Draft Ridley Island Export Logistics Park Project

Environmental Effects Evaluation in Support of a Section 82 Mitigation Measures Form

July 27, 2020

Prepared for:

Prince Rupert Port Authority

Prepared by:

Stantec Consulting Ltd.

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Prepared by ____
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Sandra Webster

Reviewed by ____
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Kara Hewgill

Approved by ____
(signature)

Mark Johannes

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Abbreviations

AIA	archaeological impact assessment
AQO	Air Quality Objectives
BC	British Columbia
BC OGC	BC Oil and Gas Commission
BMP	best management practice
CAAQO	Canadian Ambient Air Quality Objectives
CAC	criteria air contaminants
CEAA	*Canadian Environmental Assessment Act*
CIAR	Canadian Impact Assessment Registry
CMT	culturally modified tree
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
EAC	Environmental Assessment Certificate
EMP	Environmental Management Plan
FMR	Fire Modified Rock
GHG	greenhouse gases
ha	hectare
HADD	harmful alteration, disruption or destruction
HCA	*Heritage Conservation Act*

IAA	*Impact Assessment Act*
IAAC	Impact Assessment Agency of Canada
kV	Kilovolt
MAML	mobile air monitoring laboratory
MMF	mitigation measures form
NDT	Natural Disturbance Type
PRPA	Prince Rupert Port Authority
PSL	Permissible Sound Level
QA/QC	quality assurance and quality control
RIELP	Ridley Island Export Logistics Park (the Project)
RMG	rail-mounted gantry
RRUC	Road, Rail and Utility Corridor
SARA	*Species at Risk Act*
SDR	Systematic Data Recovery
TEM	Terrestrial Ecosystem Mapping
TEU	twenty-foot equivalent unit
VOC	volatile organic compound

1.0 PROJECT IDENTIFICATION

1.1 PROJECT OVERVIEW AND LOCATION

The Prince Rupert Port Authority (PRPA) is proposing to construct and operate the Ridley Island Export Logistics Park (RIELP or the Project). The Project is an export logistics platform that is intended to enhance the Port of Prince Rupert's export transloading capacity and improve operational logistics. The Project is located on Ridley Island, Prince Rupert, British Columbia (BC), within the traditional territory of the Tsimshian Nations within Schedule B federal lands managed by the PRPA (Figure 1-1). The Project footprint is shown in Figure 1-2 and will house the following components:

- New rail and a grade-separated rail crossing
- Upgrades to the existing unpaved access road
- Truck gate
- New intermodal container yard
- New bulk transload facility
- New break bulk transload facility
- Ancillary buildings and facilities
- On-site equipment

At full build out the Project footprint, which includes the logistics park, rail and road components, will cover an approximately 107 hectare (ha; 264 acres) parcel of land entirely on Ridley Island. The Project will have an annual transload container capacity of 400,000 twenty-foot equivalent units (TEUs), with the potential for expansion to 700,000 TEUs over a ten-year period. The intermodal container yard will store empty and laden containers, increasing the overall capacity of the intermodal facilities in Prince Rupert. Products will include Canadian agricultural products, resins, metals and minerals, lumber and pulp that will be delivered by rail to the bulk and break bulk facilities where they will be loaded (stuffed) into empty containers for transport back to Fairview Terminal and delivery to overseas customers.

1.2 REGULATORY CONTEXT

The Project will be located entirely on Schedule B federal lands and Schedule A waters under the jurisdiction of the PRPA. The Project does not require an impact assessment under the *Impact Assessment Act* (IAA) as it does not exceed thresholds defined under the Physical Activities Regulation (SOR/2019-285). However, because the PRPA is the Project proponent and a federal authority with jurisdiction under the *Canada Marine Act,* PRPA is responsible as a federal regulator and will make an independent Project determination of significance under section 82 of the IAA on whether or not the Project is likely to cause a significant adverse environmental effect. Based on the Impact Assessment Agency of Canada's (IAAC) document, *Interim Guidance on sections 81 to 91 of the Impact Assessment Act* (October 2019), the Project has been classified as a 'basic project' because the Project is expected to result in minor adverse effects that are well understood and for which there are established and effective mitigation measures.

The Project is located within the previously assessed footprint of the Prince Rupert LNG Project, and is adjacent to the previously assessed Ridley Island Road, Rail and Utility Corridor (RRUC), Canpotex Potash Export Terminal and Vopak Bulk Liquids Terminals.. As a basic project, completion of a basic project mitigation measures form (MMF), or equivalent documentation, is recommended by the IAAC. This assessment report is designed to meet the requirements of the MMF.

1.3 LAND USE

The Project is located at the south end of Ridley Island adjacent to Porpoise Harbour and Porpoise Channel on federal Crown land (Schedule B) that is under the jurisdiction of PRPA. Ridley Island is designated as an industrial area (M3-Waterfront Industrial Zone) in the City of Prince Rupert's Official Community Plan (City of Prince Rupert 2015), and is identified in the PRPA's 2020 Land Use Plan (AECOM 2012), as land intended for major port oriented industrial operations. Activities listed in the Land Use Plan as the focus for portions of Ridley Island adjacent to Porpoise Harbour include:

- Marine industrial development
- Marinas
- Container inspection
- Logistics industrial parks
- Shipyards
- Transfer and storage terminals
- Automobile transfer and storage
- Pipe yards
- Rail support services
- Short sea shipping services

For safety and security, public access to Ridley Island is restricted by PRPA.

1.4 LEAD AUTHORITY AND OTHER AUTHORITIES

The PRPA is the Project proponent and federal land manager for the RIELP and will be the lead authority for the Project. The PRPA is a Canadian Port Authority under the *Canada Marine Act* and is responsible for the overall planning, development and management of the Port of Prince Rupert. Information on the primary contact for the RIELP is provided in Table 1-1.

First Nations Reserve

Provincial Park, Ecological Reserve, or Protected Area

Conservancy Area

Site Location

0 1 2 3 4 Kilometers

1:100,000 (at original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Imagery: Bing Imagery

Stantec

Project Location
Ridley Island

Project Number: 123221516
Prepared by KALUCAS on 20200326
Requested by MJOHANNES on 20200324
Checked by XXXX on 20200326

Client/Project/Report
Prince Rupert Port Authority
Ridley Island Export Logistics Park

Figure No.
1-1

Title
Project Location

\\CA0183-PBAGF01\Workgroup\1232\projects\123221516\figures\reports\RIELP\fig_123221516_1_1_project_location.mxd Revised: 2020-07-24 By: cmelliship

- Trail
- Railway
- Transmission Line
- Topographic Contour
- Watercourse
- Waterbody
- Wetland
- Local Greenspace
- Municipal Boundary
- Proposed Edge of Grading - Phase I
- Proposed Edge of Grading - Full Build-Out
- Proposed Access Road
- Waste Disposal Site

0 250 500 750 m
1:20,000 (at original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

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Figure No.
1-2

Title
Project Footprint

\\CA0183-PBAGF01\Workgroup\1232\projects\123221516\figures\reports\RIELP\fig_123221516_1_2_project_components.mxd Revised: 2020-07-24 By: cmellship

Other responsible federal authorities may be required to make a determination of significance as required under section 82 of the IAA. These responsible federal authorities and their triggers are listed in Table 1-2. Federal Authorities have been and will continue to be engaged throughout the assessment process. Comments received from federal authorities at the time of submission were responded to and tracked in a tracking table that was returned to federal authorities for their review along with responses to comments provided by Indigenous groups (see Section 3.3).

Table 1-1 Proponent Contact Information

Lead Authority	Prince Rupert Port Authority (www.rupertport.com)
Contact Name	Jack Smith
Title	Director, Environmental Planning and Compliance
Mailing Address	Prince Rupert Port Authority 200-215 Cow Bay Road Prince Rupert, BC V8J 1A2
Telephone Number	Office: 1-250-627-8899
Email Address	projects@rupertport.com

Table 1-2 Other Responsible Federal Authorities

Authority	Section 82 Trigger
Transport Canada	Providing financial assistance to the Project.
Fisheries and Oceans Canada	Issues a permit, approval, or authorization. • The Project may require a section 35(2)(b) *Fisheries Act* Authorization(s). A Request for Review will be submitted to Fisheries and Oceans Canada (DFO) to determine whether authorization(s) is required.

2.0 PROJECT DESCRIPTION

2.1 DESCRIPTION OF PROPOSED PROJECT

2.1.1 Project Overview and Components

The Project is a proposed export logistics park on Ridley Island, adjacent to Porpoise Harbour and Porpoise Channel, located on federal Crown land and surrounded by waters under the jurisdiction of PRPA. The facility will handle delivery of bulk materials by rail, such as agricultural goods (legumes, grains, and pulses), resin pellets, materials and minerals, lumber, and pulp. The Project is being proposed in two phases with the first phase having an annual intermodal transloading capacity of up to 400,000 TEUs/year during the first phase and potentially increasing to up to 900,000 TEUs/year during the second phase. Construction of the first phase is expected to commence as soon as Q1 2021, with operations potentially beginning by Q1 2023. The second phase, if required by commodity value and market demands, would be built five to ten years following construction of Phase 1.

Details on project components at the different phases of the Project are summarized in Table 2-1. Additional detail is provided in the following sections.

Table 2-1 Details of Project Components during Project Phases 1 and 2

Component	Details	Project Phase
Rail	• Inbound, outbound and yard tracks • A grade-separated crossings • Up to six yard tracks capable of receiving a 12,000’ intermodal train • Approximately 100-120 rail cars/train	Phase 1: • Three inbound tracks and three outbound tracks • Up to six intermodal container yard tracks • Three trains/day (includes in and out) Phase 2: • two additional inbound tracks and one additional outbound track • 1.5 additional trains/day (includes in and out)
Access Road	• Paving and re-grading of existing access road that extends from the Ridley Island Utility Corridor south along the west side of the sediment cell to Porpoise Harbour New truck gate	Phase 1: • Paving and regrading up to 2.5 km road
Truck transits	• Travel between RIELP and Fairview Terminal along the new Fairview Connector Road (currently under construction)	Phase 1: • 1,400 round trips/day between Fairview Terminal and RIELP Phase 2: • 2,000 round trips/day between Fairview Terminal and RIELP

Table 2-1 Details of Project Components during Project Phases 1 and 2

Component	Details	Project Phase
Bulk Transload Facility	• Up to three unit trains/day of dry bulk commodities (cereal grains, specialty crops, metals and minerals and resin pellets) • Up to nine separated dumper pits for agricultural commodities and metals/minerals • Two covered grain elevators for agricultural commodity transfer to containers • Covered storage elevator for potash • Vacuum unloading platforms and covered bagging/palletizing plant for resin pellets	Phase 1: • Up to 400,000 TEUs/year (combined with Break Bulk Facility) Phase 2: • Up to 700,000 TEUs/year (combined with Break Bulk Facility)
Break Bulk Transload Facility	• Up to one and a half unit trains/day of breakbulk commodities (lumber and pulp) • Covered pulp and lumber shed	Phase 1: • Up to 400,000 TEUs/year (combined with Bulk Facility) Phase 2: • 7.9 ha • Up to 700,000 TEUs/year (combined with Bulk Facility)
Intermodal Container Yard	• Container storage yard to facilitate the movement of empty containers to both transload facilities and to store full containers until they are needed at Fairview Container Terminal • One inbound and one outbound track • Yard tracks (described above) • Cantilevered rail-mounted gantry (RMG) cranes for loading and unloading intermodal (IM) rail cars • Cantilevered RMG cranes for working the container yard • Reach stackers • Electric bomb cart (tractor trailer) for shuttling containers between gantry cranes and reach stackers and yard based /RMG cranes • Forklifts and pick-up trucks • Potential for high-density storage rack system	Phase 1: • One intermodal train/day • Two cantilevered RMG trains for loading and unloading IM rail cars Phase 2: • Up to three intermodal trains/day • Five cantilevered RMG trains for loading and unloading IM rail cars • 17 cantilevered RMG cranes for container yard
Ancillary Facilities	• Administration and maintenance building • Parking lot with capacity for at least 75 cars • Extension of existing 69 kilovolt (kV) power distribution line, telecommunications and IT system, and water distribution line • Sanitary wastewater treatment package plant or connection to central treatment plant • Stormwater management (culverts and ditches) • Security fencing	Phase 1: • Located in the east of the phase 1 footprint Phase 2: • Re-located if required within the phase 2 footprint

2.1.1.1 Utilities

Sewage Treatment

Sanitary wastewater will be generated from the administrative and maintenance buildings and will be collected and treated prior to discharge to the environment. Any waste discharged from the facility will meet relevant established water quality objectives and would utilize a new subtidal outfall. The waste stream may be connected to a central treatment plant on Ridley Island in the future.

Stormwater and Wastewater Management

Drainage ditches will be constructed to collect and convey stormwater away from the logistics park. Where needed, ditches will be lined with 150 mm riprap for erosion protection. Culverts will be installed under roads and the rail line to maintain natural drainage patterns. Stormwater will be discharged to Prince Rupert Harbour through a surface outfall.

Runoff from the rail yard will be collected and routed to an oil/water separator prior to discharge to the marine environment. The discharge will be monitored to meet relevant water quality objectives.

Power

A 69 kV powerline follows the existing Ridley Island rail loop. This powerline taps into the BC Hydro's Ridley Island Substation. The powerline will be extended from its most southerly point along the new access road and into the RIELP footprint. Under BC Hydro policy, the PRPA will be responsible for constructing and energizing the 69 kV line extension. An access road along the length of the 69 kV line, and within the existing rail corridor, will be used to facilitate construction and ongoing maintenance of the line.

2.1.1.2 Lighting

Lighting sources will include building interior and exterior lighting, streetlights and lighting for conveyors. All outdoor lights will be equipped with "dark-sky" shielded fixtures that will reduce light pollution factors.

2.1.1.3 Workforce

Construction will require crews of approximately 50-100 workers that will work an estimated 250 person years. The intent is to hire locally wherever possible. This will support the local economy and avoid the need for worker travel costs. During operations, the facility will operate three shifts, 24/7 and employ between 50 and 75 people per shift.

2.1.2 Project Activities

2.1.2.1 Construction

Construction activities will include site preparation and construction and installation of Project components described in Table 2-1. These activities are anticipated to include the following:

- Site preparation (clearing, grubbing, disposal of organic overburden at PRPA's disposal site, rock excavation, fill and placement, and site grading)
- Where existing elevation of the bedrock is below the final site grade fill will be used to bring the surface up to finished grade, this includes some areas along the rail corridor that are below the high water mark.
- Construction of rail and rail crossings (infilling, rail embankments, grading of ballast and rail bed, track installation, potential for in-water work to stabilize the rail embankment, installation of a fabricated archway to span the creek crossing on the south west of Ridley Island, installation of a grade-separated crossing)
- Paving and re-grading the access road
- Installation of a new truck gate
- Creation of the intermodal container yard (rail tracks, yard surfacing, yard reinforcements for container storage, installation of rail track for RMG cranes, installation of yard lighting)
- Construction of the break bulk and bulk transload facility (grading, installation of a covered pulp and lumber shed, installation of up to three inbound and up to three outbound tracks)
- Construction of separate dumper pits for agricultural and metal and mineral products, installation of two agri elevators and container loading tippers, one metals/minerals elevator and container loading tipper, and vacuum unloading system and covered bagging/palletizing plant for resin pellets)
- Construction of buildings and utilities (construction of a new administration and maintenance buildings and new parking lot, extension of existing power distribution line, telecommunications, Information Technology system and water distribution line, installation of new lighting, a sanitary wastewater treatment package plant and outfall, culvert and ditches to manage stormwater, and security fencing).

Land clearing and stripping of overburden include from the rail corridor and logistics park. Organic material will be disposed in the existing on-land disposal area on Ridley Island and woody debris will be burned. Large rocks, sand and gravel will be removed from the cleared site and re-used as fill.

Following clearing and stripping, grading will be conducted to level the site and introduce site drainage. Rock cuts will be necessary to bring the rail corridor and Project site to design grade. Bedrock will be ripped mechanically or blasted. In areas where the existing elevation of the bedrock is below the final site grade, engineered fill will be compacted and used to bring the surface to finished grade.

Construction of the logistics park will include the excavation of building sites, pouring of foundations, construction of facility buildings, drainage systems and installation of infrastructure. Construction of the rail corridor concrete or hardwood ties will be distributed and placed in proper line and spacing. Ballasting, final surfacing with mechanized lifting, tamping and lining equipment, and distressing and thermite welding will complete track construction. Signals and switching equipment will be installed as required.

The 69 kV transmission line will be an overhead system. The conductors, overhead ground wires and counterpoise will be hung from the poles.

It is anticipated that construction materials will be transported to site along the existing Ridley Island Road. All construction activities will occur on land. If construction activities are required to take place below the high water mark (e.g., culvert extensions) they will be scheduled during low tide dry periods (. Construction activities will occur between 0600 and 1800 where possible.

2.1.2.2 Operations

Operation activities will include operation of Project components listed in Table 2-1. Project-related activities expected to occur during operations includes:

Transport and Delivery of Commodities

Commodities will be delivered to site by bulk or breakbulk trains. Bulk commodities would be offloaded from the rail cars into designated covered dumper pits or using a vacuum unload system. The commodity would then travel along a conveyor to be stored in containers. Breakbulk commodities would be offloaded using rail forklifts or gantry cranes.

Empty containers will be delivered to site either by intermodal train or by truck from Fairview Terminal. Containers arriving by rail will be offloaded using a gantry crane or a reach stacker to bomb carts and will either be distributed to the bulk and breakbulk facilities for loading or to the container storage yard until they are needed.

Empty and laden containers will be transported between RIELP and Fairview Terminal via the Fairview Connector Road. It is estimated that there will be approximately 1,400 round trips/day between Fairview Terminal and RIELP during phase 1 and up to 2,000 daily truck trips/day at full build out.

The RIELP, in combination with the new Connector Road, will result in the diversion of all truck traffic to the logistics park that currently travels to Fairview Terminals by travelling along Highway 16 and through the city of Prince Rupert.

Commodity Storage

Storage of commodities within the container yard will vary depending on the type of commodity and product. Agricultural and metals and minerals commodities will be transferred directly from the dumper pits into TEU containers. Resin pellets will be unloaded into a covered facility where they will then be bagged and palletized before being loaded into containers. Forest products (lumber and pulp) will also be transferred to a covered facility where they will be stored until ready for export in containers. As containers are filled with commodities, they will be moved to the container yard for storage until time for export.

2.1.3 Project Schedule

Construction of Phase 1 of the RIELP is estimated to begin in Q1 2021 and to take approximately two years to complete. The estimated in-service data for the Project is Q1 2023. If required based on marked demand, Phase 2 of the Project will commence approximately five to ten years following the Phase 1 in-service date. The Project is assumed to operate for at least 50 years and there are currently no plans to decommission it.

2.2 DESCRIPTION OF THE ENVIRONMENT

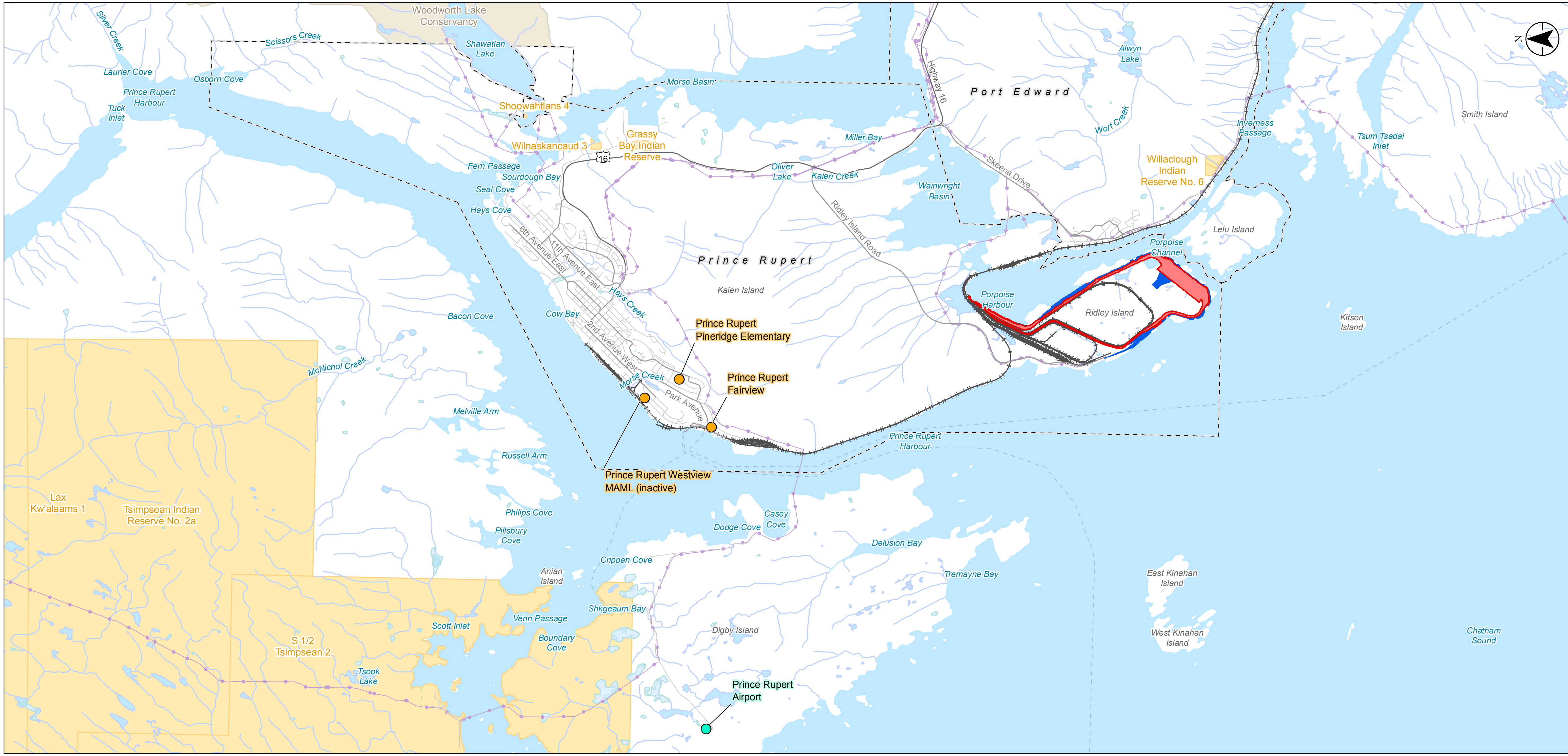
2.2.1 Biophysical Environment Baseline Conditions

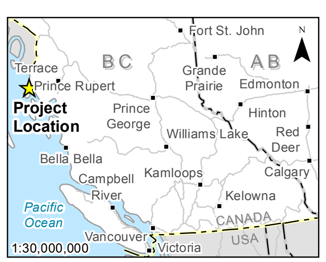
2.2.1.1 Air Quality

The Project is situated in a region with a wet but moderate climate due to moist, warm air moving eastward off the Pacific Ocean. Colder air moving south and west from the interior is mostly diverted away from the region by the Coast Mountains (PRPA 2019).

The Prince Rupert Airport Canadian climate normal station data from 1981 to 2010 indicates that the average number of days with rainfall is at least 16 days per month for all months of the year, with a maximum of 24 days in October. The annual total precipitation at the Prince Rupert Airport is 2,619 millimetres (mm), of which 92.4 mm falls as snow. Snow depths rarely exceed 2 centimetres (cm). The mean monthly air temperature at the Prince Rupert Airport ranges from 1 degree Celsius in winter to 12.8 degrees Celsius in summer (PRPA 2019). The location of the Prince Rupert Airport meteorology monitoring station is shown in Figure 2-1.

The baseline ambient air quality is considered good with the measured concentrations for criteria air contaminants (CACs) below the British Columbia Air Quality Objectives (BC AQO). Table 2-2 summarizes the baseline ambient air quality concentrations measures at monitoring stations in the vicinity of the Project. The BC AQO for NO_2 and SO_2 are based on the federal Canadian Ambient Air Quality Objectives (CAAQO).





Highway
Road
Local Street
Trail
Ferry Route
Railway
Transmission Line

Waterbody
Wetland
Railway
First Nations Reserve
Provincial Park, Ecological Reserve, or Protected Area
Conservancy Area
Municipal Boundary

Air Quality Monitoring Station
Meteorological Monitoring Station

Proposed Project Phase 1
Proposed Project Full Build-Out

0 1 2 3 4 km
1:80,000 (at original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

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Project Location
Ridley Island

Project Number: 123221516
Prepared by SFREELAND on 20200408
Requested by DJARRATT on 20200407
Checked by TDINEEN on 20200408

Client/Project/Report
Prince Rupert Port Authority
Ridley Island Export Logistics Park

Figure No.
2-1

Title
Air Quality And Meteorology Stations

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Table 2-2 Ambient Air Quality Baseline Summary Table

Contaminant	Averaging Period	Air Quality Objective (ug/m^3) (BC ENV 2020)	Prince Rupert Airshed Study (BC ENV 2016)	Prince Rupert Air Quality Monitoring Station (BC ENV 2019)	RIELP Baseline Concentration (ug/m^3)	RIELP Baseline (% of Air Quality Objective)
Nitrogen Dioxide (NO_2)	1-hour	113	24.4	42.3[a]	42.3	37
	Annual	32	5.6	3.9[a]	3.9	12
Ozone (O_3)	8-hour	123	NA	86[b]	86	70
Particulate Matter <2.5 microns ($PM_{2.5}$)	24-hour	25	7.0	6.5[a]	6.5	26
	Annual	8	3.5	3.0[c]	3.0	38
Particulate Matter <10 microns (PM_{10})	24-hour	50	NA	6.6[d]	6.6	13
Sulphur Dioxide (SO_2)	1-hour	183	10.7	1.8[e]	1.8	1.0
	Annual	13	4.0	0.26[f]	0.26	2.0

NOTES

NA = not available, a baseline value for this contaminant was not identified by the references.

[a] Prince Rupert Pineridge Elementary 2017 (201 valid days). Based on the 98th percentile of daily maximum over one year. This monitoring station did not meet the minimum standard of 75% data capture for each quarter of the calendar year.

[b] Prince Rupert Westview Mobile Air Monitoring Laboratory (MAML) based on 114 days of monitoring mostly during May to July 2013. Ozone values are typically higher during summer. This monitoring station did not meet the minimum standard of 75% data capture for each quarter of the calendar year.

[c] Prince Rupert Pineridge Elementary 2017 (201 valid days). Based on the annual average over one year. This monitoring station did not meet the minimum standard of 75% data capture for each quarter of the calendar year.

[d] Fairview Terminal Phase II Expansion Project - Terminal Air Quality Technical Data Report (Stantec 2009). The average of all daily (24-hr) averages

[e] Prince Rupert Pineridge Elementary 2017 (202 valid days). Based on the 99th percentile of the daily 1-hour maximum concentration (D1HM). This monitoring station did not meet the minimum standard of 75% data capture for each quarter of the calendar year.

[f] Prince Rupert Pineridge Elementary 2017 (202 valid days). Achievement is to be based on an average over three consecutive years, however, this monitoring location does not have three consecutive years of SO2 available. This monitoring station did not meet the minimum standard of 75% data capture for each quarter of the calendar year.

The nearest air quality monitoring stations to the Project operated by BC ENV with quality assured data are located at Pineridge Elementary School in Prince Rupert, and a temporary mobile air monitoring laboratory (MAML), that is currently inactive, at Prince Rupert Westview. The most recent air quality monitoring data from the Pineridge Elementary School is from 201 valid days of monitoring during 2017 and the data from the Westview MAML is from 114 days of monitoring during 2013. There is a third location in Prince Rupert at Fairview Terminal that has 158 valid days of monitoring during 2017.

The locations of these air quality monitoring stations are shown in Figure 2-1. The 2017 data from Pineridge Elementary school and the 2013 data from Westview MAML has been through the annual BC

ENV quality assurance and quality control (QA/QC) review process (SAS analysis) and is considered reliable for environmental assessments. The British Columbia Field Sampling Manual (BC ENV 2013) specifies that a minimum of 75% data capture is to be achieved for each quarter of the calendar year. The Pineridge Elementary School had 55% data capture for 2017 and the Westview MAML had 31% data capture during 2017; data capture for the Fairview Terminal monitoring station was not available. Hence, none of these air quality monitoring stations meet the BC ENV minimum data capture threshold (75%).

The latest available (2017) Prince Rupert air quality monitoring data from the Pineridge Elementary School is included in Table 2-1 because it had a longer period of record (201 days) than the Prince Rupert Fairview monitoring station (158 days). For comparison, Table 2-2 also includes the baseline ambient air quality concentrations that were summarized in the comprehensive Prince Rupert Airshed Study (BC ENV 2016), however that study did not have the benefit of more recent data collected at the Prince Rupert Pineridge Elementary and Fairview Terminal air quality monitoring stations.

As shown in Table 2-2, the baseline ambient air quality concentrations at the RIELP range from 1% (1 hour SO_2) to 70% (8-hour O_3) of the BC AQO. The baseline O_3 concentrations are greater than 60% of the BC AAQO because the temporary MAML collected data during the summer when the O_3 concentrations are greater than other times of the year. Most O_3 forms in the air from chemical reactions involving NOx, volatile organic compounds (VOCs) and sunlight. O_3 levels are typically highest during the afternoon hours of the summer months, when the influence of direct sunlight is the greatest.

The ambient air quality monitoring stations located in Port Edward (e.g., Port Edward Pacific, Port Edward Elementary, Prince Rupert Galloway Rapids and Port Edward Mill) are inactive.

2.2.1.2 Noise

The existing acoustic environment or baseline sound level near the logistics park and the rail corridor can be characterized as a combination of natural sounds and those generated by human activities. Human activities include marine traffic, marine terminal, aircraft flyovers, rail traffic, local residential and commercial activities, and vehicular traffic on local roads.

Seven receptors (i.e., R1 to R7) were selected for the noise assessment. These receptors include residential dwellings closest to the Project site, Port Edward community center, Port Edward Elementary School, a commercial area, and a traditional land use area. The locations for these noise receptors are shown in Figure 2-2. Receptors R1, R2, and R3 are residential dwellings along Skeena Drive. Receptors R4 and R5 represent the Port Edward community center and elementary school, respectively. Receptor R6 represents a commercial property along Skeena Dr. Receptor R7 represents the Lax Kw'alaams and Metlakatla Willaclough IR No.6 traditional land use area, at a quieter location furthest away from Skeena Drive.

The baseline sound levels for all seven receptors are summarized in Table 2-3. The baseline sound level is quantified by the day-night average sound level (L_{dn}). The L_{dn} is a 24-hour time-averaged sound level parameter, with a 10 decibel (dB) penalty applied to nighttime hours. Daytime period is 7 AM to 10 PM and nighttime period is 10 PM to 7 AM.

