

## 5 EXISTING ENVIRONMENT

The proposed Project will be primarily located on and around Lelu Island, which is on federal lands and waters under the jurisdiction of the Prince Rupert Port Authority (PRPA) and within the municipal boundaries of the District of Port Edward. Lelu Island is a small island (219 hectares) approximately 2.5 km southwest of the business centre of Port Edward and 12 km south of the business centre for the City of Prince Rupert (Figure 1-2). It has been identified as having long-term potential for a bulk terminal, shipyard and other marine activity in the Prince Rupert Port Authority's (PRPA) 2020 Land Use Management Plan (PRPA 2010). The District of Port Edward's 2013 official community plan reports that the island currently is only accessible by water and has the potential to connect to Port Edward by bridge crossing for road access off of Skeena Drive (DOPE 2013).

### 5.1 Atmospheric Environment and Climate

#### 5.1.1 Climate

The Prince Rupert area is within a thin coastal strip west of the windward slopes of the Coast Mountains. Weather conditions in the area are recorded at the Environment Canada weather station at the Prince Rupert Airport, 7 km west of Prince Rupert; and the Holland Rock weather station, 5 km northwest of Lelu Island.

Generally, westerly winds carry moist, warm Pacific air streams up and over the Coast Mountains, depositing large amounts of precipitation (mainly as rain) over the Prince Rupert region. Since the cold continental Arctic air streams are largely confined east of the Coast Mountains, the west coast of BC experiences more moderate winter climate relative to the rest of BC and Canada. Conversely, the summer climate is warm, but due to the proximity to the Pacific Ocean remains cool relative to inland areas.

Prince Rupert is Canada's wettest city, with an average of 2,963 mm of rainfall and 96.8 mm of snowfall per year (3,060 mm total annual precipitation). The high frequency of Pacific storms tracking over the Prince Rupert area during winter produce high precipitation amounts. During summer the majority of the Pacific storms track further north resulting in lower amounts of precipitation. October is the wettest month, with 27 days experiencing precipitation greater than 0.2 mm per day. Typically, the months of June to August are the driest with an average of 17 rainy days per month. The north coast experiences an average of 189 hours of fog per year, where the visibility is less than 0.8 km.

In the summer, Prince Rupert experiences average temperatures of 11.8°C to 12.7°C. In the winter, average temperatures range between 2.2°C to 3.3°C. December is the coldest month, with an average daily temperature of 1.0°C, while August is the warmest month, with an average daily temperature of 13.5°C.

The prevailing surface winds are strongly influenced by regional topography. Prince Rupert airport winds are predominantly southeasterly, averaging 3.5 m/s. Lelu Island is more exposed to wind conditions over the open waters of Hecate Strait. Data collected 5 km southwest of Lelu Island by the Holland Rock meteorological station shows prevailing winds are similar to Prince Rupert but stronger, averaging 5.8 m/s. Calm winds occur about 1.1% of the time on Holland Rock, as opposed to 5.3% at the Prince Rupert airport.

### 5.1.2 Tidal Fluctuations and Storm Surges

The Prince Rupert region experiences large tides which are sufficient to create rapid and reversing falls in the channel constrictions (Akenhead 1991). A permanent tide gauge was deployed in Prince Rupert in 1909. Data extracted for the 1990 to 2012 period showed hourly sea levels range between -0.25 m and 7.87 m, with an hourly average sea level of 3.9 m (DFO 2013a).

Storm surges are tide-like fluctuations in sea levels initiated by strong onshore or offshore coastal winds during a severe storm. The resulting effects are small at steep coasts but significant in low-lying regions and may cause flooding, especially during high astronomical tides (Thomson 1981). Prince Rupert is sheltered from storm surges by Digby Island. For this reason, storm surge events are infrequent for Prince Rupert (DFO 2013b). To the south east, Lelu Island is protected from strong storm surges by Stephens, Prescott and Kinahan islands.

Projected increase in global temperatures is expected to contribute to a rise in sea levels (IPCC 2007; Wigley and Raper 1992; Forbes *et al.* 1997), storm events, and other changes relevant to coastal stability such as surface winds, ocean wave heights, storm surges, and ice conditions (Forbes *et al.* 1997). By 2100, the Prince Rupert mean sea level rise is estimated at 0.25 to 0.46 m, with the estimate extremes ranging from 0.10 m to 1.16 m (Bornhold 2008).

### 5.1.3 Air Quality

Existing air quality in the Prince Rupert area is generally very good (Stantec 2009, 2011). This is due both to the lack of large emission sources and the regional exposure to persistent onshore winds. Lelu Island itself is somewhat distant from regional sources of domestic and industrial air contaminants. The primary sources of air emissions in the Port Edward and Prince Rupert area include domestic space heating and transportation emissions (homes, businesses, motor vehicles, aircraft), local marine vessel emissions (container ship, fishing, ferry and cruise ship traffic), and several marine bulk terminals on Ridley Island (plus their associated bulk cargo vessel emissions).

Of the substances generally considered when assessing air quality (i.e., SO<sub>2</sub>, H<sub>2</sub>S, PM<sub>10</sub>), only H<sub>2</sub>S concentrations historically exceeded the applicable regulatory criteria (e.g., BC Ambient Air Quality Objectives, Canadian Ambient Air Quality Objectives, and the Canada-wide Standards) (Stantec 2009, 2011). The historic H<sub>2</sub>S exceedances and elevated concentrations of SO<sub>2</sub> locally were largely attributed to the Skeena Cellulose bleached Kraft pulp mill, which is now decommissioned. Elevated levels of PM<sub>10</sub> were observed historically at the Galloway Rapids station. These results are likely because that station is located adjacent to the Yellowhead Highway (16), a heavily travelled thoroughfare.

Ambient concentrations for PM<sub>2.5</sub>, CO, NO<sub>2</sub> and VOCs are not available from nearby monitoring stations. However, the lack of emitters in the regional coastal setting (Stantec 2009, 2011) suggests that these levels are low.

