

4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

4.1 Environmental Background

Each biophysical Valued Component (VC) chapter contains detailed information on existing environmental conditions. This section provides a brief description of the existing biophysical environment to provide a general understanding of the area surrounding the proposed Project as described in Section 4.1 of the Application Information Requirements (AIR).

4.1.1 Atmospheric Environment

The long-term weather conditions in the Prince Rupert area are recorded by an Environment Canada climate normal station, located at the Prince Rupert Airport on Digby Island. Arithmetic calculations of observed climate values over a 30-year timeframe (1981-2010) from climate normal stations provide a high level overview of the region's average climatic conditions.

Prince Rupert experiences an oceanic climate with relatively mild winters compared to other inland places in British Columbia (BC) and, due to the proximity to the Pacific Ocean, also a mild summer. Climate normal data show an annual average daily temperature of 7.5°C with a standard deviation of 1.2°C (summer average: 12.9°C, winter average 2.6°C).

Compared to other regions in BC, Prince Rupert experiences a large amount of annual rainfall, mainly due to the high frequency of Pacific storms passing through the area during winter months. Prince Rupert is among the wettest cities in Canada with annual precipitation of 2,619 mm. Climate normal data from 1981 to 2010 show that every month in the year records more than 100 mm of precipitation. October can be classified as the wettest month with about 24 days with precipitation of more than 0.2 mm a day, and a total precipitation amount of 374 mm. Summer months are comparatively less wet with a total of 397 mm of precipitation during June until August, and an average of 17 days per month with precipitation.

At 54°N, Prince Rupert lies within the mid-latitudes, and in general, the upper level winds are prevailing from the west. However, the surface topography greatly influences the wind direction. On average, the climate normal station shows the predominant surface wind direction (measured at 10 m height) changing throughout the year, from south-east during the fall and winter months, to south and west during the summer months. Winds also tend to be weaker during the summer months; annual average wind speed is 3.3 m/s.

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.

The primary sources of air emissions in the Port Edward and Prince Rupert area currently include marine bulk terminals on Ridley Island (plus their associated bulk cargo vessel emissions), local marine vessel emissions (container ship, fishing, ferry and cruise ship traffic), and domestic space heating and transportation emissions (homes, businesses, motor vehicles, aircraft).

4.1.2 Geology and Soils

The Project is situated within the Hecate Lowland of the Hecate Depression in the Coastal Trough physiographic region (Holland 1976). This region is characterized by low topography composed primarily of volcanic felsic and basaltic rock, as well as metamorphic rock from the Paleozoic and Mesozoic era. Bedrock in the area is predominantly green schists, andesite and rhyolite (Government of British Columbia 2009).

The Project is located entirely within the Central variant of the Very Wet Hypermaritime subzone of the Coastal Western Hemlock zone (CWHvh2). Landform and soil processes are strongly driven by the high levels of precipitation and cool temperatures occurring in the area that result in deep deposits of organic materials on the forest floor (Banner et al. 2005).

The dominant surficial material on Digby Island and surrounding area is organic (veneers and blankets of Sphagnum/sedge peat or forest humus) occurring over marine and glaciomarine sediments. There are isolated areas of colluvium, primarily on the slopes of Mount Hayes, and marine bluffs around Digby Island. Exposed bedrock is found primarily as rocky bluffs and headlands in intertidal areas.

Recent fieldwork within and surrounding the Project development area (PDA) indicate the soils formed from glaciomarine silts and sands have surface drainage ranging from very poor in level and depressional areas, to moderately well-drained in sloped areas.

4.1.3 Groundwater

There are no provincially mapped aquifers on Digby Island according to the BC Water Resources Atlas, as such no information exists regarding aquifer productivity or vulnerability.

The local groundwater regime on Digby Island is comprised of both deep groundwater and shallow groundwater sources located in the peat and glaciomarine deposits (see Section 4.1.2). Shallow groundwater sources rapidly convey rainfall to the island's flashy stream systems, to seeps on beaches, and / or to the deeper groundwater sources. Shallow groundwater is highly influenced by seasonal precipitation patterns. In poorly drained areas, shallow groundwater is expected to be more perennial. Geotechnical drilling at the Project site has indicated generally shallow groundwater tables with water levels near the ground surface.

4.1.4 Vegetation and Wetlands

The Project is located within the North Coast Forest District and Skeena-Queen Charlotte Regional District (BC CDC 2015). Ecologically, the Project falls within the Hecate Lowland Ecoregion of the Coastal Gap Ecoregion of the Coast and Mountains Ecoprovince (Demarchi 2011). The Project is located entirely within the CWHvh2. This variant occupies the outer coastal areas, usually less than 25 km from the ocean, and ranges in elevation from 0 to 600 m. The natural vegetation of Digby Island is primarily forest interspersed with low lying wetlands (primarily peatlands). Productive forests (and old-growth rainforests among them) are restricted to well-drained soils on moderate and steep slopes and dominated by western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and Sitka spruce (*Picea sitchensis*). Yellow-cedar (*Xanthocyparis nootkatensis*), shore pine (*Pinus contorta* var. *contorta*), and red alder (*Alnus rubra*) are abundant on the outer coast where scrubby forests grow on organic soils over bedrock. Because fires occur rarely, early seral stands were uncommon before clear-cut logging began (Meidinger and Pojar 1991; Banner et al. 1993).