Highway
Road
Local Street
Trail
Ferry Route
Railway
Transmission Line
Topographic Contour
Watercourse

Waterbody
Wetland
First Nations Reserve
Local Greenspace
Provincial Park, Ecological Reserve, or Protected Area
Municipal Boundary

Noise Assessment Receptor
Ambient Monitoring Location

Proposed Edge of Grading - Phase I
Proposed Edge of Grading - Full Build-Out

0 250 500 750 1,000 m
1:25,000 (at original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

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Prepared by SFREELAND on 20200407
Requested by JCHUI on 20200407
Checked by TDINEEN on 20200407

Client/Project/Report
Prince Rupert Port Authority
Ridley Island Export Logistics Park

Figure No.
2-2

Title
Noise Assessment Receptors

Table 2-3 Noise Baseline Sound Level Summary Table

Receptor ID	Description	L_{dn} (dBA)
R1	Residential dwelling along Skeena Drive	48
R2	Residential dwelling along Skeena Drive	48
R3	Residential dwelling along Skeena Drive	48
R4	Port Edward community center	51
R5	Port Edward elementary school	51
R6	Commercial property location along Skeena Drive	48
R7	Lax Kw'alaams and Metlakatla Willaclough IR No.6. traditional land use area, north-eastern corner	45

The baseline sound levels at the seven receptors were based on the following information sources:

- Ambient noise monitoring conducted for PRPA in 2012 (Stantec 2013)
- BC Oil and Gas Commission Noise Control Best Practice Guideline 2018

Receptors R1 to R6 were assessed in the Pacific Northwest LNG environmental impact assessment (Stantec 2016). In the 2016 assessment, the baseline sound levels at these receptors were based on ambient noise monitoring conducted for the PRPA (Stantec 2013). Measurement results at two monitoring locations (M3 and M7) were used to represent the baseline sound level at R1 to R6. M3 monitoring location is near a residential dwelling along Skeena drive and M7 monitoring location is near the Port Edward Elementary School. The measured values are used to establish the baseline sound levels at R1 to R6. The L_{dn} of 48 A-weighted decibel (dBA) at M7 represents the baseline sound level at receptors R1, R2, R3, and R6. The L_{dn} of 51 dBA at M3 represents the baseline sound level at receptors R4 and R5.

The traditional land use receptor R7 is located at the north-eastern corner of the Lax Kw'alaams and Metlakatla Willaclough IR No.6 area. The location is approximately 400 m north of Skeena Drive. This assessment assumes a baseline sound level similar to a rural environment for this location. The baseline sound level at R7 is assumed to be 45 dBA L_{dn}, based on the BC OGC Noise Control Best Practice Guideline recommended average rural ambient sound level of 45 dBA L_{dn}.

The PRPA Fairview Bay noise monitoring station is located along Sunset Drive, Port Edward. The monitoring was installed November 2015, approximately 1.4 km north west of the Project. The station monitors sound continuously from the community, Fairview Terminal, the Alaska Ferries and BC Ferries terminals, road traffic, and rail traffic. The measurement results for the period of January to December 2019 indicate a L_{dn} of 65 dBA. This level is higher than L_{dn} range of 45 dBA to 51 dBA for baseline sound level at all receptors; however, the lower L_{dn} values assume these receptors are in a quieter environment than the PRPA Fairview Bay monitoring location.

2.2.1.3 Vegetation and Wetlands

Ridley Island is in the Coastal Western Hemlock zone, Very Wet Hypermaritime biogeoclimatic subzone, Central variant (CWHvh2) (Banner et al. 1993), within the Hecate Lowland and North Coast Fjords Ecosections. The Hecate Lowland Ecosection exists near sea-level, experiences abundant precipitation year-round, and is comprised primarily of mesic to wet temperate rainforest and bog wetlands (Banner et al.1993). The northern portion of the island has previously been developed and is generally considered a “brownfield” as the vegetation has been highly modified by current and past industrial use. Vegetation within the southern portion of the island consists of *Sphagnum* dominant open blanket bogs, western redcedar (*Thuja plicata*) and yellow-cedar (*Xanthocyparis nootkatensis*) forested bogs, open water wetlands, and patches of wet coniferous forests containing western redcedar, western hemlock (*Tsuga heterophylla*), and Sitka spruce (*Picea sitchensis*).

Previous studies have documented existing conditions in the vicinity of the Project and include Terrestrial Ecosystem Mapping (TEM), wetland surveys, and rare plant surveys. The BC Conservation Data Centre (CDC 2020) describes 23 potential rare plant species (Table 2-4), and 17 potential rare ecological communities (Table 2-5) occurring within the CWHvh2 region. There is one known record of a provincially listed plant species on the west side of Ridley Island, the blue-listed Alaska holly fern (*Polystichum setigerum*) (Figure 4-6 in AECOM 2014b). There are two other locations noted for Alaska holly fern outside Ridley Island. The other rare plant species occurrences displayed in the AECOM (2014) figure have since been de-listed and are no longer considered rare species.

There are historical occurrence records for seven species of invasive plants along the Ridley Island Access Road, northwest of the Project footprint (IAPP 2020). These seven species are: common tansy (*Tanacetum vulgare*), oxeye daisy (*Leucanthemum vulgare*), yellow hawkweed (*Hieracium pratense*), Canada thistle (*Cirsium arvense*), marsh plume thistle (*Cirsium palustre*), St. John’s wort (*Hypericum perforatum*), and Tansy ragwort (*Senecio jacobaea*).

The Canpotex Environmental Impact Statement (see Table 10-5 and Figure 10.2 in Stantec 2011b) identifies five provincially listed ecological communities on Ridley Island. The ecological communities include:

- Sitka sedge—peat moss (CWHvh2/Wf51-FS)
- Western hemlock—Sitka spruce/lanky moss (CWHvh2/04-HM)
- Western red cedar—Sitka spruce/sword fern (CWHvh2/05-RF)
- Western red cedar—Sitka spruce/skunk cabbage (CWHvh2/13-RC)
- Sitka spruce Pacific crab apple (CWHvh2/19-SC)

The CWHvh2 biogeoclimatic unit (in which the Project is situated) is considered Natural Disturbance Type 1 (NDT 1), where stand initiating events are rare. Time since stand replacing disturbance in NDT1 biogeoclimatic units is generally greater than 250 years; therefore, forests are considered old growth if they are >250 years old (BC MOFR (2010). Limited old forest has been identified by previous studies on the south half of Ridley Island (Stantec 2011, see Figure 10.3).

Wetlands cover much of Ridley Island. According to the Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor Wetland Habitat Compensation Plan (Stantec 2013), approximately 45% of the vegetation communities on the island are wetlands. Bog, fen, swamp, estuarine, and shallow open water wetlands are present throughout the island (AECOM 2014b, see Figure 4-2; Stantec 2013, see Figure 1-2). According to Stantec (2013), Ridley Island has two isolated slope bog watersheds, a large one in the center of the island and a smaller one at the southern end of the island. Both slope bogs have a gradual gradient from the upper slope bogs toward the coast.

Bogs are wetlands characterized by the accumulation of peat, most frequently dominated by Sphagnum mosses with tree, shrub, or treeless vegetation cover (NWWG 1997). They receive water almost exclusively from precipitation, leading to poor nutrient conditions. Slope bogs are a common wetland form on the north coast of British Columbia (Banner, et al. 1988). They occur in areas of high rainfall on sloping terrain (NWWG 1997).

Fens are peatlands with a fluctuating water table (NWWG 1997). Their waters are relatively rich in dissolved minerals because groundwater and surface water movement is common. Fens are characterized by an accumulation of peat, which is commonly formed from sedges and brown mosses. Stantec (2013) notes that riparian fens are the primary fen form occurring at low elevations on the north coast of British Columbia (Banner, et al. 1988).

Swamps are forested or wooded wetlands that are characterized by trees or tall shrubs and are influenced by nutrient rich groundwater and either mineral or organic soils (NWWG 1997). Most swamps on Ridley Island have been characterized as slope swamps (Stantec 2013). Slope swamps have a noticeable gradient from the highest point sloping down to the lowest point in the feature. Stantec (2013) notes that on Ridley Island, slope swamps occur in the transition between slope bogs and upland forest. They are generally located on the outer edge of Ridley Island, surrounding the central slope bog complex.

Tidal swamps develop in the zone of influence of tides, at the highest reach of tides and wave influence during storms (NWWG 1997). Forested tidal swamps exist where there is a minor influence of high tides, but not enough to kill the trees. This community is characterized by gleysolic soils and typically occurs in brackish sloughs and estuaries behind sedge marshes (Banner, et al. 1993a). The tidal swamp documented on Ridley Island consists of the Sitka spruce/Pacific crabapple CWHvh2/19 ecological community and is mapped on the east and west sides of the central island.

Marshes are wetlands with shallow, fluctuating water level and mineral soils (NWWG 1997). They receive water from the surrounding catchment area as runoff, stream inflow, precipitation, storm surges, groundwater discharge, longshore currents and tidal action. Estuarine marshes are confined to intertidal and supratidal zones of estuaries and their water levels are typically controlled by tidal elevations. Estuarine waters range from brackish to fresh according to the proportion of tidal (i.e., saline) and riverine (freshwater) inputs. Vegetation is dominated by graminoids, shrubs, forbs or emergent plants. Stantec (2013) notes that the estuarine marsh on Ridley Island is in an area of industry-altered estuarine mudflat at the south end of the island. This area was formerly known as Mudflat Bay. In the 1980s, two major rock berms and two smaller berms were constructed to enclose Mudflat Bay.

This area, now referred to as the sediment cell, was used as a settling pond for material dredged for the construction of the adjacent grain and coal sites (Stantec 2013) and more recently for sediment from the Fairview Northern Expansion project. The area has been characterized by poor water quality and limited to no connectivity with the marine environment (JWA 2008).

Table 2-4 Potentially Occurring Rare Plant Species Within the North Coast Forest District, CWHvh2

Scientific Name	Common Name	Habitat Subtype	BC List	COSEWIC	SARA
Vascular plants					
Arctanthemum arcticum ssp. arcticum	arctic daisy	Marsh; Stream/River; Intertidal Marine; Mudflats—Intertidal	Red	-	-
Callitriche heterophylla var. heterophylla	two-edged water-starwort	Pond/Open Water	Blue	-	-
Cornus suecica	dwarf bog bunchberry	Bog; Marsh; Tundra; Meadow; Conifer Forest—Mesic (average); Conifer Forest—Moist/wet	Blue	-	-
Hippuris tetraphylla	four-leaved mare's-tail	Marsh; Pond/Open Water; Mudflats—Intertidal	Blue	-	-
Platanthera ephemerantha	white-lip rein orchid	Conifer Forest—Dry; Garry Oak Woodland	Blue	-	-
Polystichum setigerum	Alaska holly fern	Riparian Forest; Riparian Shrub; Stream/River; Rock/Sparsely Vegetated Rock; Conifer Forest—Moist/wet	Blue	-	-
Non-vascular plants					
Dermatocarpon intestiniforme	quilted stippleback	-	Blue	-	-
Bryocaulon pseudosatoanum	pacific pretzel	-	Blue	-	-
Bryhnia hultenii	Hulten's bryhnia moss	-	Red	-	-
Dicranodontium asperulum	dicranodontium moss	-	Blue	-	-
Didymodon leskeoides	didymodon moss	-	Red	-	-
Diphyscium foliosum	diphyscium moss	-	Blue	-	-
Entodon concinnus	entodon moss	-	Blue	-	-

Table 2-4 Potentially Occurring Rare Plant Species Within the North Coast Forest District, CWHvh2

Scientific Name	Common Name	Habitat Subtype	BC List	COSEWIC	SARA
Hageniella micans	Sparkling signal-moss	-	Blue	-	-
Isopterygiopsis muelleriana	Mueller's isopterygiopsis moss	-	Red	-	-
Philonotis yezoana	philonotis moss	-	Blue	-	-
Pohlia columbica	pohlia moss	-	Blue	-	-
Pseudocyphellaria rainierensis	oldgrowth specklebelly	-	Blue	Special concern (April 2010)	Schedule 1 (Jul 2012)
Sphagnum aongstroemii	Aongstroem's sphagnum	-	Blue	-	-
Sphagnum balticum	Baltic sphagnum	-	Blue	-	-
Sphagnum contortum	contorted sphagnum	-	Blue	-	-
Sphagnum quinquefarium	sphagnum	-	Blue	-	-
Tetrodontium brownianum	Brown's tetrodontium moss	-		-	-

Table 2-5 Potentially Occurring Rare Ecological Communities Within the North Coast Forest District CWHvh2 Biogeoclimatic Unit

Scientific Name	Common Name	Ecosystem Group	BC List	COSEWIC	SARA
Alnus rubra / Rubus spectabilis / Equisetum arvense	red alder / salmonberry / common horsetail	Terrestrial Realm - Flood Group (F): Low Bench Flood Class (Fl)	Blue	-	-
Carex sitchensis - Oenanthe sarmentosa	Sitka sedge - Pacific water-parsley	Wetland Realm - Mineral Wetland Group: Marsh Wetland Class (Wm)	Blue	-	-
Carex sitchensis / Sphagnum spp.	Sitka sedge / peat-mosses	Wetland Realm - Peatland Group: Fen Wetland Class (Wf)	Red	-	-
Glyceria borealis Fen	northern mannagrass Fen	Wetland Realm - Peatland Group: Fen Wetland Class (Wf)	Blue	-	-
Myrica gale / Carex sitchensis	sweet gale / Sitka sedge	Wetland Realm - Peatland Group: Fen Wetland Class (Wf)	Red	-	-

Table 2-5 Potentially Occurring Rare Ecological Communities Within the North Coast Forest District CWHvh2 Biogeoclimatic Unit

Scientific Name	Common Name	Ecosystem Group	BC List	COSEWIC	SARA
Picea sitchensis / Calamagrostis nutkaensis	Sitka spruce / Pacific reedgrass	Terrestrial Realm - Forest: Coniferous - dry	Blue	-	-
Picea sitchensis / Carex obnupta	Sitka spruce / slough sedge	Terrestrial Realm - Forest: Coniferous - moist/wet	Blue	-	-
Picea sitchensis / Eurhynchium oreganum	Sitka spruce / Oregon beaked-moss	Terrestrial Realm - Forest: Coniferous - dry	Blue	-	-
Picea sitchensis / Gaultheria shallon	Sitka spruce / salal	Terrestrial Realm - Forest: Coniferous - dry	Blue	-	-
Picea sitchensis / Maianthemum dilatatum Wet Hypermaritime 1	Sitka spruce / false lily-of-the-valley Wet Hypermaritime 1	Terrestrial Realm - Flood Group (F): Highbench Flood	Red	-	-
Picea sitchensis / Malus fusca	Sitka spruce / Pacific crab apple	Terrestrial Realm - Forest: Coniferous - moist/wet	Blue	-	-
Picea sitchensis / Polystichum munitum	Sitka spruce / sword fern	Terrestrial Realm - Forest: Coniferous - moist/wet	Blue	-	-
Picea sitchensis / Trisetum canescens	Sitka spruce / tall trisetum	Terrestrial Realm - Flood Group (F): Middle Bench Flood Class (Fm); Terrestrial Realm - Forest: Coniferous - moist/wet	Red	-	-
Thuja plicata - Picea sitchensis / Lysichiton americanus	western redcedar - Sitka spruce / skunk cabbage	Terrestrial Realm - Forest: Coniferous - moist/wet; Wetland Realm - Mineral Wetland Group: Swamp Wetland Class (Ws)	Blue	-	-
Thuja plicata - Picea sitchensis / Oplopanax horridus Very Wet Hypermaritime 2	western redcedar - Sitka spruce / devil's club Very Wet Hypermaritime 2	Terrestrial Realm - Forest: Coniferous - moist/wet	Blue	-	-
Thuja plicata - Picea sitchensis / Polystichum munitum	western redcedar - Sitka spruce / sword fern	Terrestrial Realm - Forest: Coniferous - dry; Terrestrial Realm - Forest: Coniferous - mesic	Blue	-	-

Table 2-5 Potentially Occurring Rare Ecological Communities Within the North Coast Forest District CWHvh2 Biogeoclimatic Unit

Scientific Name	Common Name	Ecosystem Group	BC List	COSEWIC	SARA
Tsuga heterophylla - Picea sitchensis / Rhytidiadelphus loreus	Western hemlock – Sitka spruce/ lanky moss	Terrestrial Realm - Forest: Coniferous - mesic	Blue	-	-

2.2.1.4 Wildlife and Wildlife Habitat

Previous studies have documented existing conditions for wildlife and wildlife habitat on Ridley Island, including areas that overlap the Project site. Studies completed in the past include breeding bird surveys, raptor surveys, amphibian surveys, wildlife transects, and wildlife habitat assessments based on terrestrial ecosystem mapping (Stantec 2011a; Stantec 2014; AECOM 2014c).

As described in Section 2.2.1.3, the northern portion of Ridley Island has previously been developed and the vegetation is highly modified by current and past industrial use. The southern portion of the island is largely undeveloped, and vegetation communities in this area include *Sphagnum* dominant open blanket bogs, forested bogs of western redcedar and yellow-cedar, open water wetlands, and limited patches of wet coniferous old forests containing western redcedar, western hemlock, and Sitka spruce. Industrial development in the northern portion of Ridley Island means there is already a reduction in free movement of wildlife on Ridley Island. This industrial development also means there is already an increased risk of wildlife mortality associated with collisions with trains and vehicles using the northern portion of Ridley Island.

Based on studies completed from 2009 to 2013, a total of 62 species of terrestrial vertebrates have been detected on Ridley Island; 16 mammals, 43 birds, and three amphibians (Stantec 2011a; AECOM 2014c; Stantec 2014). Mammals observed included black-tailed deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), gray wolf (*Canis lupus*), river otter (*Lontra canadensis*), American marten (*Martes americana*), red squirrel (*Tamiasciurus hudsonicus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), porcupine (*Erethizon dorsatum*), little brown myotis (*Myotis lucifugus*), hoary bat (*Lasiurus cineurus*), Yuma myotis (*Myotis yumanesis*), California myotis (*Myotis californicus*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), and silver-haired bat (*Lasionycteris noctivagans*)(Stantec 2011a; AECOM 2014c; Stantec 2014). Birds most commonly observed were Pacific wren (*Troglodytes pacificus*), Swainson's thrush (*Catharus ustulatus*), Townsend's warbler (*Setophaga townsendi*), dark-eyed junco (*Junco hyemalis*), hermit thrush (*Catharus guttatus*), northern flicker (*Colaptes auratus*), Steller's jay (*Cyanocitta stelleri*), yellow warbler (*Setophaga petechia*), chestnut-backed chickadee (*Poecile rufescens*), Pacific-slope flycatcher (*Empidonax difficilis*), bald eagle (*Haliaeetus leucocephalus*), common raven (*Corus corax*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), and rufous hummingbird (*Selasphorus rufus*) (Stantec 2011a; AECOM 2014c; Stantec 2014). The three amphibian species detected on Ridley Island are western toad (*Anaxyrus boreas*), northwestern salamander (*Ambystoma gracile*), and rough-skinned newt (*Taricha granulosa*).

Although Ridley Island is within the range of two reptiles, the terrestrial gartersnake (*Thamnophis elegans*) and common gartersnake (*Thamnophis sirtalis*),) neither species was detected during field surveys (Stantec 2011a; AECOM 2014c; Stantec 2014).

Wildlife habitat assessments have been completed for black bear, marbled murrelet, northern goshawk, western screech-owl, and western toad (Stantec 2011a; AECOM 2014c). Black bear spring forage suitability was mostly low and very low, although there were smaller patches of moderate and moderately high suitability habitats in some locations of Ridley Island (AECOM 2014c, see Figure 4-3). Summer foraging habitats were rated higher than spring foraging habitats, with the majority of Ridley Island rated as moderate or moderately high (AECOM 2014c, see Figure 4-4).

Existing conditions for wildlife species at risk are described in Section 2.2.1.6.

2.2.1.5 Fish and Fish Habitat

Marine

Ridley Island is located on the northeast coast of the Pacific Ocean and is surrounded by marine waters on three sides. Marine waters in this area are rich and known to support a variety of marine invertebrates, fish, and vegetation. Wind and wave exposure vary along the shorelines of Ridley Island with the western side (Prince Rupert Harbour) being considerably more exposed than the eastern side (Porpoise Harbour). Marine waters in the area are influenced by outflows from the Skeena River which contribute large amounts of sediments and freshwater to the area surrounding Ridley Island.

Riparian

Ridley Island supports a range of riparian vegetation, from late stage vegetation (see Photo 1) to intertidal marsh habitat (see Photo 6). Commonly observed forest species include shrubs such as salmonberry, salal, huckleberry (*Vaccinium* spp.), copperbush (*Elliottia pyroliflora*) and red elderberry (*Sambucus racemosa var. arborescens*). Tree species (i.e., < 3 m tall) include western redcedar, western hemlock, Douglas fir (*Pseudotsuga menziesii*), red alder, and black cottonwood (*Populus trichocarpa*). Intertidal marsh habitats support a variety of vegetation including dune grass (*Leymus mollis*) and rushes (*Juncus* sp.) and salt-tolerant species such as Lyngby's sedge (*Carex lyngbyei*). Other common salt marsh species include sea plantain (*Plantago maritima*), silverweed (*Potentilla* spp.), and Scotch lovage (*Ligusticum scoticum*) with Canadian sand-spurry (*Spergularia canadensis*) and sea milkwort (*Glaux maritima L.*) (Hemmera 2019). For a more fulsome discussion of the existing vegetation on Ridley Island see Section 2.2.1.3 (Vegetation and Wetlands).

Intertidal

Ridley Island supports a variety of intertidal habitat types including rocky substrates (bedrock, boulder, cobble and gravel) and soft sediments (sand and mudflats). In addition, habitat forming vegetation (kelp and eelgrass) is also present in sections of the mid and low intertidal.

Typically, the high intertidal consists of bare rock with limpet (*Lottia* spp.) which transition into a barnacle (*Balanus* spp.) bands through the mid intertidal before transitioning to an algal layer in the lower intertidal with a subtidal kelp band. In some areas, mudflats dominate the mid and lower intertidal which support several species of bivalves.

Algae documented in the Project area include rockweed (*Fucus* spp), tar spot (*Ralfesia* spp), black pine (*Neorhodomela larix*), sea sac (*Halosaccion glandiformis*), Turkish washcloth (*Mastocarpus papillatus*), ribbon kelp (*Alaria* spp.), split kelp (*Saccharina groenlandica*), sugar kelp (*Saccharina latissima*), and pretty polly (*Polysiphonia pacifica*). Areas with abundant bull kelp (*Nereocystis luetkeana*), particularly along the more exposed western and southern sides, have also been documented. Surfgrass (*Phyllospadix* spp.) has been observed along the western side of Ridley Island with eelgrass (*Zostera marina*) documented along the western and southern shorelines in low intertidal to shallow subtidal soft sediment areas (Hemmera 2019; see Photo 5).

Infaunal digs in mudflat areas have revealed bent-nose clams (*Macoma nasuta*), butter clams (*Saxidomus gigantea*), Nuttal's cockles (*Clinocardium nuttallii*), Pacific razor clam (*Siliqua patula*), horse clam (*Tresus* spp.), shrimp, and infaunal worms. Orange sea pen (*Ptilosarcus gurneyi*) have been observed on the lower intertidal sand/mud flats (Hemmera 2019).

Intertidal invertebrate species observed on the rocky shoreline include periwinkle snail (*Littorina* spp.), limpet, chiton (Class Polyplacophora), Dungeness crab (*Metacarcinus magister*), hermit crab (*Pagurus* spp.), shore crab (*Hemigrapsus* spp.) dire whelk (*Lirabuccinum dirum*) humpback shrimp (*Pandalus hypsinotus*), coonstripe shrimp (*Pandalus danae*), crangon shrimp (*Crangon* spp.) and anemone (Order Actiniaria) (Stantec 2014c; Hemmera 2019).

Fish species caught during intertidal beach seining in nearshore waters around Ridley Island include Pacific herring (*Clupea pallasii*), shiner perch (*Cymatogaster aggregata*), staghorn sculpin (*Leptocottus armatus*), surf smelt (*Hypomesus pretiosus*), starry flounder (*Platichthys stellatus*) and tubesnout (*Aulorhynchus flavidus*) (Hemmera 2019). A multi-month marine fish survey conducted between December 2014 and August 2015 in the waters in and around Ridley Island captured 60 species of marine finfish using a combination of beach seine, trawl, fyke and purse seine nets (Stantec 2014c). The most abundant species captured included rock sole (*Lepidopsetta bilineata*), sand sole (*Psettichthys melanostictus*), sculpin (Family Cottidae), shiner perch, starry flounder, Pacific herring and surf smelt. In general, the nearshore waters around Ridley Island are expected to provide rearing habitat for the five species of Pacific salmon smolts as they migrate through the area (Stantec 2014c).

Subtidal

The east and southeast sides of Ridley Island are characterized by bivalve-inhabited mudflats with sections of barnacle and benthic algae covered bedrock in addition to sections of bull kelpbeds.

The southwest corner of Ridley Island is characterized by subtidal bedrock slopes supporting barnacles and benthic algae including ribbon kelp (*Alaria* spp.) and bladed red algae, with a southwest embayment of soft sediment sustaining an eelgrass bed bordering the low water mark.

The western side of Ridley Island is characterized by bedrock slopes at the southern end, supporting benthic algae along the low water mark and subtidal canopy forming kelps, such as bull kelp, split kelp and sugar kelp, and branching and filamentous red algae, such as summer laver (*Boreophyllum aestivale*) and red sea fan (*Callophyllis* spp.), encrusting algae, including rusty rock (*Hildenbrandia* spp.), and rock crusts (*Clathromophum* spp., *Leptophytum* spp., *Lithophyllum* spp.) near and below the low water mark.

Continuing up the western shore to the north, the nearshore subtidal zone is once again dominated by benthic algae covered bedrock with sections of eelgrass colonized soft sediment down shore of a large embayment.

Freshwater

Freshwater surveys on Ridley island include a fish habitat assessment in 2013 (AECOM 2014a), water quality assessments in 2008 (Jacques Whitford-AXYS Ltd. 2008), and 2019 (Hemmera 2019), two electrofishing surveys in 2013 (AECOM 2014a), minnow trapping in 2008 (Jacques Whitford-AXYS Ltd. 2008), 2013 (AECOM 2014a), and 2019 (Hemmera 2019) and environmental DNA (eDNA) sampling in 2019 (Hemmera 2019).

Freshwater riparian habitat on Ridley Island includes areas of grasses, salmonberry, ferns, western redcedar, red alder, sedges, bogs and wetlands of sphagnum mosses, shore pine, and skunk cabbage. A more complete description of the bog and wetland conditions can be found in Section 2.2.1.3 Vegetation and Wetlands.

Previous field surveys have concluded that freshwater habitats on Ridley Island are generally considered to be unsuitable for fish as they consist of acidic small ponds and short, disconnected watercourses draining from bogs and wetlands. In addition, the majority of the watercourses end with barriers to the marine environment, though some are culverted and have connection to marine habitat (Jacques Whitford-AXYS 2008). Of the 26 watercourses and one pond identified on Ridley Island in Hemmera's 2019 report, 10 of these watercourses and one pond were sampled by either electrofishing, minnow trapping, or eDNA analysis in 2008, 2013 and/or 2019 (Hemmera 2019). One watercourse and one pond were confirmed to support fish with an additional three watercourses classified as potentially supporting fish (Hemmera 2019). Additional unsampled watercourses and ponds exist on Ridley Island.

The one known fish-bearing watercourse on the western side of Ridley Island (Photo 6) is a 600-m long stream that is connected to the ocean and provides high quality habitat for resident fish and rearing anadromous salmonids (Hemmera 2019). This watercourse has been documented to support coastrange sculpin (*Cottus aleuticus*), Dolly Varden (*Salvelinus malma*), threespine stickleback (*Gasterosteus aculeatus*) and rearing habitat for juvenile coho salmon (*Oncorhynchus kisutch*) (Hemmera 2019).

The one known fish-bearing pond on Ridley Island is on the eastern end and supports threespine stickleback (Photo 2). The pond has no connectivity to the marine environment and may not be suitable for other freshwater fish as none were found during the minnow trapping and eDNA survey completed in 2019 (Hemmera 2019).

A watercourse on the eastern side of Ridley Island maintains connectivity with the marine environment and hosts habitat suitable for fish; however, no fish were caught during minnow trap sampling in 2019. Environmental DNA results were inconclusive but suggest the watercourse could be seasonally inhabited by fish, including salmonids (Hemmera 2019).

NOTE: Photo looking East, Taken August 29, 2019
SOURCE: Hemmera 2019.
Photo 1 Intertidal Marsh and Marine Riparian Vegetation on Eastern Side of Ridley Island

NOTE: Photo looking South, Taken August 29, 2019
SOURCE: Hemmera 2019

Photo 2 Pond Supporting Threespine Stickleback located on the Eastern Side Ridley Island

NOTE: Photo looking West, Taken June 13, 2014
SOURCE: PRPA 2018

Photo 3 Intertidal Marsh, Bedrock, Cobble and Mudflat Shoreline on East Side of Ridley Island

NOTE: Photo looking Northwest, Taken June 13, 2014
SOURCE: PRPA 2018.

Photo 4 Modified Rip-rap and Natural Bivalve Inhabited Mudflat Shoreline on South Side of Ridley Island

NOTE: Photo looking Northwest, Taken June 13, 2014
SOURCE: PRPA 2018.

Photo 5 Bedrock, Cobble and Fine Sediment Shoreline with Eelgrass Bed in Embayment on Southwest Side of Ridley Island

NOTE: Photo looking East, Taken September 2, 2019
SOURCE: Hemmera 2019
Photo 6 Fish-Bearing Watercourse Discharging into Intertidal Marsh in Embayment on West Side of Ridley Island

NOTE: Photo looking West, Taken June 13, 2014
SOURCE: PRPA 2018.
Photo 7 Intertidal Marsh, Bedrock and Cobble Shoreline within Large Embayment at Mouth of a Fish-bearing Stream on West Side of Ridley Island

2.2.1.6 Species at Risk

Existing information on species at risk and their critical habitats that have the potential to be present on Ridley Island and waters potentially affected by the Project (Table 2-6) was compiled based on occurrence records and species distribution (i.e., a query of the BC Conservation Data Centre *BC Species and Ecosystems Explorer*, Fisheries and Oceans Canada *Aquatic Species at Risk Map, and eBird Canada)* and a review of baseline surveys completed in the Prince Rupert region to identify species with habitat requirements similar to those available on Ridley Island (JWA 2008; Stantec 2011a, 2014; BC CDC 2020; eBird Canada 2020; Hemmera 2020).

According to eBird Canada (2020) Band-tailed pigeon, barn swallow, black swift, California gull, horned grebe, northern goshawk, red-necked phalarope have been observed in the general vicinity of the project area (e.g., Kaien Island, Port Edward) but not on Ridley Island. Great blue heron and peregrine falcon were observed on Ridley Island in 2018 (eBird Canada 2020). The nearest observation of olive-sided flycatcher was in 2002 in Diana Lake Provincial Park, 9 km east of the Project area (eBird Canada 2020). The nearest observation of western screech-owl was in 2015 west of Shawatlan Lake, 14 km northeast of the Project area (eBird Canada 2020).

Environment Canada has mapped a 3.4 ha area at the southeast corner of Ridley Island as a Geographic Location Polygon as a Geographic Location Polygon within which nesting critical habitat for marbled murrelet may be found (Environment Canada 2014). This polygon is mapped as potentially suitable habitat thought to contain critical marbled murrelet nesting habitat. (Environment Canada 2014). However, to confirm the presence of critical habitat, it is necessary to assess the area to determine if the biophysical attributes of suitable nesting habitat are present. This includes key microhabitat attributes (e.g., nest tree characteristics, presence of canopy gaps, branch characteristics, and presence of moss and other epiphytes for nest beds) and stand- and landscape-level attributes (e.g., distance from saltwater, elevation, stand age, tree height, and canopy complexity (Environment Canada 2014). Habitat assessment for marbled murrelet nesting indicated there was very little suitable nesting habitat on Ridley Island (Stantec 2011a, see Figure 6). Similarly, AECOM (2014) indicated that Ridley Island was unlikely to have suitable nesting habitat for marbled murrelets based on known habitat preferences.