### **5.1.4 Acoustic Environment**

The existing ambient acoustic environment in the vicinity of Lelu Island is a combination of sounds of the natural environment and human activities. Human activities include industrial facilities on Ridley Island, rail traffic, aircraft flyovers, commercial and industrial businesses in Port Edward, and traffic on local roads in Port Edward. As Lelu Island has no industrial development or residences, the acoustical environment is characterized by the natural sounds such as birds, wind, rain, and waves. Ambient sound monitoring, conducted at eight locations (three on Ridley Island and five in Port Edward) in 2012, recorded sound levels consistent with a quiet rural environment ranging from 32 to 44 dBA during the day and 26 to 40 dBA at night. Existing sound levels on Lelu Island are expected to be similar.

### **5.1.5 Ambient Light**

The existing ambient light environment reflects the relatively low density of housing and industry in Port Edward. The few docking facilities have bright lighting that were likely designed with security in mind, and less concern for excess lighting. At present, there are many locations with minimal nighttime light levels within minutes of these docks and other illuminated features in the town. In Port Edward, impacts on ambient light are glare from lights such as the security lighting at the docks, and the older “cobra” style street lights. Within the town, the ambient light levels are generally low and the sky dark.

## **5.2 Geophysical Environment**

### **5.2.1 Geology**

Lelu Island is situated within the Hecate Lowland of the Hecate Depression in the Coastal Trough physiographic region (Holland 1976). This region is characterized by a rough topography composed primarily of metamorphic rock from the Paleozoic and Mesozoic era. Bedrock in the Port Edward area is predominantly a low-grade metamorphic rock composed of metasediments (schists) and gneisses associated with intruded igneous bodies. The schist is rich in mica, amphibole, graphite and chlorite. Rocky outcrops in the area indicate highly fractured rock with two or three major bedding and joint sets, giving rise to a block structure. Local intense folding of the rock is known to exist and to have structural controls in a north-northeast direction.

Lelu Island and surrounding area is considered to be a flat, low, plain that is on average, less than 30 m elevation and is underlain by a variety of rocks of which granite predominates. Many of these low areas, including Lelu Island, are occupied by large expanses of muskeg where drainage is poorly established.

Offshore sediments consist of normally consolidated silts and clays with lesser amounts of fine sand, with the thickness increasing away from the shoreline. The offshore subsoil comprises mica schist bedrock overlain by a thin and discontinuous dense glacial till and an extensive soft silty clay layer. The silty clay layer is expected to be very weak and compressible with very small shear resistance in the first 8 m. Sediment depth is extremely variable in the area, ranging from approximately 2 m in the nearshore areas around Lelu Island, to depths exceeding 120 m at the southwestern extent of Flora Bank.

Western Canada experiences higher than average seismic activity due to its location near some major plate tectonic boundaries (the Juan de Fuca Plate near Vancouver Island, the North American Plate, upon which most of Canada rests, and the Pacific Plate, near Haida Gwaii). Movements along these boundaries cause ongoing small earthquakes and, occasionally cause earthquakes large enough to cause damage to buildings and infrastructure. Because it is not possible to predict the timing of large earthquakes, it is important that project proponents along the west coast of Canada be prepared for such events.

Between 1921 and 2012, 80 earthquakes with magnitude greater or equal to 5.0 on the Richter scale were reported within 300 km of Lelu Island. Of these, 60 were magnitude 5.0 to 5.9, and 17 were magnitude 6.0 to 6.9, and 2 were magnitude 7.0 to 7.9. The more recent of these was a magnitude 7.7 quake centered off the southwestern coast of Haida Gwaii in 2012, which was felt as far away as Kamloops in south central BC (CBC News 2012). One magnitude 8.1 quake occurred in 1949, off the northwestern coast of Haida Gwaii (Earthquakes Canada 2013). Seismic activity may also result in tsunami risk.

The largest tsunamis tend to be caused by earthquakes with offshore epicentres (Bobrowsky 2001). Even distant earthquakes can generate tsunamis that reach the coast of BC (Clague et al. 2003). The 6.1 magnitude earthquake near Haida Gwaii that occurred in 2001 generated a very small but measurable tsunami on Vancouver Island to the south, with an onshore vertical height above sea level (ASL), or run-up, of 20 cm (Rogers et al. 2002). The 2012 magnitude 7.7 quake also resulting in a small tsunami, with a peak wave height of 56 cm recorded at Kawaihae, Hawaii (NOAA 2014). However, much larger run-ups of up to 20 m ASL have been predicted for some coastal areas of BC (Bobrowsky 2001), with run-ups of about 10 m ASL considered the most common (Dorner and Wong 2003).

## **5.2.2 Bathymetry**

Lelu Island is bordered by deep water in Porpoise Harbour (up to 25 m) to the north and Inverness Passage (up to 15 m) to the south. The water is shallow west of Lelu Island along Flora, Agnew, and Horsey Banks. Flora Bank is a shallow eel-grass bed (less than 1 m deep); depths at Agnew and Horsey Bank are up to 4 and 6 m respectively. West of Agnew Bank approximately 2.7 km west of Lelu Island) there is a drop-off where the water depth increases to more than 35 m deep.

## **5.3 Surficial Geology (Terrain and Soil)**

The proposed Project is located within the Hecate Lowland along the western margin of the Kitimat Ranges of the Coast Mountain Physiographic Region (Holland 1976). Five low-lying coastal islands—Kitson, Lelu, Stapledon, Ridley and Smith Islands—as well as the mountain slopes above Port Edward and Smith Island constitute the terrestrial component. As the study area is located within the Coastal Western Hemlock—very wet hypermaritime biogeoclimatic zone (Banner et al. 2005)—landform and soil processes are strongly driven by the high levels of precipitation occurring in the area. The bedrock on Lelu Island is dominated by highly jointed plutonic rocks, most commonly granodiorite and quartz diorite, which weather to sandy silty saprolitic surficial material. A portion of the study area on Smith Island and upslope of Port Edward is dominated by steep, unstable upper slopes, and lower gently sloping terrain dissected by gullies and draws. Landslides are common on the steep Smith Island slopes, and rockfall and debris flows were observed in the upslope areas of the Port Edward area.

