dungeness Crab that were moderately abundant in the southern portion of the LSA, and flatfish including English Sole (*Parophyrs vetulus*) and Starry Flounder (*Platichthys stellatus*). Overall, relatively few finfish were observed, likely because visibility during the underwater video survey was

<1 m due to the high turbidity generated by the Skeena River discharge. The narrow band of kelp on boulder habitat in the lower intertidal and shallow subtidal habitat described in WorleyParsons (2013b) likely offers suitable foraging habitat for other marine CRA fish species that were not directly observed, such as greenlings, Lingcod (*Ophiodon elongatus*), and rockfish. Approximately 95% of the subtidal area in the LSA is mud/silt and thus offers limited habitat for kelp-dependent marine CRA finfish (WorleyParsons 2013b).

Ocean Ecology (2009) completed a subtidal survey on the west side of Ridley Island in support of the environmental assessment of the Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor. The subtidal video survey included completion of 17 transects to characterize subtidal areas that may be impacted by construction of the marine causeway, trestle and berth. A number of commercially important soft-sediment dwelling invertebrates were observed during the subtidal video survey, including spiny pink shrimp (*Pandalus borealis eous*), Dungeness crabs (Metacarcinus magister), spot prawns (*Pandalus platyceros*), geoduck clams (*Panopea abrupta*), California sea cucumbers (*Parastichopus californicus*), and scallops (*Chlamys* spp.) (Stantec 2011; Ocean Ecology 2009). Keystone Environmental Ltd. (2007) conducted an environmental assessment for a sulphur forming; handling and storage facility on RTI leased lands. Geoduck siphons were observed during an underwater survey along transect 2 that ran perpendicular from shore for about 50 m into water of about 10 m deep. The transect was located in a small bay to the south of the RTI Jetty where the substrate consisted of 40% silt and 60% sand.

Commercial and recreational crab, geoduck and recreational ground fish, and First Nation food fisheries have been identified within the RSA (PCRA 2016) and seaward towards Triple Island and Stephens Island, but are not present within the LSA.

Integrated Fisheries Management Plans

The RSA falls within DFO Fisheries Management Area 4, sub-areas 4-19 and 4-12, while the LSA falls solely within Management Area 4, sub-area 4-12. DFO uses Integrated Fisheries Management Plans (IFMPs) to guide the conservation and sustainable use of CRA fisheries. An IFMP is developed to manage the fishery of a particular species in a given region. The LSA and RSA are located within 13 DFO fisheries Management Areas (see Table 9-5) covered by Pacific Region IFMPs (DFO 2016b). The Management Areas listed below were identified within the LSA or RSA. Note that there are several Geoduck Management areas west of the proposed project LSA, all of which are greater than 10 km away.

- Salmon Seine Management Area A;
- Salmon Troll Management Area F;
- Salmon Gillnet Management Area C;

- Red Urchin Management Area RU 17;
- Opal Squid Management Area Coastwide;
- Herring Management Area PR;
- Hake Management Area OHA;
- Groundfish Management Area 5D;
- Crab Management Area B;
- Shrimp trawl Management Area PRD;
- Smelt Management Area NC (areas 1-10);
- Shrimp Prawn Trap Management Area Coastwide; and
- Tuna Management Area.

DFO Important Areas

DFO Important Areas are defined as those areas that are important for species or groups of species based on uniqueness, aggregation, fitness consequences, resilience, and naturalness (DFO 2013). DFO Important Areas are used in determining Marine Ecologically and Biologically Sensitive Areas, geographical areas that warrant enhanced management, (DFO 2013). A review of DFO Important Areas, as identified by DFO Mapster V3.1 (DFO 2016b), indicate that the LSA and RSA overlap with several Pacific North Coast Integrated Management Area (PNCIMA) Important Areas for four marine invertebrate species including Dungeness Crab, Green Sea Urchin (*Strongylocentrotus droebachiensis*), Humpback, Sidestripe and Pink shrimp *(Pandalus sp.; Pandalopsis dispar*), and Tanner Crab *(Chionoecetes bairdi);* and two marine finfish species including Eulachon and Pacific Herring (see Table 8-5).

Table 8-5: DFO Important Areas that Overlap with the LSA and/or RSA

DFO Important Areas	Overlap with LSA	Overlap with RSA
Dungeness Crab	X	X
Green Sea Urchin	X	X
Humpback, Sidestripe and Pink shrimp		X
Tanner Crab		X
Eulachon		X
Pacific Herring	X	X

Pacific Salmon

Pacific Salmon (*Oncorhynchus* sp.) have important ecological, cultural, and fishery roles in coastal BC. Pacific salmon information was collected from DFO Mapster V3.1 (DFO 2016b). Both the LSA and the RSA are located within several salmon conservation units (DFO 2016b), including Chum (*O. keta)*, Coho (*O. kisutch*), Pink (*O. gorbuscha*) (even and odd years), and Sockeye (*O. nerka*) (river). DFO (2016b) identifies five watercourses, Airport Dock Creek, Hays Creek, McNichol Creek, Morese Creek, and Wolf Creek, as salmon escapement streams. All five of these watercourses discharge into marine waters within the RSA (but not the LSA), with Airport Dock, Hays, McNichol, and Morese Creeks discharging into Prince Rupert inner harbour to the north of Ridley Island and Wolf Creek discharging into Porpoise Harbour east of Ridley Island. These watercourses were also within the distribution area for Coastal Cutthroat Trout (*O. clarkii*), Coho, Pink, and Steelhead (DFO 2016b). Spawner escapement data were limited for these areas, but Coho have been observed during several years in Hays Creek since 1980 (DFO 2016b). Pink have been observed often, and Chum and Pink occasionally in McNichol Creek since 1950 (DFO 2016b).

Ocean Ecology (2014) analyzed habitat suitability for juvenile salmonids in and around the Skeena River estuary using a model based on similar concepts to those used for Ecosystem Diagnosis and Treatment (methodology, providing a spatial and temporal ‘snapshot’ of qualitative changes in habitat attributes related to juvenile salmonid survival. From the modelling, Ocean Ecology (2014) concluded that:

- The northwest and southwest shores of Kaien Island and the southwest shore of Ridley Island are poor habitat for all salmonid species as a result of industrialization and the attendant shoreline straightening and hardening, industrial pollutants, and poor water quality resulting from sewage and industrial effluents.
- Flora Bank provides habitat for epibenthic feeding salmonid species (e.g., pink, chum, and Chinook). It is in the direct path of approximately 331 million juvenile salmon outmigrating from the Skeena River, of which about 279 million are epibenthic feeders. Therefore, both location and habitat quality make Flora Bank an extremely important juvenile salmon rearing area.
- Stapledon Island is a high value habitat for all six salmonid species, and is also in the direct path of outmigrating Skeena River juvenile salmonids.
- The southwest shore of Lelu Island and Delusion Bay are highly valuable habitats for neritic feeding species (e.g., Coho, sockeye, and steelhead).
- The shoreline segments in the basins on the east side of Kaien Island and on southeast shore of Prince Rupert Harbour provide important nursery and rearing habitats for salmon outmigrating from the local natal streams.

Over 99% of the juvenile salmon in Ocean Ecology's (2014) study area came from the Skeena River out-migration, with the remaining juvenile salmon from small natal creeks and rivers in the region (e.g., Hays, Oldfield, Silver, McNichol, and Diana Creeks, and Kloiya River). It is likely that juvenile salmon and adult returning salmon can be expected to occasionally occur along the shorelines of the LSA and RSA from spring until late autumn as well as out migrating juvenile salmonids found in the RSA. NCWA (2015) mapping application also identifies salmon migration routes occurring through the RSA, which suggests that salmon are present in these areas at various times.

Halibut

The LSA and RSA fall within the Pacific Halibut Management Area 2B; however, no specific commercial or recreational groundfish fisheries were identified within the LSA (PCRA 2016).

Herring

Pacific Herring have important ecological cultural, and fishery values in coastal BC. DFO has evaluated intertidal and shallow subtidal herring spawning in the RSA, during the late winter and early spring since 1928. Archived DFO spawn information was collected from DFO's Herring Spawn and Catch Records (DFO 2016a). DFO's records indicated that all of the RSA is considered an important area for Pacific Herring (DFO 2016a).

DFO's Cumulative Spawn records for Prince Rupert (Section 042) indicate that both the LSA and RSA have historically had relatively low herring spawn, with some herring spawn recorded along the east coast of Digby Island, and the southeast coast of Kaien Island (DFO 2016a).

Eulachon

The southeastern portion of the RSA, south of the LSA, and adjacent to the Skeena Estuary is considered an important area for Eulachon (DFO 2016b).

Rockfish Conservations Areas (RCAs)

There are no RCAs located within either the LSA or the RSA. The closest RCAs are the Gull Rocks North and Gull Rocks South (DFO 2016b, 2016c) located approximately 500 m west of the western limit of the RSA.

Shellfish

DFO, Canadian Food Inspection Agency, and Environment Canada work together in administering the Canadian Shellfish Sanitation Program, with DFO being responsible for controlling harvesting of shellfish, The LSA and RSA fall within Area 4.3 of DFO's Shellfish Contamination Closures for the Pacific Region (DFO 2016b, DFO 2016d). In relation to this closure, DFO has implemented a permanent bivalve fishing closure for the LSA and several locations within the RSA due to sanitary contamination and marine biotoxins (e.g., paralytic shellfish poisoning, domoic acid poisoning, diarrhetic shellfish poisoning, and vibrio parahaemolyticus gastrointestinal illness) in shellfish.

Summary - Marine CRA Fish

Based on the review of previous consultants' reports and available online resources and databases, several marine finfish and shellfish may occur within the LSA and/or RSA.

Table 8-6 summarizes the marine CRA fish species likely to be found within the LSA and/or RSA.

Table 8-6: Summary of Marine CRA Fish Species Potentially Found Within the LSA and/or RSA

Common Name	Scientific Name	DFO Management Area (MA)	Within LSA	Within RSA
Finfish				
Eulachon	*Thaleichthys pacificus*	Not Applicable (N/A)	Not Likely	Likely
Pacific Herring	*Clupea pallasii*	PR Management Area (MA)	Likely	Likely
Pacific Salmon	*Oncorhynchus sp.*	N/A	Likely	Likely
English Sole	*Parophyrs vetulus*	N/A	Likely	Likely
Starry Flounder	*Platichthys stellatus*	N/A	Likely	Likely
Greenlings	Not specified	N/A	Likely	Likely
Lingcod	*Ophiodon elongatus*	N/A	Likely	Likely
Rockfish species	Not specified	N/A	Likely	Likely
Shellfish				
Dungeness Crab	*Metacarcinus magister*	Crab MA B	Likely	Likely
Green Sea Urchin	*Strongylocentrotus droebachiensis*	N/A	Likely	Likely
Humpback, Sidestripe, Pink Shrimp	*Pandalus* sp.; *Pandalopsis dispar*	Shrimp Trawl MA PRD; Shrimp Prawn Trap MA coastwide	Not Likely	Likely
Tanner Crab	*Chionoecetes bairdi*	Crab MA B	Likely	Likely

8.2.2.2 Marine Non-CRA Fish

WorleyParsons (2013b) reported on results from intertidal transect surveys and boat-based underwater video surveys conducted in spring 2013 at RTI facilities to document marine fauna using intertidal and subtidal habitats in the LSA. Raw underwater video was reviewed and classified using standard methods and included records of substrate class, marine algae and fauna.

The main non-CRA fish species observed during the subtidal surveys include northern ronquil, sculpins, and eelpouts. Relatively few non-CRA finfish were observed likely because visibility during the underwater video survey was <1 m due to the high turbidity generated by the Skeena River discharge. The kelp-boulder habitats described by WorleyParsons (2013b) suggest that other non-CRA marine fish species such as gunnels may also potentially use the shallow subtidal habitats.

8.2.2.3 *Marine Species-at-Risk*

There are eleven marine fish species that occur within the LSA and/or RSA that are considered at-risk species under Schedule 1 of SARA and/or the BC Provincial Species at-risk (Red or Blue). These species can be broken down into nine finfish species and two shellfish species, and of these two finfish and one shellfish species are protected under SARA and/or the Province of BC. The remaining species are considered Special Concern under the SARA and prohibitions listed in the SARA do not apply to these species.

Table 8-7 summarizes those species that are considered at-risk and are protected under the SARA and/or the Province of BC that are likely to be present within the LSA and/or RSA.

Table 8-7: Summary of Marine Fish Species-at-Risk likely to be found within the LSA and/or RSA

Common Name	Scientific Name	SARA Status[1]	Provincial Status[2]	Occurs within LSA (Water Lot)	Occurs within RSA (PRPA Boundary)
Finfish					
Basking Shark (Pacific population)	*Cetorhinus maximus*	Endangered	No Status	Not likely	Possible
Green Sturgeon	*Acipenser medirostris*	Special Concern	Red	Possible/likely[3,6]	Possible/likely[3,6]
Shellfish					
Northern Abalone	*Haliotis kamtschatkana*	Endangered	Red	No suitable habitat[4,5] No observations recorded[5,6]	Suitable habitat may be available offshore of Ridley Island[4] No observations recorded[5,6]

1 SARA - Species at-risk Public Registry. http://sararegistry.gc.ca (GoC 2016)
2 BC Species and Ecosystems Explorer. http://www.env.gov.bc.ca/cdc/ (BC MoE 2016)
3 Environmental Impact Statement (EIS) - Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor, Ridley Island. Stantec. November 2011 (Stantec 2011)
4 Draft Project Description: Rev B. WorleyParsons. July 19, 2013. (WorleyParsons 2013c)
5 Draft Habitat Baseline Study. WorleyParsons. October 22, 2013. (WorleyParsons 2013b)
6 Marine Fish and Invertebrates of Conservation Concern Potentially Occurring within the PNW LNG local study area (Table 1, Stantec 2014b)

Basking Shark

As planktivores, Basking Sharks (*Cetorhinus maximus)* feed on zooplankton and are typically in areas with strong tidal flow. Historically, large groupings of basking sharks were observed in nearshore waters along the west coast of Vancouver Island and in one location along the central mainland coast of BC (GoC 2016); however, only six confirmed sightings in the Canadian Pacific have been reported since 1996 (GoC 2016) Basking Sharks are not likely to be present in the LSA but may possibly be present in the RSA.

Green Sturgeon

Green Sturgeons (*Acipenser medirostris*) spend most of their lives in coastal marine waters, estuaries, and the lower reaches of large rivers (BC CDC 2016a). They ascend rivers to spawn, but specific spawning and rearing habitats are poorly known. The BC CDC (2016a) also notes that Green Sturgeons occur in small numbers along the western coast of Vancouver Island and the Skeena River. Green Sturgeons are possible/likely to be present in the LSA and the RSA.

Northern Abalone

The LSA and RSA are located within the distribution range of Northern Abalone (*Haliotis kamtschatkana*) listed as Endangered in SARA Schedule 1. The habitat type in BC is mostly subtidal with adults usually found at <10 m depth (GoC 2016; BC CDC 2016b). Abalone prefer a firm substrate, usually rock, and are generally found in areas of moderate water exchange (GoC 2016). Suitable habitat for Northern Abalone is not present and individuals have not been observed in the LSA or the RSA.

Other Species

Other fish species that may occur within the LSA and/or the RSA, but are not currently considered at-risk under Schedule 1 of the SARA and/or the Province of BC include: Olympia Oyster *(Ostrea conchaphila*; SARA Special Concern, BC Blue Listed); Yelloweye Rockfish (inside waters and outside waters populations) (*Sebastes ruberrimus;* SARA Special Concern, no provincial status); Tope (*Galeorhinus galeus;* SARA Special Concern, no provincial status); Rougheye Rockfish (Type I & II) (*Sebastes aleutianus* type I & type II; SARA Special Concern, no provincial status); Longspine Thornyhead (*Sebastolobus altivelis;* SARA Special Concern, no provincial status); and Bluntnose Sixgill Shark (*Hexanchus griseus;* SARA Special Concern, no provincial status).

Stantec (2014a) noted that Northern Abalone was not observed during subtidal surveys completed in Porpoise Channel and Chatham Sound, approximately 3 km south of the proposed Project.

8.3 Assessment of Potential Adverse Environmental Effects

No construction activity is proposed to occur below the HWM and thus effects on marine fish and marine species-at-risk are also considered negligible. In the context of effects assessment, a negligible effect is defined as changes/effects that are sufficiently small that they are difficult to measure and/or differentiate from baseline conditions. Therefore, it is not anticipated that Project construction and decommissioning activities will affect marine CRA fish or species-at-risk and they will not be considered further in the assessment of adverse environmental effects of Project construction activities on the Fish VC.

8.3.1 Potential Interactions of the Project

Potential interactions between Project activities occurring in the LSA and RSA and the three subcomponents of the Fish VC are described in Table 8-8.

Project-VC interactions were categorized as follows:

- N = no interaction;
- M = minor interaction; and
- CF = interaction to be considered further in the environmental evaluation.

A minor interaction (M) results in an adverse effect that will be eliminated or reduced to negligible by using effective and established mitigation measures or best management practices. Minor interactions and their associated well-known mitigations are described below in Section 8.3.3, and therefore not included in the characterization of residual effects, determination of significance, and cumulative effects assessment.

All Project-VC interactions categorized as CF in Table 8-8 are assessed in more detail below (in Section 8.3.2) since there is reasonable level of uncertainty that there may be an effect and whether the effect may exceed acceptable levels or standards without implementation of project-specific mitigations and may result in residual adverse effects.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Project-related effects on current use of land and resources for traditional purposes will be discussed in Section 14, First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes.

Table 8-8: Project Interactions with the Fish VC

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	CRA Marine Fish	Non-CRA Marine Fish	Marine Species-at-Risk
Construction Activity				
C-1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	N	N	N
C-2	Site blasting which may involve explosives manufactured off site.	N	N	N
C-3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	N	N	N
C-4	Relocation and reconstruction of existing settling ponds. Involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sublease within RTI lease land.	N	N	N
C-5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	N	N	N
C-6	Construction of tracks.	N	N	N
C-7	Re-grading of existing sidings on RTI lease land.	N	N	N
C-8	Connection to BC Hydro grid on PRPA lands.	N	N	N
C-9	Upgrade to Existing Jetty: Installation of piping and loading arms.	N	N	N
C-10	Installation and hydrotesting of refrigerated storage tanks and equipment.	M	M	M
C-11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	N	N	N
C-12	Installation of a new vehicle access bridge to RTI coal stockyard area.	N	N	N
C-13	Local transport of materiel and personnel to and from the site and PRPA lands.	N	N	N
Operations and Maintenance				
O-1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	N	N	N
O-2	Gas powered compression, supplemented with BC Hydro power to provide approximately15 MW.	N	N	N
O-3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring twice a year and in the case of emergencies and process upsets.	N	N	N
O-4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	N	N	N
O-5	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	N	N	N

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	CRA Marine Fish	Non-CRA Marine Fish	Marine Species-at-Risk
O-6	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12 - 18 months.	N	N	N
O-7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	N	N	N
O-8	Refrigerating and storing propane. Propane is passed through a heat exchanger where it is chilled to approximately -42 C and transferred to a refrigerated storage tank.	N	N	N
O-9	Propane delivery to the carrier via new piping driven by electric pumps will occur once every 15 to 20 days and take about 48 hours.	N	N	N
O-10	Berthing of LPG carriers at the RTI berth facility.	CF	CF	CF
O-11	LPG carrier movements in PRPA navigational jurisdiction.	N	N	N
Decommissioning				
D-1	Removal of land-based above-ground infrastructure on sub-lease site.	N	N	N
Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor interaction with well-known mitigation measures enacted and are not considered further in the environmental evaluation; and CF = interaction to be considered further in the environmental evaluation.				

8.3.2 Assessment of Potential Effects

The potential adverse environmental effects of the Project on the Fish VC are restricted to the following:

- Direct fish mortality;
- Permanent alteration of fish habitat;
- Disturbance resulting from increased noise; and
- Detrimental effects on known or expected occurrence of marine species-at-risk.

The potential adverse environmental effects associated with these potential interactions are discussed below.

8.3.2.1 Construction Phase

No interactions during the construction phase were identified and carried forward into the Fish VC effects assessment. A minor interaction with hydrotesting may occur and is described below (refer to Section 6, Water Quality for a detailed description of the effects of hydrotesting on marine water quality).

It is expected that waters used in hydrotesting of propane storage tanks will be benign and appropriate mitigation measures will be applied before discharge into the marine environment and thus will not result in any adverse environmental affects to Fish.

For works proposed on the Jetty, no interaction was identified because all work will be done using a floating barge. The barge will be connected to the jetty and therefore no interaction with anchors and the seabed or piles driven to keep in place. The barge will be temporary and thus low likelihood of detectable effect from shading. It was assumed that the barge would be considered a vessel to the jetty. There will be no discharge of waste water, it will not be aground, and best practices for its use would be followed.

8.3.2.2 Operations Phase

There is a single potential interaction in the operations phase that was carried forward into the Fish VC effects assessment. This interaction was identified as Operations (O-10): Berthing of LPG carriers at the RTI jetty and is associated with disturbance resulting from increased noise. All other potential interactions during the operations phase were categorized as having no interaction (N), no direct fish mortality, no permanent alteration of fish habitat, and no detrimental effects on known or expected occurrence of marine species-at-risk are anticipated to occur during that Project phase.

The operations phase activity (O-10): Berthing of LPG carriers at the RTI jetty also has a Minor (M) potential to result in disturbance to the Fish VC.

8.3.2.2.1 Disturbance Resulting from Increased Noise

The operations phase activity (O-10): Berthing of LPG carriers at the RTI jetty has the potential to result in disturbance to marine CRA fish species, marine non-CRA fish species and marine fish species-at-risk. LPG carrier and support tug movements while berthing at the RTI jetty may cause non-pulsed underwater noise that could affect the behaviour of marine CRA and non-CRA fish species in the LSA. No marine fish species-at-risk have been observed in the LSA therefore the likelihood of interaction is unlikely and the disturbance of marine fish species-at-risk from tugs during carrier berthing is considered negligible. Noise propagation from tugs during berthing of the carrier is expected to only occur briefly (~1 h) every 15-20 days and is thus considered to have a negligible effect on the marine environment.

The response of marine CRA and non-CRA fish species in the LSA due to short-term noise propagation from tugs during carrier berthing and mooring depends upon the duration of noise, the species of fish, sensitivity of fish hearing (e.g., specialist versus generalist), and the distance from the sound source (Popper and Hastings 2009). The magnitude of response of CRA and non-CRA fish species in the LSA at the time of a LPG carrier berthing is anticipated to range from ‘mild awareness’ to startle response with no meaningful change in behaviour, and may also include temporary movements away from the area (Popper and Hastings 2009). Overall the level of behavioural change is expected to be of very low frequency and duration with very minor impacts on individuals or populations of fish. Some fish species with specialist hearing such as Pacific herring may move away from the berth area when the noise is generated, but these low frequency and duration (e.g., one hour occurring once every 15-20 days) behavioural changes are not anticipated to interfere with key lifecycle requirements, particularly since the habitat and use values in the LSA have been observed to be relatively low.

Mitigations available for reducing the interaction between underwater noise disturbance and marine fish from minor to negligible include well-known and existing vessel management methods that reduce the time required to safely berth and moor an LPG carrier, which are summarized in Section 1.3.3.2.

During normal operations, propane will be piped from on-land storage facilities to a berthed gas carrier at the RTI jetty. The propane supply loading arm located along the jetty will require additional lighting for safety reasons (AltaGas 2016). The RTI jetty currently has lighting and the additional lighting due to new Project related activities is expected to have a negligible effect on Fish in the LSA since:

- New lighting will represent a small increase in existing lighting.
- New lighting is comparable to the existing lighting on the jetty.
- Additional lighting will be used during two night-time periods while one gas carrier is loaded every 15-20 days.
- No marine species-at-risk have been noted to occur around the jetty or within the LSA, and majority of the species diversity observed was found in the lower intertidal and shallow subtidal portions of the LSA and is unlikely to be affected by the temporary use of additional lighting.
- Light affects related to the Project are detailed in Section 12, Light.

8.3.2.3 Decommissioning Phase

There are no potential interactions during the decommissioning phase that were carried forward into the Fish VC effects assessment; therefore, no direct fish mortality, no permanent alteration of fish habitat, no disturbance resulting from increased noise, and no detrimental effects on known or expected occurrence of marine species-at-risk at anticipated to occur during that Project phase.

8.3.3 Mitigation Measures

Mitigation measures for the potential adverse environmental effects of the Project on the Fish VC are outlined below for construction, operation and decommissioning phases. As mitigation measures often overlap for multiple Project activities and can be specific to individual VC sub-components, mitigation measures have been provided by Project phase and VC rather than Project activity to reduce repetition.

8.3.3.1 Construction Phase

All potential adverse effects on the Fish VC during construction are expected to be negligible; however, the effective and established mitigations shown below should be implemented on the upland portion of the site during construction to avoid or minimize potential adverse effects on Fish VC subcomponents that are present in the LSA.

- M-1: Ensuring that equipment and vehicles are in good repair and are not leaking fluids.
- M-2: Developing a spill response plan and having spill kits in all vehicles.
- M-3: Applying best practices to construction including containment of construction and hazardous wastes.
- M-4: Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.
- M-5: Ensuring that any machinery that operates on or near watercourses uses non-toxic, biodegradable hydraulic fluids.
- M-6: Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.
- M-7: Using work area lights that have shades designed to direct light down where it is needed for construction and minimize light directed sky-ward.

8.3.3.2 Operations Phase

All potential adverse effects on the Fish VC during operations are expected to be negligible when the following mitigation measures directly related to berthing and mooring of LPG carriers at the RTI jetty are employed:

- M-8: The main mitigation for reducing potential effects from berthing of LPG carriers at the RTI jetty is the use of the vessel management procedures and standards and practices from the RTI “Terminal Rules and Regulations” and the PRPA Port Information Guide (2015).
- M-9: Mandatory jetty procedures - RTI has advised AltaGas that they are currently updating their “Terminal Rules and Regulations” document as well as producing a “Port Information Booklet” specific to the handling of propane at the marine jetty. These documents will provide mandatory procedures and regulations, as well as general information for the LPG carrier to follow prior to arrival and while moored at the berth.

M-8 and M-9 are expected to effectively mitigate the potential adverse effects during operations, and the following mitigation practices identified here will also help to avoid or mitigate the effects of the Project on the fish present in the LSA and/or RSA:

- A: Tug assistance - RTI intends to comply with tug escort requirements that are defined in the PRPA’s “Harbour Practices and Procedures” guidance. Detailed tug requirements will be determined in consultation with the Pacific Pilotage Authority, Transport Canada, and the Canadian Coast Guard once berthing studies and navigation simulations are completed.
- B: Carrier berthing - Harbour tugs will be required to meet the carrier at the direction of the Pilot and Master to assist the carrier in safely berthing and mooring at the RTI jetty.
- C: Docking - A docking aid system will be installed at the existing jetty to assist the pilots and terminal operators in carrier berthing. The system will monitor and display the carrier’s approach speed, distance and angle with respect to the berthing dolphins. The system improves the safety of the berthing operation and reduces the risk of abnormal berthing events by allowing the Pilot to manage the carrier’s speed and approach vector in order to verify that the approach procedure is within the specified terminal limits.
- D: Ballast - Inbound carriers arriving in a ballasted condition will normally berth with their port sides to the loading platform allowing for the bow of the carrier to be head on into the prevailing current and wind direction.
- E: Carrier mooring - The existing mooring points are expected to be sufficient for safe mooring of the carriers calling at facility for the Project. Mooring lines will be secured to quick release hooks. The number and placement of the mooring lines will be determined for each size of carrier during the detailed engineering phase of the Project.

- F: Limiting environmental operating conditions - Operational safety limits will be established to cover visibility, wind and sea conditions. The preliminary limiting environmental operating criteria are as follows:
  - Berthing maximum wind speed: 20 m/s (40 knots)
  - Loading/unloading shutdown maximum wind speed: 25 m/s (50 knots)
  - Loading/unloading arm disconnect maximum wind speed: 30 m/s (60 knots)
  - Carrier to vacate berth: 32.4 m/s (63 knots)
  - Maximum current: 2.5 knots
  - Minimum visibility: 1.0 km
- G: Meteorological and oceanographic sensors will be installed to monitor: wind speed and direction, current speed and direction, visibility, tidal changes, and wave height and direction. Real-time data from the sensors will be transmitted to the control room for display and logging.
- H: Cargo transfer - All loading equipment on the jetty will be controlled by a central control room located on RTI lease land on Ridley Island. Topside equipment and systems can be categorized into cargo transfer systems, safety and security systems, emergency response systems, carrier services, and control systems. The cargo transfer system includes marine loading arms, manifolds, pipelines, booster pumps and valves. All cargo pipelines and hoses connecting the carrier to the marine terminal will conform to industry standards.
- I: Safety zone - A safety zone at the berth face will be established around the facility for safety purposes in consultation with RTI, PRPA and Transport Canada.
- J: Emergency response - AltaGas will work with RTI to establish and manage all land-based ERPs to avoid the discharge of contaminants from land based activities to the marine environment. The plans will be established after detailed engineering is complete and prior to construction and/or operation.
- K: Pilotage - Pilotage requirements will be in accordance with the PRPA's "Harbour Practices and Procedures", the Canada Shipping Act, the federal Pilotage Act, and the Pacific Pilotage Requirements.
- L: Marine communications - The minor interaction between LPG carrier vessels and marine mammals in the RSA will be mitigated and reduce to negligible using well-known and established vessel management practices as outlined in the PRPA Port Information Guide (PRPA 2015).

- M: Carrier speed - Carrier transit speed will be determined by the Pilot and Harbour Master to account for safe navigation, reduced collision with other vessels, and reduced interaction with marine mammals.

8.3.3.3 Decommissioning Phase

Providing that all effective and established mitigations identified for the upland portion of the site during construction are implemented during decommissioning (to avoid or minimize potential adverse effects on Fish VC subcomponents that are present in the LSA), potential adverse effects on the Fish VC during decommissioning are expected to be negligible.

8.3.3.4 Summary of Potential Adverse Effects and Mitigation

A summary of potential adverse effects and recommended mitigation measures is provided in Table 8-9.

Table 8-9: Summary of Potential Adverse Environmental Effects and Mitigation

Phase /Activity	Description of Potential Adverse Effect	Recommended Mitigation	Mitigation code	Residual Effect (Y/N)
Construction/ C1-C13	No direct effects identified.	• Standard and well known mitigations used during construction on land when adjacent to water	M-1 to M-7	N
Operations/ OM-10	Disturbance Resulting from increased noise.	• Vessel management procedures	M-8	N
		• Mandatory jetty procedures	M-9	
Decommissioning/ D1	No direct effects identified.	• Standard and well known mitigations used during decommissioning on land when adjacent to water	M-1 to M-7	N

8.3.4 Characterization of Residual Effects and their Significance

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project will not have any significant effects on marine CRA fish species, marine non-CRA fish species and/or marine fish species-at-risk. The effects that may occur are associated with marine accidents which are considered highly unlikely, a description of these events and potential effects on fish is found in Section 15, Accidents and Malfunctions.

In the absence of residual effects on the Fish VC a characterization and determination of significance for the Fish VC is not required.

8.3.5 Cumulative Effects

As there are no residual effects on Fish there is no potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents.

8.4 Follow-up Strategy

Table 8-10 provides a summary of the EMPs that will be implemented to verify the effectiveness of the mitigation measures identified for the Fish VC.

Table 8-10: Summary of all EMPs and Related Monitoring Programs Associated with the Fish VC

Environmental Management Plan	Proposed Monitoring Plan*
Construction Environmental Management Plan	
Spill and Emergency Response Plan	Aquatic Monitoring
Water Quality Management Plan	Aquatic Monitoring
Operation Environmental Management Plan	
Water Quality Management Plan	Aquatic Monitoring
Spill and Emergency Response Plan	Aquatic Monitoring
Decommissioning Environmental Management Plans	
Water Quality Management Plan	Aquatic Monitoring

* Details of any proposed monitoring programs will be determined in discussion with RTI and PRPA.

9 TERRESTRIAL WILDLIFE RESOURCES

This section presents the effects assessment for the Terrestrial Wildlife Valued Component (VC).

9.1 Context and Boundaries

The Terrestrial Wildlife Resources VC considers both wildlife and vegetation (particularly vegetation communities and rare plants) with potential to interact with the Project. However, the existing condition of the AltaGas sub-lease site is devoid of vegetation as it has been cleared, graded, and compacted by previous industry activities as described in Section 2, Project Description. Given the existing industrial nature of the AltaGas sub-lease site, the Project is expected to have negligible or no effects on vegetation communities and rare plants. As such, the effects assessment will only assess wildlife, and no further assessment of vegetation or plants is provided herein.

9.1.1 Overview and Regulatory Setting

Federal and provincial legislation governing wildlife potentially associated with the Project includes SARA, *Migratory Birds Convention Act*, *Forest and Range Practices Act* and *BC Wildlife Act*. Each is discussed below.

Species at Risk - Federal: Protection of taxa listed under the SARA applies on all lands (including private land and provincial crown land) to extirpated, endangered or threatened aquatic taxa and to migratory birds, and on federal land to all extirpated, endangered, or threatened taxa. SARA contains prohibitions that make it an offence to kill, harm, possess, collect, buy, sell or trade an individual of a taxon listed in Schedule 1 of SARA as endangered, threatened or extirpated.

Migratory Birds: Migratory birds are protected under the federal *Migratory Birds Convention Act* (MBCA) and associated regulations. The MBCA prohibits the deposition of harmful substances in waters or areas frequented by migratory birds and the disturbance or destruction of nests, eggs, or shelter of migratory birds. Birds protected under the MBCA include the majority of native bird species with the exception of raptors (e.g., eagles, owls, hawks), corvids (e.g., crows, jays), upland game birds (e.g., grouse), and cormorants.

Provincially Managed Wildlife: It is a contravention of the B.C. *Wildlife Act* to hunt, take, trap, wound or kill wildlife except as provided by regulation (hunting/trapping). The Act also protects nests occupied by a bird, its eggs, or its young, and protects the nests of certain species including: eagles, herons, Osprey (*Pandion haliaetus*), Burrowing Owl (*Athene cunicularia*), Gyrfalcon (*Falco rusticolus*) and Peregrine Falcon (*Falco peregrinus*) year-round, regardless of whether they are occupied.

The province may designate Wildlife Habitat Areas for the protection of known occurrences or important habitat of particular plant and animal species under the *Forest and Range Practices Act*. Industrial activities subject to the Act are constrained within Wildlife Habitat Areas, with the nature of the constraints depending on the desired management goals of the individual Wildlife Habitat Area and the biology of the species it protects.

In addition to the provincial legislation, species that are considered to be at risk in BC are placed on either the Red list or the Blue list by the BC CDC. The Red list includes any ecological community, and indigenous species and subspecies that is extirpated, endangered, or threatened in BC. Extirpated elements no longer exist in the wild in BC, but do occur elsewhere. Endangered elements are facing imminent extirpation or extinction. Threatened elements are likely to become endangered if limiting factors are not reversed" (BC CDC 2015a). The Blue list "includes any ecological community, and indigenous species and subspecies considered to be of special concern (formerly vulnerable) in BC. Elements are of special concern because of characteristics that make them particularly sensitive to human activities or natural events" (BC CDC 2015a).

9.1.2 Selection of Valued Component

The Terrestrial Wildlife Resource VC is included in the Project EED because of its potential:

- Ecological, aesthetic, and economic value.
- Importance to regulators, the scientific community, the public and First Nations.
- Protection under provincial, federal, and international law.

Potential effects on Terrestrial Wildlife Resources associated with the Project were assessed in order to determine whether the Project would result in adverse effects on federally or provincially listed species at risk, or species protected under the *BC Wildlife Act* or federal *MBCA* and associated regulations.

9.1.2.1 Sub Components

Sub-components of the VC were selected to structure and focus the assessment and have been chosen based on their relevance to the Project and their importance to assessing this VC. Together they enable a comprehensive understanding of the important potential environmental effects of the Project on wildlife resources.

The sub-components selected for assessment as part of the Terrestrial Wildlife Resources VC are listed in Table 9-1.

Table 9-1: Sub-components of Terrestrial Wildlife Resources VC

Sub-component	Rationale for Selection
Amphibians	Known or expected occurrence of federally or provincially listed amphibian species at risk (specifically western toad *Anaxyrus boreas*) and presence of sensitive amphibian habitat (e.g., for breeding or foraging, including wetlands); legislative obligation; management priority.
Birds	Known or expected occurrence of federally or provincially listed bird species at risk, migratory birds as defined by the *MBCA* (e.g., waterfowl, gulls, songbirds and Great Blue Heron - *Ardea herodias*), and raptors (e.g., Bald Eagle - *Haliaeetus leucocephalus*); presence of potentially suitable habitat (e.g., for breeding or foraging, including nests and roosts) for bird species at risk, migratory birds, raptors or herons; legislative obligation; management priority.
Mammals	Known or expected occurrence of federally or provincially listed mammal species at risk; and Presence of potentially suitable habitat (e.g., breeding or foraging, including dens and movement corridors) for mammal species at risk; legislative obligation; management priority.

9.1.2.2 Indicators and Linkages

Indicators were selected to measure and evaluate the interaction of the Project with the Terrestrial Wildlife Resources VC, and were chosen to be relevant, practical, measurable, responsive, accurate and predictable. Indicators of this VC are described in Table 9-2.

Table 9-2: Indicators for Terrestrial Wildlife Resources VC

Indicator	Direct or Indirect Linkage	Rationale
Known or expected occurrence of species at risk	Direct	Legislative obligation; management priority; data readily available from publicly available databases and assessment reports for other projects
Presence of potentially suitable habitat (e.g., for breeding or foraging) for species at risk	Indirect	Legislative obligation; management priority; data readily available from publicly available databases and assessment reports for other projects
Known or expected occurrence of migratory birds (e.g., waterfowl, gulls, songbirds, herons)	Direct	Legislative obligation; management priority; data readily available from publicly available databases and assessment reports for other projects
Presence of potentially suitable habitat (e.g., for breeding or foraging) for migratory birds	Indirect	Legislative obligation; management priority; data readily available from publicly available databases and assessment reports for other projects
Known or expected occurrence of raptors (e.g., Bald Eagle)	Direct	Legislative obligation; management priority; data readily available from publicly available databases and assessment reports for other projects
Presence of potentially suitable habitat (e.g., for breeding or foraging) for raptors	Indirect	Legislative obligation; management priority; data readily available from publicly available databases and assessment reports for other projects

Other relevant VC sections in this application that support or inform the Terrestrial Wildlife Resources assessment include:

- Marine Resources VC, related to marine birds.
- Water Quality IC, related to amphibians, birds and mammals.
- First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes, Section 14.

9.1.3 Assessment Boundaries

9.1.3.1 Spatial

The spatial boundaries for the Terrestrial Wildlife Resources assessment are summarized in Table 9-3. The LSA is defined as the AltaGas sub-lease site (9.7 ha) buffered by 500 m (Figure 9-1). The LSA is 167 ha in area. A portion of the marine foreshore has been included in the LSA for the assessment of marine birds that may use foreshore or nearshore habitats west of the footprint. The sub-lease site or footprint area is essentially unvegetated. The 500 m buffer will provide a zone of influence for potential Project effects specific to local wildlife (e.g., noise disturbance, habitat connectivity, wildlife corridors and wildlife-vehicle interactions) and includes:

- A railway right-of-way that was recently (2014/2015) constructed on PRPA land on the east side of (and directly adjacent to) the sub-lease site.
- Land that is currently forested to the east (beyond the railway) and south of the footprint.
- A portion of the marine waters within the PRPA jurisdictional boundary.
- The RTI coal export facility to the north.

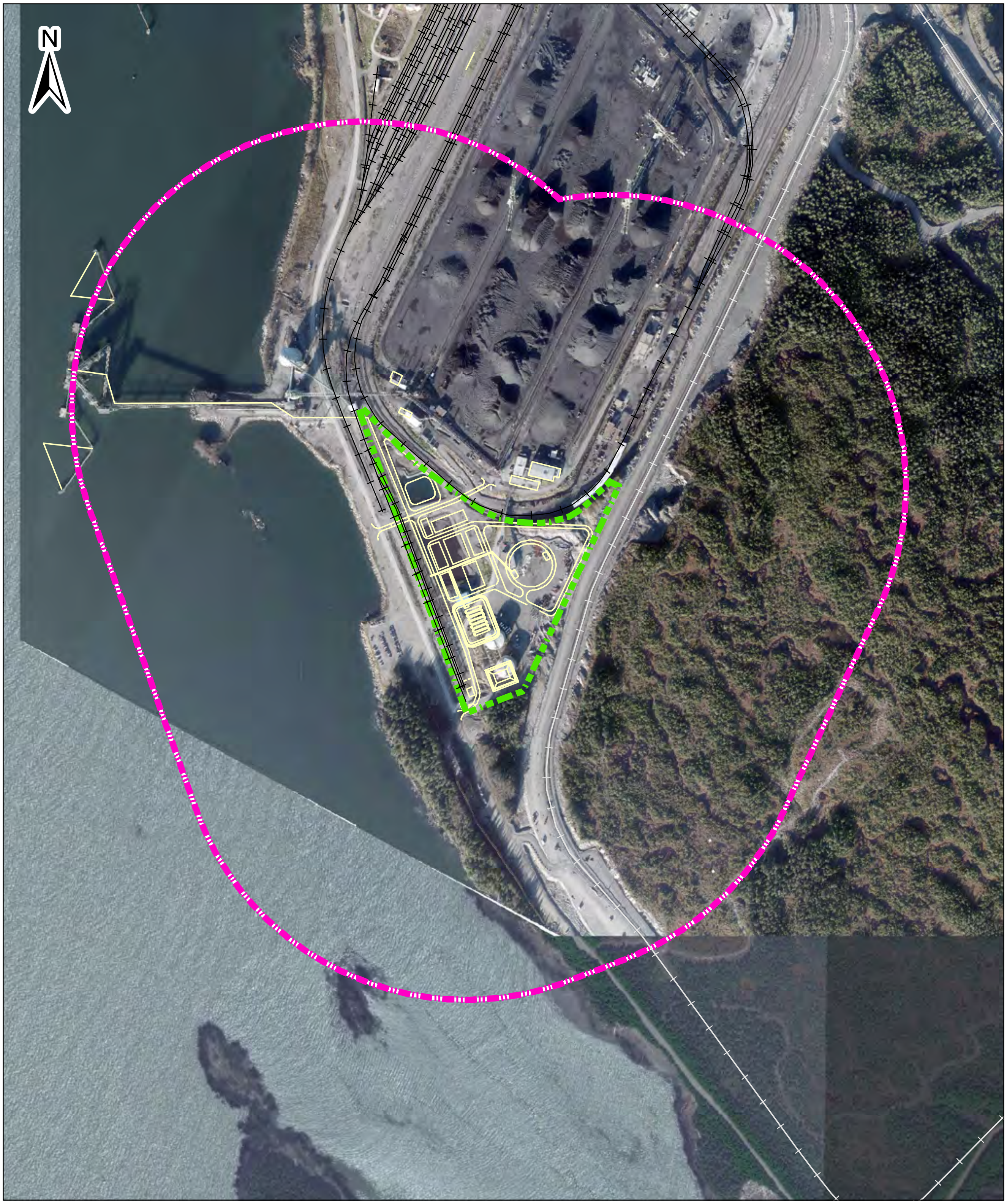
The RSA encompasses the Kaien Landscape Unit (Figure 9-1), and has been selected to provide context for potential local and possible regional Project effects on terrestrial wildlife and marine birds. It includes nearby industrial sites (e.g., Prince Rupert, Port Edward) and intersects important bird areas (IBAs). The RSA is 65,943 ha in area and includes:

- The rail transportation corridor within PRPA/RTI jurisdiction from the AltaGas sub-lease site and receptors to Port Edward.
- An area within a portion of the PRPA marine jurisdiction beyond the LSA related to berthing activities and seaward (approximately 1 km) from the RTI wharf/berth.

Although much of Ridley Island is currently undeveloped, future land use on the island is planned through port-oriented industrial operations, based on the Port's Land Use Management Plan (AECOM 2010).

Table 9-3: Spatial Boundaries for Terrestrial Wildlife Resources VC

Spatial Extent	Description	Area (ha)
LSA	AltaGas sub-lease Site buffered by 500 m	167
RSA	Kaien Landscape Unit	65,943



LEGEND

- New Railway
- Railway
- Project Components
- AltaGas Sub-Lease Site
- Terrestrial Local Study Area

0 100 200 400 600 800 Meters

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

SNC • LAVALIN

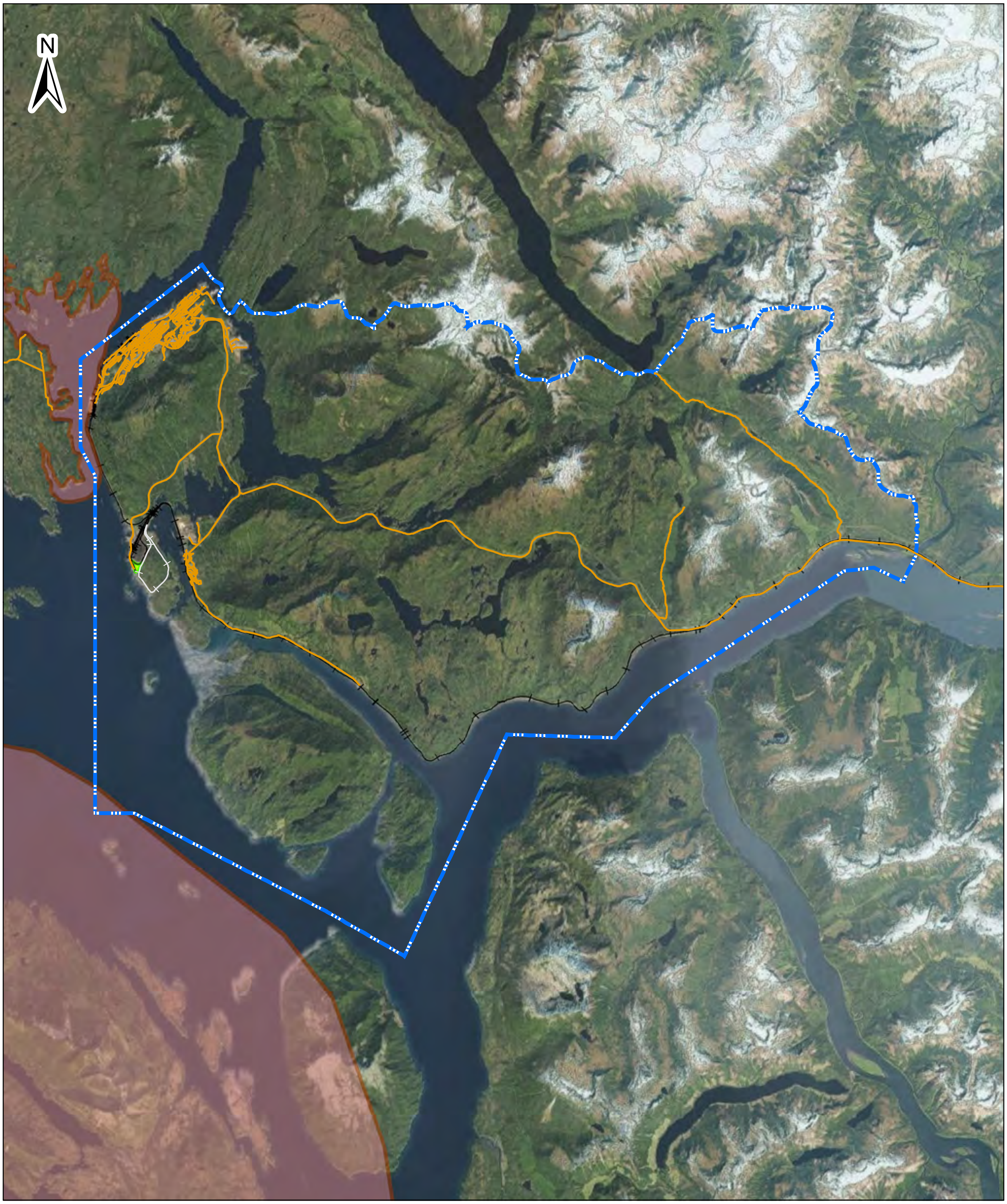
CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal Ridely Island, Prince Rupert, BC

Figure 9-1: Terrestrial Vegetation and Wildlife Local Study Area

BY: SS	DATE: 2016/06/28	SCALE: 1:10,000	REF No: REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-102_001

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_102_001_AltaGas_Terrestrial_LSA.mxd



LEGEND

- Railway
- New Railway
- Roads
- Terrestrial Regional Study Area
- Important Bird Areas
- AltaGas Sub-Lease Site

0 2,000 4,000 8,000 12,000 16,000 Meters

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

SNC • LAVALIN

CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 9-2: Terrestrial Vegetation and Wildlife Regional Study Area

BY: SS	DATE: 2016/06/28	SCALE: 1:250,000	REF No: REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-102-002

MXD Path: P:\LOBE\IAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_102_002_AltaGas_Terrestrial_RSA.mxd

9.1.3.2 Temporal

The potential effects specific to the Project are based on the main phases of the Project:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

9.2 Existing Conditions

This section describes the existing conditions pertaining to terrestrial wildlife and marine birds are described in support of the Terrestrial Wildlife Resources baseline and effects assessment.

9.2.1 Data Sources Used in the Assessment

Development of the terrestrial wildlife resources baseline for the Project LSA primarily relied on information from environmental assessments for other projects proposed or approved in nearby areas. Information included:

- Environmental Evaluation Document Tankage Change of Use – Bulk Liquids Project (Worley Parsons 2013a).
- Draft Project Description Stockpile Expansion Project. Storage Facility Parcel A (Worley Parsons 2013b).
- 2009 Ridley Island Western Toad Survey (Stantec 2009).
- Environmental Impact Statement for the Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor (Stantec 2011a).
- Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor Wildlife Technical Data Report (Stantec 2011b).
- Pacific Northwest LNG Environmental Impact Statement and Environmental Assessment Certificate Application Section 11: Terrestrial Wildlife and Marine Birds, and Appendix H: Technical Data Report for Terrestrial Wildlife and Marine Birds (Stantec 2014).
- Prince Rupert LNG Proposed Liquefied Natural Gas Facility Application Information Requirements for an Environmental Assessment Certificate Application (AECOM 2014).
- Ridley Island Western Toad Survey (Jacques Whitford-AXYS 2008).

- Environmental Assessment Document Sulphur Forming, Handling and Storage Facility for ICEC Terminals Company Ltd. (Keystone Environmental 2007).

9.2.1.1 Desktop and/ or Field Studies Conducted

Existing information on wildlife species at risk was collected through a review of available ecological databases and search engines (i.e., BC CDC 2015; iMap BC 2015 and SARA 2015a) to update the species at risk information, as applicable.

A site reconnaissance was conducted on October 28, 2015 to verify site conditions and assess the potential for Project effects on amphibians (specifically western toad mortality from road and rail traffic), birds (specifically loss of nesting habitat of migratory birds, raptors, and bird mortality from gas flaring), and mammals (specifically bat mortality from gas flaring) in the LSA. Opportunistic searches in the field for wildlife signs, including large stick nests (e.g., eagle nests), were conducted in accessible sections of the LSA.

Data recorded in the field included; observations of species or their signs (e.g., tracks), species identification, date, GPS coordinates, weather conditions and photographic documentation. Any incidental observations of wildlife species were noted.

9.2.2 Description of Existing Conditions

The Project is proposed in an area of Ridley Island for which there is existing information available from environmental assessment reports completed by other professionals for previously proposed or future major port-oriented industrial developments, including a potash export terminal (Stantec 2011a/b) and liquid natural gas facilities (AECOM 2014; Stantec 2014). The Ridley Island landscape has recently been modified due to the construction of the Ridley Island Rail and Utility Corridor (Stantec 2011a/b). There are also industrial facilities in areas surrounding Ridley Island, including Port Edward and Prince Rupert.

The summary of existing conditions includes an account of wildlife species and habitats reported or observed to exist within the LSA and adjacent parts of the RSA, including species at risk and sensitive habitat features. Wildlife species detected in the LSA during the SNC-Lavalin field reconnaissance on October 28, 2015 are summarized in Figure 9-3.

LEGEND

- Wildlife Observation
- New_Railway
- Railway
- AltaGas Sub-Lease Site
- Terrestrial Local Study Area

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

SNC • LAVALIN

CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal Ridely Island, Prince Rupert, BC

Figure 9-3: Terrestrial Wildlife Observations in the Local Study Area

0 200 400 800 1,200 1,600 Meters

BY: SS	DATE: 2016/06/28	SCALE: 1:20,000	REF No: REV: 0
CHK'D: MB	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-102_003

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_102_003_AltaGas_Terrestrial_Surveyed_Data.mxd

9.2.2.1 *Wildlife and Wildlife Habitat*

Ridley Island is located within the boundaries of a number of provincial government management units that are relevant to the terrestrial assessment, as summarized in Table 9-4. The island falls within the jurisdiction of the PRPA. No Old Growth Management Areas or Wildlife Habitat Areas have been designated on the island. The closest protected areas are Kitson Island Marine Park, 2 km south of the southern tip of Ridley Island, and Diana Lake Park, 9 km to the east.

Table 9-4: Management Units for Ridley Island

Natural Resource Area	North
Natural Resource Region	Skeena-Queen Charlotte
Natural Resource District	North Coast
Ministry of Environment Region	6 (Skeena)
Land and Resource Management Plan	North Coast
Landscape Unit	Kaien

No known mapped occurrences of any wildlife species at risk have been identified for Ridley Island in the CDC database (iMap BC 2015). Appendix 9-A lists terrestrial wildlife species at risk potentially occurring in the CWHvh2 subzone variant, and includes habitat descriptions of these species.

9.2.2.1.1 Amphibians

Amphibians have small home ranges and small body sizes, and are often cryptic or slow-moving. Amphibians lay their eggs in water, and their larval stages (tadpoles) remain in aquatic habitat until they metamorphose into their terrestrial form. Juveniles stay near the aquatic habitat or disperse (often en masse) to nearby upland habitats. The adults of some amphibian species overwinter in the mud at the bottom of waterbodies. Their requirement for aquatic habitat and their sensitivity to siltation and changes in hydrology make amphibians particularly vulnerable to alteration or contamination of waterbodies (FLNRO 2014). Three amphibian species, northwestern salamander (*Ambystoma gracile*), rough-skinned newt (*Taricha granulosa*) and western toad, have been documented as being present on Ridley Island (Stantec 2014; Stantec 2011a/b).

The AltaGas sub-lease site contains two settling ponds as well as seasonally water-filled ditches and puddles that could be used by amphibians as breeding habitat. However, due to the absence of vegetated areas within the sub-lease site, there is no suitable dispersal habitat within the sub-lease site. The LSA contains wetland habitat (e.g., muskeg, bog) east of the sub-lease site, beyond the recently built railway corridor on PRPA Land (Figure 10-3). However, movement from the sub-lease site to this wetland habitat and upland vegetated areas outside of the sub-lease site is limited by the existing infrastructure, including PRPA Land, RTI Lease Land and associated roads and railways.

Amphibian Species at Risk

The only amphibian species at risk known to inhabit Ridley Island is the western toad (Worley Parsons 2013; Stantec 2011a/b; Stantec 2014).

Western toads were identified on Ridley Island in July 2009 during transect and road surveys as part of an environmental assessment for another project (Stantec 2009; Stantec 2011a/b). The forested and upland habitat on Ridley Island was confirmed to provide suitable habitat for the living requirements of western toads. Stantec (2011a/b) recorded 63 adult western toads on Ridley Island during 2009, as well as 103 incidental sightings in 2011. Eighteen western toads were detected in 2008 during evening road surveys on Ridley Island (Jacques Whitford AXYS Ltd. 2008). The distribution of western toads observed in 2008 suggested to the surveyors that adult western toads could be found in most areas of Ridley Island (Jacques Whitford AXYS Ltd. 2008). Although not confirmed as a breeding site, the ponds in the southeast of Ridley Island (beyond the LSA for this Project) were considered highly suitable breeding habitat for western toads due to observations of toadlets in the vicinity of those wetlands (Stantec 2009; Stantec 2011a/b).

Coastal tailed frogs (*Ascaphus truei*) and northern red-legged frogs (*Rana aurora*) require habitats not present in the LSA and have therefore been removed from consideration. Coastal tailed frogs breed in clear, cold, fast-flowing mountain streams, while northern red-legged frogs (*Rana aurora*) breed in large wetlands, ponds or lake margins that are at least 0.5 m deep (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2004).

9.2.2.1.2 Birds

Information on birds (including breeding birds and migratory coastal waterbirds) is available for the Prince Rupert area through public databases and studies conducted for other projects (Bird Studies Canada 2015a/b/c; Stantec 2011a/b; Stantec 2014). In addition to breeding bird surveys published through the BC Breeding Bird Atlas (Bird Studies Canada 2015a), Bird Studies Canada has conducted BC Coastal Waterbird Surveys (Bird Studies Canada 2015b) and has collected species (and abundance/frequency) data since 1999. Although there are no designated IBAs on Ridley Island, there are three IBAs north, south and west of Ridley Island (Bird Studies Canada 2015c). The IBA nearest to Ridley Island (BC124) is located approximately 3 km north of Ridley Terminals between Big Bay and Delusion Bay, extending along Kaien Island southwest of Prince Rupert; another IBA (BC119) is located approximately 10 km south of Ridley Island and extends from Kitlatla Channel and Goschen Island north to Porcher Island (Figure 1-2). A third IBA

(BC 122) is located 11 km to the northwest of Ridley Island and includes offshore Lucy Islands west of Ridley Island and is beyond (west of) the extent of Figure 10-2.

Bird species known to be present in the vicinity of Ridley Island, as compiled by Stantec (2011b; 2014), are listed in Appendix 9-B. Overall, 122 species of migratory and non-migratory birds (including raptors, owls, waterfowl, gulls, shorebirds, alcids, passerines, woodpeckers and hummingbirds) have been recorded in a broad area around Prince Rupert.

Incidental sightings of non-migratory birds from the October 28, 2015 reconnaissance included one Belted Kingfisher (*Megaceryle alcyon*) and numerous Northwestern Crows (*Corvus caurinus*) in the marine portion of the LSA, as well as a flock of non-native Rock Pigeons (*Columba livia*) on RTI Lease Land outside of the LSA.

Migratory Birds

Migratory birds known or potentially present in the vicinity of Ridley Island as compiled by Stantec (2011b; 2014) are shown in Appendix 9-B. There are 101 species of migratory birds documented as occurring in the vicinity of Ridley Island. Most migratory birds observed in the LSA during the field reconnaissance on October 28, 2015, were seen foraging in the marine waters to the west of the sub-lease Site (Figure 10-3), including one provincially red-listed species, Common Murre (*Uria aalge*). Canada Geese were observed on the large settling pond within the sub-lease Site; however, due to the absence of vegetation, it is unlikely that geese or other migratory birds would breed on the sub-lease Site. Migratory birds using surrounding areas may cross the sub-lease Site to move between marine areas to the west, south and east, or wetland/pond areas to the southeast and north.

Foraging Great Blue Herons have been reported along the foreshore of the island and in the wetlands in the southeast portion of the island (Stantec 2011b). No heron nesting colonies are known on the island, and none were observed during the site reconnaissance on October 18, 2015. Although Great Blue Herons likely forage in the LSA, the potential for them to nest in the LSA is low.