Small patches of moderately suitable northern goshawk nesting habitat are distributed throughout Ridley Island (Stantec 2011a, see Figure 7), but given the low amount of habitat, and lack of records, Stantec (2011a) suggest they are unlikely to breed on Ridley Island. AECOM (2014) suggests the reason northern goshawks are not regularly detected on the island is the high levels of anthropogenic activity in the vicinity. Most of the south end of Ridley Island (well over 50%) was rated as low habitat suitability for northern goshawk nesting (AECOM 2014c, see Figure 4-6). The patches of moderate habitat on Ridley Island are considered small and fragmented, so AECOM (2014) consider it unlikely that goshawks would nest there.

Most of the south end of Ridley Island (well over 80%) was rated as low suitability for western screech-owl nesting, although there were patches of moderate and high suitability habitat along the shoreline of the island (AECOM 2014c, see Figure 4-8). Western screech-owl were detected near the Ridley Island Road on Kaien Island, but not on Ridley Island itself (AECOM 2014c, see Figures 4-8 and 4-9).

Most of the south end of Ridley Island (well over 80%) is considered suitable habitat for western toads. The wetlands provide suitable breeding habitats (Stantec 2011a, see Figure 9), and areas around these wetlands provide suitable terrestrial living habitats for adult western toads (Stantec 2011a, see Figure 8).

Table 2-6 Wildlife Species of Conservation Concern That Have the Potential to Occur On Ridley Island and Its Shoreline

Species Name	Scientific Name	BC List Status [1]	COSEWIC Status [2]	SARA Status [3]
Birds				
Band-tailed Pigeon	*Patagioenas fasciata*	Blue	SC	Schedule 1—SC
Barn Swallow	*Hirundo rustica*	Blue	T	Schedule 1—T
Great Blue Heron, *fannini* subspecies	*Ardea herodias fannini*	Blue	SC	Schedule 1—SC
Horned Grebe	*Podiceps auratus*	Yellow	SC	Schedule 1—SC
Marbled Murrelet	*Brachyramphus marmoratus*	Blue	T	Schedule 1—T
Northern Goshawk	*Accipiter gentilis laingi*	Red	T	Schedule 1—T
Olive-sided Flycatcher	*Contopus cooperi*	Blue	SC	Schedule 1—T
Peregrine Falcon—*pealei* ssp.	*Falco peregrinus pealei*	Blue	SC	Schedule 1—SC
Western Screech-Owl	*Megascops kennicottii kennicottii*	Blue	T	Schedule 1—T
Mammals				
Little Brown Myotis	*Myotis lucifugus*	Yellow	E	Schedule 1—E
Marine Mammals[4]				
Steller Sea Lion	*Eumetopias jubatus*	Blue	SC	SC—Schedule 1
Amphibians				
Western Toad	*Bufo boreas*	Yellow	SC	Schedule 1—SC
Marine Fish[4]				
Northern Abalone	*Haliotis kamtschatkana*	Red	E	E—Schedule 1
Quillback Rockfish	*Sebastes maliger*	No Status	T	NS—Under Consideration for Addition to Schedule 1

Table 2-6 Wildlife Species of Conservation Concern That Have the Potential to Occur On Ridley Island and Its Shoreline

Species Name	Scientific Name	BC List Status [1]	COSEWIC Status [2]	SARA Status [3]
Yelloweye Rockfish	*Sebastes ruberrimus*	No Status	SC	SC—Schedule 1

NOTES:

[1] BC List Status: Red—extirpated, endangered, or threatened; Blue –special concern; Yellow—not at risk.

[2] COSEWIC Status: E—endangered (species facing imminent extirpation or extinction); T—threatened (species likely to become endangered if limiting factors are not reversed); SC –special concern (species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats);

[3] SARA Status: Species at Risk Act schedule and status (definitions the same as COSEWIC).

[4] Only marine species considered to have a moderate to high likelihood of being exposed to potential Project effects are included

SOURCE: BC CDC (BC Conservation Data Centre). 2020. Species and Ecosystems Explorer. Available at: http://a100.gov.bc.ca/pub/eswp/. Accessed March 4, 2020.

2.2.2 Social Environment

2.2.2.1 Archaeological and Heritage Resources

Regulatory Context

There is no specific federal heritage legislation to guide the management of archaeological and heritage resources on federal lands. However, in British Columbia, archaeological and heritage resources are managed in accordance with the legal requirements and conditions stemming from the provincial *Heritage Conservation Act* (HCA). "Archaeological resources" are defined as human work or places that give evidence of human activity predating 1846 and that have heritage value as defined by the *Act*. "Heritage resources" include all resources that are of historical, cultural, aesthetic, scientific or educational worth or usefulness as sites or objects of value to British Columbia, a community, or an Aboriginal people. Furthermore, the provincial Archaeology Branch has established standards, policies, and guidelines that guide the archaeological assessment process in BC. These standards, policies, and guidelines are followed in this assessment.

Previous Archaeological Studies

In 1982 and 1983, an intensive survey of coastal portions of Ridley Island was conducted to assess the potential for impacts on heritage sites from the proposed expansion of port facilities (Archer 1984). The study discovered five culturally modified tree (CMT) sites **(GbTn-35, 36, 38, 39 and 40)** containing 28 CMTs; four of the sites were located along the east and south shores of Ridley Island within 100 m of the water and the fifth on Gay Island to the southeast. Most of the features exhibited bark stripping, although eight Aboriginally-logged features were also recorded, seven with evidence of plank removal. None of these CMTs has been directly dated.

In 2006, an archaeological impact assessment (AIA) of the then-proposed WestPac liquefied natural gas transshipment terminal identified four CMT sites consisting of seven CMTs within the proposed project footprint (Streeter 2006a). All were determined to be too recent to fall under HCA protection and were not issued permanent site numbers, instead being referenced by their temporary site numbers **GbTn-2006 T1** to **T4**. Six of the seven features were bark-stripped, with the seventh exhibiting kindling removal. During the same AIA, Streeter also assessed as low the potential for sub-tidal resources to conflict with the "berthing corridor" on the west side of the island. This was because sea level studies (Fedje et al. 2005) had concluded that, in this area, archaeological materials were not expected to exist more than 3 m below present sea level, whereas this project component was mostly located in depths of 6–7 m (Streeter 2006b).

Following the completion of a 2006 AOA for developments proposed on Ridley Island to the west of the existing coal ship loading facility (Cooper and Eldridge 2006), an AIA was conducted, resulting in the recording of CMT site **GbTn-60** (Eldridge and Cooper 2007), comprised of seven bark-stripped cedar CMTs. Two of the CMTs recorded as part of GbTn-60 had already been recorded as site GbTn-2006 T4. Although undated, the remaining five features were thought to pre-date AD 1846 and were therefore registered with the Archaeology Branch.

In 2008, an AOA produced for the Prince Rupert Port Authority for all of Ridley Island indicated that most of the inland portions of the island have low potential for heritage sites of any kind (Brunsden and Eldridge 2008) and areas of high archaeological and CMT potential are located primarily within 100 m of the modern shoreline.

Also in 2008, archaeological monitoring by Stantec of geotechnical testing for Canpotex's proposed potash export terminal project and related clearing activities identified four CMT sites consisting of seven CMTs, none of which were dated (Hutchcroft 2011). Two of these CMT sites, **GbTn-71** and **-72**, a single bark-stripped feature and test tree, respectively, were recorded as likely pre-dating AD 1846. The other two sites (**GbTn-2008 T3** and **T4**, all consisting of bark-stripped trees) were considered to post-date AD 1846.

In late 2008, an AIA of terrestrial infrastructure planned in relation to the NaiKun Wind Energy project, including a transmission line right-of-way proposed for the south coast of Kaien Island and the south and east coasts of Ridley Island, recorded CMT sites **GbTn-93** and **-94** (Hall et al. 2009). Neither site was dated, although GbTn-93, consisting of two bark-stripped features and two kindling removal trees, and GbTn-94, consisting of two bark-stripped cedars, are considered to be old enough to fall under *HCA* protection. Of these, only GbTn-93 falls on Ridley Island.

During geotechnical testing for Canpotex's proposed potash export terminal project in 2009, core samples were extracted by Stantec from submarine contexts off the west coast of Ridley Island, principally along the proposed trestle route (Hutchcroft 2011). Four vibracore samples extracted from underwater contexts shallow enough to have been subaerial or intertidal during the mid-Holocene low-stand in relative sea-levels were wet-screened through 1/8 inch (3 mm) mesh for archaeological materials. None were identified.

In March 2010, Stantec conducted archaeological reconnaissance and monitoring to confirm that CMTs were not impacted by the clearing of vegetation required to provide access for drilling equipment, or by the geotechnical borehole testing program conducted for the proposed Canpotex Potash Export Terminal. No CMTs were identified within the impact zones associated with borehole testing or related access routes. In addition, the potential for CMTs in these areas was deemed as low as most of the areas proposed for borehole testing were comprised of water-saturated muskeg. However, five proposed borehole locations along the coastal fringe of Ridley Island were assessed as having high archaeological potential; archaeological monitoring of borehole tests at these locations was subsequently completed in May 2010. No archaeological materials were identified during this study, and no additional CMTs were noted (Hutchcroft 2011).

In December 2012 and October 2013, an AIA addressing the proposed Prince Rupert LNG Project was conducted resulting in the identification of seven previously unrecorded archaeological sites, **GbTn-105, -106, -104, -109, -127, -128, and -129**, and a subsurface component of previously recorded CMT site **GbRn-39** (Fisher 2014). Additionally, as a result of this study, previously undocumented CMTs were identified at recorded archaeological sites **GbTn-38, -39, and -40**, and the remains of an early 20th century structure, possibly associated with the historically significant Barrett Point Battery or the Port Edward Cannery National Historic Site, were recorded as archaeological site **GbTn-130** (Fisher 2014).

In January 2020, an AIA addressing proposed geotechnical investigations for the PRPA was undertaken on south Ridley Island and included field visits to recorded archaeological sites **GbTn-36**, **-38**, and **-106**, and ground truthing within a small portion of **GbTn-39** (Mueller 2020). As a result of this assessment, an additional 22 potential CMTs were recorded at **GbTn-36** but none could be confirmed due to the limited scope of the project (Mueller 2020).

Recorded Archaeological and Heritage Resources

Twenty-six archaeological sites are recorded on Ridley Island. Twenty-one of these sites are entirely composed of culturally modified trees (CMTs), two are composed of CMTs, lithic scatters, faunal remains (non-human vertebrate skeletal specimens or fragments associated with human activity) and Fire Modified Rock (FMR) (broken, burnt or otherwise modified rock as a result of human activity), one is composed of FMR and a CMT, one is composed of shell midden deposits that include faunal remains, lithic artifacts, bone and antler artifacts and human remains, and one is a post-contact structure.

Eight of the archaeological sites recorded on Ridley Island fall near the Project site; six of these sites are composed of CMTs only and two are composed of CMTs, lithic scatters, faunal remains, and FMR (Table 2-7).

Table 2-7 Recorded Archaeological and Heritage Resources in the Project Footprint

Site	Type	Comments
GbTn-36	CMT	N=6; undated; additional 22 possible/unconfirmed CMTs
GbTn-38	CMT	N=27; undated but 5 CMTs assumed to pre-date 1846
GbTn-39	CMT, lithics, faunal remains, FMR	CMTs: N=21; undated but at least 1 CMT assumed to pre-date 1846
GbTn-40	CMT	N=32; undated but 8 CMTs assumed to pre-date 1846
GbTn-72	CMT	N=1; possibly pre-dates 1846 (formerly recorded as GbTn-2008 T2)
GbTn-93	CMT	N=4; undated but 2 CMTs possibly pre-date 1846
GbTn-106	CMT, lithics, faunal remains, FMR	CMTs: N=6; all assumed to pre-date 1846
GbTn-109	CMT	N=1; assumed to pre-date 1846

Potential Unrecorded Archaeological and Heritage Resources

Although much of Ridley Island has been subject to previous archaeological study, there are portions of the Project site that have not been assessed or were assessed prior to the implementation of current Provincial standards and guidelines. Therefore, there is potential for the Project to interact with unidentified archaeological and heritage resources. Based on the results of previous archaeological work and the site types identified on the island, undocumented archaeological and heritage resources potentially present at the Project site may include CMTs, lithic scatters, faunal remains, FMR, bone/antler tools, shell midden, and/or human remains. Of these types, faunal remains, bone/antler tools and FMR are most commonly recorded within and in association with broader site types such as shell midden and lithic scatters.

A CMT is a tree that has been altered by First Nations as part of their traditional use of the forest. Modifications normally take the form of: bark-stripping, wherein a tree, usually cedar, was stripped to obtain the inner bark used to manufacture numerous items such as rope, baskets, mats, clothing, etc., or; aboriginal logging, wherein trees, logs or stumps evidence plank removal for house construction, kindling removal for fuel, shaping into canoes or posts, and/or chopping to test their soundness prior to subsequent use. The CMTs recorded on Ridley Island display bark-stripping, plank removal, kindling removal, trap setting, aboriginal logging, and/or testing.

Lithic scatters are sites comprised of stone tools, stone tool fragments, and debitage—the flakes of stone that are produced when stone tools are manufactured. These stone artifacts may be found scattered across the ground surface or may have been buried since their original deposition. These sites may vary from a single, isolated artifact—a stone arrowhead, knife, adze, or hand maul, for example—to extensive scatters of hundreds of tools, tool fragments and pieces of debitage. Two of the sites on Ridley Island that are known to include lithics (**GbTn--39** and **-106**) each also include faunal remains, FMR and CMTs. The third, and only other site on Ridley Island where lithic artifacts have been found, **GbTn-19**, consists of shell midden deposits within which faunal remains, bone tools, and human remains have been recorded along with the small lithic assemblage. The lithic artifacts documented at these three sites include ground stone tools, flaked stone tools, and debitage.

A shell midden is recognizable by the presence in the soil of shellfish remains discarded after their processing for consumption, mixed in with other elements such as stone, bone, antler and/or shell artifacts, FMR, charcoal, ash, burnt soil, and/or faunal or human skeletal remains. Shell middens are unique in that the shell neutralizes normal soil acidity, leading to the preservation of archaeological materials that would otherwise quickly degrade. They are usually found near the shoreline but can also be located inland. Shell midden sites can range significantly in length and width from a few metres to several hundred metres, and in depth from 10 cm to up to 4 metres or more. They may represent short-term single-use occupation as a temporary campsite, repeated use on a seasonal basis or long-term occupation over several hundred or thousand years. In the general region, 12 recorded shell middens have been dated to between 1,500 and 3,500 years old, and another four to between 3,500 to 5,000 years old. The one site on Ridley Island comprised of shell midden (**GbTn-19**) has been dated to almost 3,000 years in age. This site has been severely disturbed or destroyed by previous developments.

Human remains can be represented by as little as a single tooth to a complete skeleton and can be from individuals of any age (i.e., infants, juveniles, adults). Mortuary features represent deliberate depositional events and can be identified by a number of different practices, some of which include barrows/mounds, burial cairns or interment within shell middens. **GbTn-19** is the only site on Ridley Island at which human remains have been identified; four human burials encountered during salvage excavations in 1978.

2.2.2.2 Current Use of Lands and Resources for Traditional Purposes

As per section 81 of the IAA the definition of environmental effects includes impact of changes to the environment as a result of the Project on the Indigenous peoples of Canada. This includes consideration of whether the Project has the potential to result in a change to the environment that may affect physical or cultural heritage, or any structure, site or thing of historical or archaeological significance, as discussed in Section 2.2.2.1. It also includes consideration of potential effects on the current use of lands and resources for traditional purposes.

Prince Rupert and the surrounding area have historically been used by the Tsimshian for thousands of years. Traditional uses known to have been carried out in the area include hunting, fishing, and harvesting of plants for foods and medicine. These areas continue to be used for traditional purposes, however, because access to Ridley Island has been restricted there are no current use activities occurring on the Island or, more specifically, at the Project site.

The PRPA has asked Indigenous groups to share information on Indigenous knowledge that could help in the understanding of how potential effects of the Project on the environment may affect Indigenous peoples. At the time of writing this draft report this information was not available. However, any studies or reports that are shared by Indigenous groups prior to finalization of this report will be reflected in the final version of the document.

3.0 RESOURCES AND CONSULTATION

Development of this assessment relied on information gathered from existing resources including environmental assessments previously completed in the area and information shared through consultation with potentially affected Indigenous groups, the public and regulatory bodies. The following sections describe available resources and results of consultation events.

3.1 INFORMATION RESOURCES

Numerous studies have taken place on Ridley Island and the surrounding area over the past ten plus years. Studies include environmental assessments, planning and monitoring initiatives, many of which have included public and Indigenous consultation. These documents were consulted as part of the effects evaluation along with information obtained from Indigenous and public consultation, federal authorities, and review of scientific articles (see Section 8.0, References, for a list of gray and peer reviewed articles referred to as part of this effects evaluation).

Environmental assessments, monitoring and planning documents referenced as part of this effects evaluation include, but are not limited to, the following:

- Ridley Island Master Development Plan (2008)
- Canpotex Potash Terminal and Road Rail Utility Corridor (2011)
- PRPA 2020 Land Use Management Plan (2012)
- Fairview Terminal Phase II Expansion Project (2012)
- Ridley Terminals Expansion Project (2012)
- PRPA Marine Environmental Water Quality Monitoring Program (since 2013)
- Prince Rupert Airshed Study (2016)
- Prince Rupert LNG Project (2013)
- Pacific NorthWest LNG Project (2016)
- AltaGas Ridley Island Propane Export Terminal Project (2016)
- Aurora LNG Project (2016)
- Pacific North Coast Integrates Management Area (PNCIMA) Plan (2017)
- Vopak Pacific Canada Bulk Liquids Export Terminal Project (2018)
- Wolverine Terminals Prince Rupert Marine Fuel Services (2018)

3.2 PUBLIC CONSULTATION

As part of efforts to complete an open, informed and meaningful assessment, and in compliance with sections 84 and 86 of the IAA, the PRPA identified various ways to obtain public input on the RIELP. PRPA initially planned on hosting open houses in Prince Rupert and Port Edward to present and invite comment on the Project Description. However, due to Covid-19 the open house format was not possible. Instead PRPA developed a project public engagement page designed to share project information through the posting of a series of brief videos summarizing key elements of the Project Description, project statistics, frequently asked questions and a link for submitting comments.

Key elements discussed in the videos included Project overview, Project description, environmental review process, existing environment, potential effects and mitigation and logistics platform overview.

A summary of comments received on the Project Description is provided in Table 3-1.

Table 3-1 Public Comments

Concern/Comment	Response
Truck activity and the status of the Ridley Island Connector Road	The Ridley Island Connector Road is under construction now and scheduled to be complete by early 2021. The five-kilometer road and rail corridor will enable dedicated direct access for trucks and trains between Fairview Container Terminal and Ridley Island, virtually eliminating container truck traffic from downtown.
Air quality monitoring and potential effects on air quality	Currently, PRPA measures ambient levels of particulate matter (PM2.5 and PM10), nitrogen oxides (NOX, NO2, NO), sulfur dioxide (SO2), and tropospheric ozone (O3). NO and NO2 are commonly referred to together as NOX. Monitoring data is collected and available on PRPA's website. The British Columbia Ministry of Environment and Climate Change Strategy has established air quality objectives for the province that PRPA measures itself against to ensure best practices. Currently, air quality monitoring happens in real-time at two sites in PRPA jurisdiction where engine combustion is most concentrated, near Westview and Fairview terminals. The environmental effects evaluation related to this project will consider whether that monitoring program should be expanded to Ridley Island.
In-water works associated with a dock or berth	This project does not include a new marine berth (dock). Containers that are loaded with exports will be trucked to DP World's Fairview Terminal on the Fairview-Ridley Connector Road currently under construction.
Consultation process	The Project Description was posted for public comment in April, 2020. PRPA had planned on hosting an open-house to support public consultation but due to Covid-19 the open-house was cancelled. Instead information, including video presentation on the Project, were posted on the Ports project public engagement webpage. The PRPA will also be invited the public to comment on the proposed Project determination.

Before making a determination on the Project the PRPA will post a notice on the Canadian Impact Assessment Registry (CIAR) notifying the public that it intends to make a determination and inviting the public to participate in a 30-day public comment period to provide comments on the determination. Comments received from the public will be tracked and reviewed be regulatory authorities and responses will be provided on how comments were considered in decision-making.

Following consideration of comments received from the public, the PRPA will post a notice of its determination on the CIAR, including any mitigation measures that were considered when making the determination.

3.3 INDIGENOUS CONSULTATION

Federal authorities utilize the environmental effects evaluation process to integrate Indigenous consultation into decision making. Consultation is guided by federal policy with the overall objective of contributing to reconciliation. This includes providing information about the Project and providing meaningful feedback and consideration on issues and concerns raised through the review process.

Federal Authorities will be engaging with Indigenous groups through the Project Description, Environmental Effects Evaluation, and Determination phases of the environmental review. Potentially affected Indigenous groups were identified based on overlap of the Project footprint with traditional territories. Based on this overlap the following Indigenous groups were identified:

- Lax Kw'alaams Band
- Metlakatla First Nation
- Kitselas First Nation
- Kitsumkalum First Nation
- Gitxaala Nation
- Gitga'at First Nation

4.0 ASSESSMENT METHODS

As per section 81 of IAA, the effects evaluation must assess potential effects of the project on the biophysical environment and then determine how these effects may in turn affect Indigenous people, health, social or economic conditions. To meet these requirements the effects evaluation first identified potential valued components (VCs; see Table 4-1). VCs where then evaluated based on the following steps:

1. Does the VC have the potential to interact with the Project
2. If there is a potential interaction with the Project, does that interaction have the potential to result in an effect on the biophysical environment; if yes the VC should be assessed
3. Where an interaction has the potential to result in an effect on the biophysical environmental is there a potential for that effect to in turn affect health, social or economic conditions; where a potential effect is identified the VC should be assessed

Based on this evaluation, the following VCs were carried forward for further evaluation (see Table 4-1 for rationale):

- Air Quality and Greenhouse Gases
- Noise
- Vegetation and wetlands
- Wildlife and wildlife habitat
- Fish and fish habitat (freshwater and marine)
- Archaeological resources

Each VC was then carried through the remaining steps of the effects assessment:

- **Describing Potential Effects and Effects Pathways:** how the Project changes could affect the VC and lead to adverse effects
- **Identification of Effective and Established Mitigation Measures**: identification of effective and established mitigation measures that reduce or eliminate potential adverse effects of the Project. Effective and established mitigation measures are those that have been implemented successfully before in similar situations; are well understand and considered reliable; and either result in the avoidance of an effect or reduce its magnitude or duration.
- **Characterization of residual effects and significance determination**: characterization of potential residual effects based on their magnitude, reversibility, geographic extent, duration and frequency. Where characterizations indicate a potential for a significant effect, criteria will be weighted based on VC-specific standard or thresholds to make a significance determination. Criteria used to characterize residual effects and the determination of significance is outlined in Table 4-2.

The potential for an effect on the biophysical environment to affect Indigenous peoples is discussed in Section 6 and was based on the results of the VC assessments.

Table 4-1 Valued Component Selection and Rationale

Valued Component	Interaction with Project	Carried Forward in Assessment	Rationale
Biophysical Elements			
Air Quality and Greenhouse gases (GHG)	Yes	Yes	The Project has the potential to affect the atmospheric environment through the release of criteria air contaminants (CACs) and GHG during construction and operation of the Project. Changes to ambient air quality could affect ecological and human health.
Noise	Yes	Yes	Project related noise emissions during construction and operation may affect residents of Port Edward or other sensitive receptors (e.g., wildlife).
Vegetation and Wetlands	Yes	Yes	The Project has the potential to affect vegetation and wetland resources in the proposed Project footprint as a result of clearing and site preparation. Wetland conservation is of importance to the federal government under the Federal Wetlands Policy, and to Indigenous groups.
Wildlife and Wildlife Habitat	Yes	Yes	Project-related site clearing may result in the loss or alteration of wildlife habitat that could affect wildlife movement patterns, and mortality risk. Operational activities could result in sensory disturbance.
Fish and Fish Habitat (freshwater and marine)	Yes	Yes	The Project has the potential to affect fish and fish habitat through removal of riparian vegetation, marine infilling and construction of watercourse crossings.
Water Quality and Quantity	Negligible	No	Construction of Project components is not expected to result in changes to water quantity or flow. Changes in water quality will be addressed in the fish and fish habitat VC.
Socio-Economic Elements			
Economy	Negligible	No	Ridley Island is under the jurisdiction of the PRPA and is not accessible to the public. The Project site is located in an undeveloped part of the island that is zoned for industrial use. As a result, potential effects of the Project on the environment are not expected to affect economic conditions.
Navigation	No	No	The Project does not include construction of Project components in navigable waterways. There may be limited in-filling in the nearshore environment, but this would not infringe on areas that are considered navigable.
Land and Resource Use	No	No	Ridley Island is under the jurisdiction of the PRPA and is not accessible to the public. The Project site is located in an undeveloped part of the island that is zoned for industrial use. As a result, potential effects of the Project on the environment are not expected to affect land and resource use.

Table 4-1 Valued Component Selection and Rationale

Valued Component	Interaction with Project	Carried Forward in Assessment	Rationale
Health Elements			
Human Health	Negligible	No	Change to air quality and noise as a result of Project activities are not expected to exceed relevant guidelines for human health. Ridley Island is under the jurisdiction of the PRPA and is not accessible to the public. As a result, there is no change in access to country foods.
Indigenous Peoples			
Current Use of Lands and Resources	No	No	Ridley Island is under the jurisdiction of the PRPA and is not accessible to the public or Indigenous groups. As a result, there is no current use of lands and resources by Indigenous peoples. DFO has closed the intertidal area of Ridley Island to shellfish harvesting.
Archaeological Resources	Yes	Yes	Project activities may result in loss or disturbance to archaeological or heritage site contents and site contexts through ground disturbance associated with brush and/ or topsoil removal, grading, trenching, vehicle traffic and use of workspaces during construction activities

Table 4-2 Characterization Criteria for Significance Determination of Residual Effects

Criteria	Not Significant	Potentially Significant
Magnitude	Low to moderate: effect results in no to moderate change in baseline conditions but within regulatory limits or objectives	High: effect results in harm to the environment and/or a change in baseline conditions that exceed regulatory limits or objectives
Reversibility	Reversible	Irreversible
Geographic extent	Site-specific: effects are limited to the Project site Local: effects are limited to Ridley Island	Regional: effects extend beyond Ridley Island
Duration	Short-term: effect is measurable for less than a month Medium-term: effect is measurable for more than a month but not exceeding two years	Long-term to permanent: effect is measurable for the life of the Project or is permanent
Frequency	Once: effect occurs once Rare: effect occurs monthly	Continuous: effect occurs daily

4.1 ASSESSMENT BOUNDARIES

Spatial boundaries for each valued component are summarized in Table 4-3. Boundaries are based on the potential extent of adverse effects.

Table 4-3 Valued Component Assessment Boundaries

Value Component	Assessment Boundary
Air Quality	The area where Project air emissions are expected to occur, generally within 500 m from the logistics platform site
Noise	3-km buffer from the logistics platform site and the rail corridor
Vegetation and wetlands	The logistics platform site and the rail corridor
Wildlife and wildlife habitat	The logistics platform site and the rail corridor
Fish and fish habitat **(includes marine and freshwater)**	The logistics platform site and the rail corridor
Archaeological resources	The logistics platform site and the rail corridor

4.2 TEMPORAL BOUNDARIES

Based on the current Project schedule, the temporal boundaries of the assessment are:

- Construction: Q1 2021 to Q4 2022
- Operations: Q1 2023
- Decommissioning: +50 years

5.0 ASSESSMENT OF POTENTIAL EFFECTS

This section of the Application provides an assessment of the potential effects of the proposed Project on the VC's identified in Table 4-1. The VCs are:

- Air Quality and Greenhouse Gases
- Noise
- Vegetation and wetlands
- Wildlife and wildlife habitat
- Fish and fish habitat (freshwater and marine)
- Archaeological resources

5.1 AIR QUALITY AND GREENHOUSE GASES

5.1.1 Scope of Assessment

Air quality is a VC because of its intrinsic importance to the health and wellbeing of humans, wildlife, vegetation and other biota. The atmosphere is an important pathway for the transport of contaminants to the freshwater, terrestrial, and human environments. Project construction, operation and decommissioning activities result in the release of CACs to the atmosphere that, owing to their physical and chemical properties, are classed as air contaminants that will change ambient air quality. These substances are activity-dependent (e.g., dust is raised during construction land clearing activities; combustion by-products emitted during construction and operation).

In addition, greenhouse gases (GHGs) are included in the VC because the change in GHGs are of scientific and regulatory concern. GHGs absorb and re-emit infrared radiation from the planetary surface, thereby introducing the potential effect of warming the lower levels of the atmosphere and acting as a thermal blanket for the planet. Globally, GHGs are emitted from numerous natural and human sources and the increased atmospheric concentrations have been associated with climate change (Intergovernmental Panel on Climate Change [IPCC] 2007). Although the science of climate change has not been advanced to the point where a clear cause-and-effect relationship can be established between project-specific and subtle changes to global climate, GHG assessments determine the effect on facility-level and jurisdictional inventories.

The primary pathway for air contaminants to reach human and ecological receptors is via airborne dispersion and deposition during Project activities. The potential effect addressed in the air quality assessment is the "change in ambient air quality" due to Project emissions.

The Project will result in the release of GHGs to the atmosphere. The key potential effect addressed in the atmospheric environment assessment is the "change in atmospheric greenhouse gases" due to Project emissions during construction, operation and decommissioning.

Potential effects and effect pathways for each effect are described in Table 5-1.

Table 5-1 Potential Effects and Effects Pathways for Air Quality and Greenhouse Gases

Potential Environmental Effect	Effect Pathway
Change in ambient air quality	Atmospheric dispersion of CAC emissions from Project equipment and activities during operation
Change in atmospheric greenhouse gases	GHG emissions from Project equipment and activities during construction and operation

5.1.2 Mitigation Measures

Mitigation measures will be implemented to manage and reduce emissions during construction, operation and decommissioning. Emission mitigation measures during the three Project phases are based on standard best management practices (BMPs) for the reduction of air emissions from construction activities (ECCC 2005). The mitigation measures to reduce air and GHG emissions are summarized in Table 5-2.

