

## Project Description

### Aurora LNG Project



June 2014

*Prepared for:*  
**Aurora Liquefied Natural Gas Ltd.**  
Calgary, Alberta

**AURORA LNG**



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## Abbreviations

AGRU	acid gas removal unit
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC EAO	British Columbia Environmental Assessment Office
BC FLNRO	British Columbia Forests, Lands and Natural Resource Operations
BC MoE	British Columbia Ministry of Environment
BC OCG	British Columbia Oil and Gas Commission
BCEAA	<i>British Columbia Environmental Assessment Act</i>
Bcf/d	billion standard cubic feet per day
BOG	boil-off gas
CAC	criteria air contaminants
CEA Agency	Canadian Environmental Assessment Agency
CEAA 2012	<i>Canadian Environmental Assessment Act, 2012</i>
CFN	Coastal First Nations
CH <sub>4</sub>	methane
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWHvh2	Coastal Western Hemlock very wet hypermaritime variant (Biogeoclimatic Zone)
DFO	Department of Fisheries and Oceans
DWT	dead weight tonnage
EA	environmental assessment
EBM	Ecosystem-Based Management
EBSA	Ecologically and Biologically Significant Areas
FEED	Front End Engineering and Design
GHG	greenhouse gases
H <sub>2</sub> S	hydrogen sulphide
ha	hectare
IA	Important Area
IBA	Important Bird Area
km	kilometres
kPaa	kilo-pascals-absolute
L/d	litres/day
LNG	liquefied natural gas
m	metres
m <sup>3</sup>	cubic metres
Mm <sup>3</sup> /d	million cubic metres per day



## Project Description

### Abbreviations

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MNBC	.....	Métis Nation of BC
MOF	.....	Materials Offloading Facility
mtpa	.....	million tonnes per annum
MW	.....	mega-watt
N <sub>2</sub> O	.....	nitrous oxide
NCLRMP	.....	North Coast Land Resource Management Plan
NEB	.....	National Energy Board
NGL	.....	natural gas liquids
NO <sub>x</sub>	.....	nitrogen oxide
PD	.....	Project Description
PJ	.....	petajoule
PJ/d	.....	petajoules per day
PM <sub>10</sub>	.....	particulate matter 10 micrometres
PM <sub>2.5</sub>	.....	particulate matter 2.5 micrometres
PNCIMA	.....	Pacific North Coast Integrated Management Area
Project	.....	Aurora LNG Project
PRPA	.....	Prince Rupert Port Authority
SARA	.....	<i>Species at Risk Act</i>
SO <sub>2</sub>	.....	sulphur dioxide
SQCRD	.....	Skeena-Queen Charlotte Regional District
t	.....	tonnes
t/d	.....	tonnes per day
VOC	.....	volatile organic carbons
WCSB	.....	Western Canadian Sedimentary Basin

## Table of Concordance (CEAA Requirements)

PD Requirements	Grassy Point PD Section	Digby Island PD Section
<b>Prescribed Information for the Description of a Designated Project Regulations under CEAA, 2012</b>		
<b>GENERAL INFORMATION</b>		
1. The Project's name, nature and proposed location.	1, 4.4, 8.1, 9.1	
2. The proponent's name and contact information and the name and contact information of their primary representative for the purpose of the description of the Project.	2,3	
3. A description of and the results of any consultations undertaken with any jurisdictions and other parties including Aboriginal peoples and the public.	10	
4. Other relevant information, including		
(a) the environmental assessment and regulatory requirements of other jurisdictions; and	6	
(b) information concerning any environmental study that is being or has been conducted of the region where the Project is to be carried out.	8.6	9.6
<b>PROJECT INFORMATION</b>		
5. A description of the Project's context and objectives.	4.2	
6. The provisions in the schedule to the Regulations Designating Physical Activities describing the Project in whole or in part.	6.1	
7. A description of the physical works that are related to the Project including their purpose, size and capacity.	8.7, 8.8	9.7, 9.8
8. The anticipated production capacity of the Project and a description of the production processes to be used, the associated infrastructure and any permanent or temporary structures.	8.7	9.7
9. A description of all activities to be performed in relation to the Project.	8.8	9.8
10. A description of any solid, liquid, gaseous or hazardous waste that is likely to be generated during any phase of the Project and of plans to manage those wastes.	8.9	9.9
11. A description of the anticipated phases of and the schedule for the Project's construction, operation, decommissioning and abandonment.	5	
<b>PROJECT LOCATION INFORMATION</b>		
12. A description of the Project's location, including		
12(a) its geographic coordinates;	8.1	9.1
12(b) site maps produced at an appropriate scale in order to determine the Project's overall location and the spatial relationship of the Project components;	8.1	9.1

**Project Description**  
**Table of Concordance (CEAA Requirements)**

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PD Requirements	Grassy Point PD Section	Digby Island PD Section
12(c) the legal description of land to be used for the Project, including the title, deed or document and any authorization relating to a water lot;	8.2	9.2
12(d) the Project's proximity to any permanent, seasonal or temporary residences;	8.1, 8.2	9.1, 9.2
12(e) the Project's proximity to reserves, traditional territories as well as lands and resources currently used for traditional purposes by Aboriginal peoples; and	8.1, 8.2, 8.3, 8.4	9.2, 9.4
12(f) the Project's proximity to any federal lands.	8.1	9.2
<b>FEDERAL INVOLVEMENT</b>		
13. A description of any financial support that federal authorities are, or may be, providing to the Project.	6.2.2	
14. A description of any federal land that may be used for the purpose of carrying out the Project.	6.2.1	
15. Any federal legislative or regulatory requirements that may be applicable including a list of permits, licenses or other authorizations that may be required in order to carry out the Project.	6.2.3	
<b>ENVIRONMENTAL EFFECTS</b>		
16. A description of the physical and biological setting.	8.12	9.12
17. A description of any changes that may be caused, as a result of carrying out the Project, to		
(a) fish as defined in section 2 of the <i>Fisheries Act</i> and fish habitat as defined in subsection 34(1) of that Act;	8.14.1.6, 8.14.1.7	9.14.1.6, 9.14.1.7
(b) aquatic species, as defined in subsection 2(1) of the <i>Species at Risk Act</i> ; and	8.14.1.6	9.14.1.6
(c) migratory birds, as defined in subsection 2(1) of the <i>Migratory Birds Convention Act, 1994</i> .	8.14.1.5	9.14.1.5
18. A description of any changes to the environment that may occur, as a result of carrying out the Project, on federal lands, in a province other than the province in which the Project is proposed to be carried out or outside of Canada.	8.14.8	9.14.8
19. Information on the effects on Aboriginal peoples of any changes to the environment that may be caused as a result of carrying out the Project, including effects on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	8.14.7	9.14.7

## Concordance Table (BC EAO Requirements)

PD Requirement		Grassy Point PD Section	Digby Island PD Section
<b>BC EAO's Guidelines for Preparing a Project Description for an Environmental Assessment in British Columbia</b>			
<b>1.0 Proponent Information</b>			
1	The proponent's name and the representative managing the project.	2	
2	Contact information, including a mailing address, phone and fax numbers, and email addresses.	3	
3	Corporate information, including a website address, particulars of company incorporation, and partner's names (if applicable).	2,3	
<b>2.0 General Background Information</b>			
4	The type and size of the project, with specific reference to thresholds set out in the Reviewable Projects Regulation.	4, 6.1	
5	Project purpose and rationale.	4.2	
6	Estimated capital cost.	4.3	
7	Number of construction jobs (in person years) and operating jobs (actual number).	4.3	
8	Location (latitude and longitude).	8.1, 9.1	
<b>3.0 Project Overview</b>			
9	A brief description of the major on-site and off-site project components, including: project's location, including:	4.4, 8.1, 8.7	4.4, 9.1, 9.7
9 (a)	options if the final site selections are not yet available.		9.7
10	A conceptual site plan and map(s) at sufficient scale to allow for clear location of all major components of the project (proponents may wish to include photographs if these would be helpful to understanding the nature and location of the proposed project).	8.7	9.7
11	The project's duration, including decommissioning if appropriate.	5	
12	The project's potential:		
12(a)	Environmental effects.	8.14.1	9.14.1
12(b)	Economic effects.	8.14.3	9.14.3
12 (c)	Social effects.	8.14.2	9.14.2

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**Table of Concordance (BC EAO Requirements)**

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PD Requirement		Grassy Point PD Section	Digby Island PD Section
12 (d)	Heritage effects.	8.14.5	9.14.5
12 (e)	Health effects (in general terms).	8.14.4	9.14.4
<b>4.0 Land Use Setting</b>			
13	A general description of existing land use in the vicinity of the project site.	7, 8.2, 8.3, 8.4, 8.11	7, 9.2, 9.3, 9.4, 9.11
14	Whether the project and its components are situated on private or Crown land.	8.2	9.2
15	Information about First Nations interests where asserted land claims to rights or title are known.	8.10	9.10
<b>5.0 Consultation Activities</b>			
16	A summary of consultation activities that have been carried out with:		
16 (a)	First Nations.	10.1	
16(b)	The public.	10.3	
16(c)	Local governments.	10.2	
<b>6.0 Proposed Development Schedule</b>			
17	A tentative schedule for submitting an application for an environmental assessment certificate and developing the project (should a certificate be issued).	5	
<b>7.0 Required Permits</b>			
18	A list of required permits, if known.	6.2, 6.3	

## **PART A - PROJECT SETTING**

## 1 INTRODUCTION

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Aurora Liquefied Natural Gas Ltd. (Aurora LNG), a joint venture between Nexen Energy ULC (Nexen), INPEX Corporation and JGC Corporation, is proposing to construct and operate a liquefied natural gas (LNG) facility and marine terminal near Prince Rupert, BC, referred to as the Aurora LNG Project (the “Project”) (Figure 1-1). Natural gas from northeast BC will be converted into LNG for shipment by LNG carrier to markets in Asia where it will be degasified and distributed.

Key components of the LNG facility will include up to four LNG processing units or ‘trains’, onsite power generation, three LNG storage tanks, and a marine terminal. Natural gas will be transported to the facility via a third party-owned pipeline, which is yet to be determined. The marine terminal will include a marine jetty and a LNG loading facility capable of accommodating LNG carriers up to Q-Flex carriers with cargo capacity up to 217,000 m<sup>3</sup>.

Construction of the Project is anticipated to occur in phases with the first phase having a design capacity of between 10 and 12 million tonnes per annum (mtpa) of LNG (two trains), required storage tanks, and the marine terminal. The planned commissioning and first shipment of LNG is expected to occur in the 2023 time frame. Full design build out would include potential expansion for an additional two liquefaction trains and additional LNG storage, with a design capacity of between 20 and 24 mtpa LNG. The timing of subsequent phases to full build out will depend on a variety of factors such as LNG market conditions, project economics, and the labour market.

It is expected that the Project will be subject to a formal environmental assessment (EA) and review process pursuant to both the *Canadian Environmental Assessment Act (CEAA), 2012* and the *British Columbia Environmental Assessment Act (BCEAA)*. Aurora LNG is submitting this Project Description to both the Canadian Environmental Assessment Agency (CEA Agency) and the BC Environmental Assessment Office (EAO) to initiate the respective EA processes.

The Project Description is intended to provide technical information at an overview level to allow the CEA Agency and BC EAO to confirm that an environmental assessment would be required under their respective legislation, and identify the issues to be considered in the EA process. It is also intended to provide information on the nature and scope of the Project to enable federal and provincial government agencies, local governments, First Nations, and other stakeholders to determine whether they have an interest in the Project, and to initiate discussions on the scope of the environmental assessment.

This Project Description has been prepared according to the guidance provided in the *Prescribed Information for the Description of a Designated Project Regulations under the Canadian Environmental Assessment Act, 2012*, and the BC EAO’s *Guidelines for Preparing a Project Description for an Environmental Assessment in British Columbia* (August 2013).

Aurora LNG is currently considering two locations to site its proposed LNG plant: Grassy Point and Digby Island. Information on these sites is presented in Part B and Part C of this document, respectively. Aspects of the Project that are common to both potential site options are described in Part A and Part D of the document.



File No.: CA17247.mxd

**Legend**

- Project Location Area
- Major Waterbodies
- City / Town
- Highway / Major Road

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0 35 70 140 210 280 350  
kilometre

0 20 40 80 120 160  
Miles

**1:8,000,000**

Projection: UTM Zone 10  
Datum: NAD 83

**AURORA LNG**

nexen INPEX  
A NEXEN LIMITED COMPANY

**GENERAL LOCATION OF THE PROPOSED PROJECT**

Date: April 15, 2014

**FIGURE 1 - 1**



## **2 PROPONENT INFORMATION**

---

### **2.1 Aurora LNG**

Aurora LNG is a joint venture between Nexen Energy ULC, INPEX Corporation, and JGC Corporation. Together, the joint venture participants bring 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 to provide complementary experience in every aspect of the LNG value chain from upstream production to export/import terminal engineering, construction, operation and marketing.

### **2.2 Nexen Energy ULC**

Nexen, a wholly-owned subsidiary of CNOOC Limited, 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 mtpa of 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.

### **2.3 INPEX Corporation**

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. It currently has working interests in seven LNG projects in the Asia-Pacific region. This includes two large operator projects, the Ichthys LNG in Australia and Abadi LNG in Indonesia, as well as the Naoetsu LNG receiving terminal in Japan, which has been in service since the end of 2013. INPEX has been producing natural gas in Japan for over 30 years as the largest producer in Japan and owns the gas distribution pipeline, which has a total length of over 1,000 km.

### **2.4 JGC Corporation**

JGC is a world-leading provider of engineering, procurement and construction services, having participated in more than 20,000 projects in over 70 countries. Since 1972, JGC has become one of the world's most experienced companies in the design and construction of facilities for the global LNG industry.

### 3 PROJECT CONTACTS

The contact information for the proponent is provided in Table 3-1.

**Table 3-1 Contact Information**

Proponent	Aurora Liquefied Natural Gas Ltd.
Address	c/o Nexen Energy ULC 801 7th Ave SW Calgary AB T2P 2V7
Chief Executive Officer	Ron Bailey CEO, Aurora LNG
Principal Contacts	Darcy Janko Environment and Site Assessment Manager of Nexen Energy ULC 801 7th Ave SW Calgary AB T2P 2V7 Telephone: 403.699.5065 Email: darcy.janko@nexencoold.com or questions@auroralng.com
Alternate Contact	Shannon Young Director of Regulatory, Stakeholder and Aboriginal Relations of Nexen Energy ULC 801 7th Ave SW Calgary AB T2P 2V7 Telephone: 403.699.4236 Email: shannon.young@nexencoold.com or questions@auroralng.com
Website	www.auroralng.com
Fax	1-403-513-9866
Email	questions@auroralng.com

### 4 BACKGROUND INFORMATION

#### 4.1 Project Overview

The Project will consist of the following key components:

- A natural gas receiving and LNG production facility (“LNG facility”), which will process between 20 and 24 mtpa of LNG at full build out. The facility will require approximately 104 million cubic metres per day (Mm<sup>3</sup>/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, it is estimated that approximately 96 Mm<sup>3</sup>/d (3.4 Bcf/d or 3.57 PJ/d) will be processed into LNG and 8 Mm<sup>3</sup>/d (0.3 Bcf/d or 0.32 PJ/d) of natural gas will be required for facility operation.

- A marine terminal (“marine terminal”) capable of accommodating up to three LNG carriers at full build out
- Supporting infrastructure and facilities, including power supply, power generation, air and water utilities, haul road, waste and wastewater management, and a materials offloading facility (MOF)
- Temporary infrastructure and facilities, including construction camp, laydown area, and construction offices
- Operation of LNG carriers and other supporting marine vessels.

At full build out, the Project will require approximately 160 to 320 LNG carrier (up to Q-Flex size) visits each year to transport the LNG to overseas markets.

Further details on key components of the Project are presented in Section 8.6, Part B and Section 9.6, Part C for the Grassy Point and Digby Island sites, respectively.

## **4.2 Project Purpose and Rationale**

Since 2000, global demand for LNG has increased at an estimated annual rate of 7.6%, and is expected to nearly double the 2012 level of 250 million metric tonnes by 2030, with strong demand growth forecast to continue at least through 2020 (Ernst & Young 2012). The strong LNG demand growth has been driven largely by the Asia Pacific region, where demand is expected to increase by over 50% from 170 mtpa in 2012 to 260 mtpa by 2020.

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 Project will play a key role in meeting the increased demand of the Asia Pacific markets, as well as other growth markets. It will be interconnected to western Canada through a network of new and existing pipeline systems, which will provide Aurora LNG with the flexibility to supplement proprietary resources with third-party sources.

The purpose of the Project is to connect natural gas resources in the Western Canadian Sedimentary Basin (WCSB) with the growing worldwide markets for LNG. 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.

## **4.3 Project Capital Cost and Employment Estimates**

The estimated capital cost for full build out of the Project is between \$17 billion and \$20 billion Canadian (in 2014 dollars). The capital costs will be further refined during the feasibility study.

A significant number of employment opportunities will be generated directly by the Project. During the initial phase, the Project will require a construction workforce of approximately 4,000 to 5,000 people, and will create approximately 20,000 person-years of direct employment at the peak of construction. During

the operation phase, the Project will employ 200 to 400 people over its estimated 25 years of operation. The Project will also create indirect employment opportunities through suppliers of goods and services.

#### **4.4 Project Location**

Two potential locations near Prince Rupert are currently being considered and assessed for this Project: one at Grassy Point, and one on Digby Island (Figure 5-1). To facilitate review of the Project by the CEA Agency and BC EAO, both potential locations are summarized in this Project Description. However, only one location will be selected for the Project based on further site evaluations and assessments of the options.

Project descriptions for each of the two potential siting options are presented in the Parts B and C of this document.

## **5 PROJECT SCHEDULE**

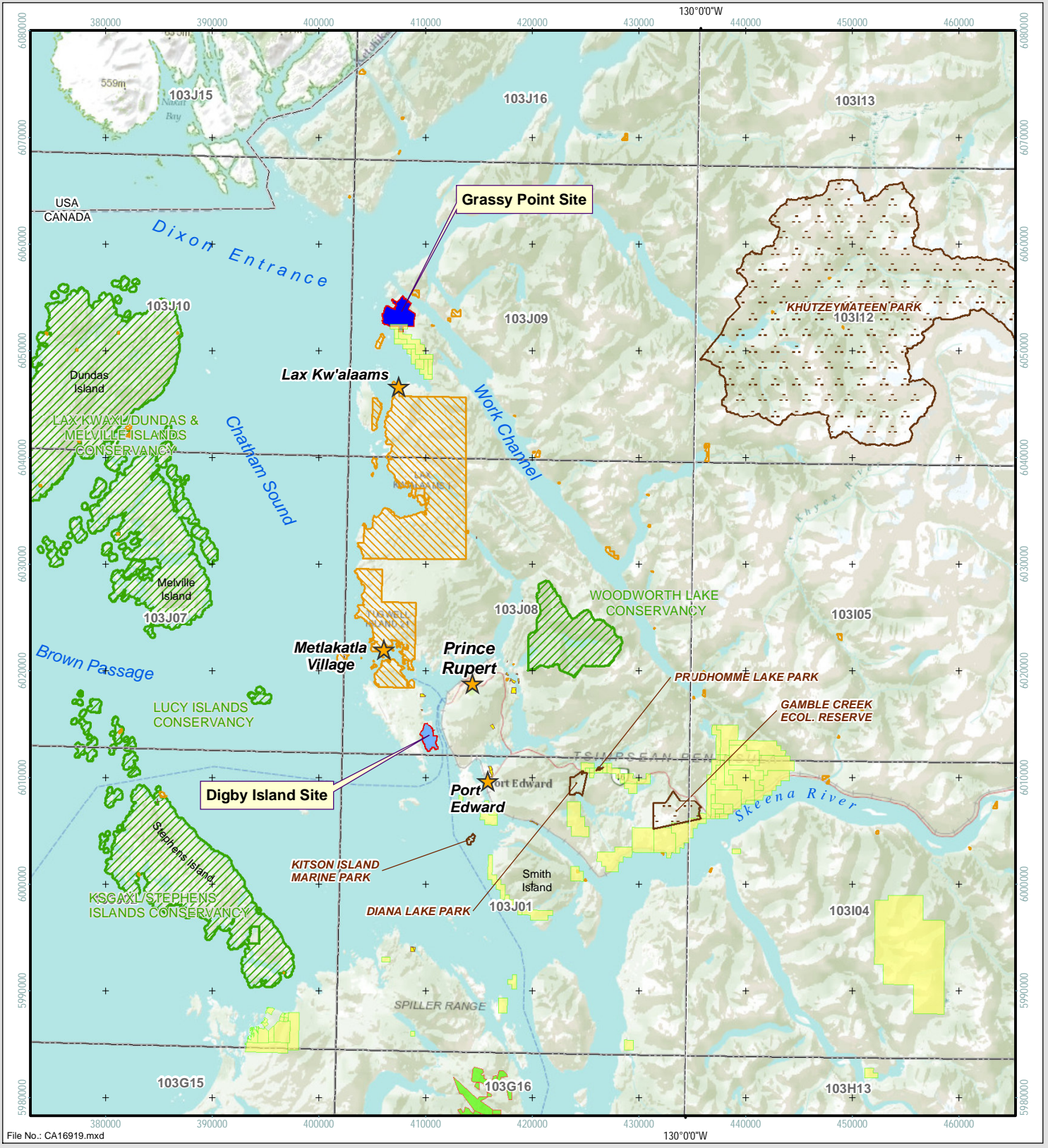
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The proposed timeline for the environmental assessment, construction, operation and decommissioning of the Project is summarized in Table 5-1. This preliminary schedule is aimed at having a final investment decision on the Project in 2017. Provided that an EA Certificate is issued and the necessary regulatory permits, approvals and authorizations are granted (see Section 6), construction for Phase 1 would commence in 2017. It is anticipated that operations will commence in 2023.

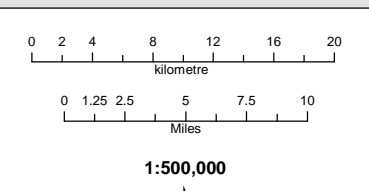
**Table 5-1 Preliminary Project Schedule**

<b>Project Activity</b>	<b>Year</b>
Geological, Engineering and Technical Studies	2014-2016
Field Studies and Environmental Assessment and Review Process	2014-2016
Final Investment Decision	2017
Construction of Phase I	2017-2022
Operations	2023-2048
Construction of Remaining Phase(s)	2023 - 2028
Decommissioning, Abandonment and Reclamation	after 2048 (after anticipated 25 years of operation)

At the end of the Project's operational life, decommissioning will occur in accordance with all applicable regulations at that time.



Legend	
	Aurora LNG - Grassy Point
	Aurora LNG - Digby Island
	Protected Areas
	First Nations Reserve
	Mineral & Placer Tenure
	Woodlot Licence
	Conservation Areas
	Urban Centre



**AURORA LNG**

**LOCATION OF POTENTIAL PROJECT SITES**

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Projection: UTM Zone 9  
Datum: NAD 83

Date: June 5, 2014 FIGURE 5 - 1

## Project Description

### PART A - PROJECT SETTING

Section 6: Federal and Provincial Involvement and Regulatory Requirements

June 2014

## 6 FEDERAL AND PROVINCIAL INVOLVEMENT AND REGULATORY REQUIREMENTS

### 6.1 Environmental Assessment and Review Requirements

Aurora LNG anticipates that the Project will require an environmental assessment under *CEAA, 2012* and *BCEAA* as it meets the criteria of a “designated project” under the federal *Regulations Designating Physical Activities* and a “reviewable project” under the provincial *Reviewable Projects Regulation*.

Under *CEAA, 2012*, all projects that meet or exceed the thresholds described in the *Regulations Designating Physical Activities* may be subject to a federal environmental assessment. Provisions that apply to the Project are summarized in Table 6-1.

**Table 6-1 Applicable Provisions of the *Regulations Designating Physical Activities* under *CEAA 2012***

Section	Description	Project
2a	<i>The construction and operation, decommissioning and abandonment of a fossil fuel-fired electrical generating station with a production capacity of 200 MW or more</i>	The Project may involve construction and operation of a fossil fuel-fired electricity generating station with a production capacity of between 200 MW and 550 MW
14d	<i>The construction, operation, decommissioning and abandonment of a new facility... for the liquefaction, storage or regasification of liquefied natural gas, with a liquefied natural gas processing capacity of 3 000 t/day or more or a liquefied natural gas storage capacity of 55,000 t or more</i>	At full site build out, the LNG facility will have a design capacity of between 20 and 24 mtpa (between 54,795 t/d and 65,750 t/d), and a total LNG storage capacity of 540,000 m <sup>3</sup> (approximately 248,000 t) (depending on density) for all three tanks
27c	<i>The construction, decommissioning and abandonment of a marine terminal designed to handle vessels larger than 25,000 DWT unless the terminal is located on lands that are routinely and have been historically used as a marine terminal or that are designated for such use in a land-use plan that has been the subject of public consultation</i>	The LNG loading facility will be capable of accommodating Q-Flex LNG carriers (109,500 DWT)

Aurora LNG also expects that the Project will require an environmental assessment under the *British Columbia Environmental Assessment Act* (BCEAA) as the Project meets several provisions of the BC *Reviewable Projects Regulation* (Table 6-2).

**Table 6-2      Applicable Provisions of the Reviewable Projects Regulation under BCEAA**

Section	Criteria	Project
Part 4, Energy Projects Table 7, Electricity Projects	<i>1(1) A new facility with a rated nameplate capacity of <math>\geq 50</math> MW of electricity that is a thermal electric power plant.</i>	The Project may involve construction and operation of a thermal electric power plant with a capacity > 50 MW
Part 4, Energy Projects, Table 8, Petroleum and Natural Gas Projects	<i>1(1) Subject to subsection (2), a new energy storage facility with the capability to store an energy resource in a quantity that can yield by combustion <math>\geq 3</math> PJ of energy</i>	The Project's total LNG storage capacity will be approximately 248,000 t (depending on density), which contains about 12 PJ of potential energy
Part 8, Transportation Projects, Table 14, Transportation Projects	<i>4(1) Subject to subsection (2), a new marine port facility, other than a ferry terminal, if construction of the facility entails dredging, filling, or other direct physical disturbance of (a) &gt;1000 m of linear shoreline, or (b) &gt; 2 hectares of foreshore or submerged land, or a combination of foreshore and submerged land, below the natural boundary of a marine coastline or marine estuary</i>	Construction of the LNG marine terminal, MOF, trestle and berths will result in direct physical disturbance of more than 2 ha of foreshore and submerged land

As the marine terminal of the Digby Island site would be located on federal Crown Land administered by a federal port authority, Aurora LNG expects that the Government of Canada (led by CEA Agency) and the Province of BC (led by the BC EAO) will develop a regulatory agreement to administer a coordinated federal/provincial environmental assessment of the Project in an effective and efficient manner.

## **6.2      Federal Involvement and Regulatory Requirements**

### **6.2.1      Federal Lands Requirements**

The marine jetty on the proposed Digby Island site would be located on a water lot within the jurisdiction and administration of the Prince Rupert Port Authority (PRPA). It is expected that the lot would be leased from the PRPA under a site lease agreement with Aurora LNG.

No federal lands will be required if the Grassy Point site is selected for the Project.

### **6.2.2      Federal Financial Support**

No federal financial support for the Project is proposed or anticipated.

### **6.2.3      Federal Legislative Requirements**

Key federal permits, licenses and authorizations that may be required to construct and operate the Project are listed in Table 6-3.

**Project Description**  
**PART A - PROJECT SETTING**

Section 6: Federal and Provincial Involvement and Regulatory Requirements  
 June 2014

**Table 6-3 Major Federal Permits, Licenses and Authorizations**

Permit, License and Approvals	Responsible Agency and Governing Legislation	Project Activities
<i>Fisheries Act</i> Authorization	Fisheries and Oceans Canada (DFO) <i>Fisheries Act</i> s. 35(1) <i>Application for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations</i>	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
<i>Navigable Waters Protection Act</i> Approval	Transport Canada <i>Navigation Protection Act</i>	Construction of marine terminal and the LNG berths
Certificates of Compliance	Transport Canada <i>Marine Transport Security Act</i> <i>Marine Transportation Security Regulations</i>	Operation of the LNG facility, marine terminal and carrier
Disposal at Sea Permit	Environment Canada <i>Canadian Environmental Protection Act</i> s.125(1) (b) <i>Disposal at Sea Regulations</i>	Potentially required for disposal of marine sediments dredged from the berth areas and MOF
Explosives Permit/License	Natural Resources Canada <i>Explosives Act</i> s. 7(1) <i>Explosives Regulations</i>	Transportation, storage and manufacture of explosives that will be used for blasting during site preparation
LNG Export License*	National Energy Board (NEB) <i>National Energy Board Act</i> s.117	Export of LNG outside of Canada to international markets
PRPA Lease	Prince Rupert Port Authority	Lease to occupy and use PRPA-administered federal land (for Digby Island site)

**NOTE:** \* Aurora Liquefied Natural Gas Ltd. (sole purpose corporation held by the Aurora LNG joint venture participants) submitted an application for a LNG export license to the NEB in November 2013. On May 2, 2014, the NEB granted approval of the export license.

The *Species at Risk Act* (SARA) prohibits the killing, harming or harassing of species listed as endangered or threatened, the damage and destruction of their residence, and the destruction of critical habitat that has been identified in a recovery strategy. These prohibitions apply to aquatic species and migratory birds. Any potential adverse effects on SARA-listed species will be avoided through Project design considerations and species-specific preventative and mitigation measures, taking into account any recovery strategies.

Environment Canada is responsible for implementing the *Migratory Birds Convention Act* (MBCA), which provides for the protection of migratory birds and their nests through the *Migratory Bird Regulations*. Currently, the regulations do not provide for authorizations or permits for the incidental take of migratory birds, their nests and/or eggs caused by industrial or other activities. Therefore, appropriate avoidance measures and best management practices will be developed and implemented for the Project to minimize the risk of detrimental effects to migratory birds, and their nests and eggs.



### 6.3 Provincial Regulatory Requirements

Key provincial permits, approval and authorizations that may be required for the construction and operation of the Project are listed in Table 6-4.

