

25 CHANGES TO THE ENVIRONMENT

This section summarizes the changes to the environment, as defined in CEAA 2012, that are linked to, or incidental to, federal decisions that would allow the Project to proceed pertaining to requirements of Section 5 (1)(a and b) CEAA 2012 (see Table 25-1). Conclusions in this section are summarized from the detailed analyses in Sections 6 through 21 and are categorized as follows:

- Changes to components of the environment within federal jurisdiction
- Changes to the environment that would occur on federal or transboundary lands
- Changes to the environment that are directly linked or necessarily incidental to federal decisions.

Table 25-1: Summary of Changes to the Environment

Topic	Changes
Changes to Components of the Environment within Federal Jurisdiction	
Fish and Fish Habitat and Aquatic Species (as defined in section 2 of the <i>Fisheries Act</i>).	<ul style="list-style-type: none"> ▪ Change in fish habitat availability ▪ Change in food and nutrient content ▪ Change in fish behavior ▪ Change in fish mortality risk
Migratory Birds	<ul style="list-style-type: none"> ▪ Change in migratory bird habitat availability ▪ Change in migratory bird mortality ▪ Change in migratory bird movement patterns
Changes to the Environment that Would Occur on Federal or Transboundary Lands	
Atmospheric Environment and Climate	<ul style="list-style-type: none"> ▪ Change in criteria air contaminant concentrations ▪ Change in meeting greenhouse gas (GHG) reduction targets
Vegetation and Wetland Resources	<ul style="list-style-type: none"> ▪ Change in abundance of plant species of management concern ▪ Change in abundance or condition of ecological communities of management concern ▪ Change in wetland functions
Terrestrial Wildlife and Marine Bird Resources	<ul style="list-style-type: none"> ▪ Change in wildlife habitat availability ▪ Change in wildlife mortality ▪ Change in wildlife movement patterns
Human Environment	<ul style="list-style-type: none"> ▪ Change in human and ecological health ▪ Change in socio-economic conditions ▪ Change in physical and cultural heritage ▪ Change in a structure, site or things of historical, archaeological, paleontological or architectural significance
Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions	
<i>Fisheries Act</i> section 35(2) authorization	<ul style="list-style-type: none"> ▪ Serious harm to fish and aquatic species
<i>Canadian Environmental Protection Act</i> section 124 permit	<ul style="list-style-type: none"> ▪ Disposal of dredged material at Brown Passage
<i>Navigable Waters Protection Act</i> section 5 approval	<ul style="list-style-type: none"> ▪ Environmental changes that restrict navigation
<i>Canada Marine Act</i> section 8 land	<ul style="list-style-type: none"> ▪ Environmental changes that impact federal lands

Topic	Changes
lease under Letters Patent	<ul style="list-style-type: none"> ▪ Environmental changes that restrict navigation
<i>Canadian Aviation Regulations</i> section 601 (lighting and marking)	<ul style="list-style-type: none"> ▪ Environmental changes that impact ambient lighting (lighting of flare towers) ▪ Environmental effects of lighting on migratory birds

25.1 Changes to Components of the Environment within Federal Jurisdiction

Changes in fish and fish habitat and aquatic species and migratory birds are summarized in Section 25.1.1 and Section 25.1.2 respectively. Greater detail is provided in Sections 11 (Terrestrial Wildlife and Marine Birds), 12 (Freshwater Aquatic Resources) and 13 (Marine Resources).

25.1.1 Fish and Fish Habitat and Aquatic Species

Marine waters surrounding Lelu Island provide diverse habitats supporting numerous species. These species contribute to the ecological, cultural and economic well-being of the region. Potential effects on fish and fish habitat and aquatic species are:

- Change in fish habitat availability
- Change in food and nutrient content
- Change in fish behaviour
- Change in fish mortality risk.

25.1.1.1 Regulatory and Policy Setting

The federal regulatory and policy setting that is pertinent to fish and fish habitat and aquatic species are:

- *Fisheries Act*
- *Species at Risk Act (SARA)*
- *Canadian Environmental Protection Act (CEPA)*
- Disposal at Sea Regulations
- Policy for the Management of Fish Habitat (and updates)
- Habitat Conservation and Protection Guidelines
- Fisheries Protection Policy Statement, 2013
- Canadian Council of Ministers of the Environment (CCME) Guidelines.

