1 PROPOSED PROJECT OVERVIEW

Nexen Energy ULC (Nexen), for and on behalf of Aurora LNG, a joint venture between Nexen and INPEX Gas British Columbia Ltd. (IGBC) (Aurora LNG), is proposing to construct and operate the Aurora LNG Project (the Project), a liquefied natural gas (LNG) facility and marine terminal near Prince Rupert, British Columbia (BC). The proposed Project will convert natural gas from northeast BC into LNG for shipment by LNG carriers to markets in Asia where it will be regasified and distributed. The Project is a reviewable project under the BC *Environmental Assessment Act* (BCEAA) and a designated project under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), and therefore requires an environmental assessment under both provincial and federal legislation. This Application has been prepared to provide sufficient information to support the provincial and federal environmental assessment decision making processes necessary for the Project to proceed.

This section of the Application provides a description of the Proponent, a description of the proposed Project, a summary of land and marine use in the vicinity of the Project, an overview of anticipated benefits of the Project, a summary of applicable authorizations required for construction and operations of the Project, and an evaluation of alternative means of undertaking the proposed Project.

1.1 Proponent Description

Nexen, for and on behalf of the Aurora LNG joint venture partners, is proposing to construct and operate the Aurora LNG Project near Prince Rupert, BC. Together, the joint venture participants bring to the Project a unique combination of expertise, market access, well established networks with customers in key growth markets, and decades of experience in the global LNG industry.

Nexen is a wholly-owned subsidiary of CNOOC Limited and is an industry leader in the development of natural gas in northeast BC. The CNOOC Group, of which CNOOC Limited is a subsidiary, is a diversified energy holding company with interests in upstream, midstream and downstream businesses including CNOOC Gas & Power Ltd. (CGPL). CGPL is currently the largest importer of LNG into China with 12.3 million tonnes per annum (MTPA) of existing LNG import capacity, an additional 8.5 MTPA under construction, and plans to expand to 60 MTPA of LNG import capacity by 2020 to meet China's growing domestic demand.

IGBC is a BC corporation; its largest shareholder is INPEX Corporation (INPEX). INPEX has been supplying LNG to Japan, Korea, Taiwan and other Asian customers since 1977 through its LNG projects, and has developed strong relationships with Japanese and other Asian utility customers who make up the majority of the global LNG demand. INPEX currently has working interests in seven LNG projects in the Asia-Pacific region, including three projects where it is the operator: Ichthys LNG in Australia, Abadi LNG in Indonesia, and Naoetsu LNG receiving terminal in Japan. INPEX has been producing natural gas in Japan for over 30 years, where it is the largest domestic distributor of natural gas and owns a gas distribution pipeline that is over 1,000 km long.

Nexen is coordinating the preparation of the application for an Environmental Assessment Certificate (EAC) (the Application) for and on behalf of the joint venture partners. If the Application is approved, the EAC and operational permits for the proposed Project will be held by Nexen on behalf of the joint venture partners.

The contact information for the Proponent is provided in Table 1-1. All communication regarding the environmental assessment for the proposed Project should be directed to the principal and alternate contacts for Nexen.

Table 1-1 Proponent Contact Information

Proponent	Nexen Energy ULC, for and on behalf of Aurora LNG
Address	c/o Nexen Energy ULC 801 7th Ave SW Calgary AB T2P 2V7
Principal Contact	Darcy Janko Sr. Manager, Regulatory Affairs - Natural Gas Telephone: (403) 699-5065 Email: darcy.janko@nexencnoocltd.com
Alternate Contact	Kristen Couzens Regulatory Lead Telephone: (403) 699-6081 Email: kristen.couzens@nexencnoocltd.com
Website	www.auroralng.com
Fax	(403) 513-9866
Email	questions@auroralng.com

Nexen has retained Stantec Consulting Ltd. (Stantec) to manage and prepare the Application. The contact information for Stantec is:

Sandra Webster
Project Manager
Stantec Consulting Ltd.
500-4730 Kingsway
Burnaby, BC V5H 0C6
Telephone: (604) 412-2986
Email: Sandra.Webster@stantec.com

1.2 Proposed Project Description

The Project will consist of the following key components:

- A natural gas receiving and LNG production facility ("LNG facility") that will process approximately 24 MTPA of LNG at full build-out. When fully developed, the LNG facility will require approximately 104 million cubic metres per day (Mm^3/d) (3.7 billion standard cubic feet per day [Bcf/d] or 3.9 Peta Joules per day [PJ/d]) of natural gas. Of this amount, it is estimated that approximately 97 Mm^3/d (3.4 Bcf/d or 3.6 PJ/d) of natural gas will be processed into LNG, and 7 Mm^3/d (0.3 Bcf/d or 0.3 PJ/d) of natural gas will be required for facility operation. At full build-out, there will be three LNG storage tanks at the LNG facility with storage capacity of up to 585,000 m^3.
- A marine terminal and LNG loading facility ("marine terminal") capable of accommodating up to two LNG carriers with a capacity up to 217,000 m^3 (Q-Flex size).
- Supporting infrastructure and facilities, including a material offloading facility (MOF), laydown area, soils storage area, air and water supply utilities, waste and wastewater management, power generation and supply, camp for operations, maintenance and turnaround personnel, access road, and haul roads.
- Temporary infrastructure and facilities during construction, including a pioneer facility, laydown area, construction camp, and construction offices.
- Operations of LNG carriers and other supporting marine vessels along the shipping route between the marine terminal at Digby Island and the pilot boarding location at or near Triple Island.

At full build-out, the Project will require approximately 160 to 320 LNG carrier visits each year to transport the LNG to overseas markets.

Project component details have been updated since the issuance of the Section 11 Order by the British Columbia Environmental Assessment Office (BC EAO) on August 25, 2014. In accordance with the Section 11 Order, the scope of the Project for the purpose of the environmental assessment does not include transportation of natural gas to the LNG facility, which is anticipated to be provided by a third party owned pipeline. The third-party pipeline provider is yet to be determined.

1.2.1 Purpose of the Project

The purpose of the Project is to convert natural gas from the Western Canadian Sedimentary Basin (WCSB) of northeast BC into LNG, through a liquefaction process, for shipment by LNG carriers to markets in Asia. At full build-out, the LNG facility will produce approximately 24 MTPA of LNG. Once delivered to markets in Asia, the LNG will be regasified and distributed, where it may reduce reliance on other non-renewable energy sources such as coal and nuclear fuels, in some markets.

According to the United States Energy Information Administration (US EIA, 2016), from 2005 to 2014 global LNG trade increased by an average of 6% per year, with expansion of 3% in 2015. World LNG trade is anticipated to expand by nearly one-third from 2012 to 2020, and more than double, from about 12 trillion cubic feet (Tcf) in 2012 to 29 Tcf in 2040 (US EIA 2016). The Asia Pacific region, which accounted for 75% of LNG trade in 2014, led the world growth in LNG demand over the past decade; however, trade is anticipated to expand as more countries transition to LNG as a flexible source of energy.

Several large-scale LNG projects will be required to meet this demand, and BC is well positioned to compete in the international LNG market. The proposed Project will play a key role in meeting the increased demand of the Asia Pacific markets, as well as other growth markets, and is consistent with provincial policies and priorities to promote the development of the LNG industry in BC.

Specifically, the Project will:

- Enhance the business capacity of the joint venture participants
- Meet increasing customer demand for LNG
- Provide benefits to BC and Canada through creation of employment and business opportunities, as well as through payment of taxes and royalties to the federal and provincial governments.

1.2.2 Project Location

The proposed Project is located on Digby Island approximately 4 km southwest of downtown Prince Rupert, on the northwest coast of BC (see Figure 1-1, Figure 1-2). The LNG facility is located on provincial Crown land within the Skeena-Queen Charlotte Regional District (SQCRD) and the North Coast Forest District. The marine terminal, MOF, pioneer facility, and a portion of the shipping route are within with the jurisdiction and administration of the Prince Rupert Port Authority (PRPA), a Canadian Port Authority under the *Canada Marine Act* and its regulations. Two water lots will be required for the Project, one for the marine terminal off Fredrick Point and one in Casey Cove for the MOF. The site layout at full build-out, including the location of the LNG facility, marine terminal, and supporting infrastructure, is shown on Figure 1-2. The Project development area (PDA) encompasses the terrestrial and marine areas that will be developed to accommodate the LNG facility and the marine infrastructure, and has an area of approximately 773 ha and 12 ha, respectively, for a total area of 785 ha. The anticipated extent of disturbance within the PDA will be refined during further detailed Project design in consideration of potential areas of environmental and archaeological concern.

As shown on Figure 1-2, two communities, Dodge Cove and Crippen Cove, are located on the east side of Digby Island approximately 1.5 km and 3.8 km, respectively, from the center of the PDA. A portion of the Metlakatla First Nation's Indian Reserve (S1/2 Tsimpsean 2) is located on the north side of Digby Island, approximately 3.8 km from the center of the PDA.

The Project is located within the asserted traditional territories of several Aboriginal Groups in the Digby Island area, including: Lax Kw'alaams Band, Metlakatla First Nation, Gitxaala Nation, Kitselas First Nation, Kitsumkalum First Nation, and Gitga'at First Nation (see Figure 1-3). The Métis Nation of BC has also indicated that their members exercise traditional practices around the Digby Island area. These groups are referred to as 'Aboriginal Groups' in this Application.

The coordinates of the centre of the principal land lot for the LNG facility are:

- Latitude/ Longitude (WGS-84) coordinates - 54.275072 / -130.391215
- Universal Transverse Mercator (UTM) coordinates – Zone 9 – East 409400 North 6015021.

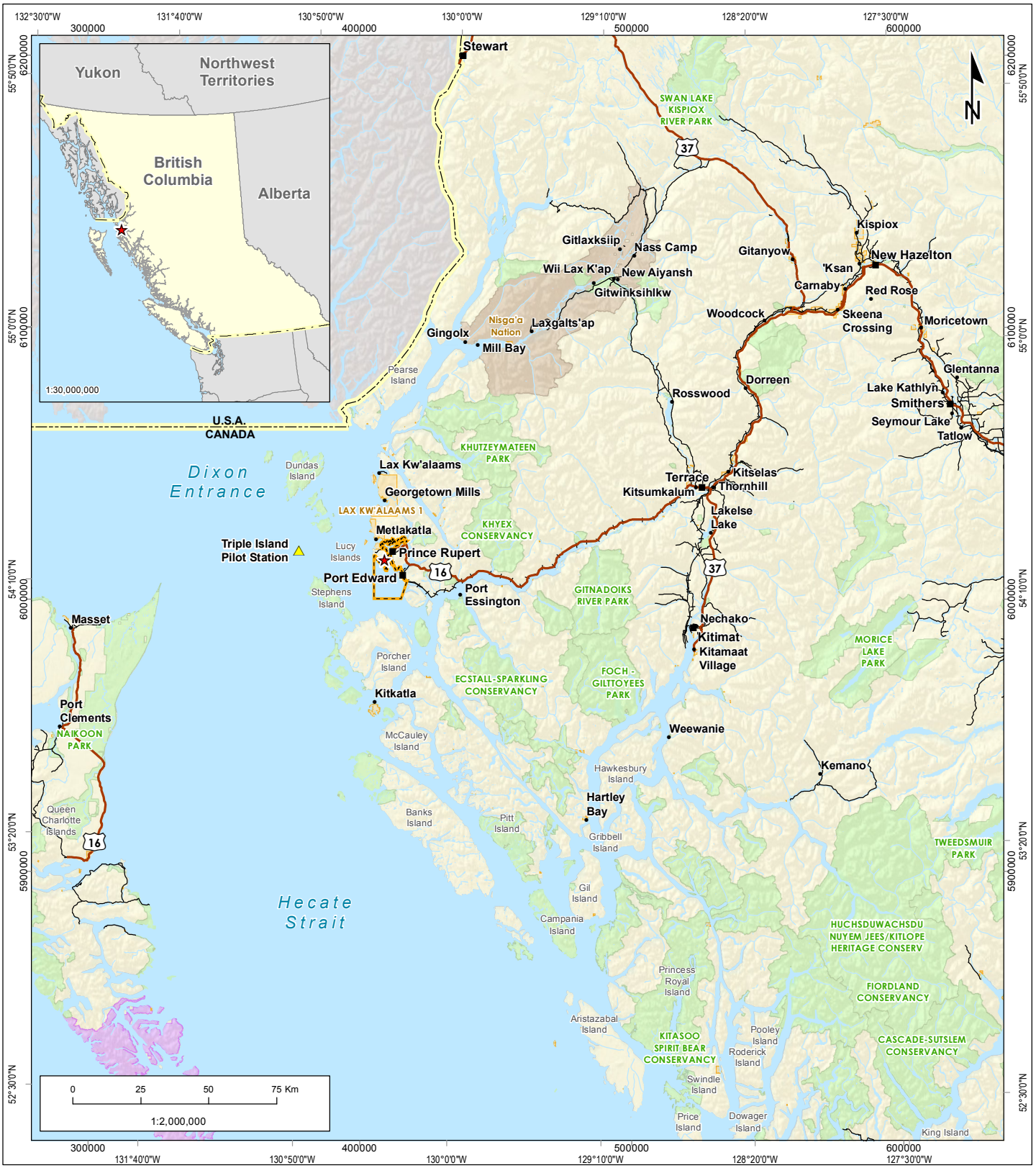
The coordinates for the marine terminal are:

- Latitude/ Longitude (WGS-84) coordinates - 54.24886 / -130.367892
- UTM coordinates - Zone 9 – East 410874 North 6012074.

The coordinates for the MOF are:

- Latitude/ Longitude (WGS-84) coordinates - 54.27987 / -130.375875
- UTM coordinates - Zone 9 – East 410421 North 6015534.

LNG carriers will transit through Chatham Sound within designated shipping zones. Figure 1-4 shows the proposed shipping route for LNG carriers between Digby Island and Triple Island.



- City, Municipality, or Town
- Community, Locality, or Village
- Triple Island Pilot Station
- Highway
- Road
- Railway
- International Boundary
- Watercourse
- Park, Protected Area, Ecological Reserve, or Conservancy
- National Park
- First Nation Reserve
- Treaty Lands
- Waterbody
- Prince Rupert Port Authority Boundary
- Project Location

Data Sources: Government of British Columbia: DataBC, Terrain Resource Information Management, National Topographic System, BC Stats, BC Oil & Gas Commission. Government of Canada: CanVec v12, National Hydrology Network, Atlas of Canada National Framework, Fisheries and Oceans Canada, Environment Canada, Natural Resources Canada. INPEX Gas British Columbia Ltd. Nexen Energy ULC.Service Layer Credits: Copyright © 2014 Esri

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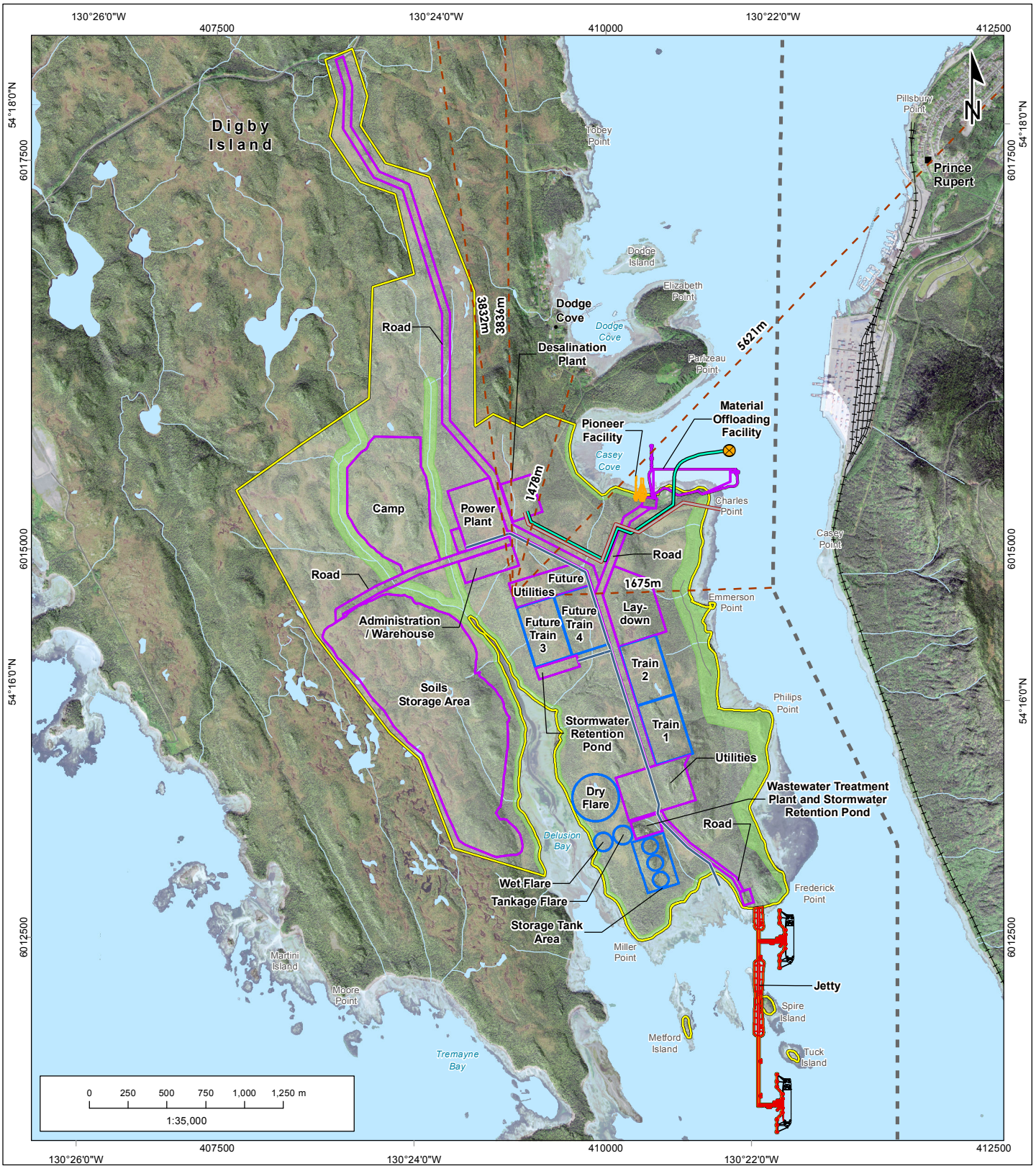
COMMUNITY COMMITMENT CONNECTION

ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

PROJECT LOCATION

Projection: UTM Zone 9 Datum: NAD 83	Fig. ID: 123220054 Date: Oct 19, 2016	Drawn By: RC Checked By: TS	FIGURE NO:	**1-1**



- City, Municipality, or Town
- Community, Locality, or Village
- Road
- Railway
- Watercourse
- Waterbody
- Prince Rupert Municipal Boundary
- Water Supply Intake
- Water Supply Line
- Marine Deep Water Outfall
- Marine Shallow Water Outfall
- Shortest Distance to Community Boundary
- Project Component
- Project Development
- Vegetation Buffer

Infrastructure Type

- LNG Facility
- Supporting Infrastructure
- Marine Terminal
- Temporary Infrastructure

Data Sources: Government of British Columbia: DataBC, Terrain Resource Information Management, National Topographic System, BC Stats, BC Oil & Gas Commission. Government of Canada: CanVec v12, National Hydrology Network, Atlas of Canada National Framework, Fisheries and Oceans Canada, Environment Canada, Natural Resources Canada. INPEX Gas British Columbia Ltd. Nexen Energy ULC.

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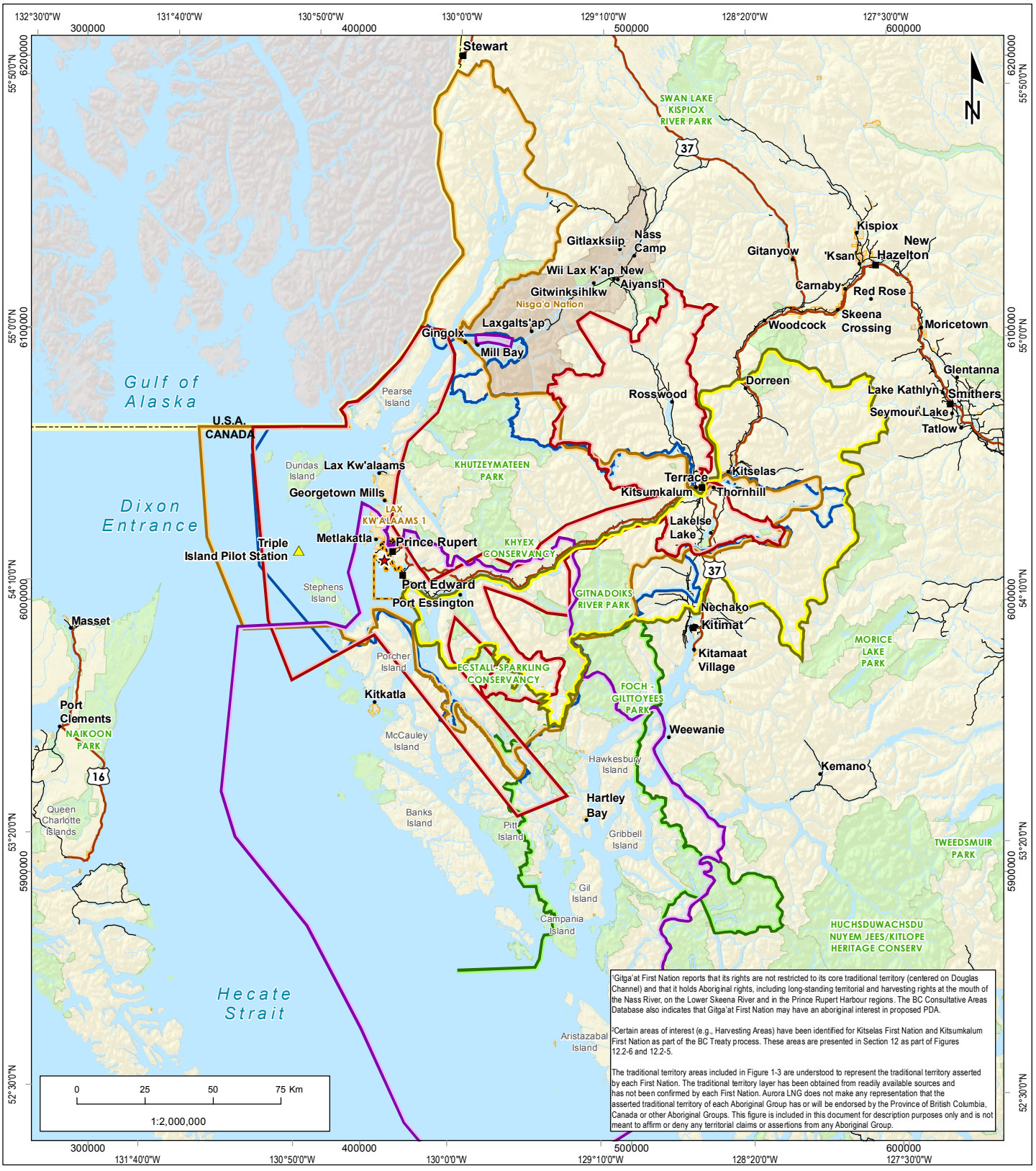
ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

CONCEPTUAL LAYOUT OF PROJECT COMPONENTS AT FULL BUILD-OUT

Projection: UTM Zone 9 Datum: NAD 83	Fig. ID:123220054 Date: Oct 28, 2016	Drawn By: RC Checked By: PM	FIGURE NO: **1-2**



[1]Gitga'at First Nation reports that its rights are not restricted to its core traditional territory (centered on Douglas Channel) and that it holds Aboriginal rights, including long-standing territorial and harvesting rights at the mouth of the Nass River, on the Lower Skeena River and in the Prince Rupert Harbour regions. The BC Consultative Areas Database also indicates that Gitga'at First Nation may have an aboriginal interest in proposed PDA.

[2]Certain areas of interest (e.g., Harvesting Areas) have been identified for Kitselas First Nation and Kitsumkalum First Nation as part of the BC Treaty process. These areas are presented in Section 12 as part of Figures 12.2-6 and 12.2-5.

The traditional territory areas included in Figure 1-3 are understood to represent the traditional territory asserted by each First Nation. The traditional territory layer has been obtained from readily available sources and has not been confirmed by each First Nation. Aurora LNG does not make any representation that the asserted traditional territory of each Aboriginal Group has or will be endorsed by the Province of British Columbia, Canada or other Aboriginal Groups. This figure is included in this document for description purposes only and is not meant to affirm or deny any territorial claims or assertions from any Aboriginal Group.