The dominant surficial material on Lelu Island is organic (veneers and blankets of Sphagnum/sedge peat or forest humus) occurring directly over bedrock. Occasionally there is a thin (approximately 10 cm) mantle of weathered/disintegrated rock overlying the bedrock. Metamorphic bedrock, consisting of schists, gneisses, and quartzite of amphibolite grade characterizes the island (Hutchison et al 1979). This is in contrast to much of the CWHvh2, which is characterized by harder, relatively nutrient-poor igneous rocks. There is a general lack of glacial tills observed in the study area, resulting in soils forming on weathered bedrock, glaciomarine deposits, or colluvium. Soils on colluvial deposits are generally acidic and occur in geomorphically-active, unstable upslope areas. Low-lying coastal islands have soil formed from glaciomarine silts and sands with surface drainage ranging from very poor in level and depressional areas, to moderately well-drained in sloped areas. The extremely high rainfall levels have resulted in a landscape dominated by thick organic surface soil layers, either as deep slightly to moderately decomposed organics overlying mineral soils or as well-decomposed organic soils developing on slopes.

## **5.4 Vegetation and Wetlands**

The proposed Project is located within the Pacific Maritime ecozone, which extends along the coast of British Columbia (BC) northward to Alaska. It is entirely within the Coastal Western Hemlock (CWH) Very Wet Hypermaritime (CWHvh2) biogeoclimatic subzone (Pojar et al. 1991). The CWH is characterized by low- to mid-elevation forests dominated by western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), and western redcedar (*Thuja plicata*).

Lelu Island has gentle topography, with moderate slopes around its perimeter rising to a central plateau area of about 40 m elevation. The sloping terrain around the perimeter of Lelu Island is dominated by moderately productive forests including western redcedar and western hemlock; however, most of Lelu Island is characterized by forested and shrubby blanket bogs. The forested and shrubby bogs are dominated by western redcedar, yellow-cedar (*Chamaecyparis nootkatensis*), western hemlock, and shore pine (*Pinus contorta* ssp. *contorta*).

## **5.5 Terrestrial Wildlife and Marine Birds**

Existing information for the CWHvh2 biogeoclimatic subzone around Prince Rupert was obtained from wildlife and marine bird studies that have been completed on Kaien and Ridley islands, volunteer-based surveys conducted in the region, as well as peer-reviewed literature, government reports, and technical field guides. Based on this review, the Prince Rupert region provides seasonal and year-round habitat to approximately 359 terrestrial wildlife species, including 62 mammals, 288 birds, five amphibians, and two reptiles (Radcliffe et al. 1994).

### **5.5.1 Mammals**

Mammal species occurring in the CWHvh2 zone include moose, black-tailed deer, grey wolf, coyote, Pacific marten, mink, short-tailed weasel, porcupine, American beaver, snowshoe hare, red squirrel, Keen's myotis, little brown myotis, silver-haired bat, deer mouse, and long-tailed vole. Grizzly bear, black bear, and wolverine are found primarily on the mainland. According to the North Coast Land Resource Management Plan, grizzly bear may occasionally use low-elevation coastal areas but are unlikely to regularly occupy shoreline and island habitats near Prince Rupert (BC MSRM 2005).

## 5.5.2 Avifauna

Coastal habitats within the CWH zone support a variety of breeding, migrating, and overwintering raptors, game birds, songbirds, and marine birds (Campbell et al. 1990, 1997, 2001). Multiple diurnal raptors such as sharp-shinned hawk, northern goshawk *laingi* subspecies (BC Red List; SARA Threatened), peregrine falcon *pealei* subspecies (BC Blue List; SARA Special Concern), red-tailed hawk, osprey, and bald eagle use habitats in the Prince Rupert region. Provincial ranges for several nocturnal raptors also overlap with Lelu Island; these include northern pygmy owl, northern saw-whet owl, short-eared owl (BC Blue List; SARA Special Concern), western screech owl *kennicottii* subspecies (BC Blue List; SARA Special Concern), barred owl, and great horned owl. Five game bird species potentially breed along the north coast of BC: ruffed grouse, spruce grouse, sooty grouse, rock ptarmigan, and willow ptarmigan (Campbell et al. 1990).

The Prince Rupert region supports breeding habitat for migratory birds with secure populations such as American robin, hermit thrush, Pacific wren, dark-eyed junco, orange-crowned warbler, hairy woodpecker, and rufous hummingbird. Terrestrial birds of management concern that have potential to use the area during the breeding season include band-tailed pigeon (BC Blue List; SARA Special Concern), great blue heron *fannini* subspecies (BC Blue List; SARA Special Concern), olive-sided flycatcher (BC Blue List; SARA Threatened), and rusty blackbird (BC Blue List; SARA Special Concern).

Including hybrids and subspecies, 90 marine bird species have been documented in the Prince Rupert region (Bird Studies Canada 2013; Stantec 2010, 2011, 2012). Species most likely to be observed on or near Lelu Island include marbled murrelet (BC Blue List; SARA Threatened), rhinoceros auklet, common murre (BC Red List), surf scoter (BC Blue List), common merganser, pelagic cormorant *pelagicus* subspecies (BC Red List), mallard, green-winged teal, mew gull, glaucous-winged gull, black turnstone, and dunlin.

Some of these species are considered pelagic (i.e., are species that spend most of their life on the open ocean, rarely coming to land), or considered vagrant species (i.e., species that occasionally stray outside of their expected breeding, migrating, or wintering ranges). Examples of pelagic and vagrant species recorded near the Prince Rupert mainland include parasitic jaeger, pomarine jaeger, and sooty shearwater; these species are recorded in lower abundance across multiple volunteer-based surveys conducted in the region (Bird Studies Canada 2013).