Fisheries and Oceans Canada (DFO) manages fisheries resources in Canada through the *Fisheries Act* and its supporting regulations and the policies and programs addressing national interests in marine and fresh waters. The *Fisheries Act* manages threats to the sustainability and ongoing productivity of Canada's commercial, recreational, and Aboriginal fisheries. DFO is also responsible for ensuring that any aquatic species or marine plants listed on Schedule 1 of SARA, and their critical habitat, are protected from harm.

Environment Canada (EC) administers CEPA, which regulates disposal of dredged material at sea, and references the CCME sediment and water quality guidelines to protect marine life.

25.1.1.2 Change in Fish Habitat Availability

Two watercourses on Lelu Island were identified as fish streams and represent a loss of 739.2 m² of marginal freshwater habitat values; the remainder are not considered fish streams because of channel width, lack of well-defined banks, lack of signs of flow, and lack of a permanent channel connection to near shore waters.

Dredging, blasting and excavation of intertidal and subtidal environments within the materials offloading facility (MOF) and marine terminal berth area, installation of piles in the MOF, trestle and pioneer dock, installation of water and sewage pipes along the seabed between Lelu Island and the mainland, and, disposal of dredged sediment or blasted rock at sea have the potential to change fish habitat availability in the marine environment. The Conceptual Fish Habitat Offsetting Strategy (see Appendix K) will mitigate potential loss of productive capacity, with the result of no net change in fish habitat availability.

25.1.1.3 Change in Food and Nutrient Content

The infilling of two streams on Lelu Island will remove the input of food and nutrients from these freshwater streams into the surrounding intertidal waters of Lelu Island, resulting in a loss of productive capacity. However, the contribution of these freshwater streams to the food and nutrient content in Chatham Sound is negligible compared to the much larger contribution from the Skeena and Nass rivers.

25.1.1.4 Change in Fish Behaviour

Blasting, dredging, pile driving, disposal at sea, construction vessel activity, tugboats and LNG carriers berthing and travelling through the local assessment area (LAA) and along Chatham Sound are all activities that generate underwater noise that could affect the behaviour of fish and marine mammals by causing them to avoid the area, depending on the noise levels. These noise effects on fish behaviour are expected to be intermittent or short term in duration.

25.1.1.5 Change in Fish Mortality Risk

Infilling, dredging, disposal of sediment, excavating, pile driving, pipe installation or blasting may increase the risk of fish mortality due to crushing or burial.

Blasting or pile driving produce pressure and sound waves that can cause physical injury in fish and communication interference in marine mammals. The effects of pressure and sound waves will be mitigated by using vibratory hammers or bubble curtains. Adherence to DFO's Operational Statement for Mitigation of Seismic Sound in the Marine Environment and blasting guidelines is expected to limit effects of pressure and sound waves.

Increased total suspended solids (from dredging, pile driving, sediment disposal, and operations at the marine terminal) can reduce light penetration needed for plant growth, and it can affect fish gills and sensitive tissues of fish and marine mammals. Sediment dispersal could introduce contaminants such as dioxins and furans, which can create toxicological effects on biota. Mitigation will include

using silt curtains, sediment fences for foreshore activities, limiting the material to be disposed at sea, and use of scour protection. These measures are expected to result in moderate magnitude adverse residual effects on fish.

Vessel strikes can also cause physical injury or mortality of marine mammals. Such occurrences are rare and, with reduced vessel speeds, are not expected to result in serious harm to marine mammals.

25.1.2 Migratory Birds

Two migratory birds of management concern, marbled murrelet and olive-sided flycatcher, are used to develop habitat suitability models and determine potential effects of the Project on migratory birds. In addition to each species being of management concern, they occupy different niches within habitats on or near Lelu Island. As a result, they have distinct roles in ecosystem function. Potential effects on migratory birds are:

- Change in migratory bird habitat availability
- Change in migratory bird mortality
- Alteration of migratory bird movement patterns.

25.1.2.1 Regulatory and Policy Setting

The federal regulatory and policy setting potentially pertinent to management of migratory birds on federal lands includes the *Migratory Birds Convention Act* (MBCA), the *Species at Risk Act* (SARA), and the Federal Policy on Wetland Conservation.