- City, Municipality, or Town
- Community, Locality, or Village
- Triple Island Pilot Station
- Highway
- Road
- Railway
- International Boundary
- Watercourse
- Park, Protected Area, Ecological Reserve, or Conservancy
- First Nation Reserve
- Treaty Lands
- Waterbody
- Prince Rupert Port Authority Boundary
- Project Location

Asserted Traditional Territories

- Gitga'at First Nation[1]
- Gitxaala Nation
- Kitsumkalum First Nation[2]
- Metlakatla First Nation
- Lax Kw'alaams Band
- Kitselas First Nation[2]

Data Sources: Government of British Columbia: DataBC, Terrain Resource Information Management, National Topographic System, BC Stats, BC Oil & Gas Commission. Government of Canada: CanVec v12, National Hydrology Network, Atlas of Canada National Framework, Fisheries and Oceans Canada, Environment Canada, Natural Resources Canada. INPEX Gas British Columbia Ltd. Nexen Energy ULC.Service Layer Credits: Copyright:© 2014 Esri

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ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

ASSERTED TRADITIONAL TERRITORIES OF ABORIGINAL GROUPS IN THE PROJECT AREA

Projection:UTM Zone 9 Datum: NAD 83	Fig. ID:123220054 Date: Nov 07, 2016	Drawn By: RC Checked By: TB	FIGURE NO: **1-3**

- City, Municipality, or Town
- Community, Locality, or Village
- Triple Island Pilot Station
- Highway
- Road
- Railway
- Watercourse
- Park, Protected Area, Ecological Reserve, or Conservancy
- First Nation Reserve
- Waterbody
- Prince Rupert Port Authority Boundary
- Shipping Route
- Pilot Boarding Zone
- Project Development Area

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ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

SHIPPING ROUTE

Projection:UTM Zone 9 Datum: NAD 83	Fig. ID:123220054 Date: Sep 08, 2016	Drawn By: RC Checked By: SW	FIGURE NO: **1-4**

1.2.3 Project Background and History

Following an initial screening of potential LNG facility sites in the Prince Rupert area, Aurora LNG selected two sites of interest for further site assessment and evaluation: Grassy Point and Digby Island. Initial engagement with Aboriginal Groups regarding the proposed Project and site investigation activities started in November 2013. In June 2014, Aurora LNG submitted a Project Description to the BC EAO and the Canadian Environmental Assessment Agency (CEA Agency) for both the Grassy Point and Digby Island sites. In August 2014, the BC EAO issued a Section 11 Order outlining the scope of the environmental assessment. This Section 11 Order was amended by a Section 13 Order in December 2014.

Based on a comprehensive evaluation of both sites, Aurora LNG made the decision to move forward with further site evaluation work at Digby Island at the end of 2014. In January 2015, Aurora LNG notified the BC EAO of the decision to proceed with the Digby Island site, withdrew the Grassy Point site from the environmental assessment process, and submitted a revised Project Description for the proposed LNG Project at Digby Island. In November 2015, the BC EAO issued the Application Information Requirements (AIR) for the Project, outlining the information required in the Application.

Aurora LNG has continued to advance the understanding of site conditions at Digby Island through ongoing geotechnical and environmental assessment programs throughout 2015 and 2016. This information has supported continued refinement of the location of marine and land-based infrastructure. Aurora LNG has continued to engage and consult with Aboriginal Groups, stakeholders and municipalities since the initiation of the Project and incorporated feedback, wherever practical. A description of changes made to the Project design as a result of feedback obtained during consultation is outlined in Section 1.2.9

1.2.4 Project Phases

The Project will occur in three phases: construction, operations, and decommissioning. The duration and anticipated schedule for each phase are shown in Table 1-2. The anticipated schedule is based on approvals and a positive final investment decision in 2020.

Construction of the proposed Project is anticipated to occur in phases and is described in further detail in Section 1.2.6. The first phase will include the construction of two liquefaction trains with a design capacity of 10–12 MTPA of LNG, two LNG storage tanks, and the marine terminal. The planned commissioning and first shipment of LNG is expected to occur in 2026. Full design build-out will include an additional two liquefaction trains and an additional LNG storage tank, with a planned ultimate design capacity of approximately 24 MTPA of LNG. The timing of subsequent phases to full build-out will depend on a variety of factors including, but not limited to, LNG market conditions, Project economics, and the labour market.

The Project is anticipating a minimum 25 year operating life, followed by decommissioning, which will occur in accordance with all applicable regulations at that time.

Table 1-2 Project Phases, Duration, and Anticipated Schedule

Project Phase		Duration	Anticipated Schedule
Construction	Site Preparation	2 years	2020-2022
	Onshore Construction (Phase 1)	3 years	2022-2025
	Dredging, including disposal at sea	3 years	2020-2023
	MOF Construction	1-2 years	2020-2022
	Marine Terminal Construction	2-3 years	2021-2024
	Commissioning and Start Up (Phase 1)	1 year	2025
	Construction and commissioning (Phase 2)	3 years	Market driven
Operations		25 years minimum	2026-2051+
Decommissioning		2 – 5 years	2052+ (will start approximately 12 months after the end of operations)

1.2.5 Project Components

The key Project components are summarized in Table 1-3.

Table 1-3 Key Components of the Project

Component	Description of Infrastructure / Activity
LNG Facility	▪ Feed gas reception system ▪ Feed gas treatment system ▪ Natural gas liquefaction system ▪ Four liquefaction trains with gas turbine driven compressors, with full build-out capacity of approximately 24 MTPA ▪ Liquefaction refrigerant storage ▪ LNG storage tanks ▪ Natural gas liquids (NGL) storage tanks and infrastructure for staging and loading of NGLs ▪ Process heat system ▪ Boil-off gas recovery system ▪ Flare system ▪ Control room
Marine Terminal	▪ Marine jetty, with up to two LNG carrier (Q-flex) berths (at full build-out) ▪ Pipe-rack corridor between the LNG facility and marine terminal ▪ LNG loading, including a conventional trestle, loading platform, loading and offloading arms ▪ Dredge areas around each berth to enable sufficient depth for LNG vessels

Table 1-3 Key Components of the Project

Component	Description of Infrastructure / Activity
Supporting Infrastructure	▪ MOF and associated dredge pocket to enable safe access ▪ Laydown areas ▪ Soil storage area ▪ Nitrogen and compressed air equipment ▪ Water supply system, including ocean water intake, pump station, desalination plant and supply pipelines ▪ Site stormwater management system ▪ Wastewater collection and treatment system ▪ Solid waste management system ▪ Power generation and supply ▪ Safety systems, including safety instruments, fire protection and safety measures ▪ Administration buildings, storage facilities and medical centre ▪ Facility and maritime security ▪ Heliport for emergency evacuation ▪ Camp for operations, maintenance, and turnaround personnel ▪ Access road ▪ Haul roads
Temporary Infrastructure and Facilities (Construction-related)	▪ Pioneer facility ▪ Laydown areas ▪ Construction camp ▪ Construction offices
Shipping	▪ Supporting marine activities during construction ▪ Shipping between the marine terminal and the pilot boarding location at Triple Island during operations, including approximately 160 to 320 LNG carrier visits each year at full build-out

The conceptual layout of the Project components at full build-out is illustrated in Figure 1-2. The site layout has evolved through the initial stages of Project design as a result of the incorporation of technical and environmental information, and input from Aboriginal Groups and key stakeholders. The site layout and equipment list will be further refined as the Project progresses through front end engineering design (FEED) and in consideration of potential areas of environmental and archaeological concern, but the extent of on-land development will remain within the PDA.

The LNG process trains, flare, utilities and laydown areas will be located on the east side of the site. The northern interior portion of the site will hold the camp, power plant, administration and warehouse buildings. Three LNG storage tanks (at full build-out) will be positioned on the south end, near the marine terminal. The soils storage area will be located to the west of Delusion Bay to accommodate the excess soils and rock excavated during Project construction that will not be required for the development and construction of the site areas, and for on-land disposal of dredged material.

Project design includes allowance for a 30 m marine riparian disturbance buffer, except where infrastructure access to the marine environment is required (e.g. Marine Terminal and MOF), or for safety or security considerations. On the east side of Digby Island this buffer will be of variable width, extending

beyond the 30 m minimum in some areas, to reduce or avoid impacts to heritage sites and culturally modified trees (CMTs) within those areas, and to reduce potential impacts to environmental features.

1.2.5.1 LNG Facility

The LNG facility will include land-based modular units for receiving and processing natural gas into LNG. The facility will include the infrastructure required to receive natural gas from the supply pipeline, gas pre-treatment, gas liquefaction and LNG storage and loading.

Construction of the LNG facility will occur in phases, with two LNG trains constructed during the first phase. Two additional LNG trains will be constructed as required by market conditions. Full build-out capacity will be approximately 24 MTPA. The exact phasing and optimization of the train size and layout will be established during FEED.

Figure 1-5 provides a block flow diagram for Phase 1 of the LNG facility. The diagram shows two parallel trains with common facilities and utilities, refrigerants storage, and LNG storage and loading. The common facilities will include the fire water system, the pressure relief and blowdown unit, and the drainage and effluent treatment facility. The additional two trains required for full build-out will have the same configuration as shown for the initial phase.

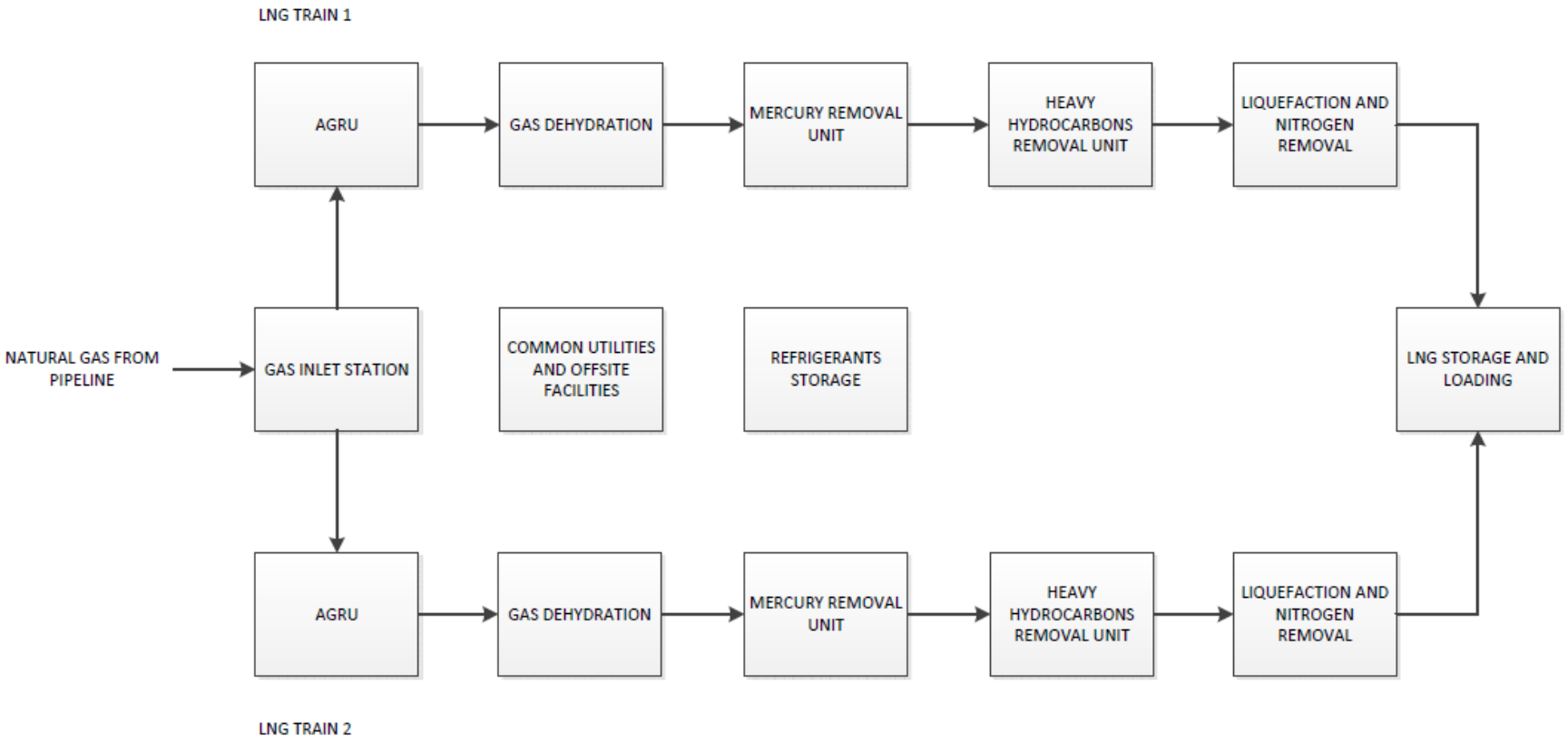


Figure 1-5 Block Scheme for the LNG Facility, Phase 1

The natural gas supply (also known as feed gas) pipeline will enter the property boundary via a dedicated pipeline delivery station. Although discussed here for context, the third party feed gas pipeline is not included in the scope of the Project. The pretreatment, processing and LNG production facilities and processes are described below.

FEED GAS TREATMENT SYSTEM

The feed gas will be cleaned by separating off impurities and various non-methane hydrocarbons and fluids for safety of the process and to ensure that the composition of the final LNG product meets end-use specifications. Carbon dioxide (CO_2) and hydrogen sulphide (H_2S) will be removed in the acid gas removal unit (AGRU). The feed gas will then undergo dehydration to remove water to prevent freezing during the liquefaction process. Any mercury in the feed gas will be removed to prevent corrosion of the cryogenic equipment.

The feed gas treatment infrastructure will include the following:

- AGRU — The AGRU will remove CO_2 and H_2S (collectively referred to as acid gas) using an amine solvent. This treatment process is widely used in natural gas processing plants and LNG facilities. The absorbed acid gases will be stripped from the solvent in an amine regeneration unit and sent to a thermal oxidizer where H_2S is oxidized to sulphur dioxide (SO_2) and the residue hydrocarbon incinerated. The treated gas will then be routed to the gas dehydration unit.
- Gas Dehydration Unit — The gas dehydration unit will remove water from the gas stream using molecular sieves to prevent ice or hydrates from forming in the downstream liquefaction unit. Condensed water from the regen gas will be recovered into a closed drain system.
- Mercury Removal Unit — Any amount of mercury present in the gas stream can cause corrosion and damage in the liquefaction unit. Mercury will be removed using fixed bed adsorption processes. As mercury is a regulated hazardous waste in BC, the bed material will be handled, transported, treated and disposed of in accordance with regulatory requirements.
- Heavy Hydrocarbon Removal Unit — The heavy hydrocarbons removal unit will be installed to recover C5+ and BTEX components to prevent freezing in the liquefaction process piping. The recovered liquids can be used as fuel, burnt in a thermal oxidizer, or if sufficient volume can be recovered, stored in onsite tanks for use as fuel or for sale to markets. The various technology options for this service will be studied further in FEED.

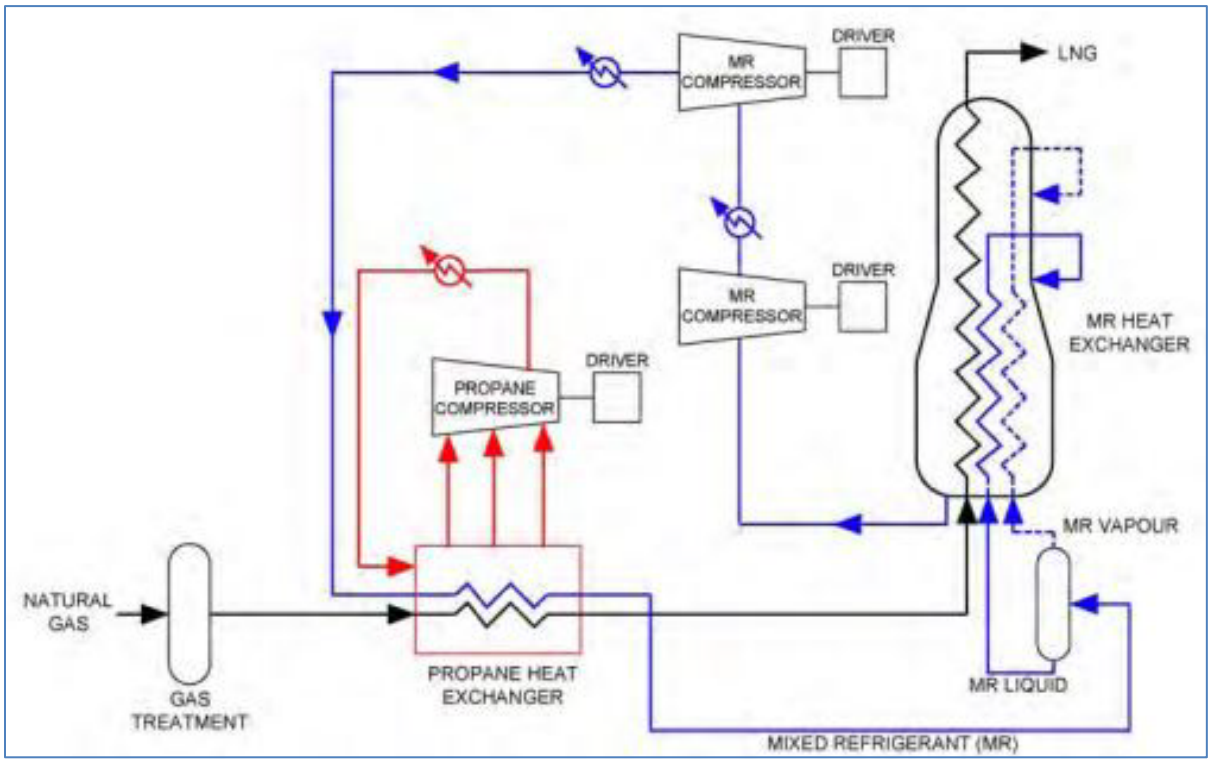
The feed gas treatment system will include bulk storage of “fresh” amine and a storage area for demineralized water. Transfer pumps from both the amine storage and demineralized water storage will allow makeup for amine solution losses within the Amine System. The recirculating amine solution will may also require corrosion inhibitor, anti-foam and/or other chemical injection.

NATURAL GAS LIQUEFACTION SYSTEM

Gas leaving the heavy hydrocarbons removal unit will be routed to the liquefaction unit of the facility, where it will be condensed into a liquid by cooling it to a cryogenic temperature of approximately -162°C. In liquid form, the natural gas will be reduced in volume by approximately 600 times at near normal ambient pressure, allowing it to be efficiently and safely stored and shipped by sea. Each LNG train will have a heat transfer system with large banks of air-cooled heat exchangers. An extensive evaluation of cooling options has concluded that conventional air cooled heat exchanger designs are the most appropriate option for the Project.

At full build-out, the design production rate from the liquefaction facility into the LNG storage tank will be approximately 24 MTPA, which may include boil off gas (BOG). This MTPA estimate will be optimized and refined during FEED. No liquefaction facility technology decisions have been made at the time of submitting this Application; however, based on current technologies, the technologies under consideration are the Air Product and Chemicals Inc. (APCI) propane pre-cooled mixed refrigerant (C3MR) and the ConocoPhillips Optimize Cascade processes. The Shell dual mixed refrigerant (DMR) liquefaction process is also being considered.

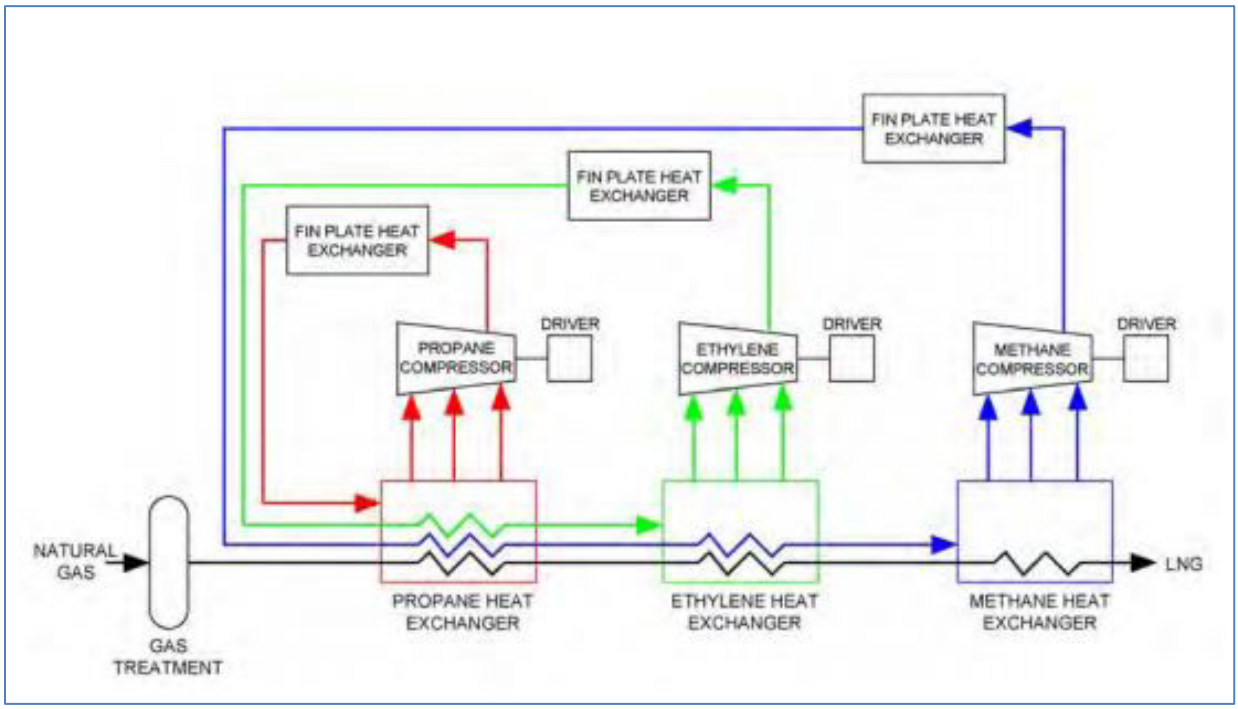
Figure 1-6 illustrates a single liquefaction train for the APCI C3 MR concept.



SOURCE:
CH•IV International 2015

Figure 1-6 APCI C3 MR Liquefaction Train Schematic

Figure 1-7 illustrates a single liquefaction train for the ConocoPhillips Cascade concept.



SOURCE:
CH•IV International, 2015

Figure 1-7 ConocoPhillips Cascade System Liquefaction Train Schematic

PROCESS HEAT SYSTEM

A closed-loop, circulating process heating system will provide process heating requirements for the amine regeneration unit, feed gas heaters, fractionation reboiler, regeneration heater, and make-up fuel gas heaters. Waste heat recovered from gas turbine drivers of the liquefaction units will be used to heat the heating fluid and the molecular sieve regeneration gas.

STORAGE TANKS

Once produced, LNG will be stored at atmospheric pressure in insulated LNG storage tanks. These tanks will be placed on insulated pads to prevent heat ingress through the tank floor and to maintain an average temperature of -162°C. A total of three LNG storage tanks will be required at full build-out; two LNG storage tanks will be required for the first phase, with one additional tank for the second phase. Each tank is currently planned to have an approximate capacity of 195,000 m^3. LNG storage tanks will be approximately 85 m in diameter with a height of approximately 55 m (to top of dome). The LNG storage tanks will be either full containment type with outer concrete walls and roof, or membrane type. The LNG storage tank area is located at the south end of the PDA near the marine terminal and is approximately 7 ha in size.

The liquefaction refrigerants will be stored in pressurized storage tanks and will be located in the utilities area between the LNG storage tanks and the liquefaction trains. The pressurized storage tank capacity for refrigerant components (ethane, ethylene, propane or other common refrigerants) will be sized based on the inventory in the liquefaction process. The source of refrigerants has not been decided as this will depend on the final technology selection, which will be determined in FEED.

Depending on the source of feed gas for full build-out, if present in sufficient quantities, NGL storage may be added within the storage tank area. NGL will either be used for use as fuel or transported offsite to market.

Climatic and seismic conditions will be considered during design and construction material selection for all storage tanks. The final size, location, type and number of the tanks required for full site build out will be determined during FEED.

BOIL-OFF GAS RECOVERY SYSTEM

A system will be installed within the LNG tank area to recover and compress boil-off gas (BOG) vapours from the tanks and ships vapor during loading operation. Recovered BOG will be used as fuel by the plant.

FLARE SYSTEM

A flare system will be required to provide reliable and safe disposal of liquid and vapour hydrocarbons during upset and emergency conditions, and during operational controlled events such as startup, shutdown, venting and purging. Gas flaring is not expected to occur during normal operating procedures, and is expected to occur only on an occasional basis (e.g. during maintenance events).

The flare system will include the following subsystems:

- A wet gas flare – emergency/operational system for wet and acid gases from the Feed Gas Treatment Facility.
- A dry gas flare – emergency/operational system for cold and dry hydrocarbon streams from the Liquefaction Facility.
- A boil off gas (BOG) flare – emergency/operational system for low pressure streams from LNG storage and loading.

A wet gas flare is provided in LNG export facilities that incorporate pre-treatment units to clean the natural gas feed removing the acid gases (primarily CO_2, H_2S, and trace compounds), mercury and other contaminants that will react with and freeze out and block downstream equipment located in the cryogenic section of the plant. During upset conditions, wet natural gas and acid gases may need to be relieved, and the wet flare is designed to accommodate such gases. During normal operations any wet acid gases are disposed of via a dedicated thermal oxidizer rather than a flare.

A dry gas flare will collect cold and dry hydrocarbon streams that result from the liquefaction unit upsets or operating conditions such as start-up, shutdown, venting, draining and de-inventorying equipment for maintenance, gas purging, and heating or cooling of equipment or piping.

The low pressure BOG flare is designed to collect vapour releases from the LNG storage tanks and the loading dock area.

Aurora LNG is evaluating two flare system options: an elevated flare derrick, and a low profile multi-point ground flare system. Both options have been assessed in the Application.

The elevated flare derrick system will be located to the southwest of the natural gas liquefaction trains 1 and 2 (Figure 1-2). The wet and dry flares are typically installed in a common derrick structure. The dry gas flare design load typically determines the height of both flare stacks. The dry gas flare area will have a 150 m radiation radius and a 150 m height. The BOG flare area and the wet gas flare area will both have a radiation radius of 80 m and a height of 100 m. Each flare stack will have an approximate inside diameter of between 1 m and 1.7 m.

The ground flare system will be sited in approximately the same location as the elevated flare stack system. The low profile multi-point ground flare system uses many smaller diameter flare tips close to grade.