Raptors

Diurnal and nocturnal raptor call-playback surveys were conducted on Ridley Island by Stantec (2011b) and nine raptors (belonging to three species) were detected during the diurnal surveys (Table 9-5)), including one Bald Eagle in the LSA. No owls were detected during nocturnal surveys (Stantec 2011b).

Table 9-5: Raptor (and Vulture) Species Detected on Ridley Island (based on Stantec 2011b)

Bald Eagle	*Haliaeetus leucocephalus*	Various locations: north of the grain silo, west of the RTI Lease Land near the jetty, forested area south of the sub-lease Site, southeast side of Ridley Island near wetland ponds, and bay north of RTI Lease Land
Turkey Vulture	*Cathartes aura*	North of the grain silo
Merlin	*Falco columbarius*	North of the grain silo

Bald Eagles have frequently been observed foraging or perching at various locations on Ridley Island (Stantec 2011b), and two Bald Eagle nests were reported. One Bald Eagle was reported as an occurrence within the LSA, in a forested area southwest of the sub-lease Site adjacent to the bay. Although a Bald Eagle was observed in this area during the field visit on October 2015, a nest could not be located and none are presumed to occur in the LSA.

Bird Species at Risk

Based on range maps, specific habitat requirements and known records (BC CDC 2015; E-Fauna 2015), 16 bird species at risk are potentially present in the vicinity of Ridley Island or surrounding marine habitats (Appendix 9-A). Some of these species may breed in the LSA while others may stop-over for foraging during migration or in winter. Only one species (Barn Swallow) may potentially breed on the sub-lease Site.

Band-tailed Pigeon (*Patagioenas fasciata*), Western Screech-owl (*Megascops kennicotti kennicotti*), and Olive-sided Flycatcher (*Contopus cooperi*) nest in forested habitat. No forest is present within the sub-lease Site although small forested patches are available within the buffer portion of the LSA, east and southwest of the sub-lease Site.

- Olive-sided Flycatchers were not detected during surveys on Ridley Island and Lelu Island (Stantec 2014; Stantec 2011b), and suitable habitat for this species is marginal in the LSA.
- The Western Screech-owl has not been detected on Ridley Island (Stantec 2011b) but has been reported from nearby Lelu Island (Stantec 2014). No Western Screech-owl nesting habitat was identified during surveys by Stantec (2014; 2011b).
- Band-tailed Pigeons may feed on spilled grain at the grain terminal on Ridley Island but habitat in the LSA is marginal for this species and this bird not likely to be attracted to the Project footprint.

Seven species (Marbled Murrelet [*Brachyramphus marmoratus]*, Tufted Puffin [*Fratercula cirrhata]*, Black Scoter [*Melanitta americana]*, Pelagic Cormorant [*Phalacrocorax pelagicus pelagicus]*, Cassin's Auklet [*Ptychoramphus aleuticus]*, Ancient Murrelet [*Synthliboramphus antiques]*, and

Common Murre) require marine habitat and may use the marine portion of the LSA for foraging. Four of these species (Marbled Murrelet, Black Scoter, Pelagic Cormorant and Common Murre) have been reported in the vicinity of the Project (Stantec 2011b; Stantec 2014; SNC-Lavalin observation of a Common Murre in October 2015 [this document]). No nesting habitat for any of the above marine bird species is present in the LSA.

Northern Goshawks (*Accipiter gentilis laingi*) require large tracts (100-200 ha) of mature or old-growth coniferous forest with closed canopy and open subcanopy for breeding (Darling 2010). The Black Swift (*Cypseloides niger*) requires cliff-side habitats (often associated with waterfalls) for nesting. The Rusty Blackbird (*Euphagus carolinus*) nests in forest and prefers the shores of large wetlands. None of these three species is expected to occur in the LSA due to the absence of suitable habitat. Peregrine Falcons have not been reported on Ridley Island. This species nests on cliffs or tall buildings in proximity to concentrations of prey such as waterfowl, shorebirds or feral pigeons. Peregrines are expected to make, at most, only occasional use of the LSA for travel and foraging.

Barn Swallows typically nest on anthropogenic structures and may use buildings or other structures in or near the footprint as nest substrates (COSEWIC 2011b). Barn Swallows were detected on surveys of Ridley Island but nesting was not confirmed (Stantec 2011b). In personal communication with RTI employees (Amy Lashek, pers. comm. 2015), it was reported that Barn Swallows historically constructed nests on some of the buildings within the sub-lease Site. It is possible that this species nests on the sub-lease Site during the breeding season.

Stantec (2011b; 2014) identified a few listed bird species in the vicinity of Ridley Island that are not included by the BC CDC for the region (Appendix 9-B). The majority of these species (Surf Scoter *Melanitta perspicillata*, Brant *Branta bernicla*, Double-crested Cormorant *Phalacrocorax auratus*, California Gull *Larus californicus*, Long-tailed Duck *Cangula hyemalis*, and Western Grebe *Aechmophorus occidentalis*) are marine birds that may occasionally forage in the area on their way to breeding areas elsewhere. One species, the Common Nighthawk (*Chordeiles minor*) nests in open habitat devoid of vegetation, such as beaches, logged areas, forest clearings, rock barrens, gravel roads, railways, quarries, marshes, and peat bogs (COSEWIC 2007b). This species was detected on Lelu Island (Stantec 2014), and has a potential to occur in the LSA; however, none were reported previously on Ridley Island (Stantec 2011b).

Great Blue Herons are discussed above in the section on migratory birds.

9.2.2.1.3 Mammals

Mammals detected on Ridley Island during field assessments for other projects (Keystone Environmental 2007; Stantec 2011b, 2014; Worley Parsons 2013b) or during the site reconnaissance on October 28, 2015, are listed in Table 9-6. None of the mammal species are species at risk. In addition, black bears (*Ursus americanus*) have been recorded on nearby Lelu Island (Stantec 2014).

Table 9-6: Mammal Species detected on Ridley Island during 2015 Field Reconnaissance or Reported in Other Assessments (Keystone Environmental 2007; Stantec 2011a/b; Stantec 2014; Worley Parsons 2013b)

Black-tailed deer	*Odocoileus hemionus*	Common throughout Ridley Island; deer were observed by Worley Parsons (2013b) and SNC-Lavalin, and tracks were observed during 2015 field reconnaissance in the sub-lease Site and within the LSA east of the new railway system
Moose	*Alces americanus*	Tracks observed during 2015 field reconnaissance in forested portion south of sub-lease Site
Grey wolf	*Canis lupus*	Tracks observed during 2015 field reconnaissance next to deer tracks within the LSA east of new railway system
Pacific marten	*Martes caurina*	Tracks were reported on south-central Ridley Island (Stantec 2011b) and east of the LSA (Worley Parsons 2013b); not detected in the LSA in 2015
Short-tailed weasel	*Mustela erminea*	Detected by Worley Parsons (2013b) east of the LSA; not detected in the LSA in 2015
American beaver	*Castor canadensis*	A beaver was detected in a wetland east of the LSA (Worley Parsons 2013b); not detected in the LSA in 2015
North American porcupine	*Erethizon dorsatum*	Tracks were detected in south-central Ridley Island (Stantec 2011b) and east of the LSA (Worley Parsons 2013b); not detected in the LSA in 2015
Red squirrel	*Tamiasciurus hudsonicus*	Detected on north-central side of Ridley Island (Stantec 2011b) and east of the LSA (Worley Parsons 2013b); not detected in the LSA in 2015
Snowshoe hare	*Lepus americanus*	Detected east of the LSA (Worley Parsons 2013b)

Mammals (such as deer) may occasionally use the sub-lease Site or move through the sub-lease Site on their way to adjacent habitats, within and outside of the LSA. Movement of mammals such as ungulates and predators is presently impeded by human presence and by existing development, particularly buildings, roads and railway systems.

Mammal Species at Risk

Mammal species at risk potentially present in the LSA are listed in Appendix 9-A. No mammal species at risk have been confirmed to use the island. Grizzly bears (*Ursus arctos*) are considered highly unlikely to use the island due to the lack of high-suitability habitat and the high degree of human disturbance. Wolverines are solitary, opportunistic hunters that have large home ranges (in the order of 500 km^2 for males and 300 km^2 for females) and are associated with large areas of wilderness (Hatler and Beal 2003) far from human activity (COSEWIC 2014); existing level of development and high amount of human activity render the LSA unsuitable for this species. Fishers prefer mature to old-growth riparian and wetland habitats; however, they are rare in coastal ecosystems and are believed to primarily occur in the boreal plains, sub-boreal interior, central interior and Taiga plains ecoprovinces occurring in northeast and central BC (Province of BC 2004c); therefore, the fisher is not considered a species of concern for the LSA.

Two bat species at risk (little brown myotis *Myotis lucifugus* and Keen's myotis *Myotis keenii*) may occur on Ridley Island. These bats roost in cavities or under bark of large trees or old buildings during summer (COSEWIC 2013); however, no records of either of these species occurring at the sub-lease site have been identified to date. In fall, these bats migrate to hibernacula to overwinter in caves or mines, which may be hundreds of kilometres from the summering areas (COSEWIC 2013). The potential for bats to be roosting on the sub-lease Site is low due to limited availability of roosting habitat. However, other areas within the LSA may have suitable roost or foraging sites and there is a potential for bats to move through the sub-lease Site from adjacent areas (within or outside of the LSA) on their way between habitats.

9.2.2.2 Wildlife and Wildlife Habitat Summary for LSA and Sub-lease Site

The LSA contains wetland and forested upland habitat east and south of the sub-lease Site, as well as marine foreshore west of the sub-lease Site. However, the vegetated areas in the LSA are presently fragmented by access roads and the recently built railway corridor on PRPA Land, and no vegetated habitat exists on the sub-lease Site.

Western toads may occur in the LSA where wetland habitat and moist forested areas exist east of the new railway corridor. Western toads also have the potential to breed on the AltaGas sub-lease Site in the settling ponds or in seasonally water-filled ditches or puddles. However, if toads were to breed within the sub-lease Site, their movement from the sub-lease Site to wetland or upland habitats in the LSA would be limited by the existing infrastructure, roads and railways.

Although migratory bird species (some of them considered at risk) are documented within the marine portion of the LSA (e.g., Common Murre, Surf Scoter, Marbled Murrelet and Great Blue Heron), none of these species is expected to breed in the LSA or on the sub-lease Site, due to the absence of nesting habitat. Similarly, Canada Geese maybe be seen swimming on the settling ponds within the sub-lease Site; however, there is no forage or nesting habitat available for this species in the sub-lease Site.

The Bald Eagle is the only raptor species that has been documented in the LSA and there are suitable nest trees along the shoreline in the southwest; however, no nests currently exist in the LSA and there is no suitable nest habitat for this species within the sub-lease Site.

Three bird species at risk (Band-tailed Pigeon, Olive-sided Flycatcher, and Western Screech-owl) may use the forested portion of the LSA for foraging; however, nesting habitat in the LSA is marginal due to the small size of available forest patches. The Common Nighthawk is known to occur on Lelu Island; however, no records exist for Ridley Island. The Barn Swallow is the only bird species at risk that may potentially nest in the sub-lease Site during the breeding season.

Nine mammal species are documented to occur on Ridley Island, three of which (deer, moose and wolf) have been detected in or near the LSA. No mammal species at risk have been documented for Ridley Island. Movement of terrestrial mammals is impeded by human presence, and by buildings, roads and railways, although deer are known to occasionally move through the sub-lease Site. Forested areas within (and outside of) the LSA may have suitable roost or foraging habitat for bats and there is a potential for bats to move through the sub-lease Site; however, the likelihood of bats to use the sub-lease Site is low due to limited roosting and foraging habitat.

9.3 Assessment of Potential Adverse Environmental Effects

The EED includes a description of physical works and activities associated with Project components and the potential for adverse environmental effects for which a reasonably direct causal link can be demonstrated between some aspect of the Project and the Terrestrial Wildlife Resources VC and sub-components.

9.3.1 Potential Interactions of the Project

The potential adverse environmental effects of the Project on the Terrestrial Wildlife Resources VC are generally considered within three main groupings:

- Habitat alteration and fragmentation; can include accidental habitat removal; maintenance of early seral habitat; fragmentation of habitats by roads, railways or Project facilities; and introduction of silt or other deleterious substances to the environment.
- Disturbance or displacement; resulting from loud or visually-disturbing construction-related activities (e.g., excavation) that can disrupt dispersal, incubation, feeding young, territorial activities and foraging, in the proposed construction footprints as well as in adjacent habitats that are not directly affected by the Project.
- Mortality; increased road use can lead to an increase in vehicle-related wildlife mortality. Smaller, less mobile life-stages (juveniles/eggs) and species with very small home ranges may suffer direct mortality related to movement of construction equipment and accidental habitat removal. Larger wildlife is also at risk from mortality due to vehicle collisions.

Potential interactions of the Project components with the Terrestrial Wildlife Resources VC sub-components are summarized in Table 9-7.

Project-VC interactions were categorized as follows:

- N = no interaction;
- M = minor interaction; and
- CF = interaction to be considered further in the environmental evaluation.

A minor interaction (M) results in an adverse effect that will be eliminated or reduced to negligible by using effective and established mitigation measures or best management practices. Minor interactions and their associated well-known mitigations are described below in Section 8.3.3, and therefore not included in the characterization of residual effects, determination of significance, and cumulative effects assessment.

All Project-VC interactions categorized as CF in Table 9-7 are assessed in more detail below (in Section 8.3.2) since there is reasonable level of uncertainty that there may be an effect and whether the effect may exceed acceptable levels or standards without implementation of project-specific mitigations and may result in residual adverse effects.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Project-related effects on current use of land and resources for traditional purposes will be discussed in Section 14, First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes.

Table 9-7: Project Interaction Table

Project Activities and Physical Works		VC Subcomponents Potentially Affected		
		Amphibians	Birds	Mammals
Construction Activity				
C-1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	CF	CF	CF
C-2	Site blasting which may involve explosives manufactured off site.	CF	CF	CF
C-3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	CF	CF	CF

Project Activities and Physical Works		VC Subcomponents Potentially Affected		
		Amphibians	Birds	Mammals
C-4	Relocation and reconstruction of existing settling ponds, involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sub-lease Site.	CF	CF	CF
C-5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	CF	CF	CF
C-6	Construction of rail tracks.	CF	CF	CF
C-7	Re-grading of existing sidings on RTI lease land.	CF	CF	CF
C-8	Connection to BC Hydro grid on PRPA lands.	CF	CF	CF
C-9	Upgrade to Existing Jetty: Installation of piping and loading arms.	N	CF	N
C-10	Installation and hydrotesting of refrigerated storage tanks and equipment.	CF	CF	CF
C-11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	CF	CF	CF
C-12	Installation of a new vehicle At-Grade road crossing to RTI coal stockyard area.	CF	CF	CF
C-13	Local transport of material and personnel to and from the site and PRPA lands.	CF	CF	CF
Operation and Maintenance				
O-1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	CF	CF	CF
O-2	Gas powered compression, supplemented with BC Hydro power to provide approximately 15 MW.	N	N	N
O-3	Ground flare to burn off the removed ethane and methane at the gas powered compression. The ground flare will be open and require maintenance flaring twice a year and otherwise only in the case of emergencies.	CF	CF	CF
O-4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	CF	CF	CF
O-5	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	CF	CF	CF
O-6	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with total deliveries of an anticipated 50-60 rail cars per day after the initial 12-18 months.	CF	CF	CF
O-7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	CF	CF	CF
O-8	Refrigerating and storing propane; propane is passed through a heat exchanger where it is chilled to approximately -42˚C and transferred to a refrigerated storage tank.	N	N	N

Project Activities and Physical Works		VC Subcomponents Potentially Affected		
		Amphibians	Birds	Mammals
O-9	Propane delivery to the carrier via new piping driven by electric pumps. Loading will occur once every 15 to 20 days and take approximately 40 hours. (i.e., 20-30 carriers per year).	N	N	N
O-10	Berthing of liquefied gas carriers at the RTI berth facility. Carriers will be met by tug escorts upon approach to the berth and will utilize a docking aid system.	N	CF	N
O-11	LPG carrier movements in PRPA navigational jurisdiction.	N	CF	N
Decommissioning				
D-1	Removal of land-based above-ground infrastructure on sub-lease Site.	CF	CF	CF
Notes:	Interactions annotated with N, M or CF, where N = no interaction, M = minor interaction, not considered further in the environmental evaluation; and CF = interaction to be considered further in the environmental evaluation			

9.3.2 Assessment of Potential Effects

For each Project phase (construction, operation and decommissioning), and each interaction (or group of interactions) identified in Table 9-8 that needs to be considered further (CF), the potential adverse environmental effects are described and discussed below. Furthermore, potential scenarios for interactions with associated accidents, malfunctions and unplanned events are described in Section 15, Accidents and Malfunctions.

9.3.2.1 Construction Phase

9.3.2.1.1 Habitat Alteration and Fragmentation

The Project is not anticipated to have an adverse effect on wildlife habitat, as no vegetated areas exist on the sub-lease Site, and construction activities such as site grading, road and rail track construction, and re-grading are limited to disturbed areas within RTI or PRPA lands that have existing road and railway infrastructure. Similarly, the bridge removal and installation of new road crossings will be contained within the sub-lease Site. Therefore, no habitat alteration or fragmentation is expected as a result of construction activities.

9.3.2.1.2 Disturbance or Displacement

Any construction activity associated with increased noise, e.g., from traffic, machinery or blasting has the potential to cause temporary wildlife disturbance or displacement.

Blasting, in particular, may lead to temporary indirect disturbance to amphibians, birds and mammals, if it takes place in proximity to areas occupied by breeding or resting individuals, potentially causing adverse behavioural effects (e.g., adverse effect on nesting or roosting or change of movement patterns). Amphibians, birds and mammals may also be disturbed by construction noise associated with site grading, or removal or installation of structures, buildings and railway tracks.

Construction activity, particularly blasting noise and lighting, may disturb birds, such as Barn Swallows nesting on structures or buildings within the sub-lease Site footprint, or waterbirds foraging in nearby wetlands or coastline within the LSA (e.g., wetlands to the east or marine foreshore to the southwest). There is also a potential that bats roosting in the LSA may be disturbed as a result of blasting noise, if they are present in nearby treed areas or on old buildings/structures at the time.

Construction of new railway tracks and re-grading of existing sidings has the potential to disturb wildlife; however, the likelihood of any disturbance of amphibians, birds or mammals is negligible due to the fact that rail tracks are to be built and sidings re-graded in areas adjacent to currently existing rail tracks, and these areas are presently highly disturbed (i.e., devoid of vegetation) and do not contain habitat suitable for wildlife.

9.3.2.1.3 Mortality

Traffic during construction may result in vehicle-wildlife collisions on roads and access paths and associated mortality of amphibians, birds or mammals. Vehicle or machinery traffic in foreshore areas, puddles or water-filled ditches, or in areas were nest sites or burrows are located, may inadvertently disturb or kill individuals and their nests or young, if present. The presence of permanent or temporary water features (i.e., settling ponds, ditches and puddles) on the sub-lease Site may attract amphibians to unsuitable breeding areas. Amphibians may be adversely affected during their upland migration from these breeding sites, although the likelihood of occurrence is considered to be low.

Removal and installation of facilities and utilities, relocation/reconstruction of settling ponds and bridge removal/at grade road crossing installation may have adverse effects on amphibians, birds or mammals, particularly if sediment or other substances toxic to wildlife enter water bodies (including settling pond, puddles or water-filled ditches). Mortality may occur from deteriorating water quality and ingestion of hazardous substances (e.g., sediment or chemical substances such as antifreeze or other toxic substances associated with removal or installation of facilities). Amphibians are particularly sensitive to changes in water quality, including pH and conductivity.

Road mortalities of birds are likely limited to species travelling between foraging areas. Construction activities (particularly removal and installation of buildings, structures and utilities, access bridge removal and installation of road crossings) during the bird nesting season may result in disturbance of nesting birds, causing mortality of eggs and nestlings. The species most vulnerable to this potential effect are those that often or preferentially nest on buildings or human structures, including Barn Swallows and American Robins (*Turdus migratorius*). Barn Swallows typically nest under eaves or other situations where an overhang is present. Robins may nest within girders, under overhangs, and on elevated structures. Nesting swallows and robins are protected under the MBCA. Rock Pigeons (*Columba livia*), Common Starlings (*Sturnus vulgaris*), and House Sparrows (*Passer domesticus)* often nest in or on buildings as well, but all of these are non-native species and their nests are not protected under law.

The demolition and installation of facilities, including buildings and other structures, could potentially lead to mortality of eggs or nestlings and destruction of nests from nest disturbance (e.g., Barn Swallow). The installation of loading arms on the existing jetty may adversely affect birds using the jetty for nesting or roosting during construction.

Although not anticipated, should bats roost in any existing buildings or structures, demolition of these facilities may potentially cause disturbance or mortality of roosting bats. Removal of the access bridge and installation of a new vehicle road crossing both have the potential to cause changes to the movement of larger mammals (e.g., ungulates, predators) through the Project site, either by impeding movement (bridge removal) or increasing potential access points (road crossing). The consequence could be increased mortality or injury from wildlife-vehicle collisions when animals use alternative routes. Mammals (particularly deer) may be killed through collisions with construction vehicles.

9.3.2.2 Operations Phase

9.3.2.2.1 Habitat Alteration and Fragmentation

Site activities during operations will be greatly reduced and limited to previously disturbed areas. No alteration or fragmentation of habitat for amphibians, birds or mammals is anticipated from site activities during operations.

9.3.2.2.2 Disturbance or Displacement

Although increased rail traffic during operations may increase disturbance to mammals through impediment of movement, the likelihood of this effect to occur is low because the railway corridor already exists, and railcars will proceed at slow speed.

Potential adverse environmental effects to marine birds may be caused by increased noise and lighting associated with the dock-side activities at the jetty. Increased light intensity at night associated with the wharf and loading arm may disrupt the migration of birds (if attracted to the light source), disorient birds during night time, and locally disturb marine birds using the shallow subtidal areas adjacent to the berth. Increased noise above water may disturb marine birds.

9.3.2.2.3 Mortality

Road traffic during operations will be greatly reduced and therefore potential effects involving wildlife will also be reduced; however, there is still the possibility that traffic during operations and maintenance may result in vehicle-wildlife collisions on roads and cause associated mortality of amphibians, birds or mammals, if present.

There is also a potential for wildlife mortality along the railway line due to increased rail traffic on the existing railway corridor between the sub-lease Site and Port Edward; however, the railway corridor already exists, and the likelihood of increased wildlife mortalities from additional rail traffic is low, considering the slow speed at which railcars proceed between these locations. The movement of railway cars into and out of the sub-lease Site may contribute to the introduction of invasive wildlife such as rats (*Rattus* sp.), which may increase the mortality risk of amphibians and birds within or outside of the sub-lease Site. However, given that the railway has been operating for many years, any additional effect from rat predation on amphibians or birds will likely be negligible.

Any potential road and rail mortality of birds may possibly be exacerbated by the attraction of birds to artificial lighting in product delivery areas. The facility will include a ground flare which is intended to be used only during emergencies, but it is possible that the system may be used under controlled instances for maintenance purposes as well. Potential adverse effects from a ground flare on wildlife is limited to birds. Ground flaring during the hours of darkness when carried out during migration periods (spring or fall) may cause mortality of migrating songbirds if attracted to the light. Artificial light sources have been known to cause disorientation of songbirds and seabirds, leading to bird injury or death from collisions with structures or to exhaustion from continuously circling (Longcore et al. 2013). However, given the proximity of Project to the existing operations adjacent to the site, it is unlikely that lights of the Project will result in an increase in bird mortality. The ground flare structure may be used as a perching site by birds (e.g., small raptors), which may, in theory, lead to mortality if flaring begins when a bird is perched on the structure (Keeping Company With Kestrels and EDM International, Inc. 2013).

No amphibians are expected to use the area of the gas powered compressor due to the absence of suitable habitat.

Potential adverse effects from berthing and moving of carriers in marine waters of the PRPA navigational jurisdiction are limited to birds, as amphibians and terrestrial mammals are not expected to use marine areas around the wharf. Mortality or injury of marine birds during operations may occur from ingestion of potentially toxic substances (e.g., carrier fuel, waste) associated with railcar unloading and vessel loading.

Wildlife such as black bears may be attracted to waste or food odours or waste disposal facilities in the sub-lease Site, if waste is not properly managed. This may potentially lead to human-wildlife conflict resulting in the need to destroy a black bear to keep employees safe.

9.3.2.3 Decommissioning

During decommissioning, land-based above-ground infrastructure (including buildings) will be removed on the sub-lease Site. Potential adverse effects on wildlife associated with these activities are expected to be limited to birds.

Decommissioning of structures and buildings may cause mortality or disturbance of nesting birds and their young, or destruction of nests or eggs (e.g., Barn Swallow). Mortality or injury of birds may also occur from ingestion of toxic substances associated with permanent removal of facilities.

9.3.3 Mitigation Measures

Mitigation measures for the potential adverse environmental effects of the Project on the Terrestrial Wildlife VC are outlined below for construction, operation and decommissioning phases. It is anticipated that adverse environmental effects can be mitigated with routine measures including careful planning, design and management practices described herein. As mitigation measures often overlap for multiple Project activities and can be specific to individual VC sub-components, mitigation measures have been provided by Project phase and VC sub-component rather than Project activity to reduce repetition. A summary of potential adverse environmental effects, mitigation measures, and expectations for any residual effect for the Terrestrial Wildlife Resources VC is provided in Table 9-8.

9.3.3.1 Construction Phase

Mitigation measures during construction relevant to all wildlife VC sub-components have been drawn from provincial or federal Best Management Practices (BMPs) (MoE 2014a; FLNRO 2014; FLNRO 2013; MWLAP 2004). Considering the historical development of the Project site, its proximity to other current or approved future projects, and the application of standard mitigation practices, no residual effect on amphibians, birds and mammals is expected from Project construction.

Standard mitigation measures recommended for minimizing effects on amphibians, birds and mammals and their habitats include:

- M-1: Developing and implementing a Wildlife Management Plan (WMP) that outlines wildlife specific mitigation and monitoring requirements, as well as potential permitting requirements.
- M-2: Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.
- M-3: Ensuring that equipment and vehicles are in good repair and are not leaking fluids.
- M-4: Developing a spill response plan and having spill kits in all vehicles.
- M-5: Applying best practices to construction including containment of construction and hazardous wastes.
- M-6: Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.
- M-7: Posting appropriate vehicle speed limits.
- M-8: Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.
- M-9: Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.
- M-10: Developing and implementing control plans for sediment, including concrete.
- M-11: Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.
- M-12: Although the potential is low, should amphibians be identified within footprint areas, amphibian salvage and re-location of affected amphibians to wetland areas outside of the Project footprint will be required. Any salvage requires a *Wildlife Act* permit to be obtained ahead of time (permits may take up to four months to obtain).

- M-13: Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.
- M-14: Conducting blasting outside of the bird nesting and bat breeding window (May 1 to July 31) if possible to reduce its potential (temporary) effect on nearby birds and bats. If not possible to avoid the bird nesting and bat breeding window a pre-work confirmation will be conducted to confirm that no birds or nests are present prior to any work that could potentially disturb the birds.
- M-15: Using work area lights that have shades designed to direct light down where it is needed for construction and minimize light directed sky-ward.
- M-16: Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.
- M-17: Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.

9.3.3.2 Operations Phase

The Project, once built, is unlikely to attract wildlife in general. Mitigation will focus on ensuring that the facilities remain unattractive or inaccessible to wildlife, minimizing mortality to any wildlife that does enter the Project footprint, and ensuring that all wastes and contaminants are contained and properly disposed of.

Mitigation measures for the operations phase that are relevant to amphibians, birds and mammals and their habitats have been drawn from provincial BMPs (MoE 2014a; FLNRO 2014; FLNRO 2013; MWLAP 2004). With the application of standard mitigation measures, no residual effect on amphibians, birds and mammals expected as a result of Project operations.

Standard mitigation measures recommended for minimizing effects on amphibians, birds and mammals and their habitats during operations include:

- M-3: Ensuring that equipment and vehicles are in good repair and are not leaking fluids.
- M-4: Developing a spill response plan and having spill kits in all vehicles.
- M-18: Applying best practices to operations including containment of hazardous and non-hazardous wastes. As per the Project Description, secondary containment systems will be provided for the facility where appropriate including berms and drip pans, and waste water will undergo treatment in a separation tank.

- M-6: Preventing sediment and runoff from entering nearby streams, wetlands and the ocean.
- M-19: Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from roadkill or other sources of mortality.
- M-20: Other standard practices that will act to mitigate potential effects are already in place within the Port of Prince Rupert. All international vessels stopping in Canada must have a valid Ship Sanitation Certificate, which certifies that the vessel is free of animal disease vectors (e.g., rats). Rats are known present in the city of Prince Rupert, but ship sanitation requirements should be effective at preventing any additional rats from entering the Port as a result of the Project.
- M-21: Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.
- M-22: Avoiding using the flare system for maintenance purposes during nocturnal periods.
- M-23: Conducting planned flaring events in consideration of migratory bird timing windows, if possible. If it is not possible to avoid flaring during migration pre-work will be completed to confirm that no birds are present prior to any planned flaring.
- M-24: Incorporating visual checks of the burner, to ensure no birds are perched on or near it, into the standard operating procedure before commencing flaring operations.
- M-25: Minimizing the use of artificial lighting wherever possible in order to avoid attracting birds.
- M-15: Using work area lights that have shades designed to direct light down where it is needed for operations and minimize light directed sky-ward.
- M-26: Ensure that vessel operation complies with existing best practices including containment of hazardous and non-hazardous wastes and implementation of appropriate carrier speed limits as specified in the Shipping Act and port regulations.
- M-16: Maintaining clean facilities, including the provision of bear-proof waste containers or daily removal of waste to secure storage before disposal, and secure storage of any substances that may be attractive to bears.
- M-27: Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.

9.3.3.3 Decommissioning Phase

Mitigation measures during decommissioning are anticipated to be similar to those for the construction phase, applied in accordance with the decommissioning activities. With the appropriate mitigation measures in place, no residual effect to amphibians, birds or mammals is expected as a result of Project decommissioning.

Table 9-8: Summary of Potential Adverse Environmental Effects and Mitigation (Including Code)

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
Construction	Applies to All	• Developing and implementing a WMP that outlines wildlife specific mitigation and monitoring requirements, as well as potential permitting requirements.	TR2-M-1 TR3-M-1	N
C-1	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with site grading	• Completing construction outside of the bird nesting window (May 1 to July 31) if possible. In the event it is not possible to conduct work outside of the breeding bird window the mitigation includes pre-work confirmation that no birds are present and breeding prior to any work that could potentially disturb the birds. No mitigation for the effect of disturbance to mammals and amphibians is required. The potential effects are low in magnitude, area, and duration even with no mitigation.	TR2-M-13 TR3-M-13	N
	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N
	Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
C-2	Disturbance or Displacement: Alienation or disorientation of birds from blasting noise disturbance	• Conducting blasting outside of the bird nesting period if possible to reduce its potential (temporary) impact on nearby birds. In the event it is not possible to conduct work outside of the breeding bird window the mitigation includes pre-work confirmation that no birds are present and breeding prior to any blasting.	TR2-M-14 TR3-M-14	N
	Disturbance or Displacement: Potential disturbance of roosting bats from blasting noise	• Conducting blasting outside of the bat breeding season (May 1 to July 31) if possible to reduce its potential (temporary) impact on nearby bats. In the event it is not possible to conduct work outside of the breeding window the mitigation includes pre-work confirmation that no bats are present and breeding prior to any blasting.	TR2-M-14 TR3-M-14	N
C-3	Disturbance or Displacement: Alienation or disorientation of birds or mammals from noise disturbance associated with removal of facilities	• Advising construction crews to be alert to the potential presence of bats near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31) if possible to reduce its potential (temporary) impact on nearby birds. In the event it is not possible to conduct work outside of the breeding bird window the mitigation includes pre-work confirmation that no birds are present and breeding prior to any work that could potentially disturb the birds.	TR2-M-13 TR3-M-13	N
	Mortality: Roadkill mortality of amphibians, birds or mammals	• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
	Mortality: Mortality or injury of eggs/nestlings from nest disturbance	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N
		• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete.	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
C-3	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
		• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N
		• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
C-4	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with relocation of settling ponds	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environ-mental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31) if possible to reduce its potential (temporary) impact on nearby birds. In the event it is not possible to conduct work outside of the breeding bird window the mitigation includes pre-work confirmation that no birds are present and breeding prior to any work that could potentially disturb the birds.	TR2-M-13 TR3-M-13	N
	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N
		• Should amphibians be identified within footprint areas, amphibian salvage and relocation to wetland areas outside of the Project footprint will be required. Any salvage requires a *Wildlife Act* permit.	TR2-M-12 TR3-M-12	N
C-4	Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environ-mental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
	Mortality: Amphibian, bird or mammal mortality from hazardous	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
	substances	• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete.	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
		• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
		• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N
		• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N
C-5	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with installation of utilities	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
C-5	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
		• Should amphibians be identified within footprint areas, amphibian salvage and relocation to wetland areas outside of the Project footprint will be required. Any salvage requires a *Wildlife Act* permit.	TR2-M-12 TR3-M-12	N
	Mortality: Mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
C-5	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N
		• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete.	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
		• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
		• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N
C-5	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
C-6	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with construction of rail tracks	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N
	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N
		• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
		• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
C-6	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N
		• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N
C-7	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with re-grading of sidings	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N
	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N
		• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete.	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
		• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
C-7	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N
		• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N
C-8	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with electric connection to grid	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
C-9	Disturbance or Displacement: Alienation or disorientation of birds from noise or light disturbance associated with installation of loading arms	• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
		• Using work area lights that have shades designed to direct light down where it is needed for operations and minimize light directed sky-ward.	TR2-M-15 TR3-M-15	N
	Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of nesting birds within and near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
C-10	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with installation of storage tanks	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	
	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N
	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N
		• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete.	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
		• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
		• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N
C-10	Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of nesting birds within and near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
C-11	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with bridge removal	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N
	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery working near any watercourse uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N
		• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete.	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
		• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
C-11	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N
		• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
	Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of nesting birds within and near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
C-12	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with installation of new road crossing	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N
	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	TR2-M-2 TR3-M-2	N
		• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	TR2-M-17 TR3-M-17	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
C-12	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	TR2-M-8 TR3-M-8	N
		• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	TR2-M-9 TR3-M-9	N
		• Developing and implementing control plans for sediment, including concrete.	TR2-M-10 TR3-M-10	N
		• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
		• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
		• Applying best practices to construction including containment of construction and hazardous wastes.	TR2-M-5 TR3-M-5	N
		• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	TR2-M-6 TR3-M-6	N
		• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N
	Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of nesting birds within and near footprint areas during construction and to inform the environmental monitor should any be detected.	TR2-M-11 TR3-M-11	N
		• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3-M-13	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
C-13	Mortality: Mortality of amphibians, birds or mammals from wildlife-vehicle collisions	• Posting appropriate vehicle speed limits.	TR2-M-7 TR3-M-7	N
		• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks. • Advising construction crews to be alert to the potential presence of amphibians, birds or other wildlife on the road and to inform the environmental monitor should any be observed.	TR2-M-17 TR3-M-17 TR2-M-11 TR3-M-11	N
O-1	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	TR2-M-3 TR3-M-3	N
		• Developing a spill response plan and having spill kits in all vehicles.	TR2-M-4 TR3-M-4	N
		• Applying best practices to operation including containment of hazardous and non-hazardous wastes. As per the Project Description, secondary containment systems will be provided for the facility where appropriate including berms and drip pans, and waste water will undergo treatment in a separation tank.	TR2-M-18 TR3-M-18	N
		• Preventing sediment and runoff from entering nearby streams, wetlands and the ocean.	TR2-M-6 TR3-M-6	N
	Mortality: Mortality of amphibians, birds or mammals due to collisions with vehicles or railway cars	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-21 TR3-M-21	N
		• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	TR2-M-27 TR3-M-27	N
		• Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from roadkill or other sources of mortality.	TR2-M-19 TR3-M-19	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
O-1	Mortality: Mortality of black bears due to human-wildlife conflict	• Maintaining clean facilities, including the provision of bear-proof waste containers or daily removal of waste to secure storage before disposal, and secure storage of any substances that may be attractive to bears.	TR2-M-16 TR3-M-16	N
O-3	Mortality: Mortality of birds due to attraction to ground flare at night	• Avoiding testing the flare system during nocturnal periods.	TR2-M-22 TR3-M-22	N
		• Conducting planned flaring events in consideration of migratory bird timing windows, if possible.	TR2-M-23 TR3-M-23	N
		• Incorporating visual checks of the burner, to ensure no birds are perched on or near it, into the standard operating procedure before commencing flaring operations.	TR2-M-24 TR3-M-24	N
O-4	Mortality: Mortality of amphibians, birds or mammals due to railway car collision	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-21 TR3-M-21	N
		• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	TR2-M-27 TR3-M-27	N
		• Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from being killed by railway cars.	TR2-M-19 TR3-M-19	N
O-5	Mortality: Mortality of amphibians, birds or mammals due to railway car collision	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-21 TR3-M-21	N
		• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	TR2-M-27 TR3-M-27	N
		• Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from being killed by railway cars.	TR2-M-19 TR3-M-19	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
O-6	Mortality: Mortality of amphibians, birds or mammals due to railway car collision	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	TR2-M-21 TR3-M-21	N
		• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	TR2-M-27 TR3-M-27	N
		• Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from being killed by railway cars.	TR2-M-19 TR3-M-19	N
O-7	Disturbance or Displacement: Disturbance of migrating birds, resting marine birds and birds using the shoreline from increased noise and lighting	• Minimizing the use of artificial lighting wherever possible in order to avoid attracting birds.	TR2-M-25 TR3-M-25	N
		• Using work area lights that have shades designed to direct light down where it is needed for operations and minimize light directed sky-ward.	TR2-M-15 TR3-M-15	N
	Mortality: Bird mortality from ingestion of hazardous substances	• Applying best practices to operation of vessels including containment of hazardous and non-hazardous wastes.	TR2-M-26 TR3-M-26	N
O-10	Mortality: Bird mortality from contact with/ ingestion of hazardous substances/carrier fuel/waste	• Applying best practices to operation of vessels including containment of hazardous and non-hazardous wastes.	TR2-M-26 TR3-M-26	N
	Mortality: Bird mortality from invasive species (e.g., rats coming off carriers)	• Standard practices that will act to mitigate potential impacts are already in place within the Port of Prince Rupert. All international vessels stopping in Canada must have a valid Ship Sanitation Certificate, which certifies that the vessel is free of animal disease vectors (e.g. rats). Rats are known present in the city of Prince Rupert, but ship sanitation requirements should be effective at preventing any additional rats from entering the Port as a result of the Project.	TR2-M-20 TR3-M-20	N

Activity	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
O-11	Mortality: Bird mortality from contact with/ ingestion of hazardous substances/carrier fuel/waste	• Applying best practices to operation of vessels including containment of hazardous and non-hazardous wastes.	TR2-M-26 TR3-M-26	N
D-1	Disturbance or Displacement and Mortality: Disturbance of birds nesting on structures, and destruction of their eggs or young	• Advising crews to be alert to the potential presence of nesting birds within and near footprint areas during decommissioning and to inform the environmental monitor should any be detected.	TR2-M-21 TR3-M-21	N
		• Completing decommissioning outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	TR2-M-13 TR3- M-13	N
	Mortality: Wildlife mortality from ingestion of hazardous substances	• Applying best practices to decommissioning activities including containment of hazardous and non-hazardous wastes.	TR2-M-5 TR3-M-5	N

9.3.4 Characterization of Residual Effects and their Significance

Based on the information presented in the above sections, the small Project footprint and the existing anthropogenic disturbance, it is concluded that the Project will result in negligible effects on Terrestrial Wildlife Resources. With the implementation of appropriate mitigation measures as described in the above sections, no residual effect on the Terrestrial Wildlife Resources VC is expected from the Project.

In the absence of residual effects on the Terrestrial Wildlife Resources VC a characterization and determination of significance is not required.

9.3.5 Cumulative Effects

As there are no residual effects on Terrestrial Wildlife Resources there is no potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents.

9.4 Follow-up Strategy

Table 9-9 provides a summary of EMPs and related monitoring programs that will be implemented to verify the effectiveness of the mitigation measures identified for the Terrestrial Wildlife Resources VC.

Table 9-9: Summary of EMPs and related monitoring programs associated with Terrestrial Wildlife Resources VC

Environmental Management Plan	Proposed Monitoring Plan*
Construction Environmental Management Plan (CEMP)	
Health and Safety Plan	Terrestrial Habitat and Wildlife Monitoring (Bears)
Wildlife Management Plan	Terrestrial Habitat and Wildlife Monitoring (Amphibians, Birds and Mammals)
Blast Management Plan	Terrestrial Habitat and Wildlife Monitoring (Birds, Bats)
Operation Environmental Management Plan	
Wildlife Management Plan	Terrestrial Habitat and Wildlife Monitoring (Amphibians and Birds)
Decommissioning Environmental Management Plans	
Wildlife Management Plan	n/a

*Details of any proposed monitoring programs will be determined in discussion with RTI and PRPA.

10 AIR QUALITY

This section presents the assessment of Air Quality Intermediate Component (IC). A technical report is available in Appendix 10-A for more detail on the information and results presented herein.

10.1 Context and Boundaries

Air Quality, for the purposes of this assessment, is defined to be the quality of ambient air as defined through government-supported objectives and standards as well as emissions into the ambient air that may directly or indirectly cause adverse human health or environmental effect. Air Quality was assessed as an IC because of the relevance to local community health and greenhouse gas emissions inventory, the potential of the Project to contribute adversely to existing air quality conditions and the potential to adversely affect other VCs.

10.1.1 Overview and Regulatory Setting

The *Environmental Management Act* (EMA, 2016), current to November 11, 2015 is relevant to the evaluation of air quality/emissions for the Project. The EMA provides the MoE with the authority to develop objectives to manage air quality. The provincial Ambient Air Quality Objectives (AAQOs) are set for this purpose. It is assumed that the AAQOs will be interpreted by the federal authorities, PRPA in particular, in a consistent manner to the provincial regulators.

The AAQOs are set to protect human health and the environment. As such, these objectives constitute key criteria by which the Project has been assessed.

The AAQOs are non-statutory limits (not legally binding) and are expected to be used in the following manner (Government of BC, 2016a):

- Evaluate current and past air quality;
- Support decisions on environmental impact assessment and authorizations;
- Inform regulatory development; and
- Develop management strategies.

Federal guidance on GHG emissions does not currently exist. However, the federal government does require annual reporting on facilities with >50K Co2e emissions. At this time, only LNG facilities in BC are regulated for their GHG emissions (Government of BC, 2016b). However, this legislation (Greenhouse Gas Industrial Reporting and Control Act) is intended to be expanded to other industrial emissions sources over time. Consistent with this evolving legislation and current environmental assessment air quality practices in the Province, the Project total GHG emissions are included in the assessment herein.

A recent 'airshed study' was completed for this area by the provincial government (BC Ministry of Environment, 2016). The purpose of the study was to evaluate potential constraints to the airshed in light of significant industrial development associated with six proposed LNG export facilities. Sulphur dioxide (SO_2), nitrogen oxides (NO_x) and fine particulate matter ($PM_{2.5}$) were addressed by estimating the total emissions associated with eight LNG build-out scenarios, including the additional transportation emissions that would accompany the facility operations, and their impacts through dispersion modelling and effects assessment. As a government-sponsored study, the implications and recommendations of the study are also considered relevant to the regulatory setting of the Project.

The results of the study, which included four receptor groups (human health, vegetation, soils and lakes), identify low to moderate risk for most receptors and some potential for effects thresholds to be exceeded, primarily in industrial areas. These conclusions are associated with the combination of existing and proposed (LNG scenario) emissions. As such, the report recommendations state that impact assessment and subsequent permitting will require refined emissions estimates and site specific field data to manage risk from future industrial emissions.

10.1.2 Selection of Intermediate Component

Air Quality is assessed as an IC with particular relevance to the Human Health VC, because the Project has the potential to adversely affect human health through changes to air quality associated with its emission sources. Effects related to Human Health as a result of changes in Air Quality are assessed in Section 13, Human Health.

10.1.2.1 Sub Components

The air quality component of the assessment has two sub-components, as shown in Table 10-1 below.

Table 10-1: Sub-components of the Human Health VC

Sub-component	Rationale for Selection
Air Emissions	Factors that affect human, animal, and environmental health
GHG emissions	Effect on climate change

10.1.2.2 Indicators

The indicators used to assess how the Project changes each of the above sub-components of air quality are shown in Table 10-2 below. In addition to GHGs, criteria air contaminants (CACs) are identified.

Table 10-2: Indicators for Air Quality

Indicator	Direct or Indirect	Rationale
Air Emissions:		
NO_x	Direct	NO_x is a CAC, with AAQOs
SO_2	Direct	SO_2 is a CAC, with AAQOs
CO	Direct	CO is a CAC, with AAQOs
VOC	Direct	VOC is a CAC
PM_{10}	Direct	PM_{10} is a CAC, with AAQO
$PM_{2.5}$	Direct	$PM_{2.5}$ is a CAC, with AAQOs
NH_3	Direct	NH_3 is a CAC
GHG Emission:		
CO_2e	Indirect	CO_2e is a measure of GHGs which influence climate change

10.1.3 Assessment Boundaries

10.1.3.1 Spatial

The air quality study uses a LSA that covers a 625 km^2 area centered on the Project site, including Prince Rupert and Port Edward as shown in Figure 10-1 and summarized in Table 10-3. The area shows the AltaGas sub-lease site as well as the RTI lease site (RTI Lease Land) that encompasses the Project sub-lease site. The LSA area was chosen since it includes the nearby communities of Prince Rupert and Port Edward as well as any additional sensitive receptors that could be influenced by the Project emissions. This constitutes the area over which the Project emissions may influence local air quality.

The LSA encompasses the areas over which the key Project activities will occur, including:

1) The Project sub-lease site and within a 500 m buffer surrounding the area for determination of project effects (e.g., gas flaring) on wildlife and the environment;

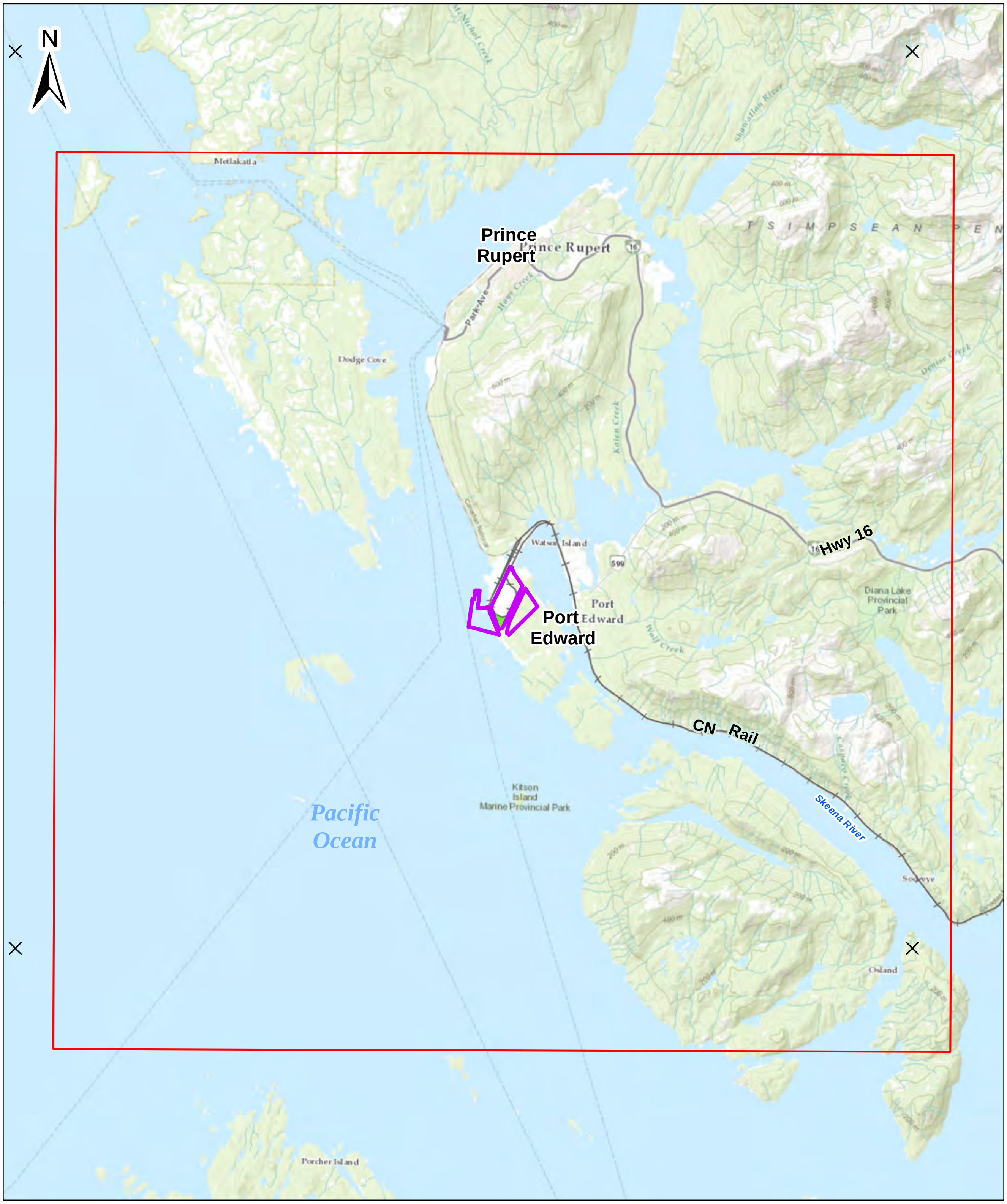
2: The rail transportation corridor within PRPA/RTI jurisdiction from the AltaGas sub-lease site and receptors to Port Edward; and

3: The area within PRPA marine jurisdiction related to berthing and transit to and from the RTI wharf/berth.

The LSA is defined to be equal to the RSA since no significant regional air quality effects due to the Project emissions are expected (i.e., the Project emissions levels are not expected to be high enough to materially influence regional air quality).

Table 10-3: Spatial Boundaries for Air Quality

Spatial Extent	Description
LSA	25 km by 25 km area roughly centered on the Project site, including the nearby communities of Prince Rupert and Port Edward.
RSA	Identical to the LSA.



LEGEND

- Air Quality Local and Regional Study Area
- AltaGas Sub-Lease Land
- Ridley Terminals Inc. Lease Lands
- Railway

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, ©

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CLIENT NAME:	PROJECT LOCATION:
AltaGas Ltd.	Ridley Terminal Ridely Island, Prince Rupert, BC

Figure 10-1: Air Quality Study Areas

0 1,350 2,700 5,400 8,100 10,800 Meters

BY: SS	DATE: 2016/06/28	SCALE: 1:160,000	REF No: REV: 0
CHK'D: BM	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-109-001

MXD Path: P:\LOBIEIAM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_109_001_Air_Quality.mxd

Project Path: P:\Current Projects\Other Projects\5078XX\507890 PRPA\Geomatics

10.1.3.2 Temporal

The potential effects specific to the Project are based on the three main phases of the Project:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

10.2 Existing Conditions

This section describes the existing conditions of the LSA and RSA as it relates to the Air Quality IC and the sub components. The existing conditions form the baseline by which potential Project-related changes to the IC and subcomponents can be measured.

The existing conditions are identified in this section, including the current climate and air quality in the region beyond the LSA/RSA, as well as the existing industrial emission sources at the Port of Prince Rupert.

10.2.1 Methods and Data Sources

Data sources described in Section 10.2.1.1 were used to characterize the existing conditions for the LSA/RSA for:

- Ambient air quality and meteorological monitoring data
- Existing Port emissions over the most recent calendar year assessed (2013)

10.2.1.1 Desktop and or Field Studies Conducted

A desktop study was completed to characterize the existing air quality and emissions in the region as well as the climate norms. In addition, the Project construction and operation emissions were characterized and a detailed air quality modelling exercise was performed to evaluate the maximum potential off-site air quality impacts that could result from the Project operations. The additional data sources used to complete the emissions and air quality modelling assessments were:

- Emission rates specific to the Project sources and the transportation sources associated with the Project operation. These rates were selected from a number of relevant emissions data providers including Environment Canada and the U.S. Environmental Protection Agency (EPA).

- The California Puff (CALPUFF) model, which is a refined regulatory dispersion model developed for the U.S. EPA (EPA, 2016) and supported by the B.C. Ministry of Environment in their Dispersion Modelling Guidelines (BC MoE, 2015a)

The climate normal for PR Roosevelt Park, situated in the community of Prince Rupert, is shown in Table 10-4. This station is approximately 9 kilometers from the Project site. Precipitation data was obtained from the Environment Canada Climate Data website (Environment Canada, 2010) for the period 1981 - 2010. Temperature data was obtained from the BC Ministry of the Environment website (BC MoE, 2015a) for the period 2012 - 2015. The location of the meteorological station is shown in Figure 10-2.

Table 10-4: Precipitation Normals and Temperature Data for PR Roosevelt Park

	Parameter	Jan.	Feb	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature (°C) (2012-2015)	Mean Daily Avg.	5	3	5	6	10	11	14	14	12	9	5	3
	Mean Daily Max.	7	6	7	9	13	15	17	17	15	11	7	5
	Mean Daily Min.	3	1	2	4	8	10	11	12	10	7	3	2
	Extreme Max.	15	12	13	13	21	27	25	23	23	20	13	13
	Extreme Min	-3	-7	-9	0	2	5	8	8	6	-2	-7	-6
Precipitation (1981 – 2010)	Monthly Rainfall (mm)	292.8	210.7	232.5	213.0	153.9	131.8	115.7	155.5	242.8	405.8	371.0	322.1
	Monthly Snowfall (cm)	292.8	210.7	232.5	213.0	153.9	131.8	115.7	155.5	242.8	405.8	371.0	322.1
	Monthly Total (mm)	314.1	238.1	242.8	216.2	153.9	131.8	115.7	155.5	242.8	406.4	383.5	342.5
	Extreme Daily Rainfall (mm)	107.2	111.5	84.2	113.8	56.6	70.9	74.4	86.1	139.2	135.4	106.4	138.8
	Extreme Daily Snowfall (cm)	30.5	39.4	34.3	38.6	3.8	0.0	0.0	0.0	0.0	7.6	26.7	40.6
	Extreme Daily Precipitation (mm)	107.2	111.5	84.2	113.8	56.6	70.9	74.4	86.1	139.2	135.4	106.4	138.8

LEGEND

★ Project Location

⊕ Meteorological Station

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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CLIENT NAME:	PROJECT LOCATION:
AltaGas Ltd.	Ridley Terminal Ridely Island, Prince Rupert, BC

Figure 10-2: Meteorological Station Location

0 625 1,250 2,500 3,750 5,000 Meters

BY: SS	DATE: 2016/06/28	SCALE: 1:75,000	REF No: REV: 0
CHK'D: BM	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-109-002

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_109_002_Meteorological Stations.mxd

Project Path: P:\Current Projects\Other Projects\5078XX\507890 PRPA\Geomatics

10.2.2 Description of Existing Conditions

The existing ambient AAQOs in BC are identified in Table 10-5. The existing air quality in the LSA is identified in Table 10-6. The ambient data shown in Table 10-6 originate from the Mobile Air quality Monitoring Laboratory (MAML) station, which was situated at Westview in Prince Rupert from April 2013 to August 2013 (data provided by PRPA staff). There are no additional ambient air quality data available for the LSA at this time. The monitoring data show full compliance with the AAQOs.

Table 10-5: BC Ambient Air Quality Objectives

Air Contaminant and Averaging Period	BC Objective (micrograms per m^3 ($\mu g/m^3$))		
	Level A	Level B	Level C
CO			
1hr max	14,300	28,000	35,000
8hr max	5,500	11,000	14,300
NO_2			
1hr max (interim)	188[1]		
Annual (interim)	60		
SO_2			
1hr (interim)	200[2]		
$PM_{2.5}$			
24hr max	25[3]		
Annual	8		
PM_{10}			
24hr	50		

1 Achievement based on annual 98th percentile of daily 1-hour maximum, over one year
2 Achievement based on annual 99th percentile of daily 1-hour maximum, over one year
3 Achievement based on 98th percentile of daily average, over one year

Table 10-6: Summary of Air Quality Monitoring Data in LSA (Refer to Table 10-5 for more information about BC ambient air quality identified below)

Substances of Interest	Parameter	MAML Westview (2013) Concentration (μg/m^3)
CO	One-hour Maximum (14,300 objective)	721.233
	One-hour 98th Percentile	320.548
	One-hour 90th Percentile	263.307
	Mean One-hour Average	190.133
	8-hour Maximum (5,500 objective)	366.340
	8-hour 98th Percentile	276.186
	24-hour Maximum	281.433
	24-hour Average	189.960
PM2.5	24-hour Maximum (25 objective)	8.054
	24-hour 98th Percentile	6.734
	24-hour 90th Percentile	5.155
	24-hour Average	2.433
	Annual Average (8 objective)	2.445
NO_2	One-hour Maximum (188 objective)	49.652
	One-hour 98th Percentile	30.280
	Mean One-hour Average	8.988
	24-hour Maximum	17.233
	24-hour 98th Percentile	16.388
	24-hour Average	8.975
SO2	One-hour Maximum (200 interim objective)	16.747
	One-hour 99th Percentile	5.757
	One-hour 98thPercentile	4.710
	One-hour Average	0.808
	24-hour Maximum	2.442
	24-hour 98th Percentile	2.373
	24-hour Average	0.803

10.3 Assessment of Potential Adverse Environmental Effects

The AltaGas sub-lease site is located within the RTI Lease Land, and on existing RTI marine structures (e.g. the wharf), which are located within PRPA jurisdiction. The assessment of potential adverse effects includes determination of the Project emissions effects on the environment.

It is not anticipated that Project construction and decommissioning activities will affect the local air quality and therefore these activities will not be considered further in the assessment of adverse environmental effects. Project operations were the focus of this assessment. The Project emissions as well as the effects of these emissions on the ambient air quality in the LSA are addressed in the following sections.

10.3.1 Potential Interactions of the Project

Potential interactions between Project components and activities occurring in the LSA and RSA and the two sub-components of the Air Quality are described in Table 10-7.

Project-VC interactions were categorized as follows:

- N = no interaction;
- M = minor interaction; and
- CF = interaction to be considered further in the environmental evaluation.

A minor interaction (M) results in an adverse effect that will be eliminated or reduced to negligible by using effective and established mitigation measures or best management practices. Minor interactions and their associated well-established mitigations are described below in Section 10.3.2, and therefore not included in the characterization of residual effects, and cumulative effects assessment.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Project-related effects on current use of land and resources for traditional purposes will be discussed in Section 14, First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes.