EC manages migratory bird populations by regulating and restricting the harvest of individuals and the disturbance of habitat in Canada through the MBCA and its supporting regulations (the Migratory Birds Regulations, Migratory Birds Sanctuary Regulations and the Migratory Game Bird Hunting Regulations). EC is also responsible for ensuring that any migratory birds listed on Schedule 1 of SARA, and their critical habitat, are protected from harm. In addition, EC protects wetlands against loss or degradation by applying the Federal Policy on Wetland Conservation to achieve no net loss of wetland function on federal lands and waters.

25.1.2.2 Change in Migratory Bird Habitat Availability

At full build-out, vegetation clearing or construction of the Project will remove 261 ha of habitat, including 164 ha of terrestrial habitat (old growth coniferous forests and treed swamps) and 97 ha of ocean and estuarine tidal habitat. This represents a loss of approximately 50% of breeding and reproductive habitat of migratory birds on Lelu Island. However, this is less than 3% of their preferred breeding habitat in the LAA.

Due to average noise levels of 65 dBA at the project site during construction, boundary habitat suitability is reduced and migratory birds generally move 2 km to avoid noise levels greater than 30 dBA. The frequency, intensity, and duration of acoustic emissions (in-air and underwater) might influence marine migratory bird foraging patterns, predator avoidance, communication, or displacement from suitable habitats. In addition, marine migratory birds will be exposed to physical

and sensory disturbance along the shipping corridor within the regional assessment area (RAA) due to increased marine traffic.

The Wetland Habitat Compensation Strategy (see Appendix F) will provide compensation for wetland habitats removed during clearing for terrestrial components of the Project. Mitigation measures to reduce noise emissions will reduce effects on migrating birds.

25.1.2.3 Change in Migratory Bird Mortality

Vegetation clearing during construction may destroy active nests, causing direct mortality of young or eggs. Noise and construction activities may create edge habitat that disturbs nesting adults and causes them to abandon their nests, resulting in mortality of young or eggs. Artificial lighting may disorient or attract migratory birds, causing collisions with project infrastructure or water-based traffic.

If clearing is required during the breeding season, bird surveys will be conducted in advance of vegetation clearing to ensure compliance with the SARA, MBCA and the Migratory Birds Regulations. Buffers will be established around active nests and clearly marked to show the extent of clearing. To reduce artificial lighting effects on migratory birds, a lighting management plan will be developed, as practical and permissible under federal safety and navigation requirements. The plan will describe reduced exterior lighting (including portable lighting structures) at the LNG facility, the MOF, marine terminal, trestle, berth, and on berthed vessels. Implementation of these mitigation strategies are expected to result in minimal magnitude residual effects on migratory bird mortality.

25.1.2.4 Alteration of Migratory Bird Movement Patterns

Migratory birds, particularly marine species, are highly susceptible to altering their movement patterns due to the location and design of project infrastructure and the timing of construction and operation activities. Project infrastructure and increased vessel traffic create barriers that displace or interfere with movement to natural foraging or breeding areas.

Artificial lighting may cause migratory birds to adjust their flight paths when attracted to lit infrastructure, particularly in foggy or rainy conditions, thereby depleting their energy reserves as they avoid, circle or land to prevent collision. In-air and underwater acoustic emissions can reduce migratory bird use of the LAA through avoidance.

Timing of blasting will avoid sensitive periods for migratory birds. To minimize artificial lighting effects on migratory birds, a lighting management plan will be developed, as practical and permissible under federal safety and navigation requirements. The plan will describe reduced exterior lighting (including portable lighting structures). Mitigation measures to reduce noise emissions will reduce effects on migratory birds and vessels will adhere to speeds to lower noise emissions. These measures are expected to result in minimal magnitude residual effects on migratory bird movement patterns.

25.2 Changes to the Environment that would Occur on Federal or Transboundary Lands

The Project is located entirely on federal lands operated by the Prince Rupert Port Authority (PRPA), except for road access to the bridge and the mainland bridge abutment. Thus, no lands outside BC or outside of Canada will be affected by the Project.

Project activities on federal lands could change all components of the environment. Changes on fish, aquatic resources and migratory birds are already discussed in Section 25.1. The remainder are covered in this section, including air quality (Section 6), GHG management (Section 7), vegetation and wetlands (Section 10), terrestrial wildlife and marine birds (Section 11; changes to migratory birds are discussed in Section 25.1.2). Noise (Section 8) and ambient light (Section 9) are included, as relevant, in the discussion of changes to terrestrial wildlife and marine bird resources and the human environment. Details on changes to the human environment are provided in Sections 14 to 20, including human and ecological health, socio-economic conditions, physical and cultural heritage, and any structure, site or thing of historical, archaeological, paleontological or architectural significance.