For either flaring system, there will be a continuously operational flare pilot for readiness to address emergency situations. The final flare system design, location and dimensions will be confirmed during FEED.

CONTROL ROOM

A continuously staffed control room will be established, either within the administrative building area located towards the north end of the PDA or in Prince Rupert.

1.2.5.2 Marine Terminal

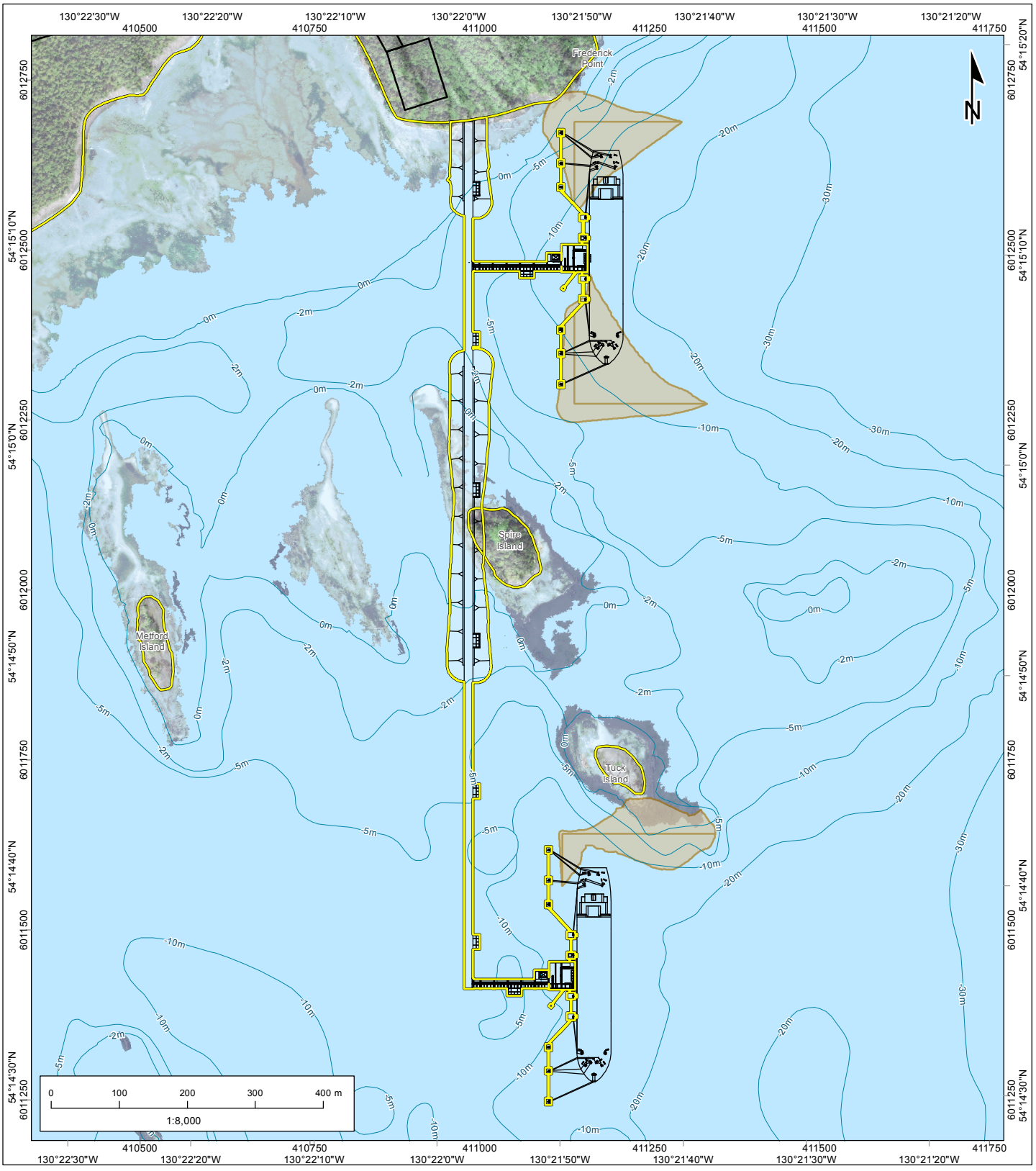
It is anticipated that the marine terminal will consist of a marine jetty with up to two LNG carrier (Q-Flex) berths (at full build-out); a pipe-rack corridor between the LNG facility and marine terminal; and LNG loading, including a conventional trestle, loading platform, loading and offloading arms.

MARINE JETTY

The Project will include a marine jetty and LNG loading facility capable of accommodating up to Q-Flex LNG carriers (315 m length, 50 m beam and 109,500 dead weight tonnage (DWT)), with a LNG cargo capacity of up to 217,000 m^3. At full build-out, the marine jetty will include two carrier berths, oriented to allow carrier approach, moorage and departure with the bow into the prevailing southeast wind and wave direction.

The marine jetty is anticipated to be a combination of both earth fill causeway and conventional pile-and-deck structures; with pile supported LNG berths (Figure 1-8). For the access trestle portion of the marine jetty, an earth fill causeway section is currently planned to originate from the shore abutment near Fredrick Point progressing southwards to an approximate water depth of 3 m (-3 m chart datum). At this point the access trestle will transition to a pile-and-deck structure which will continue south towards Spire Island. Where the water depth shallows to -3 m chart datum the access trestle will again transition to an earth fill causeway until water depths increase south of Spire Island. A final transition to a pile-and-deck trestle will occur towards the second LNG berth. The access trestle is approximately 1275 m long to access deeper waters for the berthing of LNG carriers. The structural design and location of the marine jetty will continue to be refined as the Project design progresses.

It is anticipated that dredging will not be required at the turning basin or along the marine approach as water depths are adequate to accommodate up to Q-Flex carriers. However, dredging is anticipated to be required at the berth pockets (see Figure 1-8).



Bathymetric Contour
Project Component
Dredge Area
Project Development Area

Data Sources: Government of British Columbia: DataBC, Terrain Resource Information Management, National Topographic System, BC Stats, BC Oil & Gas Commission. Government of Canada: CanVec v12, National Hydrology Network, Atlas of Canada National Framework, Fisheries and Oceans Canada, Environment Canada, Natural Resources Canada. INPEX Gas British Columbia Ltd. Nexen Energy ULC.

aurora LNG
COMMUNITY COMMITMENT CONNECTION

ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

MARINE INFRASTRUCTURE JETTY DESIGN

Projection: UTM Zone 9 Datum: NAD 83	Fig. ID:123220054 Date: Oct 21, 2016	Drawn By: RC Checked By: JM	FIGURE NO: **1-8**

PIPE-RACK CORRIDOR

A corridor between the LNG facility, the LNG storage tank area and the marine terminal will contain the pipe-rack for cryogenic rundown lines, cool-down lines, fuel gas line from the BOG compressors, and utilities. The final configuration and layout of the pipe-rack corridor within the PDA will be determined during FEED.

LNG LOADING

The LNG will be delivered from the storage tanks area to the berth through pipelines supported on an elevated pile-supported trestle (see Figure 1-8). The trestle has a width of approximately 13 m. The final configuration and layout of the LNG loading corridor within the PDA will be determined during FEED.

The loading of LNG carriers will be conducted from loading platforms located off the shoreline at the end of the marine jetty. Loading arms at each berth will transfer the LNG onto the LNG carriers, and a vapour return arm will transfer BOG back to the LNG facility. It is anticipated that the LNG carriers will be loaded at a maximum loading rate of 12,000 m^3/hour, and will typically be at berth for approximately 24 hours. The facility may allow concurrent loading of carriers at adjacent berths.

Risk reduction features for the safe loading of LNG have been considered, including the Society of International Gas Carrier and Terminal Operators (SIGTTO) *Information Paper No 14, Site Selection and Design for LNG Ports and Jetties, August 2000.*

1.2.5.3 Supporting Infrastructure and Facilities

MATERIAL OFFLOADING FACILITY

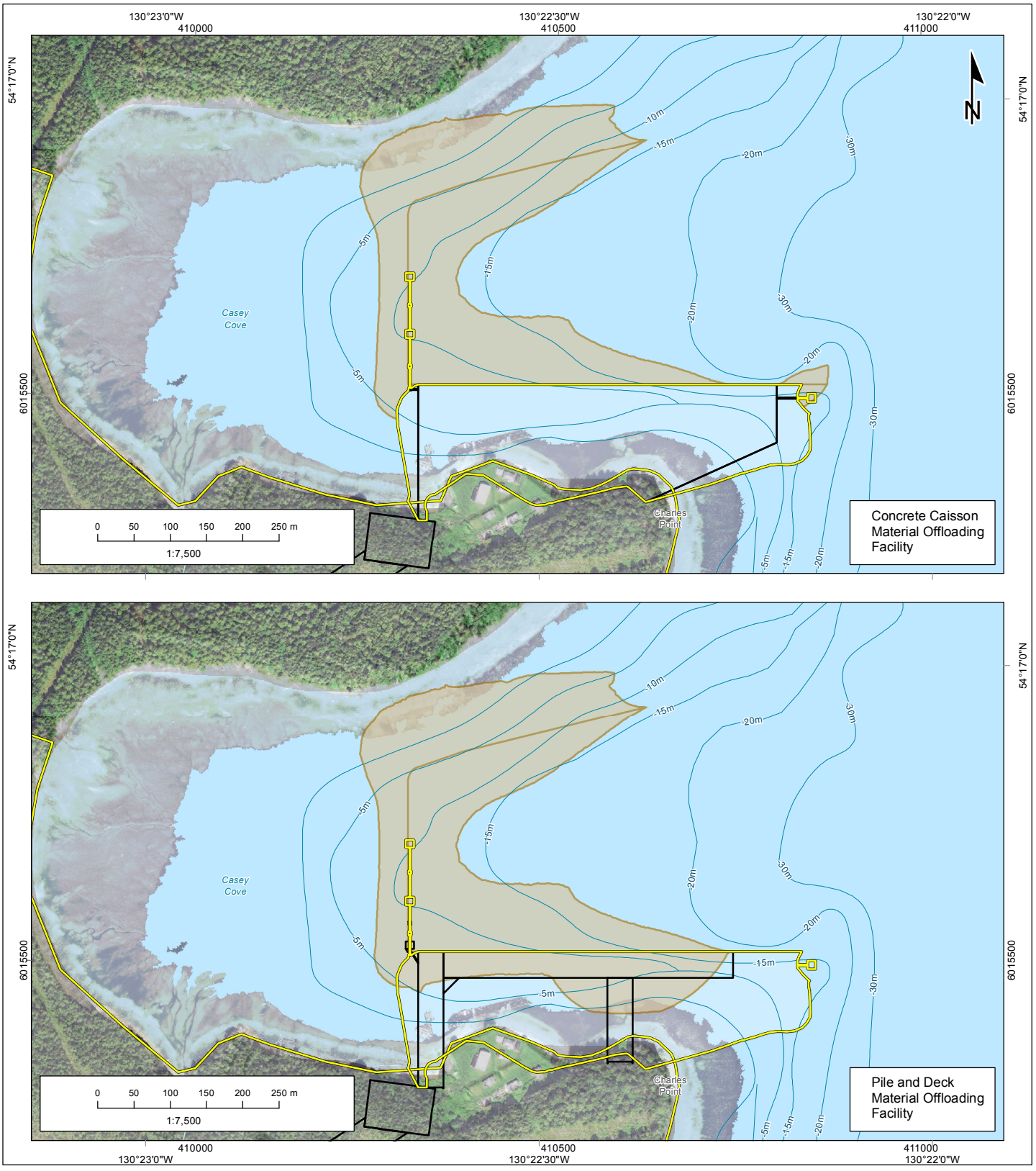
The MOF is planned to be located at the southern portion of Casey Cove and connected to the main site by a heavy haul road (Figure 1-9). The MOF will provide for the safe berthing of heavy lift and roll on/ roll off vessels, and transportation of large loads including modules. The MOF will continue to be used over the life of the Project to receive or dispatch shipments such as refrigerant, containers, rotating equipment and rotor transport canisters from ro-ro vessels.

Two MOF design options are assessed as part of the Application: pile-and-deck and concrete caisson (Figure 1-9). Both design options will require dredging of marine substrate during construction to accommodate vessel access, and will include three berthing dolphins to secure docked vessels. For either option, each dolphin will likely consist of four 1.5 m diameter steel pipes installed on the western edge of the dredge basin, and the dolphins will be connected to one another and the main wharf by means of a raised catwalk.

The pile-and-deck MOF design involves a wharf structure running east to west, parallel to the shoreline, measuring approximately 400 m by 35 m (Figure 1-9). The wharf will be connected to land by an unloading access trestle (approximate dimensions 185 m by 35 m) that will join the shore approximately 330 m west of Charles Point. A secondary, smaller (115 m by 35 m) access trestle may be installed on the north shore of Charles Point to further facilitate and expedite vessel loading and unloading. The wharf and access trestle(s) will be supported by approximately 525 piles, likely 1.5 m diameter steel pipe. Piles will likely be installed using an impact hammer through overburden and drilled or vibrated into the underlying till.

The concrete caisson MOF design involves a solid-structure wharf, composed of up to 12 precast concrete open box-like caissons (approximately 15 m wide by 45 m long and 18 high) installed on the seafloor and backfilled with ballast or rock fill (Figure 1-9). Prior to installation of the caissons, the seafloor will be prepared by installing a levelling pad, likely of crushed rock. After the caissons are backfilled with crushed rock, the topside platform (formed of precast cover slabs) will be installed at an elevation of 10.5 m CD. The resulting wharf will be approximately 455 m long and 35 m deep. The wharf may be connected to land by a concrete-deck access, measuring 115 m long and 35 m wide, oriented perpendicular to the wharf face. The wharf and access deck will border a laydown area, founded on infill.

The final configuration and structural design of the MOF will be determined during FEED, and will depend on the results of additional geotechnical studies and confirmation on the size of modules required for the Project.



Road

Bathymetric

Project

Dredge Area

Project Development Area

Project Development Area shown represents the largest extent of the project infrastructure options.

Data Sources: Government of British Columbia: DataBC, Terrain Resource Information Management, National Topographic System, BC Stats, BC Oil & Gas Commission. Government of Canada: CanVec v12, National Hydrology Network, Atlas of Canada National Framework, Fisheries and Oceans Canada, Environment Canada, Natural Resources Canada. INPEX Gas British Columbia Ltd. Nexen Energy ULC.

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ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

MATERIAL OFFLOADING FACILITY DESIGN OPTIONS

Projection: UTM Zone 9 Datum: NAD 83	Fig. ID:123220054 Date: Oct 21, 2016	Drawn By: RC Checked By: JM	FIGURE NO: **1-9**

LAYDOWN AREAS

The PDA will encompass land for the laydown and storage of materials for train maintenance. Site configuration will be designed to allow for unencumbered access to the area for construction of future trains, once the first phase is in operation.

SOILS STORAGE AREA

Preliminary cut and fill material balance analyses indicate there may be significant amounts of unusable and excess material (e.g., potentially acid generating [PAG] and structurally unsuitable material) that will result from site preparation and grading activities.

To accommodate this excess material, an onsite area will be developed to store and manage excess soils. This area will be located on the west side of Delusion Bay where there is sufficient space to accommodate the anticipated volumes of materials. In addition to providing secure containment, the area will be sited and designed to manage surface water runoff. This will likely be accomplished through the development of cells that have a perimeter berm constructed out of rock and/or fill. Internal berms will be placed within the organic soils storage area to separate materials into individual cells. The ultimate size, height and configuration of the soils storage area will be determined as Project design progresses and additional geotechnical information is acquired. The design will accommodate the final calculated volumes and types of spoil material, and will be designed in a manner which will promote the re-establishment of natural vegetation. The design will also take into account any Navigation Canada land use requirements so as to ensure terrain changes do not conflict with airport operations or aviation safety.

WATER SUPPLY

The Project will require fresh (potable) water for drinking, process water (demineralized water), power plant cooling water system, utility water and firewater. Additional water demands for construction and commissioning of the facility may include water for dust suppression, civil construction works and hydrostatic testing. It is anticipated that desalinated sea water will supply the majority of the Project's water requirements during construction and operations.

During construction, a temporary potable water treatment system will be brought in to desalinate sea water until the permanent water supply system was constructed and operational. Potable water demands during construction are estimated at 1,125 m^3/day. Any additional volumes required for activities such as dust suppression and civil works will be confirmed as Project design progresses.

For early construction works (i.e., site preparation), Aurora LNG may also evaluate transporting municipal water by barge from the Prince Rupert port to the MOF, where it will be dispensed to a water storage tank. Treated water will be used for domestic uses and civil works. Untreated water will be used for general construction activities, such as dust control. It is anticipated that early construction work activities may require one barge per day to bring municipal water to site.

Hydrostatic testing during commissioning of the LNG facility is also anticipated to use desalinated sea water. With the exception of the LNG storage tanks and select process equipment, the majority of the liquefaction train will be pneumatically tested, rather than hydrostatically tested, to prevent residual moisture that can lead to ice build-up during operations. Preliminary volumes for hydrostatic testing are estimated at approximately 210,000 m^3, as water from the first storage tank will be reused for testing of the second storage tank, with additional top-up water if required.

During operations, desalinated sea water will supply potable water, demineralized water, power plant cooling water, utility water and firewater. The total projected operational water demand for the Project at full build-out is estimated to be approximately 9,855 m^3/day. This volume will be optimized and finalized during FEED.

The desalination water supply system will include a pump station, marine intake, water supply pipeline (Figure 1-2) and desalination plant. The intake design will comply with all relevant provincial and federal legislation and guidelines in effect at the time detailed design is undertaken. Approximately 20,000 m^3/day of seawater is anticipated to be required to meet the projected operational water demand of 9,855 m^3/day.

The conceptual design includes an approximately 430 m long intake pipeline, with a shoreline terminus in the vicinity of the MOF that follows a curvilinear path to an intake structure located at the mouth of Casey Cove in a water depth of -27 m CD. This terminus depth is required to meet both the regulatory requirements of a minimum of 25 m water depth above the intake and the practical requirements to be below the deepest depth of the halocline and thermocline (to maintain consistent water quality throughout the year). Chlorine will be injected at the intake terminus to mitigate marine organism attachment to the inside of the pipe. The intake pipeline will be buried through the intertidal zone and placed directly on the seabed through the subtidal area, with adequate weighting to provide both horizontal and vertical stability. The intake pipeline will terminate at a pump station which will be located at or near the shoreline. The pump station will likely include a common intake gallery and two mirror image screen/pump chambers designed for 100% of the design flow. The screens will be washed from the inside, and the wash water with anything impinged, will be returned to the ocean through a wash water return line. A pipeline will transport seawater from the pump station to the desalination plant, which is currently anticipated to be located at the north end of the facility site adjacent to the power plant. The final design and location of the water supply system will be confirmed during FEED.

WASTEWATER MANAGEMENT

CONSTRUCTION

During the construction phase, site preparation will include clearing and grubbing, potential dewatering, soil stabilization, backfill and grading activities prior to the installation of permanent infrastructure. During site preparation, a temporary drainage and stormwater system will be established to collect and control stormwater flows and runoff from the PDA. The system will include internal and perimeter ditches, and erosion and sediment control measures that are appropriately designed for local site conditions. Some dewatering will likely be required during construction. Where excavations may accumulate water, sumps with submersible pumps may be installed at the edge of the excavated area.

During the initial few months of site preparation, and prior to establishing the marine outfall(s), relatively low runoff volumes will be allowed to drain through silt fences (or other appropriate erosion control measures) before discharging to vegetated areas and natural drainfages. Surface runoff from construction areas will be collected in ditches and treated in smaller sediment traps or larger sediment ponds, prior to discharge to either the freshwater or marine environment. All discharges to the freshwater and marine environments will meet applicable discharge criteria.

A sanitary sewage facility will be established as part of the camp system for use during the construction and operations phases. Treated sewage effluent will be discharged in marine waters through a deep water marine outfall once it meets waste discharge requirements. Sewage sludge will either be transported off site and disposed at an approved landfill or incinerated onsite, as approved by the

appropriate regulatory agencies. Prior to establishing the sewage site facilities, portable toilets will be available onsite with offsite disposal to a licensed facility.

The location of the marine outfalls will be finalized during FEED but may include a deep water marine outfall off Charles Point and a shallow marine outfall to the west of the marine terminal (between Fredrick and Miller Point) (see Figure 1-2).

OPERATIONS

The design of the facility will include provision for wastewater collection, segregation and treatment, prior to discharge to the marine environment. Discharge of treated wastewater will meet or exceed regulatory requirements.

Wastewater generated during operations of the Project may include:

- Treated sanitary wastewater (sewage and grey water)
- Stormwater runoff from non-process areas
- Runoff from the soils storage area
- Stormwater runoff from LNG process areas
- Oily waste from natural gas pre-treatment
- Reject water from the demineralized water unit
- Saline wastewater from the desalination plant
- Blowdown from the power plant cooling tower
- Ballast water.

Sanitary wastewater will be pumped to the treatment units where the wastewater will undergo biological oxidation, clarification and chlorination. The type of treatment will be determined during final design. The treated water will be monitored prior to discharge to verify that it meets all applicable federal and provincial regulatory requirements. Treated sanitary wastewater will be discharged through a deep water marine outfall currently planned to be located on the east side of Digby Island off Charles Point (Figure 1-2).

During the operations phase, stormwater runoff from roads and non-process areas will drain into a drainage ditch system with subsequent discharge into vegetated areas and natural drainages.

The soils storage area will be re-vegetated, where possible, following completion of the major earthworks portion of construction. Drainage patters will be established to manage runoff and appropriate erosion control measures will be put into place.

All runoff from process areas will be treated and directed to a detention basin for water quality testing prior to release to the environment through a shallow marine outfall.

Oily waste from natural gas pre-treatment will be collected and stored onsite in approved containers prior to transport by barge and disposal off-site in accordance with standard waste management practices and applicable regulations.

Wastewater from the desalination plant and reject water from the demineralized water unit will be combined with the power plant cooling tower blowdown and discharged through a deep water marine

outfall (Figure 1-2). Based on preliminary design, it is estimated that there will be approximately 500 m^3/d of cooling tower blowdown. The temperature of wastewater discharged through the deep water marine outfall will be determined during FEED, and will meet regulatory guidelines, outside of a small mixing zone, for the protection of aquatic life.

Aurora LNG will require that LNG carriers comply with all relevant national and international shipping requirements regarding disposal of waste and ballast water discharge. In accordance with International Maritime Organization guidelines (TC 2012), which helps prevent the introduction of invasive marine species, the Ballast Water Control and Management Regulations require that all vessels either treat their ballast water prior to discharging in waters under Canadian jurisdiction, or exchange their ballast water at deep sea prior to entering Canadian coastal waters. The Vessel Pollution and Dangerous Chemicals Regulations require that vessels must not discharge sewage or sewage sludge, and that the release of greywater must not result in deposition of solids in the water or leave a sheen.

SOLID WASTE MANAGEMENT SYSTEM

A waste disposal management plan will be developed prior to site construction to manage solid wastes in accordance with the BC *Environmental Management Act* (EMA) and the federal *Transportation of Dangerous Good Act* and *Canadian Environmental Protection Act, 1999*.

Anticipated solid wastes during construction may include:

- Solid wastes from shipment and construction of Project components, including packing materials
- Solid domestic or industrial waste from the construction camp.

Anticipated solid wastes during operations may include:

- Solid domestic and industrial waste from LNG facility operations and maintenance
- Solid waste from LNG processes (e.g. dewatered sludge, spent catalyst)
- Solid waste from LNG carriers including plastic, ash, and packaging materials.

Anticipated hazardous waste during operations may include:

- Trace mercury (removed during treatment of natural gas)
- Waste catalysts and absorbents, including filters
- Medical waste.

Non-hazardous solid wastes will either be recycled (e.g., scrap metals, paper products and containers) or reused or collected in a central secure area onsite, and transported to Prince Rupert for recycling or disposal at a local landfill or other licensed waste receiver facility. Sludge generated from the water treatment processes will be dewatered onsite. Dewatered sludge will be sent to a third party for disposal. Aurora LNG is considering the option of waste management using an onsite incinerator.

Hazardous waste will be managed separately from other solid wastes. They will be stored in an enclosed building onsite in approved containers and disposed of by a licensed facility by licensed contractors. Hazardous wastes will be transported off-site in compliance with the *Transportation of Dangerous Goods Act* and regulations, the Cargo Fumigation and Tackle Regulations, and the International Maritime Dangerous Goods Code.

POWER SUPPLY

Power supply during construction is anticipated to be provided by a combination of electric power from the existing BC Hydro grid and self-generation by natural gas or diesel-powered generators.

During operations, the LNG liquefaction trains are expected to utilize natural gas-fired turbines for the refrigeration compressor drivers.

The LNG facility and marine terminal will require electrical power to operate supporting facilities and infrastructure. Approximately 250 megawatts (MW) of power will be required at full build-out to drive the balance of LNG facility equipment, excluding the refrigeration compressors.

This will be provided by the installation of an onsite power generation facility capable of supplying the additional required electrical power. Final decisions regarding the type of power generation and capacity will be confirmed during FEED; however, the preliminary design that is being assessed is a combined cycle natural gas power plant with a recirculating cooling tower. See Section 1.7.1 for a discussion of power supply alternatives considered.

Diesel generators will be provided onsite during startup, and in the event of emergencies. The emergency diesel power generation system will provide approximately 2.5 MW of power during power outages for emergency lighting, security monitoring systems, electrical trace heating, control center monitoring and operations systems, fire protection and monitoring systems, hazard detection systems and the LNG sendout pump to maintain circulation in cryogenic pipeline systems.