**Table 6-4 Major Provincial Permits, Licenses, and Approvals**

Permit, License and Approvals	Responsible Agency and Governing Legislation	Project Activities
LNG Facility Permit	BC Oil and Gas Commission (BC OGC) <i>Oil and Gas Activities Act</i> s. 21 <i>Pipeline and Liquefied Natural Gas Facility Regulation</i>	Construction and operation of the LNG facility
License to cut timber	<i>Forest Act</i> 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 <i>Lands Act</i> s.39 and 40	Use of provincial Crown Land for the Project
Waste Discharge Permit	BC OGC BC Ministry of Environment (MoE) <i>Environmental Management Act</i> s.6(5)	Dredge disposal, wastewater discharge, facility air emissions, and waste discharges
Authorization for Sewage Facilities	BC MOE <i>Environmental Management Act</i> <i>Municipal Sewage Regulation, Sewerage System Regulation</i>	Sewage facilities for camp operations (threshold volume of 22,700 L/d)
Camp Permit	BC Ministry of Health <i>Public Health Act</i> <i>Industrial Camp Regulations</i>	Construction and operation of the construction camp
Heritage Inspection permits Heritage Investigation permits	BC FLNRO <i>Heritage Conservation Act</i> s.14	Archaeological surveys on provincial Crown Land to support the environmental assessment
Site Alteration Permit	BC FLNRO/BC OGC <i>Heritage Conservation Act</i> 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

## 7 SOCIO-COMMUNITY AND LAND USE SETTING

The Project is located within the Skeena-Queen Charlotte Regional District (SQCRD). The nearest communities include the City of Prince Rupert, the District of Port Edward, the Lax Kw'alaams community, Metlakatla, and smaller communities of Dodge Cove and Crippen Cove on Digby Island. Historically, the economy of the SQCRD has been dominated by forestry, fishing and other natural resource-based

## **Project Description**

### **PART A - PROJECT SETTING**

Section 7: Socio-Community and Land Use Setting

June 2014

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industries, which have declined over the past 15 years. However, the tourism and transportation sectors have experienced growth in recent years, including development of various ports and rail infrastructures and the addition of ferry services, as well as service industries that support tourism.

#### **7.1 Skeena-Queen Charlotte Regional District**

The SQCRD is a partnership of several electoral areas and municipalities on BC's north coast, which provides various services such as waste management, land use planning, and public safety.

Both the proposed Digby Island and Grassy Point Project sites are located within an electoral area of the SQCRD (Figure 7-1).

#### **7.2 Prince Rupert**

Prince Rupert occupies the northwest part of Kaien Island, and is located about 30 km south of the Grassy Point and 3 km east of the Digby Island site (Photograph 7-1). It is the largest city in the SQCRD, with a population of approximately 12,500 people. It provides employment and commercial services for residents of the surrounding communities of Port Edward, Metlakatla and Lax Kw'alaams. Community infrastructure and services include a hospital, fire department, schools, and a variety of recreational venues. Prince Rupert also has a deep-sea container port, BC and Alaska ferry service, and a cruise-ship dock. Key industries include forestry, fisheries, port services, and tourism.

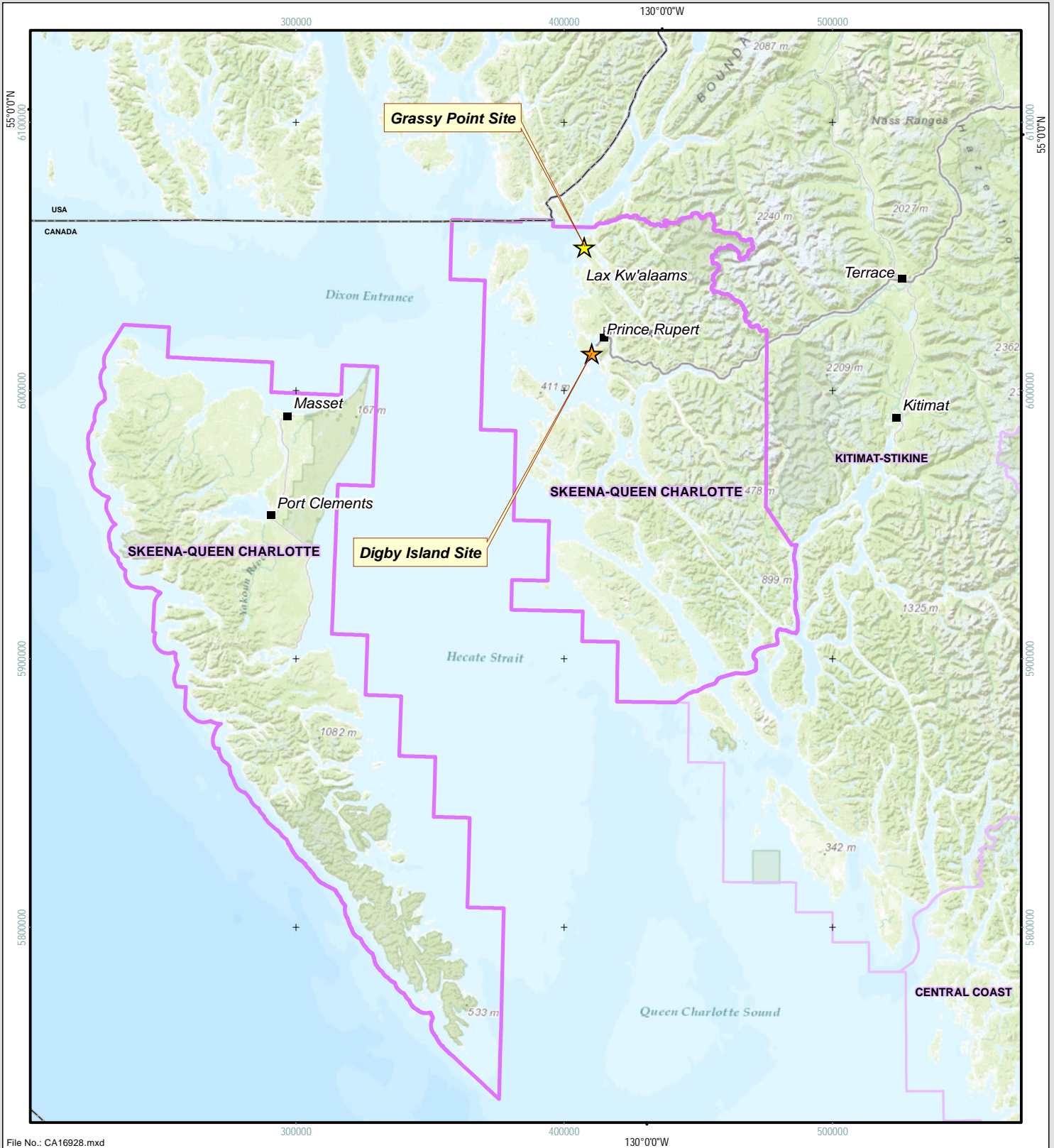
The Port of Prince Rupert is the second largest port on Canada's west coast. It has recently undergone substantial growth, and has plans for further expansion with projects such as the Road Rail Corridor and Phase 2 of Fairview Container Terminal.

The City has developed a Quality of Life Community Plan, which sets forth guiding principles for long-term investment and development in the municipality that emphasize social, environmental and economic values (City of Prince Rupert, 2007). The plan identifies key land use designations for land and water within the city of Prince Rupert and its surrounding areas.

The City supports government initiatives aimed at improving access between Prince Rupert, the airport on Digby Island, and First Nations communities northwards.

#### **7.3 Metlakatla Reserve and Community**

The Metlakatla community is located on Prospect Hill, within the S1/2 Tsimpsean 2 Indian Reserve (IR), on the northeastern end of Digby Island and the southwestern portion of the Tsimpsean Peninsula. It is located approximately 5 km from the proposed Digby Island site.



File No.: CA16928.mxd

**Legend**

- Aurora LNG - Grassy Point Site
- Aurora LNG - Digby Island Site
- Skeena - Queen Charlotte Regional District
- Other regional Districts
- Urban Centre

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kilometre

0 12.5 25 50  
Miles

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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**

**JURISDICTION OF THE  
SKEENA QUEEN CHARLOTTE  
REGIONAL DISTRICT**

Date: May 3, 2014	FIGURE 7 - 1
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## Project Description

### PART A - PROJECT SETTING

Section 7: Socio-Community and Land Use Setting

June 2014

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**Photograph 7-1 Prince Rupert**

#### 7.4 Lax Kw'alaams Reserve and Community

The Lax Kw'alaams reserve and community is located approximately 5 km south of the proposed Grassy Point site, and 30 km north of the Digby Island site. This small community is referred to as both Lax Kw'alaams and Port Simpson. The community provides the following services and infrastructure:

- Approximately 400 housing units
- A school of approximately 120 students
- A leisure centre and wellness centre
- A health centre
- A volunteer fire department
- A RCMP detachment and
- The Lax Kw'alaams Fishery & Cannery

Photograph 7-2 shows the community of Lax Kw'alaams.

#### 7.5 Digby Island

There are two small communities located on the east side of Digby Island: Dodge Cove and Crippen Cove. Each community has fewer than 100 residents. The Prince Rupert Airport, located on the northwest side of the island, services the local communities and is supported by a bus and ferry service.



**Photograph 7-2 Lax Kw'alaams Community**

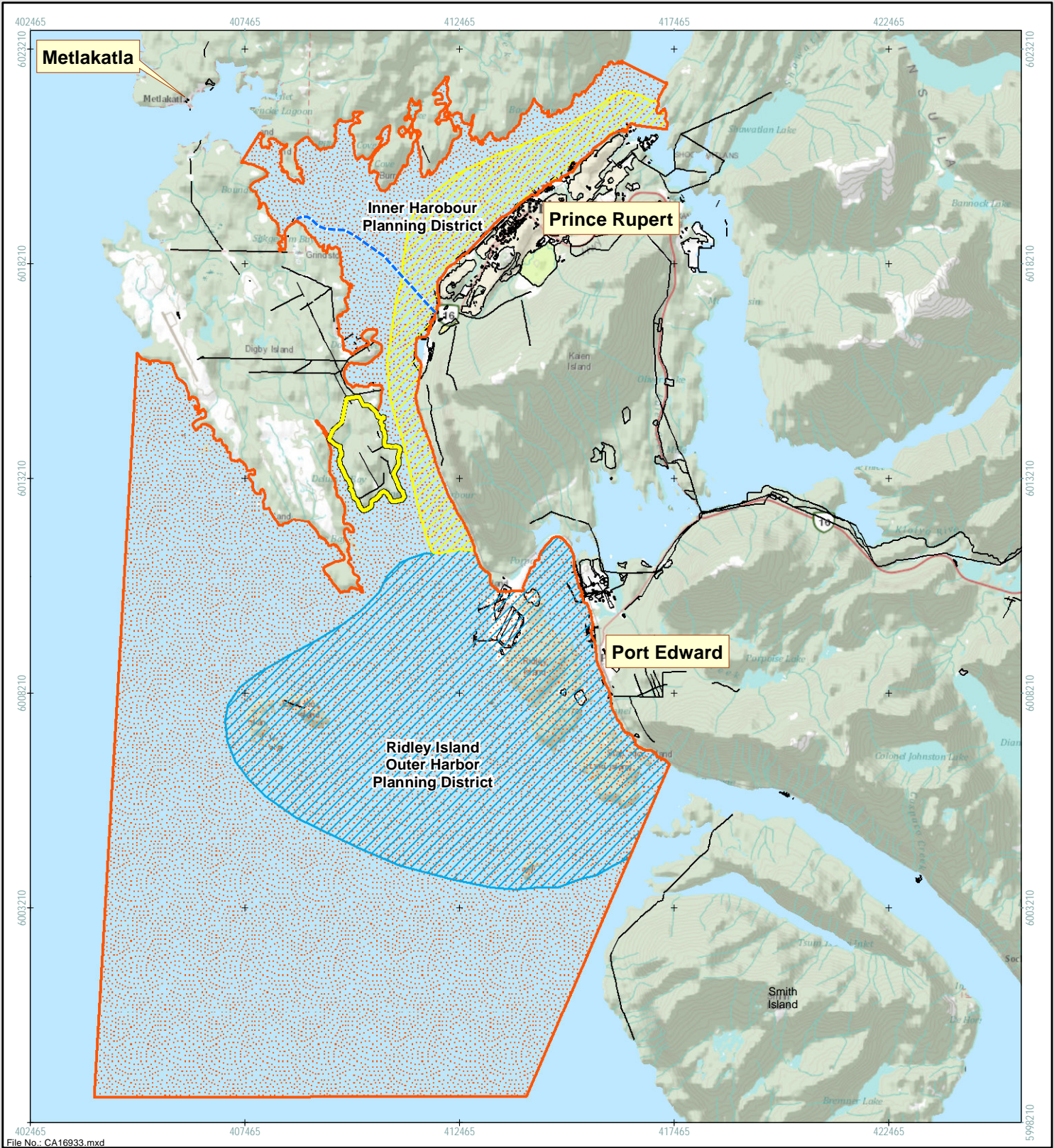
## **7.6 Prince Rupert Port Authority**

The PRPA is a federal body that operates the port under the *Canada Marine Act*. It is responsible for overall planning, development and management of the commercial port facilities within Prince Rupert Harbour (Prince Rupert Port Authority, 2010). The jurisdiction of the PRPA includes the inner harbour of Prince Rupert, the waters surrounding Ridley Island, and the waters surrounding the southern half of Digby Island (Figure 7-2) (Prince Rupert Port Authority, 2010). The marine terminal and marine access for the proposed Digby Island site will be within waters governed by the PRPA.

The PRPA has prepared a land use management plan to guide its business development. The vision of the PRPA is to “position itself as a highly competitive west coast port taking advantage of its proximity to Asia relative to other west coast ports” while ensuring sustainable and environmentally appropriate development” (Prince Rupert Port Authority, 2010).

Two main planning districts proximal to the Digby Island site include the ‘Inner Harbour Planning District’, and the ‘Ridley Island / Outer Harbour Planning District’. Both districts plan for increased industrial development, such as rail services, transload facilities, various terminals, and marine support services. Although largely undeveloped at present, the PRPA has identified Digby Island as having long-term potential for industrial development (e.g., break bulk operations and major terminals), contingent on construction of a new bridge and road between Digby Island and the north shore. This transportation link is not within the scope of the proposed Project.

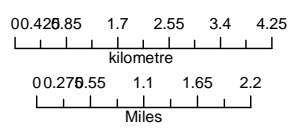
The PRPA land use management plan could affect the water lot that would be occupied by the Project.



File No.: CA16933.mxd

- Legend**
- Digby Island Site
  - Ferry Route - Prince Rupert to Digby Island
  - Prince Rupert Port Authority Jurisdiction
  - Inner Harbour Planning District
  - Ridley Island Outer Harbour Planning District
  - Road & Cutline

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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**



**PRINCE RUPERT  
PORT AUTHORITY  
JURISDICTION**

Date: May 20, 2014

FIGURE 7 - 2

## **7.7 Other Planning Initiatives**

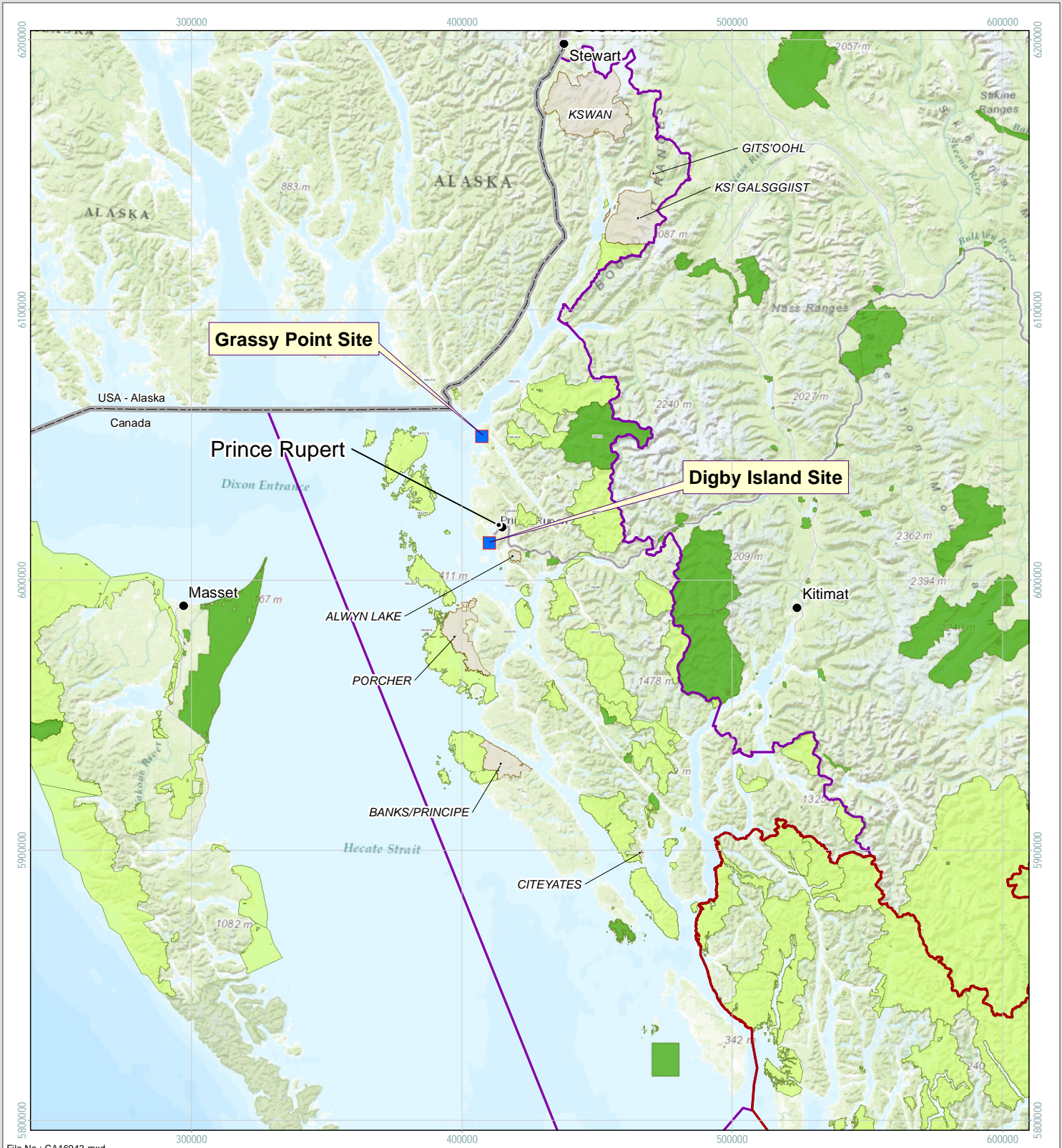
### **7.7.1 North Coast Land and Resource Management Plan**

The North Coast Land and Resource Management Plan (LRMP) was initiated in 2002 by the provincial government and First Nations as part of a strategic land use planning policy under the *Land Act* (BC Ministry of Forests, Lands and Natural Resource Operations, 2004). It covers approximately 1.7 million ha of land on BC's north coast, including both the proposed Digby Island and Grassy Point sites. The purpose of the North Coast LRMP process is to promote economic and environmental sustainability through an ecosystem-based management (EBM) approach that relies on traditional, local and scientific knowledge. The plan includes the establishment of protection areas and mechanisms to maintain healthy ecosystems and communities in the plan area. Land use designations include protection areas, biodiversity areas, special forest management areas, and EBM operating areas (Figure 7-3) (BC Ministry of Forests, Lands, and Natural Resource Operations, 2014).

Since completion of the plan in 2004, land use objectives have been legally established to guide forest resource development, and full implementation of ecosystem-based management has been completed. In 2009, a new protected area designation was established to recognize the importance of specific areas to First Nations. There have been 115 new conservancies designated in the North and Central coast regions. Fifty-five (55) of the conservancy management plans were initiated in 2011, with the remainder to be underway or completed by 2014. EBM implementation is now focused on developing a strategic landscape reserve design, designating Grizzly Bear no-hunting areas, completing conservancy management planning, and improving land use planning through adaptive management.

### **7.7.2 Pacific North Coast Integrated Management Area Initiative**

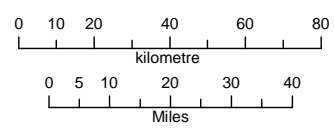
The Pacific North Coast Integrated Management Area (PNCIMA) is one of five Large Ocean Management Areas (LOMAs) that have been identified by DFO as priority regions for marine planning. These areas have been identified as priority areas due to their high ecological, social and economic importance. The PNCIMA plan is an ecosystem-based management initiative that follows the general principles of Canada's *Ocean Act*, governing BC's northern marine waters. Various federal government, provincial government, and First Nations representatives comprise the steering committee, which set the goals for this planning area (Figure 7-4). The aim of the plan is to maintain ecological integrity of the marine ecosystems while fostering economic, cultural, and spiritual human well-being (Government of Canada; North Coast Skeena First Nations Stewardship Society; Coastal First Nations Great Bear Initiative, 2014).



File No.: CA16943.mxd

- Legend**
- AURORA LNG Site
  - Existing Conservancy
  - Urban Centre / Town
  - LRMP Boundary**
  - Existing BMTA
  - North Coast
  - Existing Prot. Areas
  - Central Coast

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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**

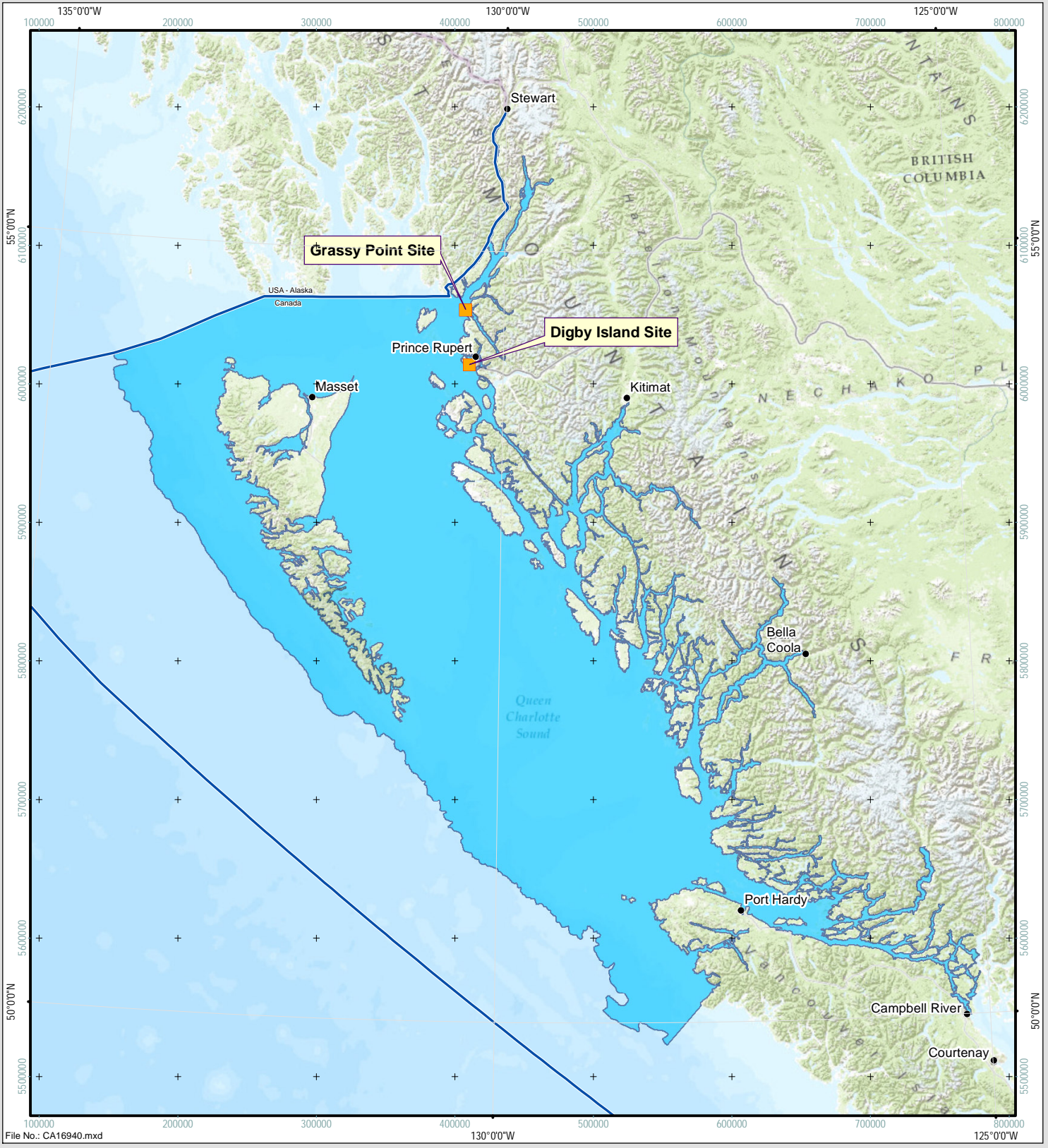


**NORTH COAST  
LAND USE AREAS**

Date: May 15, 2014

FIGURE 7 - 3

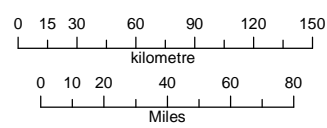




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**Legend**

- AURORA LNG Site
- Exclusive Economic Zone Boundary
- ⊕ PNCIMA Boundary
- Urban Centre / Town



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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**



**PNCIMA BOUNDARY & AURORA LNG AREAS OF INTEREST**

Date: June 5, 2014

FIGURE 7 - 4

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## Project Description

### PART A - PROJECT SETTING

Section 7: Socio-Community and Land Use Setting

June 2014

The PNCIMA initiative has identified 15 Ecologically and Biologically Significant Areas (EBSAs), and Important Areas (IAs) for marine vegetation and marine wildlife within their jurisdiction. Relevant areas near the proposed Project sites are listed in Table 7-1.

**Table 7-1 PNCIMA Recognized Areas near the Grassy Point and Digby Island Sites**

Description	Ecologically and Biologically Significant Areas (EBSAs)	Important Areas (IAs)	Other
Chatham Sound	X		
Eelgrass Distribution			X
Kelp Distribution			X
Stellar Sea Lion		X	
Humpback Whale		X	
Northern Resident Orca		X	
Important Bird Area		X	
Herring		X	
Tanner Crab		X	

### 7.7.3 International Joint Commission - Air Quality Agreement

In 1991, Canada and the US signed a bilateral Air Quality Agreement with the purpose of addressing shared issues related to trans-boundary air pollution. The objective of this agreement is to control trans-boundary air pollution between the two countries through establishing and implementing specific objectives for limiting air emissions (International Joint Commission, 1991).

For projects that have the potential to cause significant trans-boundary air pollution, the relevant jurisdiction is required to appropriately assess the project, provide notification to the other party, and implement mitigation measures as appropriate.

## **PART B - GRASSY POINT SITE OPTION**

## 8 GRASSY POINT

### 8.1 Site Location

Grassy Point is located within the Prince Rupert region on the northwest coast of British Columbia, approximately 700 km north of Vancouver (Figure 8-1). It lies within the Skeena-Queen Charlotte Regional District (SQCRD) and the North Coast Forest District.

The proposed site for the Project is on the north end of the Tsimpsean peninsula, approximately 6 km north of the Lax Kw'alaams community, 30 km north of the City of Prince Rupert, and 15 km southeast of the US border. Other First Nation reserves near the proposed site are listed in Table 8-1.

**Table 8-1 First Nation Reserves in Proximity to the Grassy Point Site**

First Nation Reserves	Distance from Proposed Site (km)
Lax Kw'alaams 1	6.3
Tymgowzan 12	2.2
Birnie Island 18	2.4
Finlayson Island 19	8.0
Union Bay 31	4.9
Ksabasn 50	3.2
Ktamgaodzen 51	4.5

The LNG facility will be located on approximately 200-400 hectares (ha) of provincial Crown land. Coordinates for the approximate centre of the site are:

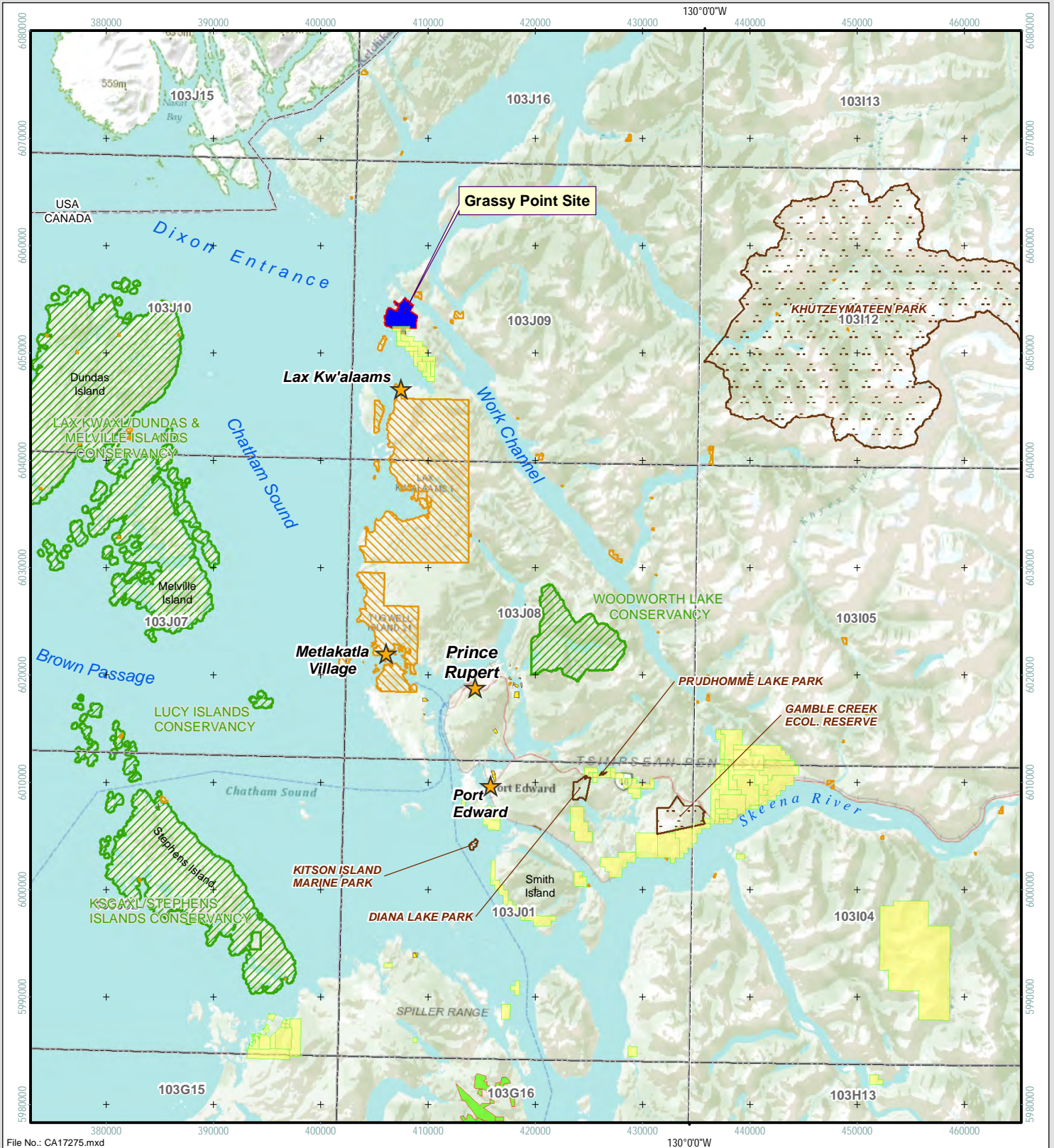
- Latitude/Longitude - 54°37'11.32"N/130°25'56.90"W
- Universal Transverse Mercator – Zone 9 East 407733.6 North 6053259.4

The marine terminal will be located at the north end of Grassy Point.