25.2.1 Atmospheric Environment and Climate

Potential effects on air quality and climate are:

- Change in criteria air contaminant concentrations
- Change in meeting greenhouse gas (GHG) reduction targets.

25.2.1.1 Regulatory and Policy Setting

The federal regulatory and policy setting potentially pertinent with respect to air quality and climate includes the CEPA, Canadian Ambient Air Quality Standards (which will come into effect in 2015) and the National Inventory System (for GHG emissions).

EC administers CEPA, which currently regulates air emissions from a number of sources, including vehicles. EC also requires that facilities emitting more than 50,000 tonnes of CO₂ equivalent (tCO₂e) report their annual emissions as part of the National Inventory System. The National Inventory System encompasses Canada's procedural, legal and institutional arrangements so that its reporting obligations are met under the United Nations Framework Convention on Climate Change.

Health Canada has an oversight role over public health risk factors in Canada and provides guidance on applying the air quality CCME Canada-Wide Standards for protecting human health and ecological receptors (with respect to country foods). The CCME guidelines will be superseded by the Canadian Ambient Air Quality Standards in 2015.

25.2.1.2 Change in Criteria Air Contaminant Concentrations

Criteria air contaminants (CAC) include nitrogen oxides, carbon monoxide, particulate matter (classified by size of particles), hydrogen sulphide, and volatile organic compounds (readily evaporate into the air). CAC emissions during construction and decommissioning activities are expected to be minimal, resulting mainly from mobile engines and diesel generators. By comparison, CAC emissions during operation of the LNG facility, use of the marine terminal and marine transport of LNG are expected to be greater than construction phase air emissions. However, maximum CAC emissions are modelled to be well below the most stringent air quality objectives (see section above), even for sensitive receptors (e.g., schools, First Nations' communities and traditional use sites, and residences) or sensitive ecosystem areas. The potential for acidification due to nitrogen and sulfur releases and eutrophication due to nitrogen release is also low.

The effect of CACs will be reduced by using dust suppressants and low sulfur fuel, smokeless flare technology, thermal oxidizers, and best available technologies. Since the CAC concentrations are

well below air quality guidelines and the extent of CAC effects is near project infrastructure, the residual effects of a change in CACs are anticipated to be not significant.

25.2.1.3 Change in Meeting Greenhouse Gas Reduction Targets

Greenhouse gas (GHG) is any atmospheric gas that absorbs and re-emits infrared radiation. GHG emissions for the Project, and other projects with similar emissions profiles will challenge BC's emission commitments. PNW LNG will work closely with regulators, and reduce GHG emissions by selecting innovative technology and implementing a GHG management plan.

The relevant GHGs for the Project include carbon dioxide, methane and nitrous oxide. Sources of GHG during construction include removal of vegetation and exhaust from diesel engines. Over 30 years of operation, the Project will release 5.2 million tCO₂e per year, which requires reporting to EC under the National Inventory System. It is estimated that the Project will increase the national GHG emission total by 0.75%.

The impact of GHG releases from the Project will be reduced, to the extent reasonably possible, through implementing a GHG emissions management plan. This plan consists largely of management of infrastructure to take advantage of emerging LNG technologies, energy efficient power generation, low emission engine fuel, and general management strategies.

25.2.2 Vegetation and Wetland Resources

This section summarizes those changes that are anticipated to be caused by the Project on vegetation and wetland resources (Section 10). It briefly examines the federal regulatory and policy setting and changes to the environment that may affect vegetation and wetland resources. Vegetation and wetland resources are included in this assessment as a VC because of their ecological, aesthetic, and recreational value, as well as their importance to First Nations communities with rights and interests in the project assessment areas, regulators and the public. Potential effects on vegetation and wetlands are:

- Change in abundance of plant species of management concern
- Change in abundance or condition of ecological communities of management concern
- Change in wetland functions.

25.2.2.1 Regulatory and Policy Setting

The federal regulatory and policy setting potentially pertinent with respect to vegetation and wetlands resources include the SARA and the Federal Policy on Wetland Conservation.

EC has an oversight role over SARA and is responsible for ensuring that any species listed on Schedule 1 of SARA, are protected from harm. In addition, EC protects wetlands against loss or degradation by applying the Federal Policy on Wetland Conservation to achieve no net loss of wetland function on federal lands and waters in Canada.