Table 10-7: Project Interaction Table

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Air Quality	GHGs
C-1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	M	M
C-2	Site blasting which may involve explosives manufactured off site.	M	N
C-3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	N	N
C-4	Relocation and reconstruction of existing settling ponds. Involving infill of settling ponds, and excavation of new settling pond in the northwest corner of the sublease within RTI lease land.	N	N
C-5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	N	N
C-6	Construction of tracks.	N	N
C-7	Re-grading of existing sidings on RTI lease land.	M	N
C-8	Connection to BC Hydro grid on PRPA lands.	N	N
C-9	Upgrade to Existing Jetty: Installation of piping and loading arms.	N	N
C-10	Installation and hydrotesting of refrigerated storage tanks and equipment.	N	N
C-11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	N	N
C-12	Installation of a new vehicle access bridge to RTI coal stockyard area.	N	N
C-13	Local transport of materiel and personnel to and from the site and PRPA lands.	N	N
O-1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	CF	CF
O-2	Gas powered compression, supplemented with BC Hydro power.	CF	CF
O-3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring twice a year and in the case of emergencies.	CF	CF
O-4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	CF	CF
O-5	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	M	M
O-6	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12 to 18 months.	CF	CF
O-7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	N	N
O-8	Refrigerating and storing propane. Propane is passed through a heat exchanger where it is chilled to approximately -42 C and transferred to a refrigerated storage tank.	N	N

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Air Quality	GHGs
O-9	Propane delivery to the carrier via new piping driven by electric pumps will occur once every 15 to 20 days and take about 48 hours.	N	N
O-10	Berthing of LPG carriers at the RTI berth facility.	CF	CF
O-11	LPG carrier movements in PRPA navigational jurisdiction	CF	CF
D-1	Removal of land-based above-ground infrastructure on sub-lease site.	N	N

Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor interaction with well-known mitigation measures enacted and are not considered further in the environmental evaluation; and CF = interaction to be considered further in the environmental evaluation

All Project-VC interactions categorized as CF in Table 10-7 are assessed in more detail below (Section 10.3.2) since there is reasonable level of uncertainty that there may be an effect and whether the effect may exceed acceptable levels or standards without implementation of project-specific mitigations and may result in residual adverse effects.

10.3.2 Assessment of Potential Effects

The potential adverse environmental effects of the Project on Air Quality are restricted to the following:

- Exceedance of the provincial AAQOs protective of human health in all public areas; and
- Identifying and limiting the release of GHGs to minimize contribution to climate change.

The potential adverse environmental effects associated with these potential interactions are assessed below.

10.3.2.1 Construction Phase

The construction phase of the Project involves demolition of the existing sulphur facility, land clearing and site grading and use of onroad and nonroad vehicles and equipment, as well as marine barging. A construction emissions inventory was developed based on the expected magnitude and duration of activities, assuming diesel fuel is used for all equipment. Engine fuel consumption and emission rates from the U.S. EPA MOVES emissions model were matched to the various equipment, assuming an average engine age of 8 years. Fugitive dust estimates were made based on profiles from the U.S. EPA AP 42 Compilation of Air Pollutant Emission Factors. Marine estimates were based on emission rates from the US EPA Smartway Barge Tool. The construction emissions inventory is shown in Table 10-8.

Table 10-8: Construction Phase Emissions Estimates

Source	Emissions (kg)								
	NO_x	SO_x	CO	VOC	PM_{10}	$PM_{2.5}$	NH_3	CO_2	CO_2e
Offroad Equipment	59,332	75	15,347	3,355	2,730	2,648	131	7,963,320	8,847,120
Marine Sources	1,358	1	232	76	22	20	3	95,868	106,474
Onroad Vehicles	390	1	400	61	37	23	3	118,279	120,246
Fugitive Dust					10,968	2,812			
TOTAL	**61,080**	**77**	**15,978**	**3,493**	**13,757**	**5,503**	**138**	**8,177,467**	**9,073,840**

There are no potential interactions during the construction phase that were carried forward into Air Quality effects assessment. No detrimental effects on CAC and GHG emissions are anticipated during this phase of the Project.

10.3.2.2 Operations Phase

Several potential interactions are carried forward into Air Quality effects assessment. These interactions are all associated with the Project emission sources (including the transportation emission sources that will not be under the control of, or managed by, AltaGas).

The effects assessment of these emissions sources requires development of an emissions inventory and determination of the fate of these emissions (air quality concentrations throughout the LSA) through application of an atmospheric dispersion model. The Project annual emissions inventory during continuous operations at the higher production rate identified by AltaGas (12-18 months after the terminal begins operations) is shown in Table 10-9.

Table 10-9: Total Annual Project Emissions (full production)

Source	Emissions (kg)								
	NO_x	SO_x	CO	VOC	PM_{10}	$PM_{2.5}$	NH_3	CO_2	CO_2e
LPG Carrier – Underway	1,966	49	153	62	29	26	1	83,772	99,761
LPG Carrier – Manoeuvre	2,192	77	173	63	40	37	0	130,215	220,895
LPG Carrier - Berthing	32,508	1,956	2,617	1,001	922	848	3	3,310,778	3,980,192
Tugs – Manoeuvre	1,354	39	106	39	22	20	0	65,590	81,604
Tugs - Escort	1,354	39	106	39	22	20	0	65,590	81,604
Rail Locomotives	2,241	1	358	102	68	66	4	135,719	198,124
Gas Powered Equipment	48,979	1,043	174,926	42,682	10,148	41	966	10,949,203	11,187,700
Flare	126.5	10	695	96	249	249	n/a	763,160	917,710
Total	**90,721**	**3,214**	**179,134**	**44,084**	**11,500**	**1,307**	**974**	**15,504,028**	**16,767,590**

The short-term maximum and short-term average emission rates were also used to evaluate compliance with the provincial AAQOs identified in Table 10-5. The short-term rates do not represent all hours of the year, since (for example) the transportation sources are not always present within the LSA. The CALPUFF dispersion model was used to complete the air quality investigations. CALPUFF is an accepted regulatory dispersion model in the province of BC. (BC MoE, 2015a).

The maximum predicted ambient concentrations from the model are shown in Table 10-10 and Table 10-11 for those air contaminants with AAQOs.

Table 10-10: Maximum Predicted Air Contaminant Concentrations (AAQOs in parentheses) – during Continuous Operations (exceedance-level predictions shown in bold)

Air Contaminant	Averaging Period	Maximum Predicted Concentration (g/m^3) on Port Lands		Maximum Predicted Concentration (g/m^3) on Public Lands	
		Max predicted	Max + background	Max predicted	Max + background
NO_2 (100% conversion)	1-hour[1] (188)	**1,296.0**	**1,339.4**	**281.0**	**324.4**
	Annual (60)	16.3	29.4	0.9	14.0
NO_2 (50% conversion)	1-hour[1] (188)	**648.0**	**691.4**	140.6	184.0
	Annual (60)	8.1	21.2	0.5	13.6
NO_2 (25% conversion)	1-hour[1] (188)	**324.0**	**367.4**	70.3	113.7
	Annual (60)	4.1	17.2	0.2	13.3
SO_2	1-hour (200)	28.7	36.6	7.9	15.8
CO	1-hour (14,300)	1,103.9	1,473.2	102.3	468.6
	8-hour (5,500)	335.9	673.6	20.5	358.2
$PM_{2.5}$	24-hour (25)	0.4	15.4	0.2	15.2
	Annual (8)	0.1	5.0	0.02	5.0
PM_{10}	24-hour (50)	16.2	36.2	0.5	15.5

Notes: [1] 99th percentile of daily 1-hour maximums over the year
[2] 98th percentile of daily 1-hour maximums over the year

Table 10-11: **Maximum Predicted Air Contaminant Concentrations (AAQOs in parentheses) - Flare Only**

Air Contaminant	Averaging Period	Maximum Predicted Concentration (g/m³) on Port Lands		Maximum Predicted Concentration (g/m³) on Public Lands	
		Model max	**Max + background**	**Model max**	**Max + background**
NO_2 (100% conversion)	1-hour[1] (188)	2.0	45.4	2.0	45.4
SO_2	1-hour[2] (200)	0.2	8.1	0.2	8.1
CO	1-hour (14,300)	59.0	425.3	34.0	400.3

Notes: [1] 99th percentile of daily 1-hour maximums over the year
[2] 98th percentile of daily 1-hour maximums over the year

These assessment results shown in Table 10-9, 10-10 and 10-11 are used to address the individual interactions identified in Table 10-7 to be considered further (CF).

O-1 *Continuous operations involving approximately 40 full time people*. The total annual Project GHG emissions during full operations were determined (Table 10-9) to assess the Project's contribution to climate change. The provincial and national GHG totals for the most recent calendar year (2013) are 65 million tonnes and 726 million tonnes CO_2e, respectively (Environment Canada, 2015). The Project's annual GHG emissions (16,768 tonnes CO_2e), as indicated by CO_2e, constitute 0.03% and 0.0002% of the provincial and national totals, respectively. Since emissions from international ships are not included in the provincial and national totals, the effective contribution of the Project to the provincial and national GHG totals will be lower than these values.

O-2, O-4, O-6, O-10 and O-11 – *interactions associated with the Project combustion sources (including transportation)*. The potential adverse environmental effect relates to nitrogen dioxide (NO_2) concentrations near the berth on Port lands. No adverse impacts are predicted on any public lands within the LSA.

The maximum short-term NO_2 predictions are primarily associated with the tug assist activity. The model predictions show potential to exceed the provincial 1-hour NO_2 objective on Port lands. The tugs are primarily responsible for the exceedances due to their shorter stack heights compared to the LPG carriers. The predicted exceedances are infrequent (occur up to 0.5 per cent of the year).

The likelihood of interaction is low for several reasons:

- The model predictions of ambient NO_2 are conservative and include assuming a high level of tug assist occurs at the dock with the LPG carrier for every hour of the year. In reality, the tugs are active for up to an hour for each arrival and departure of an LPG carrier (e.g., up to 60 hours of the year).

- The model assumes that much of the emitted NO from the ship stacks converts to NO_2 immediately upon release. In reality the NO to NO_2 conversion in the atmosphere occurs over time and distance from the source.
- The potential exceedances are very localized and do not extend far from the marine berth.

O-3 *Interactions associated with the ground flare to burn off the removed ethane and methane at the compressor. The ground flare will be open and require maintenance flaring twice a year and in the case of emergencies.* Dispersion modelling of the flare emissions showed no potential for exceeding the provincial ambient objectives.

10.3.2.3 Decommissioning Phase

There are no potential interactions during the decommissioning phase that were carried forward into Air Quality effects assessment because adverse effects on ambient air quality or GHG emissions are expected to be negligible.

10.3.3 Mitigation Measures

10.3.3.1 Construction

All potential adverse effects on Air Quality during construction are expected to be negligible; however, there are effective and established mitigations that can be followed to minimize air quality impacts as follows:

- M-1: Ensuring that equipment and vehicles engines are well maintained and in good repair.
- M-2: Limit the amount of vehicle/equipment idling.
- M-3: Use of water sprays to limit dust liberation during site grading, blasting and handling gravel, during dry periods.

10.3.3.2 Operations

The potential adverse effects on Air Quality – climate change are expected to be negligible. However, the PRPA conducts an annual emissions inventory and emissions reduction program for the port-wide operations (including tenants). The following established mitigation can be followed to minimize the Project's emissions (GHGs as well as CACs):

- M-4: Participate in the PRPA annual emissions inventory and emissions reduction program.

All potential adverse effects on Air Quality during operations are expected to be negligible when the following mitigation measures directly related to berthing and mooring of LPG carriers at the RTI jetty are employed:

- M-5: Ensure that the LPG carriers adhere to the Transport Canada Regulations for Vessel Air Emissions (Transport Canada, 2014)
- M-6: Ensure that the tug assist vessels adhere to the Sulphur in Diesel Fuel Regulations for Non-large vessels (Environment Canada, 2014)
- M-7: Ensure use of the vessel management procedures and standards and practices from the RTI "Terminal Rules and Regulations" and the PRPA Port Information Guide (PRAPA 2015)

10.3.3.3 Decommissioning Phase

The potential adverse effects on Air Quality during decommissioning are expected to be negligible.

10.3.3.4 Summary of Potential Adverse Effects and Mitigation

Table 10-12 provides a summary of potential adverse environmental effects, mitigation, and the residual effect after implementation of mitigation.

Table 10-12: Summary of Potential Adverse Environmental Effects and Mitigation

Phase	Description of Potential Effect	Mitigation	Mitigation code	Residual Effect (Y/N)
Construction/ C1-C13	No direct effect identified	Standard mitigation practices used during construction on land and during site grading	M-1 to M-3	N
Operations O-1	Project contributions to climate change	Reduce energy consumption and GHG emissions where possible. Participate in the PRPA annual emissions inventory and emissions reductions programs	M-4	N
Operations O-2, O-3, O-4, O-6, O-10, O-11	Exceedance of provincial 1-hour NO_2 objective	Follow ocean going vessel emissions standards	M-5	N
		Follow sulphur in diesel regulations for Non-large craft (tugs)	M-6	
		Ensure RTI and PRPA marine rules are followed	M-7	

10.3.4 Residual Effects

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project will not have any significant effects on air quality and GHGs/climate change. The effects that may occur are associated with accidents and unplanned events (especially in the marine transport activities) considered highly unlikely and the effects anticipated to be negligible, for further detail on this assessment refer to Section 15, Accidents and Malfunctions.

10.3.5 Cumulative Effects

As the anticipated residual effects of the Project on the sub-components of Air Quality (air emissions and GHG emission) are expected to be negligible, and largely associated with accidents and unplanned events, the likelihood of similar cumulative effects occurring with the same temporal and spatial extents is not expected. Consequently, no cumulative residual effects are expected.

11 NOISE

This section presents the assessment of the Intermediate Component (IC) Noise.

11.1 Context and Boundaries

Typically, undesirable sound is termed as “noise”, which can affect humans and wildlife. This noise effects assessment was conducted to assess the potential effects or Project-related noise on humans. Noise effects are of particular concern for sensitive receptors, which includes homes, hospitals, and supported living facilities.

Sound energy at a source is typically represented as a sound power level (Lw), while sound level at a distance away from the source is presented as a sound pressure level (Lp). Sound energy dissipates while moving away from the source (referred to as noise attenuation) so the Lw is always higher than the respective Lp, for a given sound source. The amount of noise attenuation depends on the various factors such as barriers, topographic features and meteorological factors.

Sound levels are typically represented as A-weighted decibels (dBA). These correspond to sound levels measured on a sound level meter (SLM) with a filter emphasizing the middle frequency components similar to the frequency response of the human ear. Sound levels for a receptor over a period of time are typically represented as equivalent sound level (Leq), measured at a particular distance from a receptor. The Leq value is the sound level averaged logarithmically over a period of time. This enables noise levels of a variable noise environment with passing planes, local traffic, adjacent intermittent construction, etc. to be described as a single value, and it is a recognized metric to assess the effect on humans.

11.1.1 Overview and Regulatory Setting

The guidelines that framed this assessment of the potential effects of this project on the noise sub-component of the human health VC are outlined below.

Based on feedback from PRPA, it is assumed that the guidelines will be interpreted by the federal authorities, PRPA in particular, in a manner consistent with provincial regulators.

11.1.1.1 District of Port Edward Noise Control Bylaw No. 520

The District of Port Edward has a noise control bylaw (Bylaw No. 520) which prohibits production of noise which disturbs or tends to disturb the quiet, peace, rest, enjoyment, comfort, or convenience of persons in the district.

11.1.1.2 Prince Rupert Port Authority Noise Program

PRPA has a noise program to manage noise related to terminal activities and their impact on residential areas [http://www.rupertport.com/port-authority/sustainability/noise-monitoring]. PRPA has adopted 55 dBA as a baseline for their noise management activities. It has been assumed that 55 dBA is the day time Leq limit at the receptor nearest to a port facility. Furthermore, the 55 dBA limit is assumed to be a general port-wide target. PRPA officials have indicated that in the absence of federal guidelines, provincial thresholds should be followed for environmental assessments.

11.1.1.3 BC Oil and Gas Commission Noise Control Best Practices Guideline

The BC OGC sets permissible sound levels (PSLs) that apply to oil and gas operations under the jurisdiction of the OGC. The "BC Noise Control Best Practices Guideline" does not set limits for temporary or construction noise, but does recommend, ensuring all equipment is fitted with appropriate muffler systems, taking advantage of existing physical barriers and screening, advising residents of noise events, and scheduling appropriately to limit duration of disturbance. The noise limits (or PSLs) in the guideline are only relevant to the impacts of operation of facilities.

For facility operations, the base PSL is an Leq of 40 dBA at night at the nearest dwelling to the facility. If there are no dwellings closer than 1.5 km from the facility fence line then the 40 dBA PSL applies at a distance of 1.5 km from the facility fence line. If there are dwellings closer than 1.5 km, the night-time PSL is adjusted based on dwelling density, distance to transportation sources (i.e., roadways, airports or rail lines), seasonal or existing noise levels, and temporary operations (i.e., <60 days). A daytime adjustment can also be applied, which accounts for sound levels commonly being 10 dBA higher during the day.

Under the OGC guidelines, after calculating the PSL, operators must identify all facility noise sources and their sound/pressure levels, and estimate the sound levels at various distances using a noise model. Noise levels at dwellings are compared with the calculated PSL to determine compliance with the guideline.

11.1.1.4 Health Canada's Useful Information for Environmental Assessments, Section 6

Health Canada's "Useful Information for Environmental Assessments" (Health Canada 2010) provides beneficial information under the federal authority of Health Canada for conducting environmental assessments at the federal and provincial levels. Health Canada does not have enforceable noise guidelines or thresholds of its own, so it draws on various internationally recognized acoustic standards in reference to noise assessments. While Health Canada is in the process of developing a detailed guidance document that is specific to noise assessments in Canada, Section 6 of the current document suggests the following:

- sensitive noise receptors (i.e., residences, schools, etc.) and areas with a "reasonable expectation of peace and quiet" should be identified and mapped in reference to the proposed facility;
- existing or baseline sound levels at receptors should be determined for both daytime and night-time, and included on the map of receptors;
- all potential noise sources associated with a project's construction, operations and decommissioning as well as any tonal, low frequency, impulsive or highly impulsive noise sources should be identified and their associated sound levels estimated;
- the noise levels anticipated at receptor locations during project operation should be predicted and compared with baseline levels during daytime and night-time, and, if warranted, predicted following the application of mitigation measures;
- the severity of any predicted changes in noise levels should be evaluated and, where health effects are predicted, Health Canada advises employing mitigation measures, including community consultation;
- plans for noise management and complaint resolution should be prepared as required; and
- the expected duration and frequency of noise due to construction and any other non-continuous activities should be determined for guidance on whether activities can be considered short-term with regard to complaint levels.

Events such as construction, which typically last less than two months at any given location, are considered by Health Canada to be temporary in duration and community consultation is advised. For events of less than 1 year, Health Canada considers mitigation to be required in cases where widespread complaints or strong community reaction are predicted. For a duration of greater than one year, such as operational noise, where predicted noise levels are in the range of 45-75 dB, Health Canada advises the evaluation of health impact endpoints based on the percentage of those likely to become highly annoyed (HA) and proposes mitigation when that percentage increases by >6.5% or when the predicted noise levels exceed 75 dB.

11.1.2 Selection of Intermediate Component

Noise is assessed as an IC with particular relevance to the Human Health VC, because the Project has the potential to adversely affect human health through changes to noise levels associated with construction of the Project. The rationale for including noise is identified in Table 11-1.

Table 11-1: Sub-components of the Human Health VC

Intermediate Component	Rationale for Selection
Noise (HH2)	The Project will generate noise that has the potential to affect the health and well-being of humans.

11.1.2.1 Indicators and Linkages

The indicators identified to assess how the Project changes the noise IC are identified in Table 11-2.

Table 11-2: Indicators for Noise Sub-component of Human Health VC

Indicator	Direct or Indirect	Rationale
Increase in sound levels	Direct	Sound levels facilitate the analysis of the Project's interaction with the noise sub-component of the human health VC.

11.1.3 Assessment Boundaries

11.1.3.1 Spatial

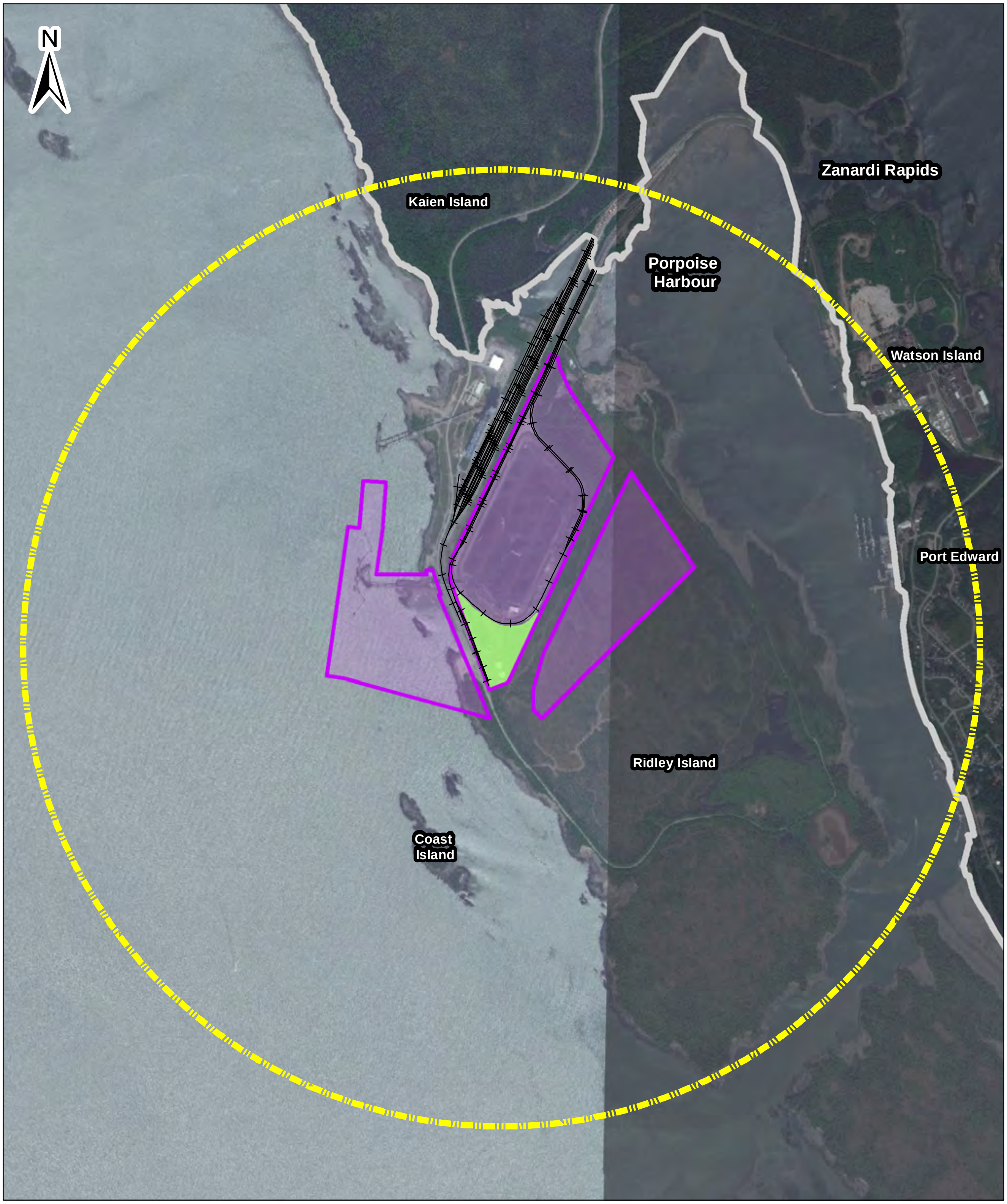
The noise study uses a local study area (LSA) shown in Figure 11-1. The LSA includes the following components:

1) The Project sub-lease site and a 2500-m buffer surrounding the area for determination of project noise effects on human health in Port Edward;
2) The rail transportation corridor within PRPA jurisdiction; and
3) The area within PRPA marine jurisdiction related to berthing and transit to and from the RTI wharf/berth.

The spatial boundaries are identified in Table 11-3. The LSA was chosen as it includes any sensitive receptors in the nearby community of Port Edward (including aboriginal groups in this community); which is the closest area over that the Project related noise might influence human health. The RSA is defined to equal the LSA since no measureable regional noise effects due to the Project are expected.

Table 11-3: Spatial Boundaries for Noise Sub-component of Human Health VC

Spatial Extent	Description
LSA	Circle with radius of 2.5km centred on the Project site, including the nearby community of Port Edward.
RSA	Same as LSA.



LEGEND

- Rail Trackage within PRPA Jurisdiction
- Local/Regional Study Area
- AltaGas Sub-Lease Land
- Ridley Terminals Inc. Lease Lands
- Prince Rupert Port Authority Jurisdiction

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS,

SNC · LAVALIN

CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 11-1: Noise Study Local/ Regional Study Area

0 312.5 625 1,250 1,875 2,500 Meters

BY: SS	DATE: 2016/06/28	SCALE: 1:30,000	REF No: 633752-105-001	REV: 0
CHK'D: JL	PROJ COORD SYS: NAD 1983 UTM Zone 9N			

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_105_001_Noise_Study_LSA_RSA.mxd

11.1.3.2 Temporal

The potential effects specific to the Project are based on the three main phases of the Project:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

11.2 Existing Conditions

The existing noise conditions are identified in this section, based on available monitoring data in Port Edward.

11.2.1 Methods and Data Sources

11.2.1.1 Data Sources Used in the Assessment

The following information sources were used to characterize the existing noise conditions:

- PRPA noise monitoring network
- Pacific NorthWest LNG Technical Data Report – Acoustic Environment (2014)
- Canpotex Potash Export Terminal – Environmental Impact Statement (2011)

11.2.1.2 Desktop and or Field Studies Conducted

A desktop review was conducted of the previous noise assessments for relevance and accuracy; the PNW LNG and Canpotex assessments were reviewed by the appropriate regulators. As such, the existing data was considered sufficient so no field monitoring studies were required.

11.2.2 Description of Existing Conditions

This section describes the existing conditions of the LSA and RSA relevant to the IC and the sub components. The existing conditions form the baseline by which potential Project-related changes to the IC and subcomponents can be measured.

Existing conditions of noise are described in support of the Noise baseline and effects assessment for the Project.

11.2.2.1 PRPA Noise Monitoring Network

PRPA is installing a network of noise monitoring stations in areas potentially impacted by port-related activities; three real-time SLMs have been commissioned to date. The most recent unit, a Brüel & Kjaer model 2250 SLM, was installed at the Sunset Drive Fire Hall in Port Edward (inside the LSA/RSA) in September 2015. The site was selected in consultation with the District of Port Edward considering resident concerns about train whistle and horn noise. Data from September 12 to December 14, 2015, was provided by PRPA for review and characterization; this data is considered representative of sound levels currently experienced in the Port Edward area of the LSA/RSA. The other two SLMs were installed near Prince Rupert, outside the LSA/RSA.

Table 11-4 summarizes the filtered noise monitoring data from the Port Edward monitoring station. The data was filtered to remove the interference of events such as periods of rain and high winds (rain and winds increase sound level readings and cannot be compared to readings during clear weather), or when the unit was out of calibration.

Table 11-4: Noise Monitoring Results for Port Edward Noise Monitoring Station

Date	Time period*	Leq* (dBA)	Ldn* (dBA)
05/10/2015	Night	55	62
05/10/2015	Day	58	
06/10/2015	Night	55	63
06/10/2015	Day	62	
24/10/2015	Night	54	61
24/10/2015	Day	58	
25/10/2015	Night	53	60
25/10/2015	Day	57	
26/10/2015	Night	56	63
26/10/2015	Day	58	
27/10/2015	Night	55	61
27/10/2015	Day	55	
25/11/2015	Night	55	63
25/11/2015	Day	61	
26/11/2015	Night	55	62
26/11/2015	Day	58	
27/11/2015	Night	58	65
27/11/2015	Day	59	
28/11/2015	Night	50	58
28/11/2015	Day	55	

Date	Time period*	Leq* (dBA)	Ldn* (dBA)
10/12/2015	Night	56	63
10/12/2015	Day	57	
12/12/2015	Night	52	59
12/12/2015	Day	55	

* Notes: Day = 7:00am to 10:00pm, night = 10:00pm to 7:00am.

Leq = Continuous equivalent sound level measured over the day-time or night-time period.

Ldn = Day-night equivalent sound level where the night time sound level (Ln) is increased by 10 dBA to account for greater sensitivity to noise at night.

Table 11-4 shows that the day-night equivalent sound level (Ldn) varies between 58 and 65 dBA while the night time sound level (Ln) varies between 50 and 58 dBA.

The location of the PRPA monitoring station in Port Edward is shown in Figure 11-1.

11.2.2.2 Pacific NorthWest LNG Technical Data Report – Acoustic Environment

As part of the PNW LNG environmental assessment, Stantec conducted a noise monitoring program in the Port Edward area in March 2012. Table 11-5 summarizes the filtered monitoring data for monitoring locations within the noise LSA. The average sound pressure levels varied between 51 and 69 dBA; the sound levels were influenced by local community activities, train traffic, airplane flyovers and vehicle traffic.

Table 11-5: Noise Monitoring Results for Pacific NorthWest LNG Noise Monitoring Program within Project LSA/RSA

ID	Location	24-hr Leq for filtered day (dBA)							Average (dBA)
		3	4	5	9	11	12	13	
M3	Port Edward Elementary School	45	46	49	41	51	56	53	51
M4	Residence (Harbour Dr and Rainbow Dr)	59	57	63	58	60	62	59	60
M6	Residence (Skeena Dr)	64	65	72	64	65	69	72	69

The location of the PNW LNG monitoring sites are shown in Figure 11-2.

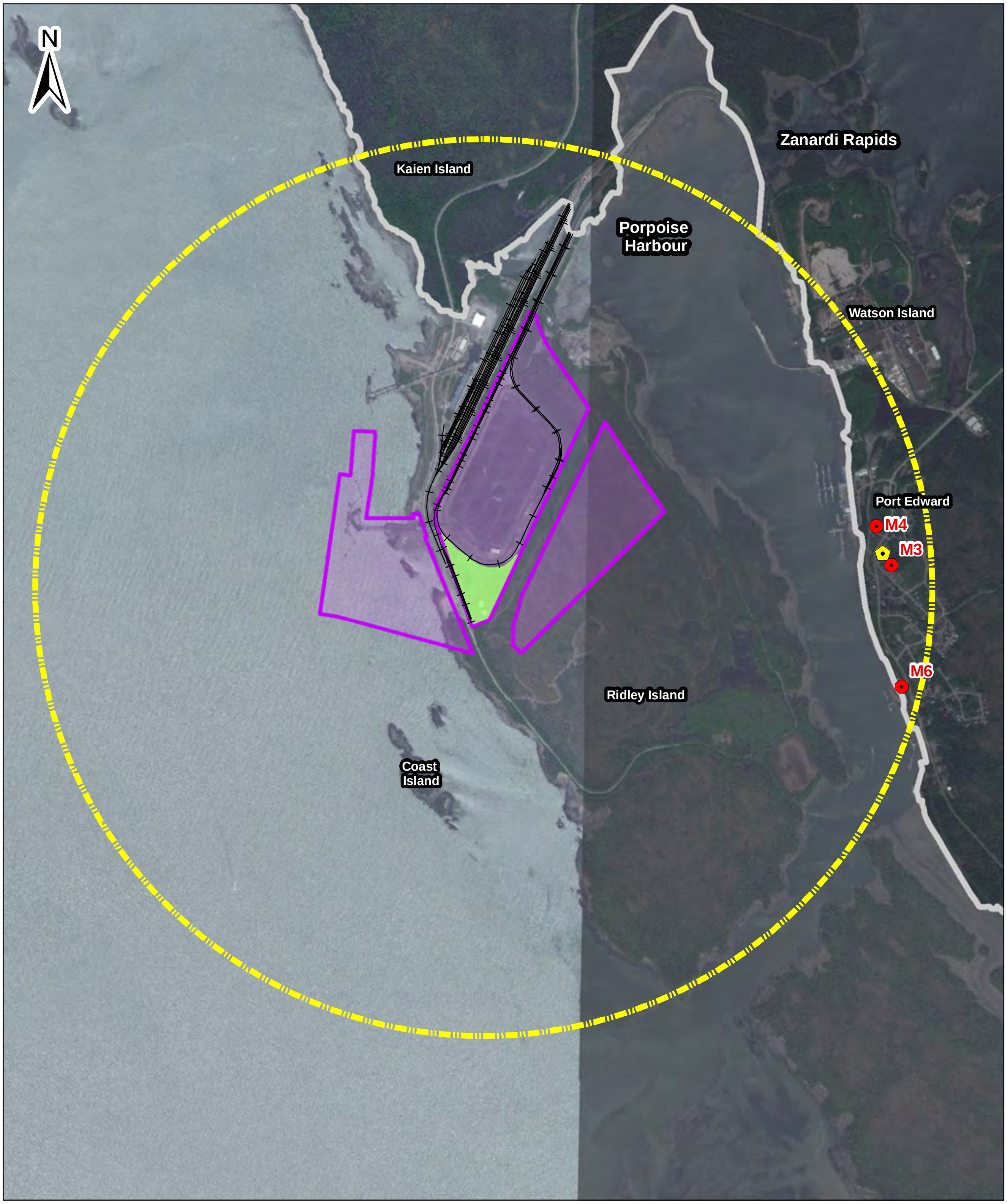
11.2.2.3 Canpotex Potash Export Terminal – Environmental Impact Statement

As part of the CanPotex Potash Export Terminal environmental assessment, Stantec conducted a noise monitoring in the Port Edward area prior to November 2011. The monitoring indicated that the average sound level in Port Edward was 43 dBA for a 40-hour measurement. The location of Port Edward monitoring was not given in the environmental assessment.

11.2.2.4 Existing Conditions Interpretation

As shown in the previous three sections, there is variability in the existing sound levels in the Port Edward area. The variations depend on the location of the monitor and the activities in the area around the monitor. The night-time sound levels at the PRPA monitoring station correspond to average night-time sound levels in urban communities close to transportation infrastructure such as highways or rail lines.

The monitoring locations for PNW LNG within the LSA/RSA and the PRPA monitoring station are considered sensitive receptors in Port Edward for comparison to the Health Canada guidance.



LEGEND

- PRPA Fixed Monitor
- PNW Monitoring Program
- Rail Trackage within PRPA Jurisdiction
- Local/Regional Study Area
- AltaGas Sub-Lease Land
- Ridley Terminals Inc. Lease Lands
- Prince Rupert Port Authority Jurisdiction

0 335 670 1,340 2,010 2,680 Meters

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, DeLorme, USGS,

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CLIENT NAME: AltaGas Ltd.

PROJECT LOCATION: Ridley Terminal
Ridely Island, Prince Rupert, BC

Figure 11-2: Locations of Existing Noise Monitoring Programs

BY: SS	DATE: 2016/06/28	SCALE: 1:32,000	REF No: REV: 0
CHK'D: JL	PROJ COORD SYS: NAD 1983 UTM Zone 9N		633752-105-002

MXD Path: P:\LOBE\AM-BC\Current Projects\AltaGas Ltd\633752 Ridley Terminal LPG_EED\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\633752_105_002_Existing_Noise_Monitoring_Program.mxd

11.3 Assessment of Potential Adverse Environmental Effects

The AltaGas sub-lease site is located within the RTI Lease Land, which is located on the PRPA port lands (Ridley Island). The assessment of potential adverse effects includes determination of the Project noise impacts on both Port lands and public lands.

11.3.1 Potential Interactions of the Project

Project noise interactions were categorized as follows:

N = no interaction;

M = minor interaction; and

CF = interaction to be considered further in the environmental evaluation.

A minor interaction (M) results in an adverse effect that will be eliminated or reduced to negligible by using effective and established mitigation measures or best management practices. Minor interactions and their associated well-known mitigations (i.e., for construction) are described below, and therefore not included in the characterization of residual effects, determination of significance, and cumulative effects assessment. However, the Project operations are the main focus of the assessment.

Table 11-6 summarizes the Project noise interactions considered in the assessment.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Project-related effects on current use of land and resources for traditional purposes will be discussed in Section 14, First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes.

Table 11-6: Project Interaction Table

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Noise
Construction Activity		
C1	Site grading and rock crushing involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	M
C2	Site blasting which may involve explosives manufactured off site.	M
C3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	M
C4	Relocation and reconstruction of existing settling ponds. Involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sublease within RTI lease land.	M
C5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	M
C6	Construction of tracks.	M
C7	Re-grading of existing sidings on RTI lease land.	M
C8	Connection to BC Hydro grid on PRPA lands.	M
C9	Installation of piping and loading arms on existing Jetty.	M
C10	Installation and hydrotesting of refrigerated storage tanks and equipment.	M
C11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	M
C12	Installation of a new vehicle access bridge to RTI coal stockyard area.	M
C13	Local transport of materiel and personnel to and from the site and PRPA lands.	M
Operation and Maintenance		
OM1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	CF
OM2	Gas powered compression, supplemented with BC Hydro power.	CF
OM3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring twice a year and in the case of emergencies.	M
OM4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	CF
OM5	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	CF
OM6	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12 - 18 months.	CF
OM7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	CF
OM8	Refrigerating and storing propane. Propane is passed through a heat exchanger where it is chilled to approximately -42 C and transferred to a refrigerated storage tank.	CF
OM9	Propane delivery to the carrier via new piping driven by electric pumps will occur once every 15 to 20 days and take about 48 hours.	CF

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Noise
OM10	Berthing of LPG carriers at the RTI berth facility.	CF
OM11	LPG carrier movements in PRPA navigational jurisdiction.	CF
Decommissioning		
D1	Removal of land-based above-ground infrastructure on sub-lease site.	M
Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor or negligible interaction not considered further in the environmental evaluation report; and CF = interaction to be considered further in the environmental evaluation.		

All Project interactions categorized as CF in Table 11-6 are assessed in more detail below as there is reasonable level of uncertainty that there may be an effect that exceeds acceptable levels or standards without implementation of project-specific mitigations. It is anticipated that Project construction and decommissioning activities will have minor or negligible interaction with the local sound levels and therefore these activities will not be considered further in the assessment of adverse environmental effects. Construction noise changes can be managed through effective and well-established Best Management Practices, identified below:

- Adhere to applicable noise bylaws or approval conditions.
- Use well-maintained equipment to reduce air pollution and noise.
- Limit idling.
- Schedule heavy vehicle access for materials deliveries in areas close to residences for daytime, non-peak hours to reduce night-time traffic near residences, to the extent practical.
- Notify potentially affected residents of any major construction activities that will be conducted at night.
- Ensure all internal combustion engines are fitted with appropriate muffler systems.
- Take advantage of acoustical screening of existing on-site buildings to shield receptors from construction equipment noise.
- Use “drive-through” site access for roads and temporary storage areas where practical and appropriate, to reduce the use of vehicle backup alarms.
- Avoid working during critical nesting periods if breeding birds (or similar wildlife) are found in close proximity to the construction areas.
- Develop a noise complaint management process for construction, as part of overall project complaint management process.

11.3.2 Assessment of Potential Effects

The potential adverse environmental effects for OM1, OM2, and OM4 through OM11 relate to increased noise associated with Project operations. Increased operational noise can potentially impact nearby sensitive receptors at Port Edwards (e.g., residences, schools, supported living facilities, aboriginal communities etc.), particularly during the night when people are sleeping. Operational noise is primarily associated with operation of stationary equipment such as compressors or condensers used to handle and move the LPG product.

The potential effects of noise produced by the operations phase of the project were assessed with a noise model. A simple noise model was developed and considered suitable due to the relatively flat topography of the area and the conservative assumptions used in the model.

The first conservative assumption was to represent all operations as a single point source at a sound power level calculated from all the noise sources at the project facility, ignoring barrier and topographic effects. The sound energy was then propagated out to a distance of 1.6 km (1.5km plus half of the 200m extent of the facility), accounting for geometric spreading and atmospheric absorption, using Equation 1:

$$Lp = Lw - 20\log_{10}(r) - 8 - A_{air} \qquad \text{Equation 1}$$

Where Lp = Sound pressure level in dBA (i.e., the sound level at a distance)

Lw = Sound power level in dBA of point source representing the project facility (i.e., the intrinsic sound power level of all noise sources at the project facility)

r = Distance (in meters) from the source

A_{AIR} = Attenuation due to atmospheric absorption

The “-8” term accounted for propagation over a reflective plane (hemisphere). Atmospheric absorption parameter A_{AIR} was set at 0.8 dB/1000 ft assuming a temperature of 20°C and 90% relative humidity. The equation is widely used in acoustical engineering practice and can be derived from ISO9613-2 Standard.

The noise sources included in the model are listed in Table 11-7. The noise levels were derived from engineering estimates based on the available characteristics of the source (size, type, power, etc.) or from SNC-Lavalin’s in-house database for similar equipment.

Table 11-7: Sources Included in Project Noise Model

Location	Source	Quantity	Sound power level (dBA)	Notes
Inside	Off-loading compressor	2	113	Estimated from physical size and Lp=85 dBA at 1m
	BOG compressor train	2	117	Estimated from similar equipment
	Gas powered compression (mechanical noise)	3	128	Estimated from similar equipment
	Instrument air package	1	99	Estimated from physical size and Lp=75 dBA at 1m
Outside	Propane pump	2	102	Estimated from physical size and Lp=85 dBA at 1m
	Mole sieve cooler	1	108	Estimated from physical size and Lp=85 dBA at 1m
	Storage tank pump	3	121	Estimated from 550-hp engine size
	Tanker BOG blower	1	104	Estimated from physical size and Lp=85 dBA at 1m
	Compressor condenser	4	105	Estimated assuming cooling capacity of 34 million British Thermal Unit per hour (BTU/hr)
	Power transformer	1	88	Estimated from NEMA rating of 64 dBA at 1m and physical size
	Variable frequency drive cooler	1	104	Estimated from physical size and Lp=85 dBA at 1m
	Rail locomotive	1	108	Estimated from Lp=70 dBA at 1m (requirement for idling locomotive)
	Gas compressor (exhaust noise)	1	145	Estimated from similar equipment
	Gas compressor (inlet noise)	1	129	Estimated from similar equipment

The noise model was developed with the following assumptions:

- Facility operates continuously 7 days per week and 24 hours per day (so model applicable to day-time and night-time operations of the facility).
- Facility operating with maximum 6,452 tonnes/day throughput, accounting for train off-loading operations, all three gas compressors operating without silencers and two compressor trains in operation.
- Standby or spare equipment is not operating.
- Emergency situations and process upsets are excluded from normal operation (e.g., flare, holding compressor).
- The noise from rail locomotives is represented by a single locomotive idling for 24 hours.

- Noise sources inside building had 10 dBA subtracted from their sound power level in Table 11-8 to account for absorption by the building.
- Noise from marine vessels (tug boats and very large gas carriers) servicing the facility are not considered in assessment against OGC PSL.
- Pipe noise is omitted because it cannot be estimated without detailed engineering estimates. However, such noise can be attenuated by selecting low noise valves and adding pipe insulation.

The noise model estimated that the sound level generated by Project operations would be 74 dBA at 1.5 km from the facility fence line (which will surround the AltaGas sub-lease site), which exceeds the BC OGC PSL of 40 dBA. The primary noise sources are the various noise components of the three gas compressors.

11.3.3 Mitigation Measures

Based on the results of the above noise model, the following mitigation measures and/or equivalent alternatives are being considered for Project operations in order to bring sound levels 1.5 km from the fence line to 40 dBA or lower:

- M1: Install silencers or equivalent on gas powered compressor exhaust to reduce sound to 40 dBA.
- M2: Install silencers or equivalent on gas compressor air inlet to reduce sound level to 40 dBA.
- M3: Construct compressor building to reduce sound level to 40 dBA.
- M4: Construct a sound enclosure to reduce sound from storage tank pumps to 40 dBA.

By integrating these mitigation measures into the existing noise model, the facility is estimated to produce a sound pressure level of 40 dBA at 1.5 km from the facility, which complies with the BC OGC night time PSL for a new facility. In addition, the change in the calculated percentage of high annoyed persons (%HA) does not exceed Health Canada's 6.5% guidance for the sensitive receptors in Port Edward, as shown in Table 11-8.

Table 11-8: Predicted Noise Levels at Port Edward Sensitive Receptors Compared to Health Canada Guidance

Location	Distance from Project (m)	Lowest Measured Ldn (dBA)	Predicted Facility Noise Level (dBA)	Combined Noise Level (dBA)	Increase in Highly Annoyed Persons (%)
Port Edward Firehall	2,200	58	36	58	0.0
PNW LNG M3	2,200	41	36	42	0.8
PNW LNG M4	2,200	57	36	57	0.0
PNW LNG M6	2,300	64	35	64	0.0

These mitigation measures should be re-assessed during detailed design work to ensure the facility still meets a sound level of 40 dBA at 1.5 km. During detailed engineering data review, an updated noise model could potentially identify more cost-effective mitigation measures.

Table 11-9 summarizes the potential adverse environmental effects with the associated mitigation measures.

Table 11-9: Summary of Potential Adverse Environmental Effects and Mitigation

Phase	Description of Potential Effect	Mitigation	Mitigation code	Residual Effect (Y/N)
OM1, OM2, OM4-OM11	An increase in noise levels at or near permissible levels	Silencers or equivalent will be installed on gas compressor exhaust to reduce sound level to 40 dBA.	M1	Y
		Silencers or equivalent will be installed on gas compressor air intake to reduce sound level to 40 dBA.	M2	
		Gas compressor building will be constructed to reduce sound level from gas compressor noise to 40 dBA.	M3	
		A sound enclosure will be constructed to reduce sound from storage tank pumps to 40 dBA.	M4	

11.3.4 Residual Effects

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project may result in residual effects related to noise levels. The assessment of the effects of increased noise related to the Project on human receptors is presented in VC effects assessment for Human Health in Section 13.

11.3.5 Cumulative Effects

The increase in noise levels may interact cumulatively with other Projects. The assessment of potential cumulative effects related to noise is presented in Section 13, Human Health.

12 LIGHT

This section presents the Intermediate Component (IC) Light.

12.1 Context and Boundaries

Lighting refers to the lighting units as well as any associated components for focusing or directing light. Proper lighting is necessary at industrial facilities, for both safety and security. However, excessive light can be bothersome or disruptive to nearby human or wildlife populations. As such, a light assessment is included in the Project EED to confirm that the light changes due to the Project are properly managed. Light is generally assessed through three attributes:

- Light trespass (or light spill): Light trespass is generated when facility lighting escapes (or spills) outside the facility boundary to the surrounding environment; an example would be bright facility lights shining through a nearby residential window. Light trespass is measured in lux (lumens/m^2).
- Glare: Glare is caused by intense and highly contrasted light which reduces human or wildlife seeing abilities. A common example is a high-beam from an oncoming vehicle on a dark highway. Glare is measured in candela (cd).
- Sky glow: Sky glow refers to cloud illumination from ground light sources emitting upwards or ground light sources reflected up into the sky. Sky glow is commonly experience as a haze at night in dense urban environments. Sky glow is measured in magnitudes per square arc second (mag/$arcsec^2$) using an inverted scale; urban sky glow is 18 or 19 mag/$arcsec^2$ while rural sky glow is 22 mag/$arcsec^2$.

12.1.1 Overview and Regulatory Setting

There are no municipal, provincial or federal guidelines for light assessments. The International Commission on Illumination (CIE) released guidelines on light trespass and glare for different zones. The CIE guidelines were adapted into recommendations for the Leadership in Energy and Environmental Design (LEED) Green Building Council Certification Program of Canada.

Table 12-1 summarizes the environmental zones used in the CIE guidelines.

Table 12-1: CIE Environmental Zones

Zone	Surrounding	Lighting environment
E1	Natural	Intrinsically dark
E2	Rural	Low district brightness
E3	Suburban	Medium district brightness
E4	Urban	High district brightness

Tables 12-2 and 12-3 summarize the maximum values for light trespass and glare in the CIE guidelines. As can be seen, more urbanized environment have a higher allowable maximum value of light trespass or glare. Furthermore, night time has lower acceptable maximum values than evening.

Table 12-2: CIE Maximum Values for Light Trespass from Properties (in lux)

Time of day	Maximum value by zone			
	E1	E2	E3	E4
Evening (19:00 – 23:00)	2	5	10	25
Night (23:00 – 6:00)	0	1	2	5

Table 12-3: CIE Maximum Values for Glare Off Site (in cd)

Time of day	Maximum value by zone			
	E1	E2	E3	E4
Evening (19:00 – 23:00)	2,500	7,500	10,000	25,000
Night (23:00 – 6:00)	0*	500	1,000	2,500

* Can be as high as 500 cd if for public lighting.

12.1.2 Selection of Intermediate Component

Light is assessed as an IC with particular relevance to the Human Health VC, because the Project has the potential to adversely affect human health through changes to light levels associated with construction and operation of the Project. Light is also an IC to the Marine Resources and Fish VCs, information regarding effects of light on fish and marine resources is found in Sections 8 and 7, respectively.

12.1.2.1 Indicators

The indicators identified to measure changes in light related to the Project are identified in Table 12-4.

Table 12-4: Indicators for Light

Indicator	Direct or Indirect	Rationale
Change in levels of light trespass, glare, and sky glow	Direct	Light trespass, glare, and sky glow facilitate the analysis of the Project's interaction with the light sub-component of the human health VC.

12.1.3 Assessment Boundaries

12.1.3.1 Spatial

The light assessment uses a LSA which includes the following components:

1) The Project sub-lease site and a 2500-m buffer surrounding the area for determination of project light effects on human health in Port Edward;
2) The rail transportation corridor within PRPA jurisdiction; and
3) The area within PRPA marine jurisdiction related to berthing and transit to and from the RTI wharf/berth.

The spatial boundaries are identified in Table 12-5. The LSA was chosen as it includes the sensitive receptors in the nearby community of Port Edward, which is the closest area where the Project related light might influence human health. The RSA is defined to equal the LSA since no significant regional light effects due to the Project are expected.

Table 12-5: Spatial Boundaries for Light IC

Spatial Extent	Description
LSA	Circle with radius of 2.5 km centred on the Project site, including the nearby community of Port Edward.
RSA	Same as LSA

12.1.3.2 Temporal

The potential effects specific to the Project are based on the three main phases of the Project:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

12.2 Existing Conditions

This section describes the existing conditions of the LSA and RSA as it relates to the IC and the sub components. The existing conditions form the baseline by which potential Project-related changes to the IC and subcomponents can be measured.

12.2.1 Methods and Data Sources

A review was conducted of previous light assessments conducted in the Prince Rupert area. Lights assessments were included in the environmental assessments for PNW LNG Export Terminal (2014) and the Canpotex Potash Export Terminal (2011). The associated reports were assessed for relevance. The PNW LNG report included measured light values and has been reviewed by the BC EAO. As such, the light assessment measurements were considered appropriate for inclusion below.

12.2.2 Description of Existing Conditions

As part of the PNW LNG environmental assessment, Stantec conducted a light monitoring program in the Port Edward area in April 2013. Table 12-6 summarizes the light measurements within the LSA/RSA. As can be seen, the measured values correspond to a low light environment consistent with a rural area. Industrial light on Ridley Island was visible in one sector of the horizon. It was also noted that existing industrial facilities on Ridley Island are of older design style with limited consideration for lighting design.

Table 12-6: Ambient Light Measurements for Pacific NorthWest LNG EA

Time	Site	Sky quality (mag/arcsec^2)*	Light (lux)**
22:11	Port Edward South	20.48	0.37
22:35	Port Edward School	19.4	0.41
22:56	Ridley Island Road	20.85	0.03

* Measured with Unihedron sky quality meter developed for astronomical applications; capable of measuring very low levels but uses non-standard units.

** Measured with conventional integrating hemispherical light meter with 0.01 lux resolution.

12.3 Assessment of Potential Adverse Environmental Effects

The AltaGas sub-lease site is located within the RTI Lease Land, which is located on the PRPA port lands (Ridley Island). The assessment of potential adverse effects includes determination of the Project-related changes on light.

12.3.1 Potential Interactions of the Project

Project light interactions were categorized as follows:

N = no interaction;

M = minor interaction; and

CF = interaction to be considered further in the environmental evaluation.

A minor interaction (M) results in an adverse change that will be eliminated or reduced to negligible by using effective and established best management practices (BMPs). Minor interactions implied that the Project activity would include use of lighting units. Minor interactions and their associated well-known BMPs are described below.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Project-related effects on current use of land and resources for traditional purposes, if relevant, will be discussed in Section 14, First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes.

Table 12-7 summarizes the Project activities which have the potential to produce light to be considered in the assessment. As lighting is existing and will only be upgraded for the Project light interactions were associated with the 24 hour operation of the Project (O1).

Table 12-7: Project Interaction Table

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Light
Construction Activity		
C1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	M
C2	Site blasting which may involve explosives manufactured off site.	N
C3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	M
C4	Relocation and reconstruction of existing settling ponds. Involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sublease within RTI lease land.	M
C5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	M
C6	Construction of rail tracks.	M
C7	Re-grading of existing sidings on RTI lease land.	M
C8	Connection to BC Hydro grid on PRPA lands.	M

Interaction ID	Project Related Construction, Operation and Decommissioning Activities	Light
C9	Installation of piping and loading arms on existing Jetty.	M
C10	Installation and hydrotesting of refrigerated storage tanks and equipment.	M
C11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	M
C12	Installation of a new vehicle access bridge to RTI coal stockyard area.	M
C13	Local transport of materiel and personnel to and from the site and PRPA lands.	M
Operation and Maintenance		
OM1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	M
OM2	Gas powered compression, supplemented with BC Hydro power.	N
OM3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring twice a year and in the case of emergencies.	M
OM4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	M
OM5	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	M
OM6	Receiving propane bullets from CN trains to sub lease area daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12 to 18 months.	M
OM7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	M
OM8	Refrigerating and storing propane. Propane is passed through a heat exchanger where it is chilled to approximately -42 C and transferred to a refrigerated storage tank.	N
OM9	Propane delivery to the carrier via new piping driven by electric pumps will occur once every 15 to 20 days and take about 48 hours.	N
OM10	Berthing of LPG carriers at the RTI berth facility.	M
OM11	LPG carrier movements in PRPA navigational jurisdiction.	M
Decommissioning		
D1	Removal of land-based above-ground infrastructure on sub-lease site.	M
Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor or negligible interaction not considered further in the environmental evaluation report; and CF = interaction to be considered further in the environmental evaluation.		

Project conceptual designs were reviewed to determine whether the Project is likely to substantially change light levels during construction and operation. The topography of Ridley Island, which slopes uphill inland, and Project location on the west side of the island will limit the visibility of light emanating from the Project in Port Edward. The 2-km distance from the Project to Port Edward will also limit visibility of light from the Project.

During construction, the light level will vary depending on the stage. Due to the topography of Ridley Island, headlights on mobile equipment are not expected to be visible from Port Edward except for a small amount of sky glow. As site components are built, permanent lighting on these structures will become the primary light source and will likely result in a somewhat higher sky glow.

During operations, light sources will include building exterior and interior lighting, street lights and marine jetty lighting. As above, the topography of Ridley Island and the distance from the Project will limit visibility of light from the Project. Some sky glow may be visible from the Project at night during night time operations. It is expected that changes to sky glow will be minor and incremental, since the property already has lighting related to the operational coal handling facility.

12.3.2 Mitigation Measures

The following light best management practices are recommended (CIE 2003, LEED 2004):

Construction phase:

- M1: Lights should be installed at a sufficient height to avoid glare.
- M2: Construction contractor should direct lighting only where needed while maintaining worker safety.
- M3: Shielded, full cut-off lighting units should be used.
- M4: Avoid pointing lights toward Port Edward.
- M5: Shut off mobile and stationary equipment (and associated lights) when not in use and when safe to do so.
- M6: Develop a light complaint management process for construction, as part of overall project complaint management process.

Operations phase:

- M7: Outdoor lighting should be equipped with dark sky shields and full cut-off designs to limit light trespass and sky glow.
- M8: Lights should be installed at a sufficient height to avoid glare.
- M9: Avoid pointing lights toward Port Edward.
- M10: Shut off mobile and stationary equipment (and associated lights) when not in use, when safe to do so.

- M11: Follow CIE guideline "Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations" during detailed lighting design where possible.
- M12: Centralized lighting control system should be installed to control lights and only turn on lights where and when needed.

Table 12-8 summarizes the potential adverse environmental effects with the associated mitigation measures.

Table 12-8: Summary of Potential Adverse Environmental Effects and Mitigation

Phase	Description of Potential Effect	Mitigation	Mitigation Code	Residual Effect (Y/N)
Construction	An increase in light due to project activities that might exceed applicable thresholds	Use work area lights that have shades designed to direct light down where it is needed for construction and minimize light directed skywards.	M1-M6	N
		Minimize the use of artificial lighting wherever possible.		
		Follow Best Management Practices		
Operations	An increase in light due to project activities that might exceed applicable thresholds	Use work area lights that have shades designed to direct light down and minimize light directed skywards.	M7-M12	N
		Follow Best Management Practices		
Decommissioning	An increase in light due to project activities that might exceed applicable thresholds	Follow Best Management Practices	All, as applicable	N

12.3.3 Residual Effects

This light effects assessment indicated that light is not anticipated to exceed applicable thresholds with the recommended mitigation measures in place, the effects of altered light conditions are not expected on any receptor VCs. The assessment of light effects on human health is not considered further.

12.3.4 Cumulative Effects

As there are no residual effects on light there is no potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents.

13 HUMAN HEALTH

This section presents the assessment of the Human Health Valued Component (VC). The human health effects assessment is supported by the ICs Air Quality (Section 10), Noise (Section 11), and Light (Section 12).

13.1 Context and Boundaries

In general, the public and First Nation groups have expressed concerns regarding potential effects on human health associated with construction and operation of similar liquid petroleum gas facilities (e.g., related to diesel emissions and fugitive dust). Specific concerns relating to adverse effects on human health most often relate to changes in air quality, water quality, country foods, noise, and lighting.

Human health in the Project area may be affected through biophysical components such as air inhalation, water consumption and dermal contact, ingestion of country foods, and exposure to altered noise and lighting levels.

The human health effects assessment considers potential changes in human health resulting from exposure to Project-related emissions for people either living or spending time within the LSA or RSA. This human health effects assessment evaluates the incremental human health risks that is attributable to the Project by comparing predicted conditions during construction, operation and decommissioning phases to existing baseline environmental conditions and where possible to thresholds established to protect human health.

The Project is located 2.5 km west of Port Edwards and 15 km south of Prince Rupert and the residents of these two population centres comprise the primary human health receptors. Port Edwards and Prince Rupert have 544 and 13,052 residents, respectively.

No pathways of effects were identified that would result in adverse changes to water quality and/or country foods (fish, animal and/or vegetation)) that would represent a potential risk to human health through ingestion or dermal contact were identified in the effects assessments completed for the Water Quality IC, Marine Resources VC, Fish VC and Terrestrial Resources VC. For this reason, potential effects on human health arising through the water quality or country food pathways of effects were not considered further.

The potential effects on human health of Project workers (while at work) was not assessed in this human health risk assessment since that aspect of human health is specifically addressed through occupational health and safety standards, codes and regulations established by the provincial and federal governments.