The nearest federal land to the proposed Project site is a reserve of the Metlakatla First Nation (Tymgowzan 12) which is located approximately 2.2 km away.








### 8.2 Land Ownership and Zoning

The Grassy Point area is composed of several land use zones (Figure 8-2). The northern finger of the Tsimpsean peninsula has been placed under a map reserve. The proposed Project site lies within this map reserve. Aurora LNG has signed a Sole Proponent Agreement with FLNRO, which grants Aurora LNG exclusive rights to pursue land tenureship for development of an LNG facility. The southern portion of the map reserve is designated for development of another LNG facility.



File No.: CA17275.mxd

**Legend**

-  Aurora LNG - Grassy Point
-  First Nations Reserve
-  Protected Areas
-  Mineral & Placer Tenure
-  Woodlot Licence
-  Conservation Areas
-  Urban Centre

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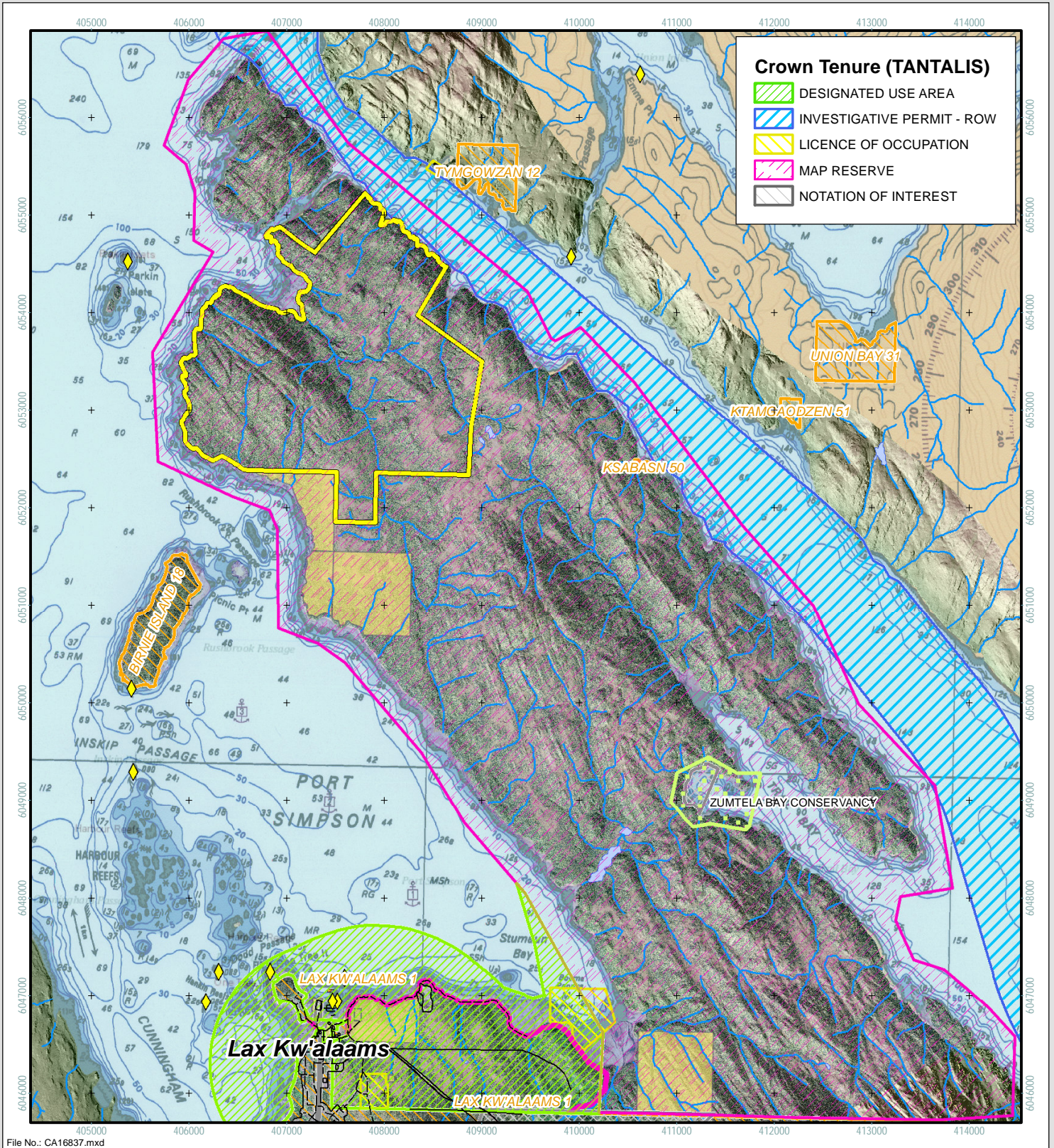
Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**



**PROPOSED PROJECT LOCATION  
GRASSY POINT SITE**

Date: June 12, 2014	FIGURE 8 - 1
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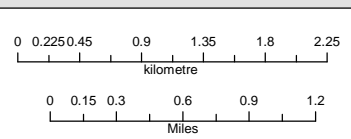


File No.: CA16837.mxd

**Legend**

Grassy Point Site	Navigational Aids
Private Land	Lake
First Nations	River / Stream
Conservation Area	

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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**



**LAND USE ZONING NEAR THE GRASSY POINT SITE**

Date: May 16, 2014

FIGURE 8 - 2

A block of private land and a mineral tenure lies immediately south of the Grassy Point site. A notation of interest has been placed on Dudevoir Passage, north of the site. Near the Lax Kw'alaams community, there are private lands, temporary permits, and licenses of occupation. The water surrounding Lax Kw'alaams is within a designated use area. The nearest identified permanent, temporary or seasonal residence is located in Port Simpson approximately 5 km south to the proposed project site.

There is a Marbled Murrelet Wildlife Habitat Area with special management requirements south of the Grassy Point site near Trail Bay (BC Ministry of Environment, 2010).

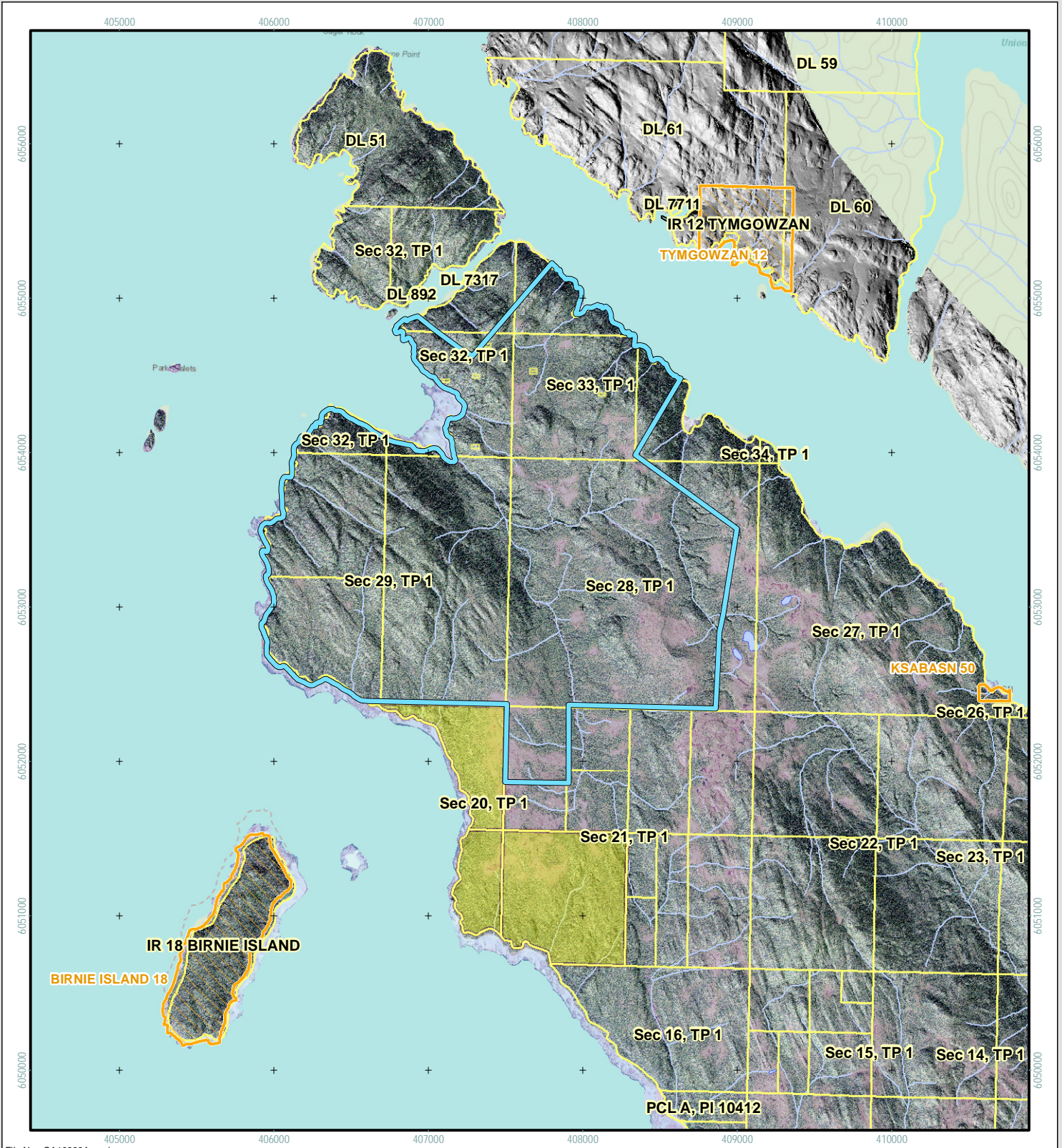
Zumtela Bay Conservancy lies approximately 5 km south of the Grassy Point site. This conservancy is listed under Schedule E of the *Protected Areas of British Columbia Act*, and is administered by the Ministry of Environment (Government of British Columbia, 2000). It covers 18 ha of upland, 31 ha of foreshore, and the marine waters within the bay. This conservancy is important to the Coast Tsimshian people, who have worked with government to establish management and strategic land use agreements (Lax Kw'alaams First Nations; Metlakatla First Nation; BC Parks, 2011).

The proposed Grassy Point site is a greenfield site with no development. At the timing of writing, the private land immediately south of the site has not been developed. No water lots have been identified around Grassy Point.

The legal land description for the site is provided in Table 8-2 and illustrated in Figure 8-3.

**Table 8-2 Lands Description for the Grassy Point Project**

<b>LNG Facility</b>	<b>Marine Terminal</b>	<b>Material Offloading (MOF) Area</b>
PIN_SID: 2747330 Section 29, Township 1 Range 5 Coast District	PIN_SID: 2747330 Section 29, Township 1 Range 5 Coast District	PIN_SID: 2737670 Section 32, Township 1 Range 5 Coast District
PIN_SID: 2737670 Section 32, Township 1 Range 5 Coast District	PIN_SID: 2737670 Section 32, Township 1 Range 5 Coast District	PIN_SID: 2741420 Section 33, Township 1 Range 5 Coast District
PIN_SID: 2735720 Section 21, Township 1 Range 5 Coast District		
PIN_SID: 2747200 Section 28, Township 1 Range 5 Coast District		
PIN_SID: 2741420 Section 33, Township 1 Range 5 Coast District		



File No.: CA16836A.mxd

**Legend**

- Aurora LNG - Grassy Point
- District Lots (TANTALIS)
- First Nations
- Road & Cutline
- Private Land
- Lake
- River / Stream

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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**

**DISTRICT LOTS NEAR  
THE GRASSY POINT SITE**

Date: May 23, 2014 FIGURE 8 - 3



### **8.3 Land Use**

Identified tenured land uses overlapping the proposed Project footprint include a trapline (TR0614T037), and a Mineral Tenure Area (ID#: 1022211). The mining tenure overlaps the southern end of the proposed site (Figure 8-4).

There are no other identified Crown tenures at the Grassy Point site. The coast line along Grassy Point is included within the provincial Recreation Features Inventory. An Environmental Protection/Conservation designation (ID # 6406454) occurs on a segment of land to the north and outside of the Project footprint.

### **8.4 Marine Use**

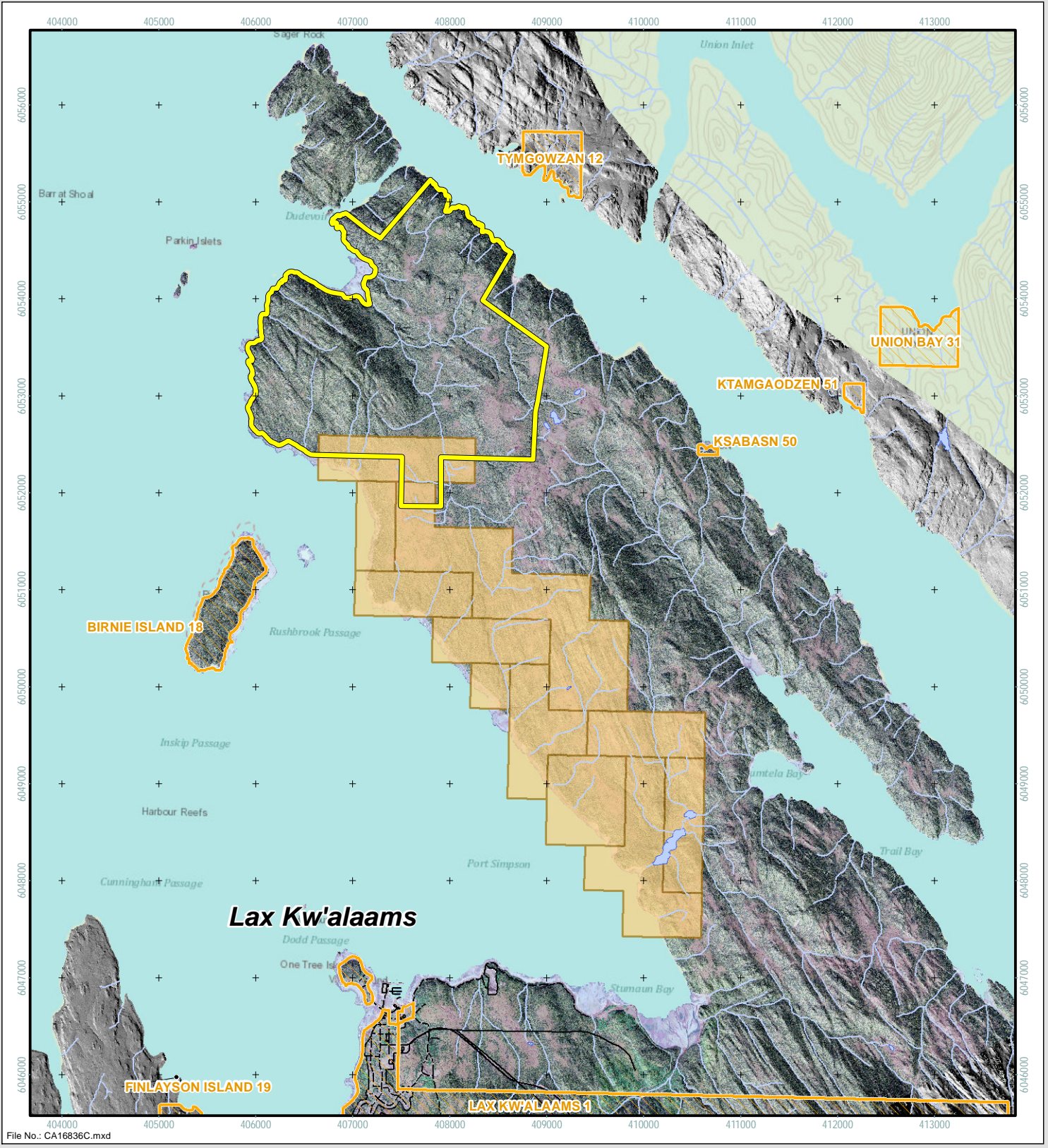
Aboriginal, recreational and commercial fisheries and harvesting activities occur around the Tsimpsean peninsula, along Work Channel, and to the west of the peninsula. Key target species include salmon, prawn, shrimp, halibut, and urchin ( Department of Fisheries and Oceans, 2012). Commercial finfish fisheries occurring in marine areas adjacent to the Project site include salmon (gillnet) and salmon (seine). Commercial invertebrate fisheries in the area include prawn (trap) and prawn (trawl). The waters surrounding the Tsimpsean peninsula are an identified First Nations Food Fishery, and recreational fishing occurs along Work Channel.

The Zumtela Bay Conservancy is of particular importance to the coast Tsimshian communities. There are several other conservancies west of Work Channel, including:

- Kts'mkta'ani Union Lake Conservancy
- Khutzeymateen Inlet Conservancy
- Ksi X'anmass Conservancy

### **8.5 Project Access**

The Grassy Point site is remote. Currently, there is no road access to the site from the Lax Kw'alaams community or Prince Rupert; access is currently limited to boat or aircraft from these two communities. Access to Prince Rupert includes the Prince Rupert Airport, located on Digby Island approximately 9 km west southwest of the city, which is accessible by ferry. The airport handles general and commercial aviation aircraft. The airstrip is long enough to accommodate Boeing 737 aircraft. The airport is serviced by two air carriers, which provide direct connections between the Prince Rupert area and Vancouver, Sandspit and Masset. BC Ferries operates ferry routes from Port Hardy and Ketchikan Alaska from May through October.



File No.: CA16836C.mxd

**Legend**

Grassy Point Site	Road & Cutline
District Lots	Lake
First Nations	River / Stream
Mineral & Placer Tenure	

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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**

**SUBSURFACE TENURES  
NEAR THE GRASSY POINT SITE**

Date: May 23, 2014

FIGURE 8 - 4

Prince Rupert is the transportation hub of the north coast with major air, road rail and marine access (Table 8-3). It is the terminus of the Canadian National Railways system and the transcontinental Highway 16.

**Table 8-3 Access to Prince Rupert**

Travel Type	Description	Duration (hours)	Distance (km)
Plane	Prince Rupert Airport on Digby Island from Vancouver Airport	2	750
Car	Prince Rupert from Terrace via Yellowhead Highway (16)	2	145
Boat	Prince Rupert from Port Hardy via BC Ferries	15	430
	Prince Rupert from Ketchikan Alaska via Alaska Marine Ferries	8	200

During the construction and operation phases, access to the Grassy Island site will be by air and marine vessels. The marine access route to the Project site will start near the Triple Island Pilotage station, where a BC marine pilot from the Pacific Pilotage Authority will board the vessel, and continue east along Hecate Strait (Brown Passage) and north up Chatham Sound (Figure 8-5).

## 8.6 Past and Current Environmental Studies in the Region

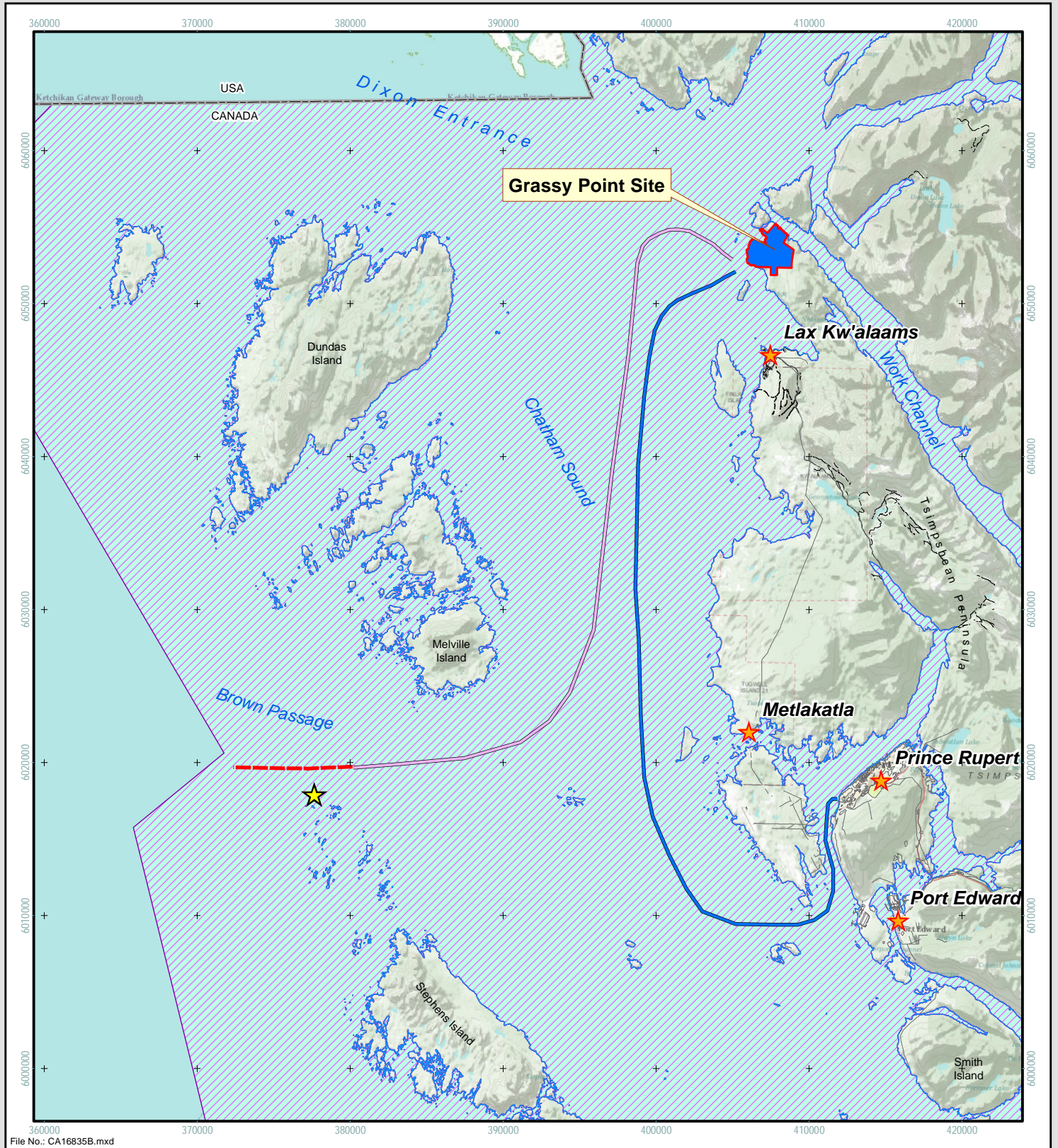
In 1981, Dome Petroleum conducted an environmental assessment for a proposed LNG facility within the Grassy Point area. The facility was never constructed.

There have not been any regional environmental studies carried out under the *CEAA* in the vicinity of the Project.

Numerous LNG and pipeline projects within the Prince Rupert region are currently entering the environmental assessment and review process and, as such, many environmental studies will likely occur in the near future to support these applications.









## 8.7 Project Components

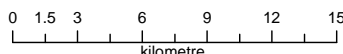
The general characteristics of the Project components are consistent with existing LNG production facilities and include the LNG facility, marine terminal, supporting infrastructure, and temporary infrastructure. The core project components are identified in Table 8-4.



File No.: CA16835B.mxd

**Legend**

-  Aurora LNG Area - Grassy Point
-  Urban Centre
-  Triple Islands Pilot Station
-  Compulsory Pilotage Areas
-  Road & Outline
- Approach Route (Conceptual)**
-  Pilot Boarding Zone
-  Grassy Point Route
-  Grassy Point Water Supply Route



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Projection: UTM Zone 9  
Datum: NAD 83

**AURORA LNG**



**MARINE ACCESS  
TO AURORA LNG  
GRASSY POINT SITE**

Date: March 3, 2014

FIGURE 8 - 5

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**Table 8-4 Key Components of the Project**

Infrastructure	Project Components
LNG Facility	<ul style="list-style-type: none"> <li>Feed gas receiving equipment</li> <li>Natural gas treatment equipment to remove impurities (CO<sub>2</sub>, H<sub>2</sub>S, mercury and natural gas liquids (NGLs)) from feed gas</li> <li>Storage tanks and infrastructure for staging and loading of NGLs</li> <li>Liquefaction refrigerant storage</li> <li>Four 5–6 mtpa liquefaction trains with gas turbine-driven compressors</li> <li>Up to three 180,000 m<sup>3</sup> LNG storage tanks</li> <li>Flare system</li> <li>Continuously manned control room</li> </ul>
Marine Terminal	<ul style="list-style-type: none"> <li>A conventional trestle</li> <li>Loading and offloading arms and associated infrastructure</li> <li>Up to three LNG carrier berths</li> <li>Cryogenic rundown and vapour return pipelines between the LNG facility and marine terminal</li> <li>Possible loading of NGL</li> </ul>
Supporting Infrastructure	<ul style="list-style-type: none"> <li>Water supply pipeline from materials offloading facility (MOF) to LNG facility</li> <li>Wastewater treatment systems</li> <li>Nitrogen and compressed air equipment</li> <li>Fuel storage</li> <li>Administration and maintenance buildings</li> <li>Materials offloading facility (MOF)</li> <li>Power infrastructure for the LNG facility and marine terminal</li> <li>Firewater system</li> <li>Demineralization water system</li> <li>Process heat system</li> <li>Solid waste collection and disposal</li> <li>Wastewater collection and treatment</li> <li>Facility stormwater management system</li> <li>Facility and maritime security</li> <li>Medical centre and fire station</li> <li>Heliport for medevac</li> <li>Camp for operational staff and maintenance turnaround personnel</li> <li>Haul road</li> </ul>
Construction-related Infrastructure and Facilities	<ul style="list-style-type: none"> <li>Construction camps</li> <li>Additional temporary laydown areas</li> <li>Construction offices</li> </ul>

A conceptual layout of the Project components is illustrated in Figure 8-6.

The marine terminal will be placed between Parkin Islands and the peninsula, and will support up to three berths. Three LNG tanks will be placed on the northwest corner of the site. The laydown area, flare, and trains will be located to the east, and the work camp will be constructed on the south end of the site.

Figure 8-7 provides a block flow diagram for Phase 1 of the LNG facility. The diagram shows two parallel trains with common facilities and utilities, NGL storage, and LNG storage and loading. The common facilities will include the fire water system, the pressure relief and liquid disposal 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.

### **8.7.1 LNG Facility**

It is anticipated that the LNG facility will comprise 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.

The facility will be built in phases, with two LNG trains constructed during the first phase, each with a processing capacity of between 5 mtpa and 6 mtpa. An additional two LNG trains will be constructed as required by market conditions. The exact phasing and optimization of the trains' size will be established during early pre-front end engineering and design (Pre-FEED).

The pre-treatment, processing and LNG production facilities and processes are described below.

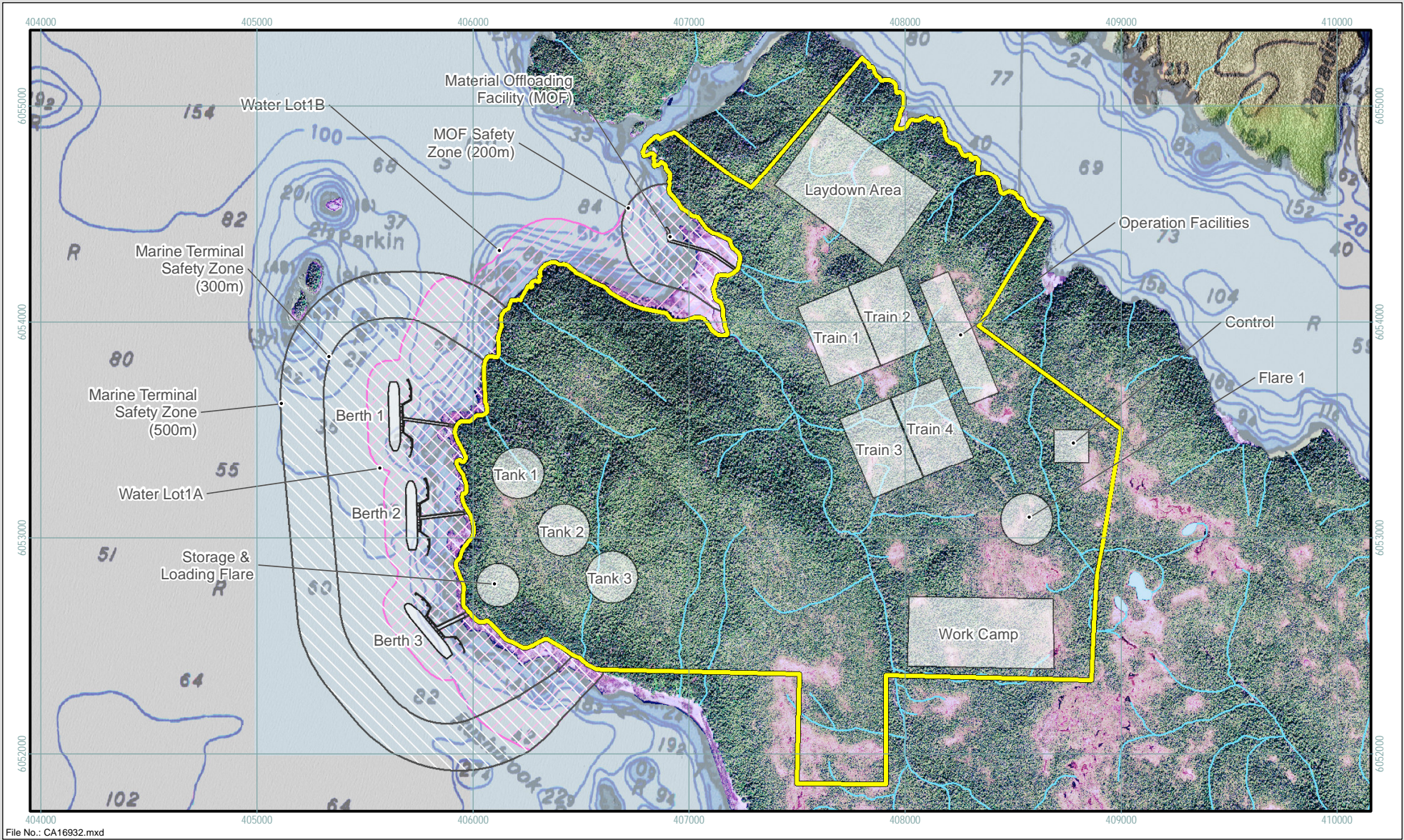
#### **8.7.1.1 Natural Gas Supply**

Supply of natural gas for the Project will be sourced primarily from the Horn River and the Liard and Cordova basins of northeast BC through a combination of proprietary natural gas holdings and third-party gas, which may include, but not limited to, purchases at market hubs, gas supply arrangements and upstream joint ventures. Natural gas will be delivered to the Project via a third party-owned pipeline(s), which is yet to be determined.