25.2.2.2 Change in Abundance of Plant Species of Management Concern

Plant species of management concern include federally-listed species at risk, plant species used by First Nations communities for traditional purposes, and non-native invasive plant species. There

were no SARA-listed vascular plants, mosses, or lichens found within the LAA. Plant species found within the LAA that are used by First Nations communities for traditional purposes include six tree species, ten shrub species, three herbs and one fern. No weeds on the noxious weeds list or the Northwest Invasive Plant Council's list of target invasive plant species were found within the LAA.

A total of 160 ha of terrestrial and wetland vegetation will be lost due to clearing, dredging, excavating and blasting to construct the LNG infrastructure. The abundance of plant species of management concern may change directly due to clearing and site preparation of 160 ha in the project development area (PDA), or indirectly through introduction of invasive non-native plant species, or altered abiotic conditions (e.g., soil moisture or light levels). Air emissions may also result in indirect and ongoing effects on vegetation and wetlands resources during the operations phase.

Standard mitigation practices will be implemented during construction to prevent introduction and spread of noxious weeds and invasive plants. During construction, a species at risk discovery contingency plan will be developed and followed to address any chance-discoveries of plant species that are at risk. Given the abundance of plant species of management concern elsewhere in the RAA and implementation of these mitigation measures, minimal magnitude residual effects are expected on plant species of management concern.

25.2.2.3 Change in Abundance or Condition of Ecological Communities of Management Concern

Although ecological communities of management concern are largely a provincial matter, their abundance or condition has the potential to affect federally regulated species at risk. Ecological communities of management concern include provincial red- and blue-listed communities and old forest. Ecological communities at risk comprise approximately 9.7 ha of the LAA, of which 2.7 ha of a blue-listed community will be lost due to clearing of the PDA; however, the design of the PDA fully avoids direct effects on the red-listed community. Old forest currently occurs within 122 ha of the LAA; 82 ha will be lost due to construction, which is 0.3% (27,333 ha) of the old forest in the RAA. The condition of ecological communities of management concern may change if invasive non-native plant species are introduced or if abiotic conditions are altered (e.g., through air emissions, soil moisture changes, or increased light levels).

Drainage and erosion controls will be implemented to maintain local surface and groundwater hydrology and protect ecological communities of management concern located adjacent to the PDA. These areas will be clearly marked to restrict access and prevent use of herbicides. Given the limited effect on ecological communities of management concern and their relative abundance in the RAA, these measures are expected to result in minimal magnitude residual effects on abundance of ecological communities of management concern.

25.2.2.4 Change in Wetland Functions

Wetland functions (hydrological, habitat or biogeochemical) will be lost as a result of clearing, filling, or draining of 119 ha of wetland area within the PDA, which is 0.7% of the wetlands in the RAA. The goal of the *Federal Policy on Wetland Conservation* is no net loss of wetland functions on all federal lands and waters; it applies to the Project because the PDA is located on federal crown land managed by the PRPA. The Wetland Habitat Compensation Plan (Appendix F) will provide compensation for wetland habitats removed as a result of terrestrial components of the Project. With the implementation of the wetland compensation plan, no net loss of wetland function will occur.

25.2.3 Terrestrial Wildlife and Marine Bird Resources

Potential effects on terrestrial wildlife and marine bird resources are:

- Change in wildlife habitat availability
- Change in wildlife mortality
- Alteration of wildlife movement patterns.

25.2.3.1 Regulatory and Policy Setting

The federal regulatory and policy setting potentially pertinent with respect to terrestrial wildlife and marine bird resources includes SARA and the Federal Policy on Wetland Conservation.

EC has an oversight role over SARA and is responsible for ensuring that any species listed on Schedule 1 of SARA are protected from harm. In addition, EC protects wetlands against loss or degradation by applying the Federal Policy on Wetland Conservation to achieve no net loss of wetland function on federal lands and waters in Canada.

25.2.3.2 Change in Wildlife Habitat Availability

Construction will result in loss of 261 ha of seasonal and year-round breeding, foraging, or shelter habitat for terrestrial wildlife and marine birds. Reclamation of habitat upon decommissioning in the PDA will be completed, as appropriate, within future land use planning initiatives by the PRPA. Physical and noise disturbance from equipment used for vegetation clearing, facility construction and installation, commissioning, and during project operations may make adjacent terrestrial and marine habitats less suitable for terrestrial wildlife and marine birds.