SAFETY SYSTEMS

Safety management systems, operating procedures, and risk assessments will be used to identify potential hazards and the safety measures required to protect facility personnel, equipment and the environment. Key safety-related equipment for emergency purposes will include shutdown and depressurization systems, fire protection, and safety flare systems (including flare stacks).

A safety-instrumented system will be used at each LNG process train and the ship-loading facilities to manage the safety, shutdown and gas depressurization processes at the Project. The system will include a combination of manual and automatic shutdown and gas depressurization processes.

Fire protection and safety measures (operating procedures and emergency response plans) will be used at the Project to protect personnel and equipment. Response equipment such as fire and gas detection systems, alarms, fire extinguishers, foam systems, firewater pumps, fire response vehicles, personal protective equipment, monitors, and passive protection will be provided onsite, at appropriate locations.

BUILDINGS AND STORAGE FACILITIES

Buildings will house functions such as administrative offices, dining, recreational and medical facilities, fire station, security office and spare parts warehouse. These buildings will be located towards the north end of the LNG facility (Figure 1-2). This area will also include parking areas, a weather station, communications tower and security post. The option of providing administration support offsite is also being considered.

Chemical storage facilities will be located in the utilities area and will house substances as required by the liquefaction, water and wastewater treatment processes. Chemicals will be stored as per requirements in the material safety data sheets (MSDS).

The location of supporting buildings and storage facilities has been selected based on consideration of safe distance, prevailing wind direction and access to LNG trains. The final location of buildings and storage facilities will be confirmed during FEED.

FACILITY AND MARITIME SECURITY

The LNG facility will have 24 hour staffed security and will be surrounded by security fencing for access control.

HELIPORT AREA

A heliport is proposed to enable emergency evacuation of injured personnel to appropriate medical facilities.

CAMP FACILITIES

During facility operation, a land-based camp will be provided onsite to accommodate operations and maintenance personnel (up to 600 people), as well as personnel required during turnaround (up to 1,000 people). The camp will be a closed-access camp, meaning that Project employees will be encouraged to remain onsite for the duration of their shift. The operations camp will be in the same location as the on-land construction camp described in Section 1.2.5.4, however as the operations camp will be smaller the additional area required to accommodate the construction camp will be repurposed or revegetated.

The camp will likely consist of pre-manufactured modular units. Utilities and facilities to directly support the camp will include maintenance buildings, recreation facilities, and sanitary facilities. The camp will access other Project facilities, such as wastewater treatment and discharge system, power generation, potable water systems, and fuel supply.

The camp and associated infrastructure will comply with all applicable health and safety requirements, including WorkSafeBC, the Northern Health Authority, and applicable local, provincial, or federal regulations.

ACCESS ROAD

An approximately 4 km long access road will be required to connect the site to the Digby Island airport road. This road will primarily be used to transport workers between the airport and the site, and may also be used to transport small goods, materials and equipment imported via air cargo. It is anticipated that the access road will be approximately 15 m wide; however a 50 m wide corridor has been assessed as part of this Application. The final alignment of the access road within the PDA will be confirmed during FEED.

HAUL ROADS

To accommodate the potential for modular construction and allow receipt of large items of equipment and gas turbine/compressors, haul roads with a maximum slope of approximately 3% will be required. Haul roads will extend from the MOF and the LNG facility to the storage tank area and marine terminal, and will enable the movement of modules or pre-assembled units from the MOF. The haul road will allow for the potential transport of modules weighing up to 6,000 tonnes with a width of up to 55 m. These haul roads have an estimated total length of 3 km. The haul road will be used throughout the operational phase of the Project for the movement of bulk refrigerants required for the liquefaction process, and large gas turbine rotor canisters required for refurbishment or repair.

An additional haul road approximately 2 km in length will connect to the soils storage area from the access road.

1.2.5.4 Temporary Infrastructure and Facilities

The Project is expected to require the following temporary infrastructure and facilities during the construction phase, as shown on Figure 1-2.

- Pioneer facility
- Construction camp
- Temporary buildings, laydown areas, roads, and utilities.

PIONEER FACILITY

The pioneer facility will consist of a barge landing and a passenger boat landing. Both are intended to facilitate the early stages of site development by allowing for the transport of initial equipment, supplies, and workforce to the Project site prior to the development of the MOF.

The barge landing will consist of a beach ramp and a rock-filled causeway. The ramp will be surfaced with crushed rock to support heavy duty off-road equipment such as bulldozers and front end loaders. Three mooring piles will extend into the water from the end of the ramp to allow barges to tie-up when unloading. The passenger boat landing will consist of a floating crew dock with articulated gangway and fixed trestle/walkway connected to an earth filled causeway. The floating crew dock will be supported by four guide piles.

Material for construction of the beach ramp will initially be delivered by a grounded barge, with subsequent loads either brought in by barge or via the access road connecting to the existing airport road, once the access road is constructed. Mooring piles will be driven using conventional floating pile driving derrick. Geotechnical investigations conducted during FEED will inform the design of the beach ramp.

After establishing the beach ramp, the causeway for the passenger boat landing will be constructed from shore using a similar construction approach. The walkway, gangway, and floating crew dock will be prefabricated offsite, delivered to site on a barge, and installed. Guide piles will be driven using conventional floating pile driving derrick.

CONSTRUCTION CAMP

The number of occupants requiring accommodation is anticipated to be approximately 365 people during the initial months of construction, and will peak at up to 5,000 people by the end of the second year of construction. To support initial site preparation activities until the on-land based construction camp has been constructed, either a temporary floating camp in Casey Cove, operated by a third party, or an open camp, will be used to house construction staff. Following initial site preparation activities, a land-based camp will be provided onsite to accommodate up to 5,000 Project workers during construction. The camp will be a closed-access camp, meaning that Project employees will be encouraged to remain onsite for the duration of their shift.

If the temporary floating camp option is advanced, it is expected that it will be in place for up to 12 months and could accommodate up to 450 workers. The floating camp will likely be connected to the pioneer facility so workers could easily access land. The barge will be self-contained in terms of potable water, sewage and waste management services, and will be powered by generators.

The on-land construction camp will be located in the northern interior portion of the PDA and is estimated to be approximately 40 ha in size at full capacity (Figure 1-2). The on-land construction camp will likely consist of pre-manufactured modular units. Utilities and facilities to support the on-land construction camp will include maintenance buildings, recreation facilities, power generation, potable water systems, sanitary facilities, and fuel supply. The on-land construction camp location will be used for the camp facilities provided during operations, as described in Section 1.2.5.3.

The temporary floating camp (if required) and the on-land construction camp will comply with all applicable health and safety requirements, including WorkSafeBC, the Northern Health Authority, and applicable local, provincial, or federal regulations.

TEMPORARY BUILDINGS, LAYDOWN AREAS, ROADS AND UTILITIES

A variety of temporary buildings, laydown areas, roads and utilities will be required to support construction, including:

- Construction offices, administration offices, temporary medical facilities, sanitary facilities, and a storage warehouse
- Concrete batch plant
- Temporary laydown areas to stage or store modules, construction equipment and materials
- Temporary construction roads, site drainage systems and fencing
- Temporary utilities including water, power, gas and sewage.

1.2.5.5 Supporting Marine Traffic

During construction the following marine traffic may be required:

- Construction vessels, including roll on/roll off shipment vessels, break-bulk ships, heavy lift vessels, tugs, barges, dredging equipment and support craft
- A dedicated ferry/taxi will carry local Project workers from Prince Rupert to/from the MOF.

At full build-out, the Project will require approximately 160 to 320 LNG carrier (up to Q-Flex size) visits to the marine terminal each year, along the shipping route (see Figure 1-4), to transport the LNG to overseas markets.

Other marine traffic during operations will include:

- Two inbound and outbound escort tugs to escort the LNG carriers to and from the PRPA boundary (see Figure 1-4)
- Four harbour tugboats will be available for berthing operations at the marine terminal
- Barges and other vessels that may be required to bring in equipment, supplies and other materials to the MOF, and remove waste during operations of the facility.

1.2.6 Construction Activities

Construction will begin once the necessary regulatory approvals and permits have been received and following the final investment decision. As outlined in Section 1.2.4, construction and commissioning of the first phase of the Project is anticipated to take approximately five to six years. Construction activities, which are described more fully below, will include:

- Site preparation (land-based and marine)
- Onshore construction
- Dredging and disposal at sea
- Marine construction
- Waste management
- Vehicle traffic to/from the facility site
- Shipping
- Commissioning and start-up.

1.2.6.1 Site Preparation

On-land site preparation within the PDA will include the following key activities:

- Vegetation clearing and grubbing based on the full build-out requirements
- Establishment of soils storage area to the west of Delusion Bay, and placement of peat and overburden excavated from the PDA. Where possible, overburden material will be reused in the construction process.
- Grading and levelling of the terrain
- Potential mechanical ripping or blasting in areas where bedrock is encountered.
- Soil compaction
- Contouring of undeveloped areas to promote good drainage
- Establishment of temporary surface water management infrastructure and erosion control measures
- Implementation of mitigation measures, as required (e.g., erosion control measures).

Fencing and/or flagging will precede site clearing to mark areas where mitigation measures are required. The site will be accessed by a combination of boat and helicopter during site preparation.

Marine-based site preparation will include the following key activity:

- Construction of the pioneer facility at Casey Cove to facilitate the early stages of site development by allowing for the transport of initial equipment, supplies and workforce to the Project site prior to the development of the MOF.

1.2.6.2 Onshore Construction

Onshore construction will include the following key activities:

- Construction, operations and decommissioning (if applicable) of temporary facilities as described in Section 1.2.5.4.
- Paving of some areas, where required
- Construction of suitable foundations, and installation of pilings
- Installation of supporting infrastructure and facilities required for the LNG facility and the marine terminal as described in Section 1.2.5.3
- Construction of major terrestrial components of the LNG facility described in Section 1.2.5.1, using modules and pre-assembled units brought to site via the MOF.

Construction workers will stay at the construction camp for the duration of their rotation (see Section 1.2.5.4). Prior to completion of the on-land construction camp, workers may stay in the temporary floating camp in Casey Cove or commute to site by boat and/or helicopter from Prince Rupert.

Materials to support onshore construction will be brought to site via the pioneer facility (prior to establishment of the MOF), the MOF, and the access road connecting to the airport.

1.2.6.3 Dredging

It is expected that construction of the marine jetty and MOF will require dredging of approximately 552,200 m^3 of marine substrate. This includes approximately 187,000 m^3 of marine substrate at the marine jetty, over an area of approximately 5.5 ha, and approximately 365,000 m^3 of marine substrate at the MOF, over an area of approximately 10.2 ha. These volumes are preliminary estimates and the final volumes of dredged material will be determined through further geotechnical and engineering design work.

At the marine jetty, the bedrock layer is estimated to be within the dredge pocket at certain locations; therefore it is currently anticipated that subsea blasting and mechanical excavation of hard rock will be required in addition to soft overburden dredging. At the MOF, the bedrock layer is estimated to be below the dredge pocket; therefore only soft overburden dredging will be required. Underwater blasting and dredging activities will be timed to occur within the least risk timing window (November 30 to February 15), unless otherwise approved by DFO, and are currently anticipated to be completed within two or three seasons. These activities will be carried out on a 24 hours per day schedule, seven days per week. Note that for blasting activities, charges will only be detonated during daytime hours.

Dredging is anticipated to be conducted using backhoe, clamshell and cutter suction dredgers; however, final selection of equipment will be determined during FEED. Aurora LNG will continue to investigate different configurations for the proposed marine jetty and MOF during FEED in order to optimize these components (e.g., to reduce blasting and/or dredging requirements).

The dredged material will be disposed of at an approved location. Up to the top 0.5 m of dredged material will be disposed of on land in an engineered disposal cell within the PDA. The location and size of the engineered disposal cell will be determined once the final volume of dredged material is known. Any suitable rock removed from the marine jetty dredge pockets will be re-used in construction of the earth fill causeway (see Figure 1-8). The remaining material is anticipated to be disposed of at sea.

The Brown Passage site has been identified as a potential disposal location as it is the closest previously used disposal at sea site to Prince Rupert, approximately 40 km west of Prince Rupert. The final disposal site will be selected through consultation with regulatory authorities, Aboriginal Groups, and stakeholders. Once the suitability of that site has been evaluated, a request will be made to Environment and Climate Change Canada under the *Canadian Environmental Protection Act* for approval for disposal.

1.2.6.4 Marine Construction

Marine construction will include the following key activities:

- Construction of the marine terminal infrastructure described in Section 1.2.5.2
- Construction of the MOF to enable materials required for construction of the LNG facility, such as modules, construction supplies, and equipment, to be transported to site via boat or barge as described in Section 1.2.5.3.

As the MOF is required to facilitate construction of the LNG facility, construction of the MOF is likely to be completed on an accelerated basis with two 10 hour shifts per day, seven days a week for approximately 18 months. Construction of the marine terminal is anticipated to take approximately two years on a schedule of a single 10 hour shift per day, working five or six days a week. Pile installation associated with construction of the MOF and marine terminal is anticipated to take place year round.

Impact pile driving will likely be required to construct both the LNG jetty and the MOF. Hammers used for this form of pile driving use force from a heavy weight to embed piles into the seafloor. Assuming the pile-and-deck MOF option is selected, installation of the MOF piles will take place over approximately one year. Piling for the LNG jetty, including the access trestle, loading platforms, breasting dolphins and mooring dolphins, will take place over approximately two years. Once piles are driven through the sediment overburden, rock socket drilling will be required to seat piles into the underlying bedrock (LNG jetty piles) or hard till material (MOF piles). This process involves drilling a vertical hole in the bedrock or till, into which the pile is inserted. Underwater blasting will be used in the berth dredge areas to fragment substrate that is too hard to be dredged in its natural state.

1.2.6.5 Waste Management

Construction of the LNG facility will generate various wastes, including solid waste, liquid waste, and hazardous waste. Project Activities will be guided by applicable policies, regulations, permits, and management plans. The activities associated with waste management are described in the wastewater and solid waste management system in Section 1.2.5.3 above.

1.2.6.6 Vehicle and Rail Traffic

Vehicle traffic to/from the facility site will involve the following key activities:

- Transport of workers on buses to and from the Digby Island airport to site
- Light vehicles and transport trucks to transport equipment, materials and goods from the airport to site, and within the Project site.

Equipment and/or materials may be transported by rail to Prince Rupert, for transfer to Digby Island by barge.

1.2.6.7 Construction Shipping

As described in Section 1.2.5.4, marine traffic during construction will initially visit the pioneer facility, allowing for the transport of equipment, supplies and workforce to the site during construction of the MOF. Once the MOF is constructed and operational, it is anticipated that the pioneer facility will be decommissioned. Section 1.2.5.5 provides a summary of the types of vessels expected at site during construction.

The pioneer facility and MOF will fall within the jurisdiction of the PRPA (Figure 1-4). The PRPA operates under the *Canada Marine Act* and the Port Authority Operations Regulations, and manages all waters of Prince Rupert Harbour. All vessels operating within this area are subject to the authority of the PRPA. The Canadian Coast Guard's Marine Communication Traffic Services (MCTS) provides marine safety communications, and manages the movement of vessel traffic in the Prince Rupert area.

1.2.6.8 Commissioning and Start-up

Commissioning and start-up will involve controlled testing of the various Project components to confirm all systems are complete and functioning as per design. Once function testing is complete the entire system of Project components and equipment will be operationally tested and optimized (e.g., repeated starting and shutdowns, testing of emergency shutdown procedures and repeated facility flaring). During commissioning and start-up, there may be a number of weeks of repeated flaring while systems are tested. Only once Aurora LNG is satisfied that the LNG facility and marine terminal are functioning optimally and safely, will operations begin.

With the exception of the LNG storage tanks and select process equipment, the majority of the liquefaction train will be pneumatically tested, rather than hydrostatically tested, to prevent residual moisture that can lead to ice build-up during operations. Preliminary volumes for hydrostatic testing are estimated at approximately 210,000 m^3, as water from the first storage tank will be reused for testing of the second storage tank, with additional top-up water if required. The testing water will be discharged to the marine environment through the deep water marine outfall once it meets discharge requirements. If biocides are used, the test water will be neutralized prior to discharge.

1.2.7 Operations Activities

As outlined in Section 1.2.4, operations will have a minimum duration of 25 years. Operations activities, which are described more fully below, include:

- Natural gas supply and receiving
- Natural gas pre-treatment and liquids extraction
- LNG production and storage
- LNG loading
- LNG shipping, including operations of supporting auxiliary marine traffic
- Waste management, including air emissions, solid waste, liquid waste, and hazardous waste.

1.2.7.1 Natural Gas Supply and Receiving

The natural gas supply (also known as feed gas) for the Project will be sourced from the Horn River and the Liard and Cordova basins of WCSB, as well as from market hubs. Gas sources are expected to include a combination of proprietary natural gas holdings in northeast BC and third-party sources including market hubs, gas supply arrangements, and upstream joint ventures. Because of the multiple sources of gas, it is expected there will be some variability in the composition of the feed gas.

Natural gas will be delivered to the Project via a third party-owned pipeline, which is yet to be determined, and not in the scope of this Project. The feed gas pipeline will enter the PDA via a dedicated pipeline delivery station.

1.2.7.2 Natural Gas Pre-treatment and Liquids Extraction

See Section 1.2.5.1 for a description of the feed gas treatment system. The feed gas will be pre-treated to remove impurities and various non-methane hydrocarbons and fluids for safety of the process and to ensure that the composition of the final LNG product meets end-use specifications. The acid gases such as carbon dioxide (CO_2) and hydrogen sulphide (H_2S) will be removed in the AGRU and the treated gases sent to the dehydration unit to prevent water carry over to the liquefaction process. Any mercury in the feed gas will be removed in the mercury removal unit to prevent corrosion of the cryogenic equipment. The heavy hydrocarbons removal unit will be installed to recover C5+ and BTEX components to prevent freezing in the liquefaction process. The recovered liquids can be used as fuel, burnt in a thermal oxidizer, or if sufficient volume can be recovered, stored in onsite tanks for use as fuel or for sale to markets.

1.2.7.3 LNG Production and Storage

Gas leaving the heavy hydrocarbon removal unit will be routed to the liquefaction unit of the facility, where it will be condensed into a liquid by cooling it to a cryogenic temperature of approximately -162°C. In liquid form, the natural gas will be reduced in volume at near normal ambient pressure, allowing it to be efficiently and safely stored and shipped by sea. See Section 1.2.5.1 for an overview of the three main liquefaction processes being considered.

Once the LNG is produced, it will be stored at atmospheric pressure in insulated LNG storage tanks located in the LNG tank area. The storage tanks will be maintained an average temperature of -162°C. See Section 1.2.5.1 for further details regarding the infrastructure involved in LNG production.

1.2.7.4 LNG Loading

LNG will be delivered from the LNG storage tank area to an LNG carrier at the marine jetty through pipelines supported on an elevated pile-supported trestle. The loading of LNG carriers will be conducted from loading platforms located off the shoreline at the end of the jetty. Loading arms at each berth will transfer LNG onto the carriers, and a vapour return arm will transfer BOG back to the facility. It is anticipated that the LNG carriers will be loaded at a maximum loading rate of 12,000 m^3/h, and will typically be at berth for approximately 24 hours. The Project may allow concurrent loading of carriers at adjacent berths. See Section 1.2.5.2 for further details regarding LNG loading infrastructure.

1.2.7.5 Operational Shipping

Shipping activities during operations will include regular transit of LNG carriers from the pilot boarding area near Triple Island to the marine terminal. At full build-out, approximately 160 to 320 LNG carriers (up to Q-Flex in size; 315 m length, 50 m beam and 109,500 DWT) will call on the marine terminal each year, depending on the size of the carrier. The LNG carriers will be contracted by Aurora LNG to carry cargo on a free-on-board (FOB) or delivered at place (DAP) basis. The carriers will be powered by a combination of low sulphur fuel and boil-off gas within the North American Emission Control Area. Escort and berthing tugs will support safe passage of the LNG carriers within the PRPA boundary.

LNG carriers will transit through Chatham Sound and Brown Passage within designated shipping zones. Operations of the vessels will be in accordance with shipping operations approved under the *Canada Shipping Act* and bylaws established by the PRPA. All LNG carriers will be double hulled, and have primary and secondary containment systems. The marine terminal and channel approach will have navigation aids that conform to the standards under the *Canada Shipping Act*.

The marine terminal and marine access to the terminal falls within the jurisdiction of the PRPA. The PRPA operates under the *Canada Marine Act* and the Port Authority Operations Regulations, and manages all waters of Prince Rupert Harbour. All ships operating within this area are subject to the authority of the PRPA. The Canadian Coast Guard's MCTS provides marine safety communications, and manages the movement of vessel traffic in the Prince Rupert area. Prince Rupert Harbour is designated as a compulsory pilotage area under the *Pilotage Act*. All vessels over 350 gross tonnes are subject to compulsory pilotage.

Shipping outside of the bounds of the PRPA and within Canadian Territorial waters will occur within established shipping channels.

Aurora LNG will enter into the Technical Review Process of Terminal Systems in Transshipment Sites (TERMPOL) for the marine shipping and marine terminal operations associated with the Project.

1.2.7.6 Waste Management

Operations of the LNG facility will generate various wastes, including air emissions, solid waste, liquid waste, and hazardous waste. Project Activities will be guided by applicable policies, regulations, permits, and management plans. The activities associated with waste management are described in the wastewater treatment system and solid waste management system in Section 1.2.5.3 above. Activities associated with air emissions are described in this section.

Air emissions, including nitrogen oxides, sulphur oxides, carbon monoxide, particulate matter, and other criteria air contaminants, will be generated during Project operations. Sources of air emissions will include the gas turbines, the feed gas sweetening system, the flare system and shipping. Fugitive emissions will be generated from heavy equipment and vehicles onsite and periodic emissions related to routine maintenance and testing of backup systems and emergency equipment such as emergency diesel generators. Air emissions will be managed in accordance with the BC *Environmental Management Act, Canadian Environmental Protection Act, 1999,* North American Emissions Control Area regulations, and International Convention for the Prevention of Pollution from Ships (MARPOL) regulations related to the Prevention of Air Pollution from Ships.

1.2.8 Decommissioning Activities

At the end of its operational life, the Project will be decommissioned. The decommissioning phase is anticipated to take approximately two to five years, and be completed in accordance with the laws, regulations, and standards in effect at the time. The Application addresses decommissioning requirements at a preliminary level; Aurora LNG anticipates that requirements for decommissioning will be established through discussions with the OGC as part of LNG facility permitting. At the end of the Project's operational life, a decommissioning and abandonment plan will be developed in consultation with the relevant regulatory agencies and potentially affected Aboriginal Groups.

Decommissioning activities may include:

- Dismantling of land-based and marine infrastructure
- Remediation and reclamation of the site
- Waste management
- Post-closure site monitoring and control measures.

The LNG facility, pipelines, storage tanks and associated supporting infrastructure will be decommissioned in accordance with the Decommissioning and Abandonment Plan. Prior to removal, equipment will be de-energized, drained, and purged to eliminate uncontrolled releases of any potential contaminants, such as hydrocarbons. Current expectations are that equipment that can be salvaged will be reused or resold. Where feasible, material that cannot be used for its original purpose will be recycled or scrapped, to reduce waste requiring disposal. All waste generated throughout the decommissioning process will be sent to an approved offsite facility.

Loading and unloading infrastructure at the marine terminal and MOF will be decommissioned in a manner similar to the LNG facility. The marine terminal and MOF may remain in place, subject to discussion with the Prince Rupert Port Authority at the time of decommissioning.

A Phase II Environmental Site Assessment will be completed prior to reclamation. Any contamination caused by the Project will be remediated in accordance with applicable regulations at the time of decommissioning. Baseline Phase I and Phase II Contaminated Site Assessments were completed in 2015-2016.

Site clean-up and reclamation will be based on discussions with regulatory agencies. This may involve preparation of the disturbed portion of Digby Island for other industrial purposes or reclamation to restore ecological values. A monitoring program for assessing the effectiveness of remediation and reclamation efforts at site will be developed as part of decommissioning.

1.2.9 Design Mitigation

This section provides an overview of key environmental mitigation measures incorporated into Project planning and the benefits of these changes, including mitigation measures related to:

- Site selection
- Engineering design features
- Feedback obtained from government agencies, Aboriginal Groups, stakeholders, and the general public.

1.2.9.1 Site Selection

A site selection exercise was conducted during the early stages of Project planning to identify the relative suitability of potential sites. Criteria used in evaluating potential sites included the practical ability to develop, construct and operate an LNG facility and marine terminal at the site. This included physical and environmental considerations such as ecological, archaeological, geological, meteorological, and oceanographic conditions.

Digby Island was selected as the most suitable site for a variety of reasons including: sheltered marine conditions, proximity to infrastructure and logistic links, suitable bedrock conditions, suitable grade, size of the site, existing infrastructure (airport and power lines), and multi-point access.

The results of environmental surveys have helped guide site selection and Project design. For example, the berths and the trestle were moved to reduce effects on marine resources. The site development has also been configured to avoid heritage sites, such as ancient village sites, along the east coast of Digby Island.

1.2.9.2 Engineering Design Features

The Project will be developed using industry best practices, in full compliance with applicable legislation and industry standards and guidelines, including:

- Canadian and BC legislation and regulations, including CSA Standard Z276-15 (or latest revision) on LNG Production, Storage and Handling, and the LNG Facility Regulation under the *Oil and Gas Activities Act* (OGAA)
- Nexen policies, standards and guidelines, including the corporate HSE&SR framework
- Applicable international codes and standards for design, construction, commissioning and operations.