It is expected that there will be some variability in the composition of the natural gas, as it will be sourced from multiple areas of the Horn River and the Liard and Cordova basins.

#### **8.7.1.2 Natural Gas Reception System**

The natural gas supply pipeline will enter the property boundary via a dedicated pipeline delivery station.

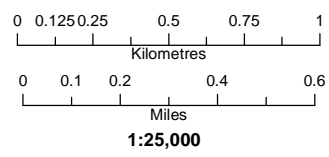


File No.: CA16932.mxd

**Legend**

- Aurora LNG - Grassy Point Site
- Water Lot
- Conceptual LNG Layout
- Rivers & Streams (TRIM)
- Lake / Waterbody (TRIM)

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Projection: UTM Zone 9  
 Datum: NAD 83

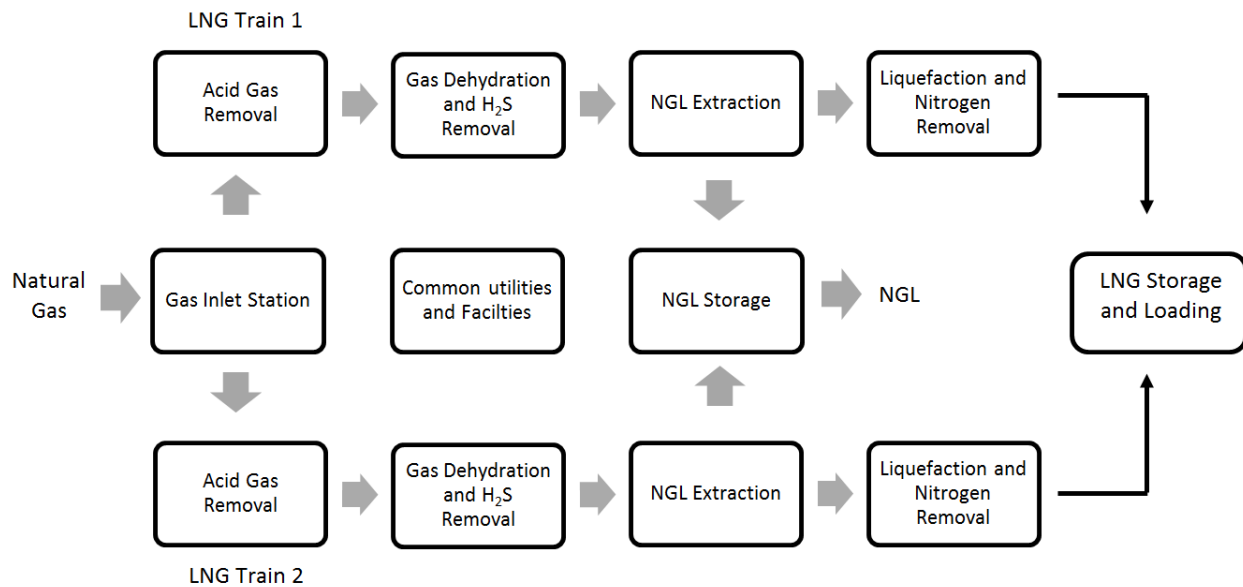
**AURORA LNG**



**CONCEPTUAL LNG LAYOUT  
GRASSY POINT SITE**

Date: June 5, 2014

FIGURE 8 - 6



**Figure 8-7 Block Scheme for the LNG Facility, Phase 1**

### 8.7.1.3 Natural Gas Pre-treatment Process

The natural 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. Any mercury in the feed gas will be removed to prevent corrosion of the cryogenic equipment. Trace amounts of carbon dioxide (CO<sub>2</sub>) and hydrogen sulphide (H<sub>2</sub>S) will then be removed. The feed gas will then undergo dehydration to remove water to prevent freezing during the liquefaction process.

Components of the gas treatment infrastructure will include:

- **Mercury Removal Unit**—Any minute amount of mercury present in the gas stream can cause corrosion and damage in the liquefaction unit. The mercury will be removed using a 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.
- **Acid Gas Removal Unit**—The acid gas removal unit (AGRU) will remove carbon dioxide (CO<sub>2</sub>) and hydrogen sulfide (H<sub>2</sub>S) (collectively referred to as acid gas) using an activated amine solvent. This treatment process is widely used in natural gas processing plants and LNG facilities. The treated gas will then be routed to the dehydration unit, and acid gases will be stripped from the solvent. Depending on H<sub>2</sub>S and CO<sub>2</sub> levels in the feed gas, the acid gases may be sent to a thermal oxidizer where H<sub>2</sub>S is oxidized to sulphur dioxide (SO<sub>2</sub>) and the residue hydrocarbon incinerated.



- **Gas Dehydration Unit**—The dehydration unit will remove water from the gas stream using a combination of refrigeration and molecular sieve to prevent ice (hydrates) from forming in the downstream liquefaction unit. Condensed wastewater from the sieve will be recovered back to the AGRU. Oily water discharge from the AGRU and dehydration system will be sent to the NGL unit.
- **NGL Extraction Unit**—The NGL extraction unit will cool the inlet gas stream, allowing for the condensation and recovery of NGLs prior to the liquefaction process. The NGLs will be stabilized in a debutanizer where the light ends will be removed and re-injected in the LNG or used as fuel. The NGL will be sent to onsite NGL storage tanks. Aurora LNG is considering the options of using the NGL for power generation or transporting the NGL to the railhead in Prince Rupert for transfer to markets. These options will be studied further in the Pre-FEED.

#### **8.7.1.4 Natural Gas Liquefaction Process**

Gas leaving the NGL extraction 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  $-162^{\circ}\text{C}$ . 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. A compressor will be located between the NGL extraction unit and the liquefaction unit to compress the gas into the optimal liquefaction pressure (6,000–7,000 kPaa) as the outlet pressure of the NGL recovery unit will be too low to allow for efficient liquefaction and sizing of the main refrigerant heat exchanger.

There are currently three main liquefaction processes being investigated for use at the Project: the Air Product and Chemicals Inc. (APCI) propane pre-cooled mixed refrigerant (C3MR) process, ConocoPhillips Optimized Cascade and Shell Dual Mixed Refrigerant (DMR) liquefaction process (Figure 8-8, Figure 8-9 and Figure 8-10). Both the C3MR and Optimized Cascade processes are well-proven technologies that are efficient in cold climates.

Each LNG train will have a heat transfer system with large banks of air-cooled heat exchangers.

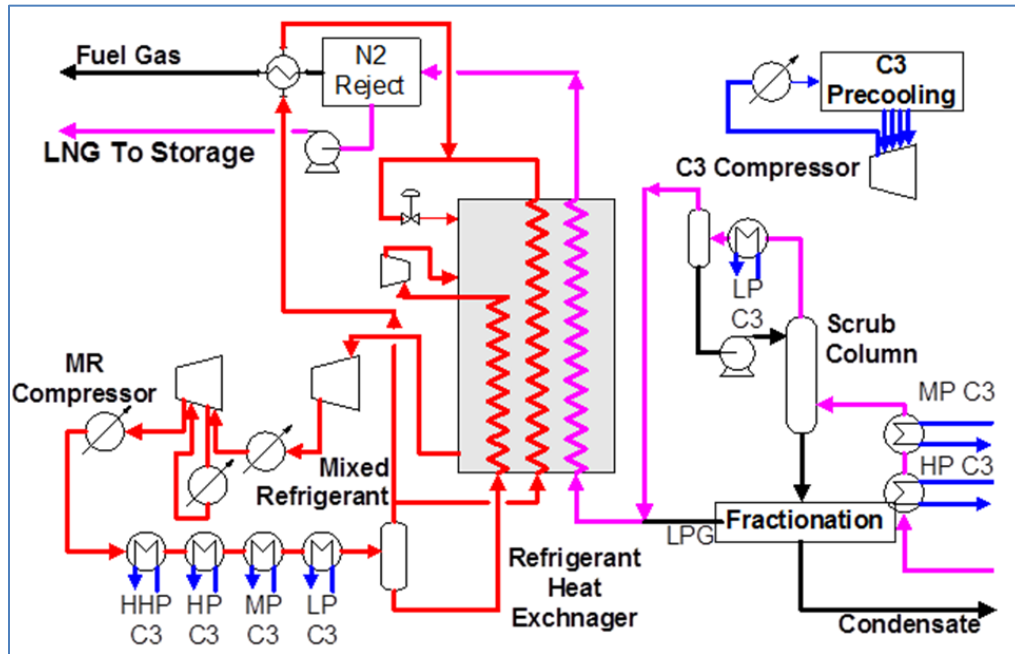


Figure 8-8 (APCI) Propane Pre-cooled Mixed Refrigerant (C3MR) Process, Typical Configuration Diagram

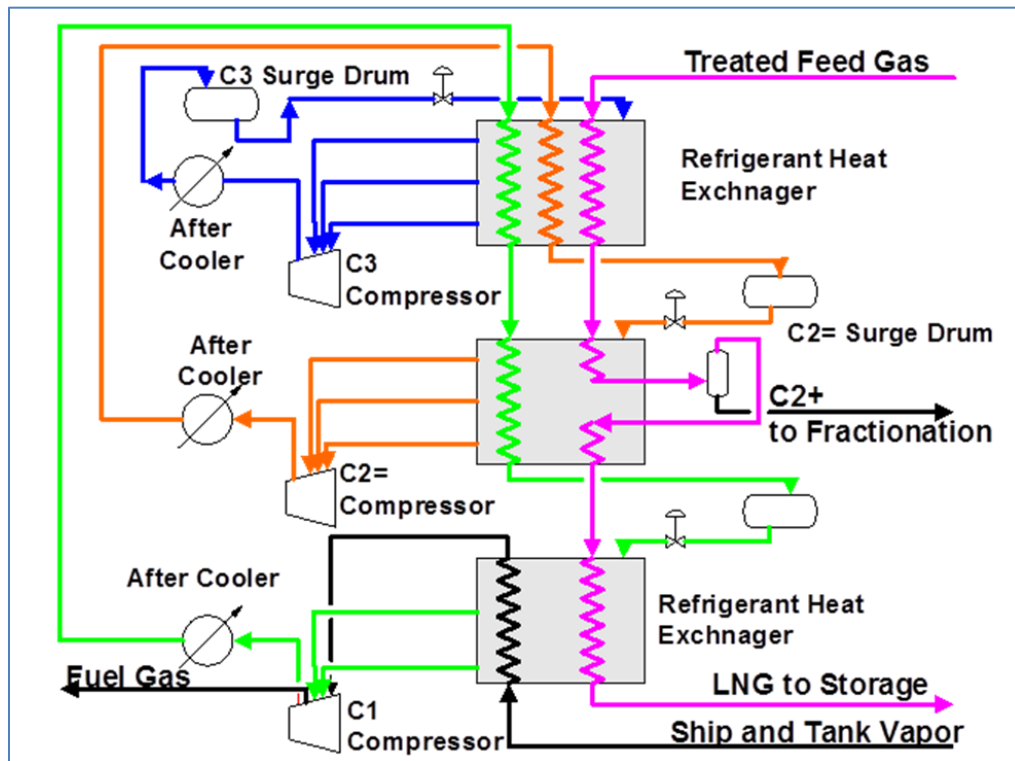
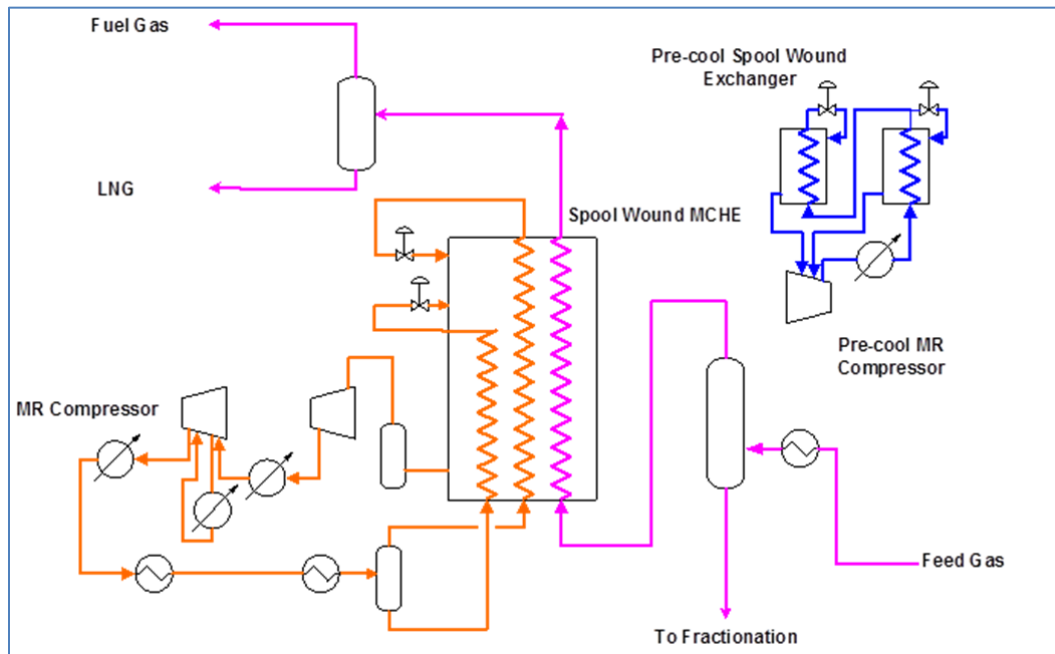


Figure 8-9 Optimized Cascade Liquefaction Process, Typical Configuration Diagram



**Figure 8-10 Dual Mixed Refrigerant (DMR) Liquefaction Process, Typical Configuration Diagram**

#### 8.7.1.5 Storage Tanks

Once the LNG is produced, it will be stored at atmospheric pressure in one of three insulated LNG storage tanks located in the LNG tank area. Each tank will have a capacity of 180,000 m<sup>3</sup>. They will be up to 60 m in height and up to 95 m in diameter. The tanks will be full containment type with outer concrete walls and roof, or membrane type storage tanks. They will be placed on insulated pads to prevent heat ingress through the tank floor and to maintain an average temperature of -162°C.

The exact size, location and number of the tanks required for full site build out will be determined in the Shipping Logistics Analysis during Pre-FEED.

The NGL storage tanks will be located in the LNG tank area. The tank capacity for refrigerant components (ethane or ethylene and propane) will be sized based on the inventory in the liquefaction process. NGL will be either used for onsite power generation or will be transported offsite to market.

#### 8.7.1.6 Process Heat System

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

### **8.7.1.7 Power Supply**

Power supply during construction will be provided by diesel-powered generators.

During operation, the Project will require a substantial amount of energy for the natural gas liquefaction process and to operate non-process related infrastructure. The LNG liquefaction trains will 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. At this point in facility design (Pre-FEED), it is estimated that approximately 120 to 300 MW of electrical power could be required for Phase 1 depending on the selected process and refrigerant compressor drivers. The total power consumption at full site build out could be between 200 and 550 MW.

It is likely that electricity for plant operations will be generated by on-site power generators driven by natural gas from the plant inlet. However, final decisions regarding the type of power generation and capacity will be studied and developed during the feasibility study and engineering phases.

Diesel generators will be provided on site during startup, and in the event of emergencies.

### **8.7.1.8 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 flare stacks, shutdown and depressurization systems, fire protection, and safety flare systems.

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 implemented at the Project to ensure protection of personnel and equipment. Response equipment, such as fire and gas detection systems, alarms, fire extinguishers, foam systems, firewater pumps, fire response vehicles, and personal protective equipment, monitors and passive protection, will be provided on site.

The flare system will 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. The flare system will include flare stacks and associated infrastructure.

### **8.7.1.9 Safety Spacing**

A no-fuel buffer zone of approximately 30 m will be established along the perimeter of the Project site to reduce the likelihood of loss of or damage to the LNG facilities 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 plant boundary to minimize damage and risk of an event escalating.

Safety spacing will also be established to accommodate lightweight construction offices to provide a buffer from operating units. This will be particularly important during the phased completion of LNG trains and when additional trains are built adjacent to the existing operating trains during the second phase of plant development.

#### **8.7.1.10 Water Supply**

Aurora LNG is intending to secure water for the Project from existing water supply infrastructure at the Port of Prince Rupert. However, onsite sources such as groundwater and desalinated seawater are also being investigated.

During construction, municipal water would be barged from the Prince Rupert port to the MOF (see Figure 8-5), where it would be dispensed to a water storage tank. Untreated water will be used for general construction activities such as dust control. Treated water will be used for domestic uses and civil works. It is anticipated that construction activities will require one barge per day. During operations, municipal water would be barged to site and conveyed from the MOF through a pipeline as feed to water treatment systems providing potable water, demineralized water, utility water and firewater. The total projected water supply requirements for the Project are estimated to be approximately 875 m<sup>3</sup>/d during construction and 50 m<sup>3</sup>/d during operations.

#### **8.7.1.11 Water Treatment**

### **SITE PREPARATION AND CONSTRUCTION**

The Project area will require clearing and grubbing, soil stabilization, backfill and grading activities prior to the installation of permanent plant infrastructure. During site preparation, a temporary drainage and stormwater system will be established to collect and control stormwater flows and runoff from the site to the marine environment. The system will include internal and perimeter ditches, and erosion and sediment control measures.

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 to marine waters once it meets current wastewater requirements. Location of the effluent point of discharge will be selected during the detailed design phase. Sewage sludge will be transported off site and disposed of at an approved landfill.

Prior to establishing the sewerage site facilities, portable toilets will be available on site with offsite disposal to a licensed facility.

## **OPERATIONS**

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

Liquid wastes generated during operation of the facility will include:

- Treated sanitary wastewater (sewage and grey water)
- Stormwater runoff from non-process areas
- Stormwater runoff or water contaminated in the LNG process
- Plant process drains system
- Water discharge from steam or condensate blowdown
- Reject water from the demineralized water unit

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 ensure that it meets all applicable federal and provincial regulatory requirements.

Runoff from roads and buildings will drain into a drainage ditch system and discharged via the stormwater outfall into marine waters. All contact water (i.e., runoff from the processing areas, process equipment and firewater system testing) will be directed to an oil separator where any oily residue will be skimmed off to a collection sump. The effluent will be treated and directed to the stormwater outfall. The location of the outfall will be selected during the detailed design phase.

### **8.7.1.12 Buildings and Storage Facilities**

The location of supporting facilities and buildings will be selected based on consideration of safe distance, prevailing wind direction and access to LNG trains.

Buildings will house functions such as the central control room and spare parts warehouse. The option of providing administration support offsite is being considered.

Chemical storage facilities will house substances required by the liquefaction process, such as propane and ethylene, fuel, acid gas removal adsorbent storage, other chemicals, and waste products.

### **8.7.1.13 Laydown Area**

The LNG plant area will encompass land for the laydown and storage of plant materials during the construction phase, train maintenance events, and for further expansion. Site configuration will ensure unencumbered access to the area for construction of future trains.

#### **8.7.1.14 LNG Tank Area**

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

A flare system will be developed for upset conditions (e.g., BOG compressor trip) and for the disposal of inerts when a carrier comes back into service.

#### **8.7.1.15 Pipe-rack Corridor**

A corridor between the LNG plant area, the LNG 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.

#### **8.7.1.16 Haul Road**

To accommodate the potential for modular construction and allow receipt of large items of equipment and gas turbine/compressors, a haul road with a maximum slope of approximately 3% will be required. The road will extend from the MOF and the LNG plant area to the LNG tank area, and will enable the movement of modules or pre-assembled units from the MOF to the LNG tank area. The haul road will allow for the potential transport of modules weighing up to 6,000 tonnes with a width of up to 50 m. 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.

### **8.7.2 Marine Jetty and LNG Loading**

The Project will include a marine jetty and LNG loading facility capable of accommodating 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<sup>3</sup>. Initially, the facility will include two carrier berths, oriented to allow carrier approach, moorage and departure with the bow into the prevailing southeast wind and wave direction. Future expansion may include a third berth. Water depths near the coast are deep, which will minimize the length of the marine jetty. Water depths at the loading berths range from approximately -20 m (relative to chart datum [CD]) to -30 m CD.

The LNG will be delivered from the LNG tank area to the berth 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. The facility may allow concurrent loading of carriers at adjacent berths. There will be loading arms at each berth for transferring the LNG onto the carriers, and a vapour return arm for transferring BOG back to the liquefaction trains. It is anticipated that the LNG carriers will be loaded at a maximum loading rate of 12,000 m<sup>3</sup>/h, and will typically be at berth for approximately 24 hours.

Risk reduction features for the safe loading of LNG have been considered based on 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*.

### **8.7.3 Materials Offloading Facility**

The north end of Grassy Point is currently being considered as the location for the marine offloading facility (MOF); however, other locations are also being investigated. The MOF will provide for the safe berthing and transportation of large loads, modules from heavy lift and roll-on roll-off (ro-ro) vessels to land transportation units. The facility will also provide space for inspection of pre-assembled units, as well as an area to stow modules or packaged equipment and park shipments so they can be received out of the required path of the construction sequence.

The MOF area will also be used for the concrete batch plant, aggregate storage and water treatment plant for concrete production. The MOF area may continue to be used over the life of the Project to receive or dispatch shipments such as refrigerant, containers, rotating equipment and rotar transport canisters from ro-ro vessels.

#### **8.7.3.1 Camp Facilities**

A construction camp will be provided onsite to accommodate up to 4,000 to 5,000 Project workers. The number of occupants is anticipated to be less than 1,000 during the initial 10 months of construction, and will peak at 4,000 to 5,000 people by month 20.

The camp will likely be constructed using pre-manufactured modular units shipped to site, which will allow for timely assembly of the camp once site preparation is completed and utilities are installed. Temporary utilities and facilities to support the construction camp will include maintenance buildings, power generation, potable water systems, sanitary facilities, waste treatment plant, a marine outfall and fuel supply.

During facility operation, the camp will continue to be used for permanent operations and maintenance personnel (up to 400), as well as those personnel required during plant turnaround (possibly in excess of 700). The camp may also be used to provide skills training and other capacity-building programs for the community.

The camp and associated infrastructure will comply with all applicable health and safety requirements of WorkSafeBC, the Northern Health Authority, the BC Construction Camp Rules and Regulations, the BC Ministry of Environment and any other local, Port, provincial or federal regulations.

### **8.7.4 Heliport Area**

A heliport is proposed to enable emergency evacuation of injured personnel to appropriate medical facilities. This will ensure that, in the rare event of an emergency, people with critical injuries can receive treatment at better equipped metropolitan hospitals, if required.



## 8.8 Project Activities

### 8.8.1 Construction

Site preparation and construction will commence once all required regulatory permits and approvals have been obtained.

Access to the site will be via a combination of boat and helicopter.

The construction phase will involve the following key activities:

- Pioneer activity of establishing facilities for site preparation
- Facility site preparation for Project components and staging areas, including:
  - Vegetation clearing and grubbing
  - Grading and levelling of the site using cut and fill of rock, overburden, and/or other materials. Depending on site specifics, this could include blasting activities
  - Compaction
  - Implementation of erosion control measures and
  - Potentially some paving in required areas
- Erection of temporary facilities such as maintenance buildings, sanitary facilities and potentially temporary water collection structures
- Construction of the MOF and haul road to allow materials required for construction to be transported to site via boat / barge and offloaded appropriately. Larger components such as LNG facility modules, construction materials, supplies, and equipment will then be shipped to site via barge.
- Installation of utilities required for the LNG facility and the marine terminal. This will include electrical power, industrial and potable water systems, wastewater collection and treatment systems, storm water collection, fire protection system, vehicle fueling stations, and an oil-water separator.
- Construction of temporary facilities such as trailers, sanitary facilities, the construction camp, and maintenance buildings on site to accommodate initial work. Construction workers will stay at the construction camp for the duration of their rotation. Prior to completion of the construction camp, workers will commute to site by boat and/or helicopter from Prince Rupert.
- Construction of suitable foundations, and installation of pilings
- Construction of major terrestrial and marine components, including:
  - Natural gas treatment, extraction, and storage facilities
  - Natural gas liquefaction trains, compressors and associated infrastructure
  - Storage tanks
  - Flare systems
  - Plant piping

- Administration buildings and storage areas and
- Access roads within the site
- Construction of the marine terminal and installation of:
  - Piles, decking, and other support infrastructure
  - Piping and electrical infrastructure
  - Containment structures
  - Cryogenic rundown and vapour return pipelines and
  - A storage and loading flare system

It is anticipated that dredging will not be required at the turning basin and along the marine approach as water depths are adequate to accommodate Q-Flex carriers. However, dredging will likely be required at the MOF. This will entail the mechanical excavation of marine sediment, and may require subsea blasting. The volumes of dredgeate will be determined through further geotechnical and engineering design work.

The dredged material will be stored and/or disposed of at a regulatory-approved location. A suitable disposal area will be identified through consultation with regulatory authorities, First Nations, and stakeholders. Brown Passage, which is located approximately 40 km west of Prince Rupert, is the current designated marine disposal site within the Prince Rupert area. The suitability of this site will be evaluated.

### **8.8.2 Commissioning and Start-up**

The commission and start-up phase will involve controlled testing of the various Project components in a logical manner to ensure all systems handed over from construction are complete and functioning as per design. Piping and vessels will be pressure-tested. Once function testing is complete, the entire systems of completed project components and equipment will then be operationally tested and optimized (e.g., repeated starting and shutdowns, testing of emergency shutdown procedures and repeated facility flaring). Only once Aurora LNG is satisfied that the LNG facility and marine terminal is functioning optimally and safely, will operations begin.

### **8.8.3 Facility Operations and Maintenance**

Operation of the LNG facility and marine terminal is expected to occur over 25 years. The following activities will occur during regular operations:

- Shipment of supplies and equipment to the MOF
- Transportation of supplies and equipment to the LNG facility
- Maintenance of all infrastructure (LNG facility, marine terminal, wastewater outfall)
- Monitoring of all operations, including emissions
- Provision of camp and food services to employees

- Shipment of solid waste generated by the Project to a licensed waste receiver
- Storage and loading of LNG onto carriers
- Storage and possible shipment of NGL to market
- Piloting of LNG carriers between Triple Island pilot boarding station and the Project site
- Operation of tugs
- Shipping of LNG to overseas markets

#### **8.8.4 Marine Shipping**

Shipping activities will include regular transit of LNG carriers to the Project. At full build-out, approximately 160 to 320 LNG carriers (up to Q-Flex size) 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) and delivered at place (DAP) basis. The carriers will be powered by a combination of low sulphur fuel and boil-off gas. Escort and berthing tugs and pilot boat operations will support safe passage of the LNG, and the shipment of equipment and materials to the MOF.

LNG carriers will transit through Chatham Sound and Brown Passage within designated shipping zones. Operation of the vessels will be in accordance with shipping operations approved under the *Canada Shipping Act*. 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*.

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

#### **8.8.5 Decommissioning and Reclamation**

At the end of its operational life, Aurora LNG will either sell the LNG facility and marine terminal, or decommission it and reclaim the land according to applicable legislation at that time. Decommissioning will include removal of all land-based LNG and storage components, the gas reception facilities, and the marine terminal and associated infrastructure.

### **8.9 Emissions, Wastes, Noise and Light**

The LNG facility will generate various wastes, emissions, and effluents during the life of the Project. Construction, operation and decommissioning activities will be guided by site- specific and activity-specific management plans to manage emissions and discharges, which will be in compliance with the applicable regulatory regime and associated government requirements and conditions.

### 8.9.1 Air Emissions

Air emissions that will be generated by the Project include:

- NO<sub>x</sub> – nitrogen oxide
- CO – carbon monoxide
- SO<sub>2</sub> – sulfur dioxide
- PM<sub>2.5</sub> – particulate matter 2.5
- PM<sub>10</sub> – particulate matter 10
- VOC – volatile organic compound
- CO<sub>2</sub> – carbon dioxide
- CH<sub>4</sub> – methane
- N<sub>2</sub>O – nitrous oxide
- Fugitive hydrocarbons

Emission sources and quantities will vary during each of the Project phases (Table 8-5).

**Table 8-5 Anticipated Sources of Air Emissions**

	<b>Construction and Decommissioning</b>	<b>Operations</b>
Emission Sources	Diesel engines in trucks and barges used to transport materials to site, and in construction and dismantling of equipment Power generation during construction, commissioning, and dismantling Particulate matter emissions from vehicle traffic on roads and the construction site	Gas turbine generators Gas turbine drivers Gas treating equipment for the removal of trace contaminants from the gas-fired reboilers, heaters and incinerators Flare system used in upset and emergency, startup and maintenance situations Back-up generators (diesel) used during start-up, shut-down and in the case of emergencies Inert gas from dry-dock LNG carriers LNG vessels and other marine support vessels Fugitive emissions from the facility Exhaust from vehicle traffic on roads

During facility construction, the primary sources of air emissions will be diesel engines, power generation, vehicle traffic, and construction activities.

Sources of emissions during operation of the Project will include the gas turbines, the acid gas removal unit, the flare system and marine vessels.