13.1.1 Overview and Regulatory Setting

Human health effects assessments are governed by the methodologies and guidelines for the conduct of human health risk assessment in Canada and BC, including:

- Federal Contaminated Sites Risk Assessment in Canada, Part V: Guidance on Complex Human Health Detailed Quantitative Risk Assessment For Chemicals (DQRACHEM)(Health Canada 2010);
- Federal Contaminated Sites Risk Assessment in Canada, Part I: Guidance on Human Health Risk Preliminary Quantitative Risk Assessment (PQRA), Version 2.0 (Health Canada 2012);
- Federal Contaminated Sites Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors Version 2.0 (Health Canada 2010a);
- Federal Contaminated Site Risk Assessment in Canada. Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRAAIR). Draft. Version 1.2. October 2010. Contaminated Sites Division – (Health Canada 2010bc);
- Canadian Council of Ministers of the Environment Guidelines for Canadian Drinking Water Quality (Health Canada);
- BC Approved and Working Water Quality Guidelines (Criteria) Reports for drinking water, irrigation, and recreation and aesthetics; and
- Useful Information for Environmental Assessments (Health Canada 2010).

The EMA (EMA, 2004), current to November 11, 2015 is relevant to the evaluation of air quality/emissions for the Project. A summary of the relevant objectives, particularly the MoE's AAQOs are described in the Air Quality effects assessment (Section 10).

In the absence of municipal, provincial or federal guidelines for light to protect human health, the International Commission on Illumination guidelines on light trespass and glare for different zones were adopted in this effects assessment to protect human health. The CIE guidelines are described in the Light effects assessment (Section 12).

The noise limits described in the District of Port Edward Noise Control Bylaw No. 520, PRPA Noise Program, BC OGC Noise Control Best Practices Guideline that are described in the Noise effects assessment (Section 11) have been adopted to protect human health.

13.1.2 Selection of Valued Component

Human Health was assessed as VC because the Project has the potential to adversely affect human health through air inhalation and exposure to altered noise and lighting levels.

13.1.2.1 Sub Components

The Human Health VC has no sub-components.

13.1.2.2 Indicators and Linkages

The indicators used to assess how the Project changes each of the above sub-components are shown in Table 13-1.

Table 13-1: Indicators for Air Quality

Indicator	Direct or Indirect	Rationale
Air Emissions		
NO_x	Direct	NO_x is a CAC, with AAQOs
SO_2	Direct	SO_2 is a CAC, with AAQOs
CO	Direct	CO is a CAC, with AAQOs
VOC	Direct	VOC is a CAC
PM_{10}	Direct	PM_{10} is a CAC, with AAQO
$PM_{2.5}$	Direct	$PM_{2.5}$ is a CAC, with AAQOs
NH_3	Direct	NH_3 is a CAC
Light		
Change in levels of light trespass, glare, and sky glow	Direct	Light trespass, glare, and sky glow facilitate the analysis of the Project's interaction with the light sub-component of the human health VC.
Noise		
Increase in sound levels	Direct	Ambient sound levels (expressed in dBA averaged required timeframes) facilitate the analysis of the Project's interaction with the noise sub-component of the human health VC.

Other relevant sections in this application that support or inform the Human Health effects assessment include:

- Air Quality, Section 10.
- Noise, Section 11.
- Light, Section 12.

13.1.3 Assessment Boundaries

13.1.3.1 Spatial

The Human Health effects assessment used the same LSA and RSA as Air Quality, Noise and Light as show in Figures 10-1 and 11-1. These are consistent with the spatial boundaries that were applied in the Air Quality, Light and Noise effects assessments and are described in Table 11-3.

Table 13-2: Spatial Boundaries for Human Health VC

Spatial Extent	Description
Air Quality LSA and RSA	25 km by 25 km area (625 km^2)roughly centered on the Project site, including the nearby communities of Prince Rupert and Port Edward
Noise and Light LSA and RSA	Circle with radius of 2.5km centred on the Project site, including the nearby community of Port Edward

13.1.3.2 Temporal

The potential effects specific to the Project are based on the main phases of the Project:

- Short-term - Construction Phase (24-28 months);
- Long-term - Operation Phase (25 years); and
- Decommissioning Phase (To be determined).

13.2 Existing Conditions

The existing conditions for air quality, noise and light that relate to the human health effects assessment are described in Section 10, Section 11, and Section 12, respectively.

13.2.1 Data Sources Used in the Assessment

The data sources for air quality, noise and light that relate to the human health effects assessment are described in Sections 10, 11, and 12, respectively.

13.2.1.1 Desktop and/ or Field Studies Conducted

A description of the desktop and/or field studies conducted for establishing the baseline conditions for air quality, noise, and light that relate to the human health effects assessment are provided in Sections 10, 11, and 12, respectively.

13.2.2 Description of Existing Conditions

Descriptions of existing conditions for air quality, noise and light that relate to the human health effects assessment are provided in Sections 10, 11, and 12, respectively.

13.3 Assessment of Potential Adverse Environmental Effects

The EED includes a description of physical works and activities associated with Project components and the potential for adverse environmental effects for which a reasonably direct causal link can be demonstrated between some aspect of the Project and the Human Health VC and sub-components.

13.3.1 Potential Interactions of the Project

The potential adverse environmental effects of the Project on the Human Health VC are generally considered within two main groupings:

- Changes in human health resulting from the inhalation of CACs generated by the Project.
- Changes in human health resulting from exposure to altered light and noise conditions (e.g., changes in percentage of highly annoyed people as per Health Canada (2010) guidance).

Since the light effects assessment indicated that light is not anticipated to exceed applicable thresholds with the recommended mitigation measures in place, the effects of altered light conditions on human health were not carried forward.

Potential interactions of Project activities with the Human Health VC are summarized in Table 13-3.

Project-VC interactions were categorized as follows:

- N = no interaction;
- M = minor interaction; and
- CF = interaction to be considered further in the environmental evaluation.

A minor interaction (M) results in an adverse effect that will be eliminated or reduced to negligible by using effective and established mitigation measures or best management practices. Minor interactions and their associated well-established mitigations are described below in Section 10.3.2, and therefore not included in the characterization of residual effects, and cumulative effects assessment.

A description of potential interactions and effects from potential accidents and malfunctions is in Section 15, Accidents and Malfunctions.

Project-related effects on current use of land and resources for traditional purposes will be discussed in Section 14, First Nation Consultation and Engagement and Current Use of Land and Resources for Traditional Purposes.

Table 13-3: Project Interaction Table

Project Activities and Physical Works		Human Health
Construction Activity		
C-1	Site grading involving operation of large machinery and a Metso Jaw Crusher and Cone crusher to recycle aggregate for cut and fill.	M
C-2	Site blasting which may involve explosives manufactured off site.	M
C-3	Removal of existing sulphur storage facilities via truck or rail (no hazardous substances expected to be encountered).	N
C-4	Relocation and reconstruction of existing settling ponds, involving infill of settling ponds, and excavation of new settling pond in the north west corner of the sub-lease Site.	N
C-5	Installation of utilities including electrical, natural gas, water, sewer, fire protection, storm water settling pond; upgrading storm water outfall pipe.	N
C-6	Construction of rail tracks.	N
C-7	Re-grading of existing sidings on RTI lease land.	M
C-8	Connection to BC Hydro grid on PRPA lands.	N
C-9	Upgrade to Existing Jetty: Installation of piping and loading arms.	N
C-10	Installation and hydrotesting of refrigerated storage tanks and equipment.	N
C-11	Removal of existing vehicle access bridge over rail tracks on RTI leased lands.	N
C-12	Installation of a new vehicle At-Grade road crossing to RTI coal stockyard area.	N
C-13	Local transport of material and personnel to and from the site and PRPA lands.	N
Operation Activity		
O-1	Continuous operations (24 hours, 365 days per year) involving approximately 40 full time people.	M
O-2	Gas powered compression, supplemented with BC Hydro power to provide approximately 15 MW.	M
O-3	Ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring twice a year and otherwise only in the case of emergencies.	CF
O-4	Rail traffic within PRPA lands associated with delivery of propane bullets to Project sub-lease lands.	CF
O-5	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with initial total deliveries of 15-20 rail cars per day for the first 12 to 18 months.	M
O-6	Receiving propane bullets from CN trains to sub-lease site daily for 365 days per year, with total deliveries of an anticipated 50 - 60 rail cars per day after the initial 12 to 18 months.	CF

Project Activities and Physical Works		Human Health
O-7	Propane unloading from railcars using unloading arms; occurs in several batches daily, for up to 24 hours per day.	CF
O-8	Refrigerating and storing propane; propane is passed through a heat exchanger where it is chilled to approximately -42˚C and transferred to a refrigerated storage tank.	CF
O-9	Propane delivery to the carrier via new piping driven by electric pumps. Loading will occur once every 15 to 20 days and take approximately 40 hours. (i.e., 20-30 carriers per year).	CF
O-10	Berthing of liquefied gas carriers at the RTI berth facility. Carriers will be met by tug escorts upon approach to the berth and will utilize a docking aid system.	CF
O-11	LPG carrier movements in PRPA navigational jurisdiction.	CF
Decommissioning Activity		
D-1	Removal of land-based above-ground infrastructure on sub-lease Site.	N

Notes: Interactions annotated with N, M or CF, where N = no interaction, M = minor interaction with well-known mitigation measures enacted and are not considered further in the environmental evaluation; and CF = interaction to be considered further in the environmental evaluation

All Project-VC interactions categorized as CF in Table 13-3 are assessed in detail since there is reasonable level of uncertainty that there may be an effect and whether the effect may exceed acceptable levels or standards without implementation of project-specific mitigations and may result in residual adverse effects.

13.3.2 Assessment of Potential Effects

The potential adverse environmental effects of the Project on Human Health are restricted to the following:

- Changes in human health resulting from the inhalation of CACs generated by the Project.
- Changes in human health resulting from exposure to altered noise and light conditions (e.g., changes in percentage of highly annoyed people as per Health Canada (2010) guidance).

The potential adverse human health effects associated with these potential interactions are assessed below.

13.3.2.1 Construction Phase

There are no potential interactions during the construction phase that were carried forward into human health effects assessment. See Section 10, 11, and 12 for more detail.

13.3.2.2 Operations Phase

Several potential interactions occurring during operations were carried forward into human health effects assessment. These interactions are all associated with the Project emission sources (including the transportation emission sources that will not be under the control of, or managed by, AltaGas) and altered ambient noise levels.

The effects assessment of these emissions sources required development of an emissions inventory and determination of the fate of these emissions (air quality concentrations throughout the LSA) through application of an atmospheric dispersion model. The results of this predictive modeling are summarized in Tables 10-8 and 10-9 of Section 10. A discussion of how these predicted CAC concentrations may potentially affect human health is summarized below.

O-2, O-4, O-6, O-10 and O-11 – *interactions associated with the Project combustion sources (including transportation)*. The potential adverse environmental effect relates to nitrogen dioxide (NO_2) concentrations near the berth on Port lands. No adverse impacts are predicted on any public lands within the LSA.

The maximum short-term NO_2 predictions are primarily associated with the tug assist activity. The model predictions show potential to exceed the provincial 1-hour NO_2 objective on Port lands. The tugs are primarily responsible for the exceedences due to their shorter stack heights compared to the LPG carriers. The predicted exceedences are infrequent (occur up to 0.5 per cent of the year).

The likelihood of interaction is low for several reasons:

- The model predictions of ambient NO_2 are conservative and include assuming a high level of tug assist occurs at the dock with the LPG carrier for every hour of the year. In reality, the tugs are active for up to an hour for each arrival and departure of an LPG carrier (e.g., up to 60 hours of the year).
- The model assumes that much of the emitted NO from the ship stacks converts to NO_2 immediately upon release. In reality the NO to NO_2 conversion in the atmosphere occurs over time and distance from the source.
- The potential exceedences are localized and do not extend far from the marine berth.

O-3 *Interactions associated with the ground flare to burn off the removed ethane and methane at the gas powered compressor. The ground flare will be open and require maintenance flaring several times a year and in the case of emergencies.* Dispersion modelling of the flare emissions showed no potential for exceeding the provincial ambient objectives.

The potential adverse environmental effects on human health are related to increased noise associated with Project operational activities OM1, OM2, and OM4 through OM11 (Table 13-3). Increased operational noise can potentially impact nearby sensitive receptors at Port Edwards (e.g., residences, schools, supported living facilities, etc.), particularly during the night when people are sleeping. Operational noise is primarily associated with operation of stationary equipment such as compressors or condensers used to handle and move the LPG product.

The potential effects of noise produced by the operations phase of the project were assessed with a noise model. A simple noise model was developed and considered suitable due to the relatively flat topography of the area and the conservative assumptions used in the model.

The noise model estimated that the sound level generated by Project operations would exceed the BC OGC PSL of 40 dBA; however, equipment specific mitigation measures (e.g., installation of silencers on gas powered compressor exhaust and air intake, sound enclosures for storage tank pumps) and/or equivalent alternatives are being considered for Project operations in order to bring sound levels 1.5 km from the fence line to 40 dbA or lower.

Further detail about noise modelling done for this assessment are found in Section 11, Noise.

13.3.2.3 Decommissioning Phase

There are no potential interactions during the decommissioning phase that were carried forward into Air Quality effects assessment because adverse effects on ambient air quality or GHG emissions are expected to be negligible.

13.3.2.4 Accidents, Malfunctions and Unplanned Events

Interactions and potential effects on Human Health related to potential Accidents and Malfunctions are discussed in Section 15, Accidents and Malfunctions.

13.3.3 Mitigation Measures

13.3.3.1 Construction

All potential adverse effects on Human Health during construction are expected to be negligible. Management practices as described in Section 10, 11 and 12 will be applied throughout construction phase to ensure negligible potential effects on Human Health.

13.3.3.2 Operations

Mitigation measures proposed to avoid, reduce or eliminate potential Project-related effects on Human Health are outlined in Section 10.3.2 and Section 11.3.3 and summarized in Table 13-4.

13.3.3.3 Decommissioning Phase

The potential adverse effects on Human Health during decommissioning are expected to be negligible.

13.3.3.4 Summary of Potential Adverse Effects and Mitigation

Table 13-4 provides a summary of previously described potential adverse environmental effects, mitigation, and the residual effect after implementation of mitigation.

Table 13-4: Summary of Potential Adverse Environmental Effects and Mitigation

Phase	Description of Potential Effect	Mitigation	Mitigation Code (Refer to Section 10.3.2 and 11.3.2)	Residual Effect (Y/N)
Construction/ C1-C13	No direct effect identified	Standard mitigation practices used during construction on land and during site grading.	AQ-M-1 to M-3	N
Operations O-1	Project contributions air emissions	Reduce energy consumption and air emissions where possible. Participate in the PRPA annual emissions inventory and emissions reductions programs.	AQ-M-4	N
Operations O-2, O-3, O-4, O-6, O-10, O-11	Exceedance of provincial 1-hour NO_2 objective to protect human health	M-5: Ensure that the LPG carriers adhere to the Transport Canada Regulations for Vessel Air Emissions (Transport Canada, 2014)	AQ-M-5	N
		M-6: Ensure that the tug assist vessels adhere to the Sulphur in Diesel Fuel Regulations for Non-large vessels (Environment Canada, 2014)	AQ-M-6	
		M-7: Ensure use of the vessel management procedures and standards and practices from the RTI “Terminal Rules and Regulations” and the PRPA Port Information Guide (PRAPA 2015)	AQ-M-7	
OM1, OM2, OM4-OM11	Interruption of sleep of sensitive noise receptors Decrease in community enjoyment Increase community annoyance	Silencers or the equivalent will be installed on gas powered compressor exhaust to reduce sound level to 40 dBA.	Noise-M1	Y
		Silencers or the equivalent will be installed on gas power compressor air intake to reduce sound level to 40 dBA.	Noise-M2	
		Gas powered compressor building or an equivalent will be constructed to reduce sound level from compressor mechanical noise to 40 dBA.	Noise-M3	
		A sound enclosure or an equivalent will be constructed to reduce sound from storage tank pumps to 40 dBA.	Noise-M4	

13.3.4 Residual Effects

Based on the assessment of potential adverse effects and recommended mitigation measures presented above, it is anticipated that the Project could have effects on human health related to increase in ambient noise levels at or near permissible thresholds (Refer to Section 11, Noise). An increase in noise levels has a direct effect on human health related to sleep interruption, community annoyance, and a decrease in community enjoyment.

Other effects that may occur are associated with accidents and unplanned events (especially in the marine transport activities) being considered highly unlikely and the effects anticipated to be negligible. The effects of potential accidents and malfunctions are considered in Section 15, Accidents and Malfunctions.

13.3.5 Characterization of Residual Effects and Their Significance

Project related noise levels would be low in magnitude, as the noise levels are expected to be mitigated at or lower than permissible noise levels (See Section 11, Noise). The noise increase would be at a local level, with only minor effects on closest sensitive receptors in Port Edward. The duration would be long term and frequent as the noise is associated with Project operations on a daily basis. The potential effects to human health would be entirely reversible, as the effects are only associated when noise-related activities are occurring. As the magnitude is low, and the potential to mitigate noise to a level at or below the permissible threshold is high, the potential adverse residual effect is not-significant. The likelihood of this residual effect is likely, and the confidence based on available data, effective proven mitigation practices (i.e., well known equipment specific mitigation measures) and model outputs is high (refer to Section 11, Noise). A summary of the characterisation and assessment of potential residual effects on Human Health is summarized in Table 13-5.

Table 13-5: Characterisation and Assessment of Potential Residual Effects Related to Human Health

Potential Residual Effect	Project Activity or Physical Works	Project Phase	Mitigation Code	Residual Environmental Effects Characterization[1]				Significance Determination			
				Magnitude	Geographic Extent	Duration	Frequency	Reversible	Level of Effect	Likelihood	Confidence
Interruption of sleep of sensitive noise receptors Interruption of sleep of sensitive noise receptors Decrease in community enjoyment Increase community annoyance	Activities related to gas powered compressor.	O	HH2-M1 HH2-M2 HH2-M3 HH2-M4	LM	L	LT	FF	R	NS	L	H

Notes: Project Phase: C = Construction (includes pre-construction and final design), O&M = Operations and maintenance, D = Decommissioning
Magnitude: NM = Negligible, LM = Low magnitude, MM = Moderate magnitude, HM = High magnitude
Extent: Project site: S, Local: L or Regional: R
Duration: LT = Long term, MT = Moderate term, ST = Short term, TT = Transient term
Frequency: CF = Continuous, FF = Frequent, UF = Uncommon, RF = Rare
Reversibility: R = Reversible, I = Irreversible, C = Change but may fluctuate from positive to adverse for the duration
Level of Effect: NS: Not Significant, S = Significant
Likelihood: C: Certain, L: Likely, UL: Unlikely
Confidence: L: Low, M: medium or H: High

13.3.6 Cumulative Effects

As there are residual effects related to increase in noise levels with the potential to affect Human Health there is a potential for the residual effects of other projects to act cumulatively within the same temporal and spatial extents of the Project. A list of other projects considered in this cumulative effects assessment please refer to Section 4.5, Cumulative Effects Assessment.

Based on the results of the noise model detailed in Section 11, Noise, the proposed mitigation measures recommended for Project operations for the facility is estimated to produce a sound pressure level of 40 dBA at 1.5 km from the facility, which complies with the BC OGC night time PSL for a new facility. In addition, the change in the calculated percentage of highly annoyed persons (%HA) does not exceed Health Canada's 6.5% guidance for the sensitive receptors in Port Edward, as shown in Table 13-6.

Table 13-6: Predicted Noise Levels at Port Edward Sensitive Receptors Compared to Health Canada Guidance

Location	Distance from Project (m)	Lowest measured Ldn (dBA)	Predicted facility noise level (dBA)	Combined noise level (dBA)	Increase in highly annoyed persons (%)
Port Edward firehall	2,200	58	36	58	0.0
PNW LNG M3	2,200	41	36	42	0.8
PNW LNG M4	2,200	57	36	57	0.0
PNW LNG M6	2,300	64	35	64	0.0

Due to the additive nature of noise represented in Table 13-6, the Project is not expected to have significant adverse effects when acting cumulatively with other projects or activities within the same spatial and temporal boundaries as the Project. Table 13-7 summarizes the characterization of the potential adverse effect and a significance determination.

Table 13-7: Characterization and Assessment of Potential Residual Effects Related to Human Health

Potential Residual Effect	Project Activity or Physical Works	Project Phase	Mitigation Code	Residual Environmental Effects Characterization[1]					Significance Determination		
				Magnitude	Geographic Extent	Duration	Frequency	Reversible	Level of Effect	Likelihood	Confidence
Interruption of sleep of sensitive noise receptors Decrease in community enjoyment Increase community annoyance	Activities related to gas powered compressor.	O	HH2-M1 HH2-M2 HH2-M3 HH2-M4	LM	L	LT	FF	R	NS	L	H

Notes: Project Phase: C = Construction (includes pre-construction and final design), O&M = Operations and maintenance, D = Decommissioning
Magnitude: NM = Negligible, LM = Low magnitude, MM = Moderate magnitude, HM = High magnitude
Extent: Project site: S, Local: L or Regional: R
Duration: LT = Long term, MT = Moderate term, ST = Short term, TT = Transient term
Frequency: CF = Continuous, FF = Frequent, UF = Uncommon, RF = Rare
Reversibility: R = Reversible, I = Irreversible, C = Change but may fluctuate from positive to adverse for the duration
Level of Effect: NS: Not Significant, S = Significant
Likelihood: C: Certain, L: Likely, UL: Unlikely
Confidence: L: Low, M: medium or H: High

Based on the above summarized effects criteria, the Project is not expected to have significant cumulative effects related to noise effects on Human Health.

13.4 Follow-up Strategy

During detailed design work, the proposed equipment specific mitigation measures to reduce noise levels should be re-visited to ensure the facility still meets a sound level of 40 dBA at 1.5 km. During detailed engineering data, an updated noise model could potentially identify more cost-effective mitigation measures.

14 FIRST NATION CONSULTATION AND ENGAGEMENT AND CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES

Section 67 of the *Canadian Environmental Assessment Act* provides that a federal authority must not permit a project to be carried out on federal lands unless it determines that the project is unlikely to cause significant adverse environmental effects. Section 5(1)(c) of CEAA says the "environmental effects" of a project to be taken into consideration with respect to aboriginal peoples are changes to:

(i) health and socio-economic conditions,

(ii) physical and cultural heritage,

(iii) the current use of lands and resources for traditional purposes, or

(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

The foregoing environmental effects on Aboriginal peoples in section 5(1)(c) of CEAA are herein called "Aboriginal Environmental Effects".

In this Section 14, AltaGas will summarize its engagement with First Nations to determine whether the Project will have any significant adverse Aboriginal Environmental Effects on the First Nations. AltaGas has also sought to identify and respond to other questions or concerns that the First Nations may have about the potential environmental impacts of the Project, which are not unique to them as Aboriginal people.

As described in Section 1.1 the Project will be developed on a site that is comprised of a terrestrial and marine area. The propane will be transported by rail tank cars to the site which is located on the terrestrial area and off-loaded to the refrigeration and storage facilities on-site. From the site the processed product will be delivered by pipeline onto large carrier vessels that will arrive and depart from the existing RTI berth facilities located in the adjacent marine area. The site (including shipping lanes to be used by vessels for the Project) is located within an area in which the following First Nations claim Aboriginal rights:

- Lax Kw'alaams
- Metlakatla
- Kitselas
- Kitsumkalum

- Gitxaala
- Gitga’at

(herein collectively called the “**First Nations”)**

This Section 14 presents the following information:

- A summary of engagement activities
- A summary of First Nations questions and issues related to the Project
- A description of potential Aboriginal Environmental Effects within the Project area
- A description of measures to avoid, reduce or mitigate potential adverse Aboriginal Environmental Effects
- A summary of preliminary conclusions respecting potential Aboriginal Environmental Effects

Summary of Engagement Activities

The Federal Authorities (RTI, PRPA and TC) have asked AltaGas to engage with the First Nations in order to assist them in determining whether the proposed Project is likely to have significant adverse effects within the meaning of section 5 of CEAA. AltaGas is specifically concerned in this section of the EED report with Aboriginal Environmental Effects.

This section describes the engagement process undertaken by AltaGas with the First Nations in order to identify potential Aboriginal Environmental Effects of the Project on those First Nations and to consider, take or propose such measures as may be appropriate to avoid, mitigate or accommodate any potential Aboriginal Environmental Effects.

AltaGas has sought and continues to seek to develop positive, productive, and lasting relationships with the First Nations as part of the engagement process.

The scope of the engagement with each Aboriginal group has varied based on the significance of the potential Aboriginal Environmental Effects identified in consultations with the First Nations, and other CEAA Section 5 environmental effects identified by the First Nations. Depending on the issues and comments that were received from the First Nations, AltaGas will continue to engage with the First Nation in order to provide them with a full description and understanding of the Project, and to take reasonable steps to respond.

The Federal Authorities have delegated to AltaGas responsibility for procedural aspects of any engagement that was or may be required with respect to any potential impact of the Project. The Federal Authorities have supervised the engagement process and taken part in the process where appropriate. They have asked for additional information or additional engagement where they felt it was appropriate. AltaGas has responded as appropriate to issues and concerns raised that go beyond Aboriginal Environmental Effects, and have kept the Federal Authorities fully informed of the engagement process.

Engagement activities undertaken by AltaGas with First Nations to date of submission of this EED:

- Distributed copies of the Project Description to First Nation leadership in April 2016.
- Formally offered to meet with Band Council and/or membership of each First Nation to review the Project Description.
- Organized and attended follow-up meetings as appropriate, including conducting tour of Project site.
- At the request of First Nations, provided clear, timely and complete responses to questions on the Project that are not addressed in the Project Description.
- Provided, and are continuing to provide ongoing opportunities and follow up for all First Nations to ask questions or express any concerns or comments they may have on the Project.
- Received, and are continuing to receive information from First Nations about their asserted rights or interests in the Project area.
- Documented all interactions with First Nations.

Questions and concerns raised by First Nations during engagement as of the date of this EED submission are summarized in the Table 14-1 below:

Table 14-1: Summary of First Nations Questions and Issues Related to the Project

Question/Concern Raised	Response
What would the effects of a train derailment be to the local environment?	Propane is non-toxic. In the event of a leak or spill, propane will dissipate. CTC/DOT 112 rail cars specifically used for transporting propane will be used in compliance with Transport Canada regulations. These cars have thicker tanks and improved puncture resistance as well as thermal protection compared to previous designs. Currently there are approximately 200 propane cars per year that travel along the Canadian National Railway (CN) rail line to Prince Rupert. AltaGas is working with CN to develop an emergency response plan. We will look to increase emergency response capacity along the rail corridor route and will apply, along with CN, for an Emergency Response Assistance Plan (ERAP) through Transport Canada.

Question/Concern Raised	Response
Whose responsibility is it to ensure the safety of propane rail shipments along the rail corridor?	It is CN's responsibility. AltaGas is working with CN to develop an emergency response plan. We will look to increase emergency response capacity along the rail corridor route and will apply, along with CN, for an Emergency Response Assistance Plan (ERAP) through Transport Canada.
Whose responsibility is it to ensure safety of the propane storage site? How will this be undertaken?	It will be AltaGas' responsibility. AltaGas operates the Ferndale Propane Export Facility which has a stellar safety record and has operated for 15 years without a safety incident. The export terminal will be designed with inherent safety systems and processes. Emergency detection, shut down and isolations systems will be integral to the operating design.
How many jobs will be created?	AltaGas expects that the facility will create approximately 40 to 50 permanent jobs and an additional 200 to 250 jobs during construction.
What are the power requirements for the project?	AltaGas will require approximately 15 megawatts (MW) of power to operate the facility. We plan to access this power through the existing power grid and through the use of propane at the site.
How will the propane be shipped?	Propane will be shipped by Very Large Gas Carriers (VLGC's). Approximately 2 VLGC's per month, or 20 to 25 VLGC's per year, will be filled at the proposed facility. AltaGas will work with the Port of Prince Rupert to ensure that all proper safety processes are in place. AltaGas will also conduct a Quantitative Risk Analysis (QRA) to manage risk and ensure safety.
How much propane will be shipped by rail to the facility?	Approximately 50 to 60 rail cars per day.
What is the potential for noise, odor and air quality impacts?	AltaGas is undertaking modelling for potential air quality and noise impacts. The project is not expected to result in any odor, as the propane that is shipped to the facility will not be infused with mercaptan.
What was the previous use of this site?	The site was previously developed by the Canadian Sulphur Corporation as a Sulphur shipping facility. This facility, however, was never commissioned. The infrastructure currently on site will be removed.
What will happen to the coal settlement ponds on site?	The coal settlement ponds will be decommissioned in accordance with applicable legislation.
Is it safe to locate a propane shipping facility next to a coal storage facility?	AltaGas is designing the propane facility so that it is completely self-contained.
Do you plan to export butane from the facility as well?	AltaGas' focus is on shipping propane from the proposed facility.
Is it safe to store this volume of propane?	AltaGas will be conducting a Quantitative Risk Analysis (QRA) to manage risk and ensure safety.
Will this propane be distributed locally for use by local residents, businesses, or First Nations?	AltaGas is not in the propane distribution business, and our focus is on providing propane to export markets in Asia.

Question/Concern Raised	Response
Will an Environmental Assessment be triggered if your facility expands?	AltaGas' focus is on the proposed propane export terminal project as outlined in the Project Description. The present site is a brownfield site, and there is no additional room available on this site to accommodate expansion.
Does the Navigation Protection Act apply to your project?	The facility will use an existing Ridley Terminals Inc. marine jetty that will be retrofitted with the installation of a new loading arm.
What will you do with topsoil that is displaced during construction?	The site was previously stripped and cleared, and there is no topsoil on site.
What is AltaGas' relationship to the Liquefied Natural Gas projects that have been proposed for the Prince Rupert Harbour area?	We have no relationship, or involvement, with any of the proposed Liquefied Natural Gas Projects.
Will the Province of British Columbia be involved in the EA process?	This project has been proposed for federal lands and, therefore, is subject to a review under Section 67 of the Canadian Environmental Assessment Act. Ridley Terminals Inc., Prince Rupert Port Authority, and Transport Canada have been identified as the responsible federal authorities and each will make their own determination under Section 67.
What will you do with the ethane that is separated from the propane?	Ethane that is separated from the propane will be used on site to power equipment. It will not be released to the atmosphere, nor will it be shipped away from the facility by rail.
When do you plan to make a final investment decision?	AltaGas is hoping to complete the regulatory process by the end of 2016. Once a regulatory determination is made, then AltaGas will proceed with a final investment decision. If the decision is positive, we anticipate proceeding with construction in 2017 and beginning operation in 2018.
What is the value of this project?	$400 to $500 million.

Description of Traditional Uses of the Land and Marine Resources within the Project Area

AltaGas has and continues to collect information with respect to the current use of the Project Area and its resources for traditional purposes by the First Nations. AltaGas has asked the First Nations whether their current use of the Project area may involve:

- Harvesting of fin fish species (i.e., salmon, halibut, sablefish, groundfish, herring, eulachon) for subsistence, recreational, and ceremonial purposes;
- Harvesting of marine mammals (i.e., seals and sea lions) for subsistence, recreational, and ceremonial purposes;
- Gathering of marine resources such as shellfish and marine vegetation for subsistence, recreational, and ceremonial purposes; and
- Marine navigation for harvesting, gathering, recreational, economic, or cultural purposes throughout the area along shipping transit routes serving the Project area.

While First Nations may have historically carried on traditional uses (i.e., hunting, trapping, resource gathering) on or within the terrestrial area of the Project, no such activities have occurred or have been capable of occurring since the mid-1970s when the site was set aside for industrial development. Since then the site has been used or prepared for use for industrial purposes, and access to the site has been restricted. The berth facilities (jetty) located in the adjacent marine area has been, and continues to be used in relation to RTI's coal facility operations.

AltaGas has and continues to seek information from the First Nations as to whether Aboriginal fishing and the harvesting of marine resources has been restricted in the vicinity of the Project, or along the shipping lanes which vessels will use to service the Project.

AltaGas has asked First Nations to share any available traditional use studies with respect to fishing or resource gathering around or near the berth facilities/jetty, or in shipping lanes that may be used by the Project if the First Nations indicate historic uses are continuing.

Any such traditional use or other studies that have been or will be provided by First Nations will be submitted as a supplemental report to this EED.

Description of Potential Aboriginal Environmental Effects within the proposed Project Area

AltaGas has engaged in consultations with the First Nations for the purpose of identifying any significant Aboriginal Environmental Effects, or other environmental effects, and to consider what steps could be taken to avoid or mitigate any that were identified. The lands and waters that will be leased by AltaGas are included in lands that have been leased since the mid-1970s by PRPA to RTI. AltaGas is proceeding on the basis that the term Aboriginal Environmental Effects does not include potential impacts on potential Aboriginal title, but has shared and will continue to share any information it receives on this subject with Federal Authorities as part of the responsibility for consultation that has been delegated to it.

As described in Section 1.1, the infrastructure relating to the partially developed sulphur export facility will be dismantled and removed, and replaced with the construction of new improvements that are required in relation with AltaGas' Project. Although such new Project improvements will be different from those that existed on the site, such new improvements will not affect any area that has not been previously developed for industrial purposes.

Relating to the new improvements, the existing rail siding will be expanded to serve the site, and that new office and administrative buildings will be constructed. This will occur on lands that had been previously cleared, levelled and used for industrial purposes. No natural habitat will be disturbed by such works. From AltaGas' perspective, the Project works on the land described in Section 2 will not result in any new or additional Aboriginal Environmental Effects on the land portion of the Project site.

Given that coal shipping will be displaced by propane shipping resulting in no net increase in shipping traffic at the RTI berth facilities, no expansion of the existing berth/jetty is required and no new works are planned below the high-water mark in the adjacent marine area. The existing RTI jetty will be retrofitted with the installation of a new loading arm on the marine jetty. AltaGas has or will explore with First Nations whether the new loading arm, and any additional lighting installed on the jetty which may be visible in the adjacent marine area, could have any impact on the current use of the area by the First Nations for traditional purposes.

AltaGas has and continues to engage with First Nations to identify whether additional Greenhouse Gas and other air contaminant emissions from the Project could have any significant adverse environmental effect on health and socio-economic conditions within the meaning of section 5.1(c)(i). AltaGas does not anticipate that this will be the case, however are committed to providing further assessment if new concerns are identified.

A preliminary screening of the proposed Project site, which is on an existing brownfield location previously developed for a sulphur facility, was conducted to ensure no presence of any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. No sites were identified and therefore no concern for potential Project interaction, based on available information were identified.

Summary of Potential Effects

The following concerns were raised by First Nations. AltaGas is continuing to engage with the First Nations in order to have a better understanding and address concerns relating to:

a) Effects of the Project on marine ecosystems and marine resource use

- Potential impact to fisheries habitat, marine mammals and vegetation resulting from loss of containment issues (i.e., propane or other spills/discharge) and/or potential water quality issues from vessel propeller turbidity.
- Vessel traffic potentially affecting fisheries and marine mammal migration, fishing and harvesting activities, and navigation.
- Potential affect to fisheries due to ambient lighting issues and/or as a result of shadowing from vessel moorage at the berth facility.

b) Effects on community health and well-being

- Air quality – facility air emissions and greenhouse gas emissions.
- Noise – increased noise levels during construction and operational phases.

<u>**Description of Mitigation Measures**</u>

In relation to the engineering design, development, construction and operation of the Project, AltaGas will exercise its expertise and experience to incorporate environmental, health and safety standards and requirements, including taking such measures as may be appropriate to address First Nations concerns and mitigate or accommodate any potential Aboriginal Environmental Effects.

Mitigation measures proposed by AltaGas to address potential Aboriginal Environmental Effects include the following, as well as measures identified in other sections of the EED:

- Develop and implement safety and emergency response systems including ground flare, fire and gas detection, spill response and fire suppression in relation to the facilities located on the terrestrial area(rail car off-loading, propane refrigeration and storage facilities) and marine area (pipeline, berth facilities/jetty).
- Adopt and comply with rules and regulations in respect to the berth and jetty facilities, including regulations relating to carrier vetting, pilotage and tug assistance, carrier berthing and mooring, cargo transfer, carrier and terminal safety and security, spill prevention and emergency response.
- Develop and implement marine communication protocols to facilitate communication between project vessels and First Nations mariners.
- Prevent impacts on marine mammals by establishing maximum speeds and collision reporting.
- Participation and compliance in PRPA's annual emissions inventory and reduction program in relation to terrestrial facility operations and carrier vessel berthing and mooring operations.
- Incorporate above and below sea level noise reduction measures into project design, and establish a noise complaint mechanism.
- Design and manage exterior lighting from all project components during construction and operation to prevent excessive emanation of light, while meeting safety requirements.
- Provide First Nations with a project implementation schedule ahead of construction and at any time when revisions to this schedule are made.
- Require project vessels to stay within designated shipping lanes.
- Other measures identified in other sections of EED but relevant to Current Use.

AltaGas will continue to identify potential mitigation or accommodation measures, as appropriate, in response to First Nations concerns as they are identified and communicated to AltaGas through the engagement process.

<u>**Summary of Preliminary Conclusions**</u>

Thus far in the engagement process, AltaGas has tentatively reached the following conclusions with respect to potential Aboriginal Environmental Effects:

- There would be no significant adverse effects on health and socio-economic conditions as a result of the Project within the meaning of section 5.1(c)(i), given the scale and nature of the impacts and the distant location of the First Nation communities.
- There would be no significant adverse effects on physical and cultural heritage at the site as a result of the Project within the meaning of section 5.1(c)(ii), given the existing condition of the Project site.
- There would be no significant adverse effects on current use of lands and resources on the land for traditional purposes, given that the Project will be located on a brownfield site, within the meaning of section 5.1(c)(iii), but AltaGas is looking closely with the First Nations at potential impacts on the current use of marine resources for traditional purposes within the meaning of section 5.1(c)(iii).
- **There would be no significant adverse effect on** any structure, site or thing on the Project lands, or in the related marine area, that is of historical, archaeological, paleontological or architectural significance within the meaning of section 5.1(c)(iv), given the existing condition of the site and what is known about it.

15 ACCIDENTS AND MALFUNCTIONS

This section identifies and summarizes the unplanned or unexpected changes resulting from potential accident and malfunction events that may be associated with the Project, and identifies effective and established standards and practices to mitigate effects on the bio-physical environment and human health. The assessment methodology presented in Section 4, Assessment Methodology, was applied to identify potential interactions between Project VCs and ICs and the described accident scenarios and subsequently assess potential effects on the environment and human health.

15.1 Identification of Potential Accidents and Malfunctions

Potential Project-related accidents or malfunctions were identified and evaluated based on existing, publicly available information, and the professional experience and judgment of Project team members, including professional engineers, technical experts, and industry stakeholders familiar with existing marine, road, and rail operations at RTI. In addition, for potential vessel-related accidents or malfunctions during Project operation, the assessment refers to a risk assessment commissioned by AltaGas during Project planning. The marine component of a navigational risk assessment was relied on for the identification, characterization and potential effects assessment of marine vessel accidents during the Project's operation phase.

For the Project three groups of potential accidents and malfunction scenarios were identified:

Group 1 Accidents at Land Based Facilities

1. Rail Tanker Car Movement in the Rail Yard: mechanical failure of rail carriage or track system, or collision resulting in integrity failure of rail tanker and subsequent propane spill/release
2. Rail Tanker Staging in the Rail Yard: non-impact related integrity failure of rail tanker resulting in propane spill/release
3. Operation of On Site Facilities for Handling and Storage of Propane:
   A. Transfer system from rail tanker to bullets experiences integrity failure resulting in propane spill/release;
   B. Pressurized storage at bullets experiences integrity failure resulting in propane spill/release;
   C. Transfer system from pressurized storage to refrigeration plant experiences integrity failure resulting in propane spill/release;

D. Refrigeration plant operations experiences integrity failure resulting in propane spill/release;

E. Transfer system from refrigeration plant to refrigerated storage experiences integrity failure resulting in propane spill/release;

F. Refrigerated storage at tank (including BOG Management) experiences integrity failure resulting in propane spill/release;

G. Transfer system from refrigerated storage to loading arms experiences integrity failure resulting in propane spill/release;

H. Loading operations (including BOG Management) experiences integrity failure resulting in propane spill/release; and

I. Emergency collection system and flaring operations experiences integrity failure or fails to ignite resulting in propane spill/release.

Group 2 Marine Based Accidents

A. Bulk Carrier Entry to Port and Manoeuvring at Berth: grounding, collision (impact with other ship moving or large marine mammal) or allision[5] (impact with other ship moored or impact with jetty) resulting in integrity failure and subsequent propane spill/release or bunker oil spill.

Group 3 Fuel Spills from Rail or Vehicles

A. Operation of Locomotive within the Rail Yard: mechanical failure in locomotive or track system in rail yard resulting in integrity failure in fuel system and subsequent fuel spill, non-impact related integrity failure in locomotive fuel system in rail yard resulting in fuel spill; and

B. Operation of Vehicles within the Plant Site: vehicular accident in yard, plant or marine terminal results in integrity failure in fuel system and subsequent fuel spill, non-impact related integrity failure in vehicular fuel system in rail yard, refrigeration plant or marine terminal resulting in vehicular fuel spill.

Each type of accident or malfunction scenarios was described in conjunction with facility specific mitigation, and were attributed a probability of occurrence, consequence rating and environmental and human health risks. Mitigation that applied to each of the accident or malfunction scenario groups was summarized for each group.

[5] A collision is when two objects strike each other, as when two ships passing make a misjudgment and one strikes another. An allision is similar, but refers to a collision where one of the two objects is stationary. The term is generally used in a nautical context. If a ship or boat strikes against a bridge abutment, this is called an allision.

15.2 Cumulative Effects

The CEA Agency's Operational Policy Statement for Assessing Cumulative Environmental Effects under *CEAA 2012*, requires that the environmental effects of accidents and malfunctions be considered in the assessment of cumulative environmental effects if they are likely to result from the Project acting in combination with the physical activities of other projects that have been or will likely be carried out.

Since accident and malfunction scenarios are unplanned and unexpected events that are foreseeable but considered unlikely to occur, the associated environmental effects from the accident and malfunction events described herein are therefore considered equally unlikely to occur. In addition, the environmental effects associated with the accident and malfunction scenarios are not expected to overlap spatially or temporally with similar effects from the physical activities of other projects that have been or will foreseeably be carried out. The exception may be potential carrier collisions with large marine mammals.

15.3 Management and Safety Plans at the Port of Prince Rupert

As context for the accident and malfunction events and associated management plans described herein, a summary of management plans that are used within the Port of Prince Rupert is provided below.

The PRPA maintain the "Prince Rupert Port Authority - Emergency Management Plan" (PRPA EMP; last accessed January, 2016). The PRPA EMP covers hazards including, earthquake, tsunami, flood, severe weather/storm surge, hazardous material events, oil spills, disease and pandemics, and emergencies. The emergencies section includes fatalities, casualties, displaced people, interruption of essential public services, property damage or loss, economic impacts, damage to basic infrastructure, and significant harm to the environment. The PRPA EMP provides contacts, organization, response agencies and stakeholders and procedures for responding to these types of hazards.

RTI has an Occupational Health and Safety Coordinator who administers an Emergency Response Program (RTI ERP), including an Environmental and Spill Section (last accessed January 27, 2016). The spill section addresses spill reporting, communications drills and inspections, and provides direction for general spill clean-up for PCB, coal and petcoke (marine), chemical, battery acid, and gas or diesel spills. Also part of the RTI ERP is the Incident Reporting and Investigations Section, which ensures that all injuries, illnesses, and incidents, including near miss incidents, on RTI leased lands are reported, in order to assist with the development of strategies to prevent recurrence. The Incident Reporting and Investigations Section identifies the responsibilities and the methodology for identifying and resolving issues related to RTI's safety, environmental and quality systems.

CN's Safety Management System (SMS) is a proactive, comprehensive program designed to minimize risk and continually reduce injuries and accidents. The federal government has increased regulatory requirements for Emergency Response Action Plans, tank cars that handle Dangerous Goods and informing communities on Dangerous Goods being transported. CN is required to notify Transport Canada of any dangerous goods incident. Local first responders have access to real time information on dangerous goods transported through their community with the Ask Rail mobile application. CN provides dangerous goods and rail safety training to first responders in communities throughout Northern BC, and has highly-trained dangerous goods responders and contractors on call to address any rail incident.

Emergency Response Assistance Canada, a national emergency preparedness and response organization, is contracted by AltaGas and available 24/7/365 to provide supplementary personnel, expertise, and resources in the unlikely event of an emergency.

15.4 Group 1: Accidents at Land Based Facilities

Group 1 focuses on accidents and malfunctions at facilities and equipment that transport, store, or handle propane. These facilities and equipment include propane rail cars, pressurized storage tanks, refrigerated storage tanks, refrigeration facilities, marine wharf loading facilities and the emergency flaring facility.

Key emergency response and safety management plans, project layout, and design criteria apply to all of these facilities and equipment. These emergency response and safety management plans and design criteria are essential to avoiding accidents and reducing effects on the bio-physical environment and human health and are summarized below. In all cases these management plans will be coordinated with and support existing PRPA RTI and CN emergency and safety management plans.

15.4.1 Group 1 Emergency and Safety Planning

- Process Safety Management protocols will be established by AltaGas consistent with practices used in other similar facilities to ensure that human errors are avoided or minimized leading to rupture of propane facilities.
- AltaGas will ensure that AltaGas workers, CN workers, and other RTI and PRPA tenant workers within the fence line are fully trained to avoid or minimize human errors and respond to warning systems specific to the facilities on site.
- Access will be strictly controlled to all facilities on site where propane storage and handling facilities are to be located. A fence line will mark the boundary within which all controls will be implemented.

- The 10^ 4 LSIR risk contour has been contained to the fence line (located around AltaGas' sub-lease site), meaning the estimated fatality risk outside of the fence line from flammable clouds, explosions and fires, is less than 10^ 4 per year, or statistically 1 in 10,000 years.
- Fire Suppression Systems, Equipment and Trained Users will be present in proximity to all propane storage and handling facilities on site.
- An emergency response, spill/release mitigation and cleanup plan will address safe operation around all propane storage and handling facilities on site, address facility specific safety requirements, warnings systems for onsite workers, and people beyond the fence line, and identify bio-physical environmental resources that may need to be addressed during an emergency event.
- Any potential propane leaks would be detected from one or more of the leak detection methods, and emergency shutdown valves (ESDs) would effectively limit the volume released.
- A deluge system will be incorporated into the design of facilities holding liquid LPG.
- Emergency Control Systems will be provided at the bullets, storage tanks, refrigeration facility, flare facility and the marine loading facility. Training will be provided to all workers who may be involved with the following:
  - Gas detection equipment;
  - Isolation valves; and
  - ESD valves.
- Proper equipment spacing will be part of the design of the site layout, to minimize the risk that an accident at one propane storage and handling facility could adversely affect another facility containing propane.
- Cleanup plans and procedures will be in place to respond post-event and ensure all environmental damage is repaired.
- AltaGas will develop a Terminal ERP and by regulation both, an Emergency Response Assistance Plan (for rail and marine transportation) and Environmental Emergency Response Plan for site operations.

15.4.2 Train – Mechanical Failure, Derailment or Collision of a Propane Car Leading to a Spill or Release

15.4.2.1 Description

The unplanned event is leakage of propane from a ruptured propane car(s) after mechanical failure, derailment or collision. Mechanical failure could potentially occur in valves, connections or welds in the tank itself, resulting in the spill of liquid propane or release of propane gas. In the event of a derailment, it is not a certainty that a propane car would be ruptured, because of the safety features incorporated into the design of the cars and low operating speeds while on PRPA/RTI lands. In addition, the number of cars that may be ruptured is also expected to be limited or relatively small since speeds will be low and typically in derailments a limited number of cars actually derail causing damage.

15.4.2.2 Effective and Established Mitigation Measures

A number of measures, processes and circumstances will be utilized to mitigate the potential for derailments and reduce the risk associated with railcar rupture, including the following:

- Rail cars will be required to travel at low speeds because of the following:
  - Slow due to approach at Port Edward; Limited speeds on the approach to Ridley Island and through Port Edwards, and slow down at the entrance onto Ridley Island.
  - Speed restrictions on Ridley Island, and into the loading racks.
  - Set speed limit within the Propane Facility boundaries.
- Safety features in rail propane cars include:
  - Certified Pressure Vessels designed for Rail Service.
  - LPG cars using DOT-112 cars. These cars are designed to meet SOR/79-101 regulations under the Canada Transportation Act. These cars have a tank head puncture resistance system and thermal protection.
  - Double couplings that limit the likelihood of cars becoming uncoupled during movement of cars during unloading.
  - Heat shielding (rail car insulation) to limit the likelihood of tanks over-heating on exposure to fire.
  - All connections for loading and unloading the propane are on top of the car. This reduces the risk of rupture when derailed.

- An empty DOT 112 type propane car will be located between the section of a train hauling propane and another section hauling other types of products (manifest trains). This reduces the risk of a non-DOT 112 type of car puncturing a propane car.

- Safety protocols established in accordance with the Railway Safety Management System Regulations will ensure that human errors leading to derailments are avoided or minimized. CN Rail under the jurisdiction of Transport Canada is responsible for the management of Rail Safety for its trains on the main line leading to Prince Rupert. AltaGas under the jurisdiction of PRPA and RTU will be responsible for car movements within PRPA's jurisdiction.

- Certification for Propane Handling: AltaGas will ensure that AltaGas workers and train operators and support staff involved in handling propane unloading and are fully trained to avoid or minimize human errors (this will include securing the rail car, inspecting the rail car, gauging and testing the contents of the rail car, determining the maximum amount of propane to be transferred, connecting liquid and vapour hoses between the rail car and the unloading riser, unloading the rail car and preparing the rail car for departure[6]).

- Design with Level Gradient: AltaGas will ensure that flat grades are provided on tracks used for unloading propane cars, to avoid uncoupled cars or trains having the potential for rolling away from workers and derailing.

- Rail Tanker Inspection Plan: AltaGas will ensure the inspection of the integrity of each rail car is performed on a periodic basis so that potentially problematic cars are identified and repair undertaken in advance of failure.

- Rail Tanker Preventative Maintenance Program: AltaGas will ensure that prospective issues with the containment systems (tank, pressure relief valves, transfer valves and transfer lines) are identified using visual inspection, non-destructive testing and manufacturer's suggested maintenance to ensure operational integrity.

- CN Advanced Mechanical Integrity Detection Systems will be utilized to ensure the ongoing integrity of each of the Rail Tankers Chassis.

- Rail Operator Pre-movement Track Inspection, Tanker Inspection and Yard Area Survey.

[6] P·T I 300-02 Propane Rai l Car Unloading - http://cpa-dev.cyansolutions.com/sites/default/files/files/300-02%20Course%20Description%20E%20-%202012-04(3).pdf

15.4.2.3 Probability

With the identified mitigation measures in place the probability of experiencing a leak of propane due to either integrity failure or a derailment in the rail yards and during unloading of the cars is considered to be very unlikely. The release frequency from yard rail car movements is 2.4E-04 per year. The release frequency from transit rail car movements is 1.1E-05 per year. The release frequency from railcar unloading operations is 1.0E-01 per year. A fire or explosion associated with the leak is considered to be even less probable for a propane car leak.

15.4.2.4 Potential Consequence

In the unlikely event of propane leakage from propane cars, the propane would be expected to disperse to the atmosphere within the PRPA/RTI property line without fire or explosion. The stronger the winds at the time of a leak the shorter the time required for dispersion. Some propane could reside for a longer duration if ground depressions are present in the area where leak occurs. Site leveling and sloping to manage transfer of propane vapours to designated safe locations will be incorporated throughout the facility.

Fire or explosion would require an ignition source within the zone of dispersion at the time of the event, and for the propane to air mixture to be between the Lower Flammability Limit (LFL) and the Upper Flammability Limit (UFL). The site will have a strictly enforced no smoking, no lighters and hot works program. In addition, all of the site electrical equipment will be design and built to the Canadian Electrical Code requiring sealed enclosures, sealed connections, sealed switches and operating systems to ensure electrical equipment and electrical systems are not ignition sources. The distance over which the leaked propane disperses will vary with wind and atmospheric pressure. The important distance in determining consequence is the distance to the LFL because at the fence line, propane will be sufficiently dispersed so that ignition is unlikely. If ignition within the fence line does occur, the fire will be limited to the source of the propane at the rail car.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.4.3 On Site Facilities for Storage and Handling of Propane

There are five locations on site involving the storage and/or handling of propane. Each is discussed separately below.

15.4.3.1 *Storage and Handling of Propane at Bullets*

15.4.3.1.1 Description

The accident or malfunction scenario is the potential rupture of a pressurized storage bullet resulting in spilled LPG. Spilled LPG will be contained within a secondary containment berm surrounding a propane bullet. Depending on location of rupture, vaporized propane may leak from the rupture once the liquid level drops beneath the point of the rupture in the bullet.

15.4.3.1.2 Effective and Established Mitigation Measures

- Certified pressure storage tanks;
- Preventative maintenance program;
- Periodic inspection plan;
- Small storage volume in propane storage bullets;
- Fire detection and fire suppression (including a deluge system) will be provided for this facility;
- Emergency Control Systems will be provided and training provided to workers who may be involved with the following:
  - Gas detection equipment;
  - Isolation valves; and
  - ESD valves.

15.4.3.1.3 Probability

With the identified mitigation measures in place the probability of a leak of propane at the pressurized storage tank is considered to be very unlikely.

15.4.3.1.4 Potential Consequence

Spilled LPG would pool within the designed secondary containment. The LPG would vaporize and the vapor cloud would safely disperse. At the fence line, propane will be sufficiently dispersed so that ignition is unlikely. In the unlikely event that ignition does occur, the fire would be contained within the fence line limited to the source of the rupture or location of the spilled product.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.4.3.2 Storage and Handling of Propane at Refrigerated Tank

15.4.3.2.1 Description

The accident or malfunction scenario is the potential rupture or damage to the interconnecting piping on top of the double walled refrigerated storage tank. Low pressure refrigerated LPG could spill onto the side of the tank where it would warm up and vaporize. The vaporized LPG would safely disperse into the atmosphere at low concentrations. If boil-off gas connections are ruptured, LPG vapor would be released to the atmosphere and dissipate.

15.4.3.2.2 Effective and Established Mitigation Measures

- Certified Refrigerated Storage Tank (-51˚C) with a three element design (outer wall, insulation and inner wall) to minimize Boil Off Gas (BOG) generation, prospective impact from external heat sources and incident related debris.
- Preventative Maintenance Program and Periodic Inspection Plan.
- Full Containment Design: The propane will be stored in a fully contained double walled tank system with no connections on the side or bottom of tank (tank top only withdrawal penetrations minimize the potential for integrity related releases of refrigerated liquid propane). This design of tank also increases the safety of the tank and reduces the risk of a propane leak from an inner tank rupture.
- Fire detection and fire suppression (including a deluge system) will be provided for this facility.
- Emergency Control Systems will be provided and training provided to workers who may be involved with the following:
    - Gas detection equipment;
    - Isolation valves; and
    - ESD valves.

15.4.3.2.3 Probability

With the identified mitigation measures in place the probability of a leak of propane at the refrigerated storage tank is considered to be very unlikely. Further, a fire associated with a propane leak at a storage tank is considered to be even less probable.

15.4.3.2.4 Potential Consequence

The LPG would vaporize and the vapor cloud would safely disperse. At the fence line, propane will be sufficiently dispersed so that ignition is unlikely as the vapor cloud should be ½LFL. There will be no explosion as the tank is not pressurized. If ignition does occur, the fire will be contained within the fence line limited to the source of the rupture or location of the spilled product.

A potential effects assessment is carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.4.3.3 Storage and Handling of Propane at Refrigeration Facilities

15.4.3.3.1 Description

The accident and malfunction scenario is the potential rupture or leak from any refrigeration equipment or any interconnected piping. Depending on the rupture location, LPG could be in either a liquid or vapor phase.

15.4.3.3.2 Effective and Established Mitigation Measures

- No In-process Bulk Storage (Open Loop Design)
- Certified Pressure Equipment and Certified Pressure Piping
- Preventative Maintenance Program and Periodic Inspection Plan
- Fire detection and fire suppression (including a deluge system) will be provided for this facility
- Emergency Control Systems will be provided and training provided to workers who may be involved with the following:
  - Gas detection equipment;
  - Isolation valves;
  - ESD valves; and
  - Alarm systems.

15.4.3.3.3 Probability

With the identified mitigation measures in place the probability of a leak of propane at refrigeration facility is considered to be very unlikely. Further, a fire or explosion associated with a propane leak at a propane refrigeration facility is considered to be even less probable.

15.4.3.3.4 Potential Consequence

Regardless of the location of the rupture, LPG would spill from the refrigeration facility into a secondary containment, and the LPG would vaporize and safely disperse. At the fence line, propane will be sufficiently dispersed so that ignition is unlikely. In the unlikely event that ignition does occur, the fire will be contained within the fence line limited to the source of the rupture or location of the spilled product. A vapor phase release of LPG will similarly, safely disperse to ½ LFL at the fence line.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.4.3.4 Storage and Handling of Propane at Marine Loading Facilities

15.4.3.4.1 Description

The accident and malfunction scenario is a potential spill of low pressure, refrigerated LPG from loading arms during loading of a VLGC.

15.4.3.4.2 Effective and Established Mitigation Measures

- Load Master Oversight (Designated Responsible Party)
- Port Specific Refrigerated Propane Loading Manual
- Certified Refrigerated Propane Loading Staff
- Certified Loading Systems
- Preventative Maintenance Program and Periodic Inspection Plan
- Transfer Integrity Management Systems, Flow Detection and Volumetric Control
- Pre-load Equipment Checklist
- Fire detection and fire suppression (including a deluge system) will be provided for this facility.
- Emergency Control Systems will be provided and training provided to workers who may be involved with the following:
  - Gas detection equipment;
  - Isolation valves;
  - ESD valves;

- Alarm systems; and
- Break-away valve system.

15.4.3.4.3 Probability

With the identified mitigation measures in place the probability of a leak of propane at marine loading facilities is considered to be very unlikely. Further, a fire associated with a propane leak at the marine loading facilities is considered to be even less probable. An explosion due to a propane leak at the marine loading facilities is not expected due to atmospheric conditions (non-pressurized – therefore likely a small volume release) and transfer temperature (-42˚C).

15.4.3.4.4 Potential Consequence

The liquid LPG would vaporize once it hits the water and the vapor cloud would safely disperse. Outside the marine safety zone, propane will be sufficiently dispersed (<1/2LFL) so that ignition is unlikely. Gas detection and ESD system would immediately isolate the loading arms and stop loading to minimize the volume spilled. In the very unlikely event that ignition does occur, the fire will be contained within the marine safety zone limited to the source of the rupture or location of spilled product.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.4.3.5 Emergency Collection and Flaring Facility

15.4.3.5.1 Description

The flare facility is a safety device used by AltaGas to control a release event when procedures for handling, cooling and storing propane are upset beyond the normal operating limits (i.e., ESD Engagement), or during facility start-up and shut down or maintenance periods.

15.4.3.5.2 Effective and Established Mitigation Measures

- Plant Manager Oversight (Designated Responsible Party)
- Certified Plant Operations Staff
- Process Control Systems, Process Instrumentation, Alarms and Automated Trips (SCADA)
- Certified Gas Systems
- Preventative Maintenance Program and Periodic Inspection Plan
- Continuous Ignition System

15.4.3.5.3 Probability

The use of emergency flaring is infrequent and of short duration.