A number of important marine bird habitat features are located in close proximity to Lelu Island. The waters around Lelu Island contain productive shallow water areas formed by sediment deposited from the Skeena River. Eelgrass beds and seasonally exposed mudflats are found in the shallow waters to the southwest of Lelu Island at Flora and Horsey Banks. Several shallow intertidal passages are located in nearby Inverness Passage and Lelu Slough. Important Bird Areas 122 (Lucy Islands), 124 (Big Bay south to Delusion Bay), and 125 (Grey and Green islets) support estuaries, mudflats, and rocky shores sustaining globally significant populations of waterfowl and seabirds (IBA 2013). Lelu Island also is near a number of islands/islets that support marine bird breeding colonies: black-legged kittiwakes have been documented breeding on Holland Rock; and black oystercatchers, glaucous-winged gull, and pigeon guillemot on East and West Kinahan islands.



### 5.5.3 Reptiles and Amphibians

Most amphibians and reptiles are not adapted to climates found on the north coast of BC. Species potentially occurring on Lelu Island include common gartersnake, western gartersnake, northwestern salamander, long-toed salamander, rough-skinned newt, and western toad (Radcliffe et al. 1994; Corkran and Thoms 2006). Coastal-tailed frog may occur in permanent, fast-flowing streams on the neighbouring mainland (Corkran and Thoms 2006); however, they do not occur on Lelu Island.

## 5.6 Freshwater Aquatic Resources

Lelu Island has an area of about 195 ha and is relatively flat with the highest point less than 100 m above sea level (ASL). Precipitation on Lelu Island is mostly governed by its location within the Coastal hydrologic zone, which extends from the Pacific coast to the windward side of the Coast Mountain range. Precipitation is high because moist maritime air is forced to rise over the range as it progresses eastward. Smaller watersheds in this hydrologic zone generally experience annual high flows in response to November rains. Annual low flows for these smaller watersheds typically occur in July and August, and stream flow in the zone is generally low in December through March due to the majority of precipitation falling as snow at higher elevations. Historical ice records show highly variable frozen conditions in the Coastal hydrologic zone and have been recorded as early as late October and as late as early May (Obedkoff and Coulson. 1998; Obedkoff 2000; Obedkoff 2001). However, the topography of Lelu Island does not contain land high enough for snow pack to accumulate. As a result, the hydrology of Lelu Island is driven by rainfall that is relatively low in the summer and higher in the fall and winter; stream flow follows this seasonal pattern.

Because there is no long-term continuous monitoring of stream flow or precipitation on the island, flow estimates of watercourses is based on regional information and information collected from nearby stations, the closest of which is 4 km northeast of Lelu Island, near Port Edward. Estimates for the long-term mean annual flows for Lelu Island watercourses are based on the surface runoff estimate at Alwyn Lake watershed. The data is not sufficient to estimate the peak flows for the two defined watercourses on the island, both of which drain into Hecate Strait from the southwest side and southeast side of the island (see Section 12), as tidal effects are not included in the estimates.

Watersheds for the two watercourses were delineated from DEM data (GeoBase 2014). The drainage area of the two watercourses is presented in Table 5-1.

**Table 5-1: Estimates of Average Annual Streamflow in Lelu Island Watercourses**

Watercourse	Drainage Area (km <sup>2</sup> )	Yield (m/y)	Flow (m <sup>3</sup> /s)
WC 8/9	0.425	1.86	0.025
WC 11	0.201	1.86	0.012

**NOTE:**

These estimates do not include tidal effects

The watercourses have lengths of 248 m and 368 m, with an average channel width of 1.2 m and are ephemeral with no flow during the low flow periods. The habitat quality for salmonids is rated as marginal as a result of low pH, the ephemeral nature of the streams, and the lack of habitat complexity (i.e., absence of overwintering and spawning habitat). Due to these factors, it is unlikely

that the watercourses on Lelu Island supports anadromous or resident salmonid species. The contribution of these drainages to the food and nutrient supply in the coastal estuarine environment is believed to be negligible due to their small size (See Section 12).

## 5.7 Marine Resources

The marine environment surrounding Lelu Island is nutrient-rich and is strongly influenced by freshwater outflow from the Skeena River. The key marine areas on and around Lelu Island are rocky shorelines, soft sediment in protected bays and channels, and the expansive mudflats of Flora Bank. Collectively, these varied environments support a diverse assemblage of fish (and fish habitat) and marine mammals.

Lelu Island is within the outflow from the Skeena River, the second largest river in BC, and its estuary, and is located at the northern terminus of Inverness Passage and Tsum Tsadai Inlet. To the northeast of Lelu Island is Porpoise Harbour, and to the west are the more open waters of Chatham Sound (see Figure 1-3). Runoff from the Skeena River is largest in spring (snowmelt during the freshet) and late fall (peak rainfall) and lowest in the summer months (Akenhead 1992). High sediment transport within Skeena outflows has created the second largest delta in BC.

The temperature and salinity of coastal waters of BC depend on the season and volume of freshwater input (Thomson 1981). Generally, the mainland side of Hecate Strait is less saline than the western side due to this freshwater influence. Over most of the BC coast, salinity of surface water ranges from about 28 to 32 parts per thousand (Jamieson and Davies 2004). The water in Hecate Strait and Queen Charlotte Sound remains consistently warmer than that of Dixon Entrance, though wind-driven currents can disrupt this trend (Thomson 1981).

Soft sediment within two bays on the north side of Lelu Island and on Flora, Agnew and Horsey Banks indicate these areas are depositional environments for sediment.

Tides on the coast of BC are semidiurnal (two low and two high tides per day, each of different heights). Large ranges in tidal fluctuations in the region can drive strong currents (Akenhead 1992) and tidal ranges expand to approximately 5 m as tides move up deep, narrow fjords (Thomson 1981). Prince Rupert harbor has up to 7.7 m tidal heights and a mean range of 4.9 m (Akenhead 1992). Wind and river outflows also produce non-tidal currents that can mask tidal currents. Lelu Island is exposed to waves generated by winds across Chatham Sound, which can, in extreme cases, produce high waves and harsh conditions. Collectively these physical conditions create the ecological setting for the marine species and habitats in the region.