The Project will also include use of leading edge, energy efficient technologies, including aeroderivative gas turbines.

Site layout will be designed with safety spacing in accordance with CSA Z276-15 – LNG Production, Storage and Handling. In particular, a no-fuel buffer zone of approximately 30 m will be established along the perimeter of the LNG facility to reduce the likelihood of loss of or damage to the LNG facility by potential forest fires. In some places, this no-fuel zone may be extended to 50 m to provide for adequate spacing along adjacent haul roads in the event of modular construction. Safety spacing may extend beyond 50 m to accommodate acceptable risk contours at the LNG facility boundary to minimize damage and risk of an event escalating.

1.2.9.3 Feedback from Government Agencies, Aboriginal Groups, Stakeholders and the General Public

Feedback obtained during consultation with government agencies, Aboriginal Groups, stakeholders and the general public was considered in Project planning and design. A summary of the mitigation measures and changes to the Project that resulted from feedback are outlined below. In other cases, the feedback received was determined to not be currently feasible, and as a result this feedback did not result in changes to the Project.

A discussion of the various alternatives considered for the Project, and the criteria used to evaluate them, is included in Section 1.7.

FEEDBACK FROM GOVERNMENT AGENCIES

Key issues and concerns raised by Government Agencies during the Pre-Application phase regarding the environmental assessment and the status of those concerns, including information on how this feedback resulted in the development of mitigation measures, are provided in Section 2.4.1 and throughout the Part B VC sections in the Application.

FEEDBACK FROM ABORIGINAL GROUPS

Aurora LNG consulted with Aboriginal Groups identified in the Section 11 Order (as amended) throughout the Pre-Application phase of the Project on various topics, including preliminary Project design. Aurora LNG considered and, where practicable, incorporated feedback provided by Aboriginal Groups into the development of mitigation measures and Project planning and design.

Examples where feedback from Aboriginal Groups resulted in mitigation measures that influenced Project planning and design include:

- In response to concerns raised by Aboriginal Groups regarding potential effects to archaeological resources and sensitive environmental features from Aurora LNG's geotechnical investigations being conducted within the PDA, Aurora LNG modified its geotechnical programs (conducted from 2014-2016) to avoid certain sensitive areas and to minimize disturbance within the PDA as a whole. Modifications to the geotechnical programs included avoidance of culturally modified trees (CMTs), heritage sites, and other sensitive environmental features such as water bodies and defined critical habitat for SARA listed wildlife. In addition, Aurora LNG collaboratively developed specific

archaeological guidelines with input from Aboriginal Groups and qualified archaeologists to support the management and protection of archaeological resources on Digby Island.

- Aboriginal Groups have identified concerns regarding impacts of the Project on archaeological and heritage resources on Digby Island. On the east side of Digby Island a minimum 30 m buffer will be implemented to reduce or avoid impacts to heritage sites and CMTs within those areas, and to reduce potential impacts to environmental features.
- Aboriginal Groups raised concerns regarding the methods and locations for disposal of marine sediment. Up to the top 50 cm of dredged material is proposed to be disposed in an engineered disposal cell within the PDA. The location and size of the engineered disposal cell will be determined once the final volume of dredged material is known. Any suitable rock removed from the marine jetty dredge pockets will be re-used in construction of the earth fill causeway. The remaining material is anticipated to be disposed of at sea – in accordance with applicable regulations and permit conditions. Aurora LNG will continue to consult with Aboriginal Groups regarding potential options for the disposal of dredge material resulting from the construction of the marine terminal and MOF.

In addition, key issues and concerns raised by Aboriginal Groups during the Pre-Application phase regarding the environmental assessment and the status of those concerns, including information on how this feedback resulted in the development of mitigation measures, are provided in Section 2.4.1 and throughout the Part B VC sections in the Application.

Furthermore, Aurora LNG will continue to consult with Aboriginal Groups throughout all Project phases and collaboratively develop strategies and mitigation measures to address concerns. See Section 12 (Aboriginal Consultation) for information on proposed future consultation activities.

FEEDBACK FROM THE GENERAL PUBLIC

Aurora LNG considered feedback provided by the public, and where practicable, incorporated feedback into the development of mitigation measures and Project planning and design. Examples of this incorporation include:

- The location of the camp was moved further to the south within the PDA, in response to concerns raised by Dodge Cove regarding proximity of the proposed camp to the community. In addition, based on feedback received, the camp will also be a closed-access camp, meaning that Project employees will be encouraged to remain onsite for the duration of their shift.
- Stakeholders have raised concerns regarding heritage resources on Digby Island. On the east side of Digby Island, a minimum 30 m buffer will be implemented to reduce or avoid impacts to heritage sites and culturally modified trees (CMTs) within those areas, and to reduce potential impacts to environmental features. Aurora LNG has also endeavored to preserve heritage artifacts found during investigative activities where appropriate, and, to this end, donated artifacts to the North Pacific Cannery Museum in August 2016.

In addition, key issues and concerns raised by the public during the Pre-Application phase regarding the environmental assessment and the status of those concerns, including information on how this feedback resulted in the development of mitigation measures, are provided in Section 2.4.2 and throughout the Part B VC sections in the Application.

Furthermore, Aurora LNG is committed to on-going consultation with public stakeholders to continue to facilitate an understanding of potential Project effects, discuss concerns and issues, and potential mitigation measures to address those concerns. See Section 13 (Public Consultation) for information on proposed future consultation activities.

1.2.10 Environmental Management Policy and Programs

Aurora LNG operates under a Health, Safety, Environment and Social Responsibility (HSE&SR) Policy with the objective of achieving best-in-class performance in HSE&SR, with an ultimate goal of zero harm to people and the environment. This policy applies equally to employees and contractors, and includes commitments to:

- Conduct our business with respect and care for people and the environment, following the principles of risk management and sustainability
- Comply with or exceed the regulatory requirements of the jurisdictions in which we operate
- Support the advancement of technologies and industry best practices and apply them where they will improve our operations
- Steward and continually improve our performance through the application and operational execution of our HSE&SR Management System
- Respond promptly, decisively and responsibly to incidents and other departures from planned arrangements and investigate them to prevent recurrence
- Set objectives and report our performance in a transparent and timely manner
- Provide a safe and attractive work environment characterized by respect, trust and cooperation
- Maintain a Company-wide culture that supports HSE&SR.

Throughout the Application process, Aurora LNG will continue to consider results of environmental surveys and will adopt an adaptive management approach.

See Section 14 of the Application for an overview of the Project specific environmental management programs and associated environmental management plans (EMPs) that will be developed for works undertaken during construction, operations, and decommissioning. There will be an overarching environmental management program for each Project phase that includes a series of EMPs based on industry best management practices and standards, applicable regulations, commitments made during the Application process, and EAC and permit condition, to protect specific components of the environment, Project personnel, and the public by reducing or avoiding potential adverse effects from Project activities.

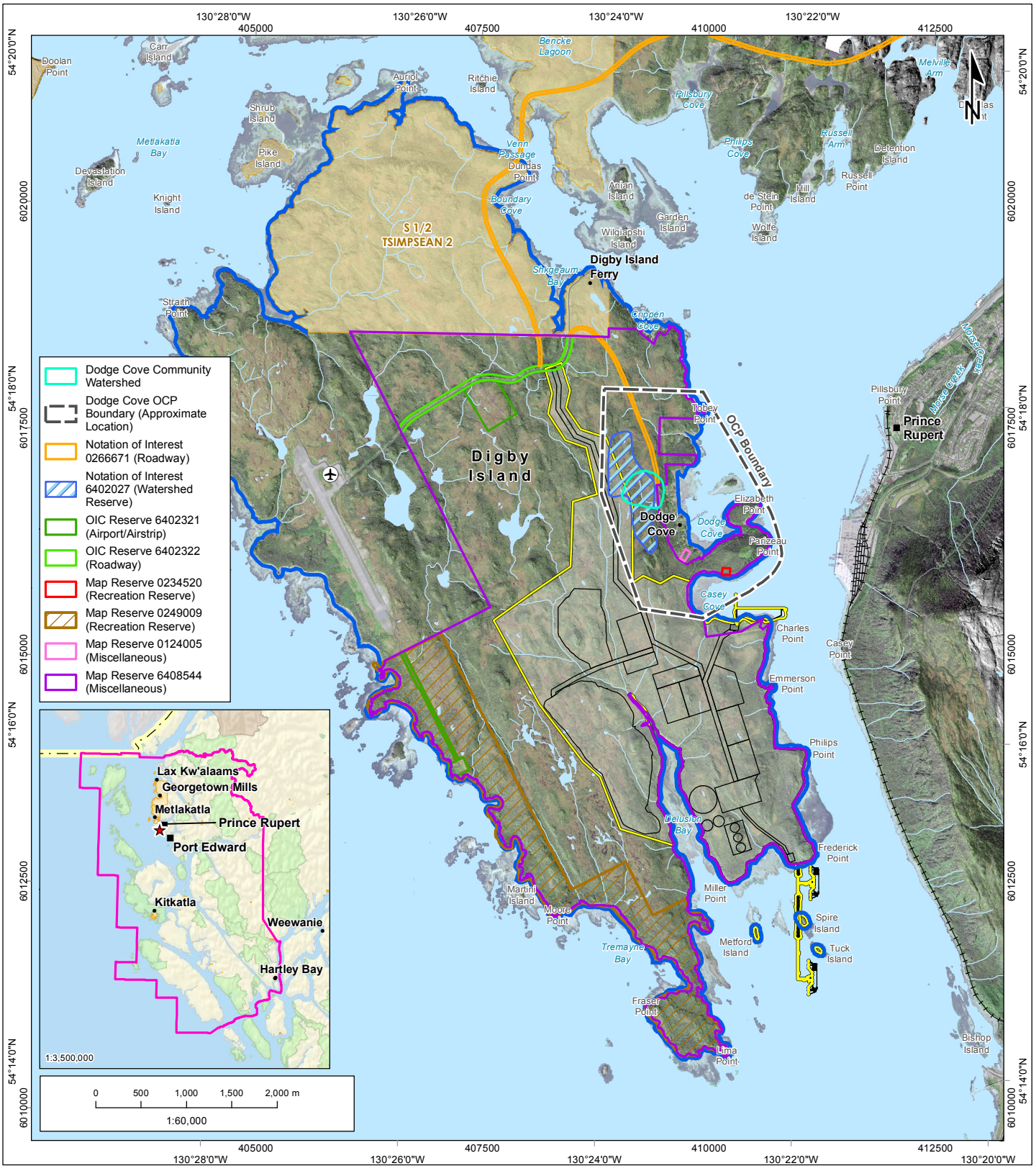
The EMPs will be developed and/or updated as needed prior to the start of the applicable Project phase, and may be subject to updates during each phase based on an adaptive management approach.

1.3 Land and Marine Use

1.3.1 Land Use

Digby Island includes provincial Crown lands, S1/2 Tsimpsean 2 Reserve, the communities of Dodge Cove and Crippen Cove, and the Prince Rupert Airport (see Figure 1-10). There are 57 private properties on Digby Island, most located in Dodge Cove and Crippen Cove. Aurora LNG joint venture partners own one private property located near Charles Point in Casey Cove that is overlapped by the Project development area (PDA). The Prince Rupert Airport is located on private property, owned by the Prince Rupert Airport Authority.

The Project will be located mainly on provincial Crown land within the Skeena-Queen Charlotte Regional District (SQCRD), and on one private lot owned by the Aurora LNG joint venture partners. The Dodge Cove Official Community Plan (OCP) was originally adopted by the SQCRD on May 25, 1990, and outlines several objectives including: future commercial enhancements to the Dodge Cove community (e.g. new ferry landing locations and airport access road) and suggested guidelines for land use within the broader OCP area. The Project PDA overlaps with the periphery of the OCP totaling approximately 13% or 49 ha of the total OCP area. The overlapped area is undeveloped Crown land that the OCP identifies as “rural” and “watershed” lands.



City, Municipality, or Town
Community, Locality, or Village
Airport
Road
Railway
Watercourse
Park, Protected Area, Ecological Reserve, or Conservancy
First Nation Reserve
Treaty Lands
Waterbody
Project Location
Project Component
Project Development Area
Local Assessment Area
Regional Assessment Area

Data Sources: Government of British Columbia: DataBC, Terrain Resource Information Management, National Topographic System, BC Stats, BC Oil & Gas Commission. Government of Canada: CanVec v12, National Hydrology Network, Atlas of Canada National Framework, Fisheries and Oceans Canada, Environment Canada, Natural Resources Canada. INPEX Gas British Columbia Ltd. Nexen Energy ULC.Service Layer Credits: Copyright © 2014 Esri

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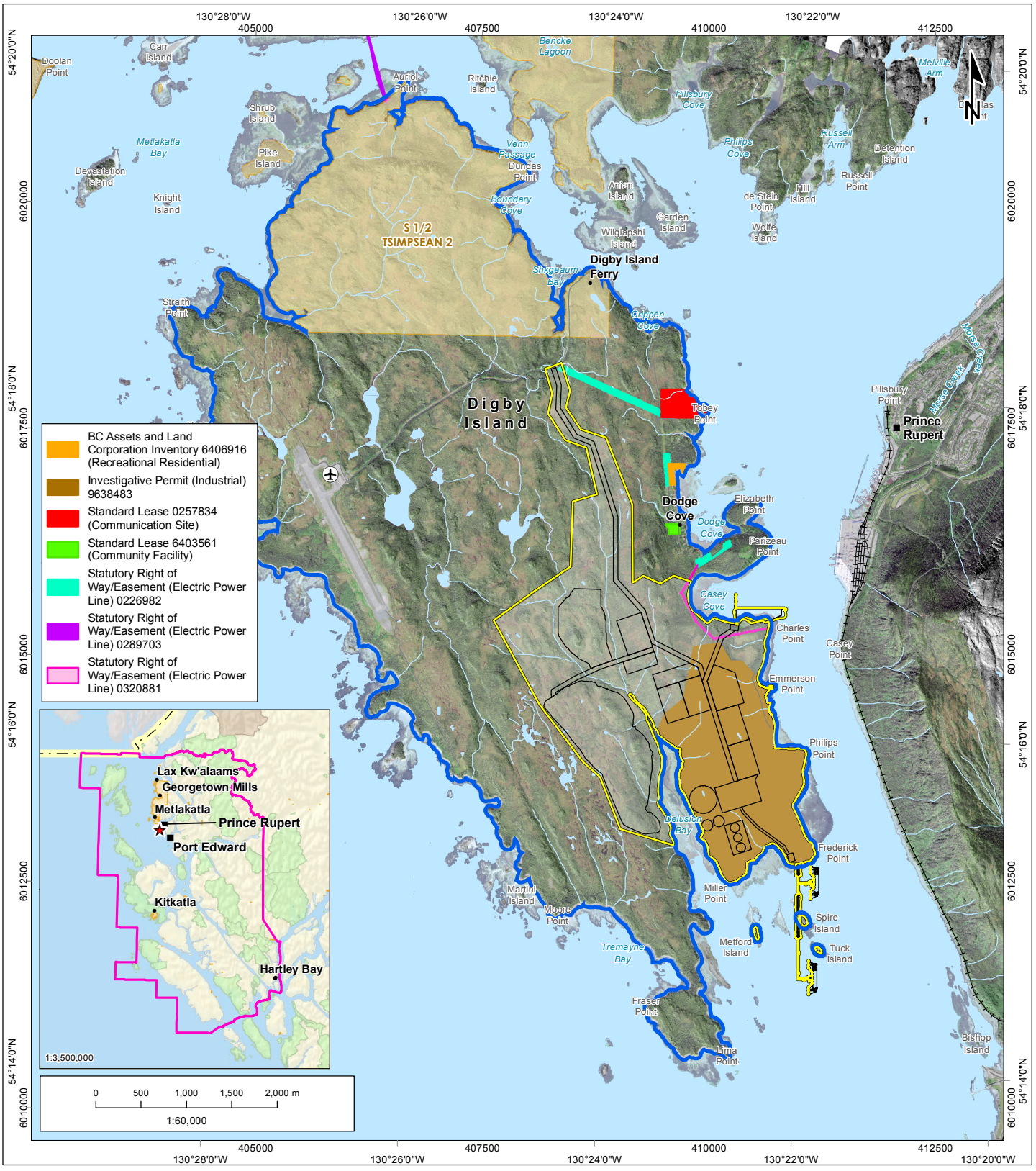
COMMUNITY COMMITMENT CONNECTION

ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

CROWN LAND RESERVES, WITHDRAWALS AND NOTATIONS

Projection: UTM Zone 9 Datum: NAD 83	Fig. ID:123220054 Date: Dec 06, 2016	Drawn By: RC Checked By: TS	FIGURE NO:	**1-10**



City, Municipality, or Town
Community, Locality, or Village
Airport
Road
Railway
Watercourse
Park, Protected Area, Ecological Reserve, or Conservancy
First Nation Reserve
Treaty Lands
Waterbody
Project Location
Project Component
Project Development Area
Local Assessment Area
Regional Assessment Area

Data Sources: Government of British Columbia: DataBC, Terrain Resource Information Management, National Topographic System, BC Stats, BC Oil & Gas Commission. Government of Canada: CanVec v12, National Hydrology Network, Atlas of Canada National Framework, Fisheries and Oceans Canada, Environment Canada, Natural Resources Canada. INPEX Gas British Columbia Ltd. Nexen Energy ULC.Service Layer Credits: Copyright © 2014 Esri

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ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION

ELECTRIC POWER LINES, COMMUNICATION SITES AND COMMUNITY AND RESIDENTIAL TENURES

Projection: UTM Zone 9 Datum: NAD 83	Fig. ID:123220054 Date: Dec 06, 2016	Drawn By: RC Checked By: TS	FIGURE NO:	**1-11**

The following provincial, regional, local, and Aboriginal planning documents influence land and marine use planning in the region including lands and waters surrounding Digby Island. At the time of writing no regional studies were available.

- North Coast Land and Resource Management Plan (LRMP) (BC MFLNRO 2009). This plan was developed to meet provincial commitments to establish an Ecosystem-Based Management (EBM) system for coastal British Columbia (BC) as a result of the Central and North Coast Biodiversity, Mining and Tourism Area Order (established October 21, 2008 under Section 7 of the *Environment and Land Use Act* and as amended on March 31, 2009 under Section 93.4 of the *Land Act)*. Plan objectives include the promotion of economic and environmental sustainability through an EBM approach that relies on traditional, local and scientific knowledge. Specific land use designations include protection areas, biodiversity areas, special forest management areas, and EBM operating areas (BC MFLNRO 2014). On January 28, 2016 the Great Bear Rainforest Land Use Order (LUO) (established under the *Land Act* and administered by the BC Ministry of Forest, Lands and Natural Resource Operations [BC MFLNRO]) was established rescinding the North Coast LRMP. The PDA does not intersect with the habitat identified under the LUO for priority wildlife species, fish and vegetation.
- North Coast Marine Plan (North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015). This collaborative plan divides the northern coast of BC into three types of management zones (general, special and protection). General management relies on EBM principles, outlined in the plan. Special zones give priority to specific marine uses and limit the permission of new uses that are incompatible. Protection zones align with the International Union for the Conservation of Nature Guidelines to protect specific resources. The marine terminal location on Digby Island is in a general management zone that permits a range of activities subject to EBM. The shipping route intersects two protection management zones (PMZs), one around Lucy Islands and the other around Tree Knob Group (North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015). Additional information on these two protection management zones is provided below:

  Lucy Islands

  - Purpose: “To protect important feeding, breeding, molting, wintering, or resting sites, and to protect areas of high cultural, historical and recreational value, including areas important for marine harvesting” (North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015:91).
  - Description: “This PMZ surrounds the Lucy Islands Conservancy, a small island with unique cultural and natural values. The Island is a globally significant breeding and nesting area for a variety of seabirds, including the rhinoceros auklet. There are approximately 26,000 nesting pairs recorded, representing about 5% of the global population. Humpback whales, killer whales, Dall’s porpoises, Pacific white-sided dolphins, sea lions and harbour seals can be seen in the area. The PMZ is considered part of the First Nations ‘breadbasket’, providing sources of food, medicine, and raw materials. There is one RAAD identified archaeological site in the area, as well as a designated vessel anchorage site” (North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015:91).
  - Additional Consideration: “Sensitive or critical features, habitat, or species and/or cultural values may be negatively impacted by large commercial vessels and smaller freight or log boom towing

vessels. Ecological and cultural values may be impacted by the anchoring of large commercial vessels" North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015:96).

Tree Knob Group

- Purpose: "To protect areas of high cultural and historical value, including areas of habitation and marine harvesting North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015:90).
- Description: "The Tree Knob Group has long been used by First Nations for food and ceremonial purposes. The islands are important intertidal harvesting areas for many species including clams, cockles, crabs, and marine plants. The area historically served as a staging area for offshore harvest and has been home to harvest camps. The terrestrial portions of these islands are important for marine mammal and bird nesting habitat, while the shallow waters around them support diverse marine plants and animals. Marine mammals that use the area include killer whales, humpback whales, stellar sea lions, Pacific white-sided dolphins, harbour seals, and porpoises. Waterfowl, eagles, and spawning salmon are found in the area. Scuba diving at the Tree Nob Group is excellent due to the high marine species diversity and large underwater reefs. This PMZ covers the marine component of the northern tip of the Ksgaxl/Stephens Islands Conservancy. Nine recognized archaeological sites and at least seven named First Nation village sites are within the conservancy" (North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015:90).
- Additional Consideration: "Sensitive and/or critical features and associated habitats and/or cultural values may be impacted by commercial and recreational fishing activity. Sensitive or critical features, habitat, or species and/or cultural values may be negatively impacted by large commercial vessels and smaller freight or log boom towing vessels. Vessel wake on foreshore areas may cause safety concerns during First Nations food harvesting periods" (North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015:96).

- Pacific North Coast Integrated Management Area Initiative (PNCIMA 2013). The draft plan comprises a number of elements related to land and marine use. Firstly, it provides an ecosystem based framework on ocean management; this is followed by goals for integrity of marine ecosystems, human wellbeing, governance and improving the understanding of complex marine ecosystems. The plan discusses implementation of these goals through collaborative governance, monitoring with adaptive management, integrating sustainable economic opportunities and expanding traditional and socio-economic parameters on risk assessment tools and cumulative effects.
- City of Prince Rupert Quality of Life Official Community Plan (City of Prince Rupert 2010). The plan is a guide for general direction of development by providing context, policies and feedback on quality of life. The plan describes quality of life as a combination of the physical environment, economic opportunities, and a supportive social network including social equity and satisfaction. Part A of the plan summarizes the context of the quality of life in Prince Rupert. Part B of the plan discusses the principles and resulting long-range land use policies. Industrial and Commercial development is largely slated for the shoreline areas. Part C of the plan outlines the involvement and implementation tools of the plan. Prince Rupert community members list a number of factors contributing to the quality of life in their communities including, but not limited to, neighborliness, optimism and opportunities for the future, access to services, and quality of air and water.

- Prince Rupert Port Authority 2020 Land Use Management Plan (PRPA 2011). The Prince Rupert Port Authority (PRPA) is mandated to create objectives to manage its property, accounting for social, economic and environmental matters. The objectives outlined are to facilitate trade to the benefit of the regional and national economy, meet or exceed the standards of Canada/US Green Marine Environmental Stewardship Program and develop compatibly with neighboring properties. The foreshore habitat quality is characterized and future initiatives are laid out with regards to infrastructure improvements, new facilities, ongoing consultation and monitoring of outcomes.
- District of Port Edward Official Community Plan (District of Port Edward 2013). The District outlines in the plan that it will continue to collaborate with the SQCRD and City of Prince Rupert to achieve the maximum benefit of heavy industrial development. It will do this by carefully locating and screening the developments, setting up development permit areas and collaborating in planning for development which will use shared infrastructure. It also provides guidance in order to protect the existing population's quality of life and facilitate an expected 5% annual population growth to 2020.
- Metlakatla Marine Use Plan Executive Summary (Metlakatla First Nation nd). This plan will guide marine resource management in Metlakatla traditional territory with the objective of attaining sustainable development that balances economic needs, ecosystem health and protects and enhances social and cultural practices. The objectives of the plan with regards to marine transportation are to improve regulation and enforcement of industry to reduce exposure to risk and allocate compensation toward Metlakatla members. The primary tools used to achieve this are EBM and marine spatial planning. The area south of Digby Island is within the Integrated Management Zone. Allowable activities under this zone include mining, logging and industrial foreshore development. With regards to climate action, the plan will provide guidance to increase ecosystem resiliency and align industry development and economic goals with environmental beliefs and interests.
- Kitsumkalum Marine Use Plan (Kitsumkalum Indian Band 2014). This plan guides marine resource management in Kitsumkalum traditional territory with the objective of attaining sustainable development that balances economic needs, ecosystem health and social and cultural wellbeing. The primary tool used to achieve this is EBM and marine spatial planning. Key policies in the plan include: co-jurisdiction management of the marine environment, receipt of economic benefits from territorial projects, revenue sharing of tax base with the provincial and federal government and use of private partnerships to plan and mitigate industrial development in the territory. The goals are: to strengthen authority to monitor and self-enforce marine laws, revitalize culture through education and employment and implement species-specific management. The plan outlines the context of competing marine resource uses in comparison to Kitsumkalum management values. Allowable activities in the Skeena Estuary Special Management Zone, immediately south of Digby Island are fishing (excluding benthic trawl), tourism, research and renewable energy. With regards to climate action, the plan will provide guidance to increase ecosystem resiliency and align industry development and economic goals with environmental beliefs and interests.
- Interim Land and Marine Resources Plan of the Allied Tsimshian Tribes of Lax Kw'alaams (Lax Kw'alaams Band 2004). The plan presents a framework of land use zones with the goal of protecting future traditional use practices and values while enabling compatible integrated resource development. The goals of the plan are to protect, restore and enhance fish habitat and marine biodiversity, enhance salmon populations and increase harvesting allowance by Lax Kw'alaams Band

members. The plan defines industrial resource development as extractive activities (forestry, mineral, oil and gas), hydroelectric, enabling developments (roads) and permanent structures development. The Kxeen (Kaien Island, Digby Island) Special Management Area (SMA) is one such land use zone which is described as having extensive resource harvesting areas for a range of land and marine resources (none specifically listed). The Management intent of the Kxeen SMA is to preserve archaeological record and support cultural tourism. Restricted activities include intensive tourism and commercial recreation, industrial development, commercial and sport fishing and shellfish aquaculture.