15.4.3.5.4 Potential Consequence

There will be emissions of NO_2, SO_2 and CO for short periods. Light emissions would be limited by within the flare stack from a ground source flare, though a sky glow may occur for a short period.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.5 Group 2: Marine Based Accidents

The carriers (sometimes referred to as VLGC) that transit PRPA marine jurisdiction to berth at the RTI wharf, to load propane from the Project facilities, are double hulled with an interstitial insulation system and self-contained refrigerated tank. The carriers are designed, built and periodically surveyed to relevant National Regulation Transport Canada, US Coast Guard, etc.), Class Society Rules (i.e. Lloyd's Register, DNV GL, American Bureau of Shipping, etc.) and International Regulation under International Marine Organization (i.e., SOLAS, MARPOL, etc.).

The carriers and project activities on the RTI wharf will be subject to regulations and requirements provided by International Maritime Organization, Transport Canada, PRPA and RTI. Except to the extent that AltaGas will be able to control which vessels can call at the facility through the vessel vetting program, AltaGas will have no operational authority over carrier operations.

The reasonably foreseeable accident and malfunction scenarios relevant to the Project's marine operations include either bulk carrier entry to port and manoeuvring at berth: grounding, collision (impact with other ship moving or large marine mammal) or allision[7] (impact with other ship moored or impact with jetty) resulting in integrity failure and subsequent propane spill/release or bunker oil spill.

15.5.1 Port Marine Traffic Management

Port Traffic will be managed under the authority of Prince Rupert Port Authority (PRPA), with qualified Marine Pilots on-board and under the procedural requirements of the Port Specific Operations Manual for each ship for all movements within the Port Area. These procedures will embody the requirements of the International Marine Organization (IMO), Transport Canada (TC), Prince Rupert Port Authority (PRPA); as well as, Ridley Terminal Inc. (RTI) and the Project. This will

[7] A collision is when two objects strike each other, as when two ships passing make a misjudgment and one strikes another. An allision is similar, but refers to a collision where one of the two objects is stationary. The term is generally used in a nautical context. If a ship or boat strikes against a bridge abutment, this is called an allision.

include communication procedures, speed limits, right-of-way, staging areas, anchoring locations, berthing, ballasting, bunkering, restrictions and other port specific requirements.

15.5.2 Effective and Established Mitigation

In conjunction with marine and navigation requirements within PRPA marine jurisdiction, the following mitigation measures apply to all marine transport associated with the Project including carrier movements during transit, berthing and loading will be in place:

- Port Specific Operations Manual;
- Qualified Marine Pilots (local knowledge-base);
- Tethered tugs will accompany all carriers in transit and berthing within PRPA marine jurisdiction;
- Transport Canada, PRPA and RTI will provide established navigation routes that will be followed by all carriers;
- Established Environmental Operating Limits;
- All carriers (VLGC) will be double hulled; and
- Berthing Simulations.

In addition, the following will apply to all marine based activities:

- Safety Protocols related to the transfer of propane from storage to the carriers will be established by AltaGas consistent with practices used in other similar propane facilities to ensure that human errors leading to leaks or accidents at propane facilities on the marine wharf are avoided or minimized.
- An ERP will address safe marine operations and response to propane related accidents and spills, in support of PRPA and RTI marine and shore based safety plans.

15.5.3 Collision or Allision or Grounding in Transit and Berthing

15.5.3.1 Description

The accident and malfunction scenario is the potential rupture through double hulled storage tanks within VLGC caused by collision, allision or grounding, while transiting PRPA marine jurisdiction and berthing at the RTI berth face.

15.5.3.2 Effective and Established Mitigation Measures

The effective and established mitigation are summarized in sections 15.5.2.

15.5.3.3 Probability

With the identified mitigation measures in place the probability of a leak of propane from a carrier is considered to be very unlikely. Further, a fire associated with a propane leak from a carrier during berthing or at berth is considered to be even less probable. An explosion due to a propane leak at the marine loading facilities is not expected.

15.5.3.4 Potential Consequence

The LPG would vaporize once it hits the water and the vapor cloud would safely disperse. Outside the marine safety zone, propane will be sufficiently dispersed (<1/2LFL) so that ignition is unlikely. Gas detection and ESD system would immediately isolate the loading arms and stop loading to minimize volume spilled. If ignition does occur, the fire will be contained within the marine safety zone limited to the source of the rupture or location of spilled product.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.5.4 Bunker Oil Spill

15.5.4.1 Description

Bunkering in Prince Rupert is uncommon, since there are no local bunkering facilities, but bunkering does happen from time to time if vessel agents order fuel to be delivered from Vancouver. Bunkering activities will not take place as part of this Project. The only possible source for a bunker oil spill resulting from the Project would be the carrier, and a spill would be associated with a collision, allision or grounding during berthing or transit through PRPA marine jurisdiction.

15.5.4.2 Effective and Established Mitigation Measures

The effective and established mitigation are summarized in Section 15.5.2. In addition, the designated response entity certified by Transport Canada, namely Western Canada Marine Response Corporation (WCMRC) has a fully outfitted response depot in Prince Rupert.

15.5.4.3 Probability

Bunker oil spills are expected to be very unlikely.

15.5.4.4 Potential Consequence

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident. WCMRC is certified by Transport Canada (under the Canada Shipping Act) to address marine oil spills up to 10,000 tonnes.

15.5.5 Collisions – with Other Vessels

In the extremely unlikely event of a collision with another ship, the impact will be dependent upon the type of collision (head on, side swipe, t-bone, etc.). The two primary incidents of interest from an environmental perspective are loss of bunker oil integrity resulting in spill or loss of propane containment integrity resulting in spill/release. The VLGC are much larger than the typical fishing fleet and pleasure craft traffic in the area and would not result in this type of event. Further assessment of larger vessel traffic risk will be undertaken in support of information provision to Transport Canada. VLGC, depending upon their age and configuration, carry a range of Marine Fuel Oil volume. Current designs for VLGC's are at ~8000 DMT MFO - WCMRC are approved currently for 10000 DMT.

15.5.5.1 Description

The accident or malfunction scenario is the potential collision or allision with smaller harbour vessels, which would be unlikely to result in a loss of cargo containment for the VLGC; however, this event may pose a safety concern for the smaller vessel. A smaller vessel was chosen as the reasonably foreseeable event given the traffic patterns and controls implemented for the Port Area.

15.5.5.2 Effective and Established Mitigation Measures

- Port Specific Operations Manual
- Qualified Marine Pilots (local knowledge-base)
- Controlled Traffic Management (i.e. Safety Zones for Transit, Berthing and Loading)
- Western Canada Marine Response Corporation (WCMRC) Spill Response Depot (in Prince Rupert)
- Established Safety Protocols
- ERP
- Existing Port Authority experienced to handle emergencies
- Tethered Tugs within PRPA Jurisdiction

- Established Navigation Routes
- Established Environmental Operating Limits
- Berthing Simulations

15.5.5.3 Probability

Very low to negligible.

15.5.5.4 Potential Consequence

The force required to rupture the outer hull of a carrier is so large that it is unlikely a smaller vessel could generate enough of the required force to penetrate the hull.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.5.6 Collisions with Marine Mammals

15.5.6.1 Description

The accident or malfunction scenario is the potential striking of a marine mammal(s) by a carrier (VLGC) while in transit to the RTI berth where loading of propane would occur.

15.5.6.2 Effective and Established Mitigation Measures

- Port Specific Operations Manual (defined seasonal migration zones [as applicable])
- Qualified Marine Pilots (local knowledge-base)
- Low speeds within PRPA Jurisdiction
- Established Navigation Routes
- Established Environmental Operating Limits

15.5.6.3 Probability

The likelihood of a collision of a carrier with a marine mammal, during transit of PRPA marine jurisdiction is considered very low.

15.5.6.4 Potential Consequence

The primary concern for any collision of a carrier with a marine mammal is the injury or death of the marine mammal. The carrier would not be expected to be damaged sufficient to cause a spill of bunker oil or leak of propane.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.6 Group 3: Fuel Spills from Rail or Vehicles

Fuel spills from rail and vehicles are normally minor interactions with low magnitude effects. If well established best management practices established by provincial and federal regulators are followed, these incidents can largely be avoided, and the potential effects would be rendered negligible. These incidents are included in this section for completeness of the discussion of accidents and malfunctions.

15.6.1 Fuel Spill from Train Locomotive Engine

15.6.1.1 Description

Rail yards generally have a low risk of engine fuel tank leaks due to ruptures, primarily due to low travel speeds. Routine equipment maintenance may cause loss of minor amounts of grease and oil to the ground.

15.6.1.2 Effective and Established Mitigation Measures

There are effective and established mitigation measures (also known as best management practices or BMPs) that are aimed at reducing and containing the spilled grease and oil. These mitigation measures include low speeds for trains, drainage ditches to contain and direct spilled material and training of staff in the practices to avoid spills, use of drip pans and absorbent spill pads.

AltaGas will conform with the requirements of PRPA and RTI for fuel spill avoidance and cleanup in the rail yards.

15.6.1.3 Probability

While the mitigation is effective in reducing the scale and frequency of spills in the rail yards, some minor spillage is anticipated.

15.6.1.4 Potential Consequence

While quantities are expected to be very small, oil, grease and other contaminants are expected to be contained in the vicinity of the rail yards.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.6.2 Vehicle Fuel Spill

Vehicle use on site can generally associated with some minor leakage of fuel and oil to the ground. Routine equipment maintenance activities may contribute as a source of minor spillage to the ground.

15.6.2.1 Effective and Established Mitigation Measures

There are effective and established mitigation measures aimed at avoiding or reducing fuel and oil spills from vehicles on site. These measures include confining all maintenance work to a designated location (whether onsite or offsite) with facilities to preventing spillage from entering the ground or drainage system, and storing fuel tanks in safe locations with impervious ground cover to prevent spillage from entering the ground or drainage system and adequate secondary containment.

15.6.2.2 Probability

While the mitigation is effective in reducing the scale and frequency of spills from vehicles onsite, very small amounts of fuel and oil may reach the ground.

15.6.2.3 Potential Consequence

While quantities are expected to be very small, fuel and oil are expected to be contained in the vicinity of the parking areas and/or designated fuel tanks and maintenance areas.

A potential effects assessment was carried out in Section 15.7 to determine the effects on the environment and humans as a result of this potential accident.

15.7 Effects Assessment

15.7.1 Identification of Potential Interactions

Based in the information presented in previous sections AltaGas identified the Project VCs and ICs with potential to interact with the identified potential accidents and malfunctions. As described in

Section 4, Assessment Methodology, potential effects on Project VCs and ICs were assessed on their potential to cause significant adverse effects.

Table 15-1 summarizes the interactions identified between potential accidents and malfunctions and Project VCs and ICs.

Table 15-1: Interaction of Project VCs/ICs with Potential Accidents and Malfunctions Related to the Project

Accident Scenarios	Terrain	Water	Marine Resources	Fish	Terrestrial Resources	Human Health
Group 1						
Train – Mechanical Failure, Derailment or Collision of a Propane Rail Car	•				•	•
Storage and Handling of Propane Bullets	•				•	•
Storage and Handling of Propane at Refrigerated Tank	•				•	•
Storage and Handling of Propane at Refrigeration Facilities	•				•	•
Storage and Handling of Propane at Marine Loading Facilities		•	•	•		•
Emergency Collection and Flaring Facility					•	•
Group 2						
Collision, Allision, Grounding resulting in Propane Leakage in Transit and at Berth		•	•	•	•	•
Bunker Oil Spill	•	•	•	•	•	•
Group 3						
Fuel Spills from Rail or Vehicles	•	•			•	

15.7.2 Potential Effects and Mitigation Measures

Mitigation measures, described in previous sections (15.4, 15.5, and 15.6), will be put in place to reduce the risk of an accident or malfunction from occurring and also to eliminate, reduce or control the adverse environmental effects that could occur in the event of a potential accident or malfunction occurring.

Based on the known effective and established mitigation measures described previously, potential effects resulting from the identified interactions are summarized in Table 15-2. A ‘N’ (no) indicates no residual effect is anticipated as mitigation measures are anticipated to reduce the probability of the event or potential adverse effects to negligible levels. Where there was considered to be the potential for adverse environmental effects to occur after application of mitigation, a residual effect was identified with a ‘Y’ (yes).

If a residual effect was identified with a ‘Y’, it was carried forward and the effect was characterized and a determination of significance was made. The characterization of residual effects and significance determination are discussed and summarized in Section 15.7.3.

Table 15-2: Summary of Potential Adverse Environmental Effects and Mitigations

<table>
<tr><th>ID # for Table 15-3</th><th>VC</th><th>Description of Potential Effect</th><th>Mitigation</th><th>Residual Effect (Y/N)</th></tr>
<tr><td></td><td colspan="4">Group 1</td></tr>
<tr><td>G1-1</td><td>Terrain</td><td>Adverse effects to surface soil quality</td><td>As described in Sections 15.4</td><td>Y</td></tr>
<tr><td>G1-2</td><td>Terrain</td><td>Adverse effects to seabed sediment quality</td><td>As described in Sections 15.4</td><td>Y</td></tr>
<tr><td>G1-3</td><td>Water</td><td>Adverse effects to groundwater quality, surface water quality and marine water quality</td><td>As described in Sections 15.4</td><td>Y</td></tr>
<tr><td>G1-4</td><td>Marine Resources</td><td>Potential adverse effects on marine invertebrates as a result of potential seabed sediment contamination</td><td>As described in Sections 15.4</td><td>N</td></tr>
<tr><td>G1-5</td><td>Fish</td><td>Potential adverse effects as a result of decreased marine water quality</td><td>As described in Sections 15.4</td><td>N</td></tr>
<tr><td>G1-6</td><td rowspan="3">Terrestrial Resources</td><td>Habitat Alteration and Fragmentation as a result of an explosion, fire, or spill</td><td rowspan="3">• Prevention, fire control or suppression
• Engineering design, safe containment and handling of LPG product
• Monitoring and alerting systems, accident response plan
• Minimizing ground conditions where propane can accumulate following a leak
• As described in Sections 15.4</td><td>N</td></tr>
<tr><td>G1-7</td><td>Disturbance or Displacement and Mortality of birds as a result of an explosion, fire, or spill</td><td>N</td></tr>
<tr><td>G1-8</td><td>Mortality as a result of an explosion, fire or spill</td><td>Y</td></tr>
</table>

ID # for Table 15-3	VC	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
G1-9	Human Health	Public safety risk in the event of fire or explosion	• Prevention, fire control or suppression • Engineering design, safe containment and handling of LPG product • Monitoring and alerting systems, accident response plan • Minimizing ground conditions where propane can accumulate following a leak • As described in Sections 15.4	N
	Group 2			
G2-1	Terrain	Adverse effects to surface soil quality	Bunker fuel spills are not considered likely because the carriers will be double hulled. In addition, response to spills in waters under PRPA jurisdiction is considered as part of effective and established management plans. • As described in Sections 15.5	N
G2-3	Terrain	Adverse effects to seabed sediment quality	Bunker fuel spills are not considered likely because the carriers will be double hulled. In addition, response to spills in waters under PRPA jurisdiction is considered as part of effective and established management plans. • As described in Sections 15.5	Y
G2-4	Water	Adverse effects to marine water quality	Bunker fuel spills are not considered likely because the carriers will be double hulled. In addition, response to spills in waters under PRPA jurisdiction is considered as part of effective and established management plans. • As described in Sections 15.5	Y
G2-5	Marine Resources	Disturbance of marine resources during carrier transit	• As described in Sections 15.5	N
G2-6		Potential collision with Marine Mammal during carrier transit	• As described in Sections 15.5	Y
G2-7		Detrimental effects on known or expected occurrence of marine species-at-risk	• As described in Sections 15.5	N
G2-8	Fish	Direct mortality. Permanent alteration of fish habitat	• As described in Sections 15.5	Y

ID # for Table 15-3	VC	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
G2-9		Disturbance resulting from increased noise		N
G2-10		Detrimental effects on known or expected occurrence of marine species-at-risk		N
G2-11	Terrestrial Resources	Disturbance or Displacement and Mortality of birds as a result of an explosion, fire, or spill	• As described in Sections 15.5	N
G2-12	Terrestrial Resources	Wildlife mortality as a result of an explosion, fire, or spill	• As described in Sections 15.5	N
G2-13	Human Health	Public Safety risks in event of fire or explosion	• As described in Sections 15.5	N
	Group 3			
G3-1	Terrain	Adverse environmental effects to soil quality	• Ensuring that equipment and vehicles are in good repair and are not leaking fluids • Developing a spill response plan and having spill kits in all vehicles • Applying best practices to operation including containment of hazardous and non-hazardous wastes. As per the Project Description, secondary containment systems will be provided for the facility where appropriate including berms and drip pans, and waste water will undergo treatment in a separation tank. • As described in Sections 15.6	Y
G3-2	Water	Adverse effects to groundwater quality and surface water quality	• As described in Sections 15.6	Y

ID # for Table 15-3	VC	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
G3-3	Terrestrial Resources	Wildlife mortality from ingestion of vehicle fuel	• Ensuring that equipment and vehicles are in good repair and are not leaking fluids • Developing a spill response plan and having spill kits in all vehicles • Applying best practices to operation including containment of hazardous and non-hazardous wastes. As per the Project Description, secondary containment systems will be provided for the facility where appropriate including berms and drip pans, and waste water will undergo treatment in a separation tank. • As described in Sections 15.6	Y

15.7.2.1 Group 1-Potential Effects

15.7.2.1.1 Terrain

Propane leakage could have the potential to cause adverse environmental effects to soil quality by introduction of regulated contaminants through combustion of propane and other materials in close proximity. In the very unlikely event of fire or explosion the effect could be exacerbated.

It is possible that Group 1 potential effects could result in adverse environmental effects to seabed sediment quality through introduction of regulated contaminants.

The described effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.1.2 Water

Train derailment could result in a puncture to one or more propane tank cars resulting in leakage of contents to PRPA and RTI lands. Propane leakage could have the potential to cause adverse environmental effects to surface water quality by introduction of contaminants through combustion of propane and other materials in close proximity. A propane handling accident at the berth could result in adverse effects on marine water quality through introduction of contaminants.

The described effect could have the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.1.3 Marine Resources

In the highly unlikely event of a VLGC allision or loading arm rupture on the wharf, the potential adverse effect on marine resources would be expected to be minimal since the LPG would vaporize once it hits the water and the vapor cloud would safely disperse. Outside the marine safety zone, propane will be sufficiently dispersed (<1/2LFL) so that ignition is unlikely. Gas detection and ESD system would immediately isolate the loading arms and stop loading within seconds to minimize volume spilled. If ignition does occur, the fire will be contained within the marine safety zone limited to the source of the rupture or location of spilled product. The likelihood of an effect on marine resources is also considered very low due to low occurrence of marine biological resources within the zone of dispersion, (i.e., within the established Marine Safety Zone) at the time of an accident.

No residual effect is anticipated as mitigation measures are anticipated to reduce the probability of the event or potential adverse effects to negligible levels; therefore this potential effect was not carried further in the assessment.

15.7.2.1.4 Fish

In the highly unlikely event of a VLGC allision or loading arm rupture on the wharf the potential adverse effect on marine resources would most likely be minimal since LPG is non-toxic and the LPG would vaporize once it contacts the water and the vapor cloud would safely disperse. Outside the marine safety zone, propane will be sufficiently dispersed (<1/2LFL) so that ignition is unlikely. Gas detection and ESD system would immediately isolate the loading arms and stop loading within seconds to minimize volume spilled. If ignition does occur, the fire will be contained within the marine safety zone limited to the source of the rupture or location of spilled product. Ultimately the likelihood of an effect on marine resources is also considered very low because of low occurrence of marine biological resources within the zone of dispersion at the time of an accident.

No residual effect is anticipated as mitigation measures are anticipated to reduce the probability of the event or potential adverse effects to negligible levels; therefore, this potential effect was not carried further in the assessment.

15.7.2.1.5 Terrestrial Resources

In the highly unlikely event of a train (tanker car) or storage tank rupture the potential adverse effect on terrestrial wildlife and habitat would most likely be associated with the consequence of an explosion or fire. Depending on the size of the rupture, the consequence can be a fireball or explosion with the potential distribution of tank fragments. This could result in wildlife habitat alteration, disturbance or displacement, and mortality as described below.

Disturbance or Displacement

In the highly unlikely event of an explosion and fireball associated with a tanker car or storage tank rupture, or due to an LPG carrier accident, there is the potential for disturbance or displacement of amphibians, birds and mammals resulting from increased noise and light effects; however, the level of behavioural change associated with such an event is expected to be of short duration. Considering the low likelihood and extent of such an event occurring, any effect on terrestrial VC subcomponents is expected to be negligible; therefore this potential effect was not carried further in the assessment.

Mortality

In the highly unlikely event of an explosion and fireball associated with a tanker car or storage tank rupture, there is the potential for direct mortality of amphibians, birds or mammals that come in contact with fire or fragments from the explosion; however, the likelihood of such an event occurring is extremely low. Even if the event occurred, only small numbers of wildlife mortalities would be expected and the potential for a population-level effect is anticipated to be low; therefore the potential effect on amphibians, birds and mammals is expected to be negligible.

The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.1.6 Human Health

The likelihood of a human casualty was considered unlikely because the public will not be allowed inside the fence line, and warning systems (such as gas detection and alarms) will be in place to alert people working within the fence line, especially those most exposed to the potential for leaked propane such as those involved in the movement of propane rail cars and propane unloading.

It is anticipated that ERPs and warning systems would alert workers of an incident well in advance of them being at personal risk and invoke safety procedures and possibly cause evacuation. As the propane would dissipate to the atmosphere, no effect on water bodies is anticipated.

With respect to potential emergency flaring risk to humans is low with negligible effect on air quality and light intrusion for receptors in Port Edwards.

No residual effect is anticipated as mitigation measures are anticipated to reduce the probability of the event or potential adverse effects to negligible levels; therefore this potential effect was not carried further in the assessment.

15.7.2.2 Group 2-Potential Effects

15.7.2.2.1 Terrain

Carrier collisions with other marine vessels could result in leakage of propane, fire and explosions causing adverse environmental effects to seabed sediment quality through introduction of regulated contaminants. An LPG carrier accident at the wharf could also result in spilled bunker fuel causing oiling of marine waters and intertidal seabed sediments. The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.2.2 Water

An LPG carrier accident at the wharf could result in leakage of propane, fire and explosions, possibly causing damage to the wharf structures. It is possible that this could cause adverse environmental effects to marine water quality through introduction of regulated contaminants.

An LPG carrier accident at the wharf could also result in spilled bunker fuel causing oiling of marine waters. Carrier collisions with other marine vessels could result in leakage of propane, fire and explosions causing adverse environmental effects to marine water quality through introduction of regulated contaminants. An LPG carrier accident at the wharf could also result in spilled bunker fuel causing oiling of marine waters and intertidal seabed sediments.

The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.2.3 Marine Resources

The transit of LPG carriers through the RSA (PRPA marine jurisdiction (Figure 7-2, Section 7) could increase the risk of collision with baleen whales (mainly humpbacks), toothed whales (Harbour Porpoise or northern resident killer whale) or pinnipeds (Steller Sea Lions), some of which are species-at-risk; however, the risk to Killer Whales and Steller Sea Lions from collisions with large ships is considered negligible by DFO (DFO 2015a).

Direct Mortality of Marine Mammals

In the highly unlikely event of either a LPG carrier accident at the wharf or LPG accident in transit in PRPA waters there is the potential for direct mortality of marine mammals, marine mammal species-at-risk or destruction of marine habitat resulting from an ignition or spill of bunker oil from the double-hulled carrier.

The explosion, shock waves, and/or sound waves associated with a potential explosion could result in direct mortality to the marine mammals in the LSA; however, two factors indicate that the potential for adverse changes on marine mammals is considered negligible; first, the extremely low likelihood of the event occurring necessarily results in a low risk scenario and second, if the event occurred the magnitude of the consequence on marine mammal populations is anticipated to be low, and of limited duration.

The release of bunker oil from the carrier due to collision could result in direct mortality of marine mammals, marine mammal species-at-risk or destroy marine habitat; however, two factors indicate that the potential for adverse changes on Marine Resources VC subcomponents is considered negligible. First, the extremely low likelihood of the event occurring necessarily results in a low risk scenario and second, although the duration would be long term if the event occurred, the magnitude of the overall consequence to marine mammal populations is anticipated to be low because of the low use of the area.

The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment. Refer to Section 15.7.3.

Disturbance Resulting from Increased Noise

In the highly unlikely event of either a LPG carrier accident at the wharf or LPG accident in transit in PRPA waters there is the potential for marine mammals to experience a disturbance resulting from increased noise resulting from an explosion. The shock waves and/or sound waves, associated with an explosion could result in temporary marine mammal movements away from the area. Overall the level of behavioural change associated with such an event is expected to be of short duration to marine mammals. This temporary behavioural change has the potential to affect marine mammals in the immediate area; however, the extremely low likelihood and extent of the event occurring in the LSA would necessarily result in a low risk scenario. The potential for adverse effects to marine mammal populations is considered negligible; therefore this potential effect was not carried further in the assessment.

Detrimental Effects on Known or Expected Occurrence of Marine Mammal Species-At-Risk

In the highly unlikely event of either a LPG carrier accident at the RTI jetty or LPG accident in transit in PRPA waters there is the potential for detrimental effects on known or expected occurrence of marine mammal species-at-risk. An explosion, shock waves, and/or sound waves associated with a explosion or the release of bunker oil due to collision could affect marine mammal species-at-risk; however, the extremely low likelihood of either event occurring necessarily results in a low risk scenario and the potential for low to no interaction with marine mammal species in the LSA area makes this accident risk to be considered negligible.

The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.2.4 Fish

Group 2 scenarios have the potential to result in direct fish mortality, disturbance resulting from increased noise, and detrimental effects on known or expected occurrence of marine species-at-risk are anticipated to occur.

Direct Fish Mortality

In the highly unlikely event of either a LPG carrier accident at the wharf or LPG accident in transit in PRPA waters there is the potential for direct mortality of marine CRA fish species, marine non-CRA fish species and/or marine species-at-risk resulting from an explosion or spill of bunker oil.

The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

Disturbance Resulting from Increased Noise

In the highly unlikely event of either a LPG carrier accident at the wharf or LPG accident in transit in PRPA waters there is the potential for marine CRA fish species, marine non-CRA fish species and/or marine species-at-risk to experience disturbance from an explosion. The shock waves and/or sound waves, associated with an explosion could result in temporary movements away from the area. Overall the level of behavioural change associated with such an event is expected to be of short duration and the temporary behavioural change has the potential to affect all of the various Fish VC subcomponents in the area affected; however, the extremely low likelihood and temporal extent of the event occurring necessarily result in a low risk scenario and the potential for adverse changes in the Fish VC subcomponents is considered negligible; therefore this potential effect was not carried further in the assessment.

Detrimental Effects on Known or Expected Occurrence of Marine Species-At-Risk

In the highly unlikely event of either a LPG carrier accident at the wharf or LPG accident in transit in PRPA waters there is the potential for detrimental effects on known or expected occurrence of marine species-at-risk. The shock waves and/or sound waves associated with an explosion or the release of bunker oil due to collision could affect marine species-at-risk; however, the extremely low likelihood of either event occurring necessarily result in a low risk scenario and the potential for adverse changes in the Fish VC subcomponents in the affected area is considered negligible; therefore this potential effect was not carried further in the assessment.

15.7.2.2.5 Terrestrial Resources

An LPG carrier accident at the wharf or in transit may cause mortality of marine birds from an explosion and fireball, or from the release of bunker oil. However, the likelihood of an LPG carrier accident occurring is extremely low. An explosion and fireball, should it occur, is only expected to affect a small number of marine birds in the immediate vicinity of the carrier at the time of the accident, and the potential for a population-level effect is anticipated to be low. Any spill of bunker fuel due to an LPG carrier accident could have greater effects, potentially oiling the ocean and shoreline up to 2 km from the site of the accident and having a notable effect on regional marine bird populations.

The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.2.6 Human Health

The likelihood of an effect on human health is considered highly unlikely because the public will not be allowed inside the fence line nor have access to the berth, and warning systems will be in place to alert people working within the fence line and in the vicinity of the berthed or berthing carrier; therefore this potential effect was not carried further in the assessment.

15.7.2.3 Group 3-Potential Effects

15.7.2.3.1 Terrain

Fuel spills could occur on PRPA lands if released from rail-car movements on the rail corridor. Spilled fuel products have the potential to cause adverse environmental effects to soil quality.

The described potential effect has the potential to cause adverse residual effects and was carried forward in the effects assessment in Section 15.7.3.

15.7.2.3.2 Water

Vehicle and equipment fuel storage and handling could result in an accidental release of fuel products on the AltaGas sub-lease Site and RTI lands. Fuel spills could also occur on PRPA lands if released from rail-car movements on the rail corridor. Spilled fuel products have the potential to cause adverse environmental effects to groundwater quality and surface water quality.

The described potential effect has the potential to cause adverse residual effects and is carried forward in the effects assessment in Section 15.7.3.

15.7.2.3.3 Terrestrial Resources

Accidental spills on site from vehicle fuel have the potential to adversely affect small numbers of amphibians, birds or mammals during construction or operations, potentially causing mortality (direct or indirect) from ingestion or physical exposure to contaminated soils or surface water.

The described potential effect has the potential to cause adverse residual effects and is carried forward in the effects assessment in Section 15.7.3.

15.7.3 Assessment of Residual Effects

Potential residual effects are characterized for each VC using the metrics: magnitude, extent, duration, frequency, reversibility, ecological context; More detail on how these metrics were applied is found in Section 4.4.3 of this document. Based on the characterization of a residual effect a significance determination was made regarding the significance of the potential residual adverse effect.

A significance determination considered the likelihood of occurrence, the level of consequence, and the significance of the residual effect. Section 4.4.3 describes these criteria further.

The following section describes the characterization of the identified potential residual effects from Table 15-2. Table 15-3 summarizes the characterization of residual effects and determination of significance for each accident and malfunction scenario that was carried forward.

Table 15-3: Characterization and Significance Determination of Potential Residual Effects

VC	Potential Effect ID # from Table15-2	Project Phase	Residual Environmental Effects Characterization					Significance Determination		
			Magnitude	Geographic Extent	Duration	Frequency	Reversible	Level of Effect	Likelihood	Confidence
Terrain	G1-1	O	LM	S	ST	RF	R	NS	UL	H
Terrain	G1-2	O	LM	S	ST	RF	R	NS	UL	H
Water	G1-3	O	LM	S	ST	RF	R	NS	UL	H
Terrestrial Resources	G1-8	O	LM	S	ST	RF	I	NS	UL	H
Terrain	G2-3	O	LM	L	LT	RF	R	NS	UL	H
Water	G2-4	O	MM	L	LT	RF	R	NS	UL	H
Marine	G2-6	O	LM	L	LT	RF	I	NS	UL	H

VC	Potential Effect ID # from Table15-2	Project Phase	Residual Environmental Effects Characterization					Significance Determination		
			Magnitude	Geographic Extent	Duration	Frequency	Reversible	Level of Effect	Likelihood	Confidence
Resources										
Fish	G2-8	O	LM	L	LT	RF	I	NS	UL	H
Terrain	G3-1	C,O	LM	S	ST	UF	R	NS	UL	H
Water	G3-2	C,O	LM	S	ST	UF	R	NS	UL	H
Terrestrial Resources	G3-3	C,O	LM	S	MT	UF	I	NS	UL	H

Notes: Project Phase: C = Construction (includes pre-construction and final design), O&M = Operations and maintenance, D = Decommissioning;
Magnitude: NM = Negligible, LM = Low magnitude, MM = Moderate magnitude, HM = High magnitude
Geographic Extent: Project site: S, Local: L or Regional: R
Duration: LT = Long term, MT = Moderate term, ST = Short term, TT = Transient term
Frequency: CF = Continuous, FF = Frequent, UF = Uncommon, RF = Rare
Reversibility: R = Reversible, I = Irreversible, C = Change but may fluctuate from positive to adverse for the duration
Level of Effect: NNS = Not-Significant - negligible, NS: Not Significant, S = Significant
Likelihood: C: Certain, L: Likely, UL: Unlikely
Confidence: L: Low, M: medium or H: High

15.7.4 Summary of Potential Residual Effects

This section characterizes the potential residual effects related to those potential effects identified in Table 15-2.

15.7.4.1 Terrain

Project-related residual effects associated with low risk accidents and malfunctions and unplanned events related to propane leakage and fuel spills are anticipated to result in non-significant adverse residual effects on the Terrain IC. The residual effects due to potential accidents, malfunctions and unplanned events as described above are anticipated to be low in magnitude, contained within the Project site, and are of short duration and unlikely to occur. It is understood that effective and established measures identified earlier must be implemented and appropriate management plans must be implemented to avoid or minimize the risk of such accidents.

15.7.4.2 Water

Project-related effects associated with low risk accidents and malfunctions and unplanned events related to propane leakage and fuel spills are anticipated to result in non-significant adverse residual effects on the Water IC. The residual effects due to potential accidents, malfunctions and unplanned events as described above are anticipated to be low in magnitude, contained within the Project site, and are of short duration and unlikely to occur. It is understood that effective and established measures identified earlier must be implemented and appropriate management plans must be implemented to avoid or minimize the risk of such accidents.

15.7.4.3 Marine Resources

Potential adverse residual effects on the Marine Resources VC associated with a carrier collision with a marine mammal are expected to be non-significant as long as the effective and established mitigations for LPG carriers in transit in PRPA waters are followed.

A collision between a LPG carrier and baleen whales in the RSA is considered unlikely and of low magnitude. These characterizations were determined based on:

- The highest densities of Humpback whales occur mostly southward of Kinihan Islands and westward near Triple Island (Figure7-3, Section 7).
- Only one gas carrier will pass through the RSA every 15-20 days.
- Projected total vessel calls in the near term at the RTI jetty, including LPG carriers, are about thirty percent less than the average total vessel calls from 2005-2015 (Table 7-4, Section 7).
- The speed of the gas carrier through the RSA will likely be 14-16 knots (but this will be determined by the Pilot and Harbour Master). Reduced vessel speeds are known to reduce collisions with marine mammals (DFO 2015a). The transit time for the gas carrier through the RSA is about one hour.

15.7.4.4 Fish

The direct mortality of fish as a result of a potential LPG incident resulting in an explosion or spill of bunker to the marine environment was identified as a potential residual Project-related effect. Two factors indicate that the potential for significant adverse effects in the Fish VC is considered negligible and non-significant. First, the extremely low likelihood of the event occurring necessarily results in a low risk scenario and second, if the event occurred the magnitude of the consequence on the Fish VC is anticipated to be spatially limited and non-significant.

15.7.4.5 Terrestrial Resources

Potential residual effects on the Terrestrial Resources VC include mortality of wildlife associated with ingestion of hazardous substances released from the identified potential accidents and malfunction scenarios. The potential for significant adverse effects is considered negligible as the extent of the potential releases would be contained to the Project area, persist for short to moderate terms, and is considered rare. The likelihood of this effect is determined to be unlikely and the residual effect is considered to be non-significant.

15.7.4.6 Human Health

No significant residual effects on human health associated with accident and malfunction scenarios were identified.

15.8 Conclusions

The primary focus for accidents and malfunctions is the management of safe operations, ensure that safety systems for leak detection, controls for responding to leaks, effective preventative maintenance programs and effective training of operations and maintenance staff is undertaken and maintained throughout the facility operating lifespan. The existing information regarding risk and proven mitigation and safety procedures as demonstrated in this section above allows the shipping and export of LPG to be carried out in a safe and predictable way ensuring the reduced likelihood of consequence to humans and the environment.

15.8.1 Environmental Consequences

The likelihood of land-or marine-based accidents and malfunctions causing a significant effect on the bio-physical resources in the LSA for the respective resources are considered to be remote. The principle possible concern would be for marine birds and marine mammals in the extremely unlikely event of a spill of bunker oil (no bunkering operations will be undertaken within the port area – PRPA).

No significant adverse residual effects on the biophysical environment are anticipated to result from the Project-related potential accidents and malfunctions, cumulative effects are therefore not considered further.

15.8.2 Human Health Consequences

There is a remote possibility of an accident causing a rupture of either a propane rail car or a propane storage tank on site. While there is a possibility of a propane leak resulting in human harm, casualties or even a fatality, this risk is considered extremely remote because there are industry proven effective and established mitigation measures as described previously.

No significant adverse residual effects on human health are anticipated to result from the Project-related potential accidents and malfunctions, cumulative effects are therefore not considered further.

16 SUMMARY OF EFFECTS AND MITIGATION

Table 16-1: Summary of Potential Adverse Effects and Mitigation

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Intermediate Components				
Terrain Resources (Section 5)	*Construction (all)*	Adverse effects to soil quality and seabed sediment quality caused during construction phase	• Use of Environmental Monitor to ensure adherence to mitigation measures outlined in CEMP, SPERP and ESCP	N
	Construction (C-1, C-4, C-5, C-6, C-7, C-8, C-11, C-12)	Adverse effects to soil quality from disturbance of existing contaminants and introduction of contaminants from imported fill or routine use of vehicles and equipment	• Disturbances to surficial soils should follow established procedures for identifying existing contamination, removal and disposal of any contaminated soil and procedures to prevent contamination from migrating to unaffected areas • CEMP to include specifications for fuel handling and vehicle and equipment maintenance • SPERP to provide specifications to reduce potential for adverse effects to soil quality and seabed sediments	N
	Construction (C-2, C-4, C-5, C-6, C-7, C-11, C-12)	Adverse effects to soil quality and terrain stability resulting from erosion occurring during construction activities	• ESCP to provide mitigation measures to reduce sedimentation and erosion caused during construction activities	N
	Operation (O-1)	Adverse effects to surface soil quality and seabed sediment quality from use of vehicles and equip-ment at the work site	• Use of CEMP and SPERP during fuelling and maintenance of vehicles and equipment to prevent adverse effects to soil quality and seabed sediment quality	N
	Operation (O-3)	Adverse effects to surface soil quality from use of flare	• Routine monitoring of performance and operation of flare to reduce potential for accumulation of contaminants that may cause adverse effects to soil quality	N
	Operation (O-10, O-11)	Adverse effects to seabed sediment quality through suspension of seabed sediments caused by carrier vessels and tug traffic	• Use of berthing procedures and established navigation routes to minimize potential for suspension and mobilization of seabed sediments	N
Terrain Resources	*Decommission (all)*	Adverse effects to soil quality, terrain stability and seabed sediment	• Use of Environmental Monitor to ensure adherence to mitigation measures	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
(Section 5)		quality	outlined in CEMP, SPERP and ESCP	
	Decommissioning (D-1)	Adverse effects to surface soil quality and seabed sediment quality from use of vehicles and mobile equipment and adverse effects to soil quality and terrain stability caused by	• Use of CEMP and SPERP during decommissioning activities to prevent adverse effects to soil quality and seabed sediment quality during fuelling and maintenance of vehicles and equipment	N
		erosion occurring during construction activities	• ESCP to provide mitigation measures to reduce sedimentation and erosion caused during decommissioning phase	
Water Quality (Section 6)	Construction *(all)*	General	• Use of a qualified environmental monitor during all construction activities	N
	Construction *(C-1, C-2, C-4, C-5, C-6, C-7, C-8, C-10, C-11, C-12, C-13)*	Adverse effects to surface water and groundwater quality from disturbance of existing contaminants in soil and materials and introduction of new contaminants from imported fill or use of vehicles and equipment	• Disturbances to surficial soils should follow established procedures for identifying contamination, removing contaminated material and procedures to prevent contamination moving off the site	N
			• CEMP	
			• SPERP	
			• ESCP	
		Adverse effects to marine water quality caused by drainage and relocation of existing settlement ponds	• Characterization of chemical quality of water contained within existing settlement ponds and controlled discharge to avoid increase in turbidity in marine water.	
	Operations *(all)*	General	• Adherence to environmental monitoring programs	N
	Operation *(O-1, O-3)*	Adverse effects to groundwater quality, surface quality and marine water quality from routine operations, waste-water and stormwater management and general use of vehicles and equipment at the work site	• EMP	N
			• Use of wastewater and stormwater management systems	
			• SPERP	

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Water Quality (Section 6)	Operation *(O-10, O-11)*	Adverse effects to marine water quality caused by vessel traffic in RTI waterlot and PRPA navigational jurisdiction	• Follow berthing procedures when operating vessels in RTI waterlot • Follow established navigational routes within PRPA navigational jurisdiction	N
	Decommissioning *(all)*	General	• Use of a qualified environmental monitor during all sensitive decommissioning activities	N
	Decommissioning (D-1)	Adverse effects to surface water quality from use of vehicles and mobile equipment at the work site	• CEMP • SPERP • ESCP	N
Air Quality (Section 10)	*Construction/ C1-C13*	No direct effect identified	• Standard mitigation practices used during construction on land and during site grading	N
	Operations O-1	Project contributions to climate change	• Reduce energy consumption and GHG emissions where possible. Participate in the PRPA annual emissions inventory and emissions reductions programs	N
	Operations O-2, O-3, O-4, O-6, O-10, O-11	Exceedance of provincial 1-hour NO_2 objective	• Ensure that the LPG carriers adhere to the Transport Canada Regulations for Vessel Air Emissions (Transport Canada, 2014) • Ensure that the tug assist vessels adhere to the Sulphur in Diesel Fuel Regulations for Non-large vessels (Environment Canada, 2014) • Ensure use of the vessel management procedures and standards and practices from the RTI "Terminal Rules and Regulations" and the PRPA Port Information Guide (PRAPA 2015)	N
Noise (Section 11)	*OM1, OM2, OM4 – OM11*	An increase in noise levels at or near permissible levels	• Silencers or equivalent will be installed on gas compressor exhaust to reduce sound level to 40 dBA. • Silencers or equivalent will be installed on gas compressor air intake to reduce sound level to 40 dBA. • Gas compressor building will be constructed to reduce sound level from compressor noise to 40 dBA. • A sound enclosure will be constructed to reduce sound from storage tank pumps to 40 dBA.	Y

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Light (Section 12)	*Construction*	An increase in light due to project activities that might exceed applicable thresholds	• Use work area lights that have shades designed to direct light down where it is needed for construction and minimize light directed skywards.	N
			• Minimize the use of artificial lighting wherever possible.	
			• Follow Best Management Practices	
	Operations	An increase in light due to project activities that might exceed applicable thresholds	• Use work area lights that have shades designed to direct light down and minimize light directed skywards.	N
			• Follow Best Management Practices	
	Decommissioning	An increase in light due to project activities that might exceed applicable thresholds	• Follow Best Management Practices	N
Valued Components				
Marine Resources (Section 7)	*Construction/ C1-C13*	No direct effects identified.	• Standard and well known mitigations used during construction on land when adjacent to water.	N
	Operations/ OM-9, OM-10, and OM-11	Disturbance of marine resources around the jetty. Disturbance of marine resources during carrier transit. Potential collision during carrier transit.	• Vessel management procedures.	N
			• Mandatory jetty procedures.	
	Decommissioning/ D1	No direct effects identified.	• Standard and well known mitigations used during decommissioning on land when adjacent to water.	N
Fish (Section 8)	*Construction/ C1-C13*	No direct effects identified.	• Standard and well known mitigations used during construction on land when adjacent to water.	N
	Operations/ OM-10	Disturbance Resulting from increased noise.	• Vessel management procedures.	N
			• Mandatory jetty procedures.	
	Decommissioning/ D1	No direct effects identified.	• Standard and well known mitigations used during decommissioning on land when adjacent to water.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Terrestrial Wildlife Resources (Section 9)	*Construction*	Applies to All	• Developing and implementing a WMP that outlines wildlife specific mitigation and monitoring requirements, as well as potential permitting requirements.	N
	C-1	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with site grading	• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction. No mitigation for the effect of disturbance to mammals and amphibians is required. The potential effects are low in magnitude, area, and duration even with no mitigation.	N
		Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area. • Posting appropriate vehicle speed limits. • Implementation of road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
		Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
	C-2	Disturbance or Displacement: Alienation or disorientation of birds from blasting noise disturbance	• Conducting blasting outside of the bird nesting period if possible to reduce its potential (temporary) impact on nearby birds. If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Disturbance or Displacement:	• Conducting blasting outside of the bat breeding season (May 1 to July 31) if possible to reduce its potential (temporary) impact on nearby bats.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
		Potential disturbance of roosting bats from blasting noise		
Terrestrial Wildlife Resources (Section 9)	*C-3*	Disturbance or Displacement: Alienation or disorientation of birds or mammals from noise disturbance associated with removal of facilities	• Advising construction crews to be alert to the potential presence of bats near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Roadkill mortality of amphibians, birds or mammals	• Posting appropriate vehicle speed limits.	N
			• Implementation of road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
		Mortality: Mortality or injury of eggs/nestlings from nest disturbance	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	N
			• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
	C-3	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete.	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
	C3		• Preventing sediment and runoff from construction sites from entering near-by watercourses, wetlands or the ocean.	N
			• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	N
Terrestrial Wildlife Resources (Section 9)	*C-4*	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with relocation of settling ponds	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	N
			• Posting appropriate vehicle speed limits.	N
			• Implementation of road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
			• Should amphibians be identified within footprint areas, amphibian salvage and relocation to wetland areas outside of the Project footprint will be required. Any salvage requires a Wildlife Act permit.	N
		Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
			bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	
Terrestrial Wildlife Resources (Section 9)	*C-4*	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
			• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	N
			• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	N
	C-5	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with installation of utilities	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	N
			• Posting appropriate vehicle speed limits.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
			• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
Terrestrial Wildlife Resources (Section 9)	*C-5*		• Should amphibians be identified within footprint areas, amphibian salvage and relocation to wetland areas outside of the Project footprint will be required. Any salvage requires a Wildlife Act permit.	N
		Mortality: Mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of breeding amphibians, nesting birds or mammals within and near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete.	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
			• Preventing sediment and runoff from construction sites from entering near-by watercourses, wetlands or the ocean.	N
			• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Terrestrial Wildlife Resources (Section 9)	*C-6*	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with construction of rail tracks	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	N
			• Posting appropriate vehicle speed limits.	N
			• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
		Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
			• Preventing sediment and runoff from construction sites from entering near-by watercourses, wetlands or the ocean.	N
			• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Terrestrial Wildlife Resources (Section 9)	*C-7*	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with re-grading of sidings	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	N
			• Posting appropriate vehicle speed limits.	N
			• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
		Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete.	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
			• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	N
			• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Terrestrial Wildlife Resources (Section 9)	*C-8*	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with electric connection to grid	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
	C-9	Disturbance or Displacement: Alienation or disorientation of birds from noise or light disturbance associated with installation of loading arms	• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
			• Using work area lights that have shades designed to direct light down where it is needed for operations and minimize light directed sky-ward.	N
		Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of nesting birds within and near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
	C-10	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with installation of storage tanks	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Mortality of	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
		amphibians, birds or mammals from machinery or vehicles	footprint area.	
			• Posting appropriate vehicle speed limits.	N
			• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
Terrestrial Wildlife Resources (Section 9)	*C-10*	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete.	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
			• Preventing sediment and runoff from construction sites from entering nearby watercourses, wetlands or the ocean.	N
			• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	N
		Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of nesting birds within and near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Terrestrial Wildlife Resources (Section 9)	*C-11*	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with bridge removal	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
Terrestrial Wildlife Resources (Section 9)	*C-11*	Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	N
			• Posting appropriate vehicle speed limits.	N
			• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
		Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete.	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
			• Preventing sediment and runoff from construction sites from entering near-by watercourses, wetlands or the ocean.	N
			• Maintaining clean worksites, including the provision of bear-proof waste containers, daily removal of garbage from worksites, and secure storage of substances that may be attractive to bears.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
		Mortality: Potential mortality or injury of eggs/nestlings from nest disturbance	• Advising construction crews to be alert to the potential presence of nesting birds within and near footprint areas during construction and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
Terrestrial Wildlife Resources (Section 9)	*C-12*	Disturbance or Displacement: Alienation or disorientation of amphibians, birds or mammals from noise disturbance associated with installation of new road crossing	• Advising construction crews to be alert to the potential presence of amphibians, nesting birds or other wildlife within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Completing construction outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Mortality of amphibians, birds or mammals from machinery or vehicles	• Carefully flagging sub-lease footprint boundaries and ensuring that all disturbance is confined to the sub-lease footprint area.	N
			• Posting appropriate vehicle speed limits.	N
			• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks.	N
		Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that any machinery that operates on or near watercourses uses nontoxic, biodegradable hydraulic fluids.	N
			• Conducting refuelling and servicing of equipment at least 30 m from any watercourse or water body.	N
			• Developing and implementing control plans for sediment, including concrete.	N
			• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
			• Applying best practices to construction including containment of construction and hazardous wastes.	N
	C-13	Mortality: Mortality of amphibians, birds or mammals from wildlife-vehicle collisions	• Posting appropriate vehicle speed limits.	N
			• Implementation of a road and rail-kill monitoring plan that includes prompt removal of dead wildlife to avoid attracting scavengers to roads and tracks • Advising construction crews to be alert to the potential presence of amphibians, birds or other wildlife on the road and to inform the environmental monitor should any be observed.	N
Terrestrial Wildlife Resources (Section 9)	*O-1*	Mortality: Amphibian, bird or mammal mortality from hazardous substances	• Ensuring that equipment and vehicles are in good repair and are not leaking fluids.	N
			• Developing a spill response plan and having spill kits in all vehicles.	N
			• Applying best practices to operation including containment of hazardous and non-hazardous wastes. As per the Project Description, secondary containment systems will be provided for the facility including berms and drip pans, and waste water will undergo treatment in a separation tank.	N
			• Preventing sediment and runoff from entering nearby streams, wetlands and the ocean.	N
	O-1	Mortality: Mortality of amphibians, birds or mammals due to collisions with vehicles or railway cars	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	N
	O-3	Mortality: Mortality of birds due to attraction to ground flare at night	• Avoiding testing the flare system during nocturnal periods.	N
			• Conducting planned flaring events in consideration of migratory bird timing windows, if possible.	N
			• Incorporating visual checks of the burner, to ensure no birds are perched on or near it, into the standard operating procedure before commencing flaring operations.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
	O-4	Mortality: Mortality of amphibians, birds or mammals due to railway car collision	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	N
			• Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from being killed by railway cars.	N
Terrestrial Wildlife Resources (Section 9)	*O-5*	Mortality: Mortality of amphibians, birds or mammals due to railway car collision	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	N
			• Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from being killed by railway cars.	N
	O-6	Mortality: Mortality of amphibians, birds or mammals due to railway car collision	• Advising operations staff to be alert to the potential presence of amphibians, nesting birds and mammals within and near footprint areas and to inform the environmental monitor should any be detected.	N
			• Posting vehicle speed limits and ensuring that facility maintenance programs include the prompt removal of any dead wildlife to avoid attracting scavengers to the site.	N
			• Avoiding the creation of conditions that may attract wildlife into areas where they will be at risk from being killed by railway cars.	N
	O-7	Disturbance or Displacement: Disturbance of migrating birds, resting marine birds and birds	• Minimizing the use of artificial lighting wherever possible in order to avoid attracting birds.	N
			• Using work area lights that have shades designed to direct light down where it is	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
		using the shoreline from increased noise and lighting	needed for operations and minimize light directed sky-ward.	
		Mortality: Bird mortality from ingestion of hazardous substances	• Applying best practices to operation of vessels including containment of hazardous and non-hazardous wastes.	N
Terrestrial Wildlife Resources (Section 9)	*O-10*	Mortality: Bird mortality from contact with/ ingestion of hazardous substances/carrier fuel/waste	• Applying best practices to operation of vessels including containment of hazardous and non-hazardous wastes.	N
		Mortality: Bird mortality from invasive species (e.g., rats coming off carriers)	• Standard practices that will act to mitigate potential impacts are already in place within the Port of Prince Rupert. All international vessels stopping in Canada must have a valid Ship Sanitation Certificate, which certifies that the vessel is free of animal disease vectors (e.g. rats). Rats are known present in the city of Prince Rupert, but ship sanitation requirements should be effective at preventing any additional rats from entering the Port as a result of the Project.	N
	O-11	Mortality: Bird mortality from contact with/ ingestion of hazardous substances/carrier fuel/waste	• Applying best practices to operation of vessels including containment of hazardous and non-hazardous wastes.	N
	D-1	Disturbance or Displacement and Mortality: Disturbance of birds nesting on structures, and destruction of their eggs or young	• Advising crews to be alert to the potential presence of nesting birds within and near footprint areas during decommissioning and to inform the environmental monitor should any be detected.	N
			• Completing decommissioning outside of the bird nesting window (May 1 to July 31). If this is not possible, use a qualified professional to conduct a survey of active nests/nesting birds prior to commencing construction.	N
		Mortality: Wildlife mortality from ingestion of hazardous substances	• Applying best practices to decommissioning activities including containment of hazardous and non-hazardous wastes.	N

Component	Activity	Description of Potential Effect	Mitigation	Residual Effect (Y/N)
Human Health (Section 13)	*Construction/ C1-C13*	No direct effect identified	• Standard mitigation practices used during construction on land and during site grading.	N
	Operations O-1	Project contributions air emissions	• Reduce energy consumption and air emissions where possible. Participate in the PRPA annual emissions inventory and emissions reductions programs.	N
	Operations O-2, O-3, O-4, O-6, O-10, O-11	Exceedance of provincial 1-hour NO_2 objective to protect human health	• Ensure that the LPG carriers adhere to the Transport Canada Regulations for Vessel Air Emissions (Transport Canada, 2014) • Ensure that the tug assist vessels adhere to the Sulphur in Diesel Fuel Regulations for Non-large vessels (Environment Canada, 2014) • Ensure use of the vessel management procedures and standards and practices from the RTI "Terminal Rules and Regulations" and the PRPA Port Information Guide (PRAPA 2015)	N
	OM1, OM2, OM4-OM11	Interruption of sleep of sensitive noise receptors Decrease in community enjoyment Increase community annoyance	• Silencers or equivalent will be installed on compressor exhaust to reduce sound level to 40 dBA. • Silencers or equivalent will be installed on compressor air inlet to reduce sound level to 40 dBA. • Compressor building will be constructed to reduce sound level from compressor mechanical noise to 40 dBA. • A sound enclosure will be constructed to reduce sound from storage tank pumps to 40 dBA.	Y

17 CONCLUSIONS

Based on the results of this effects assessment, AltaGas concludes that the Project is not likely to cause significant adverse environmental effects with the application of mitigation measures described in the Summary of Effects and Mitigation.

Because the Project is on a previous developed industrial site and within an industrially zoned area that has seen several large-scale and detailed environmental assessments recently conducted for nearby projects, the assessment largely uses available information for several key existing environmental assessments.

The methodology used in this assessment has been consistent with the guidance detailed in the December, 2014 document *Projects on Federal Lands: Making a determination under section 67 of the CEAA 2012* and current best practices for environmental assessment. This includes establishing the existing conditions of the study areas as the baseline, identifying Valued Components, characterization of project effects and interactions, identification of effects associated with accidents and malfunctions, residual effects determined after applying effective and established mitigation, and assessment of cumulative effects.

After consideration of the potential residual effects, and taking into account the ecological context of the site, the engineering design, and mitigation measures, AltaGas and its assessment team are confident that the Project can be constructed, operated, and decommissioned without significant adverse effects.

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APPENDIX 1-A

List of Prime Required Permits / Authorizations

List of prime required permits/authorizations:

- Transport Canada: Notice to Minister for modification to jetty in accordance with the Navigation Protection Act;
- Fisheries and Oceans Canada: Fisheries Act authorization for construction / commissioning activities (if necessary); and
- PRPA: Storm Water Management Plan approval.

APPENDIX 9-A

Terrestrial Wildlife Species at Risk Potentially Occurring in the Local Study Area (based on BC CDC 2015*)

APPENDIX 9-A

Terrestrial Wildlife Species at Risk Potentially Occurring in the Local Study Area (based on BC CDC 2015*)

Scientific Name	English Name	Status (BC List**, SARA***)	Preferred Habitat****
Amphibians			
Anaxyrus boreas	Western Toad	Blue, Special Concern	Breeds in permanent or temporary water bodies with shallow sandy bottoms, including shallow ponds and roadside ditches; after breeding, adults may remain to forage in the marshy or riparian edges of breeding sites, or disperse several kilometres to other wetlands, riparian areas or upland terrestrial habitats within forests, grasslands, wet shrublands and meadows (MoE 2015; SARA 2015b; COSEWIC 2012).
Ascaphus truei	Coastal Tailed Frog	Blue, Special Concern	Occurs in drainages with catchment areas ranging from 0.3-50 km^2, while breeding reaches are typically less than 10 km^2; breeds in clear, cold, fast-flowing mountain streams with coarse substrates (locked boulders and cobbles of these streams afford foraging sites for tadpoles and refugia for all life stages), where overall gradients are sufficiently high (step-pool morphology) and not excessively steep (i.e., slope should be <90%); usually found in streams adjacent to older forest with stable, moist microclimates and enough structural diversity to provide refuge sites and food. (Source COSEWIC 2011a).
Rana aurora^	Northern Red-legged Frog	Blue, Special Concern	Breeds in large wetlands, cool ponds or lake margins, slow-moving streams, marshes, bogs or swamps that have suitable vegetation and are at least 50 cm deep; adult frogs can also be found in moist forest conditions far from open water, where they prefer damp mature forests with plenty of leaf litter and fallen logs (SARA 2015c).

Scientific Name	English Name	Status (BC List**, SARA***)	Preferred Habitat****
Birds			
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	Red, Threatened	Year-round resident on Vancouver Island, Haida Gwaii and along the mainland coast (Darling 2010); breeding: sub-canopy of mature and old-growth coniferous forests, with few nests found in young stands; key structural attributes for breeding habitat include a closed canopy and open subcanopy flyways; the breeding area for nesting and post-fledging is the centre of breeding activities throughout the reproductive season (estimated 100-200 ha in coastal BC). Nest areas on the coast typically include western hemlock or Douglas-fir, usually ≥140 years old, ≥28 m high, ≥50% canopy closure, and ≤100% gradient. They exhibit very strong fidelity to a breeding area; foraging habitat is similar but can be more variable (Source: Darling 2010).
Ardea herodias fannini	Great Blue Heron, *fannini* subspecies	Blue, Special Concern	Nests in large trees (often black cottonwood) along banks of lakes or slow moving rivers; nests generally in trees 20-50 m above ground; forages in calm, shallow waters for fish, frogs, salamanders, snakes and large insects; isolation from disturbance appears to be an important factor in nest site selection.
Brachyramphus marmoratus	Marbled Murrelet	Blue, Threatened	Coastal areas, relatively sheltered inshore waters (usually within 0.5 km of the shore) including bays and sounds; nest in old-growth coniferous forest; principal prey is sand lice.
Contopus cooperi	Olive-sided Flycatcher	Blue, Threatened	Semi-open habitats with standing dead trees, often around bogs or beaver ponds. Perches in snags; preferred breeding habitat in forest and woodland, especially burned-over areas with standing dead trees; in taiga, subalpine coniferous forest and mixed coniferous-deciduous forest; non-breeding habitat a variety of forest.
Cypseloides niger	Black Swift	Blue	Nests in cliff-side habitats (often associated with waterfalls); the majority of nests have been located behind waterfalls, on ledges of steep rock faces, on cliffs, and in caves and canyons; it is thought that the moist, dark, and inaccessible environment found behind mountain waterfalls or on sea cliffs or caves is a critical habitat feature for this species.
Euphagus carolinus	Rusty Blackbird	Blue, Special Concern	Nests in the forest and favours the shores of wetlands such as slow-moving streams, peat bogs, marshes, swamps, beaver ponds and pasture edges; in wooded areas rarely enters the forest interior; during winter mainly frequents damp forests and, to a lesser extent, cultivated fields.