Although most of Lelu Island will be made industrial, access to breeding, foraging and shelter habitat will be protected, where possible. Vessel speed will be limited and project noise will be reduced to limit flushing and startling wildlife. The magnitude of residual effects on wildlife habitat availability is expected to be minimal.

25.2.3.3 Change in Wildlife Mortality

Potential direct mortality of small mammals and amphibians is greatest during vegetation clearing when they may be unable to find refuge from noise and equipment. Large mammals and marine birds may be displaced from suitable foraging habitat, causing indirect mortality.

Vegetation clearing during the breeding seasons can destroy bird and amphibian eggs, and the offspring of mammals, birds, and amphibians. Noise produced by construction activities in adjacent habitats can cause adult birds to temporarily abandon their nests, potentially increasing mortality to eggs and hatchlings from exposure to cold or predators during the adults' absence.

Increased mortality to marine birds may result from collisions with the marine terminal and trestle if night-time lighting attracts and/or disorients them. The effect of artificial lighting causing collisions can be exacerbated when a large number of birds are migrating along the coast, or when overcast, foggy or rainy conditions intensify the dispersal of light.

Sensitive areas will be marked off during construction. Mitigation to reduce increased ambient light will reduce artificial lighting impacts on birds. Mitigation measures to reduce noise emissions will

reduce effects on wildlife. Vessels will adhere to reduced speeds to lower collisions. These measures are expected to result in low magnitude residual effects on wildlife mortality.

25.2.3.4 Alteration of Wildlife Movement Patterns

Terrestrial wildlife and marine bird movements may be altered if the Project acts as a physical barrier to previously used movement corridors. This could result from construction and operation of the LNG facility, the marine terminal and trestle, and the arrival and departure of shipping vessels. Individuals may establish new routes around the PDA to access important breeding or foraging habitats. Noise disturbance associated with construction and operational activities can also induce avoidance behaviour from various wildlife species. Species may expend additional energy to adjust normal or typical movement patterns, or spend less time in preferred habitats, to avoid noisy areas.

Wildlife are expected to habituate to noise and disturbance over time since Lelu Island is close to other industrial development. Most construction activities will be scheduled between the daytime hours of 7 a.m. to 10 p.m. Nighttime construction activity will be limited to low noise activities (no impact type pile driving or blasting activities). These mitigation measures are expected to result in minimal magnitude residual effects on wildlife movement patterns.

25.2.4 Human Environment

Although direct effects of the Project on the human environment are largely a provincial matter, the changes that may occur to the human environment are the result of changes to the environment on federal lands. Potential effects on the human environment are:

- Change in human and ecological health
- Change in socio-economic conditions
- Change in physical and cultural heritage
- Change in a structure, site or thing of historical, archaeological, paleontological or architectural significance.

25.2.4.1 Regulatory and Policy Setting

Health Canada has an oversight role over public health risk factors in Canada. Specifically, effects on human health are covered by the *Hazardous Products Act* (related to Workplace Hazardous Materials Information Systems), CEPA (where applicable) and the CCME Canada-Wide Standards (guidelines for air, water, soil, sediment and tissue). Health Canada provides guidance on applying the CCME guidelines and recommendations on noise levels.

Parks Canada is designated the federal custodian of national parks, many national historic sites and the national marine conservation areas of Canada through the *Canada National Parks Act*. Parks Canada also manages the *Heritage Railway Stations Protection Act*, the Archaeological Heritage Policy Framework and the National Historic Sites of Canada System Plan to protect federal heritage and archaeological sites.

PRPA prepared the Port of Prince Rupert 2020 Land Use Management Plan to guide its development of federally owned lands.

25.2.4.2 Change in Human and Ecological Health

A change in human and ecological health could arise from changes in air quality, noise levels and ambient light. Release of CACs or vehicle dust during construction could affect the risk to human and ecological health. However, there are no exceedances of any standards for the assessed CACs for all modelled time frames, project phases and all human and ecological receptor locations, suggesting that the human and ecological health risk from the inhalation of CACs and dust is minimal.