Table 5-2 Mitigation Measures Proposed to Avoid or Reduce Change in Air Quality and Greenhouse Gases

Applicable Valued Component	Effective and Established Mitigation Measure
BOTH	Optimization of connector and access roads and infrastructure to reduce transportation and haul distances
BOTH	Engines and exhaust systems will be properly maintained to keep construction and operation equipment in good working condition
BOTH	Trucks and vehicle idling times and cold starts will be reduced to the extent possible
CAC	Connector and access roads will be maintained in good condition, with regular inspections to monitor loose dust on the roads to reduce dust “track out” onto public roads
CAC	During dry periods, water will be applied to connector and access roads to reduce dust emissions. The application of water will be limited to non-freezing temperatures to avoid icing that can present a safety hazard. Watering is most effective immediately after application, and repeated watering several times a day might be required, depending on surface and meteorological conditions.
BOTH	Truck speed on the connector and access road will be limited to maximize fuel efficiency
BOTH	During the operational phase, vehicles and project infrastructure will be evaluated to ensure electrification opportunities are maximized
CAC	Surfaces of topsoil and overburden stockpiles will be stabilized during extended periods between usage, by means of vegetating or covering the exposed surfaces
NOTES: [a] CAC = this mitigation measure will lower the Project’s CAC emissions and improve air quality GHG = this mitigation measure will lower the Project’s GHG emissions BOTH = this mitigation measure will lower the Project’s CAC and GHG emissions	

5.1.3 Residual Effects and Significance Determination

A quantitative assessment (e.g., dispersion modelling) for RIELP construction, operation and decommissioning emissions and comparison to ambient air quality objectives is not warranted given that a similar, but much larger container handling project, the Fairview Terminal Phase II Expansion Project (2012), located nearby and within the Prince Rupert airshed was concluded to have no significant effects on air quality. The Fairview Terminal Phase II Expansion Project (2012) involves 2,000,000 TEUs per year and was assessed for its environmental effects during 2013 by the regulatory authorities (including Environment Canada) under the *Canadian Environmental Assessment Act* (CEAA) process. The residual effects for the Fairview Terminal Phase II Expansion Project (2012) for air quality were assessed as "not likely to be significant" (CEA Agency 2012a). The RIELP project will involve 900,000 TEUs per year at full build out, or approximately 45% of the capacity for the Fairview Terminal Phase II Expansion Project (2012). The sources of air emissions at both projects are similar, although the RIELP project will not involve marine vessel emissions.

The air and GHG emissions for the Project were estimated based on the ratio of the production rates (e.g., TEU per year) used for the full build out scenario from the Fairview Terminal Phase II Expansion Project. To ensure the determination reflects maximum potential contributions to air quality, these estimates are based on a traditional container yard operating format. Electrification of yard vehicles and high-density storage rack systems are not included within the assessment although these features would result in significant decreases to CAC's and GHG's. The following types and quantity of mobile equipment will be used during full build out and are sources of air and GHG emissions:

- Reach stackers (22)
- Empty container handlers (11)
- Fork lifts (22)
- Pickup trucks (10)
- 4.5 trains per day (in/out)
- 2,000 transits between Fairview Terminals and RIELP (daily round trip) on a dedicated connector road

The cantilevered rail-mounted gantry (RMG) used for loading and unloading intermodal (IM) rail cars (5) and for the container yard (17) will be electric and therefore will not be sources of air and GHG emissions. Similarly, the 17 electric bomb carts that are used to move containers between gantry cranes and reach stackers and yard-based RMG cranes will not be a source of air and GHG emissions. The estimated Project air and GHG emissions for rail and land sources for the Project at full build out are summarized in Table 5-3. Emissions during construction and decommissioning are expected to be lower than the full build out operation because construction and decommissioning will have fewer emission sources and the activities will be comparatively short term and transient.

Table 5-3 Estimated Criteria Air Contaminant and Greenhouse Gas Emissions from Operation (Full Build Out)

CAC Emissions	Rail (t/y)	Land (t/y)	Total for Rail and Land (t/y)
SO_2	2.2	8.5	10.7
NO_x	117.5	90.4	207.9
CO	34.6	180.2	214.8
PM_{10}	3.5	5.2	8.7
$PM_{2.5}$	3.5	5.2	8.7
VOC	8.6	18.6	27.2
GHG Emissions	**Rail (t/y)**	**Land (t/y)**	**Total for Rail and Land (t/y)**
CO_2	7,425.0	18,940.0	26,365.0
CH_4	0.4	0.9	1.3
N_2O	3.0	7.0	10.0
CO_2e	8,362.0	21,013.0	29,375.0

Project air emissions at full build out are expected to be localized to the study area and immediate surroundings.

For comparison, the Environmental Assessment Certificate (EAC) Application for the proposed Aurora LNG project (Digby Island) (2016) included the base case emissions for the Prince Rupert area that included the Fairview Container Terminal (Phase I), Prince Rupert Grain Terminal, Ridley Terminals and supporting rail and marine-based port activities (Stantec 2016a). Marine-based activities were listed as the major source of CAC emissions. The annual emissions for the land-based base case emissions were 14.9 tonnes of SO_2, 207 tonnes of NO_x, 154 tonnes CO, 175 tonnes PM_{10} and 94.7 tonnes $PM_{2.5}$. The Project's estimated NO_x and CO emissions are greater than the base case emissions that were listed in the Aurora LNG EAC Application. The Project's estimated SO_2, PM_{10} and $PM_{2.5}$ emissions are less than the base case emissions that were considered in the Aurora LNG EAC Application.

The Canadian Environmental Assessment Agency guidance document (CEA Agency 2003) outlines how to incorporate GHG considerations in environmental assessments. This assessment aligns with the guidance document by comparing Project GHG emissions to provincial and national GHG inventories. As stated in the guidance document (CEA Agency 2003), GHG assessments cannot address the significance of a single project's potential effect on climate change, as the small effect of one project on climate change cannot be accurately quantified or measured. Although it is understood that there is a relationship between GHG emissions from anthropogenic sources over the past 100+ years and a changing climate as an effect thereof, effects on climate change cannot be addressed in this GHG assessment. The science of climate change has not advanced to the point where a clear cause and effect relationship can be established between individual project releases and measurable changes to global climate.

The Government of Canada agreed in 2016 to reduce GHG emissions by 30 percent below 2005 levels by 2030 as part of the Paris Agreement (Government of Canada 2016). In June 2017, the House of Commons reconfirmed Canada's commitment to the Paris Agreement. Closely related to these decisions, recent guidance from the federal government has become available for the strategic assessment of climate change that applies to federal impact assessments. This guidance explains how to consider GHG emissions of a designated project considering public policy beyond the scope of a single project (Government of Canada 2019). The focus of this guidance is on the following:

- Quantification of GHG emissions for the Project
- Quantification of GHGs from upstream activities
- Review of best available technologies
- Assessment of climate change resilience.

The requirement is to establish whether a designated project will hinder or contribute to Canada's ability to meet its international commitments to reduce GHG emissions by 30% below 2005 levels by 2030, and to help to achieve a low carbon economy by 2050. The assessment presented herein will consider this guidance by comparing estimated GHG emissions from the Project activities to the current provincial and national totals, and to the current provincial and federal targets.

Table 5-4 compares the Project GHG emissions to provincial and national totals.

Table 5-4 Estimated GHG Emissions from Operation

Parameter	Units	CO_2	CH_4	N_2O	Total (expressed as CO_{2e})
Operation GHG Emissions	kt/y	26.4	0.0013	0.0010	**29.4**
British Columbia GHG Emissions [a]	kt/y	49,800	8,800	1,800	**62,100 [b]**
National GHG Emissions [a]	kt/y	571,000	93,000	38,000	**716,000 [b]**
Project operation contribution to British Columbia GHG Emissions	%	0.0053%	0.000015%	0.000056%	**0.047%**
Project operation contribution to national GHG Emissions	%	0.0046%	0.0000014%	0.0000026%	**0.0041%**

NOTE:
[a] Provincial and national GHG emission totals from ECCC NIR (ECCC 2019)
[b] Provincial and national GHG emission totals include other fluorinated GHGs

While GHG emissions from a single project are negligible compared to global emissions, they do contribute to global emissions which are responsible for causing climate change. The GHG emissions from the Project are up to 29,375 tonnes CO_2e per year at full build out and are anticipated to be less than 0.047% of BC emissions and less than 0.0041% of national emissions. Though the GHG emissions from the Project are expected to be a small fraction of BC and Canada's total emissions, the Project-related GHG emissions may affect Canada's ability to meet its commitments with respect to climate change. Using 2007 as the baseline, BC is committed through legislation to a GHG reduction of 40%

by 2030. The Project-related GHG emissions at full build out may affect BC's ability to meet their emission reduction target, though the GHG emissions are expected to be a small fraction (0.047%) of BC's total emissions.

The Project residual effects on air quality and GHG are summarized in Table 5-5. The analysis was completed for full build out operation, which is expected to have a greater residual effect than construction and decommissioning because the full build out operation emissions are greater than the construction and decommissioning emissions.

The magnitude of the change in air quality is low because the air emissions would result in a moderate change to baseline conditions, but the resulting concentrations would be below the BC AQO.
The geographic extent for the change in air quality is local because the effects would be limited to Ridley Island. The duration for the change in air quality is long-term because the change in air quality would be measurable for the life of the Project operation. The frequency for the change in air quality is continuous because the air emissions occur daily. The change in air quality is reversible because the ambient air quality would quickly return to baseline conditions following the cessation of operation. At full build out the effect of Project air emissions is not likely to result in a substantial change that will alter the ambient air quality. Hence, the residual effect on a change in air quality is predicted to be not significant. The same conclusion would apply to the construction and decommissioning phases because they would have lower air emissions. In addition, the air emissions from construction and decommissioning are short-term, transient and will not contribute measurably to any regional airshed issues of concern.

The residual environmental effects on change in atmospheric GHG during operation are summarized in Table 5-5. Like the change in air quality the change in atmospheric GHG during operation are greater than construction and decommissioning due to the short-term and transient nature of the GHG emission. Hence, the residual effects for the full build out operation on change in atmospheric GHG is presented.

The magnitude for GHGs during full build out operation is rated low because GHG emissions released during full build out operation are only a fraction of the provincial and national GHG emissions. The GHG emission can be managed through the application of standard operating procedures and BMPs.
The geographic extent for change in atmospheric GHGs during full build out operation is not applicable (N/A) because the effect is global. The duration for change in atmospheric GHGs during full build out operation is long-term because the predicted increase in GHG emissions due to the Project activities is measurable for the life of the Project and the frequency for change in atmospheric GHGs during full build out operation is rated continuous because GHG emissions occur daily. The reversibility for change in atmospheric GHGs during full build out operation is rated irreversible because effect related to the release of GHG emissions from the full build out Project operation is not reversible for at least 100 years.

A significant effect on change in atmospheric GHG cannot be determined quantitatively. Provincial and federal policies and regulations do not identify specific thresholds or standards that could be used to determine significance when assessing the residual effects of the Project's GHG emissions. The primary criterion used to assess Project-related changes in GHG emissions is magnitude. The GHG emissions from the Project are compared to provincial and national inventories to establish a context for the magnitude of emissions.

The significance of Project GHG emission totals will be determined at the provincial and national jurisdictional boundaries by comparing Project GHG emission totals to provincial and national GHG emission totals.

The Project GHG emissions during full build out operation represent a small contribution to provincial and national GHG emissions. On an annual basis, the Project full build out operation contributes approximately 0.047% and 0.0041% to provincial and national GHG emission totals, respectively. Based on these results, the residual effects on change in atmospheric GHG emissions for full build out operation are predicted to be not significant. The same conclusion applies to construction and decommissioning which will have lower GHG emissions than Project operations.

Table 5-5 Project Residual Effects on Air Quality and GHGs

	Residual Effects Characterization						
Residual Effect	**Project Phase**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance Determination**
Change in ambient air quality	O	L	L	LT	C	R	NS
Change in atmospheric greenhouse gases	O	L	N/A	LT	C	I	NS

KEY
See Table 4-2 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Magnitude:
L: Low
M: Moderate
H: High

Geographic Extent:
SS: Site specific
L: Local
R: Regional

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term
N/A: Not applicable

Frequency:
O: Once
R: Rare
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Significance Determination:
NS: Not Significant
S: Significant

5.2 NOISE

5.2.1 Scope of Assessment

Noise is a VC because Project activities will generate noise, defined as unwanted sound. Noise from Project activities has the potential to affect the health and well-being of humans and wildlife. Noise effects are addressed in provincial (BC Oil and Gas Commission) and federal (Health Canada) guidelines. Most Project activities have the potential to emit noise. However, only those activities that may result in an increase in sound levels at receptors are assessed.

The assessment focuses on Project activities during the construction and operation phases. Construction and operation noise sources were modelled using Cadna (DataKustik 2019) and quantitatively assessed. In the decommissioning phase, noise from the dismantling of the facility and support infrastructure is expected to be less than the construction phase. The potential effect for decommissioning is assessed qualitatively.

The potential effect and effect pathway is described in Table 5-6.

Table 5-6 Potential Effects and Effects Pathways for Noise

Potential Environmental Effect	Effect Pathway
Increase in noise level	Noise effects due to the construction and operation of the Project

5.2.2 Mitigation Measures

Mitigation measures identified in Table 5-7 will be implemented to address noise effects during the construction and operation phases of the Project.

Table 5-7 Mitigation Measures Proposed to Avoid or Reduce Change to Noise

Environmental Effect	Effective and Established Mitigation Measure
Increase in noise level as a result of construction activities	• Maximize scheduling of construction activities during day-time hours and on weekdays. • If noise complaints related to construction traffic occur, they will be logged and investigated to assess whether they are linked to Project activities. • Development and Implementation of a Project Complaints and Response Plan for both construction and operations phases of the project.
Increase in noise level as a result of truck and rail noise during operations	• Rail lubricators may be advisable if wheel squeal is problematic where sharp track curves occur. • Standard BMPs (e.g., internal combustion engines, quality mufflers and vehicle maintenance). • Limit truck idling time and the use of engine breaks. • Fairview Connector Road will be constructed along the west shore such that traffic noise along Highway 16 and Prince Rupert will be reduced. • Maximize electrification of vehicles and equipment • Plan traffic flow to reduce or eliminate vehicle back-up alarms

5.2.3 Residual Effects and Significance Determination

During the construction and operations phases, the magnitude classification is based on the criteria described in Health Canada Evaluating Human Health Impacts in Environmental Assessment: Noise (Health Canada 2017) and BC OGC Noise Control Best Practice Guideline 2018 (BC OGC 2018).

The Health Canada noise guidance criteria is applicable to all seven receptors for both construction and operation phases. The Health Canada criteria includes change in percent highly annoyed (%HA) limit of 6.5 %, day-night average sound level (L_{dn}) limit of 75 dBA, maximum sound level of 60 dBA for sleep disturbance, and low frequency noise limit of 70 dB.

The BC OGC noise guideline criteria is applicable to residential dwelling receptors during the operation phase. The BC OGC noise criteria includes Permissible Sound Level (PSL) limit of 58 dBA daytime and 48 dBA nighttime. In addition, low frequency noise effect is assessed by the presence of low frequency tonality and a threshold of 20 dB between the C-weighted (dBC) and A-weighted (dBA) decibel level.

Noise levels at the seven receptors are predicted to result in a measurable change relative to the baseline sound level during both construction and operation period. In comparison to the Health Canada noise guidance, the predicted noise results during both construction and operation phases at the seven receptors indicate the following:

- Change in %HA less than 6.5 %
- L_{dn} less than 75 dBA
- L_{max} less than 60 dBA during the nighttime period.

In comparison to the BC OGC noise guideline criteria, the noise effects at all receptors during the operation phase are below the PSL and low frequency noise limits. The predicted results at all receptors meet the criteria recommended in the Health Canada noise guidance and BC OGC noise guideline. Therefore, the magnitude classification is predicted to be moderate. Appendix A provides detail on the noise assessment methods and prediction results at all receptors.

The geographic extent is regional because the noise effect will increase the sound level at receptors outside of the Project footprint and Ridley Island relative to baseline. The duration is medium-term for the construction phase because the activities are expected to be less than two years. The duration is long-term for the operation phase because the noise effect is measurable throughout the life of the Project. The frequency is continuous for both construction and operation phases because the noise effects will occur daily. The noise effect is reversible because the noise level would revert to baseline once the activities have been completed.

Noise during the decommissioning phase is expected to be less than the construction phase. Therefore, the residual effect classification for the decommissioning phase is conservatively assumed to be the same as the construction phase.

The significance thresholds rely on compliance with the applicable noise thresholds. With mitigation, noise from the Project is in compliance with the noise thresholds recommended in the Health Canada noise guidance and BC OGC noise guideline. Therefore, residual effects of a change in the acoustic environment during all phases of the Project are not significant.

Table 5-8 summarizes the residual effect on Noise during the construction and operation phase.

Table 5-8 Project Residual Effects on Noise

<table>
<tr><th rowspan="2">Residual Effect</th><th colspan="7">Residual Effects Characterization</th></tr>
<tr><th>Project Phase</th><th>Magnitude</th><th>Geographic Extent</th><th>Duration</th><th>Frequency</th><th>Reversibility</th><th>Significance Determination</th></tr>
<tr><td rowspan="3">Increase in noise level</td><td>C</td><td>M</td><td>R</td><td>MT</td><td>C</td><td>R</td><td>NS</td></tr>
<tr><td>O</td><td>M</td><td>R</td><td>LT</td><td>C</td><td>R</td><td>NS</td></tr>
<tr><td>D</td><td>M</td><td>R</td><td>MT</td><td>C</td><td>R</td><td>NS</td></tr>
<tr><td>KEY
See Table 4-2 for detailed definitions
Project Phase
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O: Operation
D: Decommissioning
Magnitude:
L: Low
M: Moderate
H: High</td><td colspan="4">Geographic Extent:
SS: Site specific
L: Local
R: Regional
Duration:
ST: Short-term
MT: Medium-term
LT: Long-term
N/A: Not applicable</td><td colspan="3">Frequency:
O: Once
R: Rare
C: Continuous
Reversibility:
R: Reversible
I: Irreversible
Significance Determination:
NS: Not Significant
S: Significant</td></tr>
</table>

5.3 VEGETATION AND WETLANDS

5.3.1 Scope of Assessment

The Vegetation and Wetlands VC is composed of species and communities which are of ecological, economic, and/or human importance. Ecological communities, including wetland habitats and associated biodiversity, affect ecosystem function and the ability of other organisms, including humans, to use and benefit from natural resources.

Vegetation and wetlands were selected as a VC because of the potential for Project activities to interact with vegetation and wetlands. The effect pathways for each effect are described in Table 5-9. Potential effects on vegetation and wetlands were selected based on planned Project activities during the construction and operations phases. Potential effects include both direct (e.g., direct clearing or removal during site preparation) and indirect effects (e.g., through introduction of invasive plant species) to vegetation and wetlands as a result of Project activities.

Table 5-9 Potential Effects and Effects Pathways for Vegetation and Wetlands

Potential Environmental Effect	Effect Pathway
Change in abundance of • Federally or provincially listed plant species • Invasive plants	Direct removal of federally or provincially listed plant species during construction (e.g., due to vegetation clearing, grubbing, grading, drilling and blasting, road paving, and ground disturbance) Indirect habitat alteration for federally or provincially listed plant species during construction, operations, and decommissioning (e.g., due to introduction and/or spread of invasive plants through movement of project-related machinery, vehicles, and personnel; or due to changes in abiotic conditions, such as soil moisture or light) Invasive plant abundance may increase if transported to the Project area and/or spread around the Project area during construction, operations, and decommissioning.
Change in the abundance of • Provincially listed ecological communities • Old forest	Direct removal or alteration of provincially listed ecological communities during construction (e.g., due to vegetation clearing, grubbing, grading, drilling and blasting, road paving, and ground disturbance) Indirect effects on provincially listed ecological communities during construction, operations, and decommissioning (e.g., due to introduction and/or spread of invasive plants through movement of project-related machinery, vehicles, and personnel; or due to changes in abiotic conditions, such as soil moisture or light)
Change in wetland functions	Direct effects on wetland functions of vegetation clearing and grubbing or ground disturbance Indirect effects of changes to hydrological conditions (e.g., drainage patterns, water quality and quantity)

5.3.2 Mitigation Measures

Effective and established mitigation measures to avoid or reduce potential effects on vegetation and wetlands are presented in Table 5-10.

Table 5-10 Mitigation Measures Proposed to Avoid or Reduce Change to Vegetation and Wetlands

Environmental Effect	Effective and Established Mitigation Measure
Change in abundance of • Federally or provincially listed plant species • Invasive plants	• Avoid placing Project features or temporary workspaces in the Alaska holly fern occurrence, if feasible. • Clearly flag the Project boundary prior to construction; clearing of vegetation outside the Project boundary will be prohibited. • An Invasive Plant Management Plan will be developed that includes mitigation measures to reduce the likelihood that invasive plants will be transported to and from the Project footprint. • If vegetation restoration is required, native plant and seed mixes will be used.
Change in the abundance of • Provincially listed ecological communities • Old forest	• Avoid placing temporary workspaces within known provincially listed ecological communities or old forest, where feasible. • The Project boundary will be clearly flagged prior to construction and clearing of vegetation outside the boundary will be prohibited. • An Invasive Plant Management Plan will be developed that will include mitigation measures to reduce the likelihood that invasive plants will be transported to and from the Project footprint. • Retain standing dead trees where possible and if trees must be cut for safety measures, cut trees as high as possible (3-5 m) while keeping work sites safe, to retain old forest features. • If vegetation restoration is required, native plant and seed mixes will be used.
Change in wetland functions	• Prepare and implement a Wetland Compensation Plan consistent with the Federal Policy on Wetland Conservation Implementation Guide for Federal Land Managers (1996). • Apply erosion and sediment controls to limit sediment release into the freshwater or marine environment. • Limit clearing and disturbance of riparian vegetation to the smallest extent required. • Promote riparian vegetation re-colonization through the use of native seed mixes to avoid the establishment of weed species.

It is estimated that up to 30 ha of wetland will be affected by the project footprint. In developing the Wetland Function Compensation Plan, PRPA is referencing the commitment undertaken for the Ridley Island Road, Rail Utility Corridor Project, which committed $27,000/ha of funds to contribute to wetland function compensation measures in 2013 as was developed in communications with the Canadian Wildlife Service. Correcting for inflation, PRPA is committing $30,000/ha of affected wetland to support wetland function compensation measures for the RIELP Project. Accordingly, the total commitment for wetland function compensation would be approximately $900,000. This value would be increased or decreased based on the final footprint of the project and final calculations on wetlands affected.

Funds will be applied in support of wetland functions described in the Federal Policy on Wetland Conservation Implementation Guide for Federal Land Managers (1996). As the federal land manager responsible for the implementation of the Wetland Conservation Policy, PRPA will be focusing efforts on wetland functions related to recreational, educational, and aesthetic opportunities. Recreational, educational, and aesthetic opportunities will be enhanced by creation of a shoreline public amenity that contributes to these functions.

5.3.3 Residual Effects and Significance Determination

5.3.3.1 Change in the Abundance of Federally or Provincially Listed Plant Species and Invasive Plants

Based on a desktop assessment of publicly available information, there is one known record of a provincially listed plant species in the Project footprint, the blue-listed Alaska holly fern (*Polystichum setigerum,* located at 9U 413743 E, 6008382). The Alaska holly fern occurrence is located within the proposed edge of grading for the Project access road and may be affected. There are no known records of invasive plants in the Project footprint (Section 2.2.1), however there are known invasive plant records along the access road which could be spread to disturbed soil due to Project activities.

Residual effects to federally or provincially listed plant species would occur primarily during Construction (e.g., due to vegetation clearing), whereas residual effects to invasive plants would occur during all Projects phases because there is potential for invasive plants to be spread by vehicles entering and exiting the site.

Potential effects on the abundance of federally or provincially listed plant species and invasive plants would be spatially limited to Ridley Island and are predicted to be low to moderate in magnitude during all project phases. Potential effects (e.g., disturbance of the Alaska holly fern occurrence, or introduction, spread and subsequent management of invasive plant species) could occur during construction for Alaska holly fern or invasive plants, or during operations and decommissioning for invasive plants. Potential effects to rare plants could be irreversible, and potential effects of invasive plants would be reversible when natural cover is re-established to baseline conditions following decommissioning of Project infrastructure. Potential effects during construction or operations and decommissioning would be of long-term duration for Alaska holly fern and of medium-term duration for invasive plants. Residual effects on federally or provincially listed plant species and residual effects are predicted to be not significant, as there are other documented occurrences of Alaska holly fern outside of the Project footprint. Refer to Table 5-11 for a summary of Project residual effects on the abundance of federally or provincially listed plant species and invasive plants

5.3.3.2 Change in the Abundance of Provincially Listed Ecological Communities and Old Forest

The Canpotex EIS (see Table 10-5 and Figure 10.2 in Stantec 2011b) identifies four provincially listed ecological communities within the Project footprint. The ecological communities include:

- Sitka sedge—peat moss (CWHvh2/Wf51-FS)
- Western hemlock—Sitka spruce / lanky moss (CWHvh2/04-HM)
- Western red cedar—Sitka spruce / skunk cabbage (CWHvh2/13-RC)
- Sitka spruce Pacific crab apple (CWHvh2/19-SC)

Residual effects on the abundance of provincially listed ecological communities and old forest are expected to occur during Construction (i.e., due to vegetation clearing) and are predicted to extend locally to Ridley Island since edge effects from vegetation clearing can reach up to 120 m (Chen *et al.* 1990; Voller 1998). Based on the four provincially listed ecological communities mapped in the Project footprint on Ridley Island, residual effects are predicted to be moderate in magnitude, local in extent, and occur once during construction. Since ecological communities and old forest require long periods of time to return to baseline conditions following removal, residual effects are predicted to be long-term and irreversible within meaningful time scales (e.g., it takes at least 250 years for old forest to develop). Although residual effects on abundance of provincially listed ecological communities and old forest are expected to be long-term and irreversible, residual effects are predicted to be not significant because limited old forest will be removed to construct the Project (i.e., low to moderate magnitude), and the loss of provincially listed ecological communities could be offset as part of the Wetland Compensation Plan. Refer to Table 5-11 for a summary of Project residual effects on the abundance of provincially listed ecological communities and old forest.

5.3.3.3 Change in Wetland Functions

Wetland functions include both bio-physical and socio-economic benefits. Socio-economic benefits include recreational, educational, and aesthetic benefits. The Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor Wetland Habitat Compensation Plan (Stantec 2013) identified the following bio-physical functions of wetlands on Ridley Island:

- Habitat for red and blue-listed wetland communities
- Habitat for amphibian species: western toad, rough skinned newt, and northwestern salamander (*Ambystoma gracile*)
- Foraging and nesting habitat for birds (28 species observed nesting, the most-abundant nesting species were: Pacific wren, Swainson's thrush, Townsend's warbler, orange-crowned warbler, dark-eyed junco, hermit thrush, ruby crowned kinglet, yellow warbler, barn swallow, bald eagle (*Haliaeetus leucocephalus*), lesser yellowlegs (*Tringa flavipes*), Pacific slope flycatcher (*Empidonax difficilis*), rufous hummingbird (*Selasphorus rufus*)

- Foraging and nesting (denning) habitat for wetland-associated mammals (beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) were observed)
- Atmospheric carbon storage (peat soils)
- Erosion control

Wetlands and their associated functions have been documented within the Project footprint by previous studies. The main Project effects will be to the smaller slope bog at the southern end of the island. The larger slope bog at the centre of the island will be largely undisturbed by the Project. Residual effects to wetland functions during construction (i.e., due to ground disturbance, vegetation clearing, and changes to hydrology) are predicted to be moderate in magnitude, extend locally on Ridley Island, and may occur continuously during construction due to dewatering. These potential effects are predicted to be permanent and irreversible. Residual effects are predicted to be not significant because a Wetland Compensation Plan will offset losses to select wetland functions due to the Project. Additional effects to wetland functions are not expected as a result of operations or decommissioning, provided that stormwater management measures avoid affecting the hydrology of adjacent wetlands (i.e., either by inadvertently draining wetlands or discharging water into wetlands). Refer to Table 5-11 for a summary of residual Project effects on wetland function.

Table 5-11 Project Residual Effects on Vegetation and Wetlands

Residual Effect	Residual Effects Characterization						
	Project Phase	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Significance Determination
Change in abundance of • Federally or provincially listed plant species • Invasive plants	C	L-M	L	MT-LT	O-C	R-I	NS
	O	L	L	MT	R	R	NS
	D	L	L	MT	R	R	NS
Change in the abundance of • Provincially listed ecological communities • Old forest	C	M	L	LT	O	I	NS
	O	No effects predicted					
	D	No effects predicted					
Change in wetland functions	C	M	L	LT	C	I	NS
	O	L	L	MT	C	R	NS
	D	No effects predicted					

Residual Effect	Residual Effects Characterization						
	Project Phase	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Significance Determination
KEY See Table 4-2 for detailed definitions ***Project Phase*** *C: Construction* *O: Operation* *D: Decommissioning* ***Magnitude:*** *L: Low* *M: Moderate* *H: High*		***Geographic Extent:*** *SS: Site specific* *L: Local* *R: Regional* ***Duration:*** *ST: Short-term* *MT: Medium-term* *LT: Long-term* *N/A: Not applicable*			***Frequency:*** *O: Once* *R: Rare* *C: Continuous* ***Reversibility:*** *R: Reversible* *I: Irreversible* ***Significance Determination:*** *NS: Not Significant* *S: Significant*		

5.4 WILDLIFE AND WILDLIFE HABITAT

5.4.1 Scope of Assessment

Wildlife and wildlife habitat is a VC because Project activities will interact with wildlife and wildlife habitat and these interactions may result in adverse effects. The effect pathways for each potential effect are described in Table 5-12. Potential effects of the Project on wildlife and wildlife habitat are associated with the Construction, Operations, and Decommissioning phases and include change in habitat, change in mortality risk, and change in movement. Effects pathways describe how the Project could result in potential effects to wildlife and wildlife habitat and include direct habitat loss or alteration, sensory disturbance, injury or mortality, and blockage or alteration of movement.

Table 5-12 Potential Effects and Effect Pathways for Wildlife and Wildlife Habitat

Potential Environmental Effect	Effect Pathway
Change in habitat	Direct habitat loss or alteration due to construction (e.g., clearing, grubbing, grading, rock excavation) and removal of infrastructure during decommissioning. Indirect habitat loss (i.e., alteration of habitat quality) through sensory disturbance due to construction (e.g., noise during clearing, grubbing, grading, rock excavation, track installation, construction of container yard and facilities, vehicle traffic) and operations (e.g., noise from train arrival and departure, offloading, and commodity storage, vehicle traffic).
Change in mortality risk	Damage to or destruction of habitat features (e.g., stick nests, dens) and direct mortality of birds, amphibians, and mammals (particularly fewer mobile species or during less mobile life stages), due to site preparation activities and construction (e.g., clearing, grubbing, and grading, rock excavation) if these activities are conducted in occupied habitats during peak activity periods. Potential wildlife injury or mortality due to Project lighting (e.g., at the intermodal container yard, bulk and break bulk facility, ancillary facilities). Wildlife interactions with Project equipment and personnel (e.g., collisions associated with increased vehicle traffic, wildlife encounters associated with poor waste management)
Change in movement	Blockage or alteration of movement patterns due to physical barriers or sensory disturbance associated with construction (e.g., clearing, grubbing, and grading, rock excavation, track installation, paving and red-grading of the access road, construction of container yard and facilities, installation of power distribution line), operations (e.g., noise and light produced from train arrival and departure, offloading, commodity storage, and vehicle traffic), and decommissioning of Project infrastructure (e.g., newly created openings from removal of infrastructure)

Residual effects are considered after the implementation of mitigation measures. Residual Project effects on wildlife and wildlife habitat were characterized using the criteria and definitions outlined in Table 4-2. Characterization of potential residual effects is based on their magnitude, reversibility, geographic extent, duration and frequency.

Criteria used to characterize the determination of significance is outlined in Table 4-2. For the Wildlife and Wildlife Habitat VC, residual effects are considered significant if they are high in magnitude, regional in geographic extent (i.e., extend beyond Ridley Island), long-term to permanent in duration, and irreversible.

5.4.2 Mitigation Measures

Mitigation measures were selected based on provincial and federal regulations and policies, best management practices, and peer-reviewed scientific literature. Table 5-13 outlines mitigation measures to avoid or reduce potential effects of the Project on change in habitat, change in mortality risk, and change in movement for wildlife.