- Gas Turbines - the majority of the facility's energy demands are likely be met by electric power generated by on-site power generators driven from sources in the plant such as BOG from LNG storage. These gas turbine generators will be a major source of criteria air contaminant (CAC) emissions ( $\text{NO}_x$ ,  $\text{CO}$ ,  $\text{SO}_2$ ,  $\text{PM}_{2.5}$ ,  $\text{PM}_{10}$ ,  $\text{VOC}$ ), greenhouse gas emissions (GHG) ( $\text{CO}_2$ ,  $\text{CH}_4$  and  $\text{N}_2\text{O}$ ) and, to a lesser extent, hazardous air pollutant emissions. Gas turbine drivers for the refrigerant compressors will also be a source of emissions.
- Acid Gas Removal Unit – the acid gas removal unit will extract  $\text{CO}_2$  and trace levels of  $\text{H}_2\text{S}$  from the natural gas. Depending on  $\text{H}_2\text{S}$  and  $\text{CO}_2$  levels in the feed gas, the acid gases may be sent to a thermal oxidizer where  $\text{H}_2\text{S}$  is oxidized to sulphur dioxide ( $\text{SO}_2$ ) and the residue hydrocarbon incinerated.
- Flare System – the flare system will dispose of liquid and vapour hydrocarbons during facility startup, shutdown and emergency/upset events. Flaring will generate gaseous emissions of  $\text{CO}$  and  $\text{NO}_x$ .
- Shipping – LNG carriers and support vessels used to transport equipment and materials will generate emissions of  $\text{SO}_2$ ,  $\text{NO}_2$ ,  $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{PM}_{10}$ ,  $\text{PM}_{2.5}$ , and GHG. Gaseous emissions of  $\text{CO}$ ,  $\text{CO}_2$  and  $\text{NO}_x$  will also be generated during gassing up and cool down of LNG carriers returning from dry dock.

Air emissions during facility shutdown and decommissioning are expected to be similar to those generated by construction activities. The emissions will be predominantly from the use of diesel fuel in heavy equipment used to dismantle the plant and haul away materials for salvage.

Emissions management plans will be developed to minimize releases of GHGs, CACs, and hazardous air pollutants from Project activities and infrastructure, and ensure compliance with applicable guidelines and regulations during construction and operation of the Project.

### **8.9.2 Solid and Liquid Waste**

Design of the facility will include provision for the collection, segregation, treatment, discharge and monitoring of all effluent streams. Non-hazardous liquid effluents will be controlled and discharges treated to meet all applicable federal and provincial regulatory requirements. This includes process water from construction and operation activities, storm water, and ballast water.

A waste management plan will be developed prior to site construction and operations to ensure that solid wastes are managed in accordance with relevant legislation. Non-hazardous solid wastes will be recycled, reused or collected in a central secure area on site, where they will be disposed of in a local landfill or other licensed waste receiver facility. Options for waste disposal are currently being evaluated.

All hazardous liquid and solid waste will be collected in a secure enclosed building and shipped offsite to an existing licensed hazardous waste facility.

Potential sources of solid and liquid wastes generated by the Project are listed in Table 8-6.

**Table 8-6 Anticipated Sources of Solid and Liquid Wastes**

	<b>Construction and Decommissioning</b>	<b>Operations</b>
Solid Waste	Biomass (chipped vegetative material) Excavated overburden, organic material, large boulders Construction Waste (wood, scrap metal, concrete) Domestic waste Dredge materials Sand blast waste Empty containers	Domestic waste Paper/cardboard waste Wood Scrap Metal Municipal waste Waste absorbents and adsorbents Filter cartridges Spent demineralized water membranes and/or bed material
Liquid Waste	Sanitary waste water Storm water Hydrostatic test water Used oils or solvents	Sanitary wastewater Storm water Water discharged from blow-down Reject water from water demineralization unit
Hazardous Waste	Treated sewage and sludge Medical waste Contaminated soil	Mercury removed from the feed gas Medical waste Contaminated soil Waste water contaminated with hydrocarbons or solvents Waste absorbents Used oils or solvents Treated sewage and sludge Misc. wastes, including batteries, filters, etc. Used methyl diethanolamine (MDEA) from acid gas removal

Aurora LNG will require that LNG carriers comply with all relevant national and international shipping requirements regarding disposal of waste and ballast water discharge.

### 8.9.3 Noise and Light Emissions

Table 8-7 lists the potential sources of noise and light at the Project. Noise and light emissions will be managed through best management practices incorporated into project design, and project-specific management plans.

**Table 8-7 Anticipated Sources of Noise and Light Emissions**

	<b>Construction and Decommissioning</b>	<b>Operations</b>
Noise Sources	Blasting Pile driving Facility assembly/disassembly Equipment movement Vehicle traffic Module offloading Pressure testing	Flares Vessel traffic Air coolers Gas turbines Compressors and pipework Vehicle traffic LNG carrier loading LNG carriers and tugs
Light Sources	Vehicles Construction Camp Lighting	Vehicles Vessels Facility Lighting Tugs, carriers, flares

During construction, the primary noise sources will be blasting and pile driving, moving of equipment and vehicle traffic, and assembly of the facility.

During operations, the primary noise sources will include gas turbines and compressors, vehicle and vessel traffic, air coolers, loading of the LNG carriers, and flares.

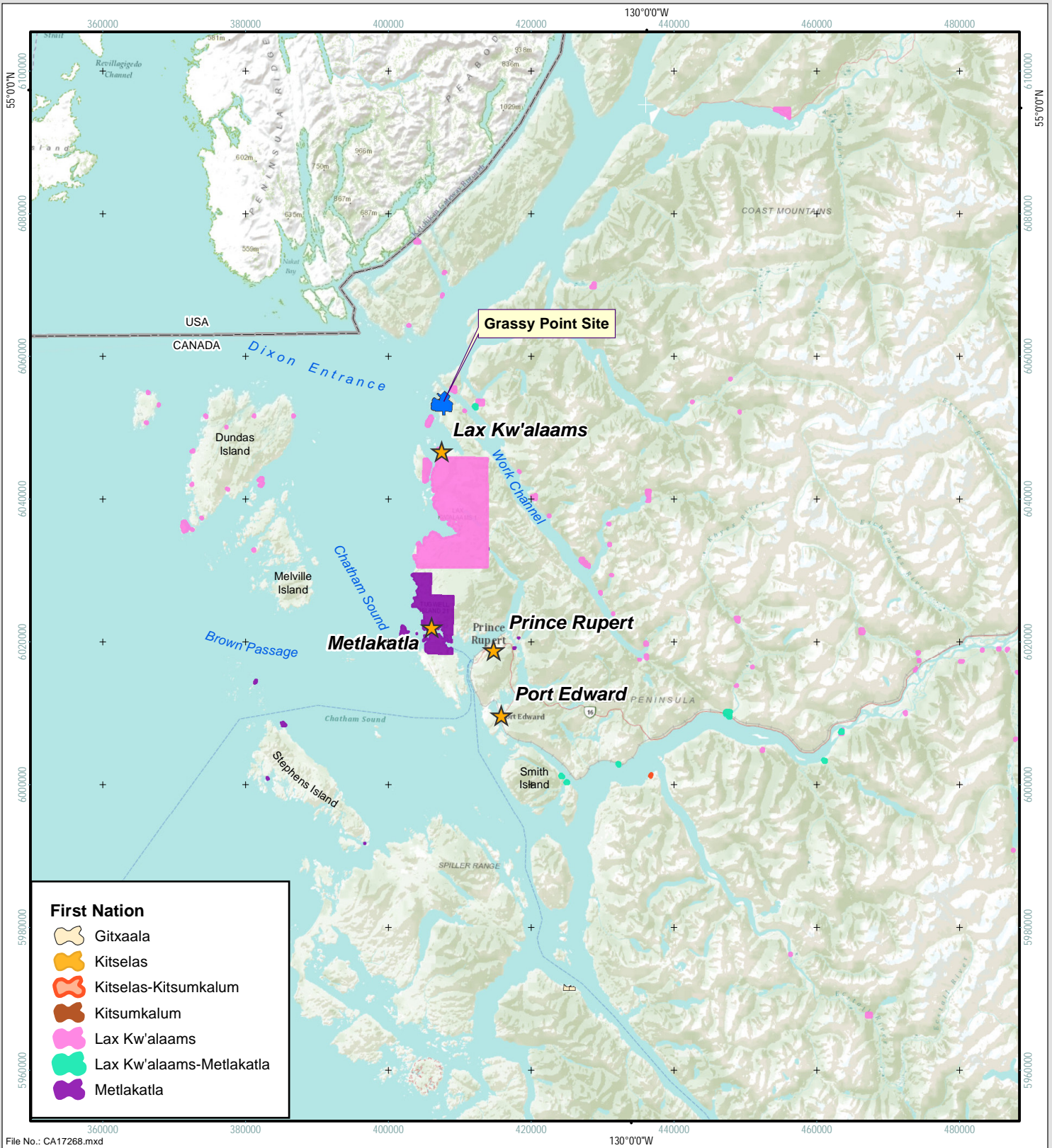
### **8.10 Aboriginal Groups**

Five First Nations and one Aboriginal Group could be affected by the Project and associated marine shipping activities. These are Gitxaala Nation, Kitselas Nation, Kitsumkalum First Nation, Lax Kw'alaams First Nation, Metlakatla First Nation and the Métis Nation of BC. The first five groups are part of a larger cultural group known historically and ethnographically as the Tsimshian. However, they represent distinct groups with different historical and cultural backgrounds.

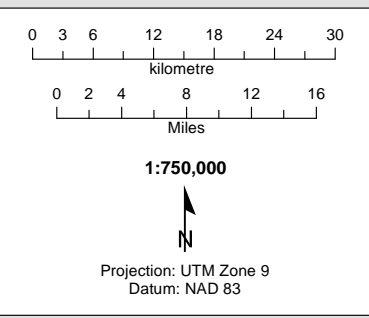
The Metlakatla, Kitselas, and Kitsumkalum are in the BC Treaty process and are represented in their negotiations by the Tsimshian First Nations Treaty Society. Lax Kw'alaams is negotiating a treaty independently. Gitxaala Nation is currently not involved in the BC treaty process.

Figure 8-11 shows First Nation reserves in the Project area. Although there are no Métis settlements within the Project area, there are a number of Métis living in the Prince Rupert area. A brief summary of each of the Tsimshian groups and the Métis is provided below.

Table 8-8 summarizes potential overlap between Project components and identified First Nations interests, with terrestrial interests identified as "Facility" and marine interests identified as "Shipping Route".



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**AURORA LNG**

**FIRST NATIONS RESERVES  
NEAR GRASSY POINT SITE**

Date: April 15, 2014

FIGURE 8 - 11



**Table 8-8 Potential Overlap between First Nations' Interests and Aurora LNG Project Components and Activities at Grassy Point**

First Nation	Potential Overlap with Identified First Nations' Interests	
	Facility	Shipping Route
Gitxaala Nation		X
Kitselas Nation		X
Kitsumkalum First Nation	X	X
Lax Kw'alaams First Nation	X	X
Metlakatla First Nation	X	X

### 8.10.1 Gitxaala Nation

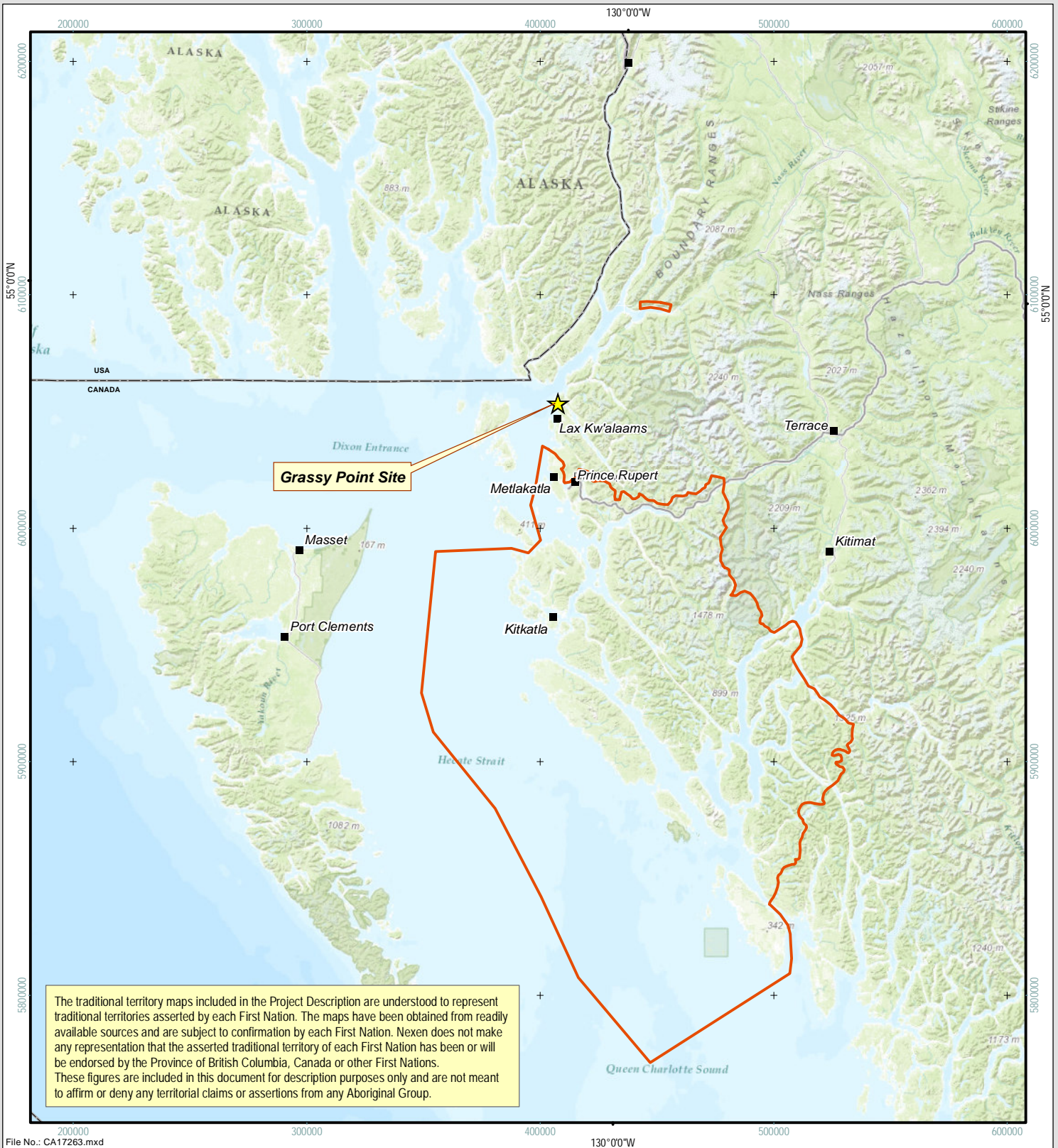
Gitxaala Nation is located across the bay from Prince Rupert in the Village of Kitkatla on Dolphin Island in Kitkatla Channel. The Nation has approximately 2,000 members, 25% of which live on reserve. Including the village of Kitkatla, Gitxaala Nation has 21 reserves covering 1,885.2 ha. The Nation's asserted traditional territory covers just over 3,000 ha encompassing the northern extent of their fishing territory on the Nass River, stretching south to the coastal islands just north of Kitasu Bay (Figure 8-12)<sup>1</sup>. The western edge of their territory extends seaward abutting against the marine territories of the Haida Nation. To the east, the territory extends to the mainland shore of Grenville Channel, where it meets Haisla and Gitga'at territories.

### 8.10.2 Kitselas Nation

Kitselas Nation has a registered population of approximately 615 members, of which approximately 50% live on two reserves: Kitselas IR 1 and Kulpai IR 6. These reserves are located along the Skeena River; IR 1 is just outside of Terrace, and IR 6 is located in the Kitselas Canyon to the east of Terrace. Kitselas First Nation has 10 reserves covering approximately 1070 ha; one reserve (Port Essington) is jointly administered with Kitsumkalum First Nation. The Kitselas asserted territory includes the watersheds of the Skeena and Kitimat rivers from Lorne Creek in the east to the Skeena and Kitimat estuaries (Figure 8-13)<sup>2</sup>. In addition to this, the Nation has previously stated that it has traditional harvesting areas in coastal areas of the Prince Rupert Port area, the lower Skeena River and its estuary, and in the Nass watershed.

<sup>1</sup> Gitxaala-British Columbia (2006). Sustainable Land Use Planning Agreement between Gitxaala Nation and the Province of British Columbia. Dated: October 2, 2006. Accessed on June 5, 2014 at: [http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central\\_north\\_coast/docs/Gitxaala\\_LUP\\_Final\\_signed.pdf](http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central_north_coast/docs/Gitxaala_LUP_Final_signed.pdf).




<sup>2</sup> Kitselas-British Columbia (2011). Forest and Range Consultation and Revenue Sharing Agreement (FCRSA) between the Kitselas Indian Band and Her majesty the Queen in Right of the Province of British Columbia. Dated: March 29, 2011. Accessed on June 5, 2014 at: [http://www.newrelationship.gov.bc.ca/shared/downloads/Kitselas\\_April2011.pdf](http://www.newrelationship.gov.bc.ca/shared/downloads/Kitselas_April2011.pdf)



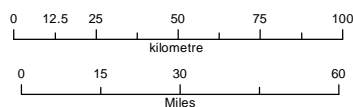
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File No.: CA17263.mxd

**Legend**

-  Aurora LNG - Grassy Point Site
-  Urban Centre
-  Asserted Traditional Territory of the Gitxaala Nation  
Source: Gitxaala-British Columbia (2006).

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Projection: UTM Zone 10  
Datum: NAD 83

**AURORA LNG**



**ASSERTED TRADITIONAL TERRITORY OF THE GITXAALA NATION**

Date: June 5, 2014




FIGURE 8 - 12



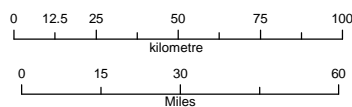
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File No.: CA17264.mxd

**Legend**

-  Aurora LNG - Digby Island Site
-  Urban Centre
-  Asserted Traditional Territory of the Kitseles Nation  
Source: Kitseles-British Columbia (2011)

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Projection: UTM Zone 10  
Datum: NAD 83

**AURORA LNG**



**ASSERTED TRADITIONAL TERRITORY  
OF THE  
KITSELES NATION**

Date: June 5, 2014

FIGURE 8 -13

### **8.10.3 Kitsumkalum First Nation**

Kitsumkalum First Nation is based near Terrace, and has a registered population of approximately 715 members. About 40% of its population lives on reserve land, primarily in the main community at Kitsumkalum IR 1. Kitsumkalum First Nation has four reserves, including the co-managed reserve at Port Essington. These reserves total approximately 600 ha of land. The Nation has identified its traditional territory as the areas surrounding the Kitsumkalum and Zymacord watersheds, as well as the Cedar River watershed (Figure 8-14)<sup>3</sup>. The Kitsumkalum has also asserted the use of areas outside these territories, including Lakelse River, Cheweanlaw, Skeena River, Ecstall River and locations along Grenville Channel, Edy Pass, Stephens Island and Work Channel. Kitsumkalum First Nation also asserts shared territory down to Low Inlet in Grenville Channel and Cape George in the Hecate Strait, stretching north to the Alaska and Nisga'a Nation borders.

### **8.10.4 Lax Kw'alaams First Nation**

Lax Kw'alaams First Nation is based in Lax Kw'alaams (formally Port Simpson). They have approximately 3500 members, of which 20% live on reserve land. The Lax Kw'alaams has 78 reserves throughout its asserted traditional territory, covering approximately 11,900 ha. Their asserted traditional territory encompasses the lands and waters between tributaries of the Skeena River, the height of land east of the Zymoetz River, and the Kitsumkalum River (Figure 8-15)<sup>4</sup>. It includes Nass Bay and Nass River to the west, and Wales and Pearse Islands, the Dundas and Stephens Islands groups as well as lands and waters at the mouth of the Skeena River, stretching south along Grenville Channel to the north.

### **8.10.5 Metlakatla First Nation**

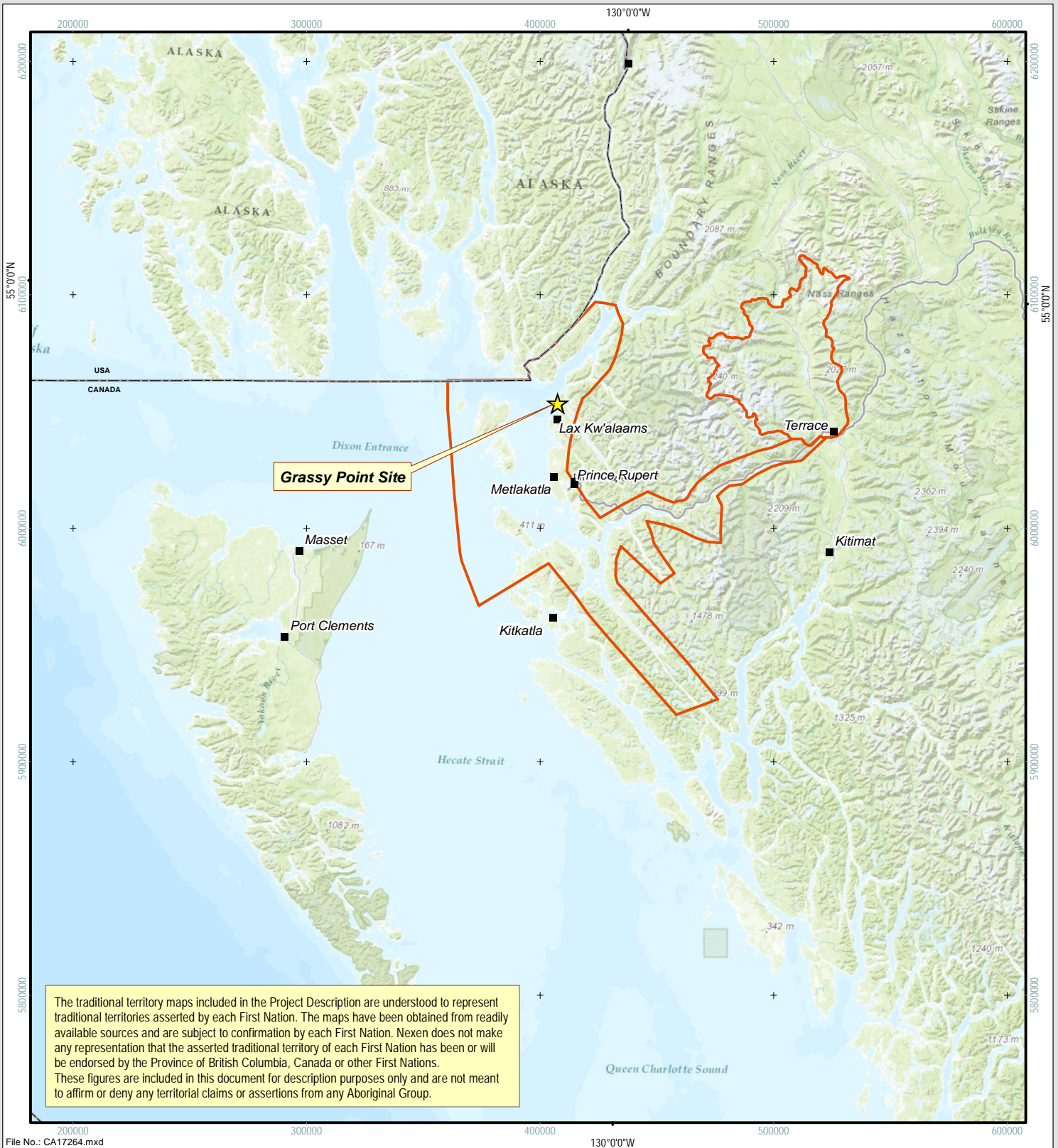
Metlakatla First Nation is based in Metlakatla, which is located on S1/2 Tsimpsean 2 reserve near Prince Rupert. The Nation has approximately 900 members, of which 10% live on reserve land in Metlakatla. The Metlakatla has 16 reserves, totaling 3,460 ha. Their asserted traditional territory extends from the coastal islands in eastern Hecate Strait to Lakelse Lake near Terrace (Figure 8-16)<sup>5</sup>. Portland Canal and Observatory Inlet mark the northern extent of the boundary, and the headwaters of the Ecstall River mark the southern borders. Their territory includes the lower portions and the mouth of the Skeena River and its tributaries.

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<sup>3</sup> Kitsumkalum-British Columbia (2011). Forest and Range Consultation and Revenue Sharing Agreement (FCRSA) Between the Kitsumkalum Indian Band and Her Majesty the Queen in Right of the Province of British Columbia. Dated March 31, 2011. Accessed on June 5, 2014 at:  
[http://www.newrelationship.gov.bc.ca/shared/downloads/Kitsumkalum\\_may\\_2011.pdf](http://www.newrelationship.gov.bc.ca/shared/downloads/Kitsumkalum_may_2011.pdf)

<sup>4</sup> Strategic Land Use Planning Agreement Between Lax Kw'alaams First Nation and the Province of British Columbia. Dated: May 9, 2008. Accessed on June 5, 2014 at:  
[http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central\\_north\\_coast/docs/SLUPA08May09FINAL\\_LAX%20Signed.pdf](http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central_north_coast/docs/SLUPA08May09FINAL_LAX%20Signed.pdf)

<sup>5</sup> Metlakatla-British Columbia (2006). Strategic Land Use Planning Agreement – Dated March 20, 2006. Accessed on June 5, 2014 at:  
[http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central\\_north\\_coast/docs/Metlakatla\\_FN\\_Signed\\_SLUPA.pdf](http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central_north_coast/docs/Metlakatla_FN_Signed_SLUPA.pdf)



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File No.: CA17264.mxd

**Legend**

- Aurora LNG - Grassy Point Site
- Urban Centre
- Asserted Traditional Territory of the Kitsumkalum First Nation  
Source: Kitsumkalum-British Columbia (2011)

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0 12.5 25 50 75 100  
kilometre

0 15 30 60  
Miles

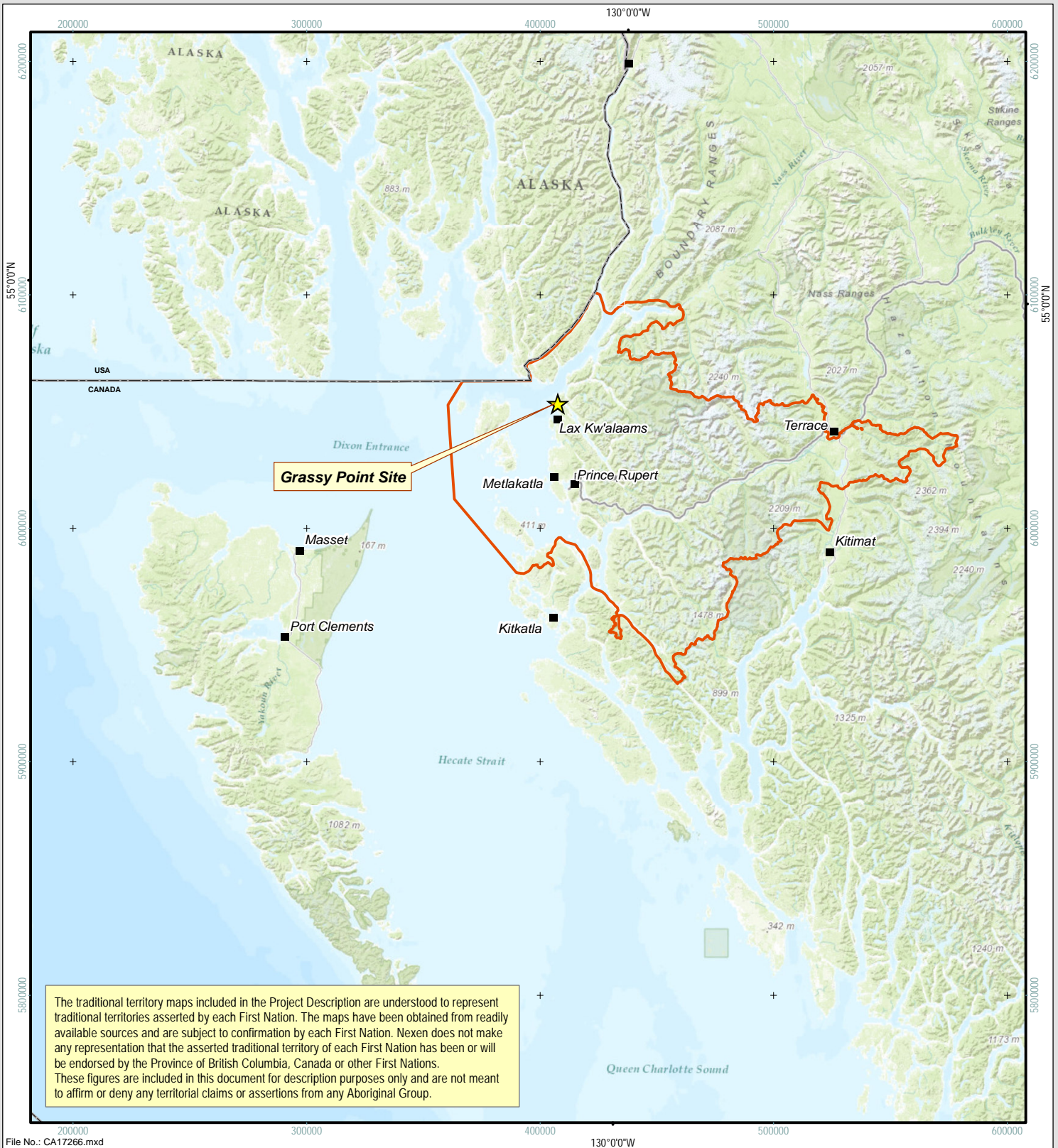
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Projection: UTM Zone 10  
Datum: NAD 83

**AURORA LNG**




**ASSERTED TRADITIONAL TERRITORY OF THE KITSUMKALUM FIRST NATION**

Date: June 5, 2014      FIGURE 8 - 14

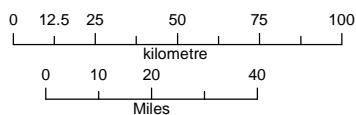


File No.: CA17266.mxd

### Legend

-  Aurora LNG - Grassy Point Site
-  Urban Centre
-  Asserted Traditional Territory of the LaxKw'alaams First Nation  
Source: Lax Kw'alaams-British Columbia (2014)

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Projection: UTM Zone 10  
Datum: NAD 83