4.1.5 Wildlife

More than 350 species of terrestrial mammals, amphibians, and birds have the potential to occur in the Prince Rupert region (Radcliffe et al. 1994); only a portion of these species are expected to use habitats on or near Digby Island (JWA 2008; Stantec 2010, 2011, 2014; Bird Studies Canada 2015; Environment Canada 2015). Previous surveys conducted in the Prince Rupert region include detections of 13 species of mammals and amphibians (see Appendix 1 of Appendix G Wildlife Resources Technical Data Report (TDR)); these species have the potential to occur in terrestrial habitat within the regional assessment area (RAA). Forest, wetland, and intertidal communities on Digby Island and adjacent areas provide habitat for a number of species of mammals and amphibians. Mammals whose range and habitat preferences overlap with Digby Island include American black bear (*Ursus americanus*), grey wolf (*Canis lupus*), coyote (*Canis latrans*), black-tailed deer (*Odocoileus hemionus*), Pacific marten (*Martes caurina*), red squirrel (*Tamiasciurus hudsonicus*), North American porcupine (*Erethizon dorsatum*) and a number of species of bat (e.g., little brown myotis). Digby Island and surrounding areas provide wetland habitat for amphibian species. Northwestern salamander (*Ambystoma gracile*) has been frequently detected on Kaien and Lelu islands (Stantec 2010, 2011, 2014) while western toads have been detected on Ridley and Kaien islands (JWA 2008; Stantec 2011). Coastal tailed frog (*Ascaphus truei*) has the potential to occur within the RAA on the mainland adjacent to Digby Island, where steep, fast-flowing streams are present (BC CDC 2015). Due to their habitat requirements, however, coastal tailed frog is unlikely to occur within the local assessment area (LAA) (BC CDC 2015). Roughskin newt (*Taricha granulosa*) has been detected on Kaien Island (Stantec 2011).

More than 111 terrestrial bird species have been detected in the Prince Rupert region and have the potential to occur within the RAA (see Appendix 1, in Appendix G Wildlife Resources TDR). Digby Island and adjacent areas provide suitable habitat for a variety of terrestrial birds; common species include Pacific wren (*Troglodytes pacificus*), dark-eyed junco (*Junco hyemalis*), yellow-rumped warbler (*Setophaga coronata*), bald eagle (*Haliaeetus leucocephalus*), and great blue heron *fannini* subspecies (*Ardea herodias fannini*). From the review of existing data (see Table 1 of Appendix I, Marine Bird TDR), 102 species of marine bird are known to occur within the Prince Rupert and Port Edward area. Across regional datasets, the most commonly documented species are glaucous-winged gull, mallard, and surf scoter.

4.1.6 Aquatic Environment

The proposed Project is located in lower Chatham Sound; an area characterized by numerous rocky inlets, straits, passes, sounds, and narrows that have been sculpted by several glacial and weathering events over the last million years (Thomson 1981). The combination of tidal mixing, non-tidal currents, and winds brings nutrient-rich deep ocean water to the surface and makes Chatham Sound a highly productive area that supports a variety of marine fish habitats (Whitney et al. 2005; Pacific North Coast Integrated Management Area [PNCIMA] 2011). Within the RAA, marine fish habitat can be grouped into the following categories: marine riparian habitat, intertidal habitat, subtidal habitat, estuaries and salt marshes, and sensitive habitats such as kelp and eelgrass beds (Jamieson and Davies 2004; Lucas et al. 2007). Motile and sessile species, from crabs to clams to fish, rely on these habitats for food, shelter, protection from predators, and for nursing/rearing purposes (Jamieson and Davies 2004). Marine habitats also provide important ecological functions such as carbon sequestration and nutrient recycling (Plummer et al. 2013).

A total of 409 species of marine fish have been documented in the coastal and offshore waters of BC, many of which occur within the LAA and RAA (Hart 1973; Klinkenberg 2014). A number of these species are targeted by commercial, recreational, and Aboriginal (CRA) fisheries including, but not limited to, Pacific salmon, eulachon (*Thaleichthys pacificus*), rockfish, Pacific herring (*Clupea pallasii*), and Pacific halibut (*Hippoglossus stenolepis*). A myriad of marine invertebrate species also occur along the coast of BC where they occupy virtually all marine habitats from the intertidal zone to the deep subtidal. Many of these species are targeted by CRA fisheries, including molluscs (e.g., clams, scallops, abalone, squid, and octopus), crustaceans (e.g., euphausiids, shrimp and prawns, and crabs), and echinoderms (e.g., sea cucumbers and sea urchins) (Lucas et al. 2007).

In addition to marine fish, a minimum of 11 species of marine mammals are known to occur within the RAA, either seasonally or year-round, and seven of these are species at risk: humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), grey whale (*Eschrichtius robustus*), Bigg's killer whale (*Orcinus orca*), northern resident killer whale, harbour porpoise (*Phocoena phocoena*), and Steller sea lion (*Eumetopias jubatus*).

There are 106 freshwater stream reaches identified within and adjacent to the Project area, which is characterized by low-relief terrain, with perennial streams fed by bog, and lake habitats (Khtada 2015). One quarter (25%) of the 106 identified reaches are known to be fish bearing, and 41% are suspected to be fish bearing (Khtada 2015). On Digby Island, freshwater CRA species include chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*), cutthroat trout (*O. ckarkii ckarkii*), and Dolly Varden (*Salvelinus malma*) (Khtada 2015).

4.1.7 Sediment Quality

Sediment quality in the vicinity of the Prince Rupert Harbour has been influenced by a variety of current and historical uses of the area. Notable industrial and human uses include the operation of the Skeena Cellulose Pulp Mill (1950s to 2001; spill in 2012) and the North Pacific Cannery (1889-1981), in addition to various shipping terminals, municipal sewage outfalls, storm drains, and log sorting facilities. Given historical pulp mill discharges to the area around Ridley Island, there is precedent for analysis of dioxins and furans in sediment when considering dredging during marine infrastructure construction. Additional potential contaminants of concern in sediment include metals and polycyclic aromatic hydrocarbons (PAHs), as these are defined through requirements under the Disposal at Sea Regulations.

4.1.8 References

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