Scientific Name	English Name	Status (BC List**, SARA***)	Preferred Habitat****
Falco peregrinus pealei	Peregrine Falcon, *pealei* subspecies	Blue, Special Concern	Coastal beaches, tidal flats, reefs, islands, marshes, estuaries and lagoons; open areas with an abundance of prey close to sea coast or interior lakes and rivers; breeding habitat nearly always contains a prominent cliff in the vicinity of seabird colonies.
Fratercula cirrhata	Tufted Puffin	Blue	Usually found singly at sea and nests in colonies in burrows or crevices on offshore islands; breeding pairs are distributed all along the outer BC coast, however major breeding colonies are restricted to the Scott Islands, Solander Island, and Haida Gwaii (CDC 2015b).
Hirundo rustica	Barn Swallow	Blue	Occurs in open country in agricultural areas, highly associated with human settlements; needs mud for nest building; nests under eves of barns and houses and under bridges and culverts, and on other human structures.
Megascops kennicottii kennicottii	Western Screech-owl, *kennicottii* subspecies	Blue, Special Concern	Inhabits lowland forests with a mix of deciduous and coniferous trees near water; nest in tree cavities often excavated by woodpeckers; availability of suitable nest cavities affects successful breeding.
Melanitta Americana	Black Scoter	Blue”	Breeding, molting and winter habitat associations are not well documented. However, the locations of several key seasonal areas have been documented, most of which are in Alaska. For BC, Rose Spit in Haida Gwaii has been identified as an important staging area for spring migrants from the south (some birds stage there for up to 6 weeks prior to migrating further north).
Patagioenas fasciata	Band-tailed Pigeon	Blue, Special Concern	Generally found in temperate and mountain coniferous and mixed forests and woodlands, especially pine-oak woodlands, and locally in southern lowlands; winter in Garry oak or arbutus; breed in mature or old deciduous or coniferous forest edges with berry-producing shrubs; forage in cultivated areas, suburban gardens and parks. Mineral sites are likely the limiting habitat for Band-tailed Pigeons. Mineral sites in marine habitats tend to be located at estuaries and consist of small pools or areas of beach where the birds can drink mineralized water or consume mineralized soil (COSEWIC 2008a).
Phalacrocorax pelagicus pelagicus	Pelagic Cormorant, *pelagicus* subspecies	Red	Coast, bays, sounds. On ocean usually rather close to shore, sometimes well out to sea. Favours rocky bays, areas of deep water near base of cliffs. Nests on islands or coasts on narrow ledges, steep slopes, other inaccessible locations.

Scientific Name	English Name	Status (BC List**, SARA***)	Preferred Habitat****
Ptychoramphus aleuticus	Cassin's Auklet	Blue	Requires nesting colony islands without alien mammalian predators and free of most human disturbances; nearby marine areas must be free of light pollution and gill net fishery; they nest on either forested or non-forested offshore islands of varying sizes, covered with grasses and forbs and little tree cover; most colony islands along the northern mainland and Haida Gwaii are covered with Sitka spruce, western hemlock and western redcedar; species burrows in deep soil on steep cliffs, seaward facing slopes or level areas; on forested islands, they burrow under mature forest as well as in grass tussocks; foraging occurs solely in marine waters, usually in areas of cold upwellings near the continental shelf break or over seamounts, by pursuit diving(Source: Province of BC 2004a).
Synthliboramphus antiquus	Ancient Murrelet	Blue, Special Concern	Requires nesting colony islands without alien mammalian predators and free of most human disturbances; nearby marine areas must be free of light pollution and gill net fishery; in BC colonies are located on forested islands offshore from the main islands in the Haida Gwaii archipelago; nests in burrows dug into the ground beneath mature Sitka spruce or western hemlock on seaward slopes of flat areas; during breeding, birds are found primarily over the continental shelf, with highest densities near the shelf break, and less frequently in inshore waters (Source: Province of BC 2004b).
Uria aalge	Common Murre	Red	Breeds on the surface of the ground in colonies on flat, sloping, or cliff habitats on islands, or occasionally on the mainland, where breeding sites are inaccessible to mammalian predators and have low levels of human disturbance; flat or gently sloping habitats are used only where mammalian predation is rare; Common Murres forage widely between coastlines and outer parts of the continental shelf, but are most common in inshore waters (Source: Manuwal et al. 2001).

Scientific Name	English Name	Status (BC List**, SARA***)	Preferred Habitat****
Mammals			
Gulo gulo luscus	Wolverine, *luscus* subspecies	Blue	Habitat defined by distribution and abundance of food, food availability in winter is key to habitat location; den in high elevation snow tunnels leading to fallen trees, coarse woody debris or rocky colluviums; solitary animal that avoids contact with humans and anthropogenic disturbances.
Myotis lucifugus	Little Brown Myotis	Yellow, Endangered	Females establish summer maternity colonies, often in buildings or large-diameter trees; foraging occurs over water, along waterways, and forest edges; in autumn, bats seek hibernacula (caves, mines) to overwinter, often far from their summering areas.
Myotis keenii	Keen's Myotis	Blue	Associated with coastal coniferous forest; roosts in southwest-facing rock crevices, among geothermally heated rocks, in tree cavities, bark crevices, and in buildings.
Pekania pennanti	Fisher	Blue	Occurs primarily in dense riparian coniferous or mixed forests, including early successional forest with dense overhead cover; continuous canopy cover very important, avoids open areas; rest sites include tree branches, tree cavities, coarse woody debris and ground sites; large diameter trees with cavities and riparian cottonwoods are important den sites in BC.
Ursus arctos	Grizzly Bear	Blue	Forage in non-forested to partially forested areas or sites with many tree gaps, including estuaries and wetlands; security habitat and day bedding areas are closed forest sites near higher quality forage; habitat strongly influenced by presence/activities of people; dig dens at high elevations for winter hibernation.

* Search Criteria: Forest District North Coast; MoE Region Skeena; Regional District Skeena-Queen Charlotte; Biogeoclimatic Zone CWH.

** BC Listing Definition - Red: Extirpated, Endangered or Threatened; Blue: Special Concern; Yellow: Not at Risk (BC Conservation Data Centre 2015).

*** SARA Public Registry, Schedule 1.

**** Habitat information based on: E-Fauna BC 2015; Sibley 2000, 2003; Corkran and Thoms 2006; Reid 2006, Jones et al. 2005; as well as status reports and species accounts available on the internet (through Ministry of Environment and COSEWIC).

^ Although not listed by BC CDC, this species has known mapped occurrences on Haida Gwaii, and therefore there is potential for this species to occur on Ridley Island.

" New Listing in 2015 (Ministry of Environment 2015).

APPENDIX 9-B

Bird Species Known Present in the Vicinity of Ridley Island, as Compiled by Stantec (2011b; 2014), with their current Federal and Provincial Status*

APPENDIX 9-B

Bird Species Known Present in the Vicinity of Ridley Island, as Compiled by Stantec (2011b; 2014), with their current Federal and Provincial Status*

English Name	Scientific Name	BC List	SARA Schedule/ Status*	Migratory Bird Convention Act	COSEWIC Status*
Alder Flycatcher	*Empidonax alnorum*	Yellow	n/a	Yes	n/a
American Robin	*Turdus migratorius*	Yellow	n/a	Yes	n/a
Anna's Hummingbird	*Calypte anna*	Yellow	n/a	Yes	n/a
Bald Eagle	*Haliaeetus leucocephalus*	Yellow	n/a	No	NAR
Band-Tailed Pigeon	*Patagioenas fasciata*	Blue	1-SC	Yes	SC
Barn Swallow	*Hirundo rustica*	Blue	n/a	Yes	T
Barrow's Goldeneye	*Bucephala islandica*	Yellow	n/a	Yes	n/a
Belted Kingfisher	*Megaceryle alcyon*	Yellow	n/a	No	n/a
Black Scoter	*Melanitta americana*	Blue	n/a	Yes	n/a
Black-backed Woodpecker	*Picoides arcticus*	Yellow	n/a	Yes	n/a
Black-capped Chickadee	*Poecile atricapillus*	Yellow	n/a	Yes	n/a
Bohemian Waxwing	*Bombycilla garrulus*	Yellow	n/a	Yes	n/a
Bonaparte's Gull	*Chroicocephalus philadelphia*	Yellow	n/a	Yes	n/a
Brant	*Branta bernicla*	Blue	n/a	Yes	n/a
Brown Creeper	*Certhia americana*	Yellow	n/a	Yes	n/a
Bufflehead	*Bucephala albeola*	Yellow	n/a	Yes	n/a
California Gull	*Larus californicus*	Blue	n/a	Yes	n/a
Canada Goose	*Branta canadensis*	Yellow	n/a	Yes	n/a
Cedar Waxwing	*Bombycilla cedrorum*	Yellow	n/a	Yes	n/a
Chestnut-Backed Chickadee	*Poecile rufescens*	Yellow	n/a	Yes	n/a
Chipping Sparrow	*Spizella passerina*	Yellow	n/a	Yes	n/a

English Name	Scientific Name	BC List	SARA Schedule/ Status*	Migratory Bird Convention Act	COSEWIC Status*
Cliff Swallow	*Petrochelidon pyrrhonota*	Yellow	n/a	Yes	n/a
Common Goldeneye	*Bucephala clangula*	Yellow	n/a	Yes	n/a
Common Loon	*Gavia immer*	Yellow	n/a	Yes	NAR
Common Merganser	*Mergus merganser*	Yellow	n/a	Yes	n/a
Common Murre	*Uria aalge*	Red	n/a	Yes	n/a
Common Nighthawk	*Chordeiles minor*	Yellow	1-T	Yes	T
Common Raven	*Corvus corax*	Yellow	n/a	No	n/a
Common Yellowthroat	*Geothlypis trichas*	Yellow	n/a	Yes	n/a
Dark-eyed Junco	*Junco hyemalis*	Yellow	n/a	Yes	n/a
Double-crested Cormorant	*Phalacrocorax auritus*	Blue	n/a	Yes	NAR
Downy Woodpecker	*Picoides pubescens*	Yellow	n/a	Yes	n/a
European Starling	*Sturnus vulgaris*	Exotic	n/a	No	n/a
Fox Sparrow	*Passerella iliaca*	Yellow	n/a	Yes	n/a
Glaucous Gull	*Larus hyperboreus*	No Status	n/a	Yes	n/a
Glaucous-winged Gull	*Larus glaucescens*	Yellow	n/a	Yes	n/a
Golden-Crowned Kinglet	*Regulus satrapa*	Yellow	n/a	Yes	n/a
Golden-Crowned Sparrow	*Zonotrichia atricapilla*	Yellow	n/a	Yes	n/a
Great Blue Heron	*Ardea herodias fannini*	Blue	1/SC	Yes	SC
Great Horned Owl	*Bubo virginianus*	Yellow	n/a	No	n/a
Green-winged Teal	*Anas crecca*	Yellow	n/a	Yes	n/a
Hairy Woodpecker	*Picoides villosus*	Yellow	n/a	Yes	n/a
Hammond's Flycatcher	*Empidonax hammondii*	Yellow	n/a	Yes	n/a
Harlequin Duck	*Histrionicus histrionicus*	Yellow	n/a	Yes	n/a
Hermit Thrush	*Catharus guttatus*	Yellow	n/a	Yes	n/a
Herring Gull	*Larus argentatus*	Yellow	n/a	Yes	n/a
House Finch	*Haemorhous mexicanus*	Yellow	n/a	Yes	n/a

English Name	Scientific Name	BC List	SARA Schedule/ Status*	Migratory Bird Convention Act	COSEWIC Status*
House Sparrow	*Passer domesticus*	Exotic	n/a	No	n/a
Killdeer	*Charadrius vociferus*	Yellow	n/a	Yes	n/a
Lesser Yellowlegs	*Tringa flavipes*	Yellow	n/a	Yes	n/a
Lincoln's Sparrow	*Melospiza lincolnii*	Yellow	n/a	Yes	n/a
Long-tailed Duck	*Cangula hyemalis*	Blue	n/a	Yes	n/a
MacGillivray's Warbler	*Geothlypis tolmiei*	Yellow	n/a	Yes	n/a
Mallard	*Anas platyrhynchos*	Yellow	n/a	Yes	n/a
Marbled Murrelet	*Brachyramphus marmoratus*	Blue	1-T	Yes	T
Merlin	*Falco columbarius*	Yellow	n/a	No	NAR
Mew Gull	*Larus canus*	Yellow	n/a	Yes	n/a
Mourning Dove	*Zenaida macroura*	Yellow	n/a	Yes	n/a
Northern Flicker	*Colaptes auratus*	Yellow	n/a	Yes	n/a
Northern Goshawk	*Accipiter gentilis*	Yellow	n/a	No	n/a
Northern Pintail	*Anas acuta*	Yellow	n/a	Yes	n/a
Northern Pygmy-Owl	*Glaucidium gnoma*	Yellow	n/a	No	n/a
Northern Rough-Winged Swallow	*Stelgidopteryx serripennis*	Yellow	n/a	Yes	n/a
Northern Shrike	*Lanius excubitor*	Yellow	n/a	Yes	n/a
Northwestern Crow	*Corvus caurinus*	Yellow	n/a	No	n/a
Olive-Sided Flycatcher	*Contopus cooperi*	Blue	1-T	Yes	T
Orange-crowned Warbler	*Oreothlypis celata*	Yellow	n/a	Yes	n/a
Osprey	*Pandion haliaetus*	Yellow	n/a	Yes	n/a
Pacific Loon	*Gavia pacifica*	Yellow	n/a	Yes	n/a
Pacific Wren	*Troglodytes pacificus*	Yellow	n/a	Yes	n/a
Pacific-Slope Flycatcher	*Empidonax difficilis*	Yellow	n/a	Yes	n/a
Pelagic Cormorant	*Phalacrocorax pelagicus*	Yellow	n/a	No	n/a
Peregrine Falcon	*Falco peregrinus*	Blue/Red**	n/a	No	SC
Pigeon Guillemot	*Cepphus columba*	Yellow	n/a	Yes	n/a

English Name	Scientific Name	BC List	SARA Schedule/ Status*	Migratory Bird Convention Act	COSEWIC Status*
Pine Grosbeak	*Pinicola enucleator*	Yellow	n/a	Yes	n/a
Pine Siskin	*Spinus pinus*	Yellow	n/a	Yes	n/a
Purple Finch	*Haemorhous purpureus*	Yellow	n/a	Yes	n/a
Red Crossbill	*Loxia curvirostra*	Yellow	n/a	Yes	n/a
Red-breasted Merganser	*Mergus serrator*	Yellow	n/a	Yes	n/a
Red-Breasted Nuthatch	*Sitta canadensis*	Yellow	n/a	Yes	n/a
Red-Breasted Sapsucker	*Sphyrapicus ruber*	Yellow	n/a	Yes	n/a
Red-eyed Vireo	*Vireo olivaceus*	Yellow	n/a	Yes	n/a
Red-necked Grebe	*Podiceps grisegena*	Yellow	n/a	Yes	NAR
Ring-Necked Pheasant	*Phasianus colchicus*	Exotic	n/a	No	n/a
Red-tailed Hawk	*Buteo jamaicensis*	Yellow	n/a	No	NAR
Red-winged Blackbird	*Agelaius phoeniceus*	Yellow	n/a	No	n/a
Rhinoceros Auklet	*Cerorhinca monocerata*	Yellow	n/a	Yes	n/a
Ring-billed Gull	*Larus delawarensis*	Yellow	n/a	Yes	n/a
Rock Pigeon	*Columba livia*	Exotic	n/a	No	n/a
Ruby-Crowned Kinglet	*Regulus calendula*	Yellow	n/a	Yes	n/a
Ruffed Grouse	*Bonasa umbellus*	Yellow	n/a	No	n/a
Rufous Hummingbird	*Selasphorus rufus*	Yellow	n/a	Yes	n/a
Sandhill Crane	*Grus canadensis*	Yellow	n/a	Yes	NAR
Savannah Sparrow	*Passerculus sandwichensis*	Yellow	n/a	Yes	n/a
Sharp-shinned Hawk	*Accipiter striatus*	Yellow	n/a	No	NAR
Snow Bunting	*Plectrophenax nivalis*	Yellow	n/a	Yes	n/a
Song Sparrow	*Melospiza melodia*	Yellow	n/a	Yes	n/a
Sora	*Porzana carolina*	Yellow	n/a	Yes	n/a
Spotted Towhee	*Pipilo maculatus*	Yellow	n/a	Yes	n/a
Spotted Sandpiper	*Actitis macularius*	Yellow	n/a	Yes	n/a

English Name	Scientific Name	BC List	SARA Schedule/ Status*	Migratory Bird Convention Act	COSEWIC Status*
Steller's Jay	*Cyanocitta stelleri*	Yellow	n/a	No	n/a
Surf Scoter	*Melanitta perspicillata*	Blue	n/a	Yes	n/a
Swainson's Thrush	*Catharus ustulatus*	Yellow	n/a	Yes	n/a
Thayer's Gull	*Larus thayeri*	Yellow	n/a	Yes	n/a
American Three-toed Woodpecker	*Picoides dorsalis*	Yellow	n/a	Yes	n/a
Townsend's Warbler	*Setophaga townsendi*	Yellow	n/a	Yes	n/a
Tree Swallow	*Tachycineta bicolor*	Yellow	n/a	Yes	n/a
Turkey Vulture	*Cathartes aura*	Yellow	n/a	No	n/a
Varied Thrush	*Ixoreus naevius*	Yellow	n/a	Yes	n/a
Vaux's Swift	*Chaetura vauxi*	Yellow	n/a	Yes	n/a
Violet-Green Swallow	*Tachycineta thalassina*	Yellow	n/a	Yes	n/a
Warbling Vireo	*Vireo gilvus*	Yellow	n/a	Yes	n/a
Western Grebe	*Aechmophorus occidentalis*	Red	n/a	Yes	SC
Western Screech-owl, *kennicottii* subspecies	*Megascops kennicottii kennicottii*	Blue	1-SC	No	T
Western Tanager	*Piranga ludoviciana*	Yellow	n/a	Yes	n/a
Western Wood-Pewee	*Contopus sordidulus*	Yellow	n/a	Yes	n/a
White-Crowned Sparrow	*Zonotrichia leucophrys*	Yellow	n/a	Yes	n/a
White-winged Crossbill	*Loxia leucoptera*	Yellow	n/a	Yes	n/a
Wilson's Snipe	*Gallinago delicata*	Yellow	n/a	Yes	n/a
Wilson's Warbler	*Geothlypis tolmiei*	Yellow	n/a	Yes	n/a
Yellow Warbler	*Setophaga petechia*	Yellow	n/a	Yes	n/a
Yellow-rumped Warbler	*Setophaga coronata*	Yellow	n/a	Yes	n/a

*NAR=Not at risk

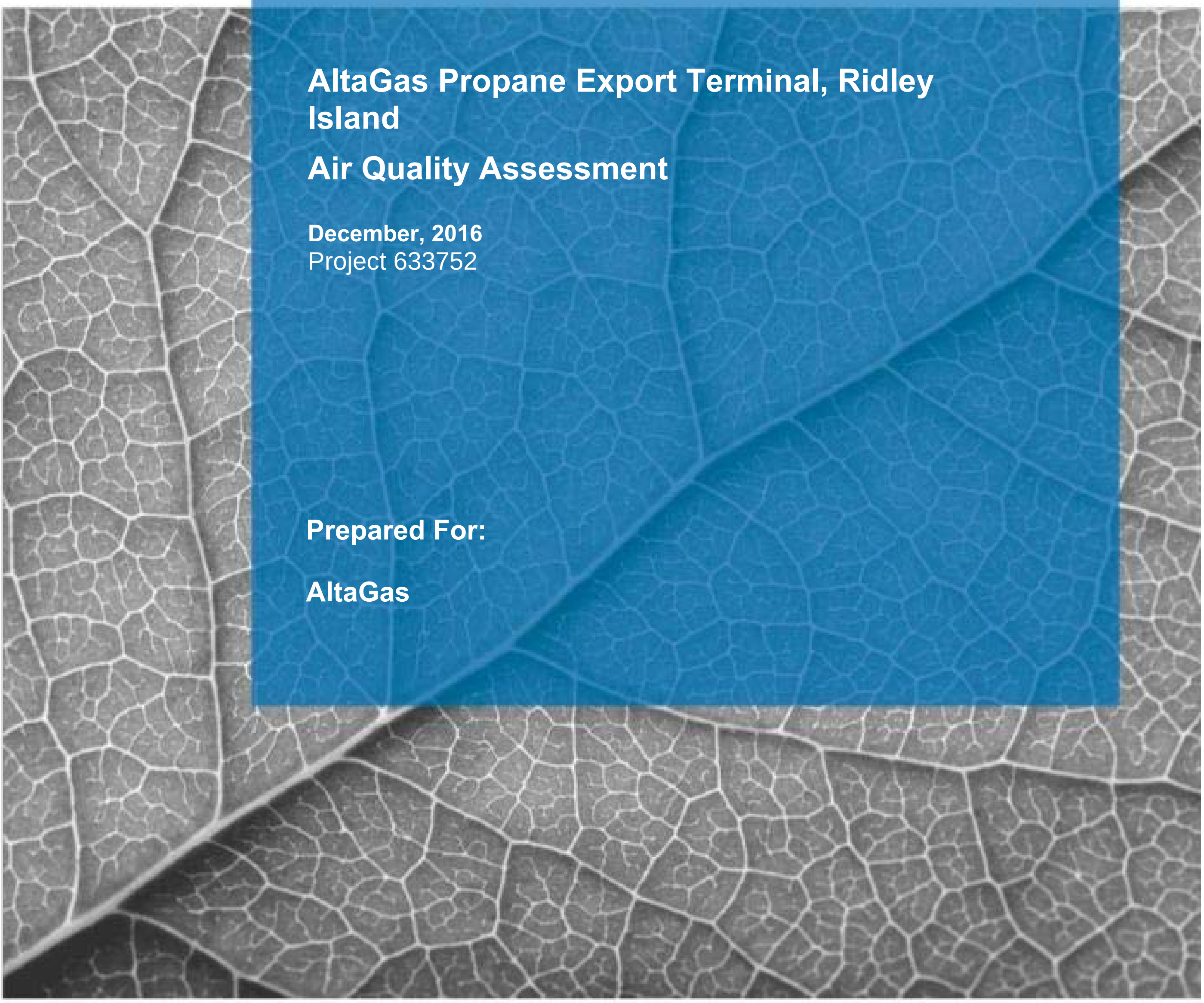
SC=Special Concern

T=Threatened

** status dependent on subspecies

APPENDIX 10-A

Air Quality Technical Report



AltaGas Propane Export Terminal, Ridley Island

Air Quality Assessment

December, 2016
Project 633752

Prepared For:

AltaGas

SNC-LAVALIN INC.

Prepared By:

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Roger Ord
Program Director

DEFINITIONS AND ACRONYM LIST

Definition/Acronym	Full Name
AAQO	Ambient air quality objective
AEP	Alberta Environment and Parks
BC	British Columbia
CAC	Criteria air contaminant
CALMET	Meteorological model within the CALPUFF system
CALPUFF	California puff model
CAPP	Canadian Association of Petroleum Producers
CH_4	Methane
CO_2	Carbon dioxide
CO_{2e}	Equivalent carbon dioxide
EI	Emissions inventory
EPA	Environmental protection agency
GHG	Greenhouse gas
GWP	Global warming potential
IPCC	Intergovernmental Panel on Climate Change
LPG	Liquid propane gas
MoE	BC ministry of the environment
N_2O	Nitrous oxide
NIR	National inventory report
NO_x	Nitrous oxide
NWP	Numerical weather prediction
PM	Pariculate matter
PM_{10}	Particulate matter of diameter between 2.5 and 10 micrometers
$PM_{2.5}$	Particulate matter of diameter less than 2.5 micrometers
Port	Port of Prince Rupert
Project	AltaGas propane export facility
PRPA	Prince Rupert port authority
RTI	Ridley Terminals Inc.
SO_2	Sulphur dioxide
VOC	Volatile organic compound
WRF	Weather research and forecast model

EXECUTIVE SUMMARY

A detailed air quality assessment was completed for the proposed AltaGas Ltd. (AltaGas) propane export facility (Project) at the Port of Prince Rupert (Port). The total Project emissions of criteria contaminants (CACs) and greenhouse gases (GHGs) were estimated using the Project-related criteria identified in the Project description and additional information supplied to SNC-Lavalin by AltaGas as well as logical assumptions that could be applied to the transportation sources associated with moving propane to and from the terminal.

The annual emission estimates associated with the significant Project sources are identified in Table ES.1. The emission estimates were made over a study area that includes rail movement through port lands as well as marine vessel movements through the Port marine jurisdiction.

Table ES-1: Total Annual Project Emissions

Source	Emissions (kg)								
	NO_x	SO_x	CO	VOC	PM_{10}	$PM_{2.5}$	NH_3	CO_2	CO_2e
LPG Carrier – Underway	1,966	49	153	62	29	26	1	83,772	99,761
LPG Carrier – Manoeuvre	2,192	77	173	63	40	37	0	130,215	220,895
LPG Carrier - Berthing	32,508	1,956	2,617	1,001	922	848	3	3,310,778	3,980,192
Tugs – Manoeuvre	1,354	39	106	39	22	20	0	65,590	81,604
Tugs - Escort	1,354	39	106	39	22	20	0	65,590	81,604
Rail Locomotives	2,241	1	358	102	68	66	4	135,719	198,124
Gas Engines	48,979	1,043	174,926	42,682	10,148	41	966	10,949,203	11,187,700
Flare	126.5	10	695	96	249	249	n/a	763,160	917,710
Total ()	**90,721**	**3,214**	**179,134**	**44,084**	**11,500**	**1,307**	**974**	**15,504,028**	**16,767,590**

The Project GHG emissions (16,768 tonnes CO_2e, above) were also compared to the total provincial and national GHG totals for further relevance. The Project GHG emissions, as indicated by CO_2e, constitute 0.03% and 0.0002% of the provincial and national totals, respectively. Since emissions from international ships are not included in the provincial and national totals, the effective contribution of the Project to the provincial and national GHG totals will be lower than these values.

Air quality modelling was also conducted as part of the study to demonstrate compliance with the provincial air quality objectives. The Project sources are not expected to cause exceedences of the provincial air quality objectives on any public lands. The Project emissions impacts were also evaluated over the port lands adjacent to the Project site. In this case, the Project sources were found to have some potential to cause exceedences of the 1-hour NO_2 provincial guideline value, but only immediately adjacent to the RTI Lease Land within which the AltaGas facility would be situated. Since the port lands are not generally accessible by the public, these may not be considered true exceedences of the provincial criteria.

Table ES-2: Maximum Predicted Air Contaminant Concentrations (AAQOs in parentheses) – Normal Operations (exceedence-level predictions shown in red)

Air Contaminant	Averaging Period	Maximum Predicted Concentration ($\mu g/m^3$) on PRPA Land		Maximum Predicted Concentration ($\mu g/m^3$) on Public Lands	
		Max predicted	Max + background	Max predicted	Max + background
NO_2 (100% conversion)	1-hour[1] (188)	1,296.0	1,339.4	281.0	324.4
	Annual (60)	16.3	29.4	0.9	14.0
NO_2 (50% conversion)	1-hour[1] (188)	648.0	691.4	140.6	184.0
	Annual (60)	8.1	21.2	0.5	13.6
NO_2 (25% conversion)	1-hour[1] (188)	324.0	367.4	70.3	113.7
	Annual (60)	4.1	17.2	0.2	13.3
SO_2	1-hour (200)	28.7	36.6	7.9	15.8
CO	1-hour (14,300)	1,107	1,473.3	102.3	468.6
	8-hour (5,500)	335.9	673.6	20.5	358.2
$PM_{2.5}$	24-hour (25)	0.4	15.4	0.2	15.2
	Annual (8)	0.1	5.0	0.02	5.02
PM_{10}	24-hour (50)	16.2	36.2	0.5	20.5

Notes: [1]99th percentile of daily 1-hour maximums over the year
[2] 98th percentile of daily 1-hour maximums over the year

Clarification of NO_2 predictions above: Due to lack of available ambient NO/NO_2 ambient data in the region, three different chemical conversion methods were employed to estimate the conversion of emitted NO to NO_2 in the atmosphere as shown in Table ES-2: 100% conversion, which is a very conservative assumption that over-estimates the actual conversion, 50% conversion and 25% conversion. Even with the 100% conversion assumption, the model shows that the exceedences on PRPA Land would occur infrequently (less than 0.5% of the time) and during periods with weak winds and low mixing heights (i.e., cool, calm conditions that may occur in the early morning hours of the day).

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1 INTRODUCTION

AltaGas Ltd. (AltaGas) is proposing to construct a new propane export facility on a site sub-leased from Ridley Terminals Inc. (RTI) located at 2110 Ridley Road, Prince Rupert, British Columbia (BC). The Project will be called the "Ridley Island Propane Export Facility". This report contains a full air quality assessment of the Project, including an emissions inventory and air quality modelling simulation.

The proposed propane export facility (the Project) is located on British Columbia's (BC) North Coast, 9 kilometers south of the City of Prince Rupert. The Project is on Ridley Island, which is federal port land administered by the Prince Rupert Port Authority (PRPA). The Project will be situated on land that is leased to Ridley Terminals Inc. (RTI), shown in Figure 1.1. The RTI site is accessible by road (Highway 16), rail (Canadian National Railway) and by marine cargo carriers using shipping lanes accessing the Port of Prince Rupert.

The purpose of the air quality assessment and report is to prepare a summary accounting of the potential air quality impacts associated with the Project. An air emissions inventory (EI) is a summary accounting of all significant emissions associated within a defined area (such as a community), industrial facility or project. The air contaminants in the inventory typically include what are known as criteria air contaminants (CACs) as well as greenhouse gases (GHGs). In some cases, select air toxics (also known as hazardous air pollutants) are also included if they are expected to be released in significant amounts. CACs are the typical air contaminants of interest to Canadian government to elaborate on potential air quality issues since they can have detrimental health and environmental effects at high enough ambient concentrations.

The PRPA completes its own port-wide EI each year. The 2013 EI contains the following air contaminants:

- CACs – NO_x, VOCs, CO, SO_2, PM, PM_{10}, $PM_{2.5}$
- GHGs – CO_2, CH_4, N_2O

Equivalent carbon dioxide (CO_2e) emissions are also included in this report, based on the Intergovernmental Panel on Climate Change (IPCC) global warming potential (GWP) values as reported in the Fourth Assessment Report (IPCC, 2007).

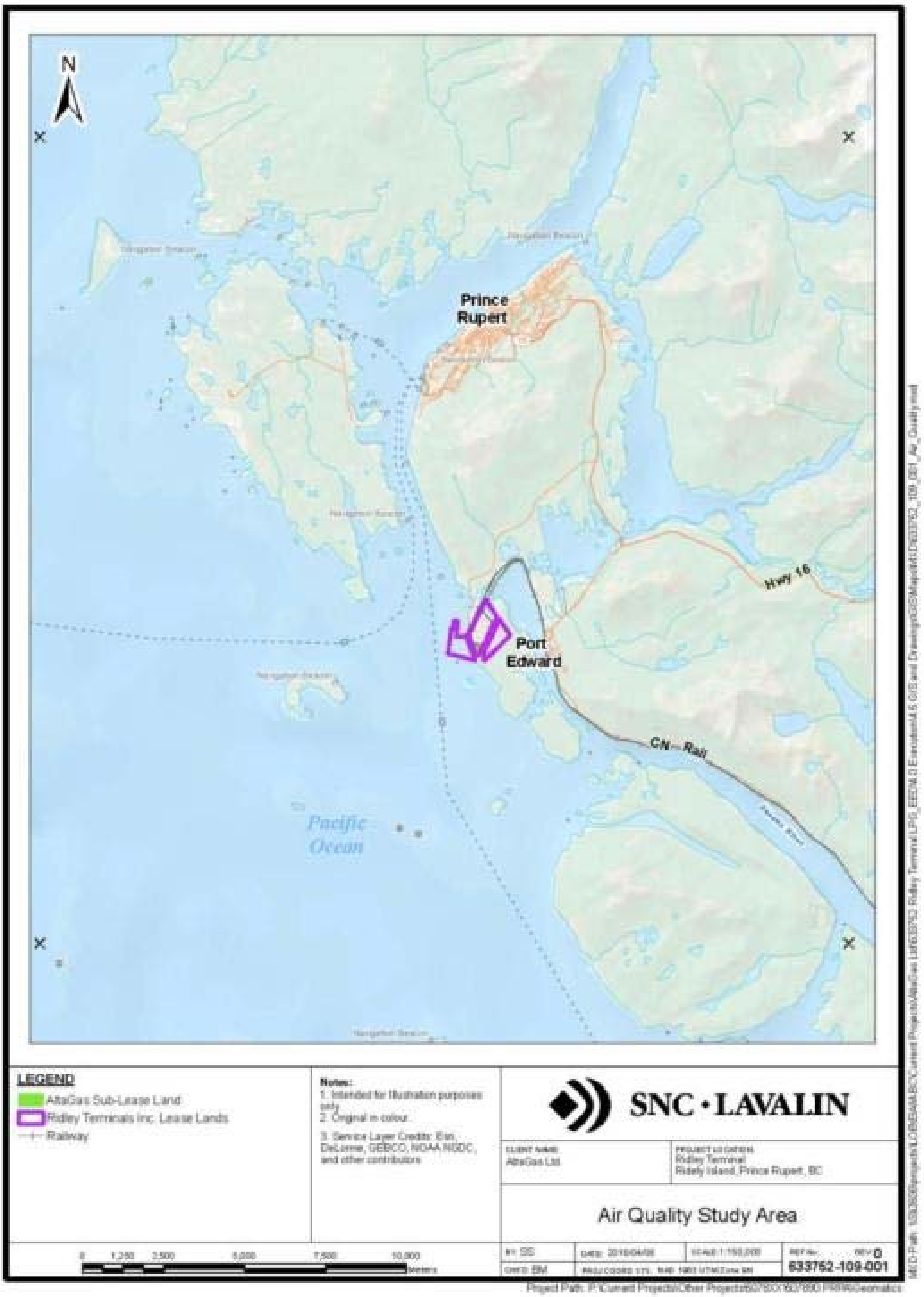
The same air contaminants in the PRPA inventory are included in the Project assessment, with the following exceptions:

- PM is not included separately since (for the Project sources) PM emissions are considered equal to PM_{10} emissions.
- IPCC Fifth Assessment Report (FAR) GWP values are used, as they are now generally accepted and used in emissions inventories.

Air quality modelling is also included in the air quality assessment. This involves use of an atmospheric model to evaluate the impacts of the Project CAC emissions. For all CACs except NOx, no chemical transformation is simulated (i.e., production of secondary contaminants from the primary contaminants emitted). With NOx, an accounting of chemical transformation is required.

NO_x is largely made up of NO and NO_2. As identified in Chapter 2, only NO_2 is considered to have potential environmental and human health effects at concentrations that may exist in ambient air. While NO_x emissions can be readily estimated in emissions inventories, the modelling assessment uses a conversion scheme to evaluate the portion of emitted NO that produces NO_2 in ambient air. This is further described in Chapter 5.

Figure 1-1: Project Location and Port of Prince Rupert



2 AIR QUALITY OBJECTIVES

Ambient air quality objectives for the province of British Columbia are shown in Table 2.1. National objectives are not shown, since the provincial values are more stringent and therefore are considered relevant for compliance purposes. Additional objectives exist for other air contaminants such as ground-level ozone and hazardous air contaminants. However, these additional objectives are not considered relevant to this study due to the nature of the emission sources at the terminal (e.g., no significant air toxic emissions are expected). Some of the BC AAQOs are expressed at three levels (A, B and C), as indicated.

Table 2-1: Applicable Ambient Air Quality in British Columbia *(National Standards in italics)* *(µg/m³)*

Air Contaminant and Averaging Period	BC Objective		
	Level A	Level B	Level C
CO			
1hr max	14,300	28,000	35,000
8hr max	5,500	11,000	14,300
NO_2			
1hr max (interim)			188[1]
Annual (interim)			60
SO_2			
1hr (interim)			200[2]
$PM_{2.5}$			
24hr max			25[3]
Annual			8
PM_{10}			
24hr			50

[1] Achievement based on annual 98th percentile of daily 1-hour maximum, over one year
[2] Achievement based on annual 99th percentile of daily 1-hour maximum, over one year
[3] Achievement based on 98th percentile of daily average, over one year

3 CURRENT AIR QUALITY AND CLIMATE

3.1 Climate and Meteorology

The climate normal for PR Roosevelt Park is shown in Table 3.1. This station is approximately 9 kilometers from the site. Precipitation data was obtained from the Environment Canada Climate Data website (Environment Canada, 2010) for the period 1981 - 2010. Temperature data was obtained from the BC Ministry of the Environment website (BC Ministry of the Environment, 2015) for the period 2012 - 2015.

Table 3-1: Precipitation Normals and Temperature data for PR Roosevelt Park

	Parameter	Jan.	Feb	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature (^{o}C) (for (2012-2015)	Mean Daily Avg.	5	3	5	6	10	11	14	14	12	9	5	3
	Mean Daily Max.	7	6	7	9	13	15	17	17	15	11	7	5
	Mean Daily Min.	3	1	2	4	8	10	11	12	10	7	3	2
	Extreme Max.	15	12	13	13	21	27	25	23	23	20	13	13
	Extreme Min	-3	-7	-9	0	2	5	8	8	6	-2	-7	-6
Precipitation (1981 – 2010)	Monthly Rainfall (mm)	292.8	210.7	232.5	213.0	153.9	131.8	115.7	155.5	242.8	405.8	371.0	322.1
	Monthly Snowfall (cm)	292.8	210.7	232.5	213.0	153.9	131.8	115.7	155.5	242.8	405.8	371.0	322.1
	Monthly Total (mm)	314.1	238.1	242.8	216.2	153.9	131.8	115.7	155.5	242.8	406.4	383.5	342.5
	Extreme Daily Rainfall (mm)	107.2	111.5	84.2	113.8	56.6	70.9	74.4	86.1	139.2	135.4	106.4	138.8
	Extreme Daily Snowfall (cm)	30.5	39.4	34.3	38.6	3.8	0.0	0.0	0.0	0.0	7.6	26.7	40.6
	Extreme Daily Precipitation (mm)	107.2	111.5	84.2	113.8	56.6	70.9	74.4	86.1	139.2	135.4	106.4	138.8

Figure 3-1 shows the relative location of two monitoring stations in the Prince Rupert community. The wind rose diagrams for these two stations (Figure 3-2) show that winds are predominantly from the south and east. Higher wind speeds tend to occur with south-easterly flow.

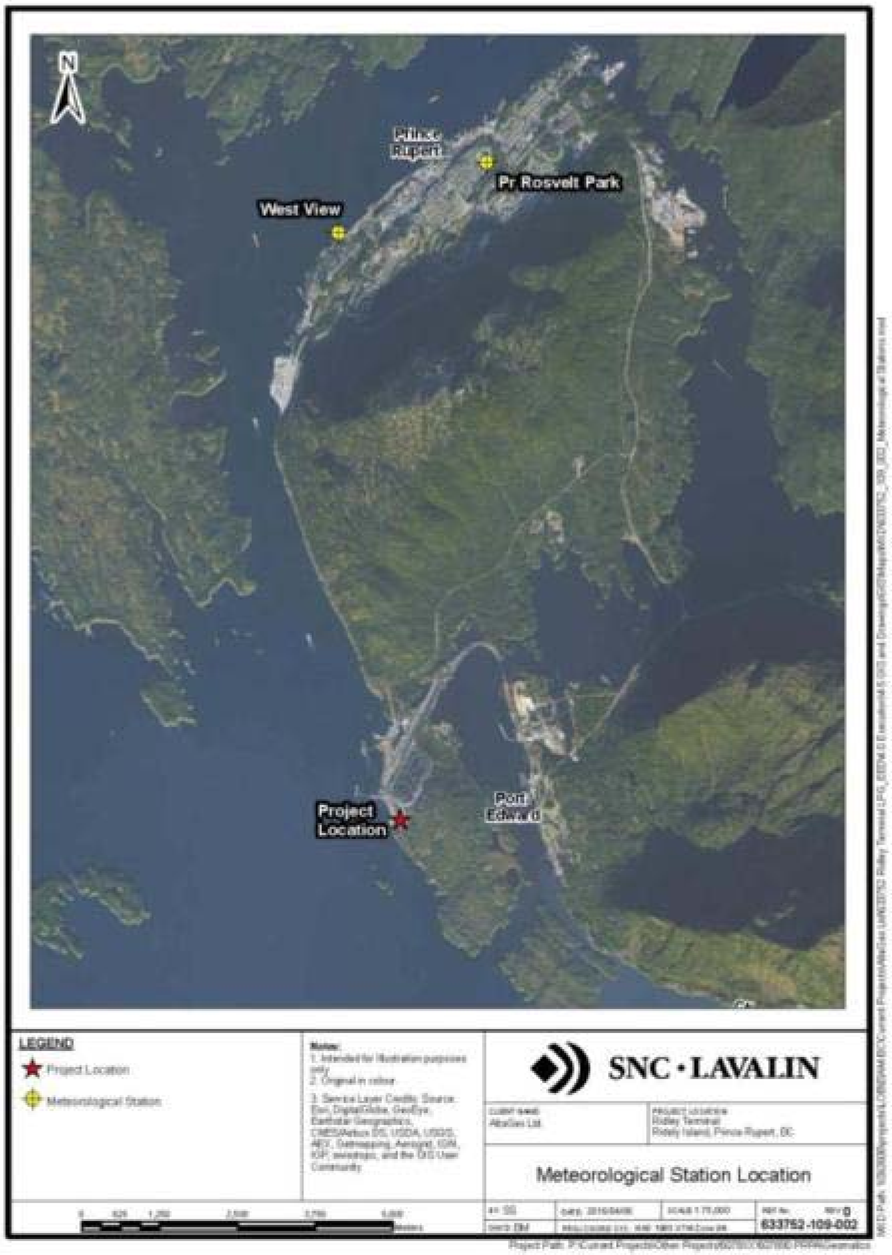


Figure 3-1: Monitoring Station Locations

Westview Monitored Winds

Roosevelt Park Monitored Winds

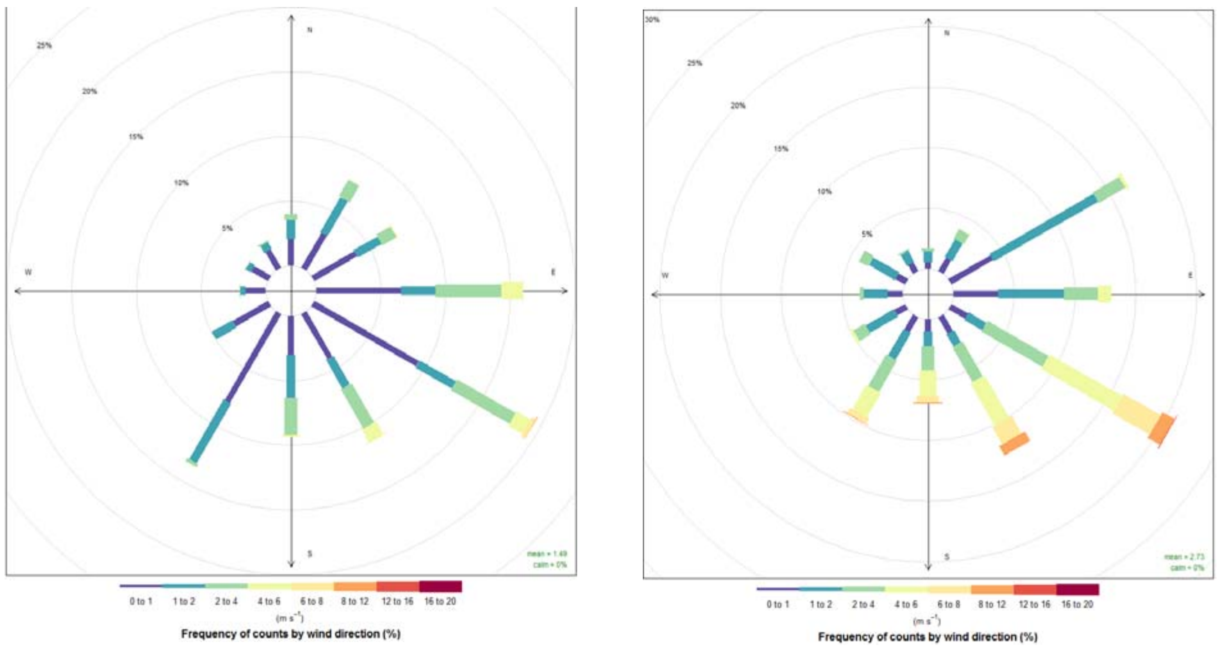


Figure 3-2: Windrose Diagrams for Roosevelt Park (left) and Westview (right), 2015

3.2 *Ambient Air Quality*

Table 3-2 provides ambient air quality data for three different monitoring stations. The Mobile Air quality Monitoring Laboratory (MAML) station was situated at Westview in Prince Rupert from April 2013 to August 2013 (data provided by PRPA staff). While this station would be considered representative of the study area, it does not span a long enough period to represent the existing air quality over a full calendar year. For this reason, ambient data were also obtained for the Tsawassen and Victoria Topaz stations (2015)[1] as these stations are situated in similar marine environments (with shipping activity) without significant industrial emission sources nearby. The Victoria Topaz and Tsawassen data sets were over 99% complete for the year. Air quality concentrations are expressed at the averaging periods of interest. Percentile values are also shown in some cases.

1 Data obtained from the provincial data archives: http://envistaweb.env.gov.bc.ca/

Table 3-2: Summary of Monitoring Data

Substances of Interest	Parameter	MAML Westview (2013) Concentration (µg/m^3)	Tsawassen (2015) Concentration (µg/m^3)	Victoria Topaz (2015) Concentration (µg/m^3)
CO	One-hour Maximum	721.233	2095.009	2222.083
	One-hour 98th Percentile	320.548	366.340	953.240
	One-hour 90th Percentile	263.307	228.963	495.704
	Mean One-hour Average	190.133	157.773	307.748
	8-hour Maximum	366.340	1081.849	1435.433
	8-hour 98th Percentile	276.186	337.72	807.322
	24-hour Maximum	281.433	506.840	1155.117
	24-hour Average	189.960	158.723	309.874
PM2.5	24-hour Maximum	8.054	56.775	62.000
	24-hour 98th Percentile	6.734	14.992	18.125
	24-hour 90th Percentile	5.155	8.601	11.417
	24-hour Average	2.433	4.955	6.320
	Annual Average	2.445	4.915	6.183
NO2	One-hour Maximum	49.652	83.506	79.368
	One-hour 98th Percentile	30.280	43.446	47.230
	Mean One-hour Average	8.988	13.136	16.121
	24-hour Maximum	17.233	52.661	38.556
	24-hour 98th Percentile	16.388	35.342	30.726
	24-hour Average	8.975	13.245	16.112
SO2	One-hour Maximum	16.747	23.812	58.876
	One-hour 99th Percentile	5.757	7.850	11.252
	One-hour 98thPercentile	4.710	3.925	2.898
	One-hour Average	0.808	1.271	2.749
	24-hour Maximum	2.442	20.240	4.345
	24-hour 98th Percentile	2.373	2.918	2.898
	24-hour Average	0.803	1.293	1.205

'Background' air quality concentrations are required to evaluate compliance with the AAQOs. These concentrations are meant to represent the emissions contribution from all other sources in the region to the ambient air quality. The background concentrations are added to the predicted concentrations associated with the Project emissions. Consistent with the BC Dispersion Modelling Guidelines (BC_MOE, 2015), background concentrations were determined from the monitoring data as 98th percentile values (one-hour, 24-hour averages) and average hourly values (annual averages). The 99th percentile is required for SO_2 1-hour concentrations only. The chosen background concentrations are identified in Table 3-3.

The Tsawassen station was chosen for the background concentrations in all cases, since this station is complete for the year and situated in a less urban setting than Victoria Topaz. The Topaz station is near a major roadway and therefore is substantially influenced by heavy traffic at times. Since traffic levels are much lower in the study area, the Tsawassen station was considered more representative but still a conservative assumption.

Table 3-3: Background Concentrations from Monitoring Data

Averaging Period	Measure	Air Contaminant Concentration (□g/m^3)				
		NO_2	SO_2	CO	PM_{10}	$PM_{2.5}$
1-hour	98th percentile (99th for SO_2)	43.4	7.9	366.3	n/a	n/a
8-hour	98th percentile	n/a	n/a	337.7	n/a	n/a
24-hour	98th percentile	n/a	n/a	n/a	20[1]	15.0
Annual	Annual avg	13.1	n/a	n/a	6.5	4.9

Notes:[1] No available data for PM_{10}. The background concentration is estimated by increasing the $PM_{2.5}$ value by 33%.

4 EMISSIONS ESTIMATES

4.1 Existing Port Sources

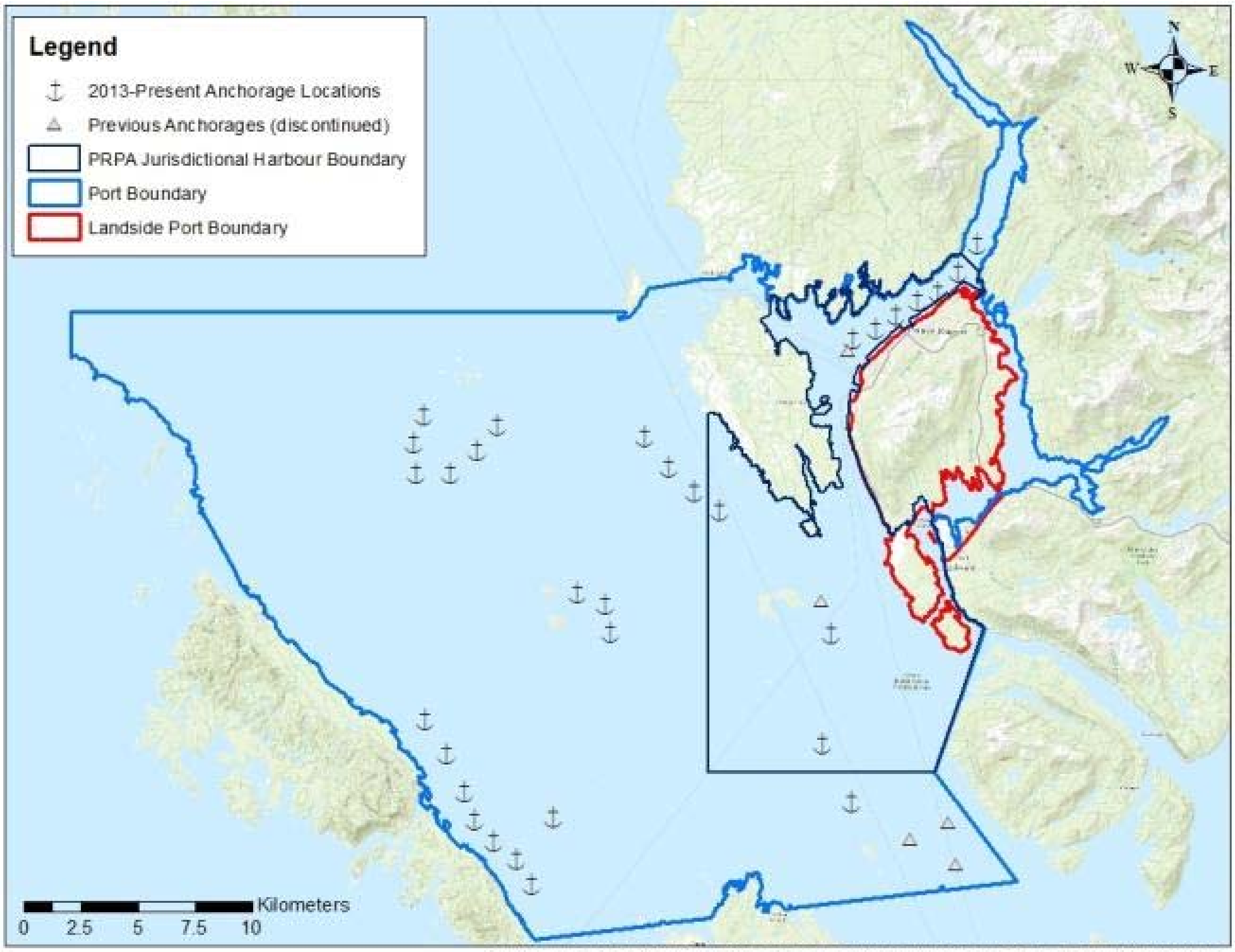
The Prince Rupert Port Authority (PRPA) completes a port-wide emissions inventory each year since 2010. The annual emissions associated with marine, rail, onroad vehicle, cargo handling equipment and administration are identified in Table 4.1 (SNC-Lavalin, 2015). These emission estimates relate to the 'Port Boundary' established by the PRPA as identified in Figure 4-1. As noted, the Port Boundary has both a water-side boundary and a land-side boundary.

Table 4-1: Estimated Port Emissions to the Port of Prince Rupert Port Boundary by Year, 2010-2013 (kg)*

Year	NO_x	SO_x	CO	VOCs	PM_{10}	$PM_{2.5}$	NH3	CO_2 (t)	CO_2e (t)
2010	761,271.8	507,552.8	105,670.9	31,419.9	63,766.4	58,723.1	1,087.7	51,673	53,642
2011	1,116,506.5	844,669.0	151,327.3	45,128.6	102,030.7	93,904.5	1,353.4	79,775	82,373
2012	982,010.3	694,599.0	135,928.8	40,606.6	85,719.6	78,891.7	1,339.1	69,354	71,989
2013	1,164,300.7	398,094.0	158,385.6	48,573.7	62,328.7	57,341.3	1,461.3	86,292	89,181

**Note: CO_2 and CO_2e are shown in tonnes, since their totals are much higher than the other contaminants*

Figure 4-1: PRPA Port Boundary for Port Emissions Inventory



4.2 Project Construction Emission Sources

Construction of the Project facility is estimated to require 250 person-years (SNC-Lavalin, 2015). The workers for the construction are expected to stay in town (Prince Rupert and/or Port Edward) and therefore no camp would be necessary. The Project site has existing infrastructure due to a sulphur export facility (constructed in 1999) that was never fully commissioned. As such, the sulphur facility will be decommissioned and removed during the Project construction phase. During this time, re-purposing for some of the existing structures will be considered.

Specific details associated with the construction tasks have not yet been identified by AltaGas. Based on similar terminal construction projects, SNC-Lavalin expects that the following equipment types will be used:

- Crew trucks, pickup trucks
- Graders, excavators, backhoes, bulldozers
- Loaders, dump trucks, maintenance trucks, mobile cranes
- Man-lifts, other

Some of these equipment are licensed for onroad use (and are subject to onroad emission standards) and some are not (and would be subject to offroad emission standards). In addition to the exhaust emissions from these equipment, some fugitive dust is expected due to land preparation and vehicle movement. Since no residential or public areas are in close proximity to the Project site, no adverse air quality effects are expected due to use of these construction sources.

4.3 Project Operation Emission Sources

Project operations are assessed over the port jurisdictional boundary and the port landside boundary as defined in Figure 4-1.

The identified emission sources that will be active at the propane facility include the following (SNC-Lavalin, 2015):

Combustion

- Up to 15 MW (total generation capacity) gas engine generators for power supply
- Backup emergency diesel generator
- Gas flare (intermittent use)

Ground level transport exhaust

- Rail transport (initially 15-20 railcars per day, increasing within 12-18 months of the start of operation to 50-60 railcars per day)

Marine transport exhaust

- Berthing (tugs), large gas carriers

Leaks

- Transfer from rail to storage (14 unloading tracks, 1022 m3/hr), storage, refrigeration, refrigerated storage marine vessel loading pipeline and loading arms

Indirect

- Electric motor driven pumps for transferring propane

Construction

- Two hundred and fifty person years of construction activity

As noted, some fugitive hydrocarbon emissions are expected with the Project, due to the loading and unloading of propane as well as minor leaks in the facility infrastructure. Some fugitive dust can also be associated with the land side transportation sources (rail, vehicle). However, the fugitive dust emissions are not expected to be high and any liberated dust would be deposited close to the sources of release.

Propane will be delivered to the facility, unloaded and stored for eventual loading to ship. The Project sources are expected to use different fuels or gas compositions as follows:

- Gas engines: light ends (methane, ethane and propane) that are evaporated from the incoming propane stream, or by pipeline natural gas. Sulphur level in propane of 75 parts per million (ppm) or less.
- Backup diesel generator: diesel with sulphur content of 15 ppm or less.
- Flare: flaring of the propane product during upset or maintenance situations. Sulphur level in propane of 75 ppm or less.
- Propane carriers: Marine bunker fuel ('Heavy Fuel Oil') with sulphur content of 0.1% or less, consistent with the North American Emissions Control Area (ECA).
- Assist tugs: Marine distillate ('Marine Distillate Oil') with sulphur content of 15 ppm or less.
- Rail locomotives: diesel with sulphur content of 15 ppm or less.

4.4 Significant Source Assumptions

The following Project-related assumptions are made to determine the emission rates and emission estimates in the following sections. These assumptions are based on information identified in the Project description as well as additional information provided to SNC-Lavalin from AltaGas. Transportation-related assumptions (ships, trains) were made by SNC-Lavalin from the cargo movement statements in the Project description:

- Reciprocating gas engines will be used to burn some of the boil off (light ends) gas captured at the facility for power generation. The Caterpillar G3612 LE model (3550 hp) model is assumed to be used (4 separate units). While up to 3 of these units are expected to be used at any time (e.g., normal operating conditions), all 4 units working at 100% capacity is assumed for the maximum short term emissions scenario.
- The Project description states that up to 60 rail cars will be processed per day. Use of the DOT-111 rail car with a carrying capacity of 65 tonnes of propane is assumed. For the maximum short term emissions scenario, one 120 car train is assumed to come to the terminal.
- The Project description states that 20 – 30 gas carrier vessels will be used to export propane. The LPG Tanker vessel category and typical engine activity rates are assumed to be relevant. There are

205 vessels of this type with sufficient cargo carrying capacity (over 40,000 tonnes) in the world fleet. 30 vessels are assumed to visit the port over a year.

- Two tugboats will be used to escort the gas carriers through the port and to assist the vessels to berth.
- One ground flare with a containment stack of height 35 m will be used at the facility for upset conditions. The flare will have a capacity of 30 million standard cubic feet (30 MMscf) per day. A single flaring event occurring over a one-hour period or less may consume up to 1.25 MMscf. Up to five flaring events may occur in a year.
- Fugitive emissions of the propane product will be released during loading, unloading and handling of the product. These fugitive emissions are expected to be low and are not estimated as part of this emissions assessment.
- The (indirect or scope 2) emissions associated with use of electricity are considered to be zero since most of the electricity used on site will be generated by the gas engines considered above.

Other assumptions were made by SNC-Lavalin based on the best available data. These additional assumptions are described in the following sections.