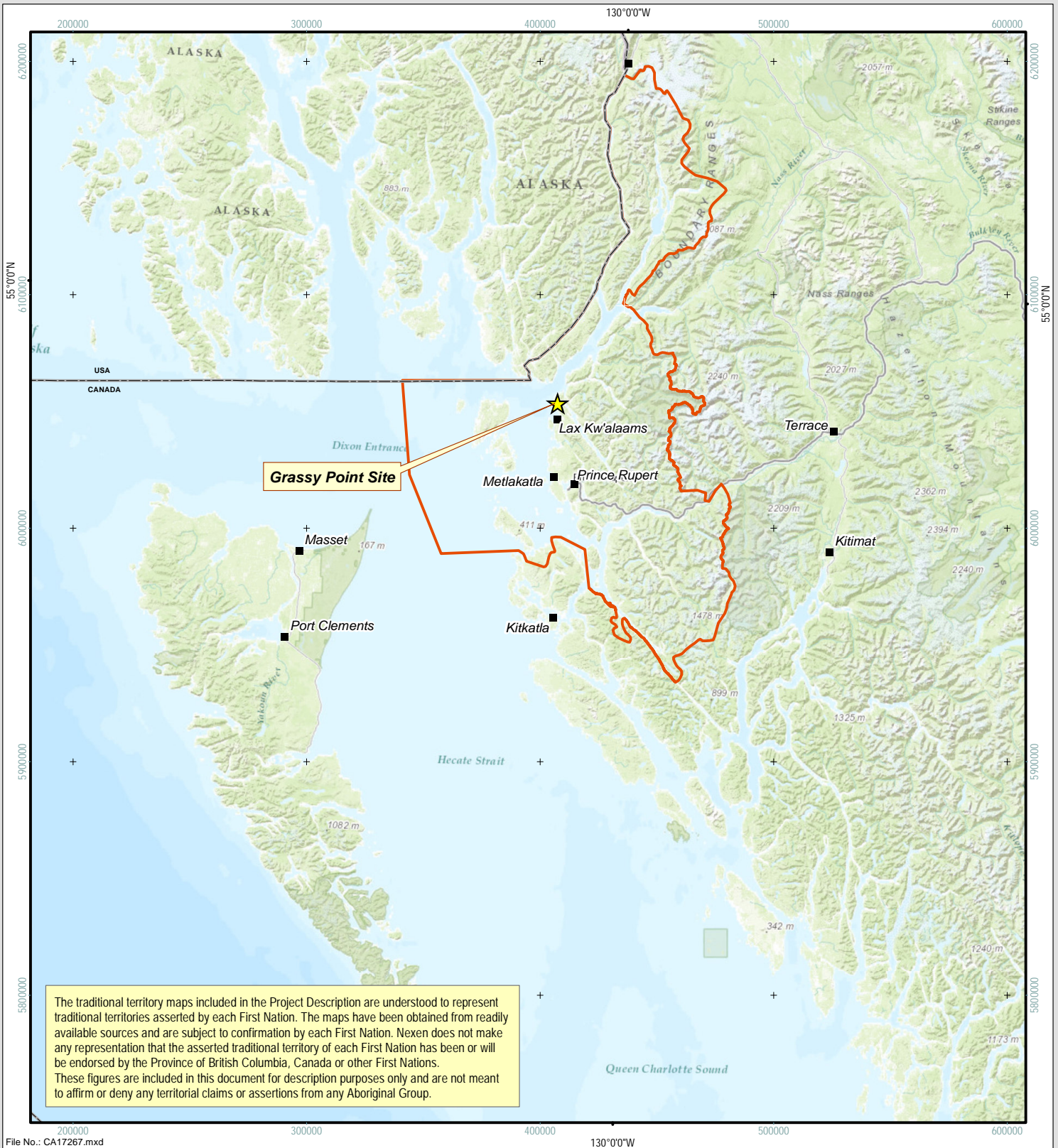
## AURORA LNG



### ASSERTED TRADITIONAL TERRITORY OF THE LAX KW'ALAAMS FIRST NATION

Date: June 5, 2014




FIGURE 8 - 15



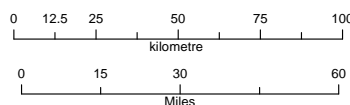
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File No.: CA17267.mxd

### Legend

-  Aurora LNG - Grassy Point Site
-  Urban Centre
-  Asserted Traditional Territory of the Metlakatla First Nation  
Source: Metlakatla-British Columbia (2006)

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Projection: UTM Zone 10  
Datum: NAD 83

## AURORA LNG



### ASSERTED TRADITIONAL TERRITORY OF THE METLAKATLA FIRST NATION

Date: June 5, 2014

FIGURE 8 - 16

### **8.10.6 Métis Nation BC**

The Métis Nation of BC (MNBC) represents Métis Citizens throughout BC. In total, there are 34 different Métis Chartered Communities, including one in Terrace, which represents Métis people throughout northwest BC. Engagement with MNBC and Métis Citizens is expected to occur as part of the Project's broader consultation program.

### **8.10.7 Coastal First Nations**

The Coastal First Nations (CFN) is an alliance of First Nations on BC's north and central coast, and Haida Gwaii. Member Nations include Metlakatla First Nation, Gitga'at First Nation, Haida Nation (Council of the Haida Nation, Sidegate, and Old Masset), Heiltsuk Nation, Kitasoo/Xaixais First Nation, Nuxalk Nation, and Wuikinuxv Nation. The CFN provides strategic regional administrative, planning and negotiation support to the member First Nations on environmental and economic issues. The CFN recently signed a Framework Agreement with the Province of BC to explore regional issues related to LNG development. The Framework Agreement commits the province to discuss air emissions, marine shipping, carbon offsets, regional renewable energy supply, and economic benefits.

## **8.11 Traditional and Current Land and Resource Use**

The Tsimshian cultural areas stretch from the lands and waters surrounding the Nass and Skeena watersheds and the coastal areas from the Nass River to Queen Charlotte Sound. Traditionally, groups have used the areas along the lower Skeena River from the Kitselas Canyon and Kitsumkalum (near Terrace) and the adjacent coast south to Milbanke Sound, including Port Simpson (Lax Kw'alaams), Metlakatla (in the Prince Rupert area), and Gitxaala (Kitkatla).

Findings through archaeological excavations and studies reveal villages dating back 5000 years. The Tsimshian have one of the oldest continuous cultural heritages in the western hemisphere. Tsimshian groups possess a rich cultural heritage and ceremonial practices, such as the potlatch feast, that continue to be observed. The Tsimshian are matrilineal, moiety, and each Tsimshian belongs to one of four tribes or totems: Frog or Raven, Wolf, Eagle, and Killer Whale. Today, hereditary chief titles are maintained for both traditional ceremonial and governance purposes.

Initial desktop research of publicly available sources and discussions with First Nations, to date, indicate that Tsimshian groups have used, and continue to use, the lands at the mouth of the Skeena River and the adjacent lands and marine areas for fishing, hunting, and marine and terrestrial food harvesting, as well as for ceremonial practices. Culturally modified trees are also common throughout the area. First Nations community members also use the marine area for commercial fishing purposes.

Traditionally, living off the land and sea, the Tsimshian typically established a permanent village where members lived during the winter months, as well as a temporary spring village and summer fishing camp. The latter were used during food harvesting seasons.

Examples of marine resources traditionally used by the local First Nations include: seaweed, halibut, salmon, eulachon, shellfish, fish roe, seal, sea lions, and sea otter. Terrestrial resources are also



traditionally harvested and include: tree bark, planks, berries, bird eggs, deer, elk, bear, and other animals. As well, Aurora LNG understands that the Project may be located nearby areas of potential cultural and spiritual significance for these groups.

Aurora LNG has initiated consultations and will continue work with each of the five First Nations to understand their current and historic uses of the Grassy Point area and surrounding marine environment for the purpose of assessing the potential effects of the Project on their respective interests.

## **8.12 Environmental Setting**

### **8.12.1 Climate**

The main climatic processes in the northwest coastal area are driven by a high frequency of frontal systems arriving from the Pacific Ocean. Constant streams of oceanic low pressure systems bring mild, moist air and create cloudy, wet weather conditions during winter. The climate of Grassy Point is dominated by fog, cloud, and drizzle. Annual precipitation varies, but can exceed 2,500 mm. In general, October through to December are the wettest months. The area receives very little precipitation in the form of snow.

The Pacific Ocean moderates temperatures in the area, with average temperatures ranging from 2°C in winter to 15°C in summer. Winds blow predominantly from the southeast, ranging from 10 km/h to 20 km/h (Ministry of the Environment 2013).

### **8.12.2 Air Quality**

The closest air quality monitoring stations to the Project site that provide continuous ambient air quality data are located in Prince Rupert and Port Edward.

Sulphur dioxide (SO<sub>2</sub>) is monitored continuously at the Prince Rupert Galloway Rapids and Port Edward Pacific monitoring stations. Over the period of record (1998-2002), the average one-hour SO<sub>2</sub> concentrations and maximum one-hour concentrations were well below the provincial Level A ambient air quality objectives. Inhalable particulate matter (PM<sub>10</sub>) values were also below ambient air quality objectives; however, hydrogen sulphide (H<sub>2</sub>S) exceedances were found at the Port Edward site primarily due to the Skeena Cellulose pulp mill, which closed in 2006.

More recent data collected by the BC MoE Mobile Air Monitoring Laboratory (MAML) in 2013 at Westview Terminal indicates that Criteria Air Contaminant (CAC) parameters of PM<sub>10</sub>, respirable particulate matter (PM<sub>2.5</sub>), SO<sub>2</sub>, nitrogen oxides (NO<sub>2</sub>), ozone (O<sub>3</sub>) and carbon monoxide (CO) are all below British Columbia ambient air quality objectives.

### **8.12.3 Acoustic Environment**

The existing ambient acoustic environment in the vicinity of Grassy Point is characterized primarily by sounds from the natural environment such as birds, wind, rain and waves along the coast. The closest

community is Lax Kw'alaams, which is located approximately 5 km from the Project site. Existing sound levels at Grassy Point are expected to be similar to that of a quiet rural environment.

#### **8.12.4 Geology and Geomorphology**

The Grassy Point area is located within the Hecate Lowlands located immediately west of the Coast Mountains. This area is characterized as coastal lowlands with elevations generally less than 175 m above sea level (Clague 1984).

Surficial geology of the Grassy Point site is generally characterized as a morainal or glaciomarine veneer (i.e., 0.5 to 1.0 m thick) deposit located in lower areas with colluvium or till veneer deposits located on the upland areas (Dome Petroleum 1981). Extensive and deep organic (coastal muskeg) deposits occur in areas of flat or gentle sloping bedrock surfaces throughout the site (Dome Petroleum 1981).

Bedrock geologic mapping by Hutchinson (1982) indicates two pre-dominant early Mesozoic and/or Paleozoic metamorphic rock packages. The western half of the site is generally comprised of higher grade (i.e., amphibolite facies) metamorphic rock consisting of dark greenish grey hornblende and impure quartzite with rare intercalated marble. The eastern portion of the site is comprised of biotite hornblende gneiss and amphibolite with minor migmatite and rare biotite schist.

A regional inferred fault identified by Hutchinson (1982), located east of the site within Work Channel, separates the hornblende gneiss and amphibolite. This fault is oriented northwest to southeast and extends from Wales Island north of the site to the Skeena River in the south.

Similar to the Prince Rupert region, the Grassy Point site is influenced by the Queen Charlotte Fairweather fault system located west of Haida Gwaii. This fault separates the Pacific and North American tectonic plates. This region is located within seismic zone #3, which indicates a zone of potential major earthquake damage with peak ground accelerations in excess of 6% g that have an annual probability of 1% (Clague 1984).

#### **8.12.5 Hydrology**

Grassy Point is located in the Central Coast Mountains hydrologic zone (Ahmed and Jackson, 2013). In this hydrologic zone, stream flow is maintained throughout the year in all but the smallest and highest elevation creeks. The proximity of the Pacific Ocean regulates temperatures, leading to cool summers and mild winters. There are 10 first and second order streams mapped at the Grassy Point site (one of these has a watershed code: 910-832300). These range from approximately 300 m to 1,800 m in length. One larger watercourse (910-831400), which is approximately 4,400 m in length, flows north through the center of the Project site. Peak annual flows in these creeks likely occur in the winter in response to rain storms off the Pacific Ocean.

### 8.12.6 Vegetation Resources

The Grassy Point site lies within the Hecate Lowland Ecoregion of the Coastal Gap Ecoregion, which is located within the larger Coast and Mountains Ecoprovince (Demarchi 2011). It is situated within the North Coast Forest District of the Coast Forest Region.

The Biogeoclimatic Ecosystem Classification (BEC) system is used in BC to describe the ecological communities that reflect the climate and elevation environment. The Project site is located entirely within the Central Very Wet Hypermaritime Coastal Western Hemlock (CWHvh2) BEC unit. The CWHvh2 biogeoclimatic zone occupies the outer coastal areas, usually less than 25 km from salt water, and ranges in elevation from 0 m to 600 m.

The natural vegetation of the Grassy Point site is primarily a mosaic of poor forest and bog. Productive forests are restricted to well-drained soils on moderate and steep slopes near the edges of the Tsimpsean peninsula and dominated by western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and Sitka spruce (*Picea sitchensis*). Yellow-cedar (*Chamaecyparis nootkatensis*), lodgepole pine (*Pinus contorta*), and red alder (*Alnus rubra*) are abundant on the outer coast where scrubby forests grow on organic soils over bedrock. Because fires occur rarely, seral stands were uncommon before clearcut logging began (Meidinger and Pojar 1991; Banner et al. 1993).

The characteristic understory species are salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), deer fern (*Blechnum spicant*), false lily-of-the-valley (*Maianthemum dilatatum*), fern-leaved goldthread (*Coptis asplenifolia*), skunk cabbage (*Lysichiton americanum*), and various bryophyte species (*Rhytidiadelphus loreus*, *Mnium* spp., *Sphagnum girgensohnii*, *Eurhynchium oregonum*, *Scapania bolanderi*, etc.) (Banner et al. 1993).

The BC CDC (2014) does not indicate any plants of conservation status at the Project site. However, until recently, little activity has occurred in the area, and there is a relatively high potential of listed plants occurring in the Project site and survey extent area.

According to information contained in the BC Conservation Data Centre (CDC), 32 plant species of conservation concern, including 25 blue-listed species and seven red-listed species, have potential to occur within 4 km of the Project area (Table 8-9). This includes 15 vascular plant species (14 flowering plants and a fern), 15 bryophyte species (11 true mosses (Bryopsida) and four peat-mosses (Sphagnopsida)), and a lichen species (*Pseudocyphellaria rainierensis*). This lichen is listed as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the *Species at Risk Act* (SARA).

**Table 8-9 Plant Species of Conservation Concern (Listed Species) with the Potential to Occur in the Project Area**

Class	English Name	Latin Name	Prov Status <sup>1</sup>	BC List	SARA Status
Bryopsida		<i>Bryhnia hulthenii</i>	S1S2	Red	
Dicotyledoneae	two-edged water-starwort	<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	S2S3	Blue	
Dicotyledoneae	yellow marsh-marigold	<i>Caltha palustris</i> var. <i>radicans</i>	S2S3	Blue	
Monocotyledoneae	lesser saltmarsh sedge	<i>Carex glareosa</i> var. <i>amphigena</i>	S2S3	Blue	
Monocotyledoneae	Gmelin's sedge	<i>Carex gmelinii</i>	S2S3	Blue	3 - Sensitive (2010)
Dicotyledoneae	dwarf bog bunchberry	<i>Cornus suecica</i>	S1S3	Red	4 - Secure (2010)
Bryopsida		<i>Dicranodontium asperulum</i>	S3	Blue	
Bryopsida		<i>Didymodon leskeoides</i>	S1	Red	
Bryopsida		<i>Diphyscium foliosum</i>	S3?	Blue	
Monocotyledoneae	Kamchatka spike-rush	<i>Eleocharis kamtschatica</i>	S2S3	Blue	3 - Sensitive (2010)
Bryopsida		<i>Entodon concinnus</i>	S3	Blue	
Bryopsida		<i>Hageniella micans</i>	S2S3	Blue	
Bryopsida		<i>Isopterygiopsis muelleriana</i>	S1S2	Red	
Monocotyledoneae	arctic rush	<i>Juncus arcticus</i> ssp. <i>alaskanus</i>	S2S3	Blue	
Monocotyledoneae	bog rush	<i>Juncus stygius</i>	S2S3	Blue	4 - Secure (2010)
Monocotyledoneae	flowering quillwort	<i>Lilaea scilloides</i>	S2S3	Blue	3 - Sensitive (2010)
Monocotyledoneae	white adder's-mouth orchid	<i>Malaxis brachypoda</i>	S2S3	Blue	
Monocotyledoneae	bog adder's-mouth orchid	<i>Malaxis paludosa</i>	S2S3	Blue	3 - Sensitive (2010)
Dicotyledoneae	dotted saxifrage	<i>Micranthes nelsoniana</i> var. <i>carlottae</i>	S3	Blue	
Bryopsida		<i>Philonotis yezoana</i>	S2S3	Blue	
Monocotyledoneae	white-lip rein orchid	<i>Piperia candida</i>	S2	Red	2 - May be at risk (2010)
Bryopsida		<i>Pleuroziopsis ruthenica</i>	S2S3	Blue	
Bryopsida		<i>Pohlia columbica</i>	S3	Blue	
Filicopsida	Alaska holly fern	<i>Polystichum setigerum</i>	S2S3	Blue	3 - Sensitive (2010)
Ascomycetes	oldgrowth specklebelly	<i>Pseudocyphellaria rainierensis</i>	S2S3	Blue	
Dicotyledoneae	Menzies' burnet	<i>Sanguisorba menziesii</i>	S2S3	Blue	3 - Sensitive (2010)
Sphagnopsida		<i>Sphagnum aongstroemii</i>	S2S3	Blue	
Sphagnopsida		<i>Sphagnum contortum</i>	S3	Blue	
Sphagnopsida		<i>Sphagnum obtusum</i>	S1	Red	
Sphagnopsida		<i>Sphagnum subobesum</i>	S2S3	Blue	

Class	English Name	Latin Name	Prov Status <sup>1</sup>	BC List	SARA Status
Bryopsida		<i>Tetradontium brownianum</i>	S3	Blue	
Monocotyledoneae	graceful arrow-grass	<i>Triglochin concinna</i>	S2	Red	

**NOTE:**

<sup>1</sup> Provincial Conservation Status applies to a species' conservation status in BC. The ranks have the following meanings: S1 – critically imperiled because of extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province; S2 – imperiled because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province; S3 – special concern, vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

Thirteen blue-listed and four red-listed ecosystems potentially occur within approximately 4 km of the Project area (Table 8-10). This includes 12 forest ecosystems and five wetland ecosystems (three fens, one marsh, and one swamp). Four ecosystems are explicitly defined as red- or blue-listed ecological communities (i.e., legally designated) in the Central and North Coast Land Use Objectives Order for Ecosystem Based Management (EBM) Implementation.

**Table 8-10 Ecological Communities of Conservation Concern (Listed Ecosystems) with the Potential to Occur in the Project Area**

Ecosystem Group	Common Name	Latin Name	Prov Status <sup>1</sup>	BC List
Wetland Fen (Wf)	northern mannagrass Fen	<i>Glyceria borealis</i> Fen	S3	Blue
Flood Lowbench (Fl)	red alder / salmonberry / common horsetail	<i>Alnus rubra</i> / <i>Rubus spectabilis</i> / <i>Equisetum arvense</i>	S3	Blue
Wetland Marsh (Wm)	Sitka sedge - Pacific water-parsley	<i>Carex sitchensis</i> - <i>Oenanthe sarmentosa</i>	S3	Blue
Wetland Fen (Wf)	Sitka sedge / peat-mosses	<i>Carex sitchensis</i> / <i>Sphagnum</i> spp.	S2	Red
Coniferous Forest (mesic), Flood Highbench (Fh)	Sitka spruce / false lily-of-the-valley <sup>4</sup>	<i>Picea sitchensis</i> / <i>Maianthemum dilatatum</i>	S2	Red
Coniferous Forest (dry)	Sitka spruce / Oregon beaked-moss	<i>Picea sitchensis</i> / <i>Eurhynchium oregonum</i>	S3	Blue
Coniferous Forest (moist/wet)	Sitka spruce / Pacific crab apple	<i>Picea sitchensis</i> / <i>Malus fusca</i>	S3	Blue
Coniferous Forest (dry)	Sitka spruce / Pacific reedgrass	<i>Picea sitchensis</i> / <i>Calamagrostis nutkaensis</i>	S3	Blue
Coniferous Forest (dry)	Sitka spruce / salal	<i>Picea sitchensis</i> / <i>Gaultheria shallon</i>	S3	Blue
Coniferous Forest (moist/wet)	Sitka spruce / slough sedge	<i>Picea sitchensis</i> / <i>Carex obnupta</i>	S2S3	Blue
Coniferous Forest (moist/wet)	Sitka spruce / sword fern	<i>Picea sitchensis</i> / <i>Polystichum munitum</i>	S3	Blue

Ecosystem Group	Common Name	Latin Name	Prov Status <sup>1</sup>	BC List
Coniferous Forest (moist/wet), Flood Highbench (Fh)	Sitka spruce / tall trisetum <sup>4</sup>	<i>Picea sitchensis</i> / <i>Trisetum canescens</i>	S1S2	Red
Wetland Fen (Wf)	sweet gale / Sitka sedge	<i>Myrica gale</i> / <i>Carex sitchensis</i>	S2	Red
Coniferous Forest (mesic)	western hemlock - Sitka spruce / lanky moss	<i>Tsuga heterophylla</i> - <i>Picea sitchensis</i> / <i>Rhytidiadelphus loreus</i>	S3	Blue
Coniferous Forest (moist/wet)	western redcedar - Sitka spruce / devil's club <sup>4</sup>	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Oplopanax horridus</i>	S3	Blue
Wetland Swamp (Ws)	western redcedar - Sitka spruce / skunk cabbage <sup>2</sup>	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	S3?	Blue
Coniferous Forest (mesic)	Western redcedar - Sitka spruce / sword fern	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Polystichum munitum</i>	S2S3	Blue

**NOTES**

<sup>1</sup> Provincial Conservation Status applies to an ecological community's conservation status in BC. The ranks have the following meanings: S1 = critically imperiled because of extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province; S2 = imperiled because of rarity due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province; S3 = special concern, vulnerable in the province due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

<sup>2</sup> Ecosystems explicitly defined as red- or blue-listed ecological communities in the Central and North Coast LUO (Land Use Objectives) Order for Ecosystem Based Management (EBM) Implementation.

**8.12.7 Wildlife Resources**

In the CWH zone, common large mammal species include black bear (*Ursus americanus*), grizzly bear (*Ursus arctos*), gray wolf (*Canis lupus*), and black-tailed deer (*Odocoileus hemionus*) (BC Ministry of Forests 1991).

Four amphibian species and two reptile species are expected to occur in the region: western toad (*Anaxyrus boreas*), rough skinned newt (*Taricha granulosa*), long-toed salamander (*Ambystoma macrodactylum*), northwestern salamander (*Ambystoma macrodactylum*), common garter snake (*Thamnophis sirtalis*), and western garter snake (*Thamnophis elegans*). Although not documented in any regional studies, coastal tailed frog (*Ascaphus truei*) may also be found in the region.

Common birds expected to occur at Grassy Point include bald eagle (*Haliaeetus leucocephalus*), common raven (*Corvus corax*), dark-eyed junco (*Junco hyemalis*), and glaucous-winged gull (*Larus glaucescens*). There are two Important Bird Areas (IBA) within the vicinity of Grassy Point: BC 124 and BC 125. BC124 extends from Big Bay south to Delusion Bay. Birds such as black turnstone (*Arenaria melanocephala*), brant (*Branta bernicla*), colonial water birds and seabirds, dunlin (*Calidris alpina*), surf scoter (*Melanitta perspicillata*), and waterfowl have been observed to congregate in large numbers in this

area (Birdlife International; Bird Studies Canada, and Nature Canada 2012). BC125 includes Grey and Green islets. Birds such as black oystercatcher (*Haematopus bachmani*), glaucous winged gull, pigeon guillemot (*Cephus columba*), and harlequin duck (*Histrionicus histrionicus*) are known to occur in large numbers (Birdlife International; Bird Studies Canada, and Nature Canada 2012).

There are 24 species of conservation concern that are known or likely to occur in the Prince Rupert region (BC CDC 2014). These are listed in Table 8-11.

**Table 8-11 Species of Conservation Concern within the Prince Rupert Region**

Species Name	Scientific Name	SARA Status	COSEWIC Status	BC Status
<b>Mammals</b>				
Grizzly Bear	<i>Ursus arctos</i>		SC	Blue
Wolverine	<i>Gulo gulo luscus</i>		SC	Blue
Fisher	<i>Pekania pennanti</i>			Blue
Keen's Myotis	<i>Myotis keenii</i>	SC (Schedule 3)	DD	Red
Little Brown Myotis	<i>Myotis lucifugus</i>		E	Yellow
<b>Amphibians</b>				
Western Toad	<i>Anaxyrus boreas</i>	SC (Schedule 1)	SC	Blue
Coastal Tailed Frog	<i>Ascaphus truei</i>	SC (Schedule 1)		Blue
<b>Birds</b>				
Surf Scoter (M)	<i>Melanitta perspicillata</i>			Blue
Ancient Murrelet (M)	<i>Synthliboramphus antiquus</i>	SC (Schedule 1)	SC	Blue
California Gull (M)	<i>Larus californicus</i>			Blue
Cassin's Auklet (M)	<i>Ptychoramphus aleuticus</i>			Blue
Common Murre (M)	<i>Uria aalge</i>			Red
Marbled Murrelet (M)	<i>Brachyramphus marmoratus</i>	T (Schedule 1)	T	Blue
Red-necked Phalarope (M)	<i>Phalaropus lobatus</i>			Blue
Tufted Puffin (M)	<i>Fratercula cirrhata</i>			Blue
Band-tailed Pigeon (M)	<i>Patagioenas fasciata</i>	SC (Schedule 1)	SC	Blue
Peregrine Falcon	<i>Falco peregrinus pealei</i>	T (Schedule 1)	SC	Blue
Northern Goshawk	<i>Accipiter gentilis laingi</i>	T (Schedule 1)	T	Red
Sooty Grouse	<i>Dendragapus fuliginosus</i>			Blue
Barn Swallow (M)	<i>Hirundo rustica</i>		T	Blue
Olive-sided Flycatcher (M)	<i>Contopus cooperi</i>	T (Schedule 1)	T	Blue
Great Blue Heron (M)	<i>Ardea herodias fannini</i>	SC (Schedule 1)	SC	Blue
Western Screech-Owl	<i>Megascops kennicottii kennicottii</i>	SC (Schedule 1)	T	Blue
Short-eared Owl	<i>Asio flammeus</i>	SC (Schedule 1)		Blue

## 8.12.8 Aquatic Resources

### 8.12.8.1 Marine Aquatic Resources

Chatham Sound is recognized by Fisheries and Oceans Canada (DFO) as an ecologically and biologically significant area (EBSA). Intertidal and subtidal habitats in this area support a diverse assemblage of marine algae, invertebrates and fish, as well as numerous species of marine mammals.

Marine intertidal and subtidal habitats in the area are characterized by rocky cliffs; rock, sand and gravel beaches; and sand flats, and support a wealth of algal and invertebrate species (BC MFLNRO 2005). Algal species including rockweed (*Fucus gardneri*), sea lettuce (*Ulva* spp.), red algae and a variety of canopy-forming and understory kelp species (e.g., *Laminaria* spp.) are likely present in the area. Eelgrass beds may also be present in the area and invertebrates such as barnacles likely inhabit the foreshore environment. Eelgrass and kelp beds provide essential feeding and rearing habitat for an array of species including juvenile salmon, Pacific herring (*Clupea pallasii*) and Dungeness crabs (*Metacarcinus magister*).

Marine waters surrounding Grassy Point are within DFO Important Areas (IAs) for tanner crab (*Cancer baerdi*), green sea urchin (*Strongylocentrotus droebachiensis*), and Pacific herring (*Clupea pallasii*). A DFO IA for shrimp is also located near Grassy Point. All five species of Pacific salmon (*Onchorhynchus* spp.) are abundant in the waters surrounding Grassy Point, especially during the migration of juvenile and adult salmon to and from the Nass and Skeena rivers. These and other fish and invertebrate species support important commercial, recreational and Aboriginal fisheries in the area.

The productive waters of Chatham Sound are also home to numerous species of marine mammals, including harbour porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), killer whale (*Orcinus orca*), grey whale (*Eschrichtius robustus*), minke whale (*Balaenoptera acutorostrata*), humpback whale (*Megaptera novaeangliae*), harbour seal (*Phoca vitulina*) and Steller sea lion (*Eumetopias jubatus*).

Table 8-12 lists key marine species that potentially occur in Chatham Sound, and indicates those that are listed as species of conservation concern by the COSEWIC or the SARA.