The waters adjacent to Lelu Island contain a wide range of marine habitats. Rocky foreshores are dominated by a diverse assemblage of algae and invertebrates. Soft sediments accumulate in sheltered areas providing habitat for eelgrass and a biologically rich invertebrate communities. Subtidal benthic substrates constitute a mix of mud, sand, and gravel with occasional rocky outcrops. Shallower nearshore areas, and those within channels, support a wide diversity of substrate types, including extensive areas of rocks and boulders (see Section 13 for a description of the biological communities supported by these habitats).

Fishing is an important cultural, commercial and recreational activity for the people of the Prince Rupert area. Pacific salmon (sockeye, Chinook, coho, pink and chum; *Oncorhynchus* spp.), have



long been the most important contributor to local fisheries and are found throughout Chatham Sound. Other fisheries species include halibut (*Hippoglossus stenolepis*), Pacific herring (*Clupea pallasii*), rockfish (*Sebastes* spp.), lingcod (*Ophiodon elongates*), Pacific cod (*Gadus macrocephalus*), eulachon (*Thaleichthys pacificus*), Dungeness crab (*Metacarcinus magister*) and shrimp (*Pandalus* spp.). Other invertebrates are commonly harvested in Chatham Sound by Aboriginal groups including cockles (*Clinocardium* spp.), butter clams (*Saxidomus* spp.), mussels (*Mytilus* spp), littleneck clam (*Protothaca staminea*) (see Section 21). Lelu Island, including Flora Bank, is a particularly important area for salmon (DFO 1985; Higgins and Schouwenburg 1973), Dungeness crab, and shrimp (North Coast Environmental Analysis Team 1975).

Numerous species of marine mammals regularly inhabit the cold waters off the coast of Prince Rupert and include: humpback whale (*Megaptera novaeangliae*), northern resident and Bigg's killer whales (*Orcinus orca*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and harbour seal (*Phoca vitulina richardsi*). Other species that are less common include minke whale (*Balaenoptera acutorostrata scammonii*), gray whale (*Eschrichtius robustus*), fin whale (*Balaenoptera physalus*), Loughlin's northern sea lion (*Eumetopius jubatus monteriensis*), and sea otter (*Enhydra lutris*). Of these species three are currently listed as *threatened* under the *Species at Risk Act* (SARA) and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (fin whale, northern resident and Bigg's killer whale), and four are listed as *special concern* under SARA and by COSEWIC (gray whale, harbor porpoise, Loughlin's northern sea lion, and sea otter). Humpback whale is listed as *threatened* under SARA and as *special concern* by COSEWIC. Marine mammal abundance will typically increase during summer when seasonal migratory fish abundance is higher.

## 5.8 Human Environment

### 5.8.1 First Nations

The proposed Project is located within the asserted territories of the Metlakatla First Nation, Lax Kw'alaams First Nation, Gitxaala Nation and the Kitsumkalum First Nation. The Kitselas First Nation asserts that its historical and current traditional use areas extend to coastal waters in the Prince Rupert area. These Aboriginal groups report that the islands, waters and coastlines in the Prince Rupert area are used by their members for traditional use activities that include hunting, fishing, harvesting marine resources and for plant gathering. Each group asserts that it has Aboriginal rights and related interests in areas potentially affected by the proposed Project.

The Metlakatla First Nation, Kitselas First Nation and Kitsumkalum First Nation have joined with the Kitasoo/Xaixais Nation and Gitga'at First Nation to form the Tsimshian First Nations Treaty Society. At the time of writing, the Tsimshian First Nations Treaty Society had reached Stage 4 (the "Negotiation of an Agreement in Principle" stage) of the BC Treaty Process (Ministry of Aboriginal Relations 2011a). The Lax Kw'alaams First Nation has reached Stage 2 (the "Readiness" stage) of treaty negotiations (Ministry of Aboriginal Relations 2011b). In 2004, the Gitxaala Nation suspended treaty negotiations and withdrew from the BC treaty process (Ministry of Aboriginal Relations 2011a).

According to Aboriginal Affairs and Northern Development Canada, the potentially affected First Nations have registered populations as listed in Table 5-2.

**Table 5-2: First Nations' Registered Populations**

First Nation	Total Registered Population	Registered Off Reserve Population
Metlakatla First Nation	857	772
Lax Kw'alaams First Nation	3,612	2,871
Gitxaala Nation	1,888	1,425
Kitselas First Nation	602	320
Kitsumkalum First Nation	715	475

Sources: Modified from AANDC (2013a, 2013b, 2013c, 2013d, 2013e)

The Metlakatla First Nation and Lax Kw'alaams First Nation have reserves that are close to the proposed Project. The community of Metlakatla (Tsimpsean Indian Reserve No. 2) is located approximately 15 km from project infrastructure.

## 5.8.2 Physical and Cultural Heritage

### 5.8.2.1 Ethnography and Ethnohistory

The study area is located within the traditional land use territory of the Tsimshian and is subject to a land claim currently being negotiated between the Tsimshian and the governments of Canada and British Columbia (BC Treaty Commission 2009). The Tsimshian ("people inside of the Skeena River") live along the Nass and Skeena rivers and along the associated coastal inlets and islands south of Milbanke Sound. They have been historically divided into three groups including the Coast Tsimshian, Gitksan and Nisga'a (Jeness 1932). Halpin and Seguin (1990) have further divided the Tsimshian into four major groups including Nisga'a on the Nass River, the Gitksan on the Upper Skeena above Kitselas Canyon, the Coast Tsimshian on the lower Skeena and adjacent coast, and the Southern Tsimshian on the coast and islands to the south.

The Tsimshian today includes seven member bands: Metlakatla First Nation, Lax Kw'alaams First Nation; Gitxaala Nation (Kitkatla); Gitga'a First Nation (Hartley Bay); Kitasoo; Kitselas First Nation and Kitsumkalum First Nation. Metlakatla First Nation and Lax Kw'alaams First Nation are the two bands closest to Lelu Island. Each of the member bands of the Tsimshian comprises several reserves and/or settlements. Metlakatla First Nation is 16 reserves and/or settlements covering an area of 3,464 ha, respectively. The Lax Kw'alaams First Nation comprises 79 reserves and/or settlements covering an area of 11,700 ha.