4.5 Project Emission Rates

4.5.1 Marine

Ships expected to be used to transport the propane are of the LPG Tanker ship type and Very Large Gas Carrier category. The IHS Fairplay dataset was reviewed to identify the current world fleet for ships of this type[2]. Two hundred and four ships were found with a gas carrying capacity greater than 40 tonnes (e.g., meeting the expected size requirement identified in the PD). The following engine criteria were associated with the largest and average vessel within this group of ships:

- Main (2-stroke) engine Maximum Continuous Rating (MCR): 17,640 kW (max), 13,260 kW (avg)
- Auxilliary (4-stroke) engine power requirements (max and avg vessels): 1,710 kW (underway, berth), 2,565 kW (maneuvering)
- Boiler power requirements (max and avg vessels): 150 kW (underway), 300 kW (maneuvering), 1,500 kW (berth)

The auxiliary engine and boiler levels were taken from a recent port emissions inventory study completed for Long Beach, CA (Starcrest, 2014). These are effective power levels used in the different modes of activity (underway, manoeuvre, berth) and not maximum capacities.

Escort/assist tugboats will also be used to bring the ships into dock. The following tugboat assumptions are used for the assessment:

[2] See the IHS Maritime World Register of Ships, https://www.ihs.com/products/maritime-world-ship-register.html

- Tug main engine capacity of 1,800 hp (1,343 kW), average engine load of 60%.
- Two tugs used for each cargo ship.
- Two hours of assist (at berth) and two hours of escort (in Port Boundary) for each cargo ship visit.

Additional assumptions were applied to estimate the marine activity levels for the assessment:

- 10 km one way transit through the Port jurisdictional waters.
- 10 knot average vessel speed and 25% main engine load through the Port jurisdictional waters.
- Thirty cargo vessels annually, with an average of 40 berth hours/visit.

Emission rates used for the marine engines and boilers are provided in Table 4.2. These rates are consistent with ICF (2009). Engine fuel consumption rates are identified in Table 4-3, obtained from (IMO, 2014). All GHG emission estimates used for marine engines and boilers are determined from the fuel consumption estimates and fuel-based GHG emission rates from Canada's National Inventory Report (NIR). The NIR rates are provided in Appendix II. SO_2 emissions are determined from the fuel consumption estimates and an assumption that 97.75 per cent of the sulphur level in fuel is converted to SO_2 through combustion (also consistent with ICF, 2009).

Table 4-2: Marine Engine and Boiler Emission Rates (g/kWh)

Engine Code	Fuel Code	NOx	CO	VOC	NH3	PM	PM10	PM2.5
A4	HFO	14.00	1.10	0.40	0.0010	0.23	0.23	0.21
A4	MDO	13.20	1.10	0.40	0.0010	0.23	0.23	0.21
A4	MGO	13.20	1.10	0.40	0.0010	0.23	0.23	0.21
M2	HFO	18.10	1.40	0.60	0.0210	0.23	0.23	0.21
M2	MDO	17.00	1.10	0.60	0.0200	0.23	0.23	0.21
M2	MGO	17.00	1.10	0.60	0.0200	0.23	0.23	0.21
M4	HFO	13.20	1.10	0.50	0.0230	0.23	0.23	0.21
M4	MDO	13.20	1.10	0.50	0.0220	0.23	0.23	0.21
M4	MGO	13.20	1.10	0.50	0.0220	0.23	0.23	0.21
BO	HFO	2.10	0.20	0.10	0.0004	0.25	0.25	0.23
BO	MDO	2.00	0.20	0.10	0.0004	0.25	0.25	0.23
BO	MGO	2.00	0.20	0.10	0.0004	0.25	0.25	0.23

Notes:

A4, M2, M4 and BO are auxiliary 4-stroke, main 2-stroke, main 4-stroke and boiler

HFO, MDO, MGO are heavy fuel oil, marine distillate oil and marine gas oil

Table 4-3: Marine Engine Fuel Consumption Rates (g/kWh)

Engine Age	Slow Speed Diesel (2-stroke)	Medium Speed Diesel (4-stroke)
Before 1983	205	215
1984 – 2000	185	195
Post 2001	175	185

4.5.2 Rail

Rail fuel consumption and emissions were characterized following the approach outlined in (EPA, 2009). The CN rail 'fuel index' value of 5.32 litres/1,000 NTK (net tonne kilometres) is sourced from the Railway Association of Canada (RAC, 2014) and is the most current measure of the locomotive fuel required to move goods in Canada by the national rail lines (CN, CP). Additional assumptions are used to develop estimates for the NTK associated with the project:

- The rail cars used to transport the propane are assumed to be the DOT-111 tank car, with capacity of 131,000 litres/car (65.5 tonnes/car)
- Annual propane throughput for the terminal is 1,258,520 tonnes/year (from the Project description)
- For the maximum short-term case, a 120 car train is processed (approximately double the average cars/train volume expected)

The EPA provide emission factors premised on work done (in g/bhp-hr) as well as conversion rates that allow determination of the locomotive work done from the fuel consumption estimates. The conversion rate for current line haul locomotives is 5.50 bhp-hr/litre. Assuming a loaded train travel distance of 7.6 km (further discussed in the following section), a total of 9,580,000 NTK, 51,000 litres of diesel and 281,000 bhp-hrs are implied over the year to move the propane rail cars to/from the terminal over the year.

The EPA rail locomotive emission rates are provided by emissions tier. To develop representative rates for CN, the current national fleet distribution by tier was identified from (RAC, 2014) to develop the 'effective rates' shown in Table 4.4. Additional GHG emissions estimates for rail also use the NIR fuel-based rates shown in Appendix II.

Table 4-4: Rail Locomotive Emission Rates in g/hp-hr (EPA, 2009)

Type	Tier	PM	VOC	NOx	CO	NH3
line	pre-tier	0.32	0.48	13.00	1.28	0.014
line	0	0.32	0.48	8.60	1.28	0.014
line	0+	0.20	0.30	7.20	1.28	0.014
line	1	0.32	0.47	6.70	1.28	0.014
line	1+	0.20	0.29	6.70	1.28	0.014
line	2	0.18	0.26	4.95	1.28	0.014
line	2+	0.08	0.13	4.95	1.28	0.014
line	3	0.08	0.13	4.95	1.28	0.014
line	4	0.02	0.04	1.00	1.28	0.014
effective rates (CN)		**0.24**	**0.36**	**8.00**	**1.28**	**0.014**

Notes: NH_3 factor sourced from the US EPA NONROAD model (2008)

PM_{10} emission rates are assumed to be equal to total PM emission rates and $PM_{2.5}$ emissions are assumed to be 97 per cent of PM_{10} emission rates. This approach is consistent with the US EPA NONROAD emissions model[3]. As with the marine sources, SO_2 emissions are determined from the fuel consumption estimates and an assumption that 97.7 per cent of the sulphur level in fuel is converted to SO_2.

4.5.3 Gas engines

The gas reciprocating engines used to produce electricity were modelled after the CAT G3612 LE model, which is expected to be used. This is a 'lean burn' model which operates with excess air to reduce combustion temperatures and NO_x emission rates. Four engines will be installed at the facility with up to three being used at any given time. The emission rates for the gas engines are identified in Table 4.5. These emission rates originate from several sources as noted.

[3] See http://www3.epa.gov/otaq/nonrdmdl.htm

Table 4-5: Gas Engine Emission Rates

Source	PM10 (lb/MMBTU)1	VOC (g/hp-hr)2	Nox (g/hp-hr)2	CO (g/hp-hr)2	NH3 (g/hp-hr)3	PM2.5 (kg/GJ)4
Gas reciprocating engine	0.0483	0.61	0.70	2.50	1.38 E-02	8.0 E -05

Notes: [1] US EPA AP-42 Chapter 3.2. Includes both filterable and condensable PM
[2] CAT G3612 LE Gas Petroleum Engine Spec Sheet, http://s7d2.scene7.com/is/content/Caterpillar/LEHW0041-02
[3] US EPA NONROAD 2008 emissions model, http://www3.epa.gov/otaq/nonrdmdl.htm
[4] Tetra Tech, 2013. Gap Analysis for Particulate Matter Emission Factors for Gas-fired Combustion Sources and Large Compression-Ignition Engines. Prepared for the Petroleum Technology Alliance of Canada (PTAC).

SO_2 emissions are determined from the fuel consumption estimates and an assumption that 97.7 per cent of the sulphur level in fuel is converted to SO_2 (as with the marine and rail sources). Additional GHG emission estimates use the NIR fuel-based GHG rates in Appendix I.

4.5.4 Flare

The propane product delivered to the facility has an expected flow rate and heating value identified in Table 4-6. The heating value was approximated by assuming a composition of 100 per cent propane.

Table 4-6: Flare Assumptions

Description	Assumption
Composition	100 per cent propane
Propane Heating Value	84,166.16 (BTU/m^3)[1]
Flow Rate (MMscfd)	30
Gas Consumption per Event (MMscf per hour of event)	1.25
Number of Flaring Events in a Year	Five full flare events per year for a duration of one hour or less.

Notes: [1] heating value from esrd.alberta.ca/air/modelling/documents/7223.xls

Table 4-7 provides the emission factors that are used to estimate emissions associated with the flare. SO_2 emissions are estimated from the total gas consumption and assumption of 100% conversion of S to SO_2. US EPA AP-42 rates were used for VOCs, NOx, PM (soot) and CO. Canadian Association of Petroleum Producers (CAPP) rates were used for CO_2 and CH_4. N_2O emissions are considered negligible (characterized as such by CAPP).

Table 4-7: Flare Emission Factors

Pollutant	Total Hydrocarbons (lb/10^6 Btu)[1]	NO_X (lb/10^6 Btu)[1]	Soot (PM) (µg/L)[1,3]	CO (lb/10^6 Btu)[2]	CO_2 (ng/MJ)[4]	CH_4 (ng/MJ)[4]
Flare Emission Factors	0.14	0.068	40	0.37	48,560	33

Notes: [1] EPA AP 42, Fifth Edition, Volume I, Chapter 13: Miscellaneous Sources, 13.5 Industrial Flares, Table 13.5-1
[2] EPA AP 42, Fifth Edition, Volume I, Chapter 13: Miscellaneous Sources, 13.5 Industrial Flares, Table 13.5-2
[3] PM and black Carbon emission factors are assumed to be equivalent to this value, which relates to lightly smoking flares
[4] CAPP, 2005. A National Inventory of GHG, CAC and H2S Emissions for the Upstream Oil and Gas Industry

4.5.5 Backup Diesel Generator

The backup generator is not expected to be used in normal operations and is of a relatively small size (compared with the gas engines). For this reason, no estimates are made for the backup generator.

4.5.6 Other

Some fugitive losses are expected during the handling of the propane product. The assumed average composition of the product is identified in Table 4-8 (values from the Material Safety Data Sheet for Grade 1 Propane in Canada[4]). While the fugitive losses are expected to be minor, there would be some contribution to the Project GHG emissions due to small portion of methane included. No estimates can be made of these fugitive losses.

Table 4-8: Product Composition

Component	CAS-No.	Weight %
Propane	74-98-6	95-98%
Ethane	74-84-0	3 - 5%
Butane	106-97-8	1 - 3%
Isobutane	75-28-5	0.1 – 0.3%
Methane	74-82-8	0.1 – 0.2%

4.6 *Estimated Emissions*

Project-related emissions are estimated to support the dispersion modelling and determination of ambient air quality. Two cases are of interest: maximum short-term emissions, which are the highest 1-hour emissions that could be associated with the Project operation and average short-term emissions. The maximum short-term emissions are used to determine compliance with the 1-hour and 8-hour ambient objectives (AAQOs) and the average short-term emissions are used to determine compliance with the longer term objectives

[4] Obtained from http://www.propane.ca/sites/default/files/files/MSDS_E_2012-07.pdf

(24-hour, annual). Total annual emissions estimates are also included. The short-term emission estimates do not include GHGs, since the GHGs only have relevance to longer timeframes (annual).

Short-term maximum emissions were estimated assuming the highest level of activity for each of the active sources. For marine sources, this relates to the largest LPG carrier in the world fleet manoeuvring near berth. LPG carrier manoeuvring has higher engine activity and emissions compared to when the ship is alongside (berthing). While the maximum underway emission rates are higher, these emissions occur further from the berth and would have lower potential impact. For rail sources, the maximum train length was assumed (120 cars), which would have higher locomotive emission rates. For the gas engines, all four were considered 'on' at maximum capacity, although this is not expected to occur. For the flare, the maximum 1-hour flow rate of gas to the flare is assumed. These emission rates are identified in Table 4-9.

Table 4-9: Short-term Maximum Emission Rates (1-hour, 8-hour timeframes)

Source	Emissions (kg/hour)						
	NO_x	SO_x	CO	VOC	PM_{10}	$PM_{2.5}$	NH_3
LPG Carrier (manoeuvre)	36.54	1.28	2.88	1.06	0.66	0.61	0.00
Tugs (assist)	22.56	0.65	1.77	0.64	0.37	0.34	0.00
Rail Locomotives (120 car train)	14.00	0.01	2.24	0.63	0.43	0.41	0.02
Gas Engines (4 @ max capacity)	9.94	0.21	35.50	8.66	2.06	0.0079	0.20
Flare (1.25 MMBtu/hr)	25.30	2.00	139.00	19.20	49.80	49.80	n/a
Total	**108.34**	**2.15**	**181.39**	**30.19**	**53.32**	**51.2**	**0.22**

The short-term average emission rates correspond to the average expected hourly emissions, which relate to an average LPG carrier at berth, an average size train (60 cars) and three of the gas engines operating at 75% load. The rail emissions are only active for one hour a day and the tug emissions are only active during ship arrival and departure. For these reasons the total tug emissions over an hour were divided by 20 (since an average vessel stay is 40 hours long) and the total rail emissions over an hour were divided by 24. The Flare is not operational under average conditions. These emission rates are identified in Table 4-9.

Table 4-10: Short-term Average Emission Rates (24-hour, annual timeframes)

Source	Emissions (kg/hour)						
	NO_x	SO_x	CO	VOC	PM_{10}	$PM_{2.5}$	NH_3
LPG Carrier (berthing)	27.09	1.63	2.18	0.83	0.77	0.71	0.00
Tugs (assist)	1.13	0.03	0.09	0.03	0.02	0.02	0.00
Rail Locomotives (60 car train)	0.29	0.00	0.05	0.01	0.01	0.01	0.00
Gas Engines (3 @ 75% capacity)	5.59	0.12	19.97	4.87	1.16	0.0046	0.11
Total ()	**34.10**	**1.78**	**22.29**	**5.75**	**1.96**	**0.74**	**0.11**

Annual emissions estimates are provided in Table 4-10. These estimates correspond to the total activity levels expected for each source over the year, as defined in Section 4.3.

Table 4-11: Annual Emission Estimates

Source	Emissions (kg)								
	NO_x	SO_x	CO	VOC	PM_{10}	$PM_{2.5}$	NH_3	CO_2	CO_2e
LPG Carrier - Underway	1,966	49	153	62	29	26	1	83,772	99,761
LPG Carrier - Manoeuvre	2,192	77	173	63	40	37	0	130,215	220,895
LPG Carrier - Berthing	32,508	1,956	2,617	1,001	922	848	3	3,310,778	3,980,192
Tugs – Manoeuvre	1,354	39	106	39	22	20	0	65,590	81,604
Tugs - Escort	1,354	39	106	39	22	20	0	65,590	81,604
Rail Locomotives	2,241	1	358	102	68	66	4	135,719	198,124
Gas Engines	48,979	1,043	174,926	42,682	10,148	41	966	10,949,203	11,187,700
Flare	126.5	10	695	96	249	249	n/a	763,160	917,710
Total	**90,721**	**3,214**	**179,134**	**44,084**	**11,500**	**1,307**	**974**	**15,504,028**	**16,767,590**

4.7 Project Emissions in Context of Port, Provincial and National Totals

The PRPA port-wide emissions inventory can be used to gain further understanding of the magnitude of the Project emissions. The Project emissions documented in this report were estimated in a more conservative manner than the port-wide emissions since actual data could be used for the port inventory and (maximum) projections are used for the Project. The Port is not a large port, so the Project emissions (when active) are expected to constitute between 2 and 15 per cent of the port total emissions in general, as identified in Table 4-12. Additional commentary is provided for values outside this range:

- The SO_x comparison appears quite low. This is because the Emission Control Area (ECA) fuel standard for marine vessels will be 0.1 per cent in 2015 and beyond (assumed for the Project assessment). The 2013 port inventory assumed a maximum of 1.0% sulphur for marine fuels in that year. In reality, the Project SO_2 emissions are likely to be similar to the NO_2 contribution level (7 per cent).
- The Project CO emissions appear relatively high. This is due to virtually no significant sources of CO currently at the port (diesel engine CO emissions are low relative to other sources such as gasoline vehicles). In addition, the assumption that three of the Project gas engines will be used at high load (75%) at all times may be overly conservative.
- The Project VOC emissions also appear relatively high. This again is due to few significant sources of VOCs currently at the port (diesel engine VOC emissions are low relative to many other types of sources).

Table 4-12: Project Emissions in Relation to 2013 Port Total (CACs in kgs, GHGs in tonnes)

NO_x	SO_x	CO	VOCs	PM_{10}	$PM_{2.5}$	NH3	CO_2 (t)	CO_2e (t)
Port Total (2013)								
1,164,300	398,094.0	158,385.	48,573.	62,328.7	57,341.3	1,461.	86,292	89,181
Project Annual Emissions								
90,721	3,214	179,134	44,084	11,500	1,307	974	15,504	16,768
Comparison: Project Emissions to Total Emissions (%)								
7.2%	0.8%	53.1%	47.6%	15.6%	2.2%	40.0	15.2%	15.8%

The Project GHG emissions can also be compared to the total provincial and national GHG totals for further relevance. The provincial and national GHG totals for the most recent calendar year (2013) are 65 million tonnes and 726 million tonnes CO_2e, respectively (Environment Canada, 2015). The Project GHG emissions, as indicated by CO_2e, constitute 0.03% and 0.0002% of the provincial and national totals, respectively. Since emissions from international ships are not included in the provincial and national totals, the effective contribution of the Project to the provincial and national GHG totals will be lower than these values.

5 AIR QUALITY MODELLING

The California Puff Model (CALPUFF) was used to simulate the release and dispersion of Project emissions. CALPUFF utilizes a three dimensional meteorological field (winds, temperature, pressure, humidity and other related variables) that influence the behaviour of an emitted plume of gas or small particles. The model was first used to simulate a full year of meteorological conditions in the area. The Project emissions were then characterized to be released into this meteorological field, with resultant predictions of maximum ambient air quality concentrations within the study domain.

The CALPUFF model simulates emissions by discrete 'puffs' that are released from a source periodically. Each puff is then free to move and disperse within the simulated meteorological field over time. The model predictions are a calculation of the total volume concentration (i.e., grams of pollutant per cubic metre of air) due to all puffs released from the source. This dispersion model is considered a 'refined' model that is identified and accepted as an appropriate dispersion model in the British Columbia Dispersion Modelling Guideline (BC_MOE, 2015).

The model is further described in the following sections, along with key data inputs.

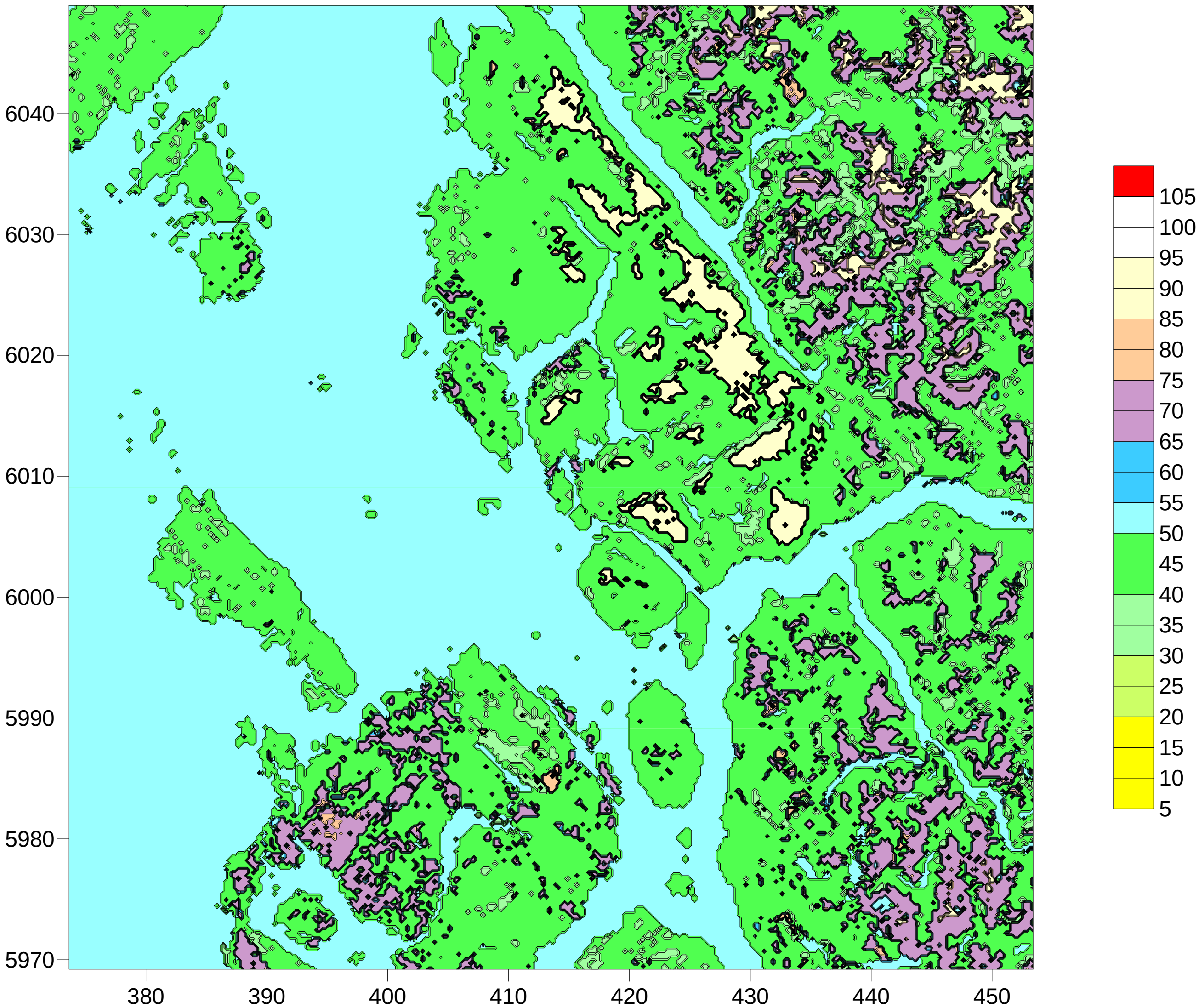
5.1 CALMET

An annual meteorological dataset was purchased for the Project study through an agreement set up by the BC Ministry of Environment. The Weather Research and Forecast (WRF) model is a 'mesoscale' weather simulation model that is considered state of the science and is often used for air quality modelling studies in BC as well as other provinces and U.S. states. A full annual WRF simulation for the entire province for the calendar year 2012 was sponsored by the BC Ministry of Environment in 2014. A specific annual data subset for an identified region of the province can be purchased for a nominal fee.

SNC-Lavalin purchased a 100 km by 100 km WRF dataset centered on the Project site. This dataset was used as the meteorological input to CALMET, the meteorological model within the CALPUFF system. The WRF fields contain meteorological parameters such as wind speed, wind direction, temperature, pressure etc for each hour of the year and through multiple layers of the atmosphere, at a horizontal grid resolution of 4 km. The CALMET model reads and ingests this data and produces its meteorological fields at a finer resolution (in this case, 250 m horizontal grid resolution). Additional CALMET model configuration steps such as setting the terrain heights and additional geophysical properties of the land and water areas were completed following the BC Dispersion Modelling Guidelines. A listing of the model settings ('switches') is provided in Appendix I.

5.1.1 Grid

CALMET was configured with a large grid of 320 by 320 grid cells, with 250 m spacing, resulting in a domain of size 80 by 80 km. The domain was configured with terrain and land-use data as identified in Figures 5.1 and 5.2.



Note: 20=urban, 30=deciduous forest, 40=evergreen forest, 50=water, 70=tundra, 90=barren land

Figure 5-1: CALMET Domain Showing Assigned Landuse Categories

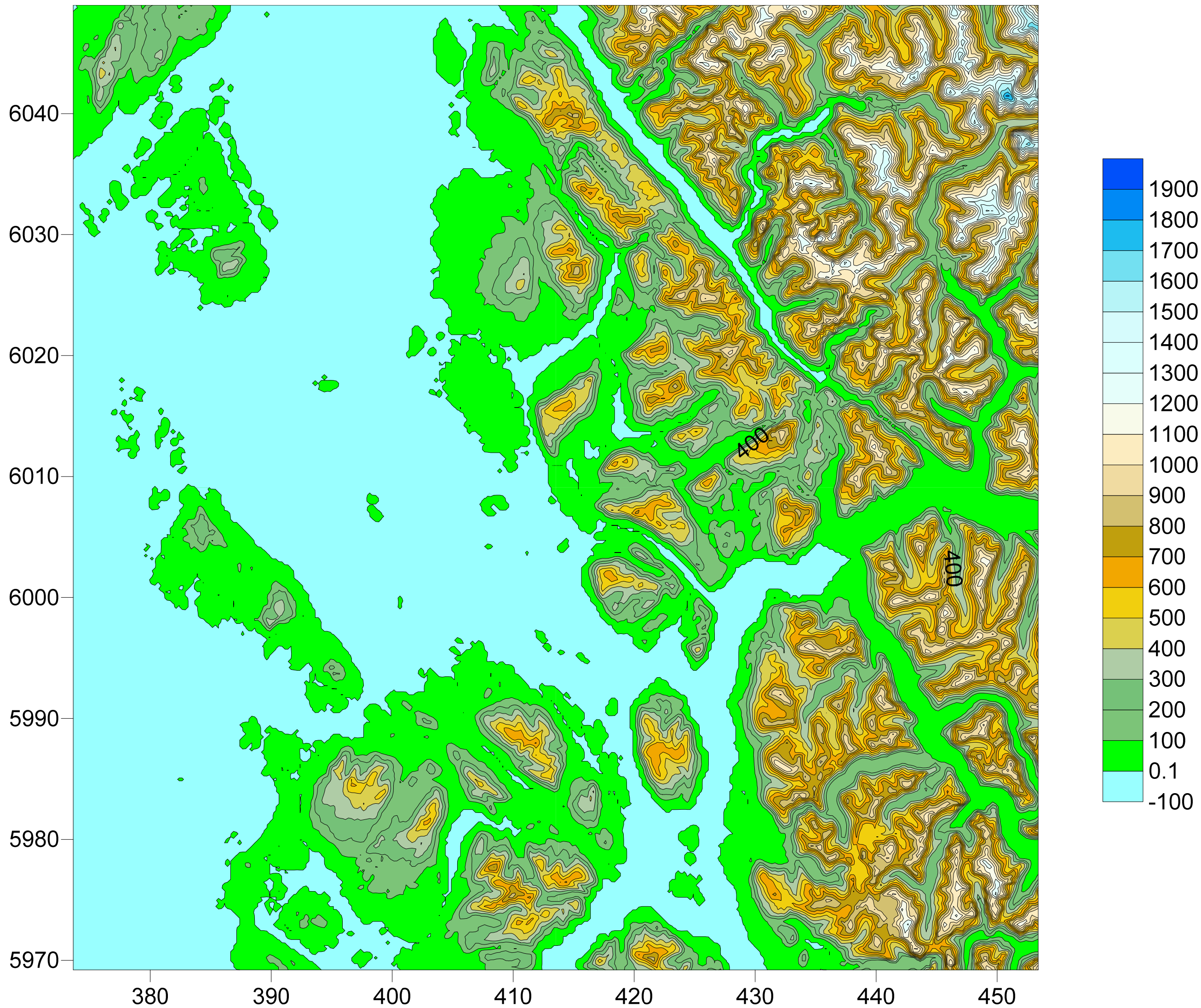


Figure 5-2: CALMET Domain Showing Assigned Terrain Heights (m)

5.2 CALPUFF

CALPUFF settings are largely associated with how the sources are characterized (source parameters) as well as the domain 'receptors' which are the specific locations the model makes its predictions. These are identified in the following sections. A specific listing of the model settings ('switches') is provided in Appendix I.

5.2.1 Grid

The model receptors were set following the BC Dispersion Modelling Guidelines (2015). These requirements include a more dense array of receptors at the facility fence-line (20 m spacing), followed by 50 m spacing within 500 m of the sources, 250 m within 2 km, 500 m within 5 km and 1,000 m spacing beyond 5 km. The distances were set from the location of the flare stack. A visualization of the receptor grid is provided in Figure 5-3.

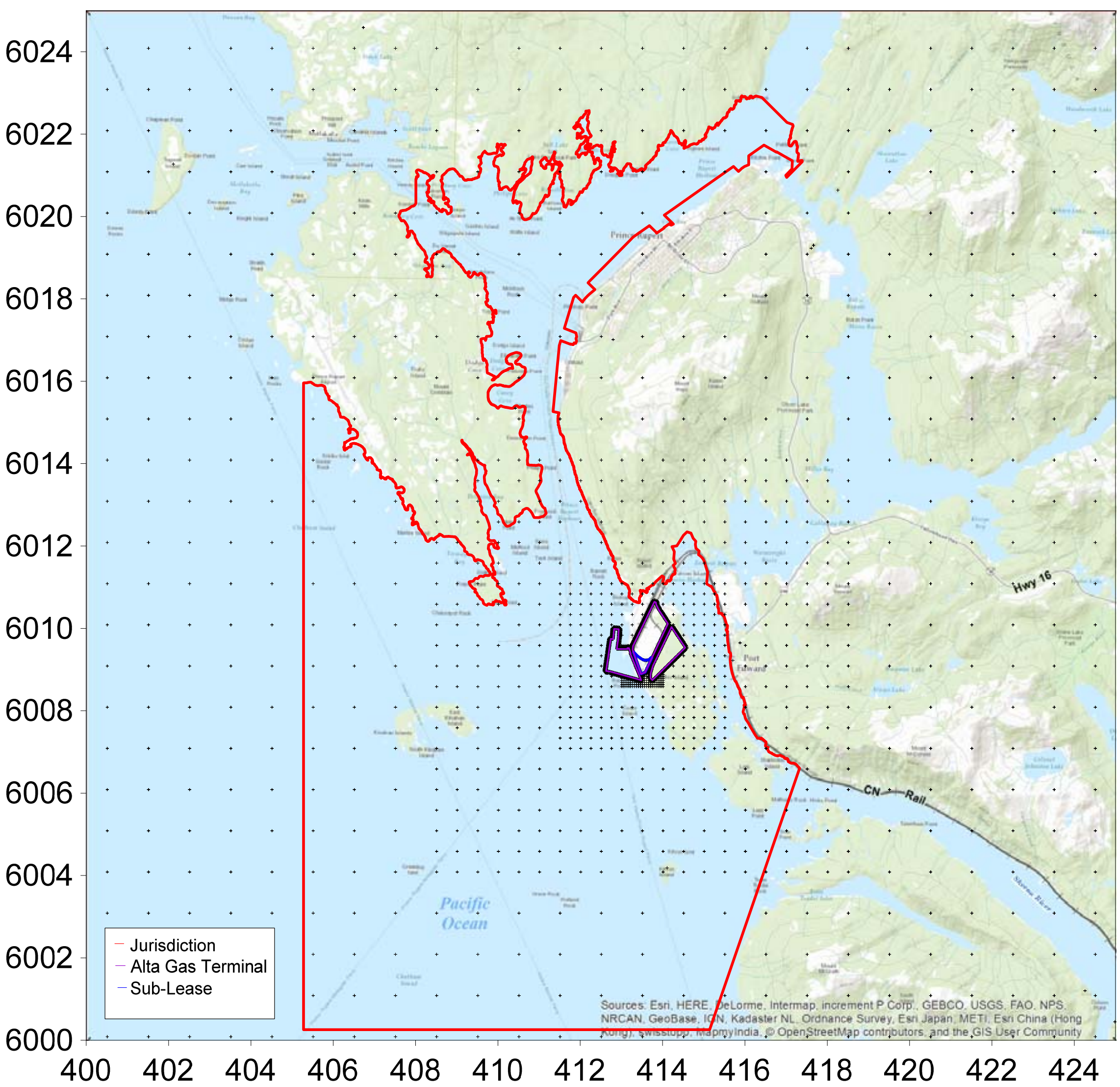


Figure 5-3: CALPUFF Receptor Grid

5.2.2 Sensitive Receptors

Sensitive receptors are chosen based on possible sensitivities to air quality. These for example include locations of hospitals or schools.

Table 5-1: CALPUFF Sensitive Receptors

Description	Name	Easting (km)	Northing (km)	Ground Elevation
nearest residence		415.707	6009.223	28.36
Elementary school	Port Edward Elementary	415.882	6009.649	37.73
park	Kitson Island Marine Provincial Park	414.11	6004.183	30.85
nearest residence		410.422	6015.345	9.78
nearest residence		412.799	6017.012	43.01
first nations	Metlakatla Tsimpsean 1	408.668	6018.791	30
first nations	Metlakatla Wilnaskancaud	417.611	6019.229	25.11
first nations	Metlakatla Tsimpsean 2	406.764	6019.284	45.04
first nations	Metlakatla Shoowahtlans	418.199	6020.652	17.24
first nations	Metlakatla and Lax Kw'alaams Bands Dashken	424.261	6001.2	12.12
first nations	Metlakatla and Lax Kw'alaams Bands Kshaoom	424.987	6000.447	28.22
first nations	Metlakatla Tugwell Island	402.116	6021.274	22.11
first nations	Metlakatla Tsimpsean 3	406.732	6024.589	64.07

5.2.3 Source Parameters

Each source modelled must be characterized with the physical attributes that affect the transport and dispersion of the emitted air contaminants. Table 5-2 provides the source parameters used in the model and Figure 5-4 shows the relative locations of the sources. While the marine vessels will use the existing berth at Ridley Terminals, the expected location of the gas engines was identified to SNC-Lavalin through a facility schematic provided by AltaGas. The rail locomotives are expected to use the existing trackage that brings trains to Ridley Terminals, with additional sidings that will be constructed as part of the Project.

Table 5-2: CALPUFF Source Parameters

Source	CALPUFF source representation	Parameter	Value	Notes
Gas engines (4)	Point sources	Exit (exhaust) temperature (K)	732.2	Exit velocity and temperature data from Caterpillar G3612 LE spec sheet. Stack height and diameter are conservative estimates made by SNC-Lavalin
		Exit velocity (m/s)	57.2	
		Stack dia (m)	0.5	
		Stack height (m)	8.0	
LNG carrier	Point source	Exit (exhaust) temperature (K)	618.0	Vessel source properties identified from Canada's Marine Emissions Inventory Tool (MEIT)
		Exit velocity (m/s)	20.0	
		Stack dia (m)	1.0	
		Stack height (m)	44.0	
Tugs (2)	Point source	Exit (exhaust) temperature (K)	618.0	Tug source properties identified by PRPA for the local tug operator for the port
		Exit velocity (m/s)	20.0	
		Stack dia (m)	0.3	
		Stack height (m)	6.0	
Rail locomotives	Volume source: split into 26 areas to represent the rail line	Effective height (m)	4.0	Emissions for the hour allocated along a 7.6 km length of track from the Project site through the community of Port Edward
		Effective radius (m)	0.22	
		Initial sigma Z (m)	3.4	
		Temperature (K)	359.0	
		Effective rise velocity (m/s)	6.8	
Flare	Point source	Stack height (m)	34	
		Stack diameter (m)	15	
		Exit temperature (K)	1,144.0	
		Exit velocity (m/s)	38.0	

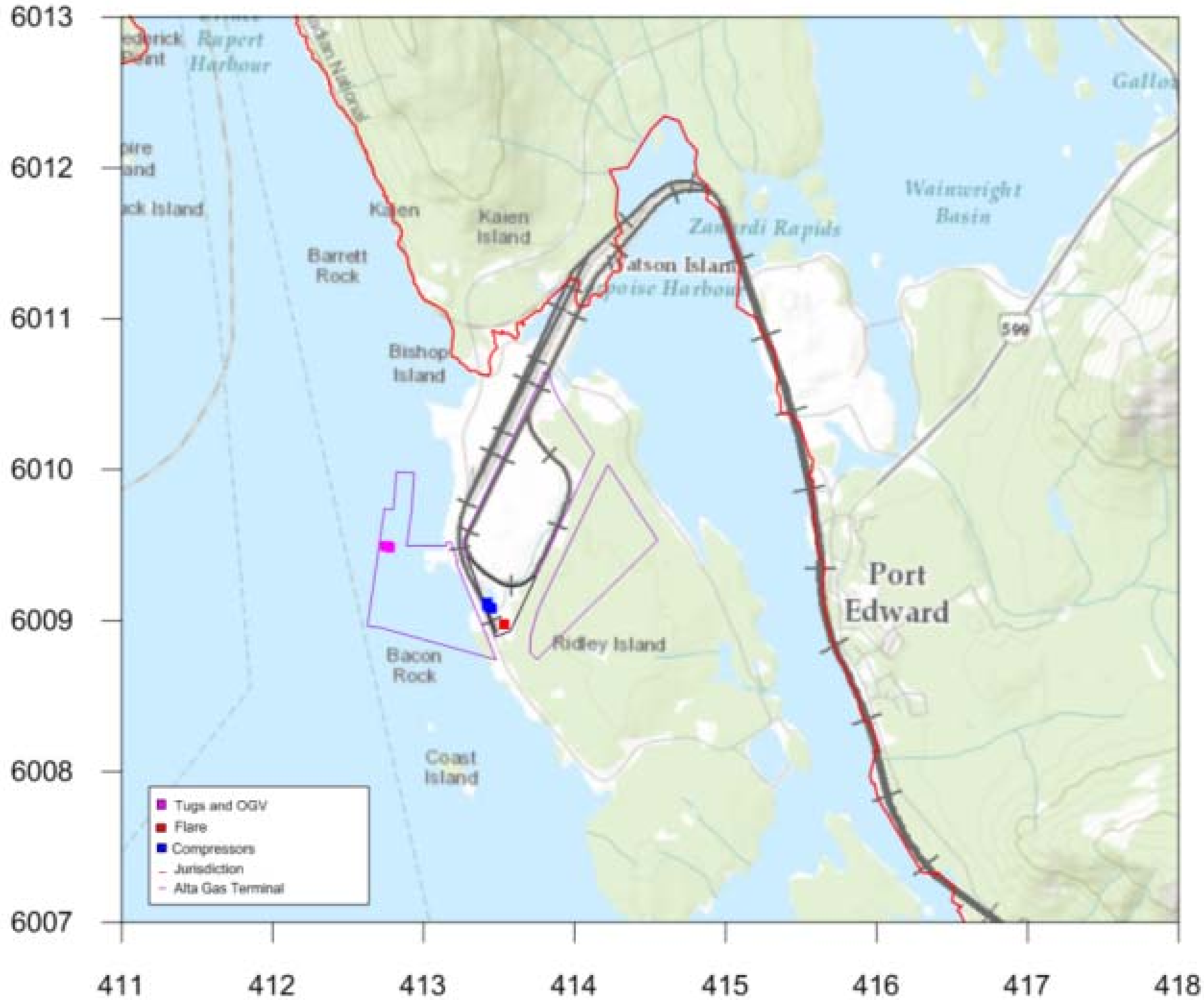


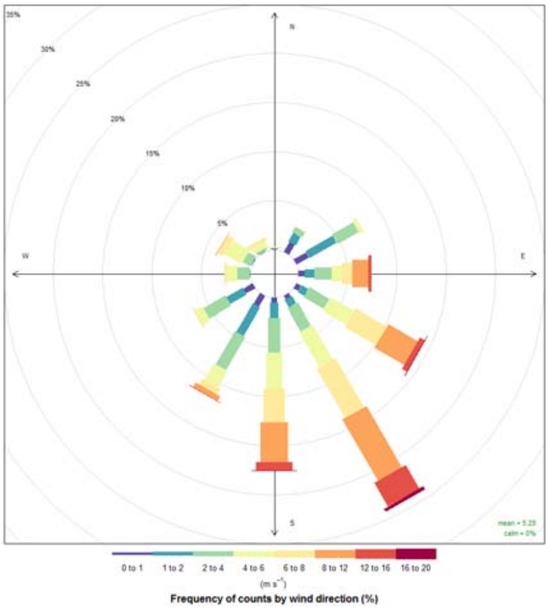
Figure 5-4: Project Source Locations

5.3 Model Validation

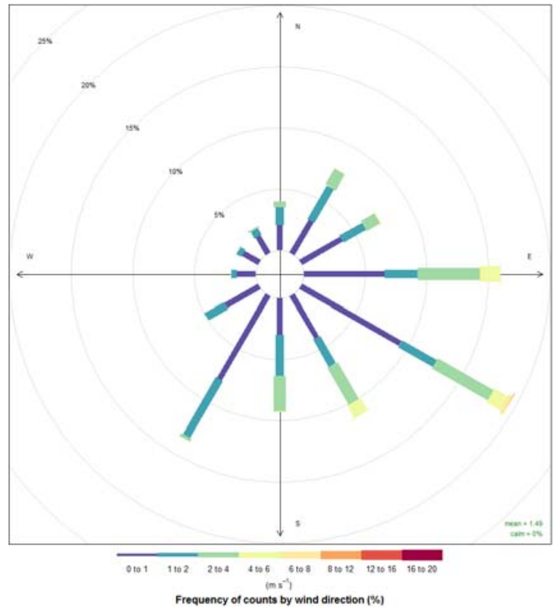
A number of model products can be viewed and assessed to check the validity of the air quality simulation. Most of these tests relate to the meteorological simulation (CALMET), to ensure that the simulated fields are reasonable in comparison to available observations. Other tests of the meteorological simulation are used to confirm errors did not occur during the configuration steps (e.g., terrain or land-use data was properly accepted by the model). Tests of the dispersion model itself are more difficult and only when all of the significant sources in a region are included in the modelling could the results be meaningfully compared to observations. For this reason, the model validation centers on the meteorological simulation.

A comparison of the modelled and measured winds at Westview and Roosevelt Park station locations is provided in Figure 5-5. Additional model validation is provided in Appendix I.

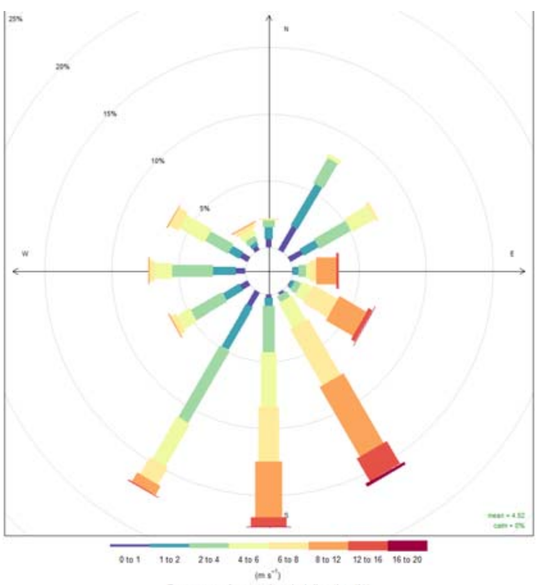
Westview Modelled



Westview Measured



Roosevelt Park Modelled



Roosevelt Park Measured

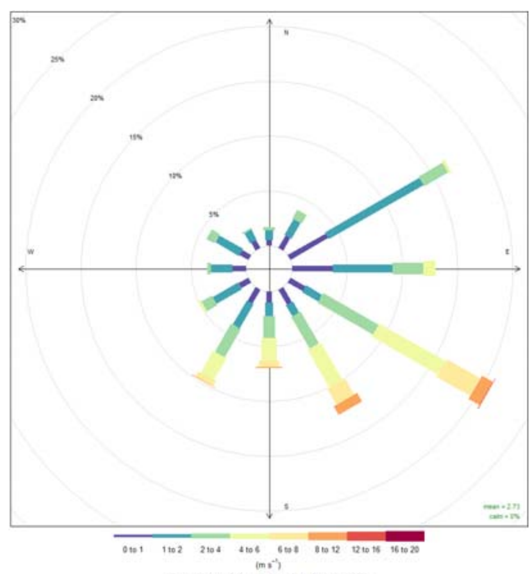


Figure 5-5: Comparison of Measured and Modelled Winds

6 MODELLING RESULTS

6.1 Compliance with AAQOs

The BC Dispersion Modelling Guidelines (BC_MOE, 2015) identify how dispersion modelling outcomes should be used to demonstrate compliance with the AAQOs. Simply put, the following procedure is to be used:

- Identify the maximum predicted concentrations over the year from the model at the averaging periods of interest.
- Add the monitoring background concentrations to account for all other sources.
- Compare the resultant values to the AAQOs.

The model predictions typically represent the maximum concentrations that could occur over any public lands. In this case, the public lands include any area beyond the port lands. Upon request of the PRPA, the maximum predictions are also made on any port lands beyond the RTI property.

6.2 NO_x to NO_2 Conversion

As previously noted, NO_x emissions include both NO and NO_2 and only NO_2 has associated AAQOs. While some of the NO_x (about 10 per cent) is directly emitted as NO_2, the remaining portion (NO) converts to NO_2 over time and distance from the point(s) of release. The BC guidelines have several identified conversion mechanisms to estimate how much of the NO is converted to NO_2. Each requires use of local ambient data to establish the representative rates. Ambient data for a one-year period or longer is required.

The following approach is to be used:

- Identify the maximum concentrations assuming 100 per cent of predicted NO_x concentrations are NO_2 (i.e., 100% conversion method)
- If the 100% conversion method implies exceedence, apply a less conservative NO_x to NO_2 conversion scheme

In the absence of available ambient data, more simplified conversion schemes can be applied as a sensitivity test to develop a range within which the maximum NO_2 prediction is expected to be[5]. These simpler conversion schemes assume 25% and 50% conversion of the total NO_x predictions. This approach was followed for the Project assessment due to lack of available ambient monitoring data.

[5] Approach identified by Dennis Fudge previously of the BC MoE in past air assessment work in the province, March 2013.

6.3 Modelling Outcomes

The CALPUFF model was used to determine the maximum predicted air quality concentrations within the study area for all averaging periods of interest (those with applicable AAQOs). The predictions were made for normal operations (Table 6.1) as well as upset conditions (Table 6.2). Upset conditions for the facility relate to use of the flare. Predictions for normal operations include all of the sources and emission rates identified in section 4.6, with the exception of the flare.

The maximum predicted ambient concentrations at the averaging periods of interest are shown in Table 6.1. The predicted concentrations are shown with and without the addition of the monitoring background concentrations. Maximum predictions associated with the flare emissions are limited to a 1-hour averaging period (since the flare would not be active over longer periods) and those air contaminants that are released in significant quantities (NO_x, SO_2, CO).

Table 6-1: Maximum Predicted Air Contaminant Concentrations (AAQOs in parentheses) – Normal Operations

Air Contaminant	Averaging Period	Maximum Predicted Concentration (µg/m^3) on Port Lands		Maximum Predicted Concentration (µg/m^3) on Public Lands	
		Max predicted	Max + background	Max predicted	Max + background
NO_2 (100% conversion)	1-hour[1] (188)	1,296.0	1,339.4	281.0	324.4
	Annual (60)	16.3	29.4	0.9	14.0
NO_2 (50% conversion)	1-hour[1] (188)	648.0	691.4	140.6	184.0
	Annual (60)	8.1	21.2	0.5	13.6
NO_2 (25% conversion)	1-hour[1] (188)	324.0	367.4	70.3	113.7
	Annual (60)	4.1	17.2	0.2	13.3
SO_2	1-hour (200)	28.7	36.6	7.9	15.8
CO	1-hour (14,300)	1,107	1,473.3	102.3	468.6
	8-hour (5,500)	335.9	673.6	20.5	358.2
$PM_{2.5}$	24-hour (25)	0.4	15.4	0.2	15.2
	Annual (8)	0.1	5.0	0.02	5.02
PM_{10}	24-hour (50)	16.2	36.2	0.5	20.5

Notes: [1] 99th percentile of daily 1-hour maximums over the year
[2] 98th percentile of daily 1-hour maximums over the year

Table 6-2: Maximum Predicted Air Contaminant Concentrations (AAQOs in parentheses) - Flare Only

Air Contaminant	Averaging Period	Maximum Predicted Concentration ($\mu g/m^3$) on Port Lands		Maximum Predicted Concentration ($\mu g/m^3$) on Public Lands	
		Model max	Max + background	Model max	Max + background
NO_2 (100% conversion)	1-hour[1] (188)	2.0	45.4	2.0	45.4
SO_2	1-hour[2] (200)	0.2	8.1	0.2	8.1
CO	1-hour (14,300)	59.0	425.3	34.0	400.3

Notes: [1] 99th percentile of daily 1-hour maximums over the year
[2] 98th percentile of daily 1-hour maximums over the year

Table 6-1 identifies predicted concentrations above the AAQOs for NO_2. These are discussed in the following section. Predicted concentrations associated with the flare are very low and are not further evaluated.

6.3.1 Spatial Distribution of Predicted Concentrations for Normal Operations

Plots of the maximum predicted ambient concentrations for normal operations are provided in Figures 6-1 to 6-7, showing contours of the predicted values. Where relevant, the contour associated with the AAQO is shown in red. For all plots, the contours represent the model predictions. The monitoring background concentration is identified in the title of the plot. The total predicted concentration at any location is therefore obtained by adding the background concentration to the contour level.

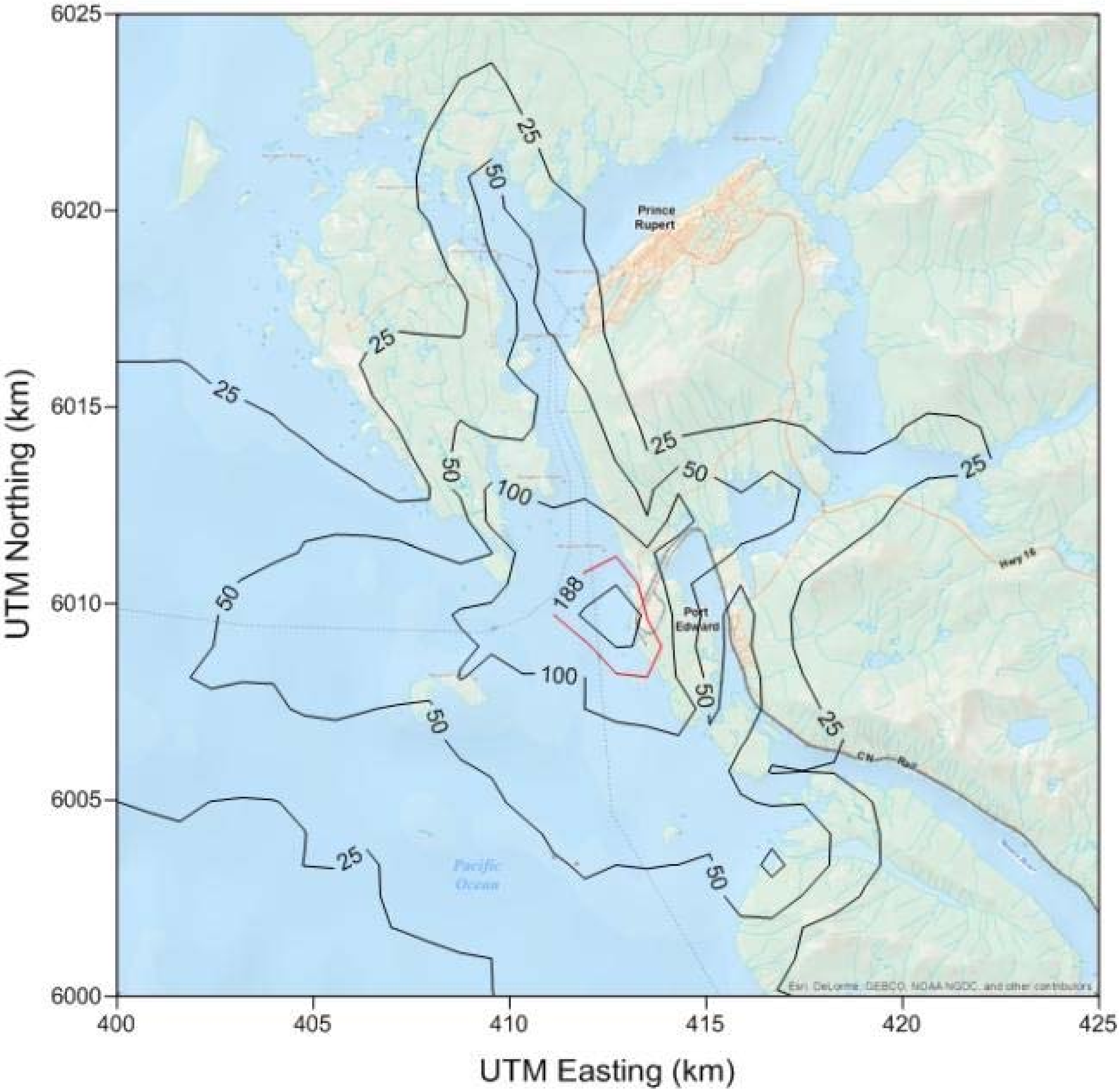


Figure 6-1a: Maximum Predicted 1-hour Concentrations of NO_2 (100% Conversion Method) (Background = 43.4 mg/m^3)

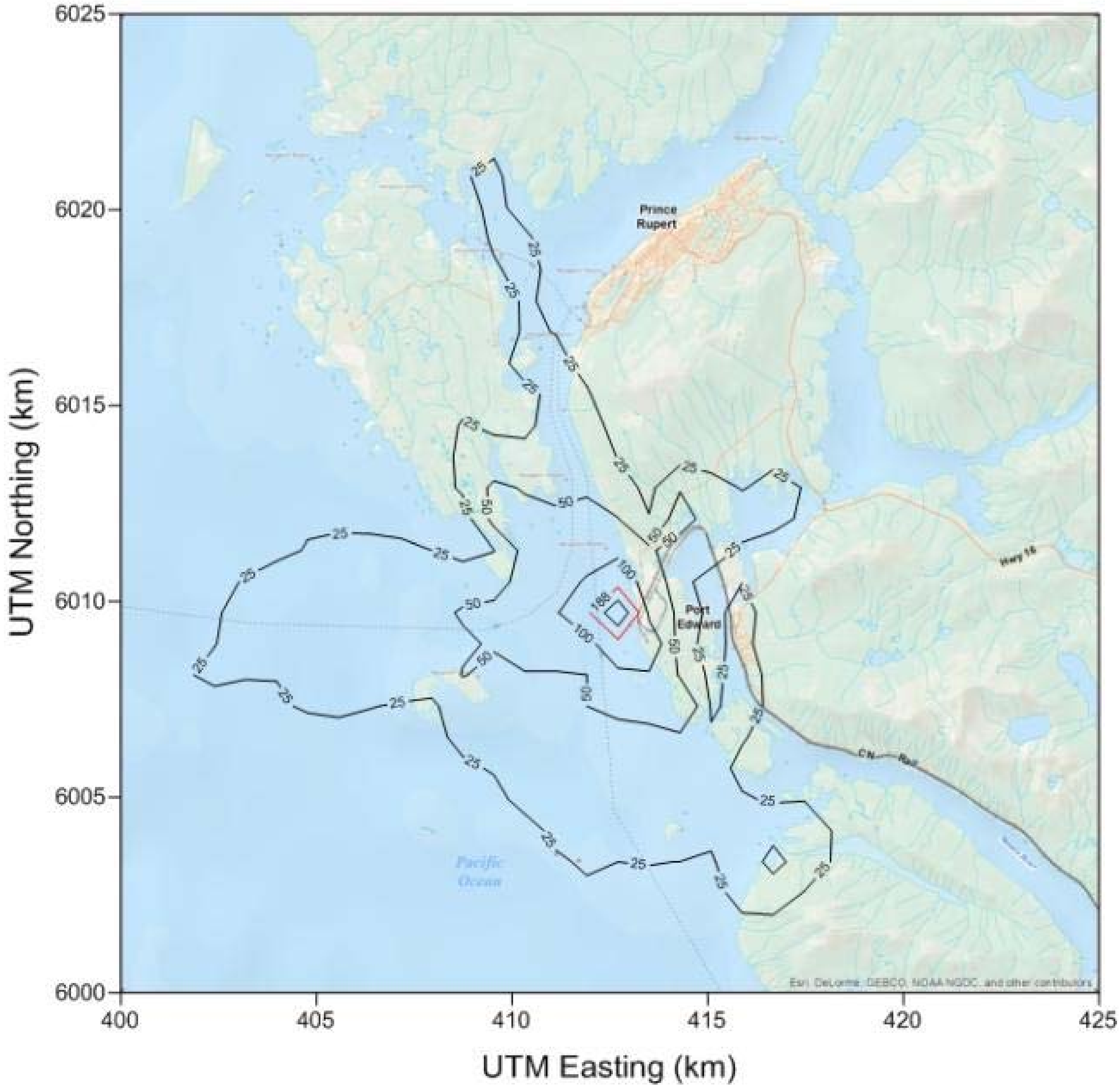


Figure 6-1b: Maximum Predicted 1-hour Concentrations of NO2 (50% Conversion Method) (Background = 43.4 mg/m^3)

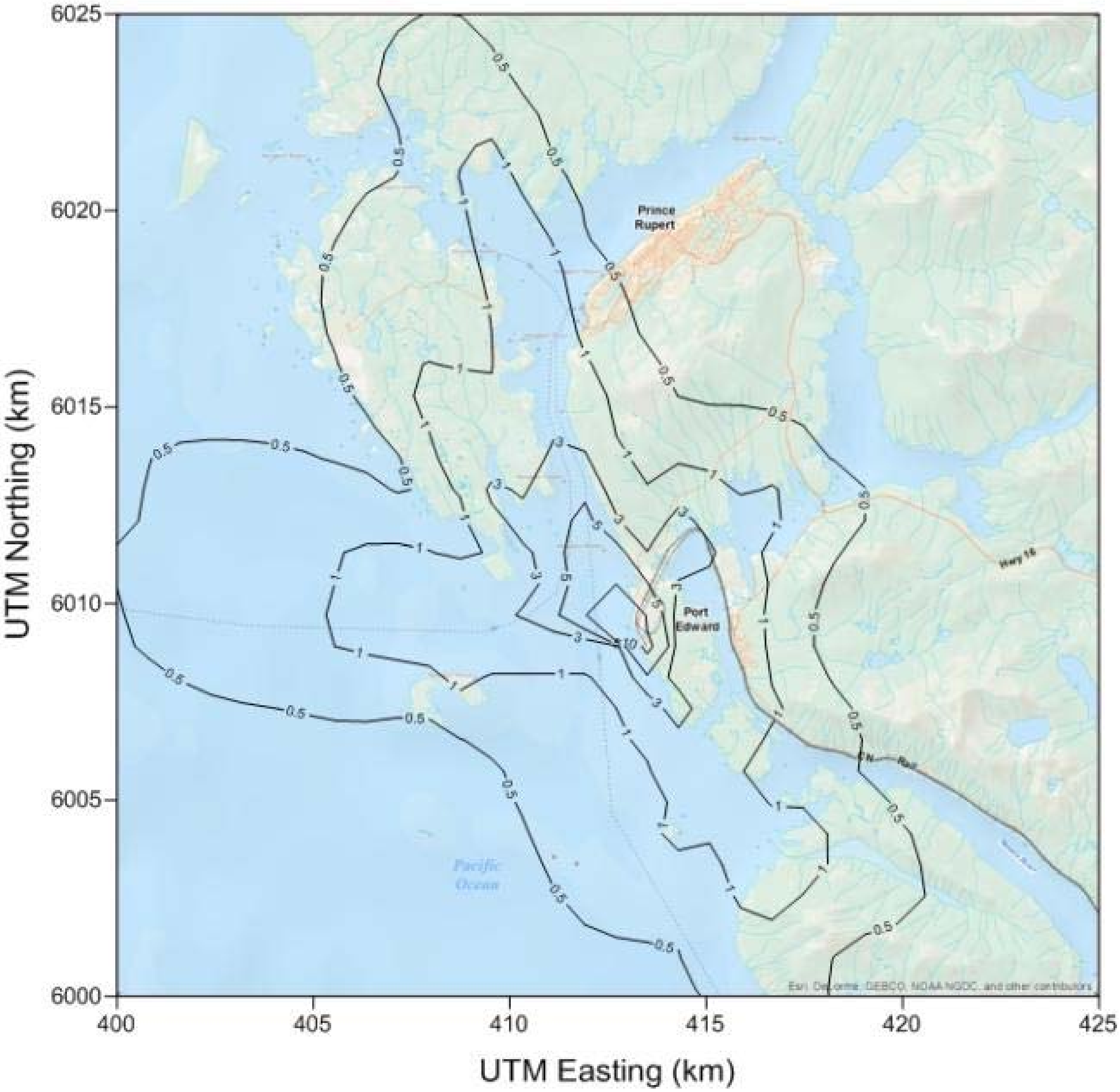


Figure 6-2: Maximum Predicted Annual Concentrations of NO2 (100% Conversion Method) (Background = 13.1 mg/m^3)