- Kitselas Land Use Plan (Kitselas Land Management Office 2012). As of 2005 Kitselas First Nation successfully transferred all legislated authority regarding management of their reserve lands from the federal government to the Kitselas Chief and Council. Developed to provide a baseline as well as inform future use and decision making procedures regarding Kitselas lands, the plan provides for each reserve an overview of descriptive information (including location, primary and existing uses and cultural significance), an overall management vision, and development and use objectives and priorities. The plan also provides information on general land use objectives and priorities as well as definitions for land use designations applied to reserve lands (including a description of the intent, priorities and allowed uses associated with each). Land use designations included in the plan are: cemetery, community, cultural education, cultural tourism, elders housing, future residential, housing, industrial, park, natural areas, resource use, tourist commercial and village special. The Project does not overlap with any Kitselas First Nation lands.

At the time of writing the Metlakatla Land Use Plan had not been received. The PDA does not intersect with any First Nations reserves; parks and protected areas; or forestry, guide-outfitting, oil, gas, or mineral tenures. Approximately 10% of trapline line tenure # TR0614T029 is overlapped by the PDA.

The planning documents identified in Section 1.3.1 include comprehensive consideration of land and marine use planning, including plans prepared by provincial agencies, local governments, the Prince Rupert Port Authority, and First Nations. In addition to these planning documents, regional studies related to land and marine resource use within northwest British Columbia, including the EAC applications for the Pacific Northwest LNG Project and the LNG Canada Project were reviewed.

The PDA partly overlaps with Map Reserve Crown lands file 6408544, which has designated Crown land within the reserve for industrial use (associated with the Project). The PDA partly overlaps Order-in-Council (OIC) Reserve Crown lands file 6402322, established by the BC MFLNRO to designate the area for potential roadway use. The PDA also partly overlaps with Notation of Interest (NOI) Crown lands file 6402027, corresponding to the protected watershed zone described in the Dodge Cove OCP. These Crown land withdrawals and NOI are identified on Figure 1-10. The PDA also overlaps with two statutory right-of-ways (Crown lands files 0226982 and 0320881) and one investigative permit (industrial) Crown lands file 9638483 (which is associated with the Project) as shown on Figure 1-11. For context, Figure 1-11 also shows Map Reserves, OICs, NOIs and Crown Land tenures on Digby Island that fall outside the PDA.

The PDA lies within the North Coast Timber Supply Area (NCTSA). Forestry activities within the NCTSA are managed and monitored by BC Timber Sales (BCTS) under the BC Timber Sales Coast Mountains Resource District Forest Stewardship Plan Replacement 2016 – 2021 (BCTS 2016).

Non-tenured use of crown land in the PDA includes recreation, hunting, fishing and vegetation and marine plant harvesting. There are no managed Recreation Sites and Trails BC camp sites or trails within the PDA (BC MFLNRO 2016); however, there are four identified areas that support, or have the potential to support recreation within the PDA (as identified in the Recreation Sites and Trails BC Recreational Features Inventory) (BC MFLNRO 2015). Hunting, fishing and harvesting uses in the PDA have been noted through the consultation process with Aboriginal Groups and the public.

Active container and bulk terminals are operated under the PRPA on Kaien Island and Ridley Island located across the channel to the east of Digby Island. Other proposed projects in vicinity of Prince Rupert and Port Edward include expansion of the Fairview Container terminal; several LNG facilities and associated gas transmission lines, at various stages of permitting; and a clean energy generation project (Mt. McDonald Wind Power Project). There are no other proposed projects on Digby Island.

1.3.2 Marine Use

The waters around Prince Rupert have been traditionally used for fishing, shipping and boat building and have seen a steady growth of industrial, commercial and recreational uses through the 20th century (see Section 6.5.3.2). The shipping route to Digby Island via Brown Passage and into Chatham Sound transits through the traditional territories of several coastal Aboriginal Groups as well as the jurisdictional area of the PRPA. The shipping route is used by Aboriginal Groups for traditional harvesting and for a variety of marine-based activities that may be affected by the Project (see Section 11.3, Requirements Under CEAA 2012 Section 5(1)(c)). The assessment for marine use and navigable waters (see Section 6.5) considers the traditional use information that was provided during the consultation process. Aboriginal boating routes that cross the PDA and the waters around Digby Island have been noted in the traditional use studies.

Marine use of Chatham Sound includes traffic of commercial and recreational fishing vessels, commercial charter vessels, pleasure craft, cargo vessels, ferries, cruise ships, tug and tow, and eco-tourism vessels. The PRPA operates and manages multiple terminals and anchorages (see Figure 6.5-4). Traffic has been managed by the Harbour Master since 1997, in coordination with other agencies (e.g., the Pacific Pilotage Authority).

Commercial and recreational fishing is managed and monitored by Fisheries and Oceans Canada, and the Project regional assessment area for the Marine Use and Navigable Waters VC includes four categories of commercial fishing (see Section 6.5.3, Figure 6.5-3). Recreational fishing locations for target species are shown on Figure 6.5-12. Marine zoning is shown on Figure 6.5-15 and includes the management zones described in the North Coast Marine Plan (North Coast Skeena First Nations Stewardship Society and Province of British Columbia 2015). This plan is further summarized in Section 6.5.3.2.

Provincial, regional, local, and Aboriginal planning documents that influence marine use planning in the region including the waters surrounding Digby Island are identified in Section 1.3.1.

1.4 Benefits of Proposed Project

1.4.1 Introduction

The Project will provide natural gas production from the WCSB of northeast BC to reach growing global markets for LNG, and offers an opportunity for increased economic growth locally in Prince Rupert, and throughout the province and country. The Project will benefit both BC and Canada through economic development and diversification, job creation, and increased government revenue. It will also support the current provincial government's strategic interests in developing an LNG industry.

Aurora LNG is estimating to spend approximately $28 billion on construction and $4.5 billion per year during a minimum 25 years of operations (inclusive of LNG facility operations and gas costs), with decommissioning expected to cost approximately $1.4 billion (figures in nominal 2016 Canadian dollars [$]). The Project is estimated to directly and indirectly create approximately 670,000 person-years (PYs) of employment (one PY is equivalent to one person working full-time for a year) in Canada during construction, minimum of 25 years of operation, and decommissioning. It will generate approximately $11.0 billion in tax revenues for the Government of Canada, during construction and operations, exclusive of corporate income taxes paid during the operations phase.

Approximately 15% of total construction costs, 96% of annual operating costs (assuming all natural gas used in LNG production will be obtained from BC sources) and 82% of decommissioning costs will be spent in BC. This will create an estimated 431,000 PYs of employment in BC during construction, operations and decommissioning. Revenue for the provincial government associated with the Project over construction and operations phases is estimated at approximately $25 billion.

The following sections provide information on Project costs, employment, government revenue (e.g., tax revenue) and contributions to the BC and Canadian economy. Methods used to derive this information are also provided. Cost and labour numbers provided in this Application are preliminary estimates for full build-out. Cost and employment estimates are subject to change as Aurora LNG is currently undertaking FEED for Phase 1 construction and operation. Cost and direct employment estimates were provided by Aurora LNG.

1.4.2 Methods

Project cost estimates were reviewed and categorized on a commodity and provincial/national basis according to detailed commodity listings provided by Statistics Canada. The costs, as categorized, were submitted to the Industry Accounts Division of Statistics Canada where custom runs of the "Statistics Canada Interprovincial Input-Output Model" (SCIPIOM) were undertaken. The SCIPIOM estimates the economic impact of the expenditures associated with the Project, although some model results were modified to adjust for Project specific direct labour costs and employment. Project benefits are presented on a full build-out basis (i.e., four trains). The actual timing for construction of subsequent phases (i.e., trains 3 and 4) will be based on market demand.

The following assumptions are used to evaluate the potential economic impacts from the Project:

- All dollar figures are expressed in nominal 2016 Canadian dollars ($).
- The CAD/USD conversion rate used is 1.3.

- Cost estimates are provided for a full build-out scenario of 24 MTPA, which consists of four LNG trains.
- Costs are inclusive of the LNG facility, including the marine terminal and associated land-based infrastructure. The estimates do not include costs of LNG carriers, or supporting marine vessels, such as escort tugs and berthing tugs.
- The spending breakdown assumes availability of Canadian and BC goods and services providers, and successful award of Project contracts.
- Gas costs assumed purchase from market
- GHG taxes were estimated based on tax rates established under the BC *Carbon Tax* act and regulation as of September 1, 2016.

At the current stage of Project design, cost estimates are considered accurate to within ±25-50% (based on current site information and probable conditions affecting the Project). Results of custom runs of the SCIPIOM model are provided in the following sections.

1.4.3 Project Costs

1.4.3.1 Capital Costs

Construction will draw labour, equipment, and materials sourced from within Canada and internationally. Table 1-4 provides an overview of estimated total capital costs for the Project. Preliminary estimates indicate that approximately 12% of construction expenditures, including labour, equipment and materials, will be procured from BC, 18% from elsewhere in Canada, and 70% internationally.

Table 1-4 Estimated Construction Spending in BC, Canada, and Internationally

	Estimate (Millions $)	Percent of Total (%)
BC	3,347	12
Other Canada	5,040	18
Total Canada	8,387	30
Internationally	19,605	70
Total	27,992	100

NOTE:
Values may not sum to totals shown because of rounding
SOURCE:
Data provided by Aurora LNG

A description of estimated capital construction costs, including a breakdown by major types of commodities and services that will be procured during construction, and the distribution of costs between BC and other parts of Canada are listed in Table 1-5. Direct construction labour costs represent the largest Canadian expenditure item, accounting for 20% of total estimated expenditures in Canada. In addition, all of the expenditure items identified as “services” in Table 1-5 also include a large labour content, which is considered to be “indirect” labour (i.e., the labour component of supplied goods and services). Expenditures on goods and services will account for 60% of total estimated Canadian

expenditures, with overhead costs and miscellaneous expenditures accounting for the remaining 20% of estimated Canadian expenditures.

Table 1-5 Estimated Construction Spending Breakdown in Canada

Construction Costs		Canadian Content		Sourced Within Canada		
		Estimate ($ millions)	Percentage of Total (%)	BC		Other Canada (%)
				Estimate ($ millions)	Percentage of Canada (%)	
Direct Labour		1,677	20	587	35	65
Services	Construction Services	838	10	356	42	58
	Professional and Engineering Services	168	2	42	25	75
	Transportation Services	503	6	201	40	60
	Camp	419	5	419	100	0
	Other Services	587	7	147	25	75
Goods	Machinery	839	10	84	10	90
	Structures	839	10	419	50	50
	Ready-mix Concrete	168	2	168	100	0
	Fuel	168	2	168	100	0
	Electricity	84	1	84	100	0
	Other Goods	419	5	210	50	50
Miscellaneous Expenditures		839	10	210	25	75
Overhead Costs		839	10	252	30	70
Total		**8,387**	**100**	**3,347**	**40**	**60**

NOTE:
Values may not sum to totals shown because of rounding.
SOURCE:
Data provided by Aurora LNG.

Expenditures within BC during construction are estimated to be $2.7 billion, exclusive of labour; see Table 1-5), of which an estimated $1.0 billion will be spent in northwest BC. It is expected that regional businesses could provide the following types of goods and services required for construction:

- Clearing
- Logging and log salvage
- Gravel supply
- Construction of access roads
- Camp operations and catering
- Security
- Air and ground transportation

- Spare parts, maintenance and office supplies
- Ready-mix concrete
- Utilities
- Other construction services.

1.4.3.2 Operating Costs

The annual operating costs are estimated to be approximately $4.5 billion, of which approximately 89% will be for natural gas, and the balance for operating expenditures needed to run the LNG facility. A summary of estimated annual operating costs over the life of the Project, including a breakdown by category is provided in Table 1-6. While the gas for the Project may be sourced from throughout the WCSB, it is assumed for modelling purposes that the gas will be sourced from BC.

Over a minimum of 25 years of operations, total operating costs, excluding natural gas, will be approximately $12 billion, of which an estimated $8 billion in spending will occur in BC; estimates are provided in nominal dollars (2016).

Table 1-6 Estimated Annual Operations Spending within Canada by Commodity and Service

Cost Item		Total Estimate ($ millions)	BC Estimate ($ millions)	Other Canada Estimate ($ millions)	Foreign Estimate ($ millions)
Natural Gas		4,129[1]	4,129	0	0
Labour		85	54	14	17
Purchased Goods and Services	Repair and maintenance	149	66	66	17
	Other Services	59	22	22	15
	Overhead Costs	44	22	22	0
Sub-total (non-gas expenditures)		336	164	124	48
Percent of non-gas expenditures		100%	49%	37%	14%
Total		**$4,465**	**$4,293**	**$124**	**$48**

NOTES:
Values may not sum to totals shown because of rounding
[1] Purchased - based on 3.67 MMBTU/day (1.04 million cubic metres per day) at 3.08 CDN/MMBTU
SOURCE:
Data provided by Aurora LNG

Annual labour costs are estimated to be $85 million, or 25% of annual non-gas operating costs. During the Project's operations phase, BC residents are expected to account for approximately 64% of operating labour, with 16% consisting of residents from other parts of Canada and 20% consisting of imported labour from outside Canada. Annual Canadian spending on goods and services (excluding gas and labor) is estimated to be $252 million. Of this, an estimated $110 million will be spent in BC each year (approximately 50% of the Canadian total).

1.4.3.3 Decommissioning Costs

High level cost estimates for decommissioning and abandonment are estimated to be approximately $1.4 billion, and all expected to occur in Canada (see Table 1-7). It is estimated that approximately 82% of decommissioning spending will occur in BC.

Table 1-7 Estimated Decommissioning Spending in Canada by Commodity and Service

Decommissioning Costs		Canadian Content		Sourced within Canada		
		Estimate ($ millions)	Percent of total (%)	BC		Other Canada (%)
				Estimate ($ millions)	Percent of Canada (%)	
Direct Labour		390	28	273	70	30
Services	Construction Services	260	19	234	90	10
	Other Professional Services	87	6	87	100	0
	Transportation (Freight)	87	6	87	100	0
	Worker Accommodation	175	12	175	100	0
	Other Services	87	6	87	100	0
Goods	Fuel	87	6	87	100	0
	Other Goods	87	6	87	100	0
Overhead Costs		139	10	28	20	80
Total		**1,400**	**100**	**1,146**	**82**	**18**

NOTE:
Values may not sum to totals shown because of rounding
SOURCE:
Data provided by Aurora LNG.

1.4.3.4 Contractor Supply Services

Aurora LNG will procure goods and services from suppliers located in northwest BC, elsewhere in BC, and elsewhere in Canada. Table 1-8 identifies the types of supply and service contracts anticipated at the local, provincial, and national level. The estimated value of service contracts during construction and annually during operations are provided in Table 1-5 and Table 1-6 respectively.

Table 1-8 Regional Breakdown of Contractor Supply Services

Business/Contract Type		Construction			Operations			Decommissioning		
		Local	BC	Other Canada	Local	BC	Other Canada	Local	BC	Other Canada
Services	Construction Services	✓	✓	✓				✓	✓	✓
	Professional and Engineering Services		✓	✓					✓	✓
	Transportation Services	✓	✓	✓				✓	✓	
	Worker Accommodation	✓	✓			✓		✓	✓	
	Repair and maintenance				✓	✓	✓			
	Other Services	✓	✓	✓	✓	✓	✓	✓	✓	✓
Goods	Machinery		✓	✓						
	Structures		✓	✓						
	Ready-Mixed Concrete	✓								
	Fuel	✓						✓		
	Electricity	✓						✓		
	Natural Gas					✓				
	Other Goods	✓	✓	✓						

1.4.4 Employment

Currently Aurora LNG employs approximately 45 full time staff, at offices in Prince Rupert, BC and Calgary, Alberta. The number of staff positions is expected to grow during construction. Aurora LNG is also employing engineers, scientists, and technicians to conduct studies associated with the EAC Application and provide other services.

1.4.4.1 Construction

DIRECT EMPLOYMENT

Total labour requirements for constructing the Project to full build-out is estimated at 21,500 PYs. Of this, an estimated 14,200 PYs of labour will be required to construct and commission Phase 1 (trains 1 and 2) and 7,300 PYs will be required to construct and commission Phase 2 (trains 3 and 4).

Current planning is for a phased construction approach. Phase 1 includes early works, such as site preparation, construction of the MOF and camp; construction and commissioning of trains 1 and 2; and construction of the marine terminal. During Phase 1, the workforce is predicted to peak at approximately 5,000 workers, with the average labour force over the 5-year construction and commissioning period being approximately 2,650 workers. Phase 2 will consist of construction and commissioning of trains 3 and 4. Employment during Phase 2 is predicted to average 3,000 persons over a 3-year construction and commissioning period, with peak employment reaching 4,250 workers.

It is estimated that 5% of the direct construction workforce will be hired locally, 25% from other parts of BC, 50% from other parts of Canada, and 20% from outside Canada (4,300 PYs). Thus, construction will directly provide approximately 17,200 PYs of employment for Canadians, including 6,600 PYS for BC residents, of which an estimated 1,100 PYs are for northwest BC residents

Table 1-9 shows the composition of direct construction workforce by construction component and trade. An estimated 85% of the construction workforce will consist of skilled trades and labourers, and 15% will be workers in management and supervisory positions. The construction labour force will be contracted on a shift-basis depending on the specific requirements at each construction stage, rather than on full-time, part-time, or seasonal basis.

Table 1-9 Estimated Composition of Project Construction Force

Labour Category	Early Works	Site Development & MOF Construction	Facility Construction (Phase 1)	Facility Commissioning (Phase 1)	Facility Construction (Phase 2)	Facility Commissioning (Phase 2)
Person Years	340	775	11,940	1,125	6,375	940
Construction Management	✓	✓	✓	✓	✓	✓
Equipment Operator	✓	✓	✓	-	✓	-
Metal worker/Welder	-	✓	✓	-	✓	-
Carpenter	✓	✓	✓	-	✓	-
Pipefitter	-	-	✓	✓	✓	✓
Process Specialist	-	-	✓	✓	✓	✓
Electrician	-	✓	✓	✓	✓	✓
Instrumentation	-	-	✓	✓	✓	✓
Insulation	-	-	✓	-	✓	-
Other Trades	-	✓	✓	-	✓	-
Labourer	✓	✓	✓	-	✓	-
HSE	✓	✓	✓	✓	✓	✓
Other	-	✓	✓	-	✓	-

NOTES:
✓ Labour category required in Project phase
- Not applicable

SOURCE:
Data provided by Aurora LNG

Table 1-10 lists minimum fair wage rates for different types of construction workers working on federal contracts that are governed by the *Fair Wages and Hours of Labour Act* in the island/coast/north zone of BC (Government of Canada 2013). Wages paid by industry often exceed minimum wage rate standards.

Table 1-10 Schedule of Wage Levels for Federal Contracts BC, Island/Coast/North Zone

Classification of Labour	Wage Rate Per Hour
Electricians	$30.60
Plumbers	$32.40
Sprinkler system installers	$32.00
Steamfitters and pipefitters	$33.40
Sheet metal workers	$30.50
Ironworkers (excluding reinforcing ironworkers)	$32.40
Reinforcing ironworkers (rebar/rodman)	$23.90
Carpenters	$28.20
Bricklayers	$29.50
Concrete finishers	$24.50
Tilesetters (including terrazzo and marble)	$27.90
Plasterers and stucco applicators	$25.00
Drywall installers, finishers, lathers and tapers	$26.90
Roofers	$24.10
Glaziers	$26.80
Insulators	$23.80
Painters	$21.10
Floor covering installers	$23.20
Construction millwrights	$35.19
Heavy equipment mechanics	$29.90
Refrigeration and air conditioning mechanics	$35.20
Elevator constructors	$43.79
Mobile crane operators	$34.20
Tower crane operators	$30.18
Straight truck drivers	$26.90
Road tractor drivers of semi-trailers and trailers	$25.90
Heavy equipment operators (excluding cranes, graders and asphalt and paving machines)	$27.40
Grader operators	$27.10
Paving machine and asphalt plant operators	$28.70
Scraper operators	$28.40
Packer (road-roller) operators	$23.40
Pressure vessel welders	$32.50
Traffic control persons	$17.50

Table 1-10 Schedule of Wage Levels for Federal Contracts BC, Island/Coast/North Zone

Classification of Labour	Wage Rate Per Hour
Form setters	$23.40
Asphalt layers (by hand - includes rakers)	$25.31
Helpers, labourers (excluding asphalt layers, traffic accommodation persons or form setters)	$18.70
Powder persons and drillers	$29.40
Helpers, labourers with first aid ticket	$19.00

NOTE:
The *Fair Wages and Hours of Labour Act* was repealed in 2014; however, contracts written when the Act was in force continue to be governed by its provisions.

SOURCE:
Government of Canada 2013

With direct construction labour costs estimated to be $1,677 million in Canada, of which $587 million will involve BC workers, the average cost of construction labour is estimated to be $91,500/PY in BC and $100,100/PY in Canada.

INDIRECT EMPLOYMENT

Indirect employment results when project spending on the goods and services required for project construction results in economic activity for all the industries that support the production of these goods and services (inter-industry effects). Based on the information in Table 1-4, Project purchases of goods and services from Canadian sources during construction will total $5.0 billion of which $2.7 billion will be purchased from BC sources. Based on this level of spending on goods and services in BC, the SCIPIOM model estimates that 13,900 PYs of indirect employment will be created in BC, and an additional 31,400 PYs of employment elsewhere in Canada (see Table 1-11). The SCIPIOM model also estimates that indirect employment will result in labour income of $2.9 billion in Canada (based on an average of $64,400 per PY) of which $0.9 billion will occur in BC (based on $61,900 per PY).

INDUCED EMPLOYMENT

Induced economic activity will occur due to spending on goods and services by individuals directly or indirectly employed by the Project. Such induced spending will reflect expenditure patterns by households, which vary between different regions. Based on the SCIPIOM results, consumer purchases by workers who are directly or indirectly employed during construction will create 6,500 PYs of induced employment in BC and an additional 14,800 PYs of employment elsewhere in Canada. The SCIPIOM model also estimates that induced employment will result in labour income of $1.1 billion in Canada (based on an average of $51,100 per PY) of which $0.3 billion will occur in BC (based on $46,800 per PY).

TOTAL CONSTRUCTION EMPLOYMENT

Project construction is expected to create 83,800 PYs of employment for Canadian workers (see Table 1-11). Approximately 21% of total employment will come from direct employment, 54% from indirect employment, and 25% from induced employment. Approximately 32% of total employment in Canada is estimated to occur in BC.

Table 1-11 Estimated Construction Employment in BC and Canada

	BC (PYs)	Other Canada (PYs)	Total Canada (PYs)
Direct Employment	6,600	10,600	17,200
Indirect Employment	13,900	31,400	45,300
Induced Employment	6,500	14,800	21,300
Total Employment	27,000	56,800	83,800

SOURCE:
Custom run of SCIPIOM 2016

Direct, indirect, and induced labour income during construction is estimated to be $5.7 billion, of which $1.7 billion will occur in BC (see Table 1-12).

Table 1-12 Estimated Labour Income in BC and Canada during Construction

	BC ($ millions)	Other Canada ($ millions)	Total Canada ($ millions)
Direct	602	1014	1721
Indirect	859	2115	2913
Induced	305	804	1091
Total	1766	3933	5725

NOTE:
Values may not sum to totals shown because of rounding
SOURCE:
Custom runs of SCIPIOM 2016

1.4.4.2 Operations

DIRECT EMPLOYMENT

To operate Phase 1 (trains 1 and 2), the Project is estimated to employ approximately 300 people. This will increase to approximately 600 people once the Project reaches full build-out (addition of trains 3 and 4). Additional operational and maintenance staff will be needed during the commissioning and start-up periods, which will extend approximately one year following completion of construction. Major turnarounds will occur every five years following full build-out, will last approximately two months and involve a labour force of approximately 1,000 persons. Minor turnarounds will occur every two years following full build-out, last two to three weeks and involve a workforce of approximately 200 persons.

Aurora LNG anticipates that 90% of the operational workforce (approximately 540 workers at full build-out) will be Canadian residents (a mix of local, regional and fly-in/fly-out workers [FIFO]), with the balance being foreign FIFO workers (approximately 60 workers). Table 1-13 provides an estimated breakdown of direct employment of operational workforce at full build-out. The operations workforce will be hired on a permanent full-time basis. However, workers involved in maintenance turn-arounds will be hired on a temporary basis.

Table 1-13 Estimated Annual Operations Labour Force

Positions	Number of Positions
Management	45
Operations	225
Technical Services & Maintenance	255
Administration & Other	75
Total	600

SOURCE:
Data provided by Aurora LNG.