Table 5-13 Mitigation Measures Proposed to Avoid or Reduce Change to Wildlife and Wildlife Habitat

Environmental Effect			Effective and Established Mitigation Measure
Change in Habitat	Change in Mortality Risk	Change in Movement	
√	√	√	Laydown areas, temporary workspaces, and storage areas will be limited to within the boundaries of the Project footprint, to the extent possible. If laydown areas, temporary workspaces, or storage areas are required outside of the Project footprint, they will be located in existing disturbed areas
√			Prepare and implement a Wetland Compensation Plan consistent with the Federal Policy on Wetland Conservation Implementation Guide for Federal Land Manager (1996) (see Section 5.3.2).
√	√		A pre-disturbance wildlife habitat features survey will be undertaken by a qualified biologist in advance of construction.
√	√		A buffer of undisturbed natural vegetation will be maintained around bald eagle nests (BC MOE 2013), where possible. Unoccupied nests within the project footprint will be relocated to a suitable location. An additional no-disturbance setback will be maintained around occupied bald eagle nests (BC MOE 2013) until nests are vacated.
√			Artificial bat roost structures will be installed to partially compensate for the loss of roosting habitat due to removal of old forest within the Project footprint. Selection of artificial bat roost structure design and installation locations will be determined by a qualified biologist.
√			Sensory disturbance from Project-generated noise will be reduced by avoiding construction along the east side of Ridley Island during night-time hours and on weekends where practicable. Additional mitigation measures for Project-generated noise are provided in Section 5.2.2.
	√		Vegetation clearing, grubbing, grading, and rock excavation should occur outside of the breeding period for migratory birds (April 9 to August 7 in Nest Zone A2 [ECCC 2020a]), great blue heron (January 15 to September 15 [BC MOE 2014]), and raptors (January 5 to September 6 [BC MOE 2013]). • If vegetation clearing and disturbance activities cannot be avoided during the breeding period for migratory birds, great blue heron, and raptors, a pre-disturbance bird nest survey will be undertaken in advance by a qualified biologist. • If nesting activity is identified during the pre-disturbance survey, appropriate no-disturbance setbacks and timing restrictions will be implemented as determined by a qualified biologist in accordance with federal or provincial guidelines (ECCC 2020b; BC MOE 2013). • If a raptor or great blue heron nest is identified within the clearing limits of the Project footprint and the boundaries of the clearing limits cannot be altered to avoid the nest, the nest will be removed or relocated once it is vacated. • Discovery of active nests will be reported to the Environmental Monitor immediately

Table 5-13 Mitigation Measures Proposed to Avoid or Reduce Change to Wildlife and Wildlife Habitat

Environmental Effect			Effective and Established Mitigation Measure
Change in Habitat	Change in Mortality Risk	Change in Movement	
	✓		Vegetation clearing, grubbing, grading, rock excavation, and disturbance of open water wetland sites should occur outside of the breeding period for amphibians (March to August, with post-breeding dispersal extending through to October [BC MFLNRO 2016]). • If vegetation clearing and disturbance activities cannot be avoided during the amphibian breeding and post-breeding dispersal period, a pre-disturbance amphibian survey will be undertaken in advance by a qualified biologist to identify amphibian breeding habitat within and adjacent to the Project footprint. • If amphibian breeding habitat is confirmed, a salvage program will be implemented by a qualified biologist. • Although salvage efforts will target western toad, native amphibians encountered during the salvage program will be captured and relocated, regardless of species.
	✓	✓	Nighttime lighting at the transloading facility, container yard, and associated infrastructure should include the following measures to reduce the risk of injury or mortality and disruption of movement for birds and bats: • Limit exterior lighting, including portable lighting, to the extent possible • Use directional or shielded lighting to reduce the vertical and horizontal distribution of light (Jones and Francis 2003; Fure 2012; Stone et al. 2015; Elmeros et al. 2016) • Use amber coloured narrowband LED lights (with a wavelength of 600 nm) that are less visible to bats, where possible (Fure 2012; Elmeros et al. 2016) and avoid using green, blue, and UV light wavelengths (Stone et al. 2015; BC Community Bat Program 2018) • Avoid the installation of light fixtures near ponds, rivers, and wetlands (Fure 2012; BC Community Bat Program 2018) • Use lighting products with adaptive controls and variable lighting regimes, where possible (e.g., timers to cycle lighting schedules to provide dark periods, dimmers, dynamic systems controlled by motion sensors) (Stone et al. 2015; Elmeros et al. 2016
	✓	✓	Maximum speed limits on roads and trails will be communicated. Project personnel will adhere to posted speed limits to reduce the risk of collisions with wildlife. Wildlife-vehicle collisions and near misses will be reported
	✓		Project wastes and recycling materials, including sewage, food wastes, and wastes associated with equipment maintenance and repairs, will be temporarily stored on site in wildlife-proof containers and will be regularly transferred to an approved disposal or sorting facility. Wildlife incidents related to garbage or human food attractants will be reported

5.4.3 Residual Effects and Significance Determination

5.4.3.1 Change in Habitat

Residual effects of change in wildlife habitat will occur locally on Ridley Island and are expected to be moderate in magnitude during construction (i.e., as a result of clearing, grubbing, and grading, rock excavation, track installation, construction of container yard and facilities, installation of power distribution line, emissions discharge and waste) and operations of the transloading facility, container yard, and associated infrastructure, and low in magnitude during decommissioning of Project infrastructure. Project effects on wildlife habitat are expected to be long-term and continuous during all phases of the Project (see Table 4-2 and Table 5-12). Residual effects to wetland functions, including wildlife habitat functions, are also predicted to be moderate in magnitude, extend locally on Ridley Island, and occur continuously during construction (see Section 5.3.3.3).

Direct habitat loss through vegetation clearing will result in the removal of habitat on Ridley Island; this will have the greatest effect on species associated with terrestrial habitats. The Project footprint includes four provincially listed ecological plant communities, including one old forest upland community (i.e., Western hemlock—Sitka spruce / lanky moss) and three wetland communities (i.e., Sitka sedge—peat moss, Western red cedar—Sitka spruce / skunk cabbage, and Sitka spruce Pacific crab apple (see Section 5.3.3). Since ecological communities and old forest require long periods of time to return to baseline conditions following removal, residual effects are predicted to be long term and irreversible within meaningful time scales (e.g., it takes at least 250 years for old forest to develop). Wildlife species with secure populations (i.e., provincially Yellow-listed or designated as Not-at-Risk under SARA) are expected to be more resilient to change in habitat, with natural recruitment expected to offset the loss of individuals within the context of the regional population.

Noise during construction, operations, and decommissioning has the potential to result in indirect loss of wildlife habitat. However, the baseline acoustic environment on Ridley Island already includes sounds generated by human activities (e.g., marine traffic, marine terminal, aircraft flyovers, rail traffic, local residential and commercial activities, and vehicular traffic on local roads). Noise levels generated by the Project are expected to result in a measurable change relative to the baseline sound levels, but with mitigation the residual effects of a change in the acoustic environment are considered not significant (see Section 5.2.3). Indirect habitat loss (i.e., alteration of habitat quality) through sensory disturbance due to construction noise and operational noise (e.g., noise from train arrival and departure, offloading, and commodity storage, vehicle traffic) may reduce use of wildlife habitat adjacent to the Project and over the water on Lelu Island and the mainland since Porpoise Channel and Porpoise Harbour are less than 500 m wide in a number of locations. Studies of songbirds (Habib 2006; Habib et al. 2007; Bayne et al. 2008; McClure et al. 2013), bats (Bunkley and Barber 2015; Bunkley et al. 2015; Schaub et al., 2008) and amphibians (Nairns 1990) indicate wildlife may avoid habitats affected by anthropogenic noise. The Project is expected to increase anthropogenic noise on Ridley Island, and this may result in indirect loss of wildlife habitat as a result of avoidance.

Implementation of mitigation measures outlined in Table 5-10 is expected to reduce residual Project effects of change in wildlife habitat. With mitigation, the Project will result in a moderate magnitude direct loss of wildlife habitat during construction and operations. This residual effect is considered long-term and continuous during construction and operations but reversible during decommissioning, except for old forest which is irreversible. Residual effects are expected to be not significant (Table 5-14).

5.4.3.2 Change in Mortality Risk

Residual effects of change in mortality risk will occur locally on Ridley Island and are expected to be moderate in magnitude during construction (i.e., clearing, grubbing, and grading, rock excavation, track installation, construction of container yard and facilities, installation of power distribution line, emissions discharge and waste) and operations of the transloading facility, container yard, and associated infrastructure, and low in magnitude during decommissioning of Project infrastructure. Effects to wildlife mortality risk are expected to be medium-term during construction and decommissioning and long-term during operations, occurring rarely throughout Project activities (see Table 4-2 and Table 5-12).

Wildlife species with secure populations (i.e., provincially Yellow-listed or designated as Not-at-Risk under SARA) are expected to be more resilient to change in mortality risk, with natural recruitment expected to offset the loss of individuals within the context of the regional population.

Mortality risk during clearing, grubbing, and grading, rock excavation, and removal of Project infrastructure will be highest for species with limited dispersal capability (e.g., nesting birds, small mammals, amphibians), that demonstrate strong site fidelity, and that require specialized habitat features (e.g., bird nests, small mammal dens, bat roosts) during breeding, denning, and roosting periods. The creation of edge habitat as a result of vegetation clearing during construction has the potential to result in reduced nest success due to increased access for predators and nest parasites (Batáry and Báldi 2003; Malt and Lank 2009). Noise levels generated by the Project are predicted to be continuous in frequency and are expected to result in a measurable change relative to the baseline sound level during the construction and operations phases, with residual effects of noise during decommissioning conservatively assumed to be the same as the construction phase (see Section 5.2.3). Persistent noise during construction, operations, and decommissioning has the potential to disrupt nesting activities of birds on Ridley Island (Habib et al. 2007), resulting in indirect mortality of eggs or nestlings due to nest abandonment (Malt and Lank 2009). Vegetation clearing, grubbing, and grading, rock excavation, and removal of Project infrastructure outside of restrictive activity periods, or application of no-disturbance setbacks to active breeding, denning, and roosting sites will reduce the risk of mortality to wildlife with the potential to breed, den, or roost within the Project site.

The Project has the potential to result in mortality or injury of wildlife through collisions with vehicles and trains. Train strikes with ungulates and bears have been shown to be positively correlated with constrained flight paths (e.g., infrastructure constricting wildlife movement along the rail bed), reduced detectability (e.g., design features impeding the sight and/or sound of oncoming trains), and reduced reaction time due to higher train speeds (Dorsey et al. 2017). Increased train traffic associated with new rail tracks serving the intermodal container yard, the bulk transload facility, and the break bulk facility has the potential to result in an increase in collisions with wildlife, especially ungulates and bears.

Road traffic can also result in injury or mortality of wildlife, particularly for species that use roadways as migration corridors or are attracted to roadside vegetation (e.g., ungulates, bears) (Fahrig and Rytwinski 2009; Grosman et al. 2011). Although the Project is expected to reduce port-related traffic on public roads, vehicle traffic on the access road has the potential to result in collisions with wildlife such as ungulates, bears, and bats. Bats are at increased risk of mortality from collision with vehicles when crossing roads between roosting and foraging habitat (Zimmerman and Glanz 2000; Russell et al. 2009). When crossing a deforested area or where the canopy height has been reduced, bats travel closer to the ground surface, increasing the risk of collision with vehicles (Russell et al. 2009). Increased vehicle traffic during construction and vehicle traffic on the access road during operations has the potential to increase mortality risk of amphibians dispersing between breeding and overwintering habitat, particularly where roads intersect or run adjacent to wetlands (Glista et al. 2007; Fahrig and Rytwinski 2009).

Lighting at the transloading facility, container yard, and associated infrastructure has the potential to increase mortality risk for birds and bats. Attraction of birds to anthropogenic light can result in direct injury or mortality due to collisions with lighting infrastructure or indirect mortality due to depletion of energy reserves as birds try to reach or continuously circle lit structures (Le Corre et al. 2002; Montevecchi 2006). Localized concentrations of insect prey at lit structures associated with the Project can attract bats, which may increase the risk of bat mortality through collisions with lighting infrastructure or vehicles, although not all bat species are attracted to lit structures (Stone 2013). Artificial lighting at the transloading facility, container yard, and associated infrastructure can also result in bat mortality due to roost abandonment and reduced foraging time resulting from delayed timing of emergence (Laidlaw and Fenton 1971; Boldogh et al. 2007; Stone 2013). Bats that avoid illuminated travel corridors associated with the Project (e.g., the new rail corridor) may experience increased mortality risk as a result of increased energy expenditure to fly longer alternate routes between roosting and foraging habitats (Stone 2013).

Lack of proper waste management practices can result in human-wildlife conflict and removal or destruction of nuisance animals. Risk of mortality associated with waste management practices will be mitigated to the extent that the residual effect will be eliminated or reduced to negligible levels. Changes in acidification and eutrophication of freshwater systems due to metal leaching and acid rock drainage can result in increased mortality risk for amphibians breeding in affected freshwater habitat. Rock drilled or blasted for the Project will be evaluated for acid rock drainage and metal leaching potential and a suitable rock management plan will be developed. Potential effects of the Project on surface water quality are considered in Section 5.5.

Implementation of mitigation measures is expected to reduce residual effects of change in mortality risk for wildlife. Residual effects are anticipated to be reversible following decommissioning and are expected to be not significant (Table 5-14).

5.4.3.3 Change in Movement

Residual effects of change in movement will occur locally on Ridley Island and are expected to be moderate in magnitude during construction (i.e., clearing, grubbing, and grading, rock excavation, track installation, paving and red-grading of the access road, construction of container yard and facilities, installation of power distribution line) and operations of the transloading facility, container yard, and associated infrastructure, and low in magnitude during decommissioning of Project infrastructure. Effects to wildlife movement are expected to be medium-term, occurring rarely during construction and decommissioning and long-term, occurring continuously throughout operations (see Table 4-2 and Table 5-12).

Wildlife movement patterns for species that migrate between Ridley Island and the mainland (e.g., black-tailed deer, grey wolf) are already restricted due to the existing development on the north end of Ridley Island. Effects of change in wildlife movement patterns due to the Project are expected to be greater for species with small home ranges that are restricted to Ridley Island (e.g., amphibians such as western toad, small mammals such as marten) since they are less able to adjust their movement patterns to navigate around the Project infrastructure and areas of disturbance. Deer, coyotes, and bears may be attracted to roadside vegetation and may use the Project's access road and new rail tracks as movement corridors (Fahrig and Rytwinski 2009; Grosman et al. 2011), although some species have been shown to avoid establishing home ranges in areas with high traffic volumes (Trombulak and Frissell 2000). Following breeding, western toad adults can disperse more than 1 km into forested areas and wet shrublands (COSEWIC 2002; Browne and Paszowski 2010). There is potential for the new rail corridor and upgraded access road to present a physical barrier to movement of western toad between aquatic breeding habitat and upland terrestrial habitat. Habitat fragmentation resulting from construction of the transloading facility, container yard, and associated infrastructure will reduce habitat connectivity for bird species that exhibit sensitivity to edge habitat and avoid crossing gaps (Bélisle and Desrochers 2002). Although some bat species may use roads as travel corridors (Russell et al. 2009), bats are also known to avoid crossing roads (Bennett and Zurcher 2013). Bat movement across roads has been shown to decrease with increased levels of traffic noise (ECCC 2018). Roads bisecting established commuting routes between roosting and foraging sites can act as barriers to bat movement resulting in habitat fragmentation (Russell et al. 2009; Bennett and Zurcher 2013). The Project's access road and the new rail corridor have the potential to act as barriers to bat movement between wetland foraging sites and old forest patches suitable for roosting.

Although responses are known to vary by species, wildlife are expected to avoid habitat subject to high sensory disturbance (Habib et al. 2007; Bayne et al. 2008; Schaub et al. 2008; Shannon et al. 2016) during clearing, grubbing, and grading, rock excavation, construction of the container yard and facilities, operational activities, and removal of Project infrastructure during decommissioning. Noise levels generated by the Project are expected to result in a measurable change relative to the baseline sound level and are predicted to be continuous in frequency, occurring over the medium-term for the construction phase and over the long-term for the operation phase (see Section 5.2.3). Over time, wildlife may habituate to exposure to Project related sensory disturbances, with subsequent reduction in the extent of avoidance behavior (Herrero et al. 2005; Kloppers et al. 2005; Stankowich 2008).

Birds (Rich and Longcore 2006) and bats (Stone et al. 2009; Stone 2013) are expected to alter behavior patterns through attraction to or disorientation by lighting at the transloading facility, container yard, and associated infrastructure, and along the rail corridor and access road. Some bat species avoid lights, including illuminated travel corridors, causing them to alter their commuting routes between roosting and foraging habitat (Stone et al. 2009; Stone 2013). Artificially lit structures and corridors associated with the Project have the potential to act as barriers to bat movement resulting in habitat fragmentation for foraging bats (Stone et al. 2015). Nighttime lighting of Project infrastructure, including along the rail corridor and roads, can also disrupt the physiology and behavior of amphibians that are active at night (Perry et al. 2008).

Implementation of mitigation measures is expected to reduce residual effects of change in movement for wildlife. Residual effects are anticipated to be reversible following decommissioning and are expected to be not significant (Table 5-14).

Table 5-14 Project Residual Effects on Wildlife and Wildlife Habitat

Residual Effect	Residual Effects Characterization						
	Project Phase	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Significance Determination
Change in habitat	C	M	L	LT	C	R*	NS
	O	M	L	LT	C	R	NS
	D	L	L	LT	C	R	NS
Change in mortality risk	C	M	L	MT	R	R	NS
	O	M	L	LT	R	R	NS
	D	L	L	MT	R	R	NS
Change in movement	C	M	L	MT	R	R	NS
	O	M	L	LT	C	R	NS
	D	L	L	MT	R	R	NS

NOTE:
* With the exception of old forest which is considered irreversible

Residual Effect	Residual Effects Characterization						
	Project Phase	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Significance Determination

KEY		
See Table 4-2 for detailed definitions ***Project Phase*** *C: Construction* *O: Operation* *D: Decommissioning* ***Magnitude:*** *L: Low* *M: Moderate* *H: High*	***Geographic Extent:*** *SS: Site specific* *L: Local* *R: Regional* ***Duration:*** *ST: Short-term* *MT: Medium-term* *LT: Long-term* *N/A: Not applicable*	***Frequency:*** *O: Once* *R: Rare* *C: Continuous* ***Reversibility**:* *R: Reversible* *I: Irreversible* ***Significance Determination:*** *NS: Not Significant* *S: Significant*

5.5 FISH AND FISH HABITAT

5.5.1 Scope of Assessment

The fish and fish habitat VC includes species and communities that are of ecological and socio-economic importance. Project construction, operation, and decommissioning activities have the potential to affect fish and fish habitat, marine mammals (i.e., harbour seals, Steller sea lions), and species at risk. Both direct (e.g., infilling, blasting) and indirect effects (e.g., habitat removal, diminished water quality) to fish and fish habitat as a result of Project activities will be considered. Potential effects of the Project include change in fish habitat, change in injury/mortality risk, and change in movement. The effect pathways for each effect are described in Table 5-15.

For the purposes of this assessment the broad Fisheries and Oceans Canada definition of fish and fish habitat is used. Under the *Fisheries Act*, these are described as:

- Fish—(a) parts of fish; (b) shellfish, crustaceans, marine animals, and any parts of shellfish, crustaceans, or marine animals, and; (c) the eggs, sperm, spawn, larvae, spat, and juvenile stages of fish, shellfish, crustaceans, and marine animals.
- Fish habitat—spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Table 5-15 Potential Effects and Effects Pathways for Fish and Fish Habitat

Potential Environmental Effect	Effect Pathway
Change in habitat	Direct habitat loss or alteration due to construction (e.g., clearing, grubbing, grading, blasting, rock excavation, infilling) and removal of infrastructure during decommissioning. Indirect habitat loss (i.e., alteration of habitat quality) through sensory disturbance due to construction (e.g., noise during clearing, grading, blasting, rock excavation, track installation, vehicle traffic) and diminished water quality (e.g., suspended sediment, contaminants) during operations.
Change in injury/mortality risk	Direct mortality of invertebrates and fish, particularly less-mobile life stages and species, due to construction (e.g., clearing, grubbing, and grading, blasting, rock excavation and infilling) and during decommissioning (removal of infrastructure).
Change in movement	Blockage or alteration of the ability of fish to migrate due to physical barriers or sensory disturbance associated with construction (e.g., clearing, grubbing, and grading, blasting, rock excavation, infilling, track installation), operations (e.g., noise and light produced from trains), and decommissioning of Project infrastructure.

5.5.2 Mitigation Measures

Mitigation measures, as outlined in Table 5-16, were selected based on provincial and federal regulations and policies, BMPs and previous experience on similar projects. The list of mitigation measures presented below is not considered an exhaustive list but rather a sample of the key measures to avoid or reduce potential effects of the Project on change in habitat, change in injury/mortality risk, and change in movement for aquatic life (freshwater and marine).

Table 5-16 Mitigation Measures Proposed to Avoid or Reduce Change to Fish and Fish Habitat

Environmental Effect	Effective and Established Mitigation Measure[1]
Change in habitat	• Habitat losses deemed to constitute a HADD by DFO will be fully offset through the rehabilitation of existing marine fish habitats and/or the creation of new habitats. • Constructions works, undertakings and activities will proceed in a way so as to limit the trapping and stranding of fish • Use of least risk construction windows to be developed in conjunction with DFO to avoid overlap of any in-water construction with potentially key or sensitive habitats areas used by aquatic species • Limit the extent of grubbing, clearing, and infilling within riparian/intertidal/subtidal areas to the amount required for safe passage of equipment and construction of the Project. • A qualified Environmental Monitor (EM) will be present during initial riparian clearing, infilling and grading of the track and laydown areas to monitor and prescribe appropriate mitigation measures for the protection of fish habitat. The EM will be onsite at all times during work below the high-water mark. • Prepare a project-specific environmental management plan that includes sediment and erosion control measures • Re-contour and restore any stream banks if disturbed by construction activities • Prohibit re-fueling or maintenance of heavy machinery within 30 m of any waterbodies • Verify that any discharged sanitary wastewater generated from the administrative and maintenance buildings meets the relevant water quality guidelines for aquatic life. • Stormwater collected onsite from operational areas will pass through an oil/water separator and will be monitored for compliance with water quality objectives for the protection of aquatic life. • Rock or other materials used for construction will not leach substances that are harmful to fish.

Table 5-16 Mitigation Measures Proposed to Avoid or Reduce Change to Fish and Fish Habitat

Environmental Effect	Effective and Established Mitigation Measure[1]
Change in injury/mortality risk	• A fish salvage will occur prior to any in-water work (if required) • Intertidal works and intertidal material placement are to be conducted in the dry (i.e. when the site is dewatered during the tidal cycle). • Use of least risk fisheries construction windows to be developed in conjunction with DFO • Construction works, undertakings or activities at risk of trapping or stranding of fish, such as excavations and infills, are to be inspected each time the tide recedes (including during evenings, weekends, and times when works are not being undertaken) for fish entrapment and stranding. Trapped and stranded fish are to be salvaged immediately and relocated to an area outside of the authorized Project footprint. If fish are becoming trapped or stranded in the work area, measures are to be put in place immediately to prevent future trapping and stranding. • A qualified environmental professional will be present at all times during all in-water marine works (i.e. subtidal material placement) to monitor for marine mammal presence. In-water marine works will cease if there is a risk of physical harm to any marine mammal from direct contact. • Any diversion of drainage channels will have appropriate erosion and sediment control measures implemented to maintaining water quality and flow downstream (where connected to fish-bearing waters). • A blast management plan will be developed to reduce the potential adverse effects on marine, anadromous, and freshwater fish. • Culvert installation and extension shall be conducted in the dry (i.e. when the site is dewatered during the tidal cycle) and in isolation of flow. Prior to culvert installation or removal in fish-bearing waterbodies, a qualified environmental(s) will establish fish exclusion and complete a fish salvage using appropriate gear, timing, and salvage techniques.
Change in movement	• Culvert installation will not impede the existing passage of anadromous fish to migrate between marine and freshwater environments.
NOTE: 1. Final mitigation measures will be defined with the *Fisheries Act* Authorization	

5.5.3 Residual Effects and Significance Determination

5.5.3.1 Change in habitat

Project activities associated with the construction phase have the potential to cause both direct and indirect habitat loss. Direct habitat loss is expected to occur as a result of riparian clearing, infilling of intertidal and subtidal habitats, and blasting. Indirect habitat loss may occur as a result of diminished water quality due to suspended sediments (construction phase) and the potential introduction of contaminants into aquatic environments (operation phase). Project effects associated with the decommissioning phase are expected to be similar to the construction phase but without blasting.

Project effects to fish habitat will vary by area but overall will include temporary and permanent alteration or loss of fish habitat. All habitat loss (temporary or permanent) deemed to constitute a harmful alteration, disruption or destruction (HADD) of fish habitat by DFO will be fully compensated for.

The specific details including summaries of the habitats affected, the organisms and life stages affected, and the conceptual offsetting plan will all be part of the permitting process involving DFO and other stakeholders.

Riparian clearing will be required in select areas along all sides of Ridley Island to facilitate the installation of the new rail tracks. Existing trees and shrubs will be cleared as part of the initial construction phase and, with the exception of clearing outside of the permanent footprint, will be a permanent loss. Riparian areas cleared temporarily (e.g., site access, laydown areas) will be replanted with native seed mixes to promote re-vegetation of the area and limit the potential for weed species to establish themselves. In many of the locations where marine riparian habitat will be cleared there is a transition zone between the high-water mark and the forested/vegetated habitat. This area is generally a bare bedrock zone that forms in the splash zone above the high-water mark (See Photo 3 through Photo 5 in Section 2.2.1.5). As such, the ecological function of this riparian habitat in these areas is diminished (e.g., limited shading, little contribution of insect litter directly to the ocean) compared to areas where mature forests abut the high-water mark. Due to the diminished function of the existing marine riparian vegetation within the Project footprint, its removal is not expected to result in a measurable change in local marine fish habitat. Freshwater riparian clearing is required within a portion of the lower reaches of a fish-bearing stream along the western side of Ridley Island. The clearing will occur near the mouth of the stream where it transitions from a terrestrial forest environment to an intertidal mudflat and connects to the ocean. Riparian vegetation along this stream is expected to enhance the fish habitat through canopy shading (e.g., water temperature regulation), contributions to habitat complexity from woody debris, and insect/leaf litter deposition which boosts the availability of food for fish in this area. The loss of riparian vegetation in this area may diminish the quality of in-water habitat for some fish species residing in, or migrating through, this area.

Project design refinements limit the overlap of the Project footprint with fish habitat however there are several areas where intertidal and subtidal infilling of marine habitats will be required to support the new rail tracks. Infilling during the construction phase will involve machinery (excavators, rock trucks, etc.) placing fill material (rip rap boulders) on top of the existing ground to build up the area to the final grade of the rail line. Fill material will consist of clean blast rock that will be tested for metal leaching/acid rock drainage prior to its use; rock that does not meet the applicable standards for the protection of aquatic life will not be used for construction. Natural substrates in the areas to be infilled consist of a mix of habitats including bedrock, boulder, cobble, gravel, and soft sediment intertidal and subtidal habitats (Hemmera 2019). Rip rap (boulder) placement on gravel and soft sediment will result in a permanent alteration of habitat for benthic and demersal species and a permanent loss for most infaunal invertebrates (i.e. soft sediment habitat will no longer available). While alteration and loss of habitat will result from infilling, the rock fill will be available for colonization and use by intertidal and subtidal species and is expected to provide attachment points for algal species including understory and canopy forming kelps (e.g., sugar wrack kelp and bull kelp). Fish and invertebrate species are also expected to colonize and use the new rock habitat, albeit potentially different species from those that inhabit soft sediment environments. Similar impacts (including a period of disturbance before recolonization) are expected with the removal of infilled areas during the decommissioning phase at the end of Project life. No ongoing impact to fish associated with the infilled areas is expected during the operational phase of the Project.

Riparian clearing and infilling activities also have the potential to mobilize and release sediment into nearby aquatic habitats (freshwater and marine) during the construction and decommissioning phase. Greatly elevated levels of suspended solids may impair or disrupt the feeding opportunities of visual predators such as salmon and surf smelt found in nearshore waters (Wilber and Clarke 2001). Further, increased suspended solids can cause gill abrasion and impeded respiratory function in fish (Newcombe and MacDonald 1991). To address these concerns, a site-specific Environmental Management Plan will be developed that will include a sediment and erosion plan to mitigate the risk of turbid waters flowing into aquatic environments. This plan will include prescriptive measures for sediment control to prevent release as well as guidance on how to deal with sediment-laden water on site. No effects relating to increase sediment suspension are anticipated during the operational phase of the Project.

In addition to the potential concerns around the release of suspended sediments into aquatic environments, discharges from the onsite sewage treatment facility as well as stormwater discharge have the potential to harm aquatic life during the operational phase of the Project. Wastewater discharges can contain harmful contaminants such as metals, pharmaceutical compounds, and bacteria. The Project will incorporate a packaged sewage treatment facility that will treat sewage accumulating from personnel onsite at the administrative and maintenance buildings. Treated waste from the facility will be discharged into a new subtidal outfall. The treatment system will be designed to meet relevant water quality objective. Stormwater will also be discharged into the ocean and will be collected and conveyed through drainage ditches installed onsite. Collected water may include dust from materials being loaded (e.g., cereal grains, specialty crops, potash and resin pellets), as well as oils/grease from locomotives and other equipment onsite. To remove potential contaminants prior to its release into the marine environment, stormwater from the maintenance building, parking area, and rail tracks will be collected and routed through an oil/water separator prior to discharge. Water quality will be monitored and will meet the relevant water quality guidelines prior to discharge.

Intertidal blasting is required in one location along the western side of Ridley Island to facilitate the installation of the new rail line. This location is near the mouth of the fish-bearing freshwater stream where the water flows out of the forest and into the ocean (see Photo 7 in Section 2.2.1.5). Blasting will result in the removal of natural bedrock and will see it replaced with rip rap fill rock. Marine organisms colonizing the natural bedrock, as well as fish and invertebrates that forage or live in this habitat are expected to re-establish and/or use the fill rock habitat upon completion of construction and given time for ecological succession.

Indirect habitat loss from sensory disturbance (e.g., noise, lighting) is expected to be limited to the construction and decommissioning phases of the Project and is expected to be localized within the immediate area surrounding the activity.

Changes to fish habitat during the construction, operation, and decommissioning phases of the Project are expected to be of low (operation) to moderate (construction and decommissioning) magnitude, site-specific (construction and decommissioning) to local (operation) in geographic extent, long-term duration, occur once (construction and decommissioning) to continuously (operation), and be reversible. When considering the mitigation measures to be implemented and the commitment to fully offset for any habitat loss deemed to be a HADD, the change to fish habitat associated with the Project is considered to be not significant. A summary of the anticipated residual effects to change in habitat can be found in Table 5-17.