Traditional Tsimshian settlement involved a pattern of seasonal mobility. Typically, people would gather in large protected winter villages until they dispersed to their traditional fishing sites in the early summer. Settlement was organized to exploit a number of seasonally and geographically restricted resources including salmon, halibut, eulachon, seaweed, tree cambium, bird eggs and various roots and berries. Exclusive control of the Nass River eulachon grease trade was an important economic activity and a source of great wealth for the Tsimshian (Halpin and Seguin 1990).

The basic social unit in Tsimshian society was the "house". These were corporate matrilineages whose members, affines, and slaves occupied one or more dwellings. Each house had exclusive ownership of specific hunting, gathering and fishing sites. These were exploited under the guidance

of the house chief – typically the man who bore the highest-ranking name in the house. House chiefs worked cooperatively with each other in matters of mutual interest to the village such as defense. Chiefs were ranked themselves to determine their respective rights in political and ceremonial events (Halpin and Seguin 1990).

#### **5.8.2.2 Prehistory**

Lelu Island is located in the northern sub area of the Northwest Coast archaeological culture area. Archaeological research in the North Coast region has been relatively limited. Much of the work undertaken has concentrated in the Prince Rupert harbour area and the Kitselas Canyon, 125 km up the Skeena River. The prehistory of the Northern Northwest Coast archaeological region can be divided into two distinct periods. The division point between the two is based upon the first appearance of shell middens on the mainland coast at approximately 5,000 years before present (BP). The Early period (10,000 to 5,000 BP) is not yet represented in mainland north coastal sites although some material from inland Paul Mason site in Kitselas Canyon dates to the transitional period between the Early and Recent period. Excavated sites are confined primarily to eleven sites in the Prince Rupert harbor area and two sites in Kitselas Canyon. All Prince Rupert harbor sites date from the Recent period (5,000 BP to the European contact) as does the bulk of the Kitselas Canyon material.

A three-period cultural sequence has been developed for the Recent Period for Prince Rupert Harbour (Ames 1984; MacDonald and Inglis 1981). Prince Rupert III encompasses the period from 5,000 to 3,500 BP. Only four Prince Rupert sites have significant Prince Rupert III components. Although, none of these sites have been identified within the PDA, these components are often associated with small shell middens, low artifact densities and diverse faunal assemblages suggesting a broad subsistence base with a strong emphasis on terrestrial resources. The basic tool kit shares a strong affinity to that of historic Tsimshian populations but is generally less complex. Bone and antler tools dominate although ground stone and cobble tools are also present. There is no evidence of large communal structures resembling ethnographic longhouses being built during this time although small postholes, post molds and heaths indicate the presence of smaller domestic structures.

Prince Rupert II spans the period from 3,500 to 1,500 BP. At least 12 known sites have significant Prince Rupert II components. Although, none of these sites have been identified within the PDA, these components are often associated with relatively thick, rapidly deposited shell middens and high artifact densities. Faunal assemblages associated with this period indicate a greater reliance on fishing and sea mammal hunting and a declining emphasis on land mammal hunting. Net weights and a third harpoon type are added to the tool kit during this period indicating the growing importance of marine resources. Stones adzes, chisels, bark shredders and bark peelers are added to the bone and antler woodworking technology associated with Prince Rupert III. The appearance of more durable stone tools suggests an expansion of the role of wood in the material culture. These tools also provide indirect evidence for the construction of larger domestic structures – specifically planked cedar long houses – during this period. Prince Rupert II appears to coincide with major social changes involving rapid population growth and an expansion and intensification of the subsistence base. These changes are evidenced in part by a major burial complex, involving interment in middens, which terminates by the end of the period (Fladmark et al. 1990).

Prince Rupert I dates from 1,500 BP to the Historic Period (ca. A.D. 1830). This period shows strong continuity with Prince Rupert II but is distinguished on the basis of several key culture traits. Midden burials disappear from the archaeological record during the Prince Rupert I period – likely giving way to less archaeologically visible ethnographic burial practices including cremation. The rate of shell midden deposition appears to slow relative to the preceding period. This possibly indicates stabilization in population growth. Subsistence patterns appear to be relatively unchanged, although slight variations in hunting technology appear to reflect a decline in the importance of marine mammal hunting relative to fishing.

No archaeological materials recovered on the mainland north coast predate 5,000 BP. The reason for this lack of early materials is not clear, particularly in light of much earlier sites located in the surrounding coastal areas (in southern Alaska to the north, on the Queen Charlottes to the west, and on the central coast of BC to the south). Fladmark et al. (1990) list a variety of possible reasons for the absence of recorded early sites in the area:

- Sites may be submerged
- Sites may be elevated and obscured by dense forest cover
- Sites may be missed due to the archaeological sampling techniques employed
- The north coast may not have been inhabited at this time.

The ability to predict the location of early sites along this part of the coast is complicated by the poorly understood history of environmental change linked to fluctuating sea levels in the last 10,000 years. Geological information regarding sea levels is particularly scarce and is further complicated by differential degrees of land mass rebound in the north coast region as melting reduced the weight of the 2 km thick Cordilleran ice sheet. As an example, 10,000 BP, the sea level in the Queen Charlottes, which were never fully glaciated, was 30 m below its present level. In contrast, the Skeena River estuary indicates that sea level was as much as 200 m above the present level 10,500 BP (Fladmark et al. 1990:229-230). Geological evidence indicates that the sea may have achieved its present level in the Skeena River Valley as early as 8,000 BP. It is relatively certain that the mainland coast achieved sea level stability by at least 5,000 BP and that this part of the north coast has unquestionably been continuously occupied since.

Hebda and Mathewes (1984) have argued that, while the modern outline of the coast is 5,000 years old, the modern climax forest is unlikely to have become fully mature before 3,000 BP. In a similar vein, Fladmark (1975) has argued that the stabilization of the mainland coastal sea level is the critical factor in the origin of the development of the area's rich salmon runs. The timing of these events is roughly paralleled by changes in the archaeological record.