Table 1-14 lists fair wage rates for trades working on federal contracts that are governed by the *Fair Wages and Hours of Labour Act* in the island/coast/north zone of BC (Government of Canada 2013). While indicative of fair wage rates for operations, technical service, and maintenance personnel, wages paid by industry often exceed minimum wage rate standards that were established for federal contracts governed by the *Fair Wages and Hours of Labour Act*.

Table 1-14 Schedule of Wage Levels for Federal Contracts BC, Island/Coast/North Zone

Classification of Labour	Wage Rate Per Hour
Electricians	$30.60
Plumbers	$32.40
Sprinkler system installers	$32.00
Steamfitters and pipefitters	$33.40
Sheet metal workers	$30.50
Ironworkers (excluding reinforcing ironworkers)	$32.40

SOURCE:
Government of Canada 2013
NOTES:
The *Fair Wages and Hours of Labour Act* was repealed in 2014; however, contracts written when the Act was in force continue to be governed by its provisions.

Annual direct labour income is estimated at $54 million in BC, and $68 million in Canada in total. Based on operations labour estimates provided in Table 1-13 average annual labour income of direct Project workers will be approximately $126,000/PY.

INDIRECT EMPLOYMENT

Indirect employment associated with the purchase of goods and services was estimated using the results of the SCIPIOM run related to Project operational spending in Canada. As shown in Table 1-6, the annual value of goods and services needed for operations (other than labour) likely to be purchased from suppliers in Canada is estimated to be $288 million, of which $164 million will be purchased from BC suppliers. Repair and maintenance are the largest costs associated with operations of the Project.

Table 1-15 shows the indirect employment associated with the Project resulting from operating and maintaining the LNG facility and the indirect employment associated with the production and transportation of natural gas. The results show that the indirect employment associated with supplying the natural gas to the facility will account for 89% of indirect employment in BC and 82% of indirect employment in Canada.

Table 1-15 Indirect Annual Operational Employment in BC and Canada

	BC (PYs)	Other Canada (PYs)	Total Canada (PYs)
Facility Operations	1,250	1,550	2,800
Gas Supply	9,800	3,400	13,200
Total Employment	11,050	4,950	16,000

SOURCE:
Custom runs of SCIPIOM 2016

The SCIPIOM model also estimates that indirect employment during operations will result in annual labour income of $1.2 billion in Canada (based on an average of $73,700 per PY) of which $0.9 billion will occur in BC (based on $75,200 per PY).

INDUCED EMPLOYMENT

Spending by households with workers directly or indirectly employed by the Project, including those involved with supplying the natural gas to the Project, will create induced employment. For every 100 direct and indirect jobs created by the Project, an estimated 36 induced jobs will be created. Total induced employment in Canada is estimated to be 6,100 PYs per year, of which 59% are predicted to occur in BC. The SCIPIOM model also estimates that induced employment will result in labour income of $0.3 billion in Canada (based on an average of $50,000 per PY) of which $0.2 billion will occur in BC (based on $46,800 per PY).

TOTAL OPERATIONS EMPLOYMENT

Table 1-16 summarizes the annual direct, indirect and induced employment associated with the operations phase, including employment associated with supplying natural gas to the Project. Annual employment associated with the Project is estimated at 22,900 PYs, of which 67% will be residents of BC. Of the total employment impacts, 18,600 PYs (81%) will be associated with natural gas exploration, production, and transportation in Canada and the other 19% will be associated with facility operation. Over its minimum 25-year operating life, the Project will create an estimated 572,000 PYs of employment.

Table 1-16 Estimated Annual Operational Employment in BC and Canada

	BC (PYs)	Other Canada (PYs)	Total Canada (PYs)
Direct Employment	434	106	540
Indirect Employment	11,300	5,000	16,300
Induced Employment	3,600	2,500	6,100
Total Employment	**15,300**	**7,600**	**22,900**
Facility Operations	2,300	2,000	4,300
Gas Supply	13,000	5,600	18,600

NOTE:
Values may not sum to totals shown because of rounding
SOURCE:
Custom runs of SCIPIOM 2016

Estimated annual direct, indirect and induced labour income, based on the results of the SCIPIOM, is listed in Table 1-17**.** Annual labour income in Canada associated with employment during operations is estimated to be approximately $1.6 billion, of which 68% will occur in BC. About 83% of the impacts on labour income ($1.3 billion) will be associated with natural gas exploration, production, and transportation in Canada and the other 17% will be associated with facility operation.

Table 1-17 Estimated Annual Labour Income in BC and Canada during Operation

	BC ($ millions)	Other Canada ($ millions)	Total Canada ($ millions)
Direct	54	14	68
Indirect	850	347	1197
Induced	169	137	306
Total	1,072	498	1570
Facility Operations	155	117	272
Gas Supply	917	381	1298

NOTE:
Values may not sum to totals shown because of rounding
SOURCE:
Custom runs of SCIPIOM 2016

1.4.4.3 Decommissioning

Employment requirements during decommissioning are conceptual, and based on the estimated expenditures that will occur during this phase. Table 1-18 summarizes direct and indirect employment associated with decommissioning spending as summarized in Table 1-7, as well as induced employment. Total employment during decommissioning is estimated to be approximately 14,300 PYs, of which an estimated 73% will involve residents of BC. Of the total employment during decommissioning, 78% will be associated with Project expenditures (direct and indirect), and 22% will be induced employment. The decommissioning labour force will be contracted on a shift-basis, rather than on full-time, part-time, or seasonal basis. It is assumed that the direct decommissioning workforce will all be Canadian residents.

Table 1-18 Estimated Decommissioning Employment in BC and Canada

	BC Estimate (PYs)	Other Canada Estimate (PYs)	Total Canada Estimate (PYs)
Direct and Indirect Employment	8,500	2,700	11,200
Induced Employment	1,900	1,200	3,100
Total Employment	10,400	3,900	14,300

SOURCE:
Estimated from Statistics Canada Input-Output multipliers for Waste Management and Remediation Services

1.4.4.4 Potential to Use Underutilized Resources

Project employment opportunities will help address unemployment in northwest BC communities, particularly Aboriginal communities, whose unemployment rates are higher than provincial averages. In 2011, the labour force of northwest BC communities near Prince Rupert was 17,265 persons, of whom 1,830 were unemployed; this is an unemployment rate of 11.1% (Statistics Canada 2011). In 2011, the average unemployment rate of Aboriginal communities was higher than for the regional population as a whole, at 23.3%.

Once Project construction commences, unemployed individuals will have numerous employment opportunities. Individuals possessing construction skills and experience will be able to seek positions through Project contractors. Other job opportunities will arise within local firms that have been awarded supply or service contracts for the Project. Finally, hospitality firms, merchants, and other service companies will likely need to hire additional staff due to induced economic activity within the region.

Given the length of Project construction, there will be opportunities for individuals to acquire experience and develop skills that will improve their employability after the Project is constructed. Some skills may be transferable to potential long-term employment with the Project when it becomes operational.

1.4.4.5 Employment Policies and Practices

Aurora LNG will first seek potential employees in northwest BC, then other parts of BC, and finally other parts of Canada. Most of the employment and contracting opportunities will be through construction contractors. However, Aurora LNG is committed to its “hire local first” approach being implemented through construction contractors; construction contractors will be required to use local labour and businesses, provided they are competitive and meet necessary standards and requirements.

Aurora LNG's selection criteria for suppliers and contractors include, but are not limited to, the following capabilities:

- Exemplary and consistent health, safety and environmental performance (HSE)
- Ability to deliver consistent product quality service
- Demonstrated commercial performance and competitive pricing
- Innovative problem solving and ways to maximize efficiency and safety
- Proven management systems capability.

To increase opportunities and benefits for local employment, Aurora LNG will also:

- Continue to participate in efforts to establish partnerships that support jobs training programs in the community and throughout the province
- Communicate the anticipated need and skill level of workers for both the construction and operations phases of the Project
- Communicate increases and decreases of workforce numbers as early as possible to avoid affecting local communities or businesses.

Additionally, Aurora LNG will increase the skills and experience of local area workers by supporting local training centres aimed at developing the skills of the local workforce and, where appropriate, providing access to the necessary environmental, health and safety training required to complete the jobs. Nexen will also participate in locally relevant training initiatives, such as the Tsimshian Round Table Training Initiative, and provide funding to training organization for capacity building and job-related education.

1.4.5 Government Revenue

1.4.5.1 Construction

During construction, sources of government revenue will include corporate taxes on contractors' profits, income taxes paid by workers directly employed on construction, and sales taxes paid on goods and services purchased from Canadian suppliers. Table 1-19 summarizes the expected tax revenues for Canada and BC, based largely on the results of the SCIPIOM model. Corporate tax estimates assume a federal corporate tax rate of 15%, and a BC tax rate of 11%, estimated by applying these against the net operating surplus, which is estimated to be 43% of the gross operating surplus[1]. Personal income taxes are based on SCIPIOM estimates of labour income multiplied by federal and provincial income tax rates[2].

[1] According to Statistics Canada (2016), the net operating surplus for corporations in Canada in 2015 accounted for 43% of their gross operating surplus.

[2] Effective federal and provincial tax rates were estimated based on the ratio between federal/provincial incomes taxes payable and total employment income for 2013 for specific income ranges (Canada Revenue Agency 2015) that matched the average income per PY estimates for direct, indirect and induced labour.

Table 1-19 Estimated Revenues for BC and Canada during Construction

Government	Revenue Type	Direct ($ millions)	Indirect ($ millions)	Induced ($ millions)	Total ($ millions)
Canada	Corporate income tax	8	80	71	159
	Personal income tax	237	294	91	622
	Sales taxes	13	13	91	118
	Other taxes and levies	15	14	41	70
	Total	**274**	**401**	**294**	**969**
BC	Corporate income tax	0	17	17	34
	Personal income tax	29	33	9	72
	Sales taxes	28	18	32	78
	Other taxes and levies	34	23	51	107
	Total	**91**	**91**	**109**	**290**
Municipal and Regional	Property tax	50	NE	NE	NE

NOTES:
NE = not estimated
Values may not sum to totals shown because of rounding
SOURCE:
Custom runs of SCIPIOM 2016. Property tax information provided by Aurora LNG.

Over the construction period, it is estimated that the Government of Canada will receive an estimated $969 million, of which 64% will be personal income taxes and 16% will be corporate income taxes, with 12% from sales tax, including PST, and 7% from other taxes and levies. Customs duties on some imported components will add to this total.

Government of BC revenue over the construction period is estimated at $290 million, with 25% from personal income taxes, 27% from sales taxes, 12% from corporate income taxes, and 37% from other taxes and levies. Municipal government revenue paid by Aurora LNG over the construction period is estimated at $50 million.

1.4.5.2 Operation

During operations, sources of government revenue will include corporate taxes on profits, income taxes paid by workers directly employed on construction, and sales taxes paid on goods and services purchased from Canadian suppliers. There will also be revenues from the carbon tax levied by BC as well as municipal property taxes. Table 1-20 summarizes the expected tax revenues for Canada, BC, and municipal governments, with the estimates based largely on the results of the SCIPIOM. Estimated property and GHG taxes are provided directly by Aurora LNG. Indirect and induced corporate taxes assume a federal corporate tax rate of 15% and a BC tax rate of 11%, and are estimated by applying these against the net operating surplus. Personal income taxes use the SCIPIOM estimates of labour income multiplied by a factor to estimate taxable income, and federal and provincial income tax rates.

On an annual basis, the Government of Canada will receive approximately $401 million, excluding any corporate incorporate taxes payable by Aurora LNG. Of this, approximately 41% will be corporate income taxes associated with Project expenditures, 41% from personal income taxes, while revenue from GST and other federal taxes will be 18% of the total. Of the total $401 million, 12% will be attributed to facility operations and 88% from gas supply.

Annual revenues for the Government of BC during operations are estimated at $982 million, excluding taxes on corporate profits payable by Aurora LNG. Of this, 10% will come from corporate income taxes associated with expenditures, 16% from sales taxes, 4% from personal incomes taxes, 36% from carbon taxes primarily from the Proponent and upstream natural gas producers, and 33% from other tax sources, including fuel taxes and other levies (does not include royalties).

Table 1-20 Estimated Annual Revenue for BC and Canada during Operations

Government	Revenue Type	Direct ($ millions)	Indirect ($ millions)	Induced ($ millions)	Total ($ millions)	Facility Operations ($ millions)	Gas Supply ($ millions)
Canada	Corporate income tax	0	142	22	164	9	155
	Personal income tax	9	133	22	165	29	135
	Sales taxes	12	19	24	55	1	54
	Other taxes and levies	2	3	13	18	3	15
	Total	**24**	**297**	**81**	**401**	**43**	**358**
BC	Corporate income tax	0	91	10	101	5	96
	Personal income tax	3	35	5	43	7	36
	Sales taxes	64	71	20	154	12	142
	Carbon tax	143	212	2	357	143	214
	Other taxes and levies	140	141	46	327	5	322
	Total	**350**	**549**	**83**	**982**	**172**	**811**
Municipal and Regional	Property tax	15	NE	NE	NE	15	NE

NOTES:
NE = not estimated
Values may not sum to totals shown because of rounding
SOURCE:
Custom runs of SCIPIOM 2016. Property tax information provided by Aurora LNG.

Annual property tax paid by the Proponent is estimated at $15 million per year.

The Project will also pay BC's LNG tax, which will be calculated based on a two-tiered system, in which the tier 1 tax will be based on net proceeds (revenues less expenses), and the tier 2 tax will be based on net proceeds less capital investment account. The amount of LNG taxes payable each year – if any - will depend on Project revenue which, in turn, depends on the price received for the LNG shipped to market. Because it is not possible to predict what LNG prices will be at the time the Project becomes operational, LNG taxes have not been estimated.

The Project's owners will pay corporate income taxes on taxable corporate income, including income derived from the Project. However, the amount of corporate income taxes paid will depend on each shareholder's specific tax position and structure, and is not included in the estimate.

1.4.6 Contribution to BC Economy

It is estimated that Project-related purchases of labour, goods and services needed for construction will generate gross domestic product (GDP) in BC valued at nearly $2.6 billion over the construction period (see Table 1-21). Direct Project effects account for 24% of total provincial GDP impacts.

Table 1-21 Estimated Impact on Gross Domestic Product in BC

	Construction (Total) ($ millions)	Facility Operations (Annual) ($ millions)	Gas Supply (Annual) ($ millions)	Decommissioning (Total) ($ millions)
Direct	603	54	0	206
Indirect	1,252	38	2,889	429
Induced	702	58	362	240
Total	**2,557**	**150**	**3,251**	**875**

During operations, the Project will contribute an estimated $3.4 billion per year to provincial GDP. Most of the GDP contribution ($3.2 billion) will be associated with natural gas production. This estimate is considered to be conservative, because corporate income taxes and LNG taxes are not included in the calculations.

Decommissioning activities will generate an estimated $875 million in GDP impacts. Based on a minimum 25-year Project life, the Project will result in cumulative GDP effects for BC that are estimated to be nearly $88 billion in 2016 nominal dollars.

1.4.7 Contribution to the Canadian Economy

It is estimated that purchases of labour, goods and services needed for construction will generate GDP in Canada in the amount of $8.5 billion over the construction period (see Table 1-22). Direct Project effects account for 22% of the total contribution to national GDP during Project construction.

Table 1-22 Estimated Impact on Gross Domestic Product in Canada

	Construction (Total) ($ millions)	Facility Operations (Annual) ($ millions)	Gas Production ($ millions)	Decommissioning (Total) ($ millions)
Direct	1,847	68	0	308
Indirect	4,258	190	3,391	711
Induced	2,358	123	576	393
Total	**8,463**	**381**	**3,967**	**1,412**

During operations, the Project will contribute an estimated $4.3 billion per year to the Canadian GDP, with indirect effects, mainly related to the supply of natural gas for the Project, accounting for 91% of the GDP contribution. This estimate is considered to be conservative, because corporate income taxes and LNG taxes are not included in the calculations.

Expenditures on decommissioning will generate approximately $1.4 billion in GDP for the Canadian economy. Based on a minimum 25-year Project life, the Project will contribute an estimated $119 billion to Canada's GDP.

1.4.8 Training and Education

The Project's requirements for skilled and unskilled labour during Project construction and operations exceed the estimated available labour force within northwest BC. The Proponent will work with the provincial government, Aboriginal communities, and training and education institutions to identify opportunities and support the development of trades training programs to address the anticipated shortfall in the local availability of skilled labour. To meet procurement standards, it is anticipated that most of these trades will require a minimum grade 12 education along with certification from appropriate governing bodies (e.g., Inter-Provincial Red Seal, BC Certification of Qualification among others).

1.5 Contributions by Aurora LNG to Community Development

Aurora LNG's community investment program is designed to help strengthen the communities where we live and work through Giving, Matching and Helping. Our Giving program directs funding through the following four areas: Supporting Communities, Inspiring Education & Innovation, Investing in Arts & Culture and Environmental Care.

During the Early Engagement and Pre-Application Phases of the Project, Aurora LNG has supported the following community organizations and events:

- All Native Basketball Tournament (annual)
- Scared Straight (Youth Odd Squad)
- Kitselas Community Christmas Dinner (annual)
- Kermode Friendship Centre Christmas Dinner (annual)
- Coastal Cultural Canoeing Society
- Game Changer Youth Expo (LNG in BC Conference)
- District of Port Edward's 50th Anniversary
- Prince Rupert Salmon Fest.

As the Project moves through the Application and ongoing engagement phases, Aurora LNG is committed to ensuring our investments are aligned with the priorities of our new neighbours in the Prince Rupert region of British Columbia through consultation with stakeholders, meetings with municipal officials and educational institutions.

1.5.1 Benefits of the Project to the Five Pillars of Assessment

Project benefits are comprised both of those directly associated with the proposed Project, including such economic benefits as job creation, enhanced business opportunities, and government revenue generation, as well as benefits of the proposed Project. When considering the entire Project life cycle, Project benefits have and will occur for valued components within all five assessment pillars (environmental, economic, social, heritage, and health).

1.5.1.1 Environmental Benefits

Environmental benefits of the proposed Project include lessening dependence of foreign markets on more carbon intensive fossil fuels through the production and export of LNG. Additional environmental benefits include increasing the knowledge and understanding of environmental conditions in the Project assessment area through the collection of environmental data, and participation in local environmental monitoring and research programs (e.g. Skeena Area Marine Research Collaborative).

1.5.1.2 Economic Benefits

Economic benefits of the proposed Project are described above in Section 1.4.6 through Section 1.4.8.

1.5.1.3 Social Benefits

Predicted social benefits of the proposed Project, which include effects on training and employment are provided in the Sections 1.4.8.

1.5.1.4 Heritage Benefits

During the archaeological impact assessments (AIAs) conducted for the Project, 62 new and previously recorded *Heritage Conservation Act* (HCA) protected archaeological sites and 479 unprotected (post AD 1846) culturally modified trees (CMTs) and historical heritage sites were recorded or revisited. Information gathered on these heritage resources and the potential for additional finds, will advance the knowledge and understanding of the archaeology and history of Digby Island.

1.5.1.5 Health Benefits

No benefits from the proposed Project to the health pillar have been identified.

1.6 Applicable Authorizations

The applicable federal, provincial, and municipal licenses, leases, permits, authorizations and/or approvals anticipated to be required for the construction and operations of the proposed Project, including shipping activities, and the associated responsible regulatory body, are listed in Table 1-23 below.

A request for concurrent permitting will not be submitted under the Concurrent Approval Regulation pursuant to BCEAA.

Table 1-23 Authorization Table

Name of Authorization	Authorizing Agency and Status	Description of Need for Authorization
Fisheries Act Authorization	Fisheries and Oceans Canada (DFO) *Fisheries Act* s. 35(1) Application for Authorization under Paragraph 35(2)(b) of the *Fisheries Act* Regulations	Construction and operational activities may result in serious harm to fish (or fish habitat) that are a part of a commercial, recreational, or Aboriginal fishery or to fish that support such a fishery. These include facilities on the foreshore, offloading docks and the LNG berths, and temporary and permanent infrastructure in and around streams
Navigation Protection Act Approval	Transport Canada *Navigation Protection Act* s.5(1)	Construction of marine terminal, MOF, and pioneer facility in or about a navigable water
Certificates of Compliance	Transport Canada *Marine Transportation Security Act* s.4(1) Marine Transportation Security Regulations	Operations of the LNG facility, marine terminal and carrier
Permit under Canadian Aviation Regulations	Transport Canada *Aeronautics Act* Canadian Aviation Regulations	Potential permit for the flare

Table 1-23 Authorization Table

Name of Authorization	Authorizing Agency and Status	Description of Need for Authorization
Disposal at Sea Permit	Environment Canada *Canadian Environmental Protection Act* s.125(1) (b) Disposal at Sea Regulations	Potentially required for ocean disposal of marine sediments dredged from the LNG berth areas and MOF
Explosives Permit/License	Natural Resources Canada *Explosives Act* s. 7(1) Explosives Regulations	Transportation, storage and manufacture of explosives that will be used for blasting during site preparation
LNG Export License*	National Energy Board (NEB) *National Energy Board Act* s.117	Export of LNG outside of Canada to international markets
PRPA Lease	Prince Rupert Port Authority *Canada Marine Act* Port Authorities Operations Regulations	Lease to occupy and use PRPA-administered federal land (Digby Island site)
Section 11 approval for changes in and about a stream	*Water Sustainability Act*	Approval for changes to waterbodies/wetlands
Waste Discharge Permit(s)	BC OGC *Environmental Management Act*	Dredge disposal (on land), wastewater discharge, hydrostatic test water, Project air emissions, and waste discharges
LNG Facility Permit	BC Oil and Gas Commission (BC OGC) *Oil and Gas Activities Act* s. 21 Pipeline and Liquefied Natural Gas Facility Regulation	Construction and operations of the LNG facility
License to cut timber	*Forest Act* s.47	Removal of timber from provincial Crown Land to clear sites for construction camp and ancillary construction facilities (e.g., laydown areas, warehouses)
Tenure on provincial Crown Land	BC OGC or MFLNRO *Lands Act* s.39 and 40 or MFLNRO *Ministry of Lands, Parks and Housing Act*	Use of provincial Crown Land for the Project
Authorization for Sewage Facilities	BC MOE *Environmental Management Act* Municipal Wastewater Regulation *Public Health Act* Sewerage System Regulation	Sewage facilities for camp operations (threshold volume of 22,700 L/d)
Fuel Storage Registration	BC MOE *Environmental Management Act* Petroleum Storage and Distribution Facilities Storm Water Regulation	Temporary fuel storage (e.g., camp, storage areas)

Table 1-23 Authorization Table

Name of Authorization	Authorizing Agency and Status	Description of Need for Authorization
Camp Permit	BC Ministry of Health *Public Health Act* Industrial Camp Regulations	Construction and operations of the construction camp
Heritage Inspection permits Heritage Investigation permits	BC FLNRO *Heritage Conservation Act* s.14	Archaeological surveys on provincial Crown Land to support the environmental assessment
Site Alteration Permit	BC FLNRO/BC OCG *Heritage Conservation Act* s.12	Systematic collection of heritage materials through excavations and/or measures to prevent damage or degradation of heritage resources (if found) on provincial Crown Land

NOTE:

* Aurora Liquefied Natural Gas Ltd. (sole purpose corporation held by the Aurora LNG joint venture participants) received approval from the NEB for a LNG export license to the NEB on May 2, 2014.

1.7 Alternative Means of Undertaking the Proposed Project

Evaluation of technically and economically feasible alternative means of carrying out a designated project and the environmental effects of any such alternative means is required by Section. 19(1)(g) of CEAA 2012. Aurora LNG has and continues to evaluate a number of alternative designs and technologies, collectively referred to as the 'alternative means' for the Project, including alternatives for:

- Power supply
- Water supply
- Orientation of onsite LNG facilities
- Marine terminal design and location
- Disposal of marine sediments and terrestrial overburden
- Access road routing
- Flare design and location
- Construction camp location(s)
- Construction camp operations (i.e., water use, employee transportation and waste disposal).

Criteria used to assess each option include:

- Technical requirements to construct and operate the LNG facility and its related infrastructure
- Economic feasibility of alternative technologies for construction and operations of the LNG facility
- Feedback received from Aboriginal Groups, including feedback related to Aboriginal Interests and CEAA 2012 section 5(1)(c) factors (includes potential effects on physical and cultural heritage, and current use of lands and resources for traditional purposes)

- Reducing adverse effects on environmental and heritage resources including potential effects to factors identified in CEAA 2012 section 5(1)(a) and (b) and 5(2)(a) and (b). This includes, where applicable:
    - Changes that may be caused to fish and fish habitat, aquatic species and migratory birds as defined in subsection 2(1) of the *Fisheries Act*, *Species and Risk Act* and *Migratory Birds Convention Act* respectively
    - Changes to the environment that occur on federal lands, in another province, or outside Canada
- Industry safety standards and regulatory requirements.

As per CEAA 2012 guidance, if an alternative was deemed technically or economically unfeasible, no further assessment of that alternative using other criteria was conducted. All potential alternative means have an opportunity to interact with environmental effects as identified in Section 5 of CEAA 2012.

Preferred alternatives have been selected based on the results of the assessment.

During workshops with Aboriginal Groups, Project design alternatives under consideration were reviewed and discussed. Feedback was received from Aboriginal Groups regarding power supply, disposal of marine sediments and camp location and is noted below in Section 1.7.1, 1.7.5 and 1.7.8, respectively. No further feedback was received from Aboriginal Groups regarding the other alternative means of undertaking the Project. Feedback related to CEAA 2012 Section 5(1)(c) factors and Aboriginal Interests are outlined in Sections 11.3 and 12 of the Application, respectively.