Noise levels during construction are expected to meet Health Canada's suggested thresholds for humans. There is potential, however, for avoidance behaviour in terrestrial wildlife and marine birds adjacent to the site, as a result of construction noise levels. While marine mammals are more likely to be affected by underwater noise, pinnipeds are known to be sensitive to ambient air noise. The magnitude of the acoustics effects will range from negligible (imperceptible) to moderate (above baseline sound level but in compliance with all regulatory criteria). With the implementation of the noise mitigation measures, the magnitude of the residual environmental effect of a change in the acoustic environment will be minimal.

Marine shipping, security and other required lighting will induce a change in ambient light. The storage tanks and flares will be visible to human receptors located in Port Edward and directly across from and to the north of Lelu Island, while the marine terminal and associated exterior lighting and the ships will likely not be visible from Port Edward (see Section 17). Surrounding areas will remain characteristic of a rural/sub-rural and natural/rural environment. Existing lighting in Port Edward will continue to be the greatest source of light pollution in the area. Local topography, vegetation and project design will help reduce the amount of light that reaches surrounding areas, resulting in low magnitude residual effects.

25.2.4.3 Change in Socio-Economic Conditions

A change in socio-economic conditions could arise from changes in a number of project-related factors, including:

- Change in regional employment
- Change in earnings and income
- Change in education and training
- Change in regional economic diversification
- Change in municipal government finance
- Change in community health and well-being
- Change in infrastructure and services
- Change in visual quality (as related to tourist revenues).

Regional employment will increase due to both direct and indirect (supporting businesses) jobs created within the RAA for the duration of the Project. Because jobs on the Project require greater skills than those presently available in the RAA, earnings and income, as well as education levels will improve. This could occur through both in-migration and education of local workers.

The regional economy will diversify in response to project construction and operation. Construction would result in approximately 8,000 direct person-years of employment, and would generate 18,890 person-years of indirect employment and 11,045 person-years of induced employment. Operations would directly employ 464 people (334 within the region), as well as 135 contractor positions. Operations would also generate 200 indirect jobs and 525 induced jobs. However, upon decommissioning the regional economy may become less diversified. Because of the Project, tax revenues will increase for municipal government finance by approximately \$15 million per year. There will be greater pressure on infrastructure and services (traffic and transportation, housing availability and affordability, and capacity of community services) and potential effects on community health and well-being due to disparities in wealth.

Changes in visual quality (Section 17) due to the LNG facility and introduction of lighting may reduce First Nations', visitors' and recreationalists' enjoyment of the area, potentially lowering revenues generated by the tourism industry. Lelu Island is designated an industrial site in the Port of Prince Rupert 2020 Land Use Management Plan; it is evident from the Port Edward 2013 Official Community Plan that the community is generally supportive of LNG development on Lelu Island. The Project will maintain the aesthetic quality of viewsapes to the extent possible for local and First Nation communities as well as for areas used by recreationalists, tourists and travellers, which will help to result in low magnitude residual effects.

25.2.4.4 Change in Physical and Cultural Heritage, and Structure, Site or Thing of Historical, Archaeological, Paleontological or Architectural Significance

There are several national historic sites in the north coastal region that are protected by Parks Canada:

- Metlakatla Pass at the northern entrance to Prince Rupert Harbour
- the Canadian National Railway Station in the town of Prince Rupert
- *Gwaii Haanas National Park Reserve and Haida Heritage Site on Lyell Island (Haida Gwaii)*
- Triple Island Light Tower at the entrance of Brown Passage, marking marine vessel passage into Chatham Sound.

Parks Canada has identified the waters around Gwaii Haanas National Park Reserve and Haida Heritage Site as a potential national marine conservation area reserve. None of these sites will be affected directly or indirectly by the Project.

A change in physical and cultural heritage or structure, site or thing could arise from project-related changes in natural landforms and visual quality (e.g., culturally important viewsapes) (see Section 17 and 20). Project-related construction will heavily alter natural landforms and natural features on Lelu Island that may be culturally important; in addition, shipping activity may affect visual quality. However, at the time of writing, no specific information indicating the presence of natural features or landforms on Lelu Island with cultural importance had been provided to PNW LNG. Because Lelu Island is included in the PRPA's industrial lands expansion plans, these potential changes were already considered when the Port of Prince Rupert 2020 Land Use Management Plan was developed.