### **5.8.3 Health and Socio-economic Conditions**

Traditionally, the economy of the Skeena Queen Charlotte Regional District was sustained by fishing and forestry. Up until the 1980's much of the northwest experienced rapid population growth. Young families were attracted to the region by BC's expanding resource industry base (forestry, with additional activity in mining, oil and gas, fishing and agricultural development) (Hanlon and Hasleth 2005). Since the late 1990's, the City of Prince Rupert, the District of Port Edward and surrounding areas have experienced industrial closures in the resource sector and a general decline in shipments of grain and coal out of its port facilities.

Economic activities in the Skeena-Queen Charlotte Regional District currently include fishing, forestry, energy, transportation, and tourism (BC Stats 2012a). The Port of Prince Rupert currently serves as a major economic driver in the SQCRD.

### **5.8.3.1 Population and Demographics**

The Skeena Queen Charlotte Regional District (SQCRD) has generally experienced a loss of population over the last 20 years. This trend is expected to reverse at least marginally in the long term as the resource sector recuperates. Between 2011 and 2036, the regional population is expected to increase from approximately 19,000 to 20,700. In 2006, approximately 4% of the population of the SQCRD belonged to an Aboriginal group (Statistics Canada 2007). Overall dependency will continue to increase as the population ages; by 2036, there are projected to be approximately eight dependents per ten people of working age (BC Stats 2012a).

The SQCRD has experienced greater levels of unemployment than BC overall. At 14.2%, the 2011 unemployment rate for the region was substantially higher than that of the province, which stood at 6.7%. A relatively high unemployment rate was also recorded for the Prince Rupert Census Metropolitan Area (CMA), which includes Port Edward, compared to the province as a whole (2013a). Labour force statistics for 2012 indicate that employment in the region continues to be lower than in the province overall; as of 2012, the combined unemployment rate for the North Coast and Nechako economic development regions was 10.7%, compared to 6.7% for BC as a whole (Statistics Canada 2013b). In 2011, 28% of the workforce aged 25-64 in the Prince Rupert CMA had high school or equivalent as their highest educational attainment, compared to 26% for SQCRD, and 25% for BC. There were slightly higher percentages of workers with apprenticeship or trades certificates or diplomas in the LAA (14%) and RAA (13%) compared to BC as a whole (11%) (Statistics Canada 2013a). The labour force distribution by major field of study was comparable for the LAA, RAA, and the province overall in 2006. However, relative to the rest of BC, there was a higher proportion of people with no post-secondary education in the RAA (58%), as well as in the Prince Rupert CMA (57%).

## **5.8.4 Infrastructure and Services**

### **5.8.4.1 Schools and Colleges**

There are eight public schools in the Prince Rupert School District (52), which includes Prince Rupert, the District of Port Edward, Kitkatla and Hartley Bay. There is also one independent school within the boundary of the school district. Northwest Community College's satellite campus is based in Prince Rupert with the main campus located in Terrace. The University of Northern British Columbia also has a satellite campus based in Terrace. In Prince Rupert, there are a number of employment and training centres: Hectate Straight, Tricorp, St. Johns Ambulance, First Nations Training & Development, Skeena Driving School, and Fire and Rescue Training.

### **5.8.4.2 Housing and Accommodations**

The City of Prince Rupert and District of Chetwynd are among the most affordable places in BC to purchase a home. The average price for a house in Prince Rupert was \$246,462. The average price for a house in Port Edward was \$110,877 in 2012 (BC Stats 2012c). Prince Rupert still has opportunities for redevelopment, as well as some new housing development. Should major economic initiatives require future development areas, several have been identified, largely adjacent to the

existing urban area complementing the successes of current development patterns (COP 2007). Prince Rupert also has 700 to 750 hotel rooms.

Port Edward's official community plan indicates that housing in Port Edward is dated and that residents would like to see a variety of housing types (townhouses, senior housing complex, family oriented housing and low income) and more medium density developments (DOPE OCP 2008, DOPE OCP 2013).

#### **5.8.4.3 Recreation**

Port Edward and Prince Rupert offer a variety of recreational opportunities. The area has a number of indoor sport arenas and clubs, museums and historic sites (the North Pacific Cannery National Historic Site and Museum of Northern British Columbia), outdoor playing fields, provincial parks, and eco-tours, among other recreational venues. There are two provincial parks within the vicinity of Port Edward and Prince Rupert: Dianna Lake and Prudhoe Lake. The closest recreational area to Lelu Island is Kitson Island, which is located 5 km south of Port Edward at the mouth of the Skeena River. Recreational activities within the parks and Kitson island include swimming, fishing, canoeing, hiking, and kayaking (BC Parks 2013).

#### **5.8.4.4 Health Care Services**

Medical services available in Prince Rupert service the communities of the District of Port Edward, Lax Kw'alaams First Nation, Kitkatla, Hartley Bay, Metlakatla, Alice Arm, Kits Ault (an abandoned town), Ozona River (pop. 45), Gigolo (Kincolith), and Laxgalts'ap (Greenville). Health care services in Prince Rupert are provided by the Northern Health Authority, funded by the provincial Ministry of Health. The four main facilities providing health care services are:

- Prince Rupert regional hospital
- Prince Rupert community health
- Summit residences
- Acropolis manor.

Other health care support services offered in the region by Northern Health and other local not for profit societies include: food programs, mental health programs, violence against women programs, addiction programs, and needle exchange services. In the Northwest Health Region, there were a total of 178 physicians per 100,000 populations as of January 2013 (Statistics Canada 2013). This is less than the national and provincial ratios in 2011 (209 and 212 physicians per 100,000 population, respectively). There are 15 general practitioners in the community and specialists in the areas of pediatrics, radiology, obstetrics, gynecology, surgery, internal medicine, podiatry and orthopedics. Visiting specialists provide other specialties from time to time (Northern Health, 2013).