1.7.1 Power Supply

Power is required for the production and storage of LNG and to operate supporting Project infrastructure (see Section 1.2.5.3). The following three power supply options are being considered for the Project:

- 250 MW combined or simple cycle natural gas plant and natural gas driven liquefaction process
- Electric grid power from the existing BC Hydro grid
- 1000 MW combined cycle natural gas plant, with an electric drive liquefaction process.

1.7.1.1 Evaluation Criteria

The power supply options are being evaluated using the following criteria (Table 1-24):

- Technical feasibility
- Capacity of existing infrastructure within the BC Hydro grid
- Reliability of power supply
- Cost and affordability (including installation and operation)
- Environmental constraints, including greenhouse gas emissions and archaeological resources
- Safety standards.

BC Hydro will be evaluating the feasibility of providing power from the existing hydro grid to Digby Island. This will require infrastructure upgrades and the installation of a new transmission line to the Project site.

Engagement to date with BC Hydro has indicated that it is unlikely that the existing grid can supply all of the power to produce LNG and operate Project infrastructure. The feasibility of this option is subject to the results of BC Hydro's evaluation.

The modelled or base case option conservatively includes natural gas fired compressor turbine drives for liquefaction and on-site power generation turbines. As the facility design advances through detailed engineering (Pre-FEED and FEED) efficiencies and optimum equipment selections are expected to result in reduced overall project operation emissions. This option is considered feasible and in keeping with standard LNG facility design.

During pre-application consultation, Gitga'at First Nation requested that different options for LNG liquefaction be considered including the use of electric drive. An electric drive option is considered in Table 1-24.

Table 1-24 Evaluation Summary – Power Supply

Evaluation Criteria		All Power Sourced from the BC Hydro Grid	1000 MW Combined Cycle Natural Gas Plant, with an Electric Drive Liquefaction Process	250 MW Combined or Simple Cycle Natural Gas Plant and Natural Gas Driven LNG Trains
Technical Criteria	Feasibility	Pending the outcome of BC Hydro's evaluation	Yes	Yes
	Sufficient Existing Grid Capacity	No, requires expansion of power grid and installation of new generating capacity	Not applicable	Not applicable
	Power Reliability Concerns	Potential challenges if system is not built with normal redundancy of supply	No	No
Economic Criteria	Power Cost	High	Moderate	Moderate
Environmental and Heritage Resources Criteria	Environmental Constraints*	Potentially (BC Hydro scope)	Air emissions expected	Air emissions expected
	Greenhouse Gas Emissions**	Low	High	High
	Potential Archaeological Effects	Potentially (BC Hydro scope)	Yes	Yes
Safety Criteria	Safety Concerns	None expected	None expected	None expected
Selection	Preferred	No	No	Yes

NOTES:

* The PDA would be the same for all alternatives, as such potential environmental and heritage effects resulting from site preparation and clearing are not expected to differ between the options and are consistent with the effects assessment included in Part B, including the assessment of CEAA 2012 factors summarized in Section 11.

** Greenhouse gas emissions from all alternatives will contribute to the cumulative global release of GHGs.

1.7.1.2 Preferred Alternative

The preferred option is the combined natural gas turbines and the combined cycle natural gas power plant. The combined option provides a cost effective and reliable power source that does not require electrical grid access or infrastructure.

1.7.2 Water Supply

The Project requires a water supply system for construction and operations activities as described in Section 1.2.5.3. Project water requirements during construction are anticipated to be 1,125 m^3/day, and during operations are anticipated to be 9,855 m^3/day.

The following three water supply options were considered for the Project:

- Municipal water barged from the Prince Rupert Port
- Water pipeline coming into site from one of several existing water supplies
- Seawater intake with an associated on-site desalination plant.

Digby Island is limited in the available freshwater resources in both surface and groundwater availability. Due to the Project's water demands it is unfeasible that natural freshwater sources on Digby will be sufficient to provide all the required needs.

1.7.2.1 Evaluation Criteria

The water supply options were evaluated using the following criteria (Table 1-25):

- Technical feasibility, including reliability of supply
- Cost and affordability (including installation and operation)
- Environmental constraints, including land disturbance and archaeological effects
- Safety standards and training requirements.

Given potential limitations in available water supply, both from municipal sources and from local groundwater or surface water sources, a hybrid approach to water supply is likely required. This could involve using municipal water supply during early construction (i.e., site preparation), and constructing a desalination plant with intake to address water needs during construction and operations.

Table 1-25 Evaluation Summary – Water Supply

Evaluation Criteria		Municipal Water from Barge	Municipal Water Pipeline to Site	Seawater Intake with Desalination
Technical Criteria	Feasibility	Feasible for early construction water needs; insufficient for operational water needs	Feasible for early construction water needs; insufficient for operational water needs	Feasible for construction and operational water needs
	Reliability of Supply	Moderate during construction; low during operations	Moderate during construction; low during operations	High
Economic Criteria	Cost	High	High	High
Environmental and Heritage Resources Criteria	Environmental Constraints	Air emissions and increased vessel traffic from barge	Potential effects to marine fish and fish habitat and aquatic species from pipeline right-of-way	Air emissions and saline discharge Potential effects to marine fish and fish habitat and aquatic species from intake pipe
	Land Disturbance	Low	Pipeline right-of-way	Low (within PDA)
	Potential Archaeological Effects	None	Yes	Yes
Safety Criteria	Training Requirements	Marine Vessel and safe loading/unloading	Low	Water Treatment Personnel
Selection	Preferred	Yes - Early construction (i.e., site preparation)	No	Yes - Late construction, including commissioning, and Operations

1.7.2.2 Preferred Alternative

Barging water from a municipal source is the preferred option during early construction (i.e., site preparation) due to the limited requirement of infrastructure. Later in construction and during operations, the desalination plant with associated intake is preferred due to the ongoing volumes required and the need for a reliable water supply to address construction and operations water demands.

1.7.3 Orientation of Onsite LNG Facilities

During development of the site layout, multiple orientations of Project infrastructure within the PDA were considered to determine the most efficient layout that will be feasible for construction and operations of the LNG facility. Orientation options for the following three Project components were considered:

- Flare location – sited either to the east or the west of the LNG facility
- Construction and operations camps – either two small camps, or one large camp

- LNG trains – either four trains built in close proximity, or two trains on the east and two trains on the north of the PDA.

1.7.3.1 Evaluation Criteria

The onsite orientation of Project infrastructure was evaluated using the following criteria (Table 1-26):

- Technical feasibility
- Cost (including installation and operation)
- Environmental concerns including land disturbance, archaeological effects, socio-economic effects (e.g., visual quality and light pollution, marine navigation)
- Safety, including engineering specifications, air traffic, and navigation.
- Feedback from Dodge Cove and surrounding community.

The feasibility of alternative orientations of Project infrastructure considers the surrounding environment and socio-economic values including visual quality, economics, and land use.

Digby Island is limited in the available space for orienting Project infrastructure due to the presence of an airport, communities in Dodge Cove and Crippen Cove and geographical constraints. Constraints on orientation of the flare stacks were primarily associated with safety, proximity to a well-used shipping route and the airport but it also considered the potential effects of the flare on light pollution and visual quality. Placement of the construction camp considered feedback from Dodge Cove regarding proximity of the camp to the community, while still allowing reasonable access to the worksite. Orientation of the four LNG trains was reviewed predominantly according to engineering requirements and cost, including considerations for phased construction.

Table 1-26 Evaluation Summary – Orientations of Onsite LNG Facilities

Evaluation Criteria		Flare		Camp		LNG Trains	
		East Side of LNG Facility	**West Side of LNG Facility**	**Two Camps**	**One Camp**	**Four Trains Built Together**	**Two Trains to the East with Two Trains to the North**
Technical Criteria	Feasibility	Yes	Yes	Yes	Yes	Yes	Yes
Economic Criteria	Cost	High	High	High	Moderate	High	High
Environmental and Heritage Resources Criteria	Environmental Constraints	Low (risk to migratory birds, bats)	Moderate (risk to migratorybirds, bats)	Moderate (larger footprint; potential effects to fish and fish habitat and migratory birds)	Low (more compact footprint)	Moderate (more spread out footprint; potential effects to fish and fish habitat and migratory birds)	Low (more compact footprint)
	Potential Archaeological Effects	Yes	Yes	Potential	Potential	Yes	Yes
	Visual Quality and Light Pollution	Moderate (more visible to marine users)	Low (less visible to marine users)	Low	Low	Moderate	Moderate
	Other Effects on Dodge Cove and Surrounding Communities (including socio-economic and marine navigation)	Moderate (more visible to marine users)	Low (less visible to marine users)	Moderate	Moderate	Moderate	Moderate
Safety Criteria	Safety Concerns	Moderate	Moderate	Moderate (less efficient worker movement around site)	Low (more efficient worker movement around site)	Moderate (co-activity during construction of Phase 2 and operations of Phase 1)	Low (reduce co-activity concerns during construction of Phase 2)
Selection	Preferred	No	Yes	No	Yes	No	Yes

1.7.3.2 Preferred Alternative

Placing the flare on the west side of the LNG facility is preferred as it reduces visual quality and light pollution effects to nearby communities while considering proximity to the airport and shipping route.

A single camp is preferred because it reduces the size of the camp within the PDA, resulting in reduced environmental effects.

The preferred orientation for the trains is two trains on the east side and two trains to the north of the facility. This option is preferred due to engineering feasibility and cost, including requirements related to constructing Phase 2 infrastructure while Phase 1 is operating.

The site layout and orientations of onsite infrastructure will be further refined as the Project progresses through FEED, but the extent of on-land development will remain within the PDA.

1.7.4 Marine Terminal Design and Location

During the initial design of the jetty, two main locations and construction designs were considered. Considerations for jetty locations focused on options that enabled safe and efficient loading and unloading of vessels on the south point of Digby Island. Considerations for jetty designs focused on feasibility and potential environmental concerns.

Two jetty locations were considered for the Project:

- Miller Point
- Frederick Point.

Two jetty design options were considered for the Project:

- Pile-and-deck
- Partial infill and pile-and-deck.

1.7.4.1 Evaluation Criteria

Marine terminal location and design were evaluated using the following criteria (Table 1-27):

- Technical feasibility, including engineering requirements, navigability, and dredge volumes
- Cost of construction
- Environmental concerns including effects on marine fish and fish habitat (including marine mammals), land disturbance, archaeological effects, socio-economic effects related to marine use and navigation
- Safety, including engineering design, and risk to health and the environment.

Consideration of terminal location options include navigability of the shipping vessels for loading, habitat disturbances and natural features, and existing navigability of other ships between Digby Island and Kaien Island. Jetty design will consider existing habitat and recreational use of the area. The economic cost of infill versus pile installation also varies, and has been taken into consideration with respect to feasibility.

Table 1-27 Evaluation Summary – Marine Terminal

Evaluation Criteria		Location of Marine Terminal		Type of Marine Terminal	
		Miller Point	Frederick Point	Jetty Pile Installation Option	Jetty Partial Infill and Pile Option
Technical Criteria	Feasibility	Yes	Yes	Yes	Yes
	Navigability of Loading Ships	Moderate (some effects to marine users)	High (navigability maintained)	High (navigability maintained)	High (navigability maintained)
	Dredge Volumes	High	Moderate	Moderate	Moderate
Economic Criteria	Cost of Construction	High	Moderate	High	Moderate
Environmental and Heritage Resources Criteria	Effects on Marine Fish and Fish Habitat (including marine mammals and aquatic species)	High	Moderate	High	Moderate
	Land Disturbance (includes potential effects to fish and fish habitat and migratory birds)	High (greater area affected)	Moderate	Moderate	Moderate
	Potential Archaeological Effects	Potentially	Potentially	Potentially	Potentially
	Interaction with Marine Use and Navigation	Low-Moderate	Moderate	Moderate	Moderate
Safety Criteria	Can Meet Industry Safety Standards and Regulatory Requirements	Yes	Yes	Yes	Yes
Selection	Preferred	No	Yes	No	Yes

A larger amount of dredging and habitat disturbance will be required for the Miller Point marine terminal location. This could increase the potential for residual effects to marine fish and fish habitat, and marine mammal use of the area. The Frederick Point location reduces the magnitude of these effects.

The jetty pile installation option has the potential to result in adverse effects to marine mammals and residents within the vicinity of the Project as a result of pile driving during construction. The jetty infill option will have substantially fewer piles and therefore less concerns with above and underwater noise, though it will result in a larger footprint of disturbance.

1.7.4.2 Preferred Alternative

Locating the jetty at Frederick Point is preferred as it has lower dredging requirements and reduced potential effects to marine fish and fish habitat, relative to the Miller Point location. The preferred jetty design option is partial infill with piles. This option results in greater loss of marine fish habitat but reduces the effects of underwater noise from pile driving on marine mammals.

1.7.5 Disposal of Marine Sediments and Terrestrial Overburden

Dredging of marine sediment and stripping of terrestrial overburden will be required at the marine terminal and MOF to accommodate LNG carriers and structures. Terrestrial overburden will be disposed of at the soils storage area. Three options were considered for disposal of dredged marine sediments:

- Disposal at sea (Brown Passage)
- On-land disposal
- Hybrid option of both on-land and at sea disposal.

1.7.5.1 Evaluation Criteria

Options for disposal of dredged materials were evaluated based on the following criteria (Table 1-28):

- Technical feasibility of disposal option, including availability and capacity of suitable disposal sites
- Costs, including initial and follow-up costs
- Regulatory requirements, including and compatibility of land uses
- Environmental constraints related to the marine, freshwater and terrestrial environments
- Safety standards
- Feedback received from Aboriginal Groups.

Disposal of dredged material at sea is regulated by Environment and Climate Change Canada (ECCC) under Section 127 of the *Canadian Environmental Protection Act, 1999,* and requires application for a Disposal at Sea Permit. A permit is granted following a detailed application process, which includes an effects assessment and sets out conditions to protect the marine environment and human health. The Brown Passage site has been identified as a potential disposal location as it is the closest previously used disposal at sea site to Prince Rupert. Brown Passage is located approximately 30 km away from the Project and reaches maximum depths of 200 m. The Coast Island Disposal Site, which was proposed to be used as the disposal site for dredged material associated with the proposed Canpotex Potash Export Terminal, was considered for use but, following consultation with ECCC, Aurora LNG has decided to no longer pursue this option. The on-land disposal option involves disposing all dredged sediments in an engineered disposal cell, within the boundaries of the PDA on Digby Island. The hybrid option considers disposing the sediment from up to the top 0.5 m layer in an engineered disposal cell within the PDA and the remainder at sea. The location and size of the engineered disposal cell will be determined once the final volume of dredged material is known. Dredged material and terrestrial overburden deposited on land in BC must comply with the EMA and its regulations, including contaminated sites and hazardous waste regulations, administered by the Ministry of Environment (MOE). For land disposal, the regulations require sediment with elevated salt content to be placed in an area where saline runoff does not affect other land uses (e.g., agricultural use).

During drafting of the AIR, Metlakatla First Nation requested that Aurora LNG consider alternatives to disposal at sea, and alternative disposal at sea sites. Aurora LNG is now considering on-land disposal as an alternative to a disposal at sea program (see Table 1-28). An alternative disposal at sea site located just south of Frederick Point was considered by Aurora LNG; however, ECCC indicated that this site was not an acceptable option as a result of concerns previously raised by Aboriginal Groups. Therefore, this alternative disposal site was not pursued further.

Table 1-28 Evaluation Summary – Disposal of Dredge Material

Evaluation Criteria		Deep Water Disposal at Brown Passage Disposal Site	On-land Disposal of all Dredge Sediments at Soil Storage Area	Hybrid Option of On-land and At Sea Disposal
Technical Criteria	Feasibility	Yes	Yes	Yes
	Suitable Sites Available	Yes	Yes	Yes
Economic Criteria	Cost	Moderate	High	Moderate-High
	Follow-up Cost	Low (related to monitoring)	Low	Low (related to monitoring)
Regulatory Requirements	Existing or Proposed Land Use Conflicts	Not applicable	None	None
Environmental Criteria	Environmental Constraints (Potential effects to marine fish and fish habitat and aquatic species)	Moderate Presence of dioxins and furans (within the allowable ECCC disposal at sea screening limits)	Low Dewatering of dredge material	Low - Moderate Presence of dioxins and furans (within the allowable ECCC disposal at sea screening limits) Dewatering of dredge material
	Potential Archaeological Effects	No	Yes	Yes
	Land Disturbance	Moderate	Moderate	Moderate
Safety Criteria	Safety Concerns	None expected	Potential, ongoing management of disposal site	Potential, ongoing management of disposal site
Selection	Preferred	No	No	Yes

1.7.5.2 Preferred Alternative

Further investigation and consultation is required to determine the preferred alternative for disposal of dredged materials; however, disposal at sea at Brown Passage and on-land disposal in an engineered disposal cell within the PDA are the preferred methods and locations. Up to the top 0.5 m of marine sediments will be disposed of in an engineered disposal cell within the PDA, as dioxins and furans have been detected in this layer of sediment albeit at levels that are within the allowable ECCC disposal at sea screening limits. The source of dioxins and furans is historical effluent discharges from the former Skeena Cellulose pulp and paper mill. The remaining marine dredged material will be disposed of at the Brown Passage Disposal Site. The preferred approach is consistent with feedback received from Aboriginal Groups indicating that disposal of contaminated marine sediment (i.e., dioxins and furans) at a dispersive site will not be acceptable.

1.7.6 Access Road Routing

During the design of the access road route, two main options were reviewed as alternatives to determine the most efficient route. The access road will be constructed within the Road Corridor Study Area as defined within the PDA. Considerations for the final alignment will be to maintain a height of land between the community of Dodge Cove and the road. Additionally, the road alignment will be designed to not interfere with the Dodge Cove watershed. Potential environmental and social concerns were also reviewed when considering the two route options.

The following two alternatives for the access road to the facility were considered:

- The road alignment in the Dodge Cove Official Community Plan (OCP)
- The road alignment in the Road Corridor Study Area for the Project.

1.7.6.1 Evaluation Criteria

The access road selection was evaluated using the following criteria (Table 1-29):

- Technical feasibility, including engineering requirements, land availability, and road fill availability
- Cost to construct and maintain
- Environmental concerns related to routing, in consideration of environmental and social effects
- Safety, including interaction with other road users.

Both routes are technically and economically feasible for accessing the LNG facility from the north. The constructed access road will be built to gain access to the site from the Prince Rupert airport and the ferry terminal from the north. Both road alignments are constructed on undisturbed land.

Table 1-29 Evaluation Summary – Access Road Routing

Evaluation Criteria		Access Road in Dodge Cove OCP	Access Road in Road Corridor Study Area
Technical Criteria	Feasibility	Yes	Yes
	Land Available	Yes	Yes
	Road Fill Available	Yes	Yes
Economic Criteria	Cost	High	High
Environmental Criteria	Environmental Constraints (fish and fish habitat, migratory birds)	Moderate	Moderate
	Potential Archaeological Effects	Potentially	Potentially
	Social Constraints	Low	Low
Safety Criteria	Interaction of Traffic with Dodge Cove Residents	Low (access road is closed to public traffic)	Low (access road is closed to public traffic)
Selection	Preferred	No	Yes

1.7.6.2 Preferred Alternative

The preferred access road within the Road Corridor Study Area is located further from Dodge Cove and will decrease the potential for adverse effects on the community of Dodge Cove.

1.7.7 Flare Design

Two flare design types are being considered: ground flare and elevated flare. The different designs are being reviewed to determine the most efficient layout that will be feasible for operations of the LNG facility and that will balance potential environmental and socio-economic effects. Flare location alternatives can be found in Section 1.7.3.

1.7.7.1 Evaluation Criteria

Flare design is being evaluated using the following criteria (Table 1-30):

- Technical feasibility
- Cost to construct
- Environmental criteria related to extent of land disturbance, air emissions, light pollution, and interaction with wildlife (specifically birds and bats)
- Social criteria such as visual quality and navigability
- Industrial safety requirements related to proximity to Prince Rupert Airport and worker safety.

Both flare designs are technically and economically feasible for the LNG facility. Both designs give the facility the required flare capacity. The ground flare will occupy a larger footprint compared to the elevated flare; however both could be facilitated in the current PDA.

Table 1-30 Evaluation Summary – Flare Design

Evaluation Criteria		Elevated Flare	Ground Flare
Technical Criteria	Feasibility	Yes	Yes
Economic Criteria	Cost	High	Moderate
Environmental Criteria	Land Disturbance (includes potential effects to fish and fish habitat)	Low	Moderate
	Air Emissions	Moderate	Moderate
	Light Pollution	Moderate-High	Moderate
	Wildlife Interactions (migratory birds/bats)	Moderate-High	Low
	Potential Archaeological Effects	Yes	Yes
Social Criteria	Visual Quality Effects	Moderate-High (more visible)	Moderate
	Navigability Effects	Moderate (related to airplane traffic)	Low (related to airplane traffic)
Safety Criteria	Risk to Airplane Buoyancy	Moderate	Low
	Worker Safety Concerns	Low	Low
Selection	Preferred	Pending	Pending

1.7.7.2 Preferred Alternative

Both flare designs continue to be assessed and are included in the assessment of potential effects. The design of the flares required for the LNG facility will be refined through the Project planning and detailed design phase.

1.7.8 Camp Location(s)

The camp will be designed for a maximum of 5,000 workers and will be required during the construction phase (between 5 and 6 years). The camp is anticipated to require approximately 40 ha within the PDA. No alternative camp locations outside of the PDA have been considered besides a temporary third party operated floating camp in Casey Cove to support initial site preparation activities. During drafting of the AIR, Metlakatla First Nation recommended considering alterantives to the proposed camp location, including locating the camp on the mainland. However, for logistical and economic reasons these options were not pursued further by Aurora LNG.

1.7.9 Construction Camp Operations

Construction camp operations alternatives include potable water use, waste management, and employee transportation to and from the work camp during the construction phase of the Project. Potable water options are considered under the water supply alternatives assessment in Section 1.7.2. For the waste management and employee transportation, the following alternatives were considered:

- Waste management via onsite or offsite landfill
- Waste management via onsite or offsite incinerator
- Employee transportation via bus from airport and local communities
- Employee transportation via personal worker vehicles.

1.7.9.1 Evaluation Criteria

Camp operations alternatives were evaluated using the following criteria (Table 1-31):

- Technical feasibility, including availability of existing infrastructure
- Cost to construct and maintain
- Regulatory requirements, including suitable land use zoning
- Effect on environmental and heritage resources, including traffic noise, air and greenhouse gas emissions, land disturbance, archaeological effects, and wildlife interactions
- Safety issues and concerns.

For employee transportation, using bus services to and from the surrounding community and the airport to the LNG facility is considered feasible. Regularly scheduled bus and ferry service currently run between Prince Rupert and the Prince Rupert airport. Using personal vehicles as a form of worker transportation to the construction camp will present technical feasibility challenges related to space requirements for a parking lot, and place demand on the ferry service from Prince Rupert.

For waste management, barging solid waste to a designated landfill will be technically feasible. Finding a location for an onsite landfill for non-hazardous solid waste will be difficult due to the nature of the bedrock and limitations of space on Digby Island.

Use of an onsite or offsite incinerator could also be viable alternatives for camp waste management

Table 1-31 Evaluation Summary – Construction Camp Operations

Evaluation Criteria		Bus from Airport and Local Communities	Personal Worker Vehicles	Onsite Landfill	Offsite Landfill	Offsite Incinerator	Onsite Incinerator
Technical Criteria	Feasibility	Yes – existing services	Potentially	Potentially	Yes	Potentially	Yes
	Existing Infrastructure	Present	Not Present – Ferry and parking lot will require constructing	Not Present –will require constructing	Yes	Not Present –will require constructing	No
Economic Criteria	Cost	Minimal	High – Ferry and Parking lot will be required	High	Moderate (will potentially require upgrading)	High	Moderate
Regulatory Requirements	Suitable Land Use Zoning	Yes, currently under operation	Will require additional area	Will need to be determined	Yes, already under operation	Yes, requires permit	Yes, requires permit
Environmental or Heritage Resources Criteria	Traffic Noise	Low - only increase in bus frequency	High – many additional vehicles will be required	Low – within PDA	Moderate – additional barge trips	Moderate – additional barge trips	Low – within PDA
	Air and Greenhouse Gas Emissions	Low - only increase in bus frequency	Moderate – many additional vehicles will be required	Moderate – potentially adds to methane emissions	Moderate	Low	Low
	Land Disturbance	Low	Moderate – new parking lot	Moderate – within PDA	Low – already present	Likely low – assumed to be within existing landfill footprint	Low – within PDA
	Potential Archaeological Effects	Negligible	Moderate – new footprint for parking lot	Low –within PDA	Low – already present	Likely low – assumed to be within existing landfill footprint	Low – within PDA
	Wildlife Interactions	Low – increase in bus frequency	High – new potential for wildlife strikes	Negligible	Negligible	Negligible	Negligible
Safety Criteria	Vehicle Accidents	Low	High – higher volumes of traffic resulting in higher risk	Low – traffic primarily remains within PDA	Moderate – will be increase in traffic	Moderate – will be increase in traffic	Low – traffic primarily remains within PDA
Selection	Preferred	Yes	No	No	Yes	Pending	Pending

1.7.9.2 Preferred Alternative

For employee transportation, busing workers between the Project site and the airport and local communities is the preferred alternative as it will result in fewer vehicles on local roads commuting to the Project site. This will decrease the potential adverse effects on wildlife, emissions, traffic, and noise, and improve worker safety during the Project.

For waste management, an onsite landfill is not considered feasible. An offsite landfill is a preferred alternative for some waste types. Onsite and offsite incinerator options continue to be considered.

1.8 References

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