**Table 8-12 Key Marine Species with the Potential to Occur in Chatham Sound**

Species Type	Common Name	Scientific Name	COSEWIC Status	SARA Status
Invertebrate	Dungeness crab	<i>Metacarcinus magister</i>	Not listed	Not listed
Invertebrate	Prawn/Shrimp	<i>Pandalidae</i>	Not listed	Not listed
Invertebrate	Tanner crab	<i>Chionoecetes</i> spp.	Not listed	Not listed
Invertebrate	Sea urchin	<i>Strongylocentrotus</i> spp.	Not listed	Not listed
Invertebrate	Geoduck	<i>Panopea abrupta</i>	Not listed	Not listed
Invertebrate	Northern abalone	<i>Haliotis kamtschatkana</i>	Endangered	Schedule 1, Endangered
Invertebrate	Octopus	<i>Octopoda</i>	Not listed	Not listed
Invertebrate	Sea cucumber	<i>Holothuroidea</i>	Not listed	Not listed



Species Type	Common Name	Scientific Name	COSEWIC Status	SARA Status
Fish	Pacific salmon	<i>Oncorhynchus spp.</i>	Not listed	Not listed
Fish	Halibut	<i>Hippoglosses stenolepis</i>	Not listed	Not listed
Fish	Pacific herring	<i>Clupea pallasii</i>	Not listed	Not listed
Fish	Eulachon	<i>Thaleichthys pacificus</i>	Endangered	No Schedule, No Status
Fish	Pacific sand lance	<i>Ammodytes hexapterus</i>	Not listed	Not listed
Fish	Copper rockfish	<i>Sebastes caurinus</i>	Not listed	Not listed
Fish	Quillback rockfish	<i>Sebastes maliger</i>	Threatened	No Schedule, No Status
Fish	Yelloweye rockfish	<i>Sebastes ruberrimus</i>	Special Concern	Schedule 1, Special Concern
Fish	Canary rockfish	<i>Sebastes pinniger</i>	Threatened	No Schedule, No Status
Fish	Bocaccio	<i>Sebastes paucispinis</i>	Endangered	No Schedule, No Status
Fish	Lingcod	<i>Ophiodon elongates</i>	Not listed	Not listed
Fish	Spiny dogfish	<i>Squalus suckleyi</i>	Special Concern	No Schedule, No Status
Fish	Bluntnose sixgill shark	<i>Hexanchus griseus</i>	Special Concern	Schedule 1, Special Concern
Mammal	Harbour seal	<i>Phoca vitulina richardsi</i>	Not at Risk	Not Listed
Mammal	Steller sea lion	<i>Eumetopias jubatus</i>	Special Concern	Schedule 1, Special Concern
Mammal	Harbour porpoise	<i>Phocoena phocoena</i>	Special Concern	Schedule 1, Special Concern
Mammal	Dall's porpoise	<i>Phocoenoides dalli</i>	Not at Risk	Not Listed
Mammal	Northern Resident Killer whale	<i>Orcinus orca</i>	Threatened	Schedule 1, Threatened
Mammal	Bigg's (Transient) Killer whale	<i>Orcinus orca</i>	Threatened	Schedule 1, Threatened
Mammal	Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>	Not at Risk	Not Listed
Mammal	Minke whale	<i>Balaenoptera acutorostrata scammonii</i>	Not at Risk	Not Listed
Mammal	Gray whale	<i>Eschrichtius robustus</i>	Special Concern	Schedule 1, Special Concern
Mammal	Humpback whale	<i>Megaptera novaeangliae</i>	Not at Risk	Threatened
Mammal	Sei whale	<i>Balaenoptera borealis</i>	Endangered	Schedule 1, Endangered
Mammal	Fin whale	<i>Balaenoptera physalus</i>	Threatened	Schedule 1, Threatened
Mammal	Blue whale	<i>Balaenoptera musculus</i>	Endangered	Schedule 1, Endangered

**Sources:** Community Mapping Network 2013; Fisheries and Oceans Canada 2013; Government of Canada 2014; Williams and Thomas 2012.

### 8.12.8.2 Freshwater Aquatic Resources

As noted earlier in Section 8.11.5, several small watercourses are located within or adjacent to the proposed Grassy Point site. One larger watercourse (910-831400) flows north through the center of the site, and provides about 2,500 m of habitat upstream of the proposed footprint. Trail Bay Creek (910-835200) is situated near the Project site, and is similar in size to 910-831400.

Anadromous and resident fish species important for commercial, recreational, and/or aboriginal fisheries that could be present within the Grassy Point watercourses are listed in Table 8-13. Historical fish capture information is not available for the majority of the watercourses. The exceptions are for Trail Bay Creek, where pink salmon (*Oncorhynchus gorbuscha*), Dolly Varden (*Salvelinus malma*), and rainbow trout (*O. mykiss*) have been captured, and watercourse 910-831400, where coho salmon (*O. kisutch*), Dolly Varden, and sculpin (not identified to species) have been captured (HabitatWizard 2013).

**Table 8-13 Freshwater Fish with the Potential to Occur in Watercourses within the Grassy Point Site**

Common Name	Latin Name	Species at Risk	Supports CRA Fisheries
Coho Salmon	<i>Oncorhynchus kisutch</i>	N	Y
Pink Salmon	<i>O. gorbuscha</i>	N	Y
Chum Salmon	<i>O. keta</i>	N	Y
Cutthroat Trout	<i>O. clarki</i>	N	Y
Rainbow Trout/Steelhead	<i>O. mykiss</i>	N	Y
Dolly Varden	<i>Salvelinus malma</i>	N (Blue Listed in BC)	Y

## 8.13 Anticipated Scope of the Project and Environmental Assessment

### 8.13.1 Scope of Project

The physical works and activities to be performed in relation to the Project for construction, operations and decommissioning are collectively referred to as the Project scope. Details relating to the components and activities are discussed in Sections 7.5 to 7.7.

The major components of the Project include:

- LNG facility
  - Natural gas inlet station
  - Natural gas treatment equipment
  - LNG production facilities
  - LNG and NGL storage facilities
  - Pipe-rack corridor(s), including cryogenic rundown and vapor return pipelines between LNG production facility and marine jetty
- Marine terminal

- Marine jetty and LNG loading infrastructure
- LNG carrier berths
- Materials offloading facility
- Flare systems
- LNG carriers and other support vessels along the marine access route
- Supporting infrastructure and facilities
  - Administration and maintenance buildings, and offices
  - Water supply, storage and pipelines
  - Wastewater collection, treatment, and disposal infrastructure
  - Stormwater management system
  - Firewater systems
  - Waste management (collection, storage, and disposal)
  - Workforce accommodations
  - Storage and laydown areas
  - Heliport
  - Haul road and vehicle traffic
  - Power infrastructure
  - Power generation
  - Medical services

Key construction activities include:

- Pioneering site establishment
- Clearing vegetation
- Blasting and grading
- Removing soil and overburden
- Constructing roads within the site and marine berth
- Underwater blasting and/or dredging of marine sediments
- Pile driving
- Transporting equipment and modules to site
- Transporting workforce to and from site
- Installing utilities
- Installing infrastructure related to the facility and terminal
- Pressure testing.

Key operational activities include:

- Receiving and processing inlet gas
- LNG liquefaction
- LNG and refrigerant storage
- Loading carriers
- Carrier marine traffic
- Shipping supplies and equipment to site
- Maintenance activities
- Monitoring
- Waste generation.

Expected concurrent activities that are not within the scope of the Project but would be considered in a cumulative effects assessment include:

- Construction and operation of a third-party gas supply pipeline to deliver feed gas to the Project
- Marine traffic associated with construction of a gas supply pipeline

### **8.13.2 Scope of Environmental Assessment**

Under CEAA 2012, the Project Description must address the potential for the Project to cause changes to:

- Fish and fish habitat
- Aquatic species
- Migratory birds
- Federal and other lands
- Aboriginal peoples

The BC EAO guidelines require the Project Description to address potential environmental, economic, social, heritage, and health effects of the Project.

Based on the existing biophysical and socio-economic environments of the Grassy Point area and the requirements of BCEAA and CEAA 2012, it is anticipated that the EA will focus on the following aspects of the environment.

- Biophysical environmental effects (air quality, noise, vegetation, wildlife resources including migratory birds, marine and freshwater resources)
- Social effects
- Health effects
- Economic effects

- Heritage effects
- First Nations or other Aboriginal Group interests
- Cumulative effects
- Transboundary effects
- Federal and other lands

These are discussed in more detail in Section 8.13.

## **8.14 Potential Project Effects**

### **8.14.1 Natural Environment**

#### **8.14.1.1 Air Quality**

Key Project activities that could cause a change in air quality include those that involve emissions of criteria air contaminants (CAC). The primary substances of concern include gaseous compounds (SO<sub>2</sub>, NO<sub>x</sub>, CO), particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>), and GHGs. Anticipated sources of air emissions include:

- Construction: land clearing, blasting, grading, hauling, material handling, fuel combustion, power generation
- Operations: vehicle traffic, power generation, fuel combustion, LNG vessels and other marine support vessels, and fugitive emissions from the LNG facility
- Decommissioning: fuel combustion, removal of infrastructure, backfilling and contouring

#### **8.14.1.2 Climate (GHG Management)**

The Project will result in the emission of greenhouse gases, including CO<sub>2</sub> and methane, which will contribute to global climate change. GHG emissions of concern will be related primarily to the operational phase, although some emissions are also expected to occur during site preparation (i.e., clearing of vegetation to accommodate the facility footprint) and construction.

#### **8.14.1.3 Acoustic Environment**

The Project has the potential to affect the acoustic environment of the surrounding area as a result of noise emissions generated by equipment and vehicles during site preparation and onshore construction activities, and operation of the LNG facility and marine terminal. In-water activities such as construction of the trestle and marine terminal, dredging and operation of marine vessels could also generate underwater noise, which could adversely affect the marine acoustic environment. Increased noise levels could result in human health effects (annoyance, sleep disturbance) and/or wildlife effects (displacement and disturbance).

#### **8.14.1.4 Vegetation and Wetland Resources**

The Project has the potential to cause changes in vegetation and wetland resources due to a direct loss of these resources from vegetation clearing and surface disturbance, as well as air emissions and dust deposition. Site clearing and preparation will remove vegetation from the footprint and may affect surrounding vegetation indirectly through changes in environmental conditions.

The potential direct and indirect effects on vegetation and wetland resources could include:

- Change in abundance of plant species of interest, including at-risk species, species of cultural significance, and invasive species
- Change in abundance or condition of ecological communities, including those of conservation interest (e.g., old forest and provincially at-risk)
- Change in wetland function (this may be subject to the “no net loss of wetland functions” of the Federal Policy on Wetland Conservation (Government of Canada 1991)).

#### **8.14.1.5 Wildlife Resources**

Construction and operation of the facility has the potential to affect terrestrial wildlife and marine birds, including migratory birds as defined in the *Migratory Birds Convention Act, 1994*. The key potential effects on wildlife resources include:

- Change in habitat: loss or alteration of terrestrial habitat directly due to vegetation clearing during site preparation and indirectly due to sensory disturbance during construction and operation, and atmospheric noise and lighting
- Change in movement: alteration of movement patterns during construction and operation, including displacement of marine birds, due to noise, human activity and vessel activity
- Change in mortality risk: alteration of mortality risk during construction and operation of the facility, including risk of collisions for marine birds.

#### **8.14.1.6 Marine Aquatic Resources**

The *Fisheries Act*, the *Species at Risk Act*, and supporting regulations and policies define the marine species that need to be considered during a federal environmental assessment. This includes fish, fish habitat and aquatic species, as defined by the *Fisheries Act*.

Certain Project-related activities such as construction of the marine terminal infrastructure, dredging and disposal at sea, wastewater discharges, and LNG vessel operations could adversely affect marine fish and fish habitat, including marine mammals and marine plants. The key potential effects on marine resources include:

- Permanent alteration or destruction of marine fish habitat (i.e., marine riparian habitat, intertidal habitat, and/or subtidal habitat, includes marine plants) during construction as a result of dredging, pile driving, and disposal of dredgeate

- Injury or mortality of marine fish, invertebrates and/or marine mammals due to underwater noise created by in-water construction activities
- Injury or mortality of marine mammals due to marine vessel strikes
- Change in marine sediment or water quality due to increased turbidity, resuspension of existing contaminants during in-water construction, and operations (i.e., stormwater/wastewater discharge)
- Behavioural disturbance to marine fish and marine mammals due to underwater noise generated by construction and operation-related activities.

#### **8.14.1.7 Freshwater Resources**

The Project has the potential to cause changes in freshwater fish and fish habitat. Key potential effects include:

- Permanent alteration or loss of fish habitat from clearing of riparian forest, and construction of the LNG facility, haul road, marine terminal, material offloading ramp, and temporary construction infrastructure and facilities
- Reduced habitat quality due to changes in surface water quality and sediment quality from sediment releases and introduction of nutrients and metals from blasting (potential effect dependent upon site geology).

### **8.14.2 Social Environment**

#### **8.14.2.1 Infrastructure and Services**

The in-migration of workers, their spouses and dependents as well as an increase in the number of transient workers during construction and operation of the Project has the potential to increase local and regional populations and alter demographics. Changes in population and demographics could, in turn, increase demand on community infrastructure and services (e.g., utilities, transportation, education, emergency services, and social and recreational services) and cause a change in housing availability in the City of Prince Rupert, the District of Port Edward, and nearby First Nations communities.

#### **8.14.2.2 Land and Marine Use**

Construction and operation of the LNG facility and marine terminal could affect other tenured and non-tenured land and resources uses, including forestry, trapping, guide outfitting, and recreation activities, currently occurring on or near the proposed Project footprint. Fishing and marine harvesting are important activities in the SQRD, and it is possible that the marine terminal, exclusion zones, and vessel traffic could affect marine navigation in waters used for commercial, recreational, and subsistence fishing and other marine uses.

### **8.14.3 Economic Environment**

The Project will create approximately 4,000 to 5,000 short-term jobs during the five-year construction period, and an estimated 400 long-term jobs during Project operations. Substantial indirect investments into the community will also occur in the form of additional goods and services required by the Project itself and employees drawn to the area. Potential adverse effects to the local and regional economies are also expected to occur as a result of competition for limited labour supply and changes in the economic activity of other sectors (i.e., cost of living, availability of goods and services).

### **8.14.4 Human Health**

The Project has the potential to interact with human health through various pathways. Emissions of contaminants from facility construction and operation, and from vessels berthed at the facility could degrade ambient air quality, resulting in inhalation health risks. The primary air contaminants of interest are SO<sub>2</sub>, NO<sub>2</sub>, CO, respirable particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and H<sub>2</sub>S. Human health could also be affected by emissions to both the terrestrial and marine environments, as well as noise emissions, which could lead to elevated stress and annoyance levels.

The potential presence of historic contaminants in marine sediments and soils may pose a risk to human health if contaminants are re-introduced to the environment during Project construction activities. These contaminants could be taken up by terrestrial or marine biota, and subsequently ingested by humans through consumption of traditional foods.

### **8.14.5 Heritage Environment**

Potential effects on heritage and archaeological resources, if they are present, are likely to occur as a result of site preparation activities during Project construction. In particular, the clearing of vegetation and any excavation works that disturb native sediments have the potential to disturb archaeological and heritage resources. It is anticipated that any adverse effects on heritage resources will be mitigated through data recovery or other standard acceptable approaches to mitigation.

Operational activities could also cause damage to archaeological and heritage sites even if they have been mitigated by data recovery. For example, a large lithic site may be sample excavated and monitored during construction, but individual artifacts could be exposed by vehicle traffic, pipeline monitoring or accessing service sites.

### **8.14.6 Cumulative Effects and Transboundary Effects**

The scope of the environmental assessment will consider the potential for direct and indirect effects of the Project on the biophysical and human environments, as well as potential cumulative effects, and trans-boundary effects. The cumulative effect assessment will include:

- Past projects (e.g., Canpotex, Fairview Terminals 2)



- Current and future marine terminal infrastructure and industrial facilities in Prince Rupert and Port Edward
- Development of other proposed LNG projects in the area (e.g., Pacific Northwest LNG, Prince Rupert LNG, Woodside, LNG Canada, Kitimat LNG)
- Development of gas pipelines associated with the Project and other proposed LNG projects
- Marine traffic associated with current and reasonably foreseeable projects and activities between Triple Island and the Port of Prince Rupert

#### **8.14.7 Aboriginal Communities**

The Project could affect traditional land and marine-based activities of Aboriginal people such as hunting, fishing, gathering, and tree harvesting as a result of changes in land use, restricted access and increased marine traffic. Examples of marine resources traditionally used by Aboriginal people of the area include: seaweed, halibut, salmon, eulachon, shellfish, fish roe, seal, sea lions, and sea otter. Terrestrial resources include: tree bark, planks, berries, bird eggs, deer, elk, bear, and other animals.

Traditional activities of Aboriginal people could also be affected indirectly as a result of potential changes to the biophysical environment, including effects on freshwater and marine fish, fish habitat and aquatic species, vegetation resources and wildlife resources, including marine birds, which could affect harvesting patterns and/or harvesting success.

Aurora LNG anticipates that the Project could also adversely affect Aboriginal people through human health effects, social and cultural effects and effects on heritage resources. The following is a list of potential adverse effects that may be included in the assessment. The list will be refined based on the results of on-going discussions with First Nations.

- Human health effects
- Degradation of air quality as a result of air emissions generated by construction equipment and activities (e.g., blasting) and operation of the LNG facility and marine vessels
- Sensory disturbance due to noise exposure during construction and operation activities
- Social effects
- Sensory disturbances that affect traditional lifestyle values
- Heritage effects
- Damage or destruction of archaeological or heritage sites from site preparation and ground disturbances
- Cultural effects
- Changes in spiritually or culturally important areas
- Changes in traditional use areas

Through ongoing consultation activities with the five Nations, including providing support and opportunities to undertake traditional use studies, the incorporation of traditional ecological information (when available), Aurora LNG will continue to advance its understanding of Aboriginal interests in the Project area, and how the Project could adversely affect these interests taking into account proposed mitigation measures.

#### **8.14.8 Federal Land and Other Lands**

Most land-based environmental effects are anticipated to be localized to the Project area within provincial Crown lands. Marine-based environmental effects are expected to occur in waters outside of PRPA jurisdiction. Environmental effects are not anticipated to occur on federal lands, or in a province other than BC. Due to the proximity of the Project site to the US border (15 km), there is potential that trans-boundary air quality effects could occur.

## **PART C - DIGBY ISLAND SITE OPTION**

## **9 DIGBY ISLAND**

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### **9.1 Site Location**

Digby Island is on the northwest coast of BC, approximately 700 km north of Vancouver. The potential Project site is located on the southeast corner of Digby Island, approximately 3 km southwest of Prince Rupert, and 50 km south southeast of the US border (Figure 9-1). Digby Island is situated within the Skeena-Queen Charlotte Regional District (SQCRD) and the North Coast Forest District.

The LNG facility will be located on approximately 200-400 ha of provincial Crown land. Coordinates for the approximate centre of the site are:

- Latitude/Longitude - 54°16'5"N/130°22'58"W
- Universal Transverse Mercator – Zone 9 East 409945.6 North 6014228.5

The marine terminal will be located at the south end of Digby Island on a water lot within the jurisdiction and administration of the PRPA. It is expected that the lot would be leased from the PRPA under a site lease agreement with Aurora LNG.

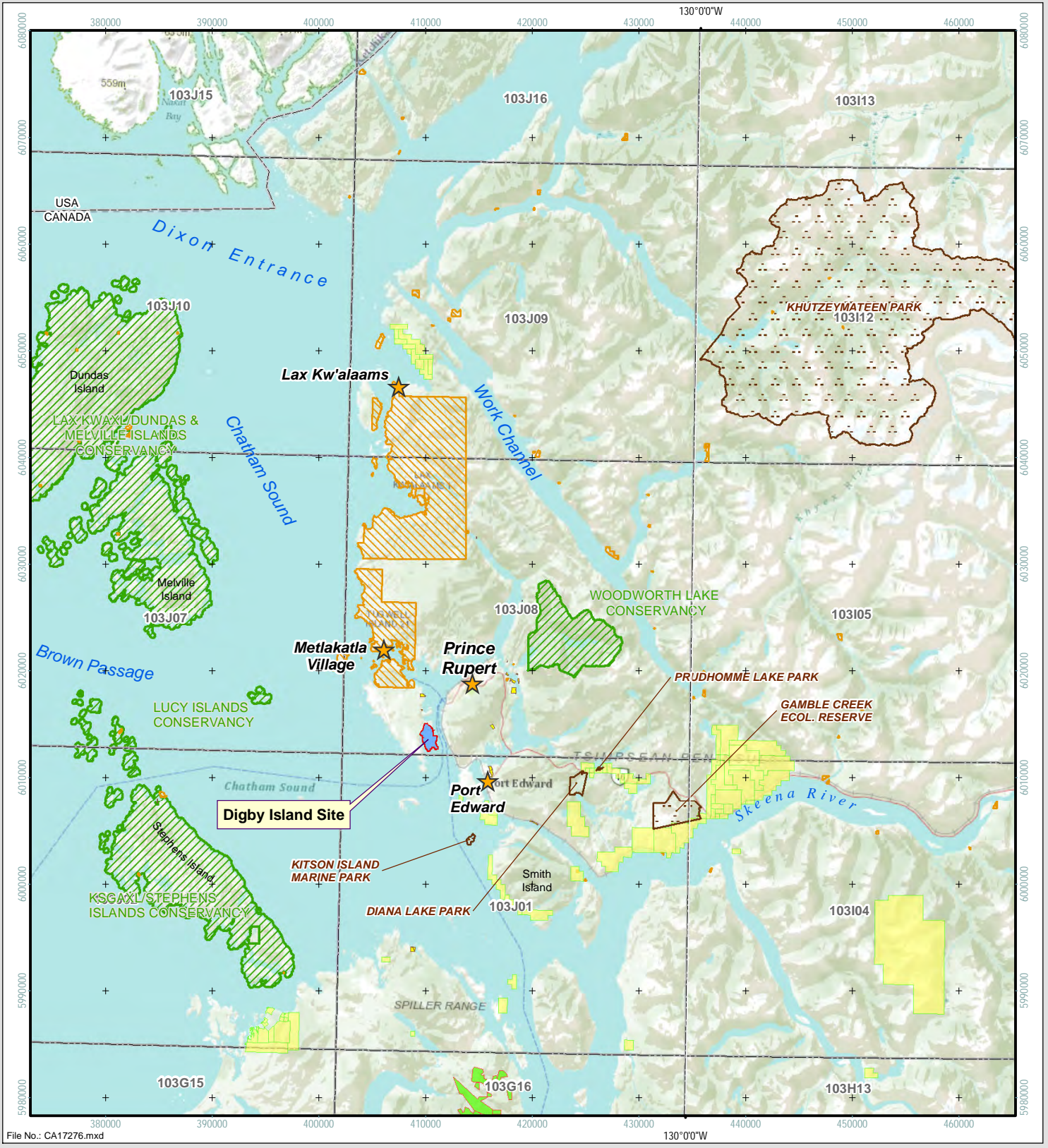
The nearest federal land to the proposed Project site is a First Nation Reserve that belongs to the Metlakatla First Nation (S 1/2 TSIMPSEAN 2) which is approximately 5 km away on the northeastern part of Digby Island.

### **9.2 Land Ownership and Zoning**

Digby Island is a small island with two small communities of Dodge Cove and Crippen Cove. These communities are located on small lots of private lands on the east side of the island approximately 2 km and 6 km from the Project site, respectively. The northeastern portion of the island is a First Nations Reserve belonging to the Metlakatla (S 1/2 Tsimpsean 2), which is located about 5 km from the Project site (Figure 9-2). Other nearby First Nations reserves include Wilnaskancaud 3, Shoowahtlans 4, Tugwell Island 21, which are located approximately 10 km from the proposed site. The nearest identified permanent, temporary or seasonal residence is located approximately 0.4 km north to the proposed project site.

The northwestern portion of Digby Island contains the Prince Rupert Airport, which is on lands owned by the City of Prince Rupert through the incorporation of the Prince Rupert Airport Authority. An Order-in-Council reserve extends east to west, connecting the airport to east edge of the island.

There is a CBC repeater station on CBC Hill near Dodge Cove, and several submerged BC hydro-lines near Dodge Cove that connect Digby Island to Kaien Island. A notation of interest exists immediately west of Dodge Cove that extends linearly northwards. The remainder of the island is designated as a map reserve. The proposed Project site is situated within this map reserve.



File No.: CA17276.mxd

**Legend**

- Aurora LNG - Digby Island
- Protected Areas
- First Nations Reserve
- Mineral & Placer Tenure
- Woodlot Licence
- Conservation Areas
- Urban Centre

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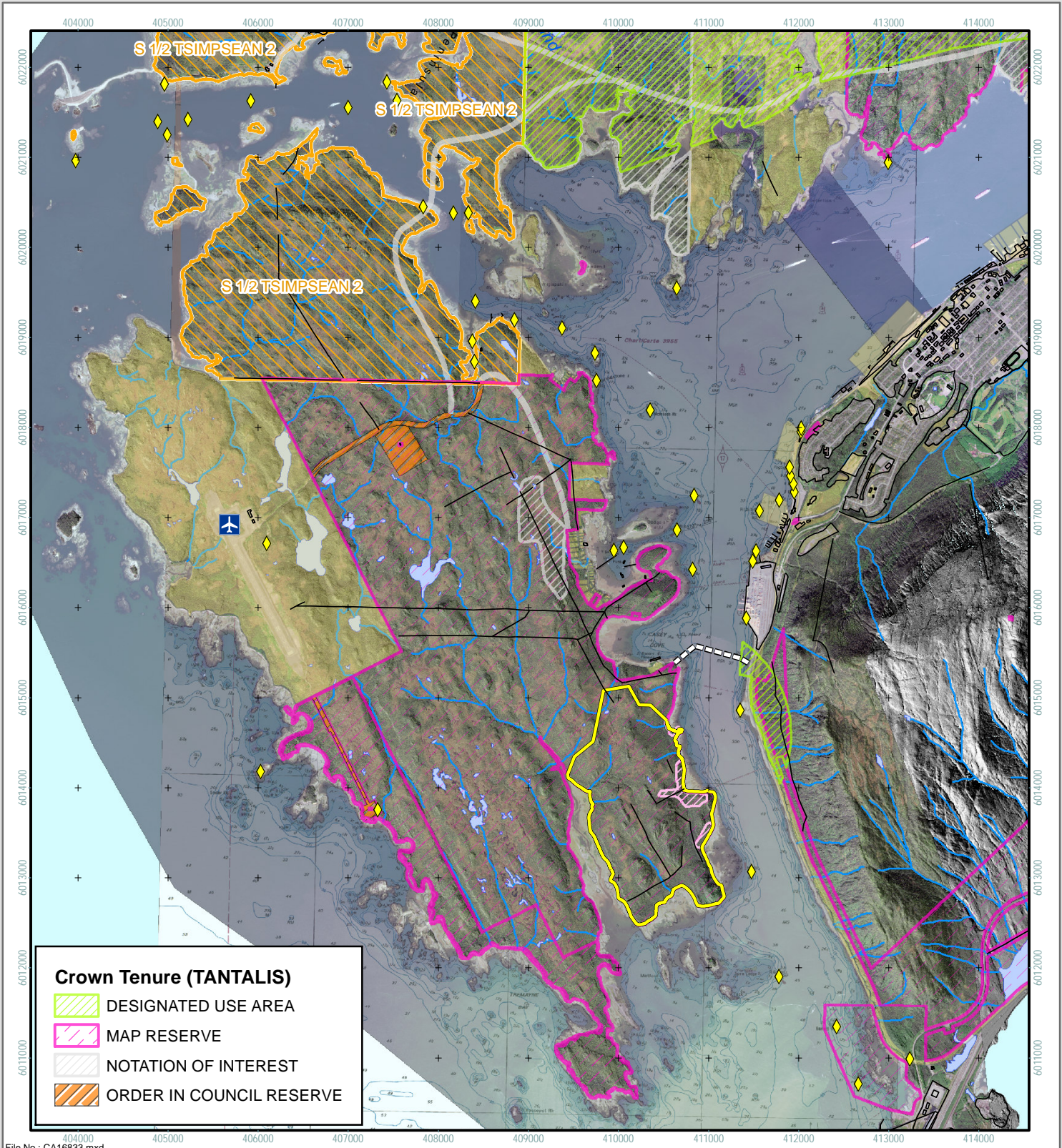
**AURORA LNG**

nexen INPEX

**PROPOSED PROJECT LOCATION  
DIGBY ISLAND SITE**

Date: June 6, 2014

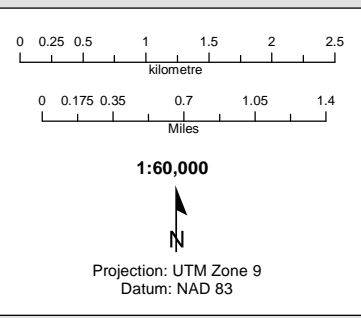
FIGURE 9 - 1



**Legend**

- Digby Island Site
- Archeological Area
- First Nations
- Submerged BC Hydro Lines
- Prince Rupert Airport
- Road & Cutline
- Private Land
- Lake
- River / Stream
- Navigational Aids

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A CHESBROUGH COMPANY

**LAND USE ZONING OF DIGBY ISLAND**

Date: June 6, 2014

FIGURE 9 - 2

A description of the lands proposed for the LNG facility site and marine terminal is provided in Table 9-1 and Figure 9-3. The PRPA zoning does not extend to Digby Island. Discussion with the PRPA indicates that there are no registered water lots within the project area. There are no Crown tenures or permits in the proximity to the Digby Island site. The only federal Crown lands within the proximity of the site are marine areas administered by the PRPA.

The Kitson Island Marine Park and Diana Lake Park are located approximately 10 km and 14 km from the proposed site, respectively. The Woodwork Lake Conservancy is about 11 km to the northeast of the site.