#### **5.8.4.5 Emergency Services**

The City of Prince Rupert has a Royal Canadian Mountain Police (RCMP) detachment, firefighting services and ambulance services. In the Prince Rupert area, the RCMP has a provincial force and a municipal force. Rural and unincorporated areas are policed by the RCMP provincial force while municipalities are policed by the municipal force. The ambulance service in Prince Rupert is provided by the public British Columbia Ambulance Service (BCAS). Medivac service is available in the Prince



Rupert region (Hartley Bay, Kitkatla, Dona River and Port Simpson), as well as Terrace and North (Kitimat, New Aiyansh, Greenville). Haida Gwaii also receives Medivac service. Prince Rupert has one of three Sikorski S76 helicopters in the Province with a dedicated flight crew on call. The staff can provide services while in flight, with the exception of Advanced Cardiac Care (PRCMDFE 2012).

Prince Rupert Fire Rescue Department consists of two chief officers and eighteen career firefighters. Port Edward Fire Department has a one-sided mutual aid agreement with the Department (Petit 2013). The Port Edward Fire Department fluctuates between five and thirteen volunteer firefighters, and operates one fire truck and a rescue van (Petit 2013). The 911 Dispatch Centre, located in the Prince Rupert Fire Rescue Department since 2004, answers all 911 calls made in the Prince Rupert and Port Edward area. The 911 Dispatch Centre is manned 24 hours a day by four full-time dispatchers working rotating 12-hour shifts.

#### **5.8.4.6 Transportation**

Prince Rupert Harbour, located 885 km north of Vancouver, BC, is one of the deepest, natural, ice-free harbours in the world. Entry to the harbour by ship or ferry is from the south between Digby and Kaien islands. Large ships over 350 gross tonnes entering the harbour must stop at Triple Island, 35 km west of Prince Rupert, in order to be piloted into the harbour along established shipping lanes (PEPEEDC 2010). The port is connected by railway (CN Rail) to other North American destinations. Large volumes of cargo shipped through Prince Rupert are destined for CN Intermodal terminals in Toronto, Chicago and Memphis (PEPEEDC 2010).

By road, Prince Rupert is connected to other parts of the province and eastern Canada by the Yellowhead Highway, Highway 16, which extends east to Prince George (715 km from Prince Rupert) and Edmonton (1,450 km from Prince Rupert). By air, Prince Rupert Airport is a commercial airport located on Digby Island at an elevation of 35 m above sea level. The airport has one runway, which is 1,829 m long and 61 m wide. The air terminal building houses airline passenger services, pilot services and administrative offices.

#### **5.8.4.7 Solid and Liquid Waste Management**

The only solid waste disposal facility in the area is the Prince Rupert Landfill, which is owned and operated by the City of Prince Rupert. The landfill accepts material from residential, commercial, industrial, institutional, demolition, land clearing, and construction sources. Recycling of wood, metal, concrete, and soil/overburden is provided by the facility. It does not accept hazardous materials or a number of other products that are recycled through specialized programs (e.g., tires, batteries, waste oil, cardboard, computers, TVs, monitors, or printers). The landfill has approximately 75 years of capacity remaining (at the current rate of fill) (PRPEEDC 2010). The City of Prince Rupert has identified the need for improved treatment of sewage. Port Edward has two sewage treatment plants that include screening, oxidation, digesters and clarification, prior to discharge (COPR 2010). The treated sewage goes through an outfall in Porpoise Harbour (COPR 2010). The present sewage treatment facility is designed for a population of 1,500 people (DOPE 2008).

#### **5.8.4.8 Water Infrastructure**

Water is supplied to the District of Port Edward from Alwyn Lake, a protected watershed. There is a dam on Alwyn Lake and the water flows down Wolf Creek to another dam from where the District of Port Edward collects the water. The District of Port Edward constructed a new Water Treatment Plant in 2004, which can provide treated water for a design population of 1,000 people.

Water is supplied to Prince Rupert from Woodworth Lake and Shawatlans Lake. The normal supply is the gravity supply from Woodworth Lake, while the pumped supply from Shawatlans Lake is strictly a backup source. Water is impounded by a 92-year old dam on Woodworth Lake.

#### **5.8.4.9 Power Infrastructure**

Prince Rupert is serviced by BC Hydro via a 287 kV hydroelectric transmission line that runs from the Skeena Substation in Terrace to the Rupert Substation off Highway 16, east of Port Edward. From the Prince Rupert Substation, separate lines service the Prince Rupert town site, Watson Island and Ridley Island.

#### **5.8.4.10 Port of Prince Rupert**

The Port of Prince Rupert is administered by the PRPA under the *Canada Marine Act*. Several facilities in the Port of Prince Rupert reside on land owned by the Federal Government and managed by the PRPA. PRPA also owns some of these facilities, such as the Fairview Terminal, Westview, Atlin and Northland. BC Ferries, Alaska Ferry, Ridley Terminals and the Prince Rupert Grain Terminal facilities are independently owned and operated. Additionally, there are a number of smaller leisure boat terminals for recreational fishing charters and yachts. The PRPA's 2020 Land Management Plan includes as part of its vision to enable improvements to Port infrastructure and terminal capacity to accommodate future growth in container traffic, general cargo, and bulk commodities. In March 2013, work began on the Port of Prince Rupert's \$90 million Road, Rail and Utility Corridor Project, which includes construction of five parallel rail tracks, a two-lane roadway, and a port-owned power distribution system along an 8 km corridor.

Currently all deep sea vessel traffic approaches the Port of Prince Rupert from the open waters north of Haida Gwaii, through Dixon Entrance north of Stephens Island, following established shipping routes. It is anticipated that future ships will approach and exit using this pre-established route. The southern approach sometimes used by smaller vessel traffic traveling to Prince Rupert is between Kitson Island, Lelu Island, and Ridley Island, on the east side, and between Holland Rock, East Kinahan Island, and Digby Island, on the west side (NGIA 2013). Commercial fisheries continue to occur year-round, with some fisheries having specific timing and quotas determined on an annual basis, and sometimes with a few days' notice (e.g., salmon) depending on migration times and biomass estimates. Recreational or subsistence fishers can obtain permits from the PRPA to fish within the inner harbour if the fishing does not interfere with navigation (Stantec 2009).

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