5.5.3.2 Change in Injury/Mortality Risk

Project activities associated with the construction phase have the potential to cause direct mortality and/or injury to fish, marine mammals (i.e. harbour seal or Steller sea lion), or species at risk during the construction and decommissioning phases of the Project. No ongoing impacts associated with the operational phase of the Project are anticipated. Direct mortality and/or injury to fish (including invertebrates) is primarily expected to occur as a result of infilling of intertidal and subtidal habitats in the marine environment. Infilling activities have the potential to entrain or bury organisms that either can't flee the area (e.g., sessile invertebrates, fish eggs, algae) or that have the ability to flee but are prevented from leaving (e.g., mobile invertebrates, finfish). To limit the extent of direct mortality, mitigation measures such as a commitment to only infill intertidal areas when the area is dry (i.e. when the site is dewatered during the tidal cycle) in addition to a commitment to salvage target species from the intertidal and subtidal footprint prior to infilling. The specific species to be salvaged will be agreed upon with DFO during the permitting phase and will be outlined in a salvage plan but are anticipated to included species of commercial interest such as sea urchin, sea cucumber, and swimming scallop. Despite salvage efforts there will inevitably be some level of mortality due to infilling activities associated with infaunal invertebrates (e.g., worms, ghost shrimp, bivalves), epifaunal invertebrates (e.g., sea pens, mussels, barnacles), or simply species that are targeted but not recovered during salvage efforts.

The progression of infilling activities will be coordinated so as to prevent the trapping or stranding of fish during daily tidal cycles. A qualified environmental professional(s) will be onsite during all in-water works and will assist in the coordination of fish salvage efforts in the event that they become trapped or stranded in a work area. A qualified environmental professional(s) will also monitor infill areas for signs of Pacific herring spawn and will temporarily suspended in-water works at that location. The qualified environmental professional(s) will also scan the work area for the presence of any marine mammals hauled out on land (i.e., harbour seal, Steller sea lion) prior to infilling activity commencing.

Any construction activities (e.g., blasting, infilling) that have the potential to impact fish-bearing freshwater streams/ponds will have the work area isolated and salvaged prior to any in-water work. Currently there are two known overlaps with confirmed fish-bearing waterbodies; one watercourse along the western side of Ridley Island and one pond along the eastern side of Ridley Island. If, however, additional information becomes available that changes the fish-bearing status of any other watercourse within the Project footprint, that area(s) will also be isolated and salvaged prior to in-water works.

Machinery, vessels, and barges will be operated so as to limit the disturbance to marine flora and fauna. Construction areas will be clearly demarcated, and machinery will refrain from traversing outside of these areas to the extent possible. For on-water work, barges will avoid grounding and/or anchoring in areas where eelgrass is present or in kelp beds.

One location in the high-intertidal zone on the western side of Ridley Island will require blasting (where the rail track will pass over a confirmed fish-bearing stream). To mitigate the potential for fish mortality blasts will only be detonated when the area is dry (between tidal cycles). Further, a specific Blast Management Plan will be developed to address the environmental concerns specific to this activity and location. This plan will include information such as maximum charges, use of blast mats, pre-blast salvages (as required), timing, and seasonal restrictions on blasting (if applicable).

In-water work is anticipated to be confined to a specific time period, anticipated to be approximately July 15 to February 15. A least risk window of July 15 to February 15 has been accepted by DFO on recent projects in the local area (Prince Rupert Port Authority Fairview/Ridley Island Connector Road Project, CN Zanardi Bridge, Causeway and Corridor Connection Project) and represents a modification from the standard DFO north coast least risk window (November 30 to February 15). The modification was approved by DFO based on marine fish studies in the local area and a greater understanding of fish movement and migration along these nearshore waters.

Of the marine species at risk potentially occurring in the Project area (Table 2-6), northern abalone are considered the most at risk due to their limited ability to flee the placement (construction) and removal (decommissioning) of low intertidal and subtidal fill rock. Porpoise Channel, where low intertidal and subtidal infilling is planned, is not considered ideal habitat for northern abalone due to the relatively low salinity as a result of freshwater runoff from the Skeena River. While the likelihood of this species being found within the Project footprint is considered low to moderate, northern abalone have been documented in Prince Rupert Harbour pers. obs. author). A project-specific survey to look for the presence of abalone has not yet occurred but is anticipated as part of the permitting process with DFO. If northern abalone are found, they will be salvaged and relocated prior to in-water works. The two other SARA/COSEWIC listed species potentially occurring in the Project footprint are quillback and yelloweye rockfish; both are relatively common in nearshore areas of the north coast, particularly during their juvenile stages. It is expected that the majority of these fish (and any other highly mobile fish species) will be able to flee infilling activities due to the slow nature of the progression of rock placement. While the majority of fish are expected to flee the work area during rock installation/removal, some fish species (including rockfish), may end up seeking refuge in rock crevices in the immediate area and be crushed/buried as a result.

Overall, change in injury/mortality risk during the construction and decommissioning phases of the Project is expected to be of moderate magnitude, site-specific geographic extent, medium-term duration, occur once, and be irreversible. Mitigation measures will help to limit the level of mortality, particularly to marine invertebrates, however some level of mortality is inevitable. Fish and invertebrate populations in the local area are not expected to be measurably altered despite this loss and overall numbers are expected to be able to recover within 2 to 10 years (depending on the species). As such, the injury/mortality risk associated with the Project is considered to be not significant. A summary of the anticipated residual effects to change in mortality/injury risk can be found in Table 5-17.

5.5.3.3 Change in movement

Concern associated with limiting or preventing the movement of fish focuses primarily on the one fish-bearing watercourse along the western side of Ridley Island known to support anadromous fish (coho salmon and Dolly Varden). This watercourse is connected to the ocean via an intertidal marsh that has a drainage channel carved through it (see Photo 6 in Section 2.2.1.5). Construction activities in this area include the blasting of bedrock, the installation of a culvert, and the subsequent infilling of the area around the drainage channel to support the new rail tracks. A clear-span open bottom culvert will be installed to maintain connection between freshwater and marine environments and will be designed in a way to accommodate fish passage and use. The specific details on culvert installation and design will be discussed and agreed upon with DFO as part of the permitting process.

While only one watercourse had currently been identified as being fish-bearing within the Project footprint, culvert installation on any other watercourses later identified as being fish-bearing will also follow the same requirement to permit free passage of fish.

Fish movement is not anticipated to be impeded during the operational phase of the Project due to sensory disturbance from light and/or noise. The relatively low frequency of train movement (4.5 trains/day at full phase 2 buildout) and their associated noise as they pass over culverts is not expected to prevent anadromous fish from transiting from marine to freshwater environments (and vice versa), although there may be a temporary flee response for any fish as trains pass directly overhead. The track itself will not be lit by artificial lighting outside of the main transload facility and the headlights of the passing trains are not anticipated to disturb fish in nearshore waters. Routine maintenance to the culvert (e.g., large woody debris removal) is expected throughout the operational phase of the project and will be timed so as to avoid peak migration periods (except in emergency situations).

Change in fish movement as a result of the construction, operation, and decommissioning phases of the Project are expected to be of low magnitude, site-specific in geographic extent, short-term (operation and decommissioning) to medium-term (construction) duration, occur once (construction and decommissioning) or rarely (operation), and be reversible. When considering the commitment to make any culverts placed in fish-bearing waters to be passable and not impede movement, the change to fish movement associated with the Project is considered to be not significant. A summary of the anticipated residual effects to change in movement can be found in Table 5-17.

Table 5-17 Project Residual Effects on Fish and Fish Habitat

Residual Effect	Residual Effects Characterization						
	Project Phase	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Significance Determination
Change in fish habitat	C	M	SS	LT	O	R	NS
	O	L	L	LT	C	R	NS
	D	M	SS	LT	O	R	NS
Change in injury/mortality risk	C	M	SS	MT	O	I	NS
	D	M	SS	MT	O	I	NS
Change in movement	C	L	SS	MT	O	R	NS
	O	L	SS	ST	R	R	NS
	D	L	SS	ST	O	R	NS

KEY See Table 4-2. for detailed definitions ***Project Phase*** *C: Construction* *O: Operation* *D: Decommissioning* ***Magnitude:*** *L: Low* *M: Moderate* *H: High*	***Geographic Extent:*** *SS: Site specific* *L: Local* *R: Regional* ***Duration:*** *ST: Short-term* *MT: Medium-term* *LT: Long-term* *N/A: Not applicable*	***Frequency:*** *O: Once* *R: Rare* *C: Continuous* ***Reversibility:*** *R: Reversible* *I: Irreversible* ***Significance Determination:*** *NS: Not Significant* *S: Significant*

5.6 ARCHAEOLOGICAL AND HERITAGE RESOURCES

5.6.1 Scope of Assessment

Potential effects of the Project on archaeological resources are associated with the construction phase and include the alteration of archaeological and heritage sites within the Project footprint. Effects pathways describe how the Project could result in the alteration of archaeological and heritage sites and include the loss or disturbance to site contents and site contexts, and vandalism as a result of the unauthorized collection of archaeological and heritage resources. Table 5-18 outlines the potential Project effects on archaeological and heritage resources and the effects pathways of the potential effects.

Table 5-18 Potential Effects and Effects Pathways for Archaeological Resources

Potential Environmental Effect	Effect Pathway
Changes to archaeological and/or heritage site(s)	• Loss or disturbance to site contents and site contexts through vegetation clearing and/or ground disturbance associated with brush and/ or topsoil removal, grading, trenching, construction vehicle traffic and use of workspaces during construction activities • Vandalism (e.g., if the Project creates new human access opportunities) or unauthorized collection of archaeological and heritage resources by workers during construction

5.6.2 Mitigation Measures

Mitigation measures were selected based on provincial standards and guidelines, best management practices, and peer-reviewed scientific literature. Table 5-19 outlines mitigation measures to avoid or reduce potential effects of the Project on archaeological and heritage resources.

Table 5-19 Mitigation Measures Proposed to Avoid or Reduce Change to Archaeological and Heritage Resources

Environmental Effect	Effective and Established Mitigation Measure
Changes to archaeological and/or heritage site(s)	Avoidance of archaeological and heritage sites through Project design
	Systematic Data Recovery (SDR) of CMT sites which typically involves: • Level II recording as outlined in the CMT Handbook (Archaeology Branch 2001) including the direct dating of CMTs by stem-round sampling • If stem round samples are to be collected, removal of the CMT will be monitored by a professional archaeologist and a local First Nations representative to verify that the stem-round samples are properly collected for CMT dating purposes
	SDR of other surface/subsurface archaeological and heritage sites which typically involves: • Scientific excavation and recovery of some or all portions of the sites to be affected • Collection and processing of carbon samples for dating, as appropriate • Other appropriate specialized analytical processes (e.g., geochemical analyses of stone tools, blood residue analysis, etc.) • Cataloguing of all collected artifacts and their subsequent curation in an approved facility
	Archaeological monitoring of Project construction activities to support SDR
	Development and delivery of a Project-specific chance find procedure for archaeological and heritage resources

5.6.3 Residual Effects and Significance Determination

In the event that unrecorded archaeological and heritage resources are found in conflict with proposed clearing and construction activities, residual effects will be adverse, low to moderate in magnitude, and site-specific in extent (Table 5-20). While the effects will occur only once, they will be permanent and irreversible. Based on information regarding previous disturbances to the Project footprint, these effects may occur in a disturbed or an undisturbed archaeological context.

During construction, the potential for development activities to conflict with unidentified archaeological and heritage resources is low, given that the majority of the Project footprint has been previously assessed and the likelihood that any archaeological and heritage resources present within those portions of the Project footprint that have not been assessed will be recorded during future Project-specific AIA survey of those areas. As a result, the probability of significant adverse residual effects associated with unrecorded archaeological and heritage resources is low.

Established mitigation techniques will be applied before and/or during construction to avoid or limit residual effects on archaeological and heritage resources. With the implementation of the established mitigation measures (e.g., completion of SDR studies and/or archaeological monitoring where Project effects cannot be avoided, implementation of resource collection prohibitions and adherence to a chance find procedure during construction, etc.), site-specific information regarding prehistoric and historic use within the Project footprint will not be lost. Therefore, the Project is not anticipated to have significant residual effects on archaeological and heritage resources (Table 5-20).

Table 5-20 Project Residual Effects on Archaeological Resources

	Residual Effects Characterization						
Residual Effect	**Project Phase**	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Significance Determination**
Alteration of archaeological and heritage site(s)	C	L/M	SS	N/A	O	I	NS

KEY See Table 4-2 for detailed definitions ***Project Phase*** *C: Construction* *O: Operation* *D: Decommissioning* ***Magnitude:*** *L: Low* *M: Moderate* *H: High*	***Geographic Extent:*** *SS: Site specific* *L: Local* *R: Regional* ***Duration:*** *ST: Short-term* *MT: Medium-term* *LT: Long-term* *N/A: Not applicable*	***Frequency:*** *O: Once* *R: Rare* *C: Continuous* ***Reversibility:*** *R: Reversible* *I: Irreversible* ***Significance Determination:*** *NS: Not Significant* *S: Significant*

5.7 MANAGEMENT OF ACCIDENTS AND MALFUNCTIONS

The accidents and malfunctions scenarios that pertain to the Project and are considered in the assessment of risks of accidents and malfunctions are fuels spills onto land and/or into water and train derailment into the marine environment.

5.7.1 Fuel Spill

Fuel and lubricants will be stored on site for use by equipment and vehicles. Release of these hydrocarbons into the environment has the potential to result in adverse effects on the environment. Potential means with which hydrocarbons could be released include vehicle accidents and a spill during maintenance or refueling of vehicles. The most probable scenario considered for this assessment is a spill of up to 100 L of hydrocarbons.

The potential for a hydrocarbon spill will be mitigated through the following:

- Fuel handling infrastructure and equipment will be regularly inspected and maintained
- Construction and operations management plans will be developed that include handling and storage requirements for hazardous materials and will incorporate spill contingency procedures
- Designated refueling and storage sites will be a safe distance from ignition sources, waterbodies and sensitive habitats.

The construction contractor and project operator will be required to develop a site-specific Emergency Response Plan as well as a detailed Spill Response Plan. These plans will include elements focused on safety and containment of the material to keep it from spreading into the marine environment or other sensitive habitats. In addition, personnel will have emergency response and spill contingency training and knowledge and emergency response equipment to limit the consequences of spills and prompt containment and clean-up actions. The potential for a spill to enter the marine environment is considered unlikely given that the majority of the Project footprint is greater than 20 m from the shoreline, that designated refueling and fuel storage sites will be a safe distance from the marine shoreline, and fuel spill recovery kits will be located on equipment, and in vehicles and maintenance buildings.

5.7.2 Train Derailment

In the event of a train derailment hazardous and non-hazardous materials could be introduced into the marine environment. Trains delivering products to the logistics park will use two or three locomotives and 100-120 cargo-laden rail cars. The engines of locomotives typically carry the following hazardous materials: diesel, lube oil, compressor oil, greases, and lead acid batteries.

To limit the potential for a derailment and spill into the marine environment the following mitigation measures will be implemented:

- Speed limits will be observed
- Tracks will be regularly inspected and properly maintained to avoid potential malfunction
- National and international engineering codes and standards will be followed

In the event of a derailment and if a spill does occur an emergency response protocol will be initiated as soon as it is safe to do so. This will include activation of spill handling procedures as included in operations management plans, including containment, diverting the spill away from the ocean and sensitive habitat, and deployment of absorbent booming. Personnel will have emergency response and spill contingency training and knowledge and emergency response equipment to limit the consequences of spills and prompt containment and clean-up actions.

6.0 EFFECTS ON INDIGENOUS PEOPLES

Changes to the biophysical environment that occur as a result of Project activities have the potential to affect Indigenous peoples. For instance, potential changes to the environment may affect physical or cultural heritage, the current use of lands and resources for traditional purposes or a structure, site or thing that is of historical or archaeological significance.

Potential effects of the Project on the biophysical environment are assessed in Section 5.0. Potential residual effects identified in Section 5.0 have the potential to affect Indigenous peoples through changes to physical or cultural heritage or the current use of lands and resources for traditional purposes. Residual biophysical effects also have the potential to result in a change of historical, archaeological or paleontological significance. These potential effects are discussed below.

6.1 CHANGE IN PHYSICAL AND CULTURAL HERITAGE AND CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL PURPOSES

6.1.1 Air Quality

The assessment of potential effects on air quality concluded that the Project would result in a moderate change to baseline air quality, but concentrations of CACs would not exceed BC AQO. The geographic extent of the change in air quality would be limited to Ridley Island. Given that concentrations of CACs are not predicted to exceed guidelines and are limited to Ridley Island for which there is no public access, it is not expected that changes in air quality would affect current use of lands and resources for traditional purposes or physical or cultural heritage.

6.1.2 Noise

Potential effects of the Project on baseline noise levels concluded that all receptors would experience an increase in noise levels from baseline during all Project phases, however, the predicted results meet the criteria recommended in the Health Canada noise guidance and BC OGC noise guideline. The increase in noise levels may adversely affect the experience of Indigenous harvesters who use nearby areas (not on Ridley Island) for hunting, fishing and gathering. Given the proximity of the Project site to harvesting areas and the implementation of mitigation measures identified in Section 5.2 effects are expected to be low in magnitude and are therefore not anticipated to adversely affect current use of lands and resources for traditional purposes. However, the assessment acknowledges that Indigenous groups may choose not to pursue these activities near the Project site following start-up of Project construction.

6.1.3 Vegetation

Clearing of the Project site is expected to result in a loss of vegetation including plant species, ecological communities, and old forest, and a change in wetland function. There is also the potential for Project activities to result in an increase in invasive plants. Because these activities will be restricted to the Project site and access to Ridley Island by the public, including Indigenous groups, is restricted these changes to vegetation are not anticipated to result in an adverse effect on Indigenous people. Furthermore, the PRPA will be working with Indigenous groups to identify opportunities to offset the loss of wetland function. The areas identified for offsetting are anticipated to support and enhance local opportunity for access and use.

6.1.4 Wildlife and Wildlife Habitat

Project activities, including site clearing and sensory disturbance during construction and operations, are expected to result in changes to wildlife habitat, mortality risk and movement. However, because these activities will be restricted to the Project site and access to Ridley Island by the public, including Indigenous groups, is restricted these changes to wildlife and wildlife habitat are not anticipated to result in an adverse effect on Indigenous people.

6.1.5 Fish and Fish Habitat

Potential interactions between the Project and fish and their habitat can result in a change in the habitat, injury or mortality risk, or movement of freshwater and marine fish. Because Project activities will be restricted to the Project site and access to Ridley Island by the public, including Indigenous groups, is restricted, changes to freshwater fish and fish habitat are not anticipated to result in an adverse effect on Indigenous people. However, there is the potential that changes could affect the marine fishing practices of Indigenous groups. Given the limited amount of proposed in-water marine works and proposed mitigation measures, these potential effects are anticipated to be low in magnitude and are therefore not anticipated to adversely affect current use of lands and resources for traditional purposes. Furthermore, the PRPA will be working with Indigenous groups to identify opportunities to offset the loss of fish habitat. Areas identified for offsetting are anticipated to support and enhance local opportunity for access and use.

6.2 CHANGE IN A STRUCTURE, SITE OR THING OF HISTORICAL OR ARCHAEOLOGICAL SIGNIFICANCE

Sites of archaeological significance have been identified within the Project footprint and have the potential to be affected by the Project. With the use of established mitigation measures (e.g., completion of SDR studies and/or archaeological monitoring where Project effects cannot be avoided, implementation of resource collection prohibitions and adherence to a chance find procedure during construction, etc.), site-specific information regarding prehistoric and historic use within the Project footprint will not be lost.

Development activities may conflict with unidentified archaeological and heritage resources. However, this probability is considered low given that the majority of the Project footprint has been previously assessed and the likelihood that any archaeological and heritage resources present within those portions of the Project footprint that have not been assessed will be recorded during future Project-specific AIA survey of those areas. As a result, it is anticipated that Project activities will result in a change to items of historical or archaeological significance, however, with the implementation of proposed mitigation, information associated with these items will not be lost.

7.0 CONCLUSIONS

7.1 SUMMARY OF FACTORS

When making a determination on whether or not a project is likely to cause significant adverse environmental effects authorities must consider the IAA's section 84(1)(a) to (e) factors. The five factors, and information on where and how the factor was considered in the effects evaluation is provided in Table 7-1.

Table 7-1 Section 84(1) Factors and the Consideration in the Effects Evaluation

Section 84(1) Factor	Section of Assessment	Summary
Any adverse impacts the project may have on the rights of the Indigenous peoples of Canada and affirmed by section 35 of the Constitution Act, 1982	Section 6	Federal Authorities have invited Indigenous groups to participate throughout the effects evaluation process, through meetings and through invitation to comment on the Project Description, the Environmental Effects Evaluation and the Determination. Potential impacts to the rights of indigenous groups will be identified through the review period of overall Environmental Effects Evaluation process and will be considered in the Environmental Effects Determination. Additionally, the Project site has been identified for industrial development through a long-term land use planning process that involved consultation with local Indigenous groups.
Indigenous knowledge that is provided with respect to the project	Section 2.2.2.2	Federal Authorities will continue to consult with Indigenous groups on potential Project effects and concerns and any Indigenous knowledge provided will be considered in reaching the environmental effects determination.
Community knowledge that is provided with respect to the project	Section 3.2	Federal Authorities will continue to consult with the communities of Port Edward and Prince Rupert on potential Project effects and concerns and any community knowledge provided will be considered in reaching the environmental effects determination.

Table 7-1 Section 84(1) Factors and the Consideration in the Effects Evaluation

Section 84(1) Factor	Section of Assessment	Summary
Comment received from the public	Section 3.2	Due to limitations on in-person meetings as a result of Covid-19, PRPA developed a digital open house on the PRPA website that included an interactive component aimed at helping to enhance public understanding of the Project and potential effects. Comments received through this process, as well as comments on the Project Description posted on the PRPA website, were considered and incorporated into the effects evaluation where appropriate. A summary of comments and their status is provided in Section 3.2. Comments obtained through a comment period on this document will also be considered by Federal Authorities in reaching the environmental effects determination.
Mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effect of the project that the authority is satisfied will be implemented	Sections 5.1.2, 5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6.	Mitigation measures are summarized in section 7.2.

7.2 SUMMARY OF ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

As per section 81 of IAA, the effects evaluation must assess potential effects of the project on the biophysical environment and determine how these effects may in turn affect Indigenous peoples, health, social or economic conditions. Table 7-2 summarizes the residual effects on the biophysical environment and indicates whether or not those residual effects are relevant to Indigenous peoples, health, social or economic conditions. Table 7-2 also summarizes the mitigation measures recommended to avoid or limit the potential effects.

Potential residual effects will be further managed through the implementation of the following management plans:

- Construction Environmental Management Plan (EMP) consisting of the following plans:
  - Wildlife Management Plan
  - Emergency Response Plan
  - Archaeology Features Management Plan
  - Invasive Plant Management Plan
  - Sediment and Erosion Control Plan
  - Blast management plan
  - Project complaints and response plan
  - Traffic Management Plan

- Rock Management Plan
- Fish Habitat Offsetting Plan
- Wetland Function Compensation Plan
- Operations EMP

Table 7-2 Summary of Environmental Effects and Mitigation Measures

Potential Environmental Effect	Indigenous Peoples	Health	Social	Economic	Effective and Established Mitigation Measure
Air Quality					
Change in ambient air quality	-	-	-	-	• Optimization of connector and access roads and infrastructure to reduce transportation and haul distances • Engines and exhaust systems will be properly maintained to keep construction and operation equipment in good working condition • Trucks and vehicle idling times and cold starts will be reduced to the extent possible • Connector and access roads will be maintained in good condition • During dry periods, water will be applied to connector and access roads to reduce dust emissions • Truck speed on the connector and access road will be limited to reduce road dust • Surfaces of topsoil and overburden stockpiles will be stabilized during extended periods between usage
Change in atmospheric greenhouse gases	-	-	-	-	• Optimization of connector and access roads and infrastructure to reduce transportation and haul distances • Engines and exhaust systems will be properly maintained to keep construction and operation equipment in good working condition • Trucks and vehicle idling times and cold starts will be reduced to the extent possible • Truck speed on the connector and access road will be limited to maximize fuel use efficiency • During the operational phase, vehicles and project infrastructure will be evaluated to ensure electrification opportunities are maximized
Noise					
Increase in noise level as a result of construction activities	✓	-	-	-	• Maximize scheduling of construction activities during day-time hours and on weekdays. • If noise complaints related to construction traffic occur, they will be logged and investigated to assess whether they are linked to Project activities. • Development and Implementation of a Project Complaints and Response Plan for both construction and operations phases of the project.
Increase in noise level as a result of truck and rail noise during operations	✓	-	-	-	• Rail lubricators may be advisable if wheel squeal is problematic where sharp track curves occur. • Standard BMPs (e.g., internal combustion engines, quality mufflers and vehicle maintenance). • Limit truck idling time and the use of engine breaks. • Fairview Connector Road will be constructed along the west shore such that traffic noise along Highway 16 and Prince Rupert will be reduced. • Maximize electrification of vehicles and equipment • Plan traffic flow to reduce or eliminate vehicle back-up alarms
Vegetation					
Change in abundance of • Federally or provincially listed plant species • Invasive plants	-	-	-	-	• Avoid placing Project features or temporary workspaces in the Alaska holly fern occurrence, if feasible. • Clearly flag the Project boundary prior to construction; clearing of vegetation outside the Project boundary will be prohibited. • An Invasive Plant Management Plan will be developed that includes mitigation measures to reduce the likelihood that invasive plants will be transported to and from the Project footprint. • If vegetation restoration is required, native plant and seed mixes will be used.
Change in the abundance of • Provincially listed ecological communities • Old forest	-	-	-	-	• Avoid placing temporary workspaces within known provincially listed ecological communities or old forest, where feasible. • The Project boundary will be clearly flagged prior to construction and clearing of vegetation outside the boundary will be prohibited. • An Invasive Plant Management Plan will be developed that will include mitigation measures to reduce the likelihood that invasive plants will be transported to and from the Project footprint. • Retain standing dead trees where possible and if trees must be cut for safety measures, cut trees as high as possible (3–5 m) while keeping work sites safe, to retain old forest features. • If vegetation restoration is required, native plant and seed mixes will be used.
Change in wetland functions	-	-	-	-	• Prepare and implement a Wetland Compensation Plan consistent with the Federal Policy on Wetland Conservation. • Apply erosion and sediment controls to limit sediment release into the freshwater or marine environment. • Limit clearing and disturbance of riparian vegetation to the smallest extent required. • Promote riparian vegetation re-colonization through the use of native seed mixes to avoid the establishment of weed species.

Table 7-2 Summary of Environmental Effects and Mitigation Measures

Potential Environmental Effect	Indigenous Peoples	Health	Social	Economic	Effective and Established Mitigation Measure
Wildlife and Wildlife Habitat					
Change in habitat, Change in Mortality Risk; and Change in Movement	-	-	-	-	• Laydown areas, temporary workspaces, and storage areas will be limited to within the boundaries of the Project footprint, to the extent possible. If laydown areas, temporary workspaces, or storage areas are required outside of the Project footprint, they will be located in existing disturbed areas
Change in habitat	-	-	-	-	• Prepare and implement a Wetland Compensation Plan consistent with the Federal Policy on Wetland Conservation (see Section 5.3.2). • Artificial bat roost structures will be installed to partially compensate for the loss of roosting habitat due to removal of old forest within the Project footprint. Selection of artificial bat roost structure design and installation locations will be determined by a qualified biologist in consultation with the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. • Sensory disturbance from Project-generated noise will be reduced by avoiding construction along the east side of Ridley Island during night-time hours and on weekends where practicable. Additional mitigation measures for Project-generated noise are provided in Section 5.2.2.
Change in habitat; and Change in Mortality risk	-	-	-	-	• A pre-disturbance wildlife habitat features survey will be undertaken by a qualified biologist in advance of construction. • A buffer of undisturbed natural vegetation will be maintained around bald eagle nests (BC MOE 2013) where possible, and unoccupied nests within the project footprint will be relocated. An additional no-disturbance setback will be maintained around occupied bald eagle nests (BC MOE 2013) until nests are vacated.
Change in mortality risk	-	-	-	-	• Vegetation clearing, grubbing, grading, and rock excavation should occur outside of the breeding period for migratory birds (April 9 to August 7 in Nest Zone A2 [ECCC 2020a]), great blue heron (January 15 to September 15 [BC MOE 2014]), and raptors (January 5 to September 6 [BC MOE 2013]). – If vegetation clearing and disturbance activities cannot be avoided during the breeding period for migratory birds, great blue heron, and raptors, a pre-disturbance bird nest survey will be undertaken in advance by a qualified biologist. – If nesting activity is identified during the pre-disturbance survey, appropriate no-disturbance setbacks and timing restrictions will be implemented as determined by a qualified biologist in accordance with federal or provincial guidelines (ECCC 2020b; BC MOE 2013). – If a raptor or great blue heron nest is identified within the clearing limits of the Project footprint and the boundaries of the clearing limits cannot be altered to avoid the nest, the nest will be removed or relocated once the nest is vacated. – Discovery of active nests will be reported to the Environmental Monitor immediately. • Vegetation clearing, grubbing, grading, rock excavation, and disturbance of open water wetland sites should occur outside of the breeding period for amphibians (March to August, with post-breeding dispersal extending through to October [BC MFLNRO 2016]). – If vegetation clearing and disturbance activities cannot be avoided during the amphibian breeding and post-breeding dispersal period, a pre-disturbance amphibian survey will be undertaken in advance by a qualified biologist to identify amphibian breeding habitat within and adjacent to the Project footprint. – If amphibian breeding habitat is confirmed, a salvage program will be implemented by a qualified biologist. – Although salvage efforts will target western toad, native amphibians encountered during the salvage program will be captured and relocated, regardless of species. • Project wastes and recycling materials, including sewage, food wastes, and wastes associated with equipment maintenance and repairs, will be temporarily stored on site in wildlife-proof containers and will be regularly transferred to an approved disposal or sorting facility. Wildlife incidents related to garbage or human food attractants will be reported.
Change in mortality risk; and Change in movement	-	-	-	-	• Nighttime lighting at the transloading facility, container yard, and associated infrastructure should include the following measures to reduce the risk of injury or mortality and disruption of movement for birds and bats: – Limit exterior lighting, including portable lighting, to the extent possible – Use directional or shielded lighting to reduce the vertical and horizontal distribution of light (Jones and Francis 2003; Fure 2012; Stone et al. 2015; Elmeros et al. 2016) – Use amber coloured narrowband LED lights (with a wavelength of 600 nm) that are less visible to bats, where possible (Fure 2012; Elmeros et al. 2016) and avoid using green, blue, and UV light wavelengths (Stone et al. 2015; BC Community Bat Program 2018) – Avoid the installation of light fixtures near ponds, rivers, and wetlands (Fure 2012; BC Community Bat Program 2018) – Use lighting products with adaptive controls and variable lighting regimes, where possible (e.g., timers to cycle lighting schedules to provide dark periods, dimmers, dynamic systems controlled by motion sensors) (Stone et al. 2015; Elmeros et al. 2016 • Maximum speed limits on roads and trails will be communicated. Project personnel will adhere to posted speed limits to reduce the risk of collisions with wildlife. Wildlife-vehicle collisions and near misses will be reported

Table 7-2 Summary of Environmental Effects and Mitigation Measures

Potential Environmental Effect	Indigenous Peoples	Health	Social	Economic	Effective and Established Mitigation Measure
Fish and Fish Habitat					
Change in fish habitat/ Change in injury/mortality risk	✓				• Use of least risk construction windows to be developed in conjunction with DFO to avoid overlap of any in-water construction with potentially key or sensitive habitats areas used by aquatic species
Change in fish habitat	✓	-	-	-	• Habitat losses deemed to constitute a HADD by DFO will be fully offset through the rehabilitation of existing marine fish habitats and/or the creation of new habitats. • Constructions works, undertakings and activities will proceed in a way so as to limit the trapping and stranding of fish • Limit the extent of grubbing, clearing, and infilling within riparian/intertidal/subtidal areas to the amount required for safe passage of equipment and construction of the Project. • A qualified Environmental Monitor (EM) will be present during initial riparian clearing, infilling and grading of the track and laydown areas to monitor and prescribe appropriate mitigation measures for the protection of fish habitat. The EM will be onsite at all times during work below the high-water mark. • Prepare a project-specific environmental management plan that includes sediment and erosion control measures • Re-contour and restore any stream banks if disturbed by construction activities • Prohibit re-fueling or maintenance of heavy machinery within 30 m of any waterbodies • Verify that any discharged sanitary wastewater generated from the administrative and maintenance buildings meets the relevant water quality guidelines for aquatic life. • Stormwater collected onsite from operational areas will pass through an oil/water separator and will be monitored for compliance with water quality objectives for the protection of aquatic life. • Rock or other materials used for construction will not leach substances that are harmful to fish.
Change in injury/mortality risk	✓	-	-	-	• A fish salvage will occur prior to any in-water work (if required) • Intertidal works and intertidal material placement are to be conducted in the dry (i.e. when the site is dewatered during the tidal cycle). • Construction works, undertakings or activities at risk of trapping or stranding of fish, such as excavations and infills, are to be inspected each time the tide recedes (including during evenings, weekends, and times when works are not being undertaken) for fish entrapment and stranding. Trapped and stranded fish are to be salvaged immediately and relocated to an area outside of the authorized Project footprint. If fish are becoming trapped or stranded in the work area, measures are to be put in place immediately to prevent future trapping and stranding. • A qualified environmental professional will be present at all times during all in-water marine works (i.e. subtidal material placement) to monitor for marine mammal presence. In-water marine works will cease if there is a risk of physical harm to any marine mammal from direct contact. • Any diversion of drainage channels will have appropriate erosion and sediment control measures implemented to maintaining water quality and flow downstream (where connected to fish-bearing waters). • A blast management plan will be developed to reduce the potential adverse effects on marine, anadromous, and freshwater fish. • Culvert installation and extension shall be conducted in the dry (i.e. when the site is dewatered during the tidal cycle) and in isolation of flow. Prior to culvert installation or removal in fish-bearing waterbodies, a qualified environmental(s) will establish fish exclusion and complete a fish salvage using appropriate gear, timing, and salvage techniques.
Change in movement	✓	-	-	-	• Culvert installation will not impede the existing passage of anadromous fish to migrate between marine and freshwater environments.
Archaeological and Heritage Resources					
Changes to archaeological and/or heritage site(s)	✓	-	-	-	• Avoidance of archaeological and heritage sites through Project design • SDR of CMT sites • SDR of other surface/subsurface archaeological and heritage sites • Archaeological monitoring of Project construction activities to support SDR • Development and delivery of a Project-specific chance find procedure for archaeological and heritage resources
KEY ✓ = The environmental effect may affect the category. - = The environmental effect is not expected to affect the category.					