**Table 9-1 Lands Description for the Digby Island Project Site**

LNG Facility	Marine Terminal	Material Offloading Area
PIN_SID: 2586370 District Lot 1993 Range 5 Coast District	PIN_SID: 2586370 District Lot 1993 Range 5 Coast District	PIN_SID: 2586370 District Lot 1993 Range 5 Coast District
PIN_SID: 1685201 District Lot 1993 Range 5 Coast District except assigned LOT A, Plan 1620, Assigned LOT B, LOT C, Plan 954	PIN_SID: 1685201 District Lot 1993 Range 5 Coast District except assigned LOT A, Plan 1620, Assigned LOT B, LOT C, Plan 954	PIN_SID: 1685201 District Lot 1993 Range 5 Coast District except assigned LOT A, Plan 1620, Assigned LOT B, LOT C, Plan 954
PIN_SID: 1686821 Block E District Lot 1993 Range 5 Coast District		

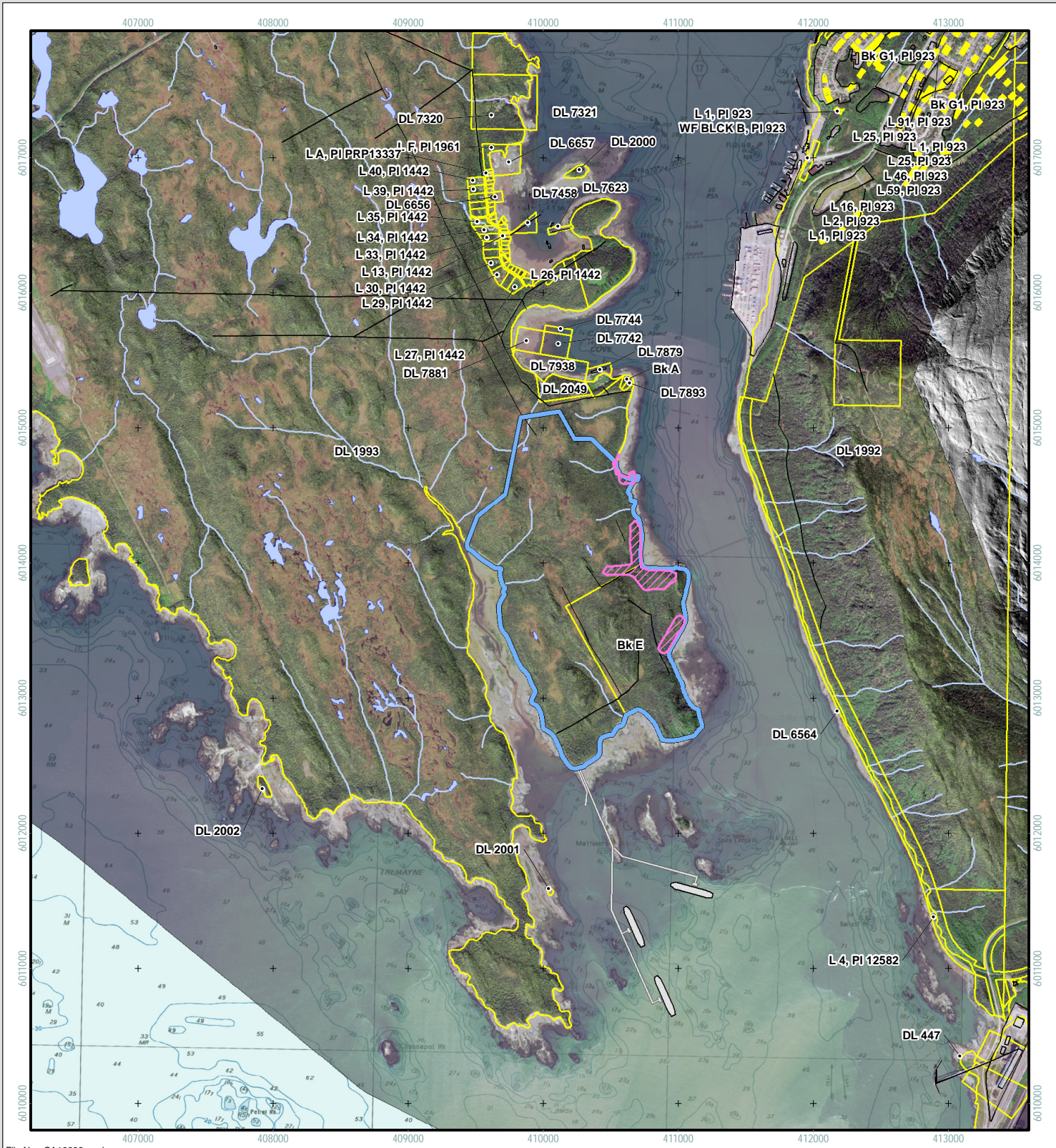
### 9.3 Land Use

The Digby Island site is within the Skeena Block of the North Coast Timber Supply Area. Trapline (TR0614T029) overlaps with the proposed Project site, but no other tenured land uses have been identified in the area. The coast line along the south end of Digby Island is included within the provincial Recreation Features Inventory.

### 9.4 Marine Use

The marine channel between Digby Island and Kaien Island is the main navigable entrance to the Prince Rupert Harbour. This channel experiences significant volumes of commercial marine traffic, as well as ferry traffic. The Prince Rupert Port Authority governs these waters, and Transport Canada has installed several navigational aids between the islands. In 2008, there were 281 vessels calling at the Port of Prince Rupert. With expansion of the Fairview Terminal and Ridley Island Inc. terminal, and the Canpotex facility, the number of vessels is expected to increase by 864 vessels per year by 2018.

Commercial shrimp trawl and prawn trap fisheries occur in waters surrounding the Digby Island site, and a prawn (trawl) fishery occur in waters to the south and west. A commercial salmon gillnet and seine fishery also occurs off the south end of Digby Island. A First Nations Food fishery occurs in waters immediately offshore, to the east, west and south of the Project site.



File No.: CA16832.mxd

**Legend**

- Digby Island IUP
- District Lots
- Archeological Area
- Marine Terminal
- Lake
- River / Stream
- Road & Cutline

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Projection: UTM Zone 9  
Datum: NAD 83

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A CHIEF ENERGY COMPANY

**DISTRICT LOTS  
DIGBY ISLAND SITE**

Date: June 6, 2014      FIGURE 9 - 3



## 9.5 Project Access

The southeast portion of Digby Island is relatively undeveloped and access to site is currently limited to helicopter and boat from Prince Rupert. The island is served by the Prince Rupert Airport and daily bus and ferry transportation (Figure 9-4). The airport is located approximately 3.5 km from the Project site and 9 km west of Prince Rupert, and currently handles general and commercial aviation aircraft. The airstrip is long enough to accommodate Boeing 737 aircraft. The airport is serviced by two air carriers, which provide direct connections between Prince Rupert area and Vancouver, Sandspit and Masset.

Prince Rupert is the transportation hub of the north coast with major air, road, rail and marine access (Table 9-2). It is the terminus of the Canadian National Railways system and the transcontinental Highway 16. It also has ferry service provided by BC Ferries, which operate ferry routes from Port Hardy and Ketchikan Alaska from May through October.

**Table 9-2 Access to Prince Rupert**

Travel Type	Description	Duration (hours)	Distance (km)
Air	Prince Rupert Airport on Digby Island from Vancouver Airport	2	750
Land	Prince Rupert from Terrace via Yellowhead Highway (16)	2	145
Marine Vessel	Prince Rupert from Port Hardy via BC Ferries	15	430
	Prince Rupert from Ketchikan Alaska via Alaska Marine Ferries	8	200

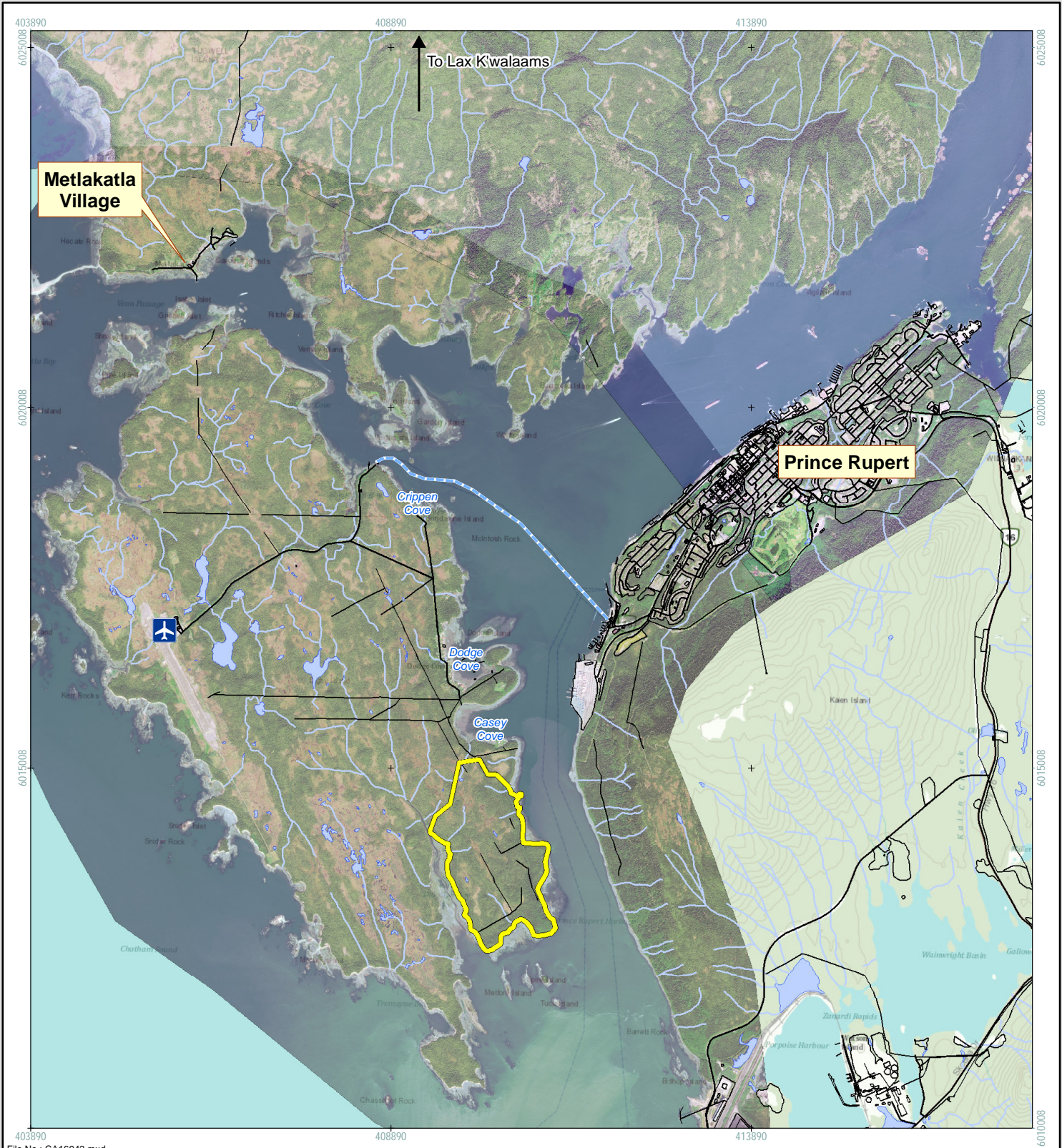
During the construction and operation phases, access to the Digby Island site will be by air and marine vessels. The marine access route for LNG carriers will start near the Triple Island Pilotage station where a BC marine pilot from the Pacific Pilotage Authority will board the vessel, and continue east along Hecate Strait. The vessel will turn southeast and circle the south end of Digby Island to reach the Project site (Figure 9-5).

## 9.6 Past and Current Environmental Studies in the Region

Two relevant environmental assessments have been conducted for projects in close proximity to Digby Island: the 2012 Canpotex Potash Terminal Project on Ridley Island, and the 2013 Fairview Terminal Phase II Expansion Project. In addition, there are two other LNG-related projects within the Prince Rupert region that are currently within the environmental assessment and review process:

- Prince Rupert LNG (BG Group and Spectra Energy Natural Gas)
- Pacific Northwest LNG (PETRONAS & Progress)

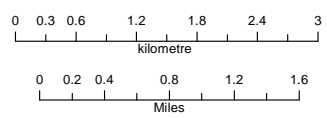
Existing publicly available information for these projects, in addition to available scientific literature and grey literature (technical reports, government reports) will be reviewed for this Project. Project-specific baseline studies will also be conducted to support the environmental, socio-economic and health assessments for the Project.



File No.: CA16942.mxd

- Legend**
- Digby Island Site
  - Prince Rupert Airport - Digby Island
  - Lake
  - River / Stream
  - Ferry Route
  - Road & Cutline

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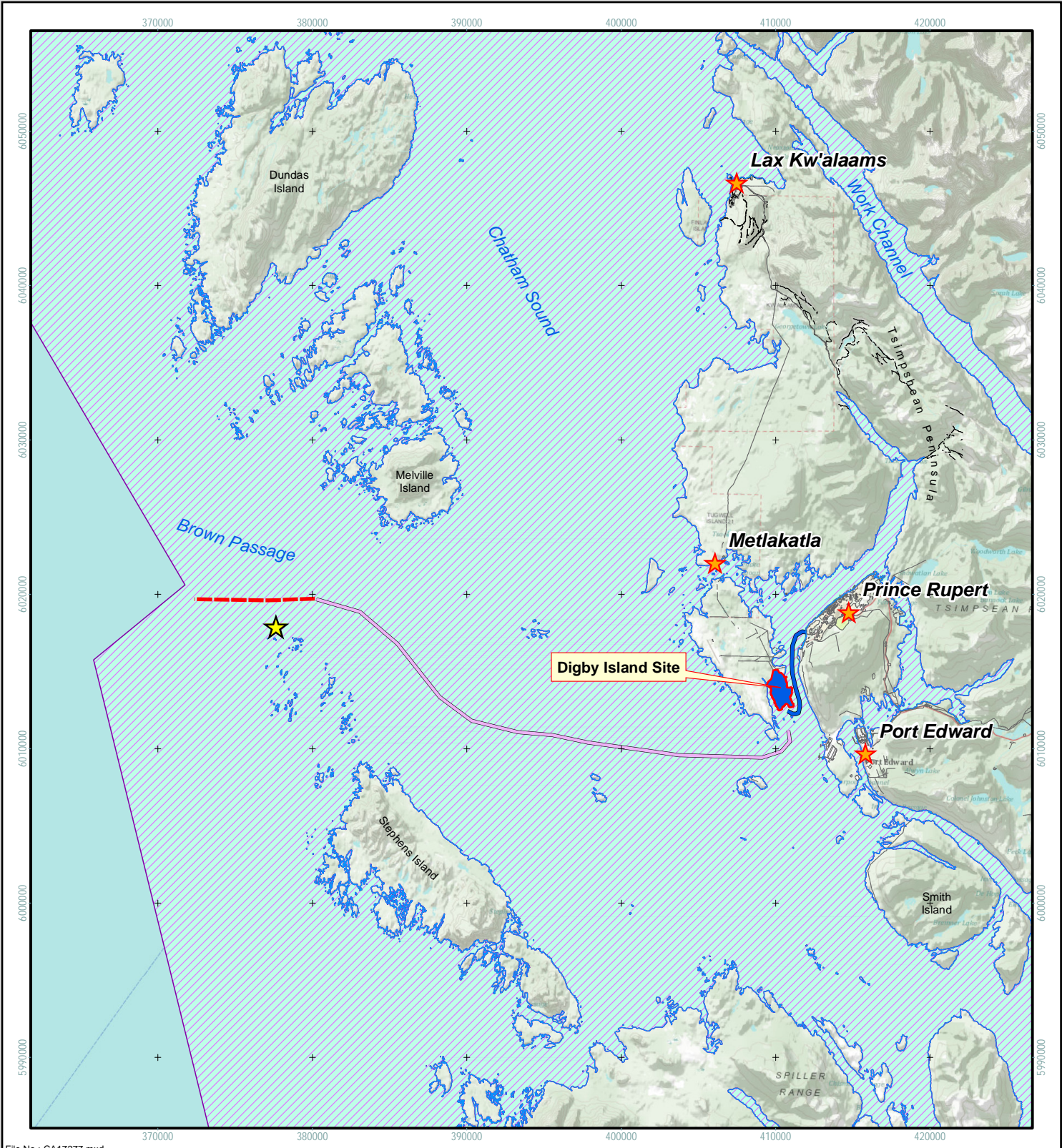
# AURORA LNG



## ACCESS TO DIGBY ISLAND SITE

Date: March 20, 2014

FIGURE 9 - 4

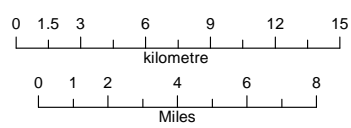


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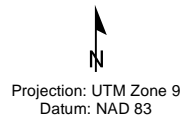
**Legend**

- Aurora LNG Area - Digby Island
- ★ Urban Centre
- ★ Triple Islands Pilot Station
- ⊕ Compulsory Pilotage Areas
- Road & Outline
- Approach Route (Conceptual)**
- - - Pilot Boarding Zone
- Digby Island Route
- Digby Island Water Supply Route

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**AURORA LNG**



**MARINE ACCESS ROUTES  
DIGBY ISLAND SITE**

Date: March 3, 2014

FIGURE 9 - 5

## 9.7 Project Components

The general characteristics of the Project components are consistent with existing LNG production facilities and include the LNG facility, marine terminal, supporting infrastructure, and temporary infrastructure. The core components associated with each are identified in Table 9-3.

**Table 9-3 Key Components of the Project**

Infrastructure	Project Components
LNG Facility	Feed gas receiving equipment Natural gas treatment equipment to remove impurities (CO <sub>2</sub> , H <sub>2</sub> S, mercury and natural gas liquids(NGLs)) from feed gas Storage tanks and infrastructure for staging and loading of NGLs Liquefaction refrigerant storage Four 5 mtpa - 6 mtpa liquefaction trains with gas turbine driven compressors Up to three 180,000 m <sup>3</sup> LNG storage tanks Flare system Continuously manned control room
Marine Terminal	A conventional trestle Loading and offloading arms and associated infrastructure Up to three LNG carrier berths Cryogenic rundown and vapour return pipelines between the LNG facility and marine terminal Possible loading of NGL
Supporting Infrastructure	Water supply pipeline from MOF to LNG facility Wastewater treatment systems Nitrogen and compressed air equipment Fuel storage Administration and maintenance buildings Materials offloading facility (MOF) Power infrastructure for the LNG facility and marine terminal Fire water system Demineralization water system Process heat system Solid waste collection and disposal Wastewater collection and treatment Facility stormwater management system Facility and maritime security Medical centre and fire station Heliport for medevac Camp for operational staff and maintenance turnaround personnel Haul road
Construction-related Infrastructure and Facilities	Construction camps Additional temporary laydown areas Construction offices

The conceptual layout of the Project components is illustrated in Figure 9-6. The trains and flare will be located on the west side of the site. The interior will hold the laydown area and camp. Three tanks will be positioned on the south end, near the marine terminal. The exact location of the tanks will depend on final site selection for the marine terminal. The trestle will extend southwards from the island, and will support up to three berths. Aurora LNG is currently evaluating three alternate berthing locations (Figure 9-7). At present, Option C is the preferred location. Final site selection will be made once further site evaluations and assessments are completed. Design of the selected option will be based on providing up to three LNG carrier berths.

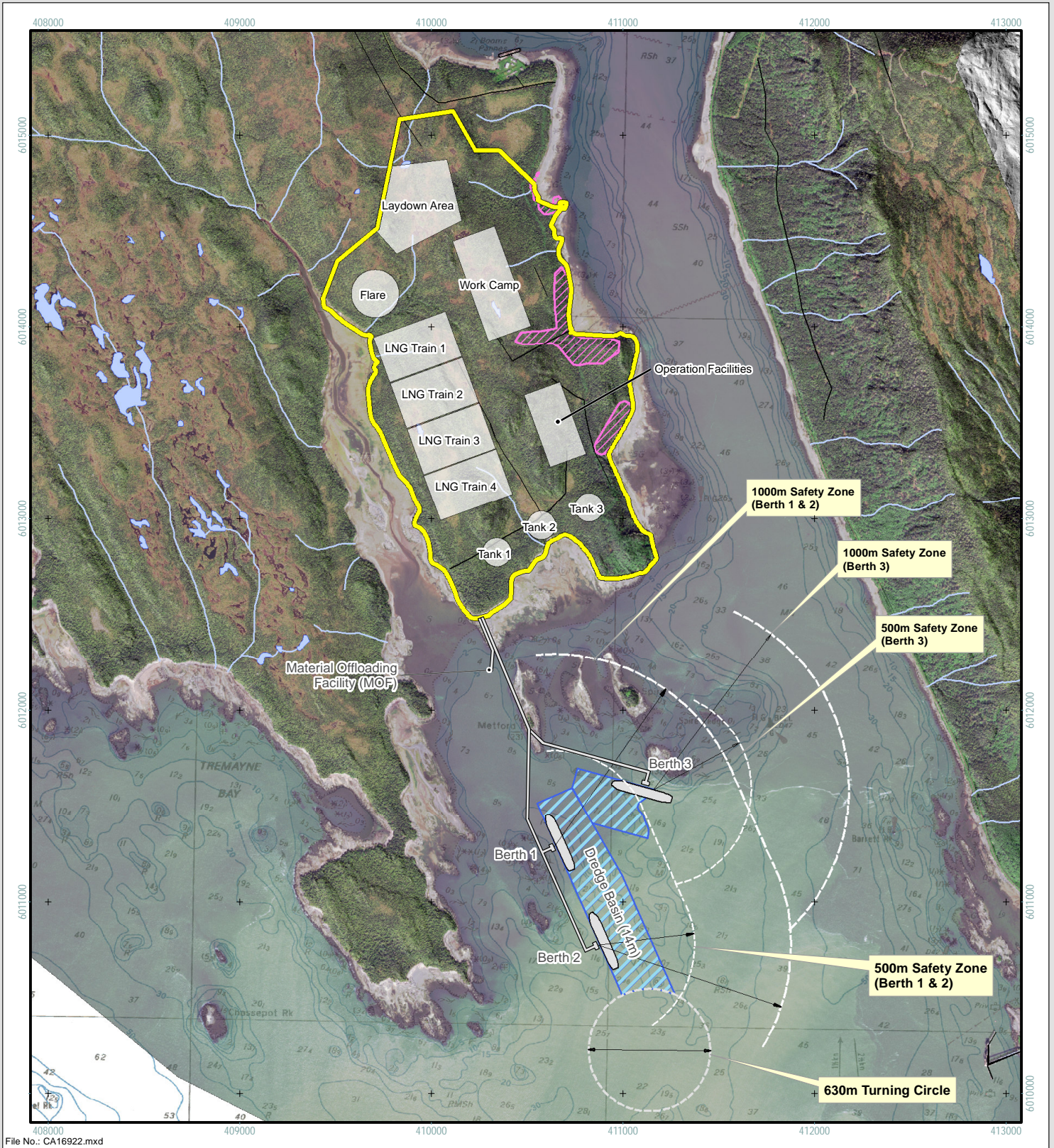
Figure 9-8 provides a block flow diagram for Phase 1 of the LNG facility. The diagram shows two parallel trains with common facilities and utilities, NGL storage, and LNG storage and loading. The common facilities will include the fire water system, the pressure relief and liquid disposal unit, and the 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.

### **9.7.1 LNG Facility**

It is anticipated that the LNG facility will comprise a 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.

The facility will be built in phases, with two LNG trains constructed during the first phase each with a processing capacity of between 5 and 6 mtpa. An additional two LNG trains will be constructed as required by market conditions. The exact phasing and optimization of the trains' size will be established during early pre-front end engineering and design (Pre-FEED).

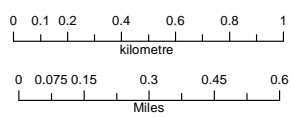
The pre-treatment, processing and LNG production facilities and processes are described below.



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Legend	
Digby Island Site	Road & Cutline
Marine Terminal & LNG Vessel	Lake
Archeological Area	River / Stream
Conceptual LNG Layout	
Conceptual Dredge Basin	

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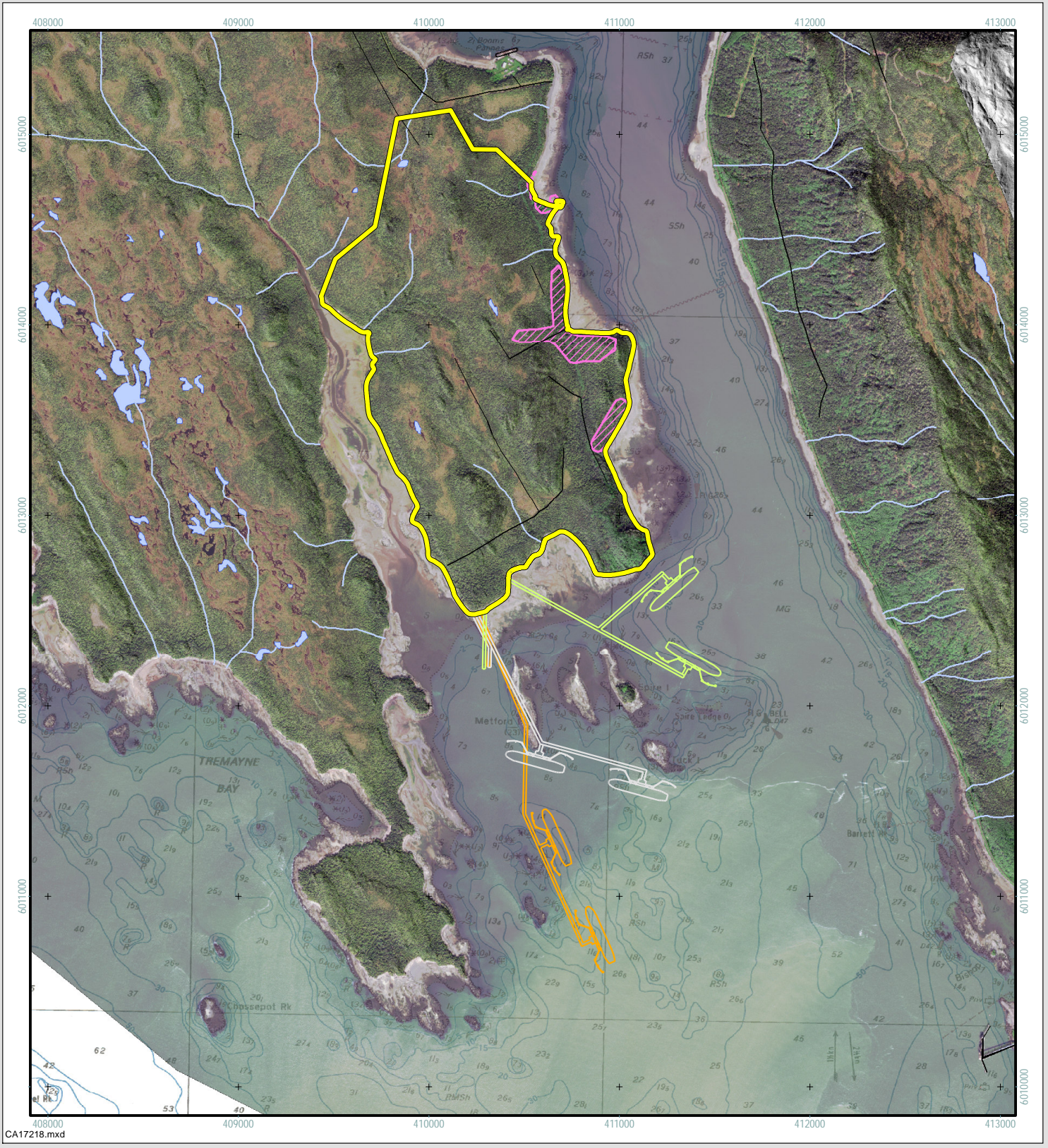
# AURORA LNG



## CONCEPTUAL LNG LAYOUT DIGBY ISLAND SITE

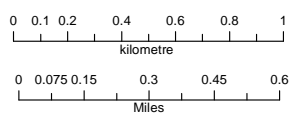
Date: June 6, 2014

FIGURE 9 - 6



Legend	
	Digby Island Site
	Archeological Area
	Road & Cutline
	Lake
	River / Stream
<b>Marine Terminal Options (Conceptual)</b>	
	Marine Terminal Option A
	Marine Terminal Option B
	Marine Terminal Option C

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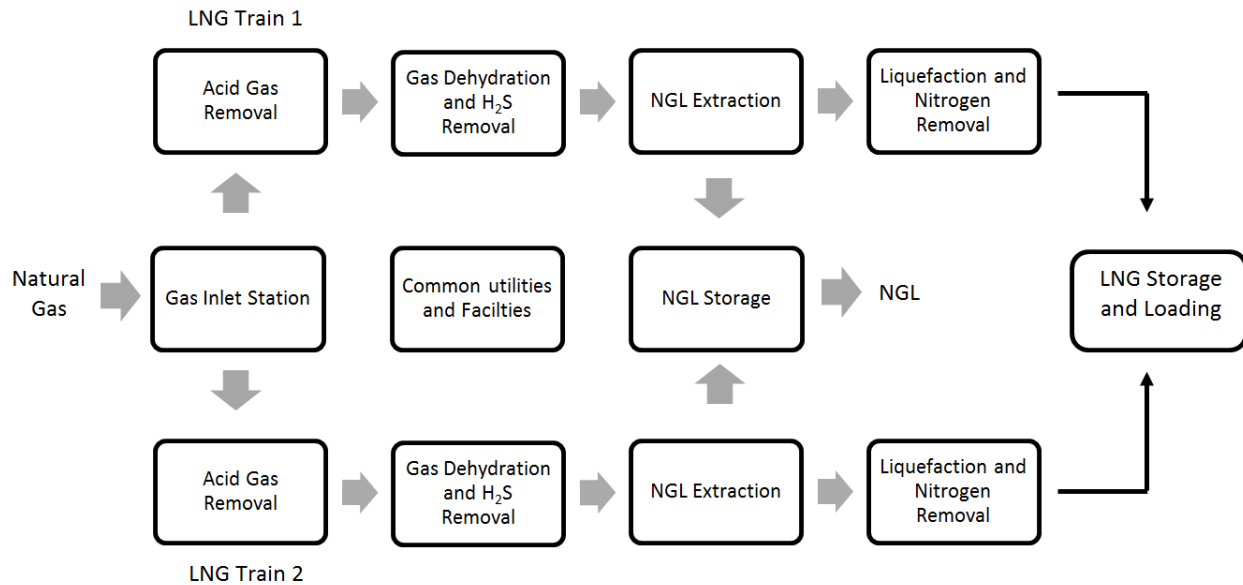
# AURORA LNG



## SITING OPTIONS FOR THE LNG CARRIER BERTHS AT THE MARINE TERMINAL, DIGBY ISLAND SITE

Date: March 20, 2014

FIGURE 9 - 7



**Figure 9-8 Block Scheme for the LNG Facility, Phase 1**

### 9.7.1.1 Natural Gas Supply

Supply of natural gas for the Project will be sourced primarily from the Horn River and the Liard and Cordova basins of WCSB through a combination of proprietary natural gas holdings in northeast BC and third-party gas, which may include, but not limited to, purchases at market hubs, gas supply arrangements and upstream joint ventures. Natural gas will be delivered to the Project via a third party-owned pipeline(s), which is yet to be determined.

It is expected that there will be some variability in the composition of the feed gas as it will be sourced from multiple areas of the Horn River and the Liard and Cordova basins.

### 9.7.1.2 Natural Gas Reception System

The natural gas supply pipeline will enter the property boundary via a dedicated pipeline delivery station.

### 9.7.1.3 Natural Gas Pre-treatment Process

The natural 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. Any mercury in the feed gas will be removed to prevent corrosion of the cryogenic equipment. Trace amounts of carbon dioxide (CO<sub>2</sub>) and hydrogen sulphide (H<sub>2</sub>S) will then be removed. The feed gas will then undergo dehydration to remove water to prevent freezing during the liquefaction process.



Components of the gas treatment infrastructure will include:

- **Mercury Removal Unit**—Any minute amount of mercury present in the gas stream can cause corrosion and damage in the liquefaction unit. The mercury will be removed using a 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.
- **Acid Gas Removal Unit**—The acid gas removal unit (AGRU) will remove carbon