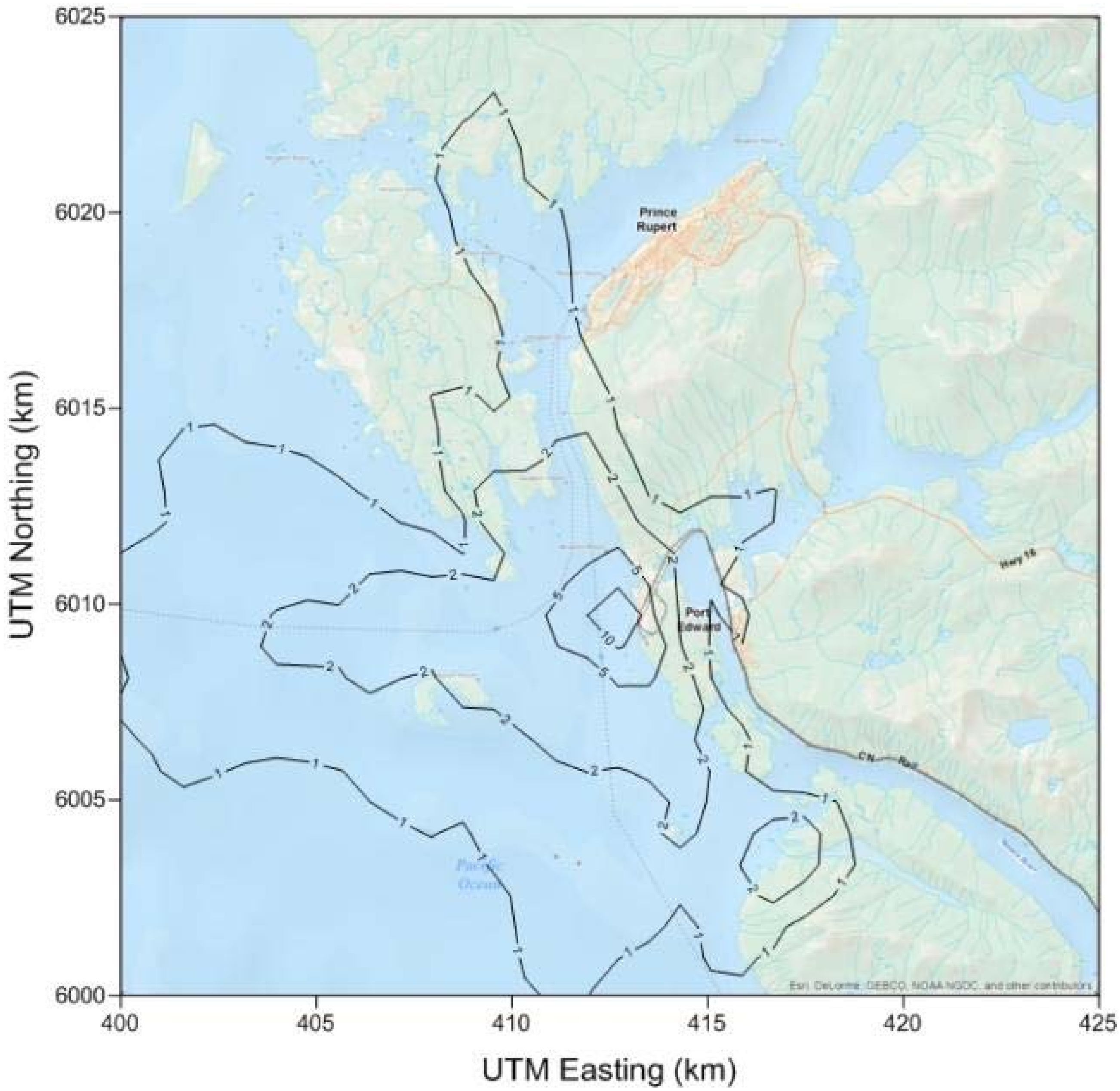


Figure 6-3: Maximum Predicted 1-hour Concentrations of SO2 (Background = 7.9 mg/m^3)

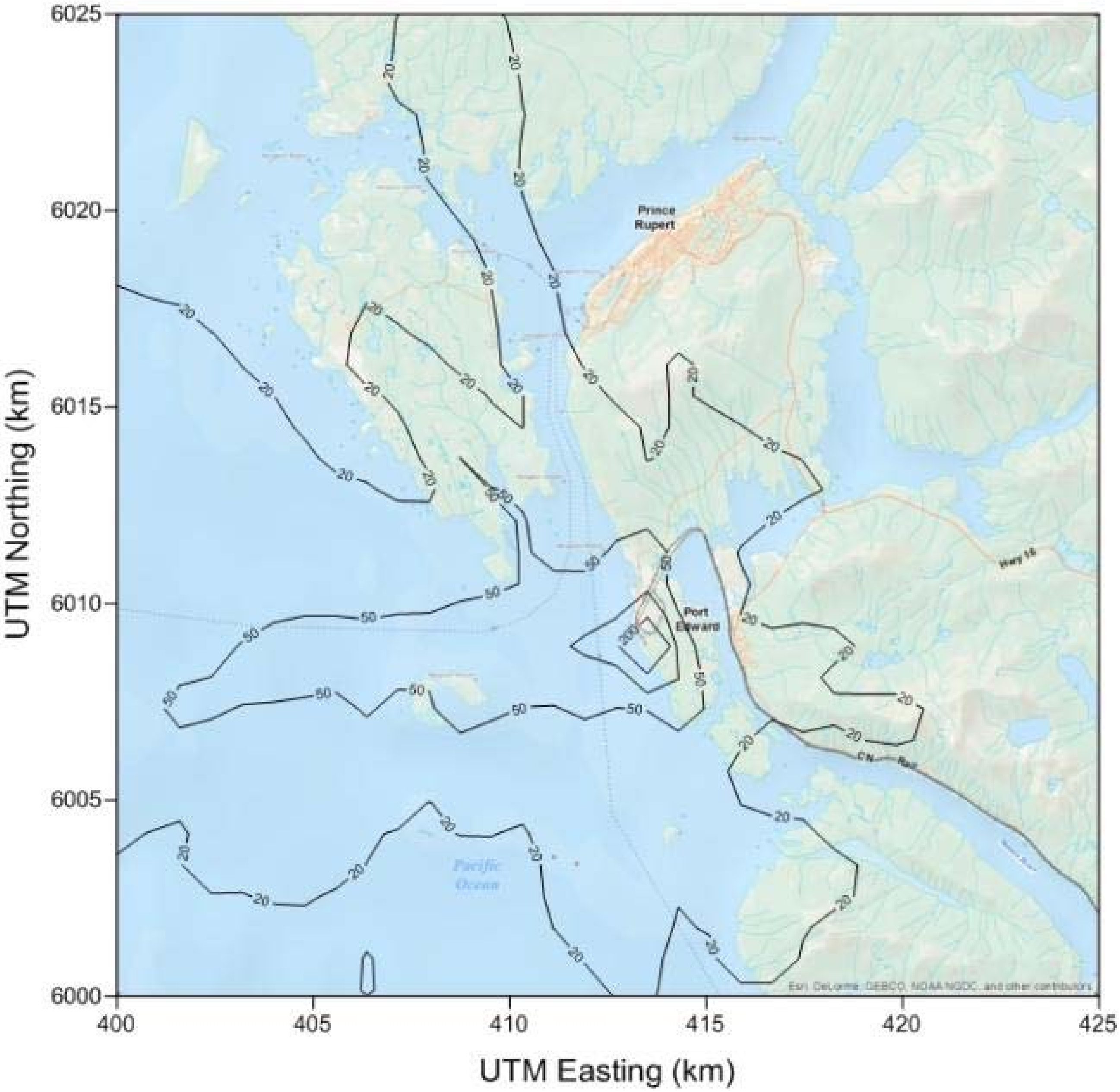


Figure 6-4: Maximum Predicted 1-hour Concentrations of CO (Background = 366.3 mg/m^3)

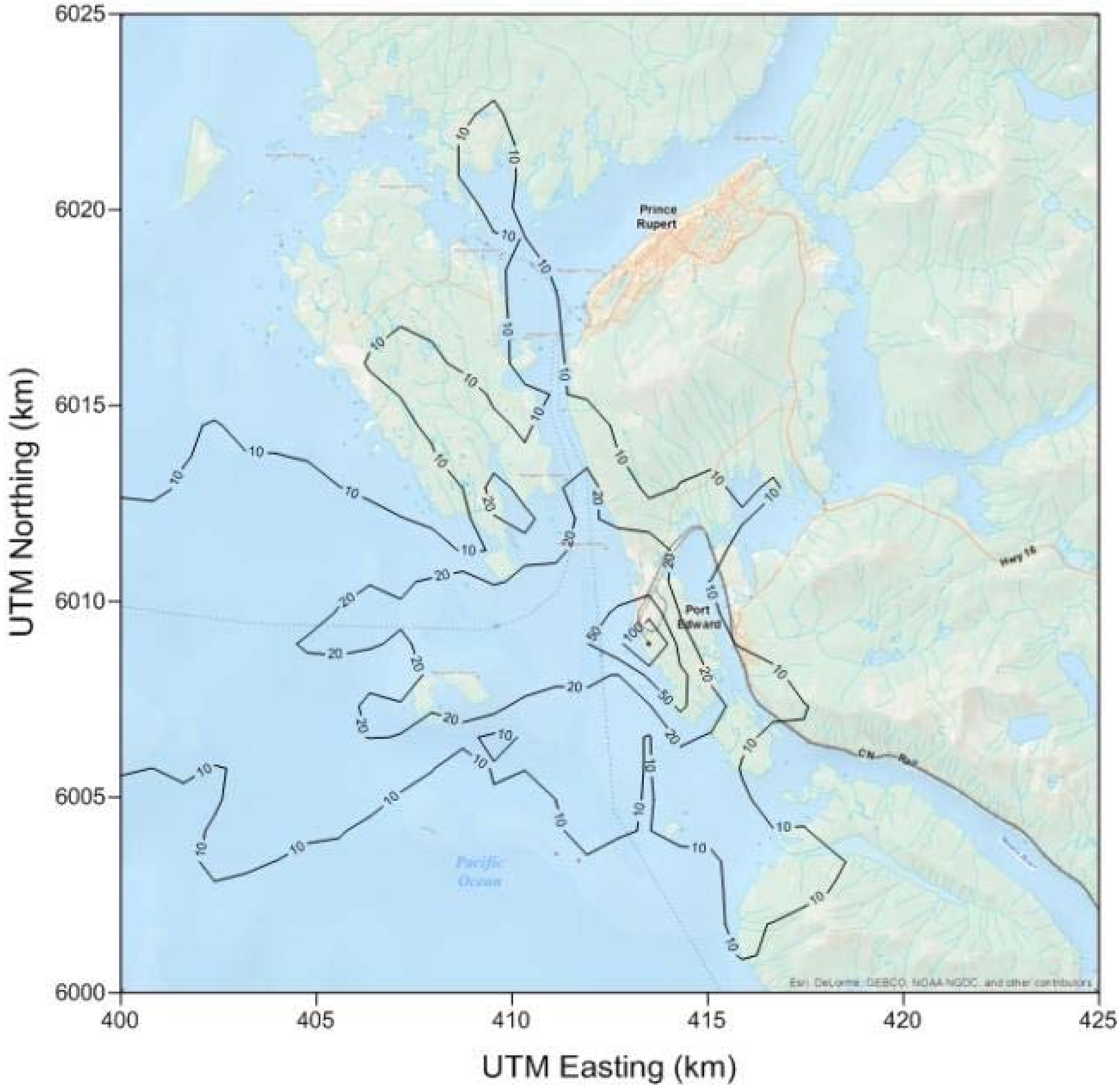


Figure 6-5: Maximum Predicted 8-hour Concentrations of CO (Background = 337.7mg/m^3)

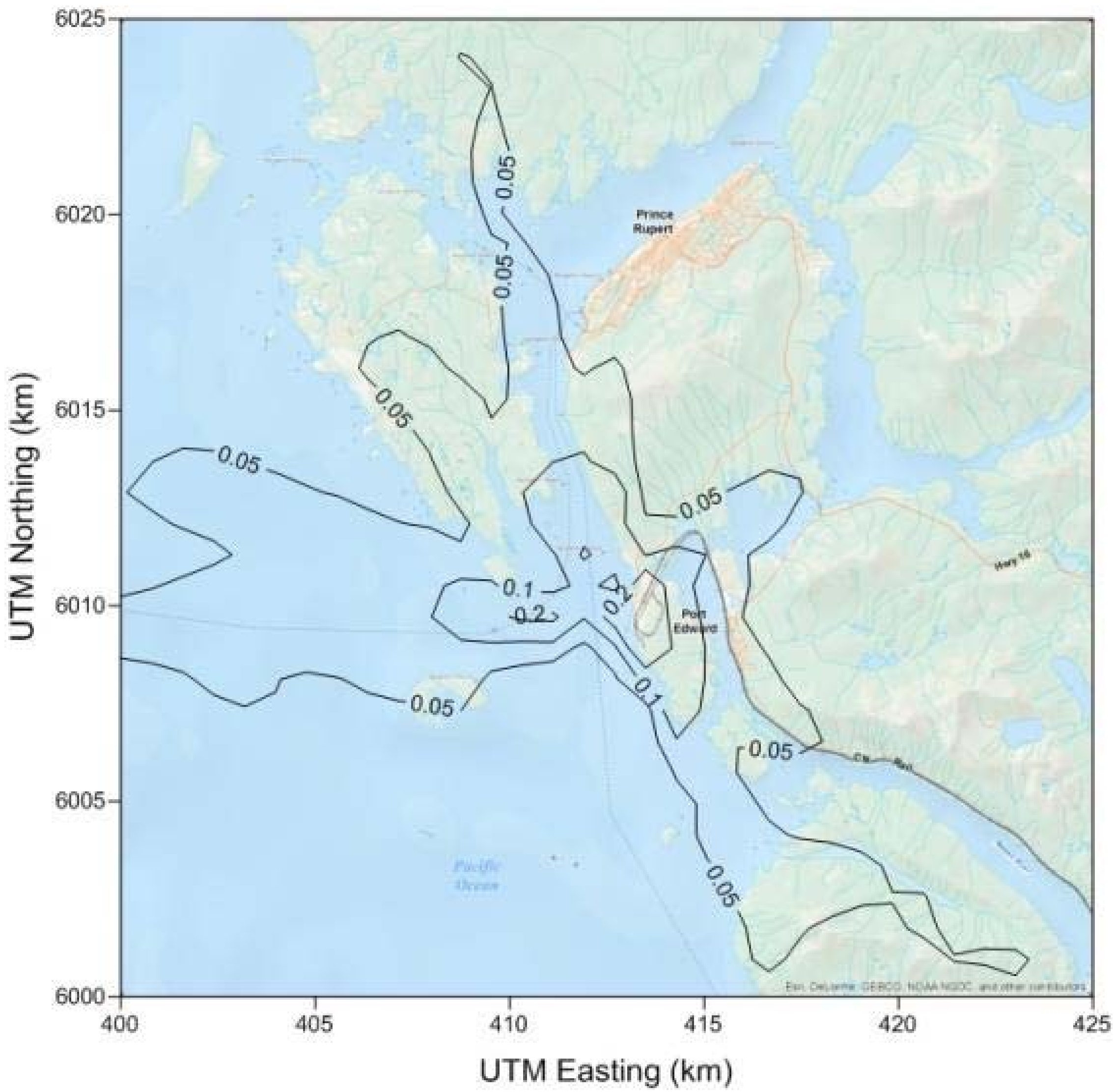


Figure 6-6: Maximum Predicted 24-hour Concentrations of PM2.5 (Background = 15.0 mg/m^3)

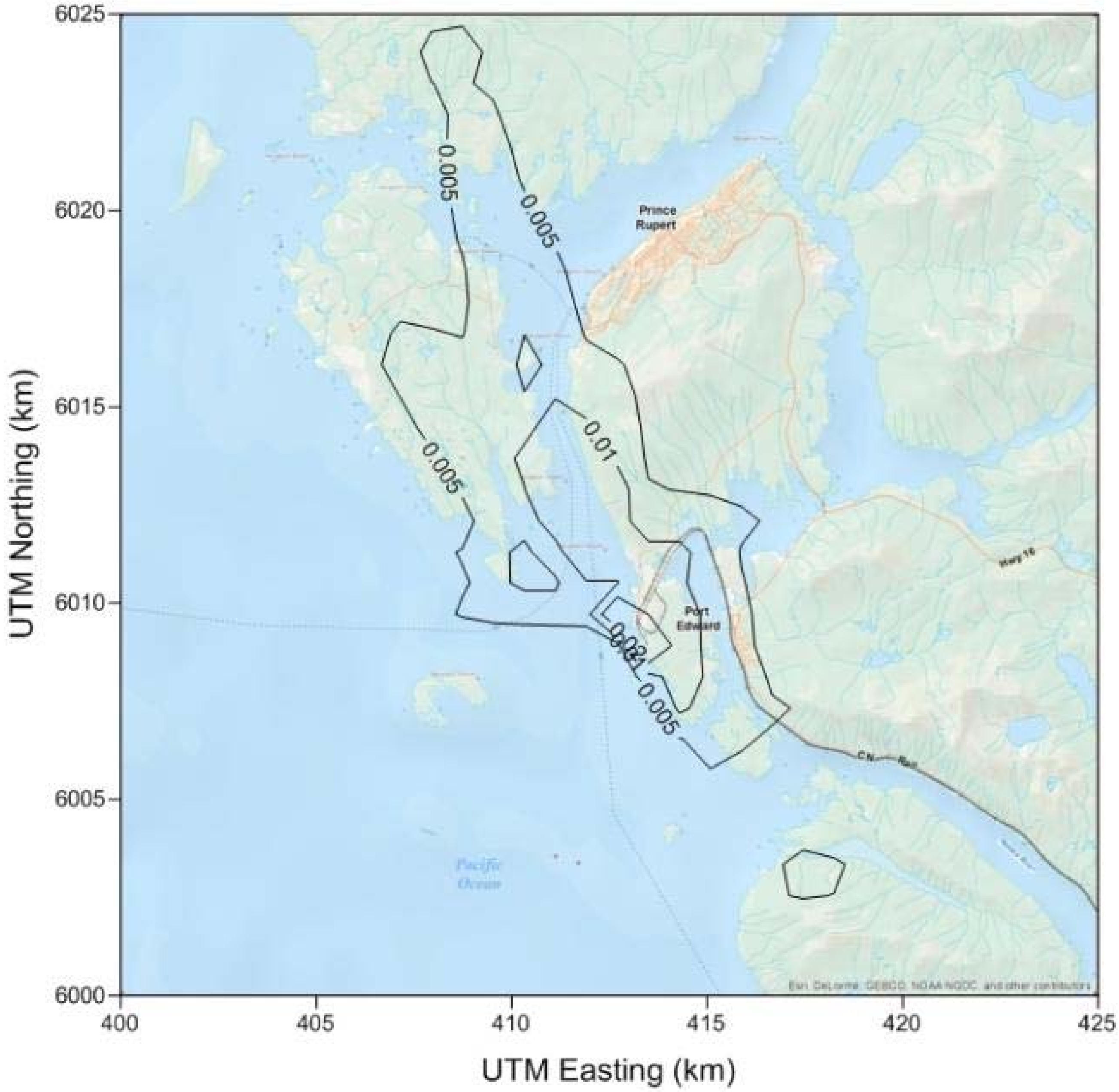


Figure 6-7: Maximum Predicted 24-hour Concentrations of PM10 (Background = 20.0 mg/m^3)

6.3.2 Evaluation of Predicted Exceedences

As noted in Table 6-1, exceedences of the AAQOs are identified for NO_2 (1-hour average concentrations). These situations are observed in greater detail in Figures 6-8 and 6-9.

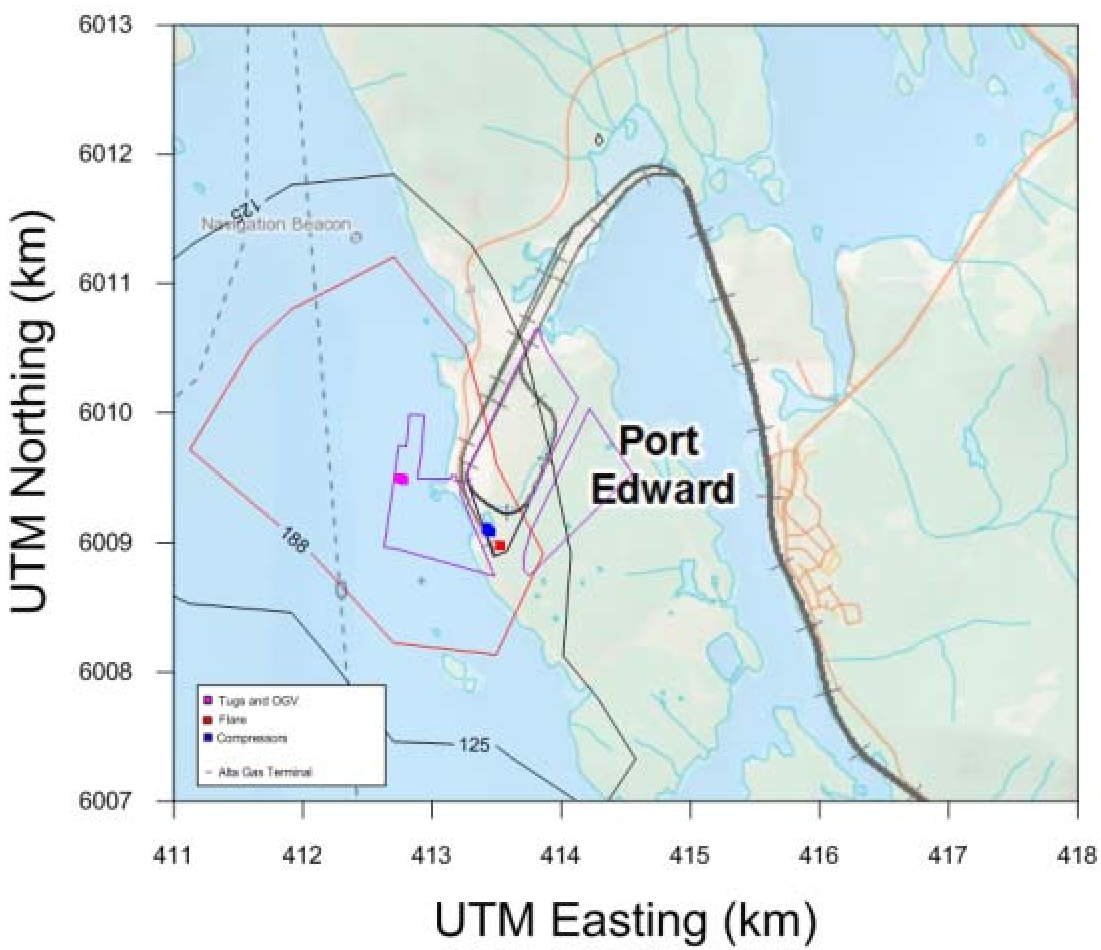


Figure 6-8: Maximum Predicted 1-hour Concentrations of NO2 near the Project site (100% Conversion Method) (Background = 43.4 mg/m^3)

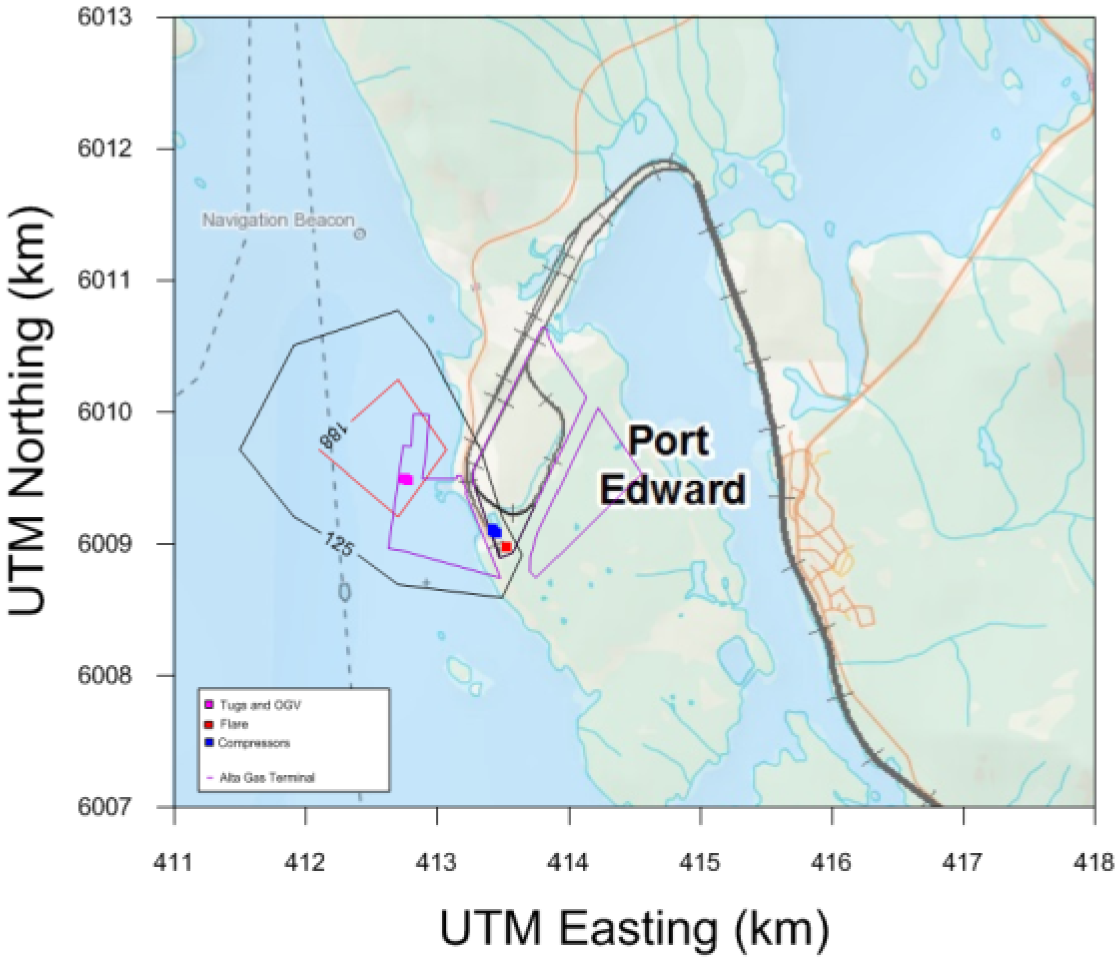


Figure 6-9: Maximum Predicted 1-hour Concentrations of NO2 near the Project site (50% Conversion Method) (Background = 43.4 mg/m^3)

The following conclusion is made:

- The NO_2 1-hour concentrations above the AAQO extend beyond the RTI grounds on Ridley Island to the southern tip of Kaien Island (when background is added) only when 100% conversion of NO to NO_2 is assumed. With assumption of 50% conversion, no exceedences are predicted on any public lands.

Further evaluation of the modelling results show that the tug emissions are primarily responsible for the predicted NO_2 exceedences (due to their low stack heights). Even if assuming 100% conversion of NO to NO_2, the exceedence of the 1-hour criteria on port lands adjacent to the berth are predicted to be infrequent (less than 0.5% of the time) and would tend to occur during light winds and low mixing heights, characteristic of the early morning hours of calm, cool days.

Due to the limited spatial extent of the predicted exceedences, and the conservative nature of the modelling, no actual exceedences of any applicable AAQOs are expected on public lands.

6.4 Predictions at Sensitive Receptors

Maximum modelled air quality concentrations are shown for the sensitive receptor locations in Table 6.2. As with the maximum predictions identified in Table 6.1, the maximum short-term emission rates were used for the 1-hour and 8-hour concentration predictions and the average short-term emission rates were used for the 24-hour and annual concentration predictions. In this case, only the 100% conversion method for NO to NO_2 is shown, since there are no predicted exceedences of the AAQOs with this conservative assumption.

Table 6-3: Maximum Predicted Air Concentrations in µg/m³ at Sensitive Receptors (AAQOs in parentheses)

Receptor	NO_2 (100%)	SO_2	CO	PM_{10}	$PM_{2.5}$
nearest residence 1	1-hr: 102 (188) ann: 0.4 (60)	1-hr: 1 (200)	1-hr: 29 (14,300) 8-hr: 5 (5,500)	24-hr: 0.2 (50)	24-hr: 0.06 (25) ann: 0.009 (6)
Port Edward Elementary	1-hr: 70 (188) ann: 0.3 (60)	1-hr: 1 (200)	1-hr: 19 (14,300) 8-hr: 3 (5,500)	24-hr: 0.2 (50)	24-hr: 0.05 (25) ann: 0.006 (6)
Kitson Island Marine Provincial Park	1-hr: 107 (188) ann: 0.1 (60)	1-hr: 3 (200)	1-hr: 33 (14,300) 8-hr: 8 (5,500)	24-hr: 0.2 (50)	24-hr: 0.03 (25) ann: 0.002 (6)
nearest residence 2	1-hr: 40 (188) ann: 0.5 (60)	1-hr: 1 (200)	1-hr: 20 (14,300) 8-hr: 4 (5,500)	24-hr: 0.2 (50)	24-hr: 0.06 (25) ann: 0.01 (6)
nearest residence 3	1-hr: 19 (188) ann: 0.2 (60)	1-hr: 1 (200)	1-hr: 9 (14,300) 8-hr: 2 (5,500)	24-hr: 0.1 (50)	24-hr: 0.04 (25) ann: 0.003 (6)
Metlakatla Tsimpsean 1	1-hr: 34 (188) ann: 0.2 (60)	1-hr: 1 (200)	1-hr: 14 (14,300) 8-hr: 3 (5,500)	24-hr: 0.1 (50)	24-hr: 0.03 (25) ann: 0.005 (6)
Metlakatla Wilnaskancaud	1-hr: 9 (188) ann: 0.1 (60)	1-hr: 0.2 (200)	1-hr: 7 (14,300) 8-hr: 1 (5,500)	24-hr: 0.05 (50)	24-hr: 0.01 (25) ann: 0.001 (6)
Metlakatla Tsimpsean 2	1-hr: 18 (188) ann: 0.2 (60)	1-hr: 0.5 (200)	1-hr: 12 (14,300) 8-hr: 3 (5,500)	24-hr: 0.1 (50)	24-hr: 0.03 (25) ann: 0.004 (6)
Metlakatla Shoowahtlans	1-hr: 9 (188) ann: 0.1 (60)	1-hr: 0.2 (200)	1-hr: 8 (14,300) 8-hr: 1 (5,500)	24-hr: 0.05 (50)	24-hr: 0.01 (25) ann: 0.001 (6)
Metlakatla and Lax Kw'alaams Bands Dashken	1-hr: 11 (188) ann: 0.1 (60)	1-hr: 0.3 (200)	1-hr: 7(14,300) 8-hr: 2 (5,500)	24-hr: 0.1 (50)	24-hr: 0.03 (25) ann: 0.002 (6)
Metlakatla and Lax Kw'alaams Bands Kshaoom	1-hr: 11 (188) ann: 0.1 (60)	1-hr: 0.3 (200)	1-hr: 9 (14,300) 8-hr: 2 (5,500)	24-hr: 0.1 (50)	24-hr: 0.04 (25) ann: 0.002 (6)
Metlakatla Tugwell Island	1-hr: 12 (188) ann: 0.1 (60)	1-hr: 0.3 (200)	1-hr: 13 (14,300) 8-hr: 2 (5,500)	24-hr: 0.1 (50)	24-hr: 0.03 (25) ann: 0.002 (6)
Metlakatla Tsimpsean 3	1-hr: 13 (188) ann: 0.2 (60)	1-hr: 0.4 (200)	1-hr: 18 (14,300) 8-hr: 3 (5,500)	24-hr: 0.1 (50)	24-hr: 0.03 (25) ann: 0.004 (6)

7 CONCLUSION

A detailed air quality assessment was completed for the proposed AltaGas propane export facility at the Port of Prince Rupert. The total Project emissions of criteria contaminants (CACs) and greenhouse gases (GHGs) were estimated using the Project-related criteria identified in the Project description and additional information supplied to SNC-Lavalin by AltaGas as well as logical assumptions that could be applied to the transportation sources associated with moving propane to and from the terminal. The total estimated annual emissions for the terminal are shown in Table 7-1.

When active, the Project emissions would represent approximately 2 – 15 per cent of the Port total emissions (Port emissions were obtained for the 2013 calendar year), with the exception of CO and VOCs. The Project CO and VOC emissions would account for approximately 50 per cent of the Port of Prince Rupert total. The reason for the higher contribution to total CO and VOC emissions is due to relatively few significant sources of these air contaminants currently at the port. If the total community emission sources were added to this comparison, their relative contribution would fall dramatically.

Table 7-1: Total Annual Project Emissions

Source	Emissions (kg)								
	NO_x	SO_x	CO	VOC	PM_{10}	$PM_{2.5}$	NH_3	CO_2	CO_2e
LPG Carrier – Underway	1,966	49	153	62	29	26	1	83,772	99,761
LPG Carrier – Manoeuvre	2,192	77	173	63	40	37	0	130,215	220,895
LPG Carrier - Berthing	32,508	1,956	2,617	1,001	922	848	3	3,310,778	3,980,192
Tugs – Manoeuvre	1,354	39	106	39	22	20	0	65,590	81,604
Tugs - Escort	1,354	39	106	39	22	20	0	65,590	81,604
Rail Locomotives	2,241	1	358	102	68	66	4	135,719	198,124
Gas Engines	48,979	1,043	174,926	42,682	10,148	41	966	10,949,203	11,187,700
Flare	126.5	10	695	96	249	249	n/a	763,160	917,710
Total ()	**90,721**	**3,214**	**179,134**	**44,084**	**11,500**	**1,307**	**974**	**15,504,028**	**16,767,590**

The Project GHG emissions can also be compared to the total provincial and national GHG totals for further relevance. The provincial and national GHG totals for the most recent calendar year (2013) are 65 million tonnes and 726 million tonnes CO_2e, respectively (Environment Canada, 2015). The Project GHG emissions, as indicated by CO_2e, constitute 0.03% and 0.0002% of the provincial and national totals, respectively. Since emissions from international ships are not included in the provincial and national totals, the effective contribution of the Project to the provincial and national GHG totals will be lower than these values.

Air quality modelling was also conducted as part of the study to demonstrate compliance with the provincial standards (AAQOs). The Project sources were found to have some (infrequent) potential to cause exceedences of the 1-hour NO_2 AAAQO, but only on port lands immediately adjacent to the RTI property (by the wharf). Since the port lands are not generally accessible by the public, these may not be considered true exceedences of the provincial criteria.

8 REFERENCES

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Appendix I – Additional AQ Model Validation

CALPUFF Model Settings

The non default model settings for the CALMET and CALPUFF models are identified in the following two sections.

CALMET

Option	Parameter	Guideline Value*	Value Used	Comments/Justification
Determines whether observation data are used, or in combination with NWP model output, or NWP data only	NOOBS	0, 1 or 2	2	just NWP output
Extrapolate surface wind observations to upper layers?	IEXTRP	–4	1	no extrapolation is done
Extrapolate calm winds aloft?	ICALM	0 or 1	0	no extrapolation is done
Layer-dependent biases.	BIAS	varies	0,0,0,0,0,0, 0,0,0,0,0,0, 0,0,0	zero BIAS leaves weights unchanged
Gridded prognostic wind field model output fields.	IPROG	0, or 14	14	used winds from MM5/3D.DAT file as initial guess field
Use varying radius of influence?	LVARY	F	T	Not applicable
Maximum radius of influence over land of the surface layer.	RMAX1	varies	30	Not applicable
Maximum radius of influence over land aloft.	RMAX2	varies	30	Not applicable
Maximum radius of influence over water.	RMAX3	varies	50	Not applicable
Radius of influence of terrain features.	TERRAD	varies	5	No default exists. In units of km.

Distance from a surface station at which the station observations and the first-guess field are equally weighted.	R1	varies	3	Not applicable
Distance from an upper station at which the observation and the first-guess field are equally weighted.	R2	varies	5	Not applicable
Maximum number of stations used in each layer for the interpolation of data to a grid point.	NINTR2	99	5,5,5,5,5,5, 5,5,5,5,5,5, 5,5,5	Not used.
Number of barriers to interpolation of the wind fields.	NBAR	0 depends	0	Not used.
Level (1 to NZ) up to which barriers apply.	KBAR	varies	10	Not used.
X and Y coordinates of barriers.	XBBAR YBBAR XEBAR YEBAR	varies	0,0,0,0	Not used.
Diagnostic module surface met station to use.	ISURFT	-1	-2	Not used.
Diagnostic module upper air station to use for lapse rate.	IUPT	-1	-2	Not used.

*Values enclosed in black, dark grey, or light grey correspond to the MoE guidance of "do not touch", "recommended default", or "expert judgement required to determine", respectively (*Guidelines for Air Quality Dispersion Modelling in British Columbia*, 2015).

CALPUFF

Option	Parameter	Guideline Value*	Value Used	Comments/Justification
Stack-tip downwash?	MTIP	1 or 2	1	Stack-tip downwash modelled.
Method used to simulate building downwash?	MBDW	1 or 2	2	PRIME method used.
Chemical transformation scheme.	MCHEM	0 or 6	0	Chemical transformation not modeled.
Aqueous-phase transformation flag (only used if MCHEM = 1 or 3)	MAQCHEM	1	0	Aqueous phase transformation not modeled.
Wet removal modelled?	MWET	0 or 1	0	Wet deposition not modelled.
Dry deposition modelled?	MDRY	0 or 1	0	Dry deposition not modelled.
Gravitational settling (plume tilt)?	MTILT	0 or 1	0	Gravitational settling not modelled.
Probability distribution function used for dispersion under convective conditions?	MPDF	0 or 1	1	Used since MDISP = 2.
Sub-grid TIBL module used for shoreline?	MSGTIBL	0 or 1	0	Not used.
Boundary conditions (concentration) modelled?	MBCON	0	0	Not used.
Configure for FOG Model output?	MFOG	0	0	Not used.
Test options specified to see if they conform to regulatory values?	MREG	0	0	Not used.

*Values enclosed in black, dark grey, or light grey correspond to the MoE guidance of "do not touch", "recommended default", or "expert judgement required to determine", respectively (*Guidelines for Air Quality Dispersion Modelling in British Columbia*, 2015).

NWP Comparisons

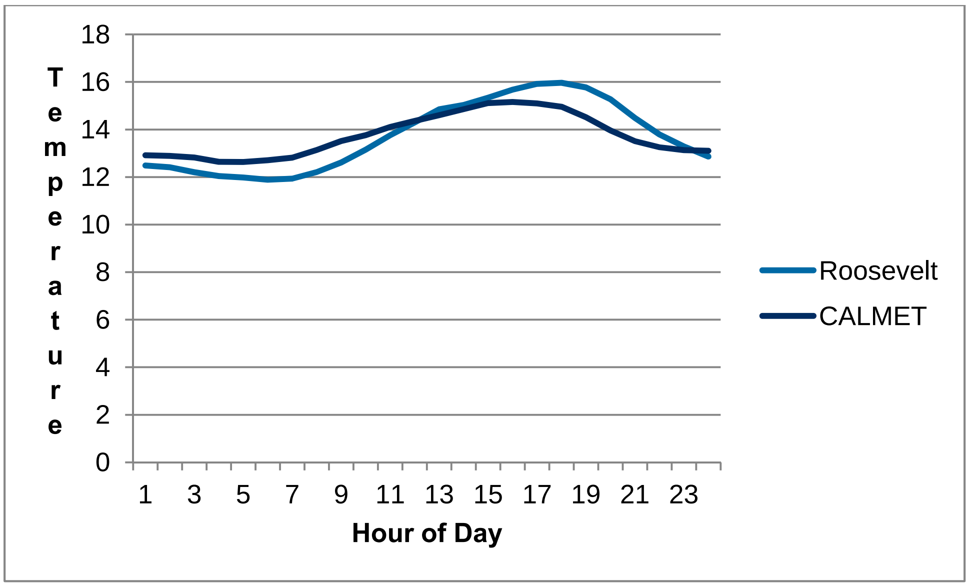
A number of checks were made on the CALMET meteorological fields produced from the WRF input data. These checks are defined as follows:

- Identify the diurnal temperature profile for one location in the modelling domain. Check for reasonableness
- Frequency distribution of modelled wind speeds at a station location. Compare to observed.

- For different 24 hr periods within summer and winter, plot a surface, mid level and upper level wind field for a period with light winds and stable conditions. Check for extent of terrain effects, reasonableness of wind flow (not necessarily documented in report)

Temperature Comparison

Figure 1 shows that the modelled and observed average hourly temperatures during the months of August and December compare reasonably well. The average temperatures are very similar in August whereas CALMET has a slight bias (warmer) of about 0.5°C during December.



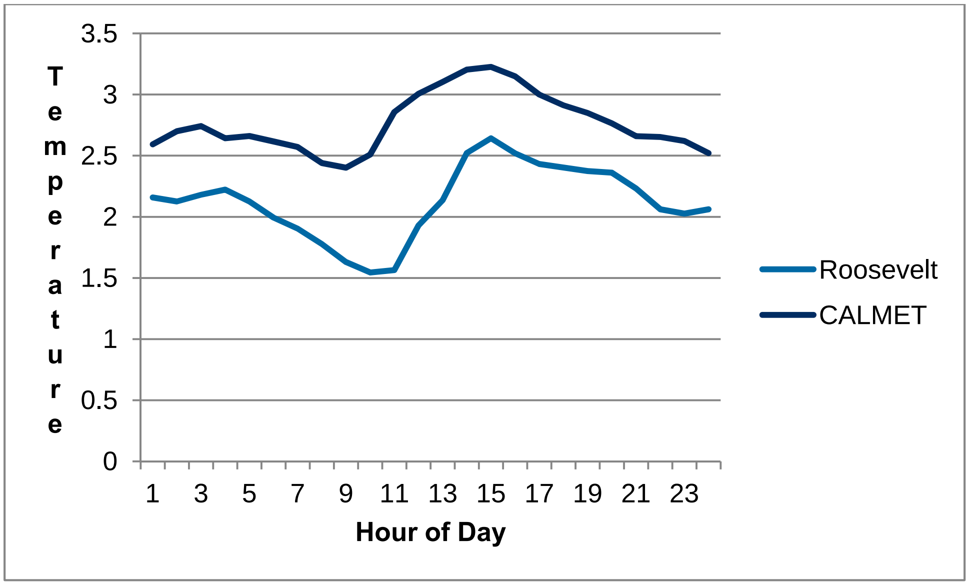
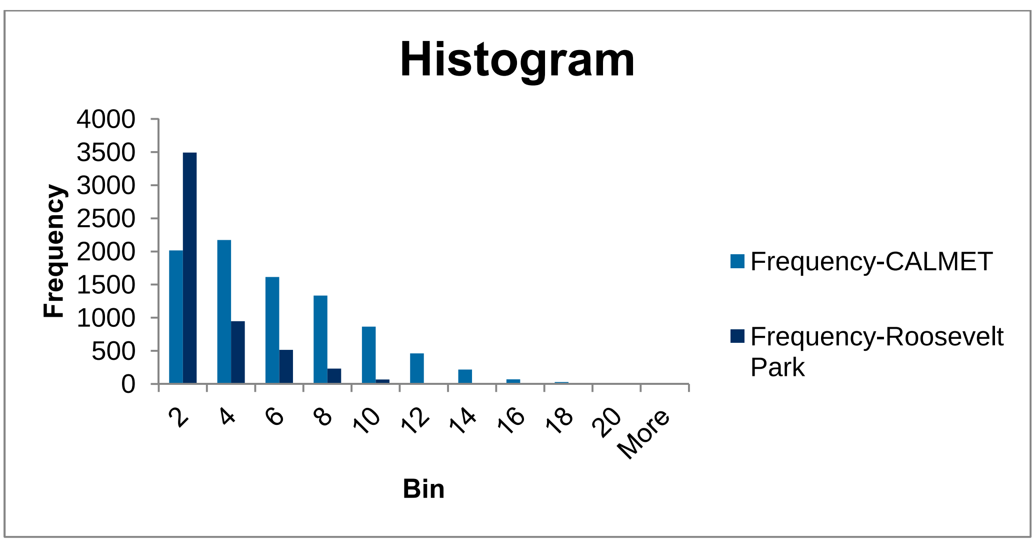


Figure 1: Average Diurnal Temperature Profile for Roosevelt Station in Prince Rupert. August 2012 (top), December 2012 (bottom)

Wind Speed Frequency

Figure 2 shows that the CALMET derived winds have a much higher frequency of high wind speeds and lower frequency of low wind speeds, compared to the station observations.



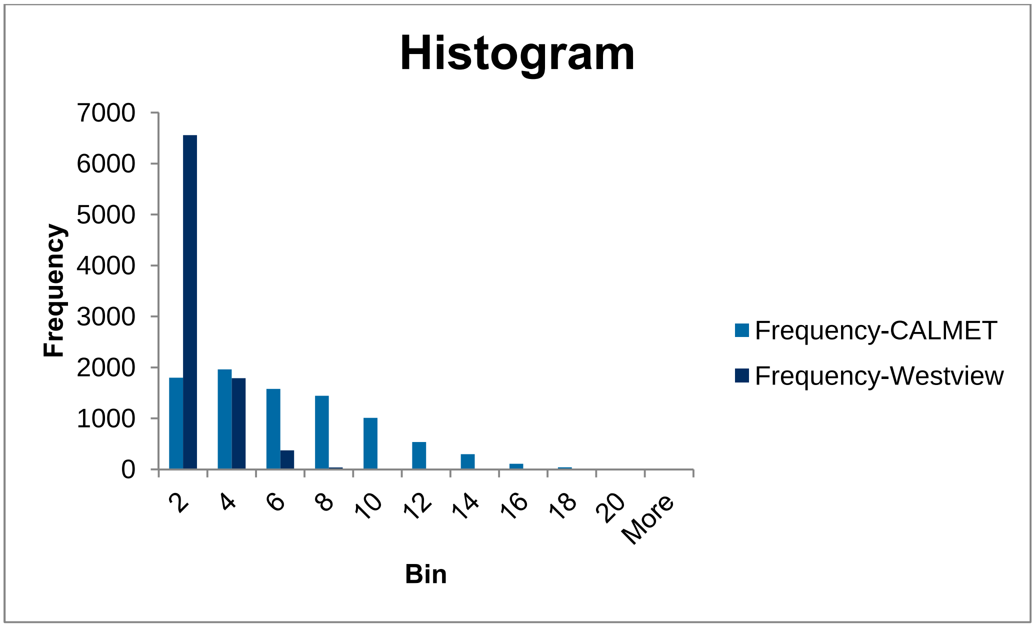


Figure 2: Wind Speed Frequency Comparison for Roosevelt (top) and Westview (bottom) Stations vs CALMET

Wind Field

Figures 3 and 4 show plots of the surface wind vectors over the modelling domain. Figure 3 shows the winds on April 15 at 5 am. At this time the winds are light in general with higher speeds at the upper elevations. Some channelling is evident through the valleys. Figure 4 shows the winds on August 15 at 5 pm. At this time the opposite flow is observed again with some channeling of the winds onshore winds through the inlets and valleys.

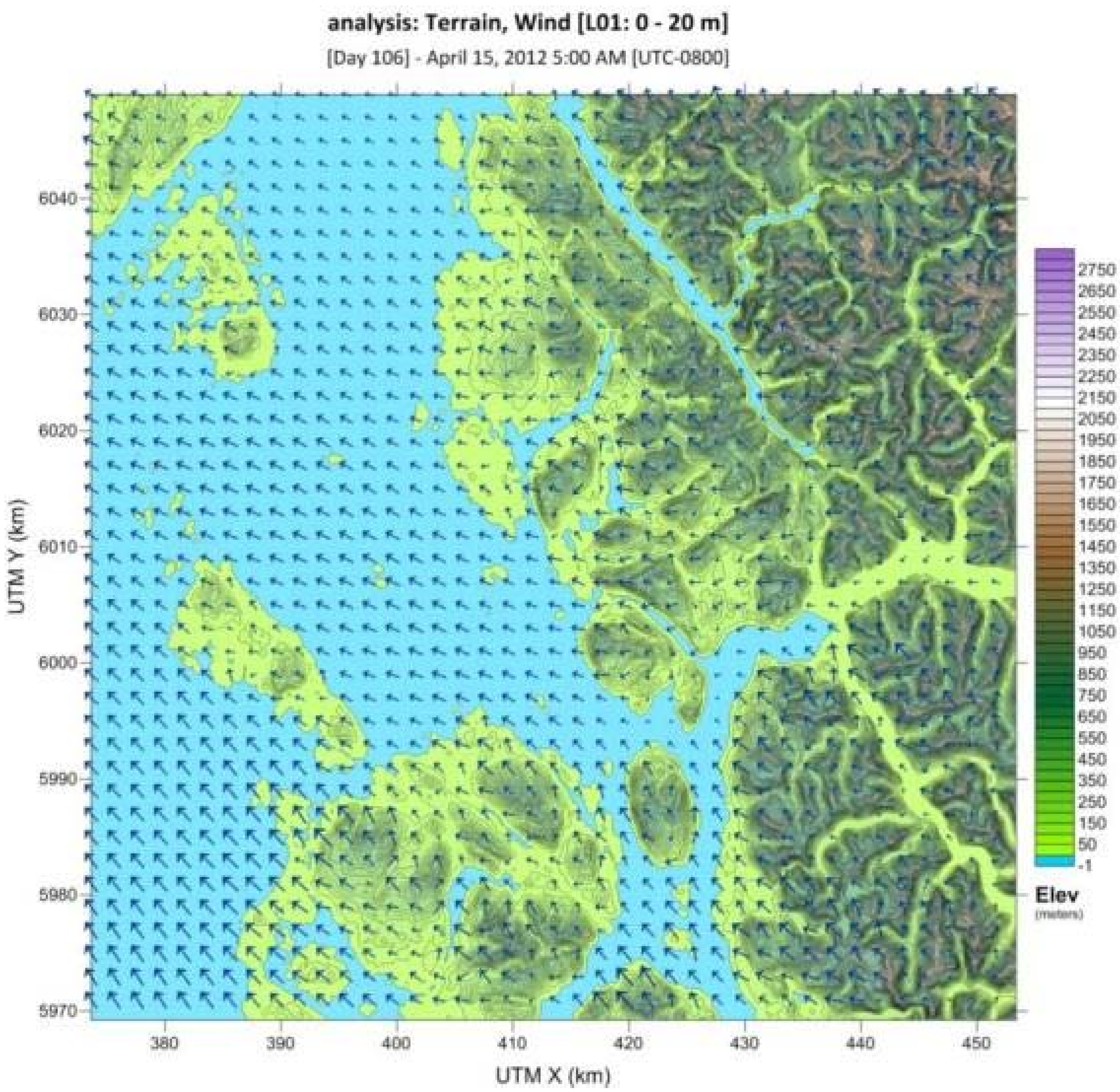


Figure 3: Surface Wind Vectors on April 15, 5 am

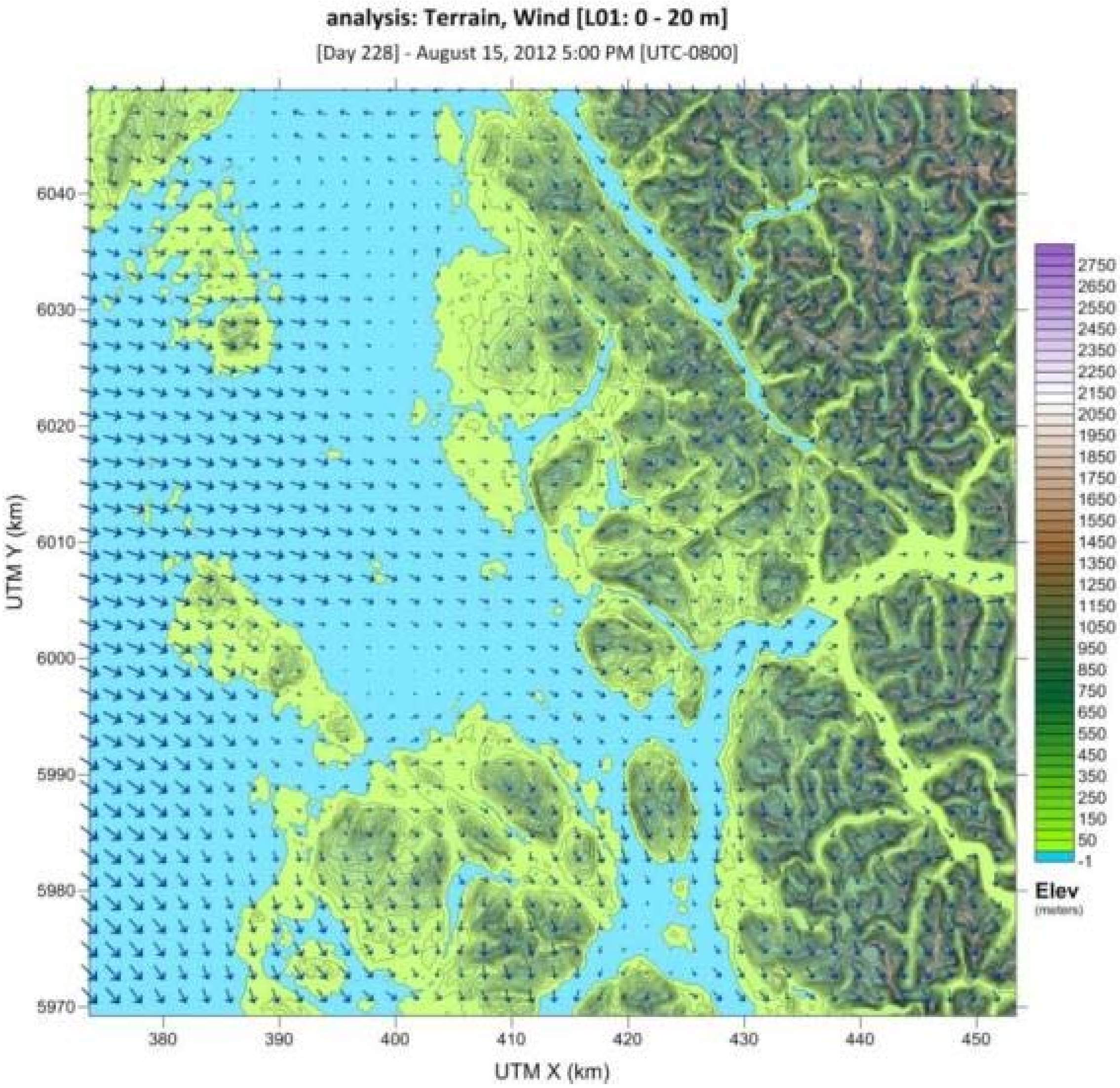


Figure 4: Surface Wind Vectors on August 15, 5pm

Appendix II – NIR GHG Emission Rates

EC fuel based Emission Factors (EC NIR 2015). Units in g/litre

Table 1: NIR GHG Emission Factors (g/litre)

Fuel type	Source Group	Equipment Type	CO_2 (0% renewable)	CO_2 (100% renewable)	CH_4	N_2O
Diesel	Admin	All	2,690	2,474	0.150	1.100
	CHE	All	2,690	2,474	0.150	1.100
	Onroad	Passenger car, <2004	2,690	2,474	0.100	0.160
		Passenger car, 2004-2006	2,690	2,474	0.068	0.210
		Passenger car, >2006	2,690	2,474	0.051	0.220
		Passenger truck, <2004	2,690	2,474	0.0858	0.160
		Passenger truck, 2004-2006	2,690	2,474	0.068	0.210
		Passenger truck, >2006	2,690	2,474	0.068	0.220
		Commercial trucks and buses, <2004	2,690	2,474	0.150	0.075
		Commercial trucks and buses, 2004-2006	2,690	2,474	0.140	0.082
		Commercial trucks and buses, >2006	2,690	2,474	0.110	0.151
	Rail	All	2,690	2,474	0.150	1.100
Gasoline	Admin	All	2,316	1,509	2.700	0.050
	CHE	All	2,316	1,509	2.700	0.050
	Onroad	Passenger car, <1996	2,316	1,509	0.320	0.660
		Passenger car, >1996	2,316	1,509	0.14	0.022
		Passenger truck <1996	2,316	1,509	0.210	0.660
		Passenger truck, >1996	2,316	1,509	0.140	0.0220
		Commercial trucks and buses	2,316	1,509	0.490	0.084

Fuel type	Source Group	Region	CO_2	CH_4	N_2O
Heavy fuel oil	Marine	All	3,156	0.280	0.079
Marine distillate oil	Marine	All	2,753	0.260	0.073
Marine gas oil	Marine	All	2,690	0.15	1.1
Light Fuel Oil	Non-marine	All	2,753	0.026	0.031
Heavy Fuel Oil	Non-marine	All	3,156	0.057	0.064
Natural gas*	Admin	Alberta	1.928	0.000037	0.000035
		British Columbia	1.926	0.000037	0.000035
		Manitoba	1.886	0.000037	0.000035
		Northwest Territories	2.466	0.000037	0.000035
		Ontario	1.888	0.000037	0.000035
		Quebec	1.887	0.000037	0.000035
		Saskatchewan	1.829	0.000037	0.000035
		Yukon	1.901	0.000037	0.000035
		New Brunswick	1.901	0.000037	0.000035
		Nova Scotia	1.901	0.000037	0.000035
		Newfoundland and Labrador	1.901	0.000037	0.000035
		Rest of Canada	1.947	0.000037	0.000035
	CHE	All	1.9	0.009000	0.000060
	Marine	All	1.9	0.009000	0.000060
	Onroad	All	1.9	0.009000	0.000060
Propane	Admin	All	1,515	0.024	0.108
	CHE	All	1,515	0.640	0.028
	Onroad	All	1,515	0.640	0.028

* Natural gas rates are for standard temperature and pressure.

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