7.3 SUMMARY OF LIKELIHOOD OF SIGNIFICANT ADVERSE EFFECTS

This effects evaluation for the RIELP Project considered potential effects of project activities on the biophysical environment and then determined how these effects may in turn affect Indigenous people, health, social or economic conditions. Results of the effects evaluation indicated that Project activities have the potential to result in residual effects on air quality, noise, vegetation, wildlife and wildlife habitat, fish and fish habitat and archaeological and heritage resources and that some residual effects have the potential to be long-term. However, with the implementation of mitigation measures outlined in the analysis of each VC and summarized in Table 7-2 it was determined that all potential effects will be of low to medium magnitude and site-specific or local in extent, with the exception of noise which has the potential to have a regional effect. The geographic extent of noise is regional because the noise effect will increase the sound level at receptors outside of Ridley Island relative to baseline. However, a comparison of potential sounds levels to the BC OGC noise guideline criteria indicated that noise effects at all receptors during the operation phase are below the PSL and low frequency noise limits. Furthermore, the predicted results at all receptors meet the criteria recommended in the Health Canada noise guidance and BC OGC noise guideline.

Based on the characterization of residual effects the likelihood of Project activities resulting in significant adverse effects is considered low. No further analysis is considered necessary.

8.0 REFERENCES

AECOM. 2012. Port of Prince Rupert 2020 Land Use Management Plan. Available at https://www.rupertport.com/app/uploads/2019/11/prpa-2020-land-use-management-plan.pdf. Accessed March 25, 2020.

AECOM. 2014a. Prince Rupert LNG: Proposed Liquefied Natural Gas Facility – Freshwater Fish Technical Study Report. Burnaby, BC.

AECOM. 2014b. Prince Rupert LNG: Proposed Liquefied Natural Gas Facility – Vegetation Technical Study Report. Burnaby, BC.

AECOM. 2014c. Prince Rupert LNG: Proposed Liquefied Natural Gas Facility – Wildlife Technical Study Report. Burnaby, BC.

Ames, Kenneth M. 1984. Second progress report: analysis and comparisons of the artifact assemblages from GbTo:31, GbTo 33 and GbTo:23, Prince Rupert Harbour, British Columbia. Report on file, Archaeological Survey of Canada.

Archer, David J. W. 1984. Prince Rupert Harbour Project Heritage Site Evaluation and Impact Assessment. Permit 1983-032. Ministry of Forests, Lands and Natural Resource Operations, Victoria, BC.

Aurora LNG 2017. Memo: Wildlife Passive Acoustic Monitoring Program. Aurora LNG Project, June 2017.

Banner, A., R.J. Hebda, E.T. Oswald, J. Pojar and R. Trowbridge 1988. Chapter 8 Wetlands of Pacific Canada. In: Wetlands of Canada, National Wetlands Working Group, 1988.

Banner, A., W. Mackenzie, S. Haeussler, S. Thomson, J. Pojar and R. Trowbridge. 1993. A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region. Land Management Handbook N0. 26. Part 1. Ministry of Forests, Research Program.

Batáry, P. and A. Báldi. 2003. Evidence of an edge effect on avian nest success. *Conservation Biology* 18: 389-400.

Bayne, E.M., L. Habib, and S. Boutin. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. *Conservation Biology* 22: 1186-1193.

Bélisle, M. and A. Desrochers. 2002. Gap-crossing decisions by forest birds: an empirical basis for parameterizing spatially-explicit, individual-based models. *Landscape Ecology* 17: 219–231.

Bennett, V.J. and A.A. Zurcher. 2013. When corridors collide: Road-related disturbance in commuting bats. *Journal of Wildlife Management* 77(1):93–101.

Boldogh, S., D. Dobrosi, and P. Samu. 2007. The effects of the illumination of buildings on house-dwelling bats and its conservation consequences. *Acta Chiropterologica* 9: 527-534.

BC Community Bat Program. 2018. Bat-Friendly Communities – a Guide for Managing and Enhancing Bat Habitat in British Columbia. Available at: https://www.bcbats.ca/images/BC-Bat-friendly-Communities-Guide-2018.pdf. Accessed: March 2020.

BC CDC (British Columbia Conservation Data Centre). 2020. Available at: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/species-and-ecosystems-explorer. Accessed February 2020.

BC ENV (British Columbia Ministry of Environment and Climate Change). 2013. British Columbia Field Sampling Manual. Available at: https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual. Accessed: March 2020.

BC ENV. 2016. Prince Rupert Airshed Study. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/pr-airshed-study-report-summ.pdf. Accessed: March 2020.

BC ENV. 2019. 2018 Ambient Air Quality data from BC ENV. Data summaries as developed through SAS analysis, provided in Excel format by the BC ENV in June 2019.

BC ENV. 2020. British Columbia Air Quality Objectives - Updated February 28, 2020. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/prov_aqo_fact_sheet.pdf. Accessed: March 2020.

BC MOE (British Columbia Ministry of Environment). 2013. Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (2013). Available at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/raptor_conservation_guidelines_2013.pdf. Accessed: March 2020.

BC MFLNRO (British Columbia Ministry of Forests, Lands and Natural Resource Operations). 2016. Best Management Practices for Amphibian and Reptile Salvages in British Columbia. Available at: http://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=10351. Accessed: March 2020.

BC MOFR and BC MOE (BC Ministry of Forests and Range and BC Ministry of Environment). 2010. Field Manual for Describing Terrestrial Ecosystems 2nd Edition. Land Management Handbook 25.

Browne, C.L., and Paszkowski, C.A. 2010. Hibernation sites of western toad (*Anaxyrus boreas*): characterization and management implications. *Herpetological Conservation and Biology* 5: 49-63.

Brunsden, Jo and Morley Eldridge 2008. Archaeological Overview Assessment, Ridley Island, B.C. Unpublished report on file, Prince Rupert Port Authority, Prince Rupert, BC, and Millennia Research Limited, Victoria BC.

Bunkley, J.P. and J.R. Barber. 2015. Noise reduces foraging efficiency in pallid bats (Antrozous pallidus). Ethology 121(11). Available at: https://www.researchgate.net/publication/282790585_Noise_Reduces_Foraging_Efficiency_in_Pallid_Bats_Antrozous_pallidus. Accessed April 2020.

Bunkley, J.P., C.J.W. McClure, N.J. Kleist, C.D. Francis, and J.R. Barber. 2015. Anthropogenic noise alters bat activity levels and echolocation calls. Global Ecology and Conservation 3: 62-71. Available at: https://www.sciencedirect.com/science/article/pii/S235198941400064X. Accessed April 2020.

CEA Agency (Canadian Environmental Assessment Agency). 2003. Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners. Canadian Environmental Assessment Agency. Published by the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment. November 2003. Available at: https://www.ceaa-acee.gc.ca/Content/A/4/1/A41F45C5-1A79-44FA-9091-D251EEE18322/Incorporating_Climate_Change_Considerations_in_Environmental_Assessment.pdf. Accessed March 2020.

CEA Agency 2012a. Canada Environmental Assessment Agency. Comprehensive Study Report: Fairview Terminal Phase II Expansion Project proposed by the Prince Rupert Port Authority and Canadian National Railway Company. September 2012. Available at: https://iaac-aeic.gc.ca/050/documents_staticpost/37956/CSR_-_Fairview_Terminal_Phase_II_Expansion-eng.pdf. Accessed March 2020.

CEA Agency 2012b. Canada Environmental Assessment Agency. Comprehensive Study Report: Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor. September, 2012. Available at https://iaac-aeic.gc.ca/050/documents/p47632/81285E.pdf. Accessed February 2020.

Chen, J., J.F. Franklin, and T.A. Spies. 1990. Microclimatic patter and basic biological responses at the clearcut edges of old-growth Douglas-fir stands. Northwest Environment 6(2): 424-5.

City of Prince Rupert. 2015. Prince Rupert Zoning Map 2015. Available at http://www.princerupert.ca/sites/default/files/Bylaws/Prince_Rupert_Zoning_2015-02.pdf. Accessed March 25, 2020.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2002. COSEWIC assessment and update status report on the western toad, *Anaxyrus boreas,* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON, 85 pp.

Cooper, Diana and Morley Eldridge 2006. An Archaeological Overview Assessment, District Lot 447, Range 5 Coast District, Ridley Island, B.C. Unpublished report on file, Prince Rupert Port Authority, Prince Rupert, BC, and Millennia Research Limited, Victoria BC.

DataKustik (DataKustik GmbH). 2019. Cadna/A Computer Aided Noise Abatement Model, Version 2019 MR2 (build:173:4950), Munich, Germany.

Dorsey, B.P., A. Clevenger, and L.J. Rew. 2017. *Relative Risk and Variables Associated with Bear and Ungulate Mortalities Along a Railroad in the Canadian Rocky Mountains*. In: Borda-de-Água. L., R. Barrientos, P. Beja, and H.M. Pereira Editors. 2017. *Railway Ecology*. Springer Open. 336 pp.

eBird Canada. 2020. Database of bird observations (website). Cornell Lab of Ornithology, Cornell University, Ithica, NY. Available at: https://ebird.org. Accessed April 2020.

Eldridge, Morley and Diana Cooper 2007. District Lot 447, Range 5 Coast District, Ridley Island, B.C.: An Archaeological Impact Assessment. Unpublished report on file, Prince Rupert Port Authority, Prince Rupert, BC, and Millennia Research Limited, Victoria BC.

Elmeros, M., J.D. Møller, J. Dekker, I. Garin, M. Christensen, and H.J. Baagøe. 2016. Bat mitigation measures on roads – a guideline. Available at: http://www.roadsandwildlife.org/data/files/Documents/f400cad3-b9d9-4f15-885e-74a0f95aaf6e%20%20.pdf. Accessed: March 2020.

ECCC (Environment and Climate Change Canada). 2002. Sulphur in Diesel Fuel Regulations. SOR/2002-254. Available at: https://laws-lois.justice.gc.ca/PDF/SOR-2002-254.pdf. Last accessed on April 7, 2020.

ECCC (Environment and Climate Change Canada). 2005. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities. March 2005. Prepared by: Cheminfo Services Inc. Prepared for: Environment and Climate Change Canada. Available at: http://www.bv.transports.gouv.qc.ca/mono/1173wew259.pdf. Last accessed on April 7, 2020.

ECCC (Environment and Climate Change Canada). 1996. The Federal Policy on Wetland Conservation: Implementation Guide for Federal Land Managers.

ECCC (Environment and Climate Change Canada). 2018. Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 172 pp.

ECCC (Environment and Climate Change Canada). 2019. National Inventory Report for Canada to the United Nations Climate Change. Available at: https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019. Accessed: March 2020.

ECCC. 2020a. General nesting periods of migratory birds. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html. Accessed: March 2020.

ECCC. 2020b. Guidelines to reduce risk to migratory birds. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html. Accessed: March 2020.

Environment Canada. 2014. Recovery Strategy for the Marbled Murrelet (Brachyramphus marmoratus) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. v + 49 pp

Fahrig, L. and T. Rytwinski. 2009. Effects of roads on animal abundance: an empirical review and synthesis. *Ecology and Society* 14: 21.

Fedje, D., H. Josenhans, J. Clague, J. Barrie, D. Archer and J. Southon. 2005. Hecate Strait palaeoshorelines. In Haida Gwaii human history and environment from the time of the loon to the time of the iron people, UBC Press, Vancouver, BC.

Fisher, Tal. 2014. Archaeological Impact Assessment No. 9657m. Unpublished report on file, Prince Rupert Port Authority, Prince Rupert, BC, and Archer CRM Partnership, Fort St. John, BC.

Fladmark, Knut R. 1975. A palaeoecological model for Northwest coast prehistory. Archaeological Survey of Canada, Mercury Series, Paper 43. National Museum of Civilization, Ottawa ON.

Fladmark, Knut R., Kenneth M. Ames and Patrica D. Sutherland 1990. Prehistory of the northern coast of British Columbia. Handbook of North American Indians: Northwest Coast 7:229-239. Smithsonian Institution, Washington DC.

Fure, A. 2012. Bats and lighting – six years on. *The London Naturalist* 91: 69-88.

Glista, D.J., T.L. DeVault, J. A. DeWoody. 2007. Vertebrate road mortality predominantly impacts amphibians. *Herpetological Conservation and Biology* 3: 77-87.

Grosman, P.D., J.A.G. Jaeger, P.M. Biron, C. Dussault, and J-P. Ouellet. 2011. Trade-off between road avoidance and attraction by roadside salt pools in moose: An agent-based model to assess measures for reducing moose-vehicle collisions. *Ecological Modelling* 222: 1423-1435.

Government of Canada 1991. Federal Policy on Wetland Conservation., Ottawa, Ontario. Website publication (http://dsp-psd.communication.gc.ca/Collection/CW66-116-1991E.pdf). Accessed March 2012.

Government of Canada. 2016. Canada ratifies the Paris Agreement on October 5th, 2016, following a vote in Parliament. Available at: https://www.canada.ca/en/environment-climate-change/services/climate-change/paris-agreement.html. Accessed: March 2020.

Government of Canada. 2019. Draft Strategic Assessment of Climate Change. Available at: https://www.canada.ca/en/services/environment/conservation/assessments/environmental-reviews /get-involved/draft-strategic-assessment-climate-change.html. Accessed: March 2020.

Habib, L. 2006. Effects of chronic industrial noise disturbance on boreal forest songbirds. M.Sc. Thesis. University of Alberta, Edmonton, AB.

Habib, L. Bayne, E.M. and Boutin, S. 2007. Chronic industrial noise affects pairing success and ago structure of ovenbirds *Seiurus aurocapilla*. *Journal of Applied Ecology* 44:176-184.

Habitat Wizard. 2020. Data Query of Project location. Available at: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/ecosystems/habitatwizard. Accessed February 2020

Hall, Dave, Fraser Bonner, Olivia Dodd, and Ian Cameron 2009. Archaeological Impact Assessment of the Terrestrial Portion of NaiKun Wind Development Inc.'s NaiKun Offshore Wind Energy Project. Report on file with the B.C. Environmental Assessment Office.

Hanson, A., L. Swanson, D. Ewing, G. Grabas, S. Meyer, L. Ross, M. Watmough, and J. Kirby 2008. Wetland Ecological Functions Assessment: An Overview of Approaches. Canadian Wildlife Service Technical Report Series No. 497. Atlantic Region. 59pgs.

Hebda, Richard and Rolf W. Matthews 1984. Holocene history of cedar and native Indian cultures of the North American Pacific Coast. Science 225:711-713.

Hemmera 2019. Ridley Island Fish and Fish Habitat Baseline Assessment Report. Prepared for Prince Rupert Port Authority. 105 pp.

Herrero, S., T. Smith, T.D. DeBruyn, K. Gunther, and C.A. Matt. 2005. Brown bear habituation to people: Safety, risks and benefits. *Wildlife Society Bulletin* 33: 362-373.

Hutchcroft, Dave. 2011. Archaeological impact assessment, Canpotex Potash Export Terminal, Ridley Island, BC. Report prepared for Canpotex Terminals Limited, Vancouver, BC.

iMapBC. 2020. British Columbia Geographic Warehouse (Website). Available at: https://maps.gov.bc.ca/ess/hm/imap4m. Accessed April 2020.

IPCC. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team: R. K. Pachauri and A. Reisinger (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

Jacques Whitford-Axys Ltd. 2008. Ridley Island Master Development Plan: Environmental Resource Assessment and Recommendations. Prepared for: Prince Rupert Port Authority. Prince Rupert, BC. 41 pp.

Jacques Whitford-Axys Ltd. 2008. Technical Data Report Freshwater Fish and Aquatic Habitat Assessment, LNG Transshipment Terminal, Ridley Island, BC. WestPac LNG Corporation.

Jones, J. and C.M. Francis. 2003. The effects of light characteristics on avian mortality at lighthouses. *Journal of Avian Biology* 34: 328-333.

Kloppers, E.L., C.C St. Clair, and T.E. Hurd. 2005. Predator-Resembling Aversive Conditioning for Managing Habituated Wildlife. *Ecology and Society* 10: 31.

Laidlaw, G. W. J., and M. B. Fenton. 1971. Control of nursery colony populations of bats by artificial light. *The Journal of Wildlife Management* 35: 843-846.

Le Corre, M., A. Ollivier, S. Ribes, and P. Jouventin. 2002. Light-induced mortality of petrels: a 4-year study from Réunion Island (Indian Ocean). *Biological Conservation* 105: 93-102.

Letham, Bryn, Andrew Martindale, Rebecca Macdonald, Eric Guiry, Jacob Jones and Kenneth Ames 2016. Postglacial Relative Sea Level History of the Prince Rupert Area, British Columbia, Canada. Quaternary Science Reviews 153: 156-191.

MacDonald, George F. 1983. Prehistoric art of the northern Northwest Coast. In Indian Art Traditions of the Northwest Coast. Edited by Roy L Carlson. Simon Fraser University, Archaeology Press, Burnaby BC.

MacDonald, George F. and Richard Inglis 1981. An overview of the North Coast prehistory project 1966-1980. In Fragments of the past: B.C. archaeology in the 1970s, edited by K.R. Fladmark. B.C. Studies 6-7:37-63.

Malt, J.M., and D.B. Lank. 2009. Marbled Murrelet Nest Predation Risk in Managed Forest Landscapes: Dynamic Fragmentation Effects at Multiple Scales. *Ecological Applications* 19: 1274-1287.

McClure, C.J., H.E. Ware, J. Carlisle, G. Kaltenecker, and J.R. Barber. 2013. An experimental investigation into the effects of traffic noise on distributions of birds: avoiding the phantom road. Proceedings of the Royal Society B 280:1–9.

Montevecchi, W.A. 2006. Influences of artificial light on marine birds. Ecological Consequences of Artificial Night Lighting. *Island Press*: 94-113.

Mueller, Christine 2020. Archaeological Assessment for Ridley Island Expansion Geotechnical Program. No-Permit Report. Unpublished report on file, Prince Rupert Port Authority, Prince Rupert, BC, and Millennia Research Limited, Victoria, BC.

Nairns, P.M. 1990. Seismic communication in anuran amphibians. Bioscience 40:268–274

National Wetlands Working Group 1997. The Canadian Wetland Classification System, Second Edition. Wetlands Research Centre, University of Waterloo, Waterloo, ON.

Newcombe CP, MacDonald DD (1991) Effects of suspended sediment on aquatic ecosystems. N Am J Fish Manag 11:72–82

Perry, G., B.W. Buchanan, R.N. Fisher, M. Salmon, and S.E. Wise. 2008. Effects of artificial night lighting on amphibians and reptiles in urban environments. *Herpetological Conservation* 3: 239-256.

PNW LNG (Pacific Northwest LNG). 2017. Pacific Northwest LNG Project Bat Monitoring Program Summary of Results 2014-2016. Prepared for the Canadian Wildlife Service: Species at Risk Recovery Unit, Pacific and Yukon Region.

Province of British Columbia. 2020. Invasive Alien Plant Program Database and Map Display. Available at: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species/iapp . Accessed March 13, 2020.

PRPA (Prince Rupert Port Authority). 2018. Port of Prince Rupert shorezone mapping. Accessed: May 2020. Available at: https://www.arcgis.com/apps/webappviewer/index.html?id=2fe5da0bd65b422a87031bc083152062

Rich, C. and T. Longcore. 2006. *Ecological Consequences of Artificial Night Lighting*. Washington, DC. 22 pp.

Russell, A. L., C. M. Butchkoski, L. Saidak, and G. F. McCracken. 2009. Road-killed bats, highway design, and the commuting ecology of bats. *Endangered Species Research* 8: 49-60.

Schaub, A., J. Ostwald, and B.M. Siemers. 2008. Foraging Bats Avoid Noise. *Journal of Experimental Biology* 211: 3174-3180.

Shannon, G., M.F. McKenna, L.M. Angeloni, K.R. Crooks, K.M. Fristrup, E. Brown, K.A. Warner, M.D. Nelson, C. White, J. Briggs, S. McFarland, and G. Wittemyer. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife. *Biological Reviews* 91:982–1005.

Stankowich, T. 2008. Ungulate flight responses to human disturbance: A review and meta-analysis. *Biological Conservation* 141: 2159-2173.

Stantec (Stantec Consulting Ltd.) 2011a. Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor: Wildlife Technical Data Report. Prepared by Stantec Consulting Ltd. for Canpotex Terminals Limited and Prince Rupert Port Authority, November 2011. Available at: https://www.ceaa.gc.ca/050/documents/53480/53480E.pdf. Accessed February 2020.

Stantec 2011b. Environmental Impact Statement: Canpotex Potash Export Terminal and Ridley Island Road, Rail, and Utility Corridor. Prepared by Stantec Consulting Ltd. for Canpotex Terminals Limited and Prince Rupert Port Authority, November 2011.

Stantec 2013. Wetland Habitat Compensation Plan: Canpotex Potash export Terminal and Ridley Island Road, Rail, and Utility Corridor. Prepared by Stantec Consulting Ltd. for Canpotex Terminals Limited and Prince Rupert Port Authority.

Stantec 2014a. Pacific Northwest LNG: Summary of the Environmental Impact Statement and Environmental Assessment Certificate Application. Prepared by Stantec Consulting Ltd. for Pacific Northwest LNG Limited Partnership, February 2014. Available at https://iaac-aeic.gc.ca/050/documents/p80032/98729E.pdf. Accessed February 2020

Stantec 2014b. Technical Data Report: Terrestrial Wildlife and Marine Birds. Prepared for Pacific Northwest LNG Limited Partnership, February 2014.

Stantec 2014c. Pacific Northwest LNG Project Marine Fish and Fish Habitat Survey Results: December 2014 to August 2015 Interim Data Report.

Stantec 2016a. Environmental Assessment Certificate (EAC) Application for the Aurora LNG Project (Digby Island). Available at: https://projects.eao.gov.bc.ca/p/588511eeaaecd9001b828062/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1586814530166. Accessed: March 2020.

Stantec 2016b. Pacific Northwest LNG Project Bat Monitoring Program 2014- 2015. Prepared by Stantec Consulting Ltd. for Pacific Northwest LNG Limited Partnership, April 2016.

Stantec 2016c. Wildlife Resources (Terrestrial) Technical Data Report. Prepared by Stantec Consulting Ltd. for Aurora LNG, November 2016.

Stone, E.L. 2013. Bats and lighting: Overview of current evidence and mitigation guidance. Bats and Lighting Research Project, University of Bristol.

Stone, E.L., S. Harris, and G. Jones. 2015. Impacts of artificial lighting on bats: a review of challenges and solutions. *Mammalian Biology* 80: 213–219.

Stone, E.L., G. Jones, and S. Harris. 2009. Street lighting disturbs commuting bats. *Current Biology* 19: 1123–1127.

Streeter, Ian. 2006a. Archaeological inventory and impact assessment WestPac LNG Transhipment Terminal, Ridley Island, B.C. Non-permit. Ministry of Forests, Lands and Natural Resource Operations, Victoria BC.

Streeter, Ian. 2006b. Overview of potential for sub-tidal archaeological resources, WestPac LNG Transhipment Terminal, Ridley Island, B.C. Report on file with Stantec, Sidney, BC.

Voller, J. 1998. Extension Note 21 Biodiversity and Interior Habitats: The need to minimize edge effects. Part 6 of 7. BC Ministry of Forest Research Program Victoria, BC.

Trombulak, S.C., and C. A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology* 14: 18-30.

Wilber, D.H., and Clarke, D.G. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. North American Journal of Fisheries Management 21(4):855-875

Zimmerman, G. S., and Glanz, W. E. 2000. Habitat use by bats in eastern Maine. *Journal of Wildlife Management* 64: 1032-1040.

APPENDIX A

Noise Assessment Report

Prince Rupert Port Authority—Ridley Island Export Logistics Park Project

Noise Assessment Report

July 24, 2020

Prepared for:

Prince Rupert Port Authority
200-215 Cow Bay Road
Prince Rupert, BC V8J 1A2

Prepared by:

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Abbreviations

%HA	percent highly annoyed
BC OGC	British Columbia Oil and Gas Commission
CTA	Canadian Transportation Agency
dB or dBL or dBZ	linear (unweighted) decibel sound level
dBA	A-weighted decibel sound level
dBC	C-weighted decibel sound level
EA	Environmental Assessment
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HC	Health Canada
ID	identification
ISO	International Organization for Standardization
LAA	local assessment area
LFN	low frequency noise
Ld	daytime equivalent sound level
Ldn	day-night average sound level

Leq	equivalent sound level
Lmax	maximum sound level
Ln	nighttime equivalent sound level
PDA	Project Development Area
SELref	Reference Sound Exposure Level
US	United States of America
UK	United Kingdom
WHO	World Health Organization

Glossary

Ambient Sound Level	The pre-project background noise or vibration level, which is often used interchangeably with "existing noise" in this document.
Background Sound Level (i.e., Baseline)	It includes noise from all sources other than the sound of interest (i.e., sound from other industrial noise not being measured, transportation sources, animals, and nature)
Bands (octave, 1/3 octave)	A series of electronic filters separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. Each octave band has a centre frequency that is double the centre frequency of the octave band preceding it
Daytime	The hours from 7:00 am to 10:00 pm
day-night Sound Level (L_{dn})	An equivalent continuous sound level taken over 24 hours, with the night-time (10 p.m. to 7 a.m.) contributions adjusted by +10 dB. (This is a type of rating level because of the night-time adjustments.) The night-time adjustment (or addition of 10 dB to the night-time period) is used to account for the expected increased annoyance due to noise-induced sleep disturbance and the increased residential population at night relative to daytime, by a factor of 2–3. US EPA 1974 suggests that in quiet areas, the night-time levels naturally drop by about 10 dB and this level of adjustment has been used with success in the U.S.
dB - Decibel	A logarithmic unit associated with sound pressure levels and sound power levels
dBA - Decibel, A-Weighted	A logarithmic unit where the recorded sound has been filtered using the A frequency weighting scale. A-weighting somewhat mimics the response of the human ear to sounds at different frequencies. A-weighted sound pressure levels are denoted by the suffix 'A' (i.e., dBA), and the term pressure is normally omitted from the description (i.e., sound level or noise level)
dBC - Decibel, C-Weighted	The logarithmic units associated with a sound pressure level, where the sound pressure signals has been filtered using a frequency weighting. The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). C-weighted sound pressure levels are denoted by the suffix 'C' (i.e., dBC). C-weighted levels are often used in low-frequency noise analysis, as the filtering effect is nearly flat at lower frequencies

Decibel Addition	In acoustics, due to the logarithmic nature of the decibel scale, the addition of two or more sound pressure levels (denoted as SPL_1, SPL_2, … SPL_n) is done as follows: $SPL_1 + SPL_2 + \ldots SPL_n = 10 \log (10^{(SPL1/10)} + 10^{(SPL2/10)} + \ldots + 10^{(SPLn/10)})$ As an example: 50 dB + 50 dB = 53 dB
Energy Equivalent Sound Level (L_{eq})	An energy-average sound level taken over a specified period of time. It represents the average sound pressure encountered for the period. The time period is often added as a suffix to the label (e.g., L_{eq} (24) for the 24-hour equivalent sound level). L_{eq} is usually A-weighted. An L_{eq} value expressed in dBA is a good, single value descriptor of the annoyance of noise. Here is a list of L_{eq} used in this assessment: • $L_{eq,1hr}$ Hourly equivalent sound level • L_d Daytime period equivalent sound level (15 hours, 7:00 AM to 10:00 PM) • L_n Nighttime period equivalent sound level (9 hours, 10:00 PM to 7:00 AM) • L_{dn} day-night sound level (also see definitions for day-night Sound Level)
Frequency	Number of cycles per unit of time. In acoustics, frequency is expressed in hertz (Hz), i.e. cycles per second
Hertz (Hz)	Unit of measurement of frequency, numerically equal to cycles per second
Idle	The speed at which an engine runs when it is not under load
Low Frequency Noise (LFN)	Noise in the low frequency range, 20 Hz up to 200 Hz: • where the difference between the overall C-weighted sound level and the overall A-weighted sound level exceeds 20 dB; or • ANSI 2005 indicates that sounds in the 16, 31.5 and 63-Hz octave bands greater than 70 dB may result in noise-inducted rattles, Low frequency noise can be associated with the introduction of noticeable vibrations and rattles in some structures
Maximum Sound Level (L_{max})	The maximum value of the sound pressure level during a noise event, measured with a sound level meter using a Fast Time Weighting. This level can be applied to pass-by noise from transportation noise sources and impulsive noise events.
Nighttime	The hours from 10:00 PM to 7:00 AM
Noise	Unwanted sound
Noise Level	Same as Sound Level, except applied to unwanted sounds

Percent Highly Annoyed (%HA)	Using the dose-response relationship between noise levels and annoyance, as described in the Health Canada 2017 noise guidance, one can calculate the percentage of a typical community that would report being "highly annoyed," expressed as %HA
Sound	A dynamic (fluctuating) pressure
Sound Pressure Level (SPL)	The logarithmic ratio of the root mean square sound pressure to the sound pressure at the threshold of hearing. The sound pressure level is defined by equation below where P is the RMS pressure due to a sound and P_0 is the reference pressure. P_0 is usually taken as 2.0×10^{-5} Pascals. SPL (dB) = $20 \log(P_{RMS}/P_0)$
Sound Exposure Level (SEL)	The 1-second equivalent continuous sound level that would be measured if the total energy in a noise event occurred during that one second. This level can be applied to pass-bys of transportation noise sources and impulsive noise events (Health Canada 2017)
Sound Power Level (PWL)	The logarithmic ratio of the instantaneous sound power of a noise source to that of the reference power. The sound power level is defined by equation below where W is the sound power of the source in watts, and Wo is the reference power of 10^{-12} watts PWL (dB) = $10 \log(W/W_0)$
Spectrum	The description of a sound wave's resolution into its components of frequency and amplitude
Transmission Loss	The ratio of the sound energy striking one side of a wall, relative to the transmitted sound energy through the wall, expressed in decibels.
Tonal Components	Often industrial facilities exhibit tonal components. Examples of tonal components are transformer hum, sirens, and piping noise. The test for the presence of tonal components consists of two parts (as per tonality prescribed in AUC Rule 012). The first part must demonstrate that the sound pressure level of any one of the slow-response, A-weighted, 1/3-octave bands between 20 and 16 kHz is 10 dBA or more than the sound pressure level of at least one of the adjacent bands within two 1/3-octave bandwidths. In addition, there must be a minimum of a 5 dBA drop from the band containing the tone within 2 bandwidths on the opposite side. The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum

1.0 INTRODUCTION

The Prince Rupert Port Authority (PRPA) is proposing to develop and operate an export logistics park on Ridley Island on the northwest coast of British Columbia (BC). The Ridley Island Export Logistics Park Project (RIELP or 'the Project') is intended to enhance the export transloading capacity and improve operational logistics at the Port of Prince Rupert. This assessment was completed to quantify the noise effects at seven noise receptors near the Project. The results were compared to provincial and federal noise thresholds for the seven receptors.