Project-related construction will potentially affect heritage values, specifically in regards to culturally modified trees. Systematic Data Recovery (SDR) studies will be conducted on any culturally modified trees on Lelu Island that will be affected by the Project. This would entail systematically recording a representative sample of the culturally modified trees, including detailed recording, stem round collection, direct dating, cataloguing, and monitoring of removal by archaeologists and First Nation representatives. These trees will then be offered to First Nations for their removal and use, as they see fit.

25.3 Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions

Following a positive decision on the Project by the Minister of Environment, and before the Project can proceed, federal decisions are required under the *Fisheries Act*, the CEPA, the *Navigable Waters Protection Act* and the *Canada Marine Act*.

25.3.1 Fisheries Act

Potential for serious harm to fish and aquatic species is anticipated due to the infilling of two fish steams on Lelu Island (although these streams have marginal habitat quality), and due to dredging, blasting, excavating, pile driving and pipe laying in the marine intertidal and subtidal areas adjacent to Lelu Island. Prior to issuing section 35(2) authorizations under the *Fisheries Act* for these changes to the environment, DFO will require PNW LNG to prepare a Fish Habitat Offsetting Strategy (see Appendix K).

25.3.2 Canadian Environmental Protection Act

Disposal of dredged material, geological matter and uncontaminated organic matter at the Brown Passage marine disposal site will result in elevated total suspended solids above CCME standards for water quality, but for less than 24 hours, each time sediment is disposed at the site. The total suspended solids will decrease to less than 1 mg/L above background within a few days after disposal. While levels of dioxins and furans exceed CCME standards, settling and dispersal of sediment over an area of 1.85 km² on sediments of similar chemical composition would not increase the risk to fish, mammals or the marine environment. Prior to issuing a permit under the CEPA for these changes to the environment, EC will require evidence that materials to be disposed will not contaminate the marine environment and that disposal at sea is the environmentally preferable and practical option.

25.3.3 Navigable Waters Protection Act

Construction of the marine offloading facility, the pioneer dock, the bridge from Lelu Island to the mainland, and the marine terminal (including a trestle and berth structures) may induce changes to the environment that alter marine navigation due to additional restrictions on movements of vessels. Removal of 7.7 million m³ of marine sediment will provide sufficient depth for berthing and keel clearance in the embayment area. However, dredging and disposal of marine sediment will interfere with recreational boating and recreational, commercial, and Aboriginal fishing by introducing additional marine traffic and support vessels (e.g., cranes, tug boats, drill rig, vibro-hammer excavator and dredger) in Porpoise Channel and by providing berthing for commercial LNG vessels, which will

prohibit access between Lelu Island and Flora Banks. Visual quality will be affected by introducing lighting at the terminal, which may interfere with nighttime navigational aids.

Prior to issuing an approval under the *Navigable Waters Protection Act*, Transport Canada will require detailed information on any works constructed or placed in, on, over, under, through, or across navigable waters that may constitute a substantial interference with navigation and information on navigation aids and lighting that comply with federal safety and navigation requirements.

25.3.4 Canada Marine Act

The PRPA, as do most large commercial ports in Canada, operates under the provisions of the *Canada Marine Act* (CMA), S.C. 1998, c.10 and related CMA regulations, and through Letters Patent issued by the federal Minister of Transport under the CMA. This regulatory framework gives the PRPA the authority to operate the Port in Prince Rupert Harbour.

In order for the Project to proceed, a lease pursuant to PRPA's Letters Patent under the CMA will be required to occupy federal lands managed by the PRPA. Under the Port of Prince Rupert 2020 Land Use Management Plan, long-term opportunities suggested for Lelu Island include bulk commodity terminals and general industrial uses. PNW LNG will also need to obtain a permit for water discharge to the marine environment from PRPA under the *Port Authorities Operations Regulations* in cooperation with the BC MOE.

PNW LNG and marine contractors will also be required to manage potential navigation conflicts by filing Notice to Shipping and Notices to Mariners to advise other vessels of potential obstacles during construction and operation.

25.4 Summary of Changes to the Environment

The Project is located on federal land on a greenfield site, which is identified for industrial development in the Port of Prince Rupert 2020 Land Use Management Plan. Changes to the environment under federal jurisdiction, on federal lands and requiring federal decisions due to direct and indirect effects of the Project are expected to result in low magnitude residual effects. Over the long-term, improved educational attainment and employment experience created by the Project, in combination with implementation of a project closure strategy, will bring additional sustainable benefits to the local population. For a detailed review of the expected changes and mitigation, see Sections 6 through 21.