2.0 PROJECT DESCRIPTION

The following sections provide descriptions for the noise emission sources during construction and operation phases. Detailed information for Project construction and operation is presented in the RIELP Environmental Effects Evaluation in Support of a Section 82 Mitigation Measures Form.

2.1 CONSTRUCTION

Construction of Phase 1 of the Project is estimated to begin in Q1 2021 and will take approximately two years to complete. Construction will include the following construction phases:

- Site preparation
- Rail and rail crossings
- Access road and truck gate to the intermodal container yard
- Intermodal container yard
- Break build transload facility
- Bulk transload facility
- Buildings and utilities

Yard equipment would be ramped up as required, additional earthworks for potential future expansion would be sometime beyond Q1 2023. The construction hours will be typically 12 hours per day during daytime (6 AM to 6 PM). This noise assessment considered one scenario for earthwork activities during the site preparation phase to represent construction. Site preparation is considered the worst-case scenario because of the type and quantity of equipment included. The equipment types and their quantity for the site preparation are summarized in Table 1. The information presented in Table 1 is based on the construction noise assessment scenario for the Fairview Terminal Phase II Expansion Project (Stantec 2012).

Table 1 Site Preparation Noise Emitting Equipment

Item	Equipment Type	Quantity
1	Dump Truck (29 Tons)	10
2	Backhoe (8 Tons)	3
3	Bulldozer (35 Tons)	2
4	Drill Rig (12.5 Tons)	1
5	Graders (25 Tons)	2
6	Compactor	3
7	Chain Saw	10
8	Log Loader	2

The construction of infrastructure such as rail track, container yard, and transloading facility follows the completion of earthworks.

2.2 OPERATION

The Project is expected to have a transload container capacity of 400,000 twenty-foot equivalent units per year (TEUs/year), with the potential for a full expansion to 700,000 TEUs/year over a 10-year period. RIELP operations is planned to begin by Q1 2023 at the 400,000 TEUs/year capacity. Operation hours will be 24/7. The operation phase will include the following activities:

- Train arrival, offloading, and departure
- Commodity storage
- Containers loading and unloading
- Truck movement on Fairview Connector Road
- Truck movement on public roads

The noise assessment for the Project operation phase includes the main train yarding, yard car loading, and truck unloading. Table 2 presents the noise sources considered for the full expansion operation scenario (700,000 TEUs/year) in the noise assessment.

Table 2 Operation Phase Noise Emitting Equipment

Item	Equipment Type	Quantity
1	Electric Rubber Tire Gantry (RTG) cranes for intermodal (IM) rail cars	5
2	Electric RTG for IM container yard	17
3	Trucks and bomb carts	17
4	Forklifts	22
5	Pickup trucks	10
6	Reach stackers	22
7	Empty Container Handlers	11
8	Trains	4.5 per day
9	Truck traffic between RIELP and Fairview Terminal via the Fairview Connector Road	2000 round trips per day
10	Truck traffic between RIELP and Highway 16	140 round trips per day

3.0 NOISE RECEPTORS

The assessment considered seven "most affected" receptors (i.e., R1 to R7) closest to the Project. These receptors include residential dwellings closest to the Project footprint, Port Edward community center, Port Edward elementary school, commercial area, and a traditional land use area. The receptor ID, description, location, and approximate distance to the Project boundary are summarized in Table 3. The receptor locations are shown in Figure 1.

Table 3 Receptor Location

Receptor ID	Description	UTM [a] (easting)	UTM [a] (northing)	Distance to Project Boundary(m)
R1	Residential dwelling along Skeena Drive	416092	6007960	760
R2 [b]	Residential dwelling along Skeena Drive	416005	6008367	660
R3 [b]	Residential dwelling along Skeena Drive	415953	6008508	660
R4	Port Edward community center	415907	6008844	750
R5	Port Edward elementary school	415813	6009245	820
R6	Commercial property location along Skeena Drive	416780	6006922	1700
R7	Lax Kw'alaams and Metlakatla Willaclough IR No.6. traditional land use area, north-eastern corner	417399	6007053	2200
NOTES: [a] Coordinate System: NAD 1983 UTM Zone 9 [b] closest receptors to the Project				

- Highway
- Road
- Local Street
- Trail
- Ferry Route
- Railway
- Transmission Line
- Topographic Contour
- Watercourse
- Waterbody
- Wetland
- First Nations Reserve
- Local Greenspace
- Provincial Park, Ecological Reserve, or Protected Area
- Municipal Boundary
- Noise Assessment Receptor
- Ambient Monitoring Location
- Proposed Edge of Grading - Phase I
- Proposed Edge of Grading - Full Build-Out

0 250 500 750 1,000 m
1:25,000 (at original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Stantec

Project Location
Ridley Island

Project Number: 123221516
Prepared by SFREELAND on 20200407
Requested by JCHUI on 20200407
Checked by TDINEEN on 20200407

Client/Project/Report
Prince Rupert Port Authority
Ridley Island Export Logistics Park

Figure No.
1

Title
Noise Assessment Receptors

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4.0 NOISE IMPACT ASSESSMENT THRESHOLD

The assessment considered noise effects such as annoyance, sleep disturbance, and low frequency noise at the receptors. The assessment of these noise effects was based on the provincial noise guideline and federal noise guidance, i.e. the British Columbia Noise Control Best Practices Guideline by BC Oil and Gas Commission (BC OGC 2018) and the Health Canada Evaluating Human Health Impacts in Environmental Assessment: Noise (Health Canada 2017).

The following sections provide details on the applicable noise thresholds used in this assessment.

4.1 BC OGC NOISE GUIDELINE

The assessment of operational noise is based on the BC OGC noise guideline. The BC OGC noise guideline is a receptor-oriented regulation, which specifies allowable sound levels from energy-related facilities during operation.

In accordance with the BC OGC noise guideline, all new energy-related facilities must meet a daytime (07:00 to 22:00) and nighttime (22:00 to 07:00) Permissible Sound Level (PSL) at a distance of 1.5 km (1.5 km criteria boundary) from the facility boundary or at the nearest receptor, whichever is closer. The daytime PSL is set at 10 dB above the nighttime value. Adjustment to the PSL is applicable for receptor located within 500 m of a heavily traffic road or rail line. Only receptors that are permanently or seasonally occupied are considered. Therefore, any employee or worker residence, dormitory, or construction camp located within an industrial plant boundary are excluded from consideration.

Receptors R1, R2, and R3 are residential dwellings that are considered as receptors in accordance with the BC OGC noise guideline. The BC OGC PSLs for these receptors were established in the Pacific NorthWest LNG Project environment impact assessment (Stantec 2014). The daytime PSL of 58 dBA and nighttime PSL of 48 dBA is applicable to receptors R1, R2, and R3. Receptors (i.e., R4 to R7) are not residential dwellings and there is no PSL limit associated with these receptors.

In addition to the PSL, the BC OGC noise guideline also addresses low frequency noise (LFN) concerns. According to the BC OGC noise guideline, an LFN effect may occur at a receptor where a clear tone is present at or below 250 Hz and the difference between the overall C-weighted sound level and the overall A-weighted sound level exceeds 20 dB. The presence of both conditions at a residential dwelling receptor indicates the potential for LFN concerns.

4.2 HEALTH CANADA NOISE GUIDANCE

4.2.1 Annoyance

Health Canada has published noise guidance (Health Canada 2017) that has been used in environmental assessments. The guidance provides objectives for noise levels based on several measurable noise parameters such as daytime or nighttime equivalent sound levels (L_d and L_n, respectively), day-night average sound level (L_{dn}), change in percent highly annoyed (%HA), and maximum sound level (L_{max}) to quantify noise effects. The L_{dn} is a 24-hour time-averaged sound level parameter, with a 10 decibels (dB) penalty applied to nighttime hours.

The receptor-based threshold for an acceptable increase in %HA is 6.5% for project activities with duration more than one year. Therefore, this threshold is applicable to construction and operation phase of the Project. If the change in %HA is exceeded, noise effects are of concern and may require mitigation. Health Canada also recommends mitigation of Project noise if the L_{dn} exceeds 75 dBA, even if the change in %HA does not exceed 6.5%. Health Canada (2017) definition for a noise sensitive receptor includes residential dwellings, traditional land use area, school, community center, and commercial premises; therefore the %HA threshold applies to R1-R7.

4.2.2 Sleep Disturbance

The Health Canada noise guidance recommends that maximum events sound levels (L_{max}) should not exceed 45 dBA indoor more than 10 to 15 times during the nighttime period. In the absence of actual indoor field measurements or calculations, the outdoor-to-indoor transmission loss of 15 dB with windows partially open and 27 dB with windows fully closed is applied. Based on the transmission loss of 15 dB, the maximum outdoor noise level of 60 dBA $L_{max,\ outdoor}$ with the maximum occurrence of 10 events was used as the threshold for sleep disturbance. These thresholds in the Health Canada noise guidance are based information from the World Health Organization (WHO) Guidelines for Community Noise (WHO 1999) with respect to sleep disturbance. Health Canada (2017) definition for a noise sensitive receptor includes residential dwellings, traditional land use area, school, community center, and commercial premises; therefore the sleep disturbance threshold applies to R1-R7.

5.0 NOISE MODELLING

Sound propagation calculations used in this assessment were completed in accordance with ISO 9613, Part 1 and 2 Standards (ISO 1993 and ISO 1996). ISO 9613 is commonly used among noise practitioners and is accepted by the BC OGC. Calculations under ISO 9613-2 account for mild inversion and/or downwind conditions (winds from source to receiver of 1 to 5 m/s) and therefore calculations under this standard meet the requirements of BC OGC (2018) regarding meteorological effects. Propagation calculations were performed using Cadna/A noise modeling software package, a computer program published by DataKustik (DataKustik 2019), which incorporates ISO 9613 algorithms.

The model accounts for the following factors:

- Geometric spreading
- Ground absorption
- Screening effects
- Atmospheric absorption
- Noise source characteristics—sound power level, location, elevation, and directivity
- Atmospheric effects of downwind conditions and/or mild temperature inversion

Modelling parameters used in the noise assessment for the Project are summarized in Table 4.

Table 4 Noise Model Setting

Model Parameters	Model Setting
Temperature	10°C
Relative Humidity	70%
Number of reflections	1
Propagation Standard	ISO 9613-1, ISO 9613-2
Ground Conditions and Attenuation Factor	G = 0.1 (water surface) Surrounding area: G = 0.6 (mix area: developed and undeveloped)
Receptor Height	1.5 m above grade
Topography	Terrain data with 50 m x 50 m resolution based on Canadian Digital Elevation Model (CDEM) Natural Resources Canada

6.0 BASELINE SOUND LEVEL

The baseline sound levels for all seven receptors are summarized in Table 5.

Table 5 Baseline Sound Level

Receptor ID	Description	L_{dn} (dBA)
R1	Residential dwelling along Skeena Drive	48
R2	Residential dwelling along Skeena Drive	48
R3	Residential dwelling along Skeena Drive	48
R4	Port Edward community center	51
R5	Port Edward elementary school	51
R6	Commercial property location along Skeena Drive	48
R7	Lax Kw'alaams and Metlakatla Willaclough IR No.6. traditional land use area, north-eastern corner	45

The baseline sound levels at the seven receptors were based on the following information sources:

- Ambient noise monitoring conducted for PRPA in 2012 (Stantec 2013)
- PRPA Fairview Bay continuous noise monitoring stations

Receptors R1 to R6 were assessed in the Pacific Northwest LNG environmental impact assessment (Stantec 2016). In the 2016 assessment, the baseline sound levels at these receptors were based on an ambient noise monitoring conducted for the PRPA (Stantec 2013). Measurement results at two monitoring locations (M3 and M7) were used to represent the baseline sound level at these receptors. M3 monitoring location is near a residential dwelling along Skeena drive and M7 monitoring location is at the Port Edward Elementary School. M3 and M7 locations are shown in Figure 1. The L_{dn} of 48 A-weighted decibel (dBA) at M7 represent the baseline sound level at receptors R1, R2, R3, and R6. The L_{dn} of 51 dBA at M3 represents the baseline sound level at receptors R4 and R5. The measured values are used to establish the baseline sound levels at R1 to R6.

The traditional land use receptor R7 is located at the north-eastern corner of the Lax Kw'alaams and Metlakatla Willaclough IR No.6 area. The location is approximately 400 m north of Skeena Drive. The baseline sound level at R6 is assumed to be 45 dBA L_{dn}, based on the BC OGC noise guideline recommended average rural ambient sound level of 45 dBA L_d, 35 dBA L_n, and 45 dBA L_{dn}.

The PRPA Fairview Bay noise monitoring station is located along Sunset Drive, Port Edward. The monitoring was installed November 2015, approximately 1.4 km north west of the Project footprint. The station monitors sound continuously from the community, Fairview Terminal, the Alaska Ferries and BC Ferries terminals, road traffic, and rail traffic. The measurement results between the period of January to December 2019 indicates a L_{dn} of 65 dBA. This level is higher than L_{dn} range of 45 dBA to 51 dBA for baseline sound level at all receptors; however, the lower L_{dn} values assume these receptors are in a quieter environment than the PRPA Fairview Bay monitoring location.

7.0 PROJECT NOISE EMISSION

Based on the information included in the EEE and other references, sound power levels were estimated for construction and operation. The references that were considered include the following:

- Fairview Terminal Expansion noise assessment (Stantec 2012)
- Department for Environment Food and Rural Affairs (DEFRA). United Kingdom. Noise Database for Prediction of Noise on Construction and Open Sites (DEFRA 2005)
- Stantec's measurement of similar equipment (Stantec database)
- Environmental Statement for Port of Southampton, UK (South Hampton 2011)
- Canadian Transportation Agency (CTA) Railway Noise Measurement and Reporting Methodology Federal noise guideline for rail development (CTA 2011)
- Noise modelling software database (DataKustik 2019)

The sound power levels of noise sources used in the construction and operation phase noise models are summarized in Table 6 and Table 7, respectively. The sound power level represents each piece of equipment with different operating schedule as presented in Section 2 (i.e. 12 hours during construction and 24/7 during operation). During the operation phase, the train locomotive and rail car arrival and departure noise effect is based on the noise model (DataKustik 2019) train emission database. The train emission database is based on information from the US Federal Transit Administration (FTA) and Federal Railroad Administration (FRA). A reference sound exposure level (SEL_{ref}) of 97 dBA and 100 dBA were used for the locomotive and rail cars, respectively.

Table 6 Sound Power Levels used in Construction Noise Model

Item	Noise Sources	Sound Power Level (dBA)	Reference
1	Dump Truck (29 Tons)	117	Stantec 2012
2	Backhoe (8 Tons)	97	Stantec 2012
3	Bulldozer (35 Tons)	118	Stantec 2012
4	Drill Rig (12.5 Tons)	115	Stantec 2012
5	Graders (25 Tons)	119	Stantec 2012
6	Compactor	110	Stantec 2012
7	Chain Saw	96	Stantec 2012
8	Log Loader	101	Stantec 2012
9	Backup Alarm	119	Stantec database

.

Table 7 Sound Power Levels used in Operation Noise Model

Item	Noise Sources	Sound Power Level (dBA)	Reference
1	Electric Rubber Tire Gantry (RTG) cranes for intermodal (IM) rail cars	101	Stantec 2012
2	Electric RTG for IM container yard	101	Stantec 2012
3	Trucks and bomb carts	106	Stantec 2012
4	Forklifts	110	Stantec database
5	Pickup trucks	106	Stantec 2012
6	Reach stackers	110	Stantec 2012
7	Empty Container Handlers	112	Stantec 2012
8	Backup Alarm	119	Stantec database
9	Container dropping	119	Southampton 2011
10	Truck	109	DEFRA 2005
12	Train (locomotive idling)	107	CTA 2018
14	Train (coupling)	119	Stantec database

8.0 ASSUMPTIONS

The modelling results presented in Section 8 is based on the following assumptions for the Project:

- Train frequency: 4.5 trains total per day (inbound or outbound)
- Number of locomotives per train: 2x
- Number of rail cars per train: 100
- Train locomotive idling time on site: 120 minutes
- No train horn event within Project area
- Train speed within Project Area: 8 km/hr
- Truck speed along connector road and access road: 50 km/hr
- Connector road truck traffic: 2000 round trip per day
- Access road truck traffic: 140 round trip per day
- All gantry cranes are electric rubber tire gantry and electric rail mounted gantry (e-RMG)
- Container stack levels: two for IM Rail and five or higher for container yard

9.0 MODELING RESULTS

9.1.1 Day-night Sound Level

Construction and operation noise effect predictions were assessed at the seven receptors. The daytime (L_d), nighttime(L_d), and day-night average sound level (L_{dn}) results are presented in Table 8 and Table 9 for construction and operation phases, respectively.

Table 8 Daytime, Nighttime, and Day-Time Average Sound Level during Construction

Receptor ID	Construction Phase—Site Preparation (dBA)		
	L_d	L_n	L_{dn}
R1	47.5	39.3	48.3
R2	46.3	38.1	47.1
R3	45.1	37.0	45.9
R4	43.0	34.8	43.8
R5	40.3	32.1	41.1
R6	38.2	30.0	39.0
R7	36.0	27.8	36.8

Table 9 Daytime, Nighttime, and Day-Time Average Sound Level during Operation

Receptor ID	Operation Phase (dBA)		
	L_d	L_n	L_{dn}
R1	45.5	45.5	51.9
R2	46.0	45.9	52.3
R3	46.2	46.1	52.5
R4	45.8	45.7	52.1
R5	45.0	44.9	51.3
R6	38.6	38.6	45.0
R7	36.1	36.1	42.5

9.1.2 Maximum Sound Level

Table 10 summarizes the predicted maximum sound levels (L_{max}) at the seven receptors due to container impact, backup alarm, and train car coupling event. The L_{max} value is typically higher than the L_d, L_n, and L_{dn} values for an activity because it represents the maximum sound level for an event rather than an average level over a time period. Due to their intermittent, short duration, and impulsive nature for these activities, the predicted L_{max} sound levels were used to evaluate sleep disturbance potential in Section 10.2.2.

Table 10 Maximum Sound Level at Receptors

Receptor ID	Container Impact L_{max} (dBA)	Backup Alarm L_{max} (dBA)	Train Car Coupling L_{max} (dBA)
R1	43.4	47.2	36.8
R2	42.5	46.9	39.7
R3	42.5	46.7	47.3
R4	41.8	45.0	44.7
R5	40.2	42.5	41.2
R6	36.5	37.3	26.2
R7	28.5	28.9	21.9

9.1.3 Low Frequency Noise

The predicted noise levels at the seven receptors in A-weighted and C-weighted sound levels are presented in Table 11 and Table 12 for the construction and operation phase, respectively.

Table 11 Low Frequency Noise Results during Construction Phase

Receptor ID	Daytime Sound Level (L_d)			Nighttime Sound Level (L_n)		
	dBA	dBC	dBC minus dBA	dBA	dBC	dBC minus dBA
R1	47.5	59.0	11.5	39.3	50.8	11.5
R2	46.3	58.2	11.9	38.1	50.0	11.9
R3	45.1	57.1	12.0	37.0	48.9	11.9
R4	43.0	55.7	12.7	34.8	47.5	12.7
R5	40.3	54.0	13.7	32.1	45.8	13.7
R6	38.2	52.4	14.2	30.0	44.2	14.2
R7	36.0	52.1	16.1	27.8	43.9	16.1

Table 12 Low Frequency Noise Results during Operation Phase

Receptor ID	Daytime Sound Level (L_d)			Nighttime Sound Level (L_n)		
	dBA	dBC	dBC minus dBA	dBA	dBC	dBC minus dBA
R1	45.5	62.6	17.1	45.5	62.6	17.1
R2	46.0	63.0	17.0	45.9	63.0	17.1
R3	46.2	63.5	17.3	46.1	63.5	17.4
R4	45.8	64.2	18.4	45.7	64.1	18.4
R5	45.0	64.0	19.0	44.9	63.9	19.0
R6	38.6	57.5	18.9	38.6	57.5	18.9
R7	36.1	55.5	19.4	36.1	55.5	19.4

10.0 COMPARISON TO NOISE THRESHOLDS

10.1 BC OGC

10.1.1 Permissible Sound Level

The predicted cumulative sound levels from the Project are compared to the BC OGC PSLs for the three residential dwelling receptors (i.e., R1, R2, and R3) closest to the Project. The cumulative sound level is determined by combining the ambient sound level (ASL) and Project noise effect results from Table 9. As per BC OGC noise guideline, the ASL is 5 dB below the PSL. PSLs at the three receptors are based on values determined in the Pacific Northwest LNG noise assessment (Stantec 2016), which received approval from federal government on September 2016 and received permission from the BC OGC on January 2017. Table 13 summarizes the cumulative sound level results for three receptors. The results indicate the cumulative sound level does not exceed the PSL limits at the three receptors.

Table 13 BC OGC Permissible Sound Level

Receptor ID	Project Sound Level (dBA)		Ambient Sound Level [a] (dBA)		Cumulative Sound Level (dBA)		Permissible Sound Level [b] (dBA)	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
R1	45.5	45.5	53	43	53.7	47.4	58	48
R2	46.0	45.9	53	43	53.8	47.7	58	48
R3	46.2	46.1	53	43	53.8	47.8	58	48

NOTES:
[a] Based on Ambient Sound Level prescribed in BC OGC 2018 Noise Guideline
[b] Based on PSL determined in Pacific Northwest LNG noise assessment (Stantec 2014)

10.1.2 Low Frequency Noise

Low frequency noise (LFN) effect is assessed at all receptors during the operation period. Results in Table 11 and Table 12 show that the difference in C-weighted and A-weighted sound levels are below the recommended threshold of 20 dB. Therefore, this assessment concludes that LFN effect at all receptors is not expected.

10.2 HEALTH CANADA

10.2.1 Percent Highly Annoyed

Baseline L_{dn}, Project L_{dn}, Cumulative L_{dn}, Baseline %HA, and Cumulative %HA are required to determine the change in %HA at the receptors. The Baseline L_{dn} and Project L_{dn} values are results presented in Section 7.1.1. The Cumulative L_{dn} values are determined by combining (e.g. logarithmic addition) the Baseline L_{dn} and Project L_{dn} results. The Baseline %HA and Cumulative %HA are determined by the Baseline L_{dn} and Cumulative L_{dn}, respectively. A sample calculation for the %HA and change in %HA at receptor (R1) is shown in Appendix A.

Table 14 presents the results for the construction phase site preparation activities. The results for the operation phase are shown in Table 15. A comparison of Baseline L_{dn} and Cumulative L_{dn} results in both tables indicate that noise levels at the seven receptors are predicted to result in a measurable change relative to the baseline sound level during both construction and operation period.

Health Canada noise guidance recommends mitigation if project noise L_{dn} exceeds 75 dBA and if the change in %HA exceeds 6.5%. The results indicate that the Project L_{dn} is below 75 dBA and the change in %HA are below the limit of 6.5% at all receptors for the seven receptors during both construction and operation phases.

Table 14 Change in %HA for Construction

Receptor ID	Baseline L_{dn} [a] (dBA)	Project L_{dn} [b] (dBA)	Cumulative L_{dn} [c] (dBA)	Baseline %HA [d] (%)	Cumulative %HA [d] (%)	Change in %HA (%)
R1	48.0	48.3	51.1	1.7	2.5	0.8
R2	48.0	47.1	50.6	1.7	2.4	0.7
R3	48.0	45.9	50.1	1.7	2.2	0.5
R4	51.0	43.8	51.8	2.5	2.7	0.3
R5	51.0	41.1	51.4	2.5	2.6	0.1
R6	48.0	39.0	48.5	1.7	1.8	0.1
R7	45.0	36.8	45.6	4.2 [e]	4.5 [e]	0.3

NOTES:
[a] based on Table 5 results
[b] based on Table 8 results
[c] combined Baseline and Project sound levels
[d] based on method shown in Appendix A %HA calculation sample
[e] +10 dB adjustment for "peace and quiet" expectation at rural area (i.e. Baseline L_{dn} = 45 dBA) is included in the %HA calculation.

Table 15 Change in %HA for Operation

Receptor ID	Baseline L_{dn} [a] (dBA)	Project L_{dn} [b] (dBA)	Cumulative L_{dn} [c] (dBA)	Baseline %HA [d] (%)	Cumulative %HA [d] (%)	Change in %HA (%)
R1	48.0	51.9	53.4	1.7	3.4	1.7
R2	48.0	52.3	53.7	1.7	3.5	1.8
R3	48.0	52.5	53.8	1.7	3.6	1.9
R4	51.0	52.1	54.6	2.5	3.9	1.5
R5	51.0	51.3	54.2	2.5	3.7	1.2
R6	48.0	45.0	49.8	1.7	2.1	0.4
R7	45.0	42.5	46.9	4.2 [e]	5.3 [e]	1.1

NOTES:
[a] based on Table 5 results
[b] based on Table 9 results
[c] combined Baseline and Project sound levels
[d] based on method shown in Appendix A %HA calculation sample
[e] +10 dB adjustment for "peace and quiet" expectation at rural area (i.e. Baseline L_{dn} = 45 dBA) is included in the %HA calculation.

10.2.2 Sleep Disturbance

The maximum sound levels (L_{max}) results presented in Table 10 for container dropping, backup alarm, and rail car coupling events are below the sleep disturbance L_{max} threshold of 60 dBA.

11.0 CONCLUSION

This assessment was completed to quantify the noise effects at seven "most affected" receptors during the construction and operation phases for the Project. During the construction phase, noise effects due to site preparation were assessed. During the operation phase, noise effects due to train traffic, truck traffic, and other Project activities (i.e. gantry crane, mobile equipment, container dropping) were assessed. The results indicate that noise effects are below the BC OGC and Health Canada thresholds at seven receptors.

12.0 REFERENCES

DataKustik 2019. DataKustik GmbH Cadna/A Computer Aided Noise Abatement (CadnaA) Model, Version 2019 MR2 (build:173.4950), Munich, Germany.

CTA 2011. Canadian Transportation Agency (CTA) Railway Noise Measurement and Reporting Methodology (August 2011)

DEFRA 2005. Department for Environment Food and Rural Affairs (DEFRA). United Kingdom. Update of Noise Database for Prediction of Noise on Construction and Open Sites. 2005

Health Canada 2017. Evaluating Human Health Impacts in Environmental Assessment: Noise, published by Health Canada January 2017

International Organization for Standardization (ISO). 1993. ISO 9613. 1993. International Standard ISO 9613-1, Acoustics – Attenuation of Sound during Propagation Outdoors. Part 1: Calculation of Absorption of Sound.

ISO. 1996. ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors -- Part 2: General method of calculation.

Southampton 2011. Environmental Statement for Port of Southampton, Berth 201/202 Works Update 2011. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR050001/TR050001-000649-DIRFT%20III%20ES%20Appendix%20J7%20-%20Operational%20Noise%20Assumptions.pdf

Stantec Consulting Ltd. (Stantec) 2012. Fairview Terminal Expansion. Comprehensive Study Report and Technical Data Reports. Prepared for CN Rail.

Stantec 2013. Ambient Noise Monitoring Report 2012 – Ridley Island and Port Edward, BC. Prepared for Prince Rupert Port Authority.

Stantec 2014. Pacific NorthWest LNG Project. Environmental Impact Assessment and Technical Data Reports. Prepared for Pacific NorthWest LNG Limited Partnership.

Stantec 2020. Ridley Island Export Logistics Project Environmental Effects Evaluation in Support of a Section 82 Mitigation Measures Form. July 2020

World Health Organization (WHO) 1999. World Health Organization (WHO), Berglund, B., Lindvall, T. & Schwela, D.H (Eds.). (1999). Guidelines for Community Noise.

APPENDIX A

HEALTH CANADA PERCENT HIGHLY ANNOYED CALCULATION EXAMPLE

Appendix A HEALTH CANADA PERCENT HIGHLY ANNOYED CALCULATION EXAMPLE

This section presents detailed sample calculation for the change in %HA at receptor R1 during the operation phase (see Table 15). The %HA is calculated using equation F4 in Appendix F of Health Canada 2017:

$$\%HA = 100 / [1 + e^{(10.4 - 0.132 * L_{dn}}] \qquad [F1]$$

Baseline %HA

At R1, the Baseline L_{dn} value of 48 dBA results in the Baseline %HA of 1.7 %. The calculation is based on the equation F1 as follows:

$$\text{Baseline } \%HA = 100 / [1 + e^{(10.4 - 0.132 * 48 \text{ dBA})}] = 1.7 \%$$

Cumulative L_{dn}

The Cumulative L_{dn} of 53.4 dBA is determined by the logarithmic adding of Baseline L_{dn} of 48 dBA and Project L_{dn} of 51.9 dBA, calculated as follows:

$$\text{Cumulative } L_{dn} = 10 \log[10^{(0.1 \times 48 \text{ dBA})} + 10^{(0.1 \times 51.9 \text{ dBA})}] = 53.4 \text{ dBA}$$

Cumulative %HA

The cumulative (Baseline and Project) %HA of 3.4 % is determined by applying the cumulative L_{dn} of 53.4 dBA in equation F1 as follows:

$$\text{Cumulative } \%HA = 100 / [1 + e^{(10.4 - 0.132 * 53.4 \text{ dBA})}] = 3.4 \%$$

Change in %HA

The change in %HA of 1.7 % at R1 is determined by the different in the cumulative (Baseline and Project) %HA of 3.4 % and Baseline %HA of 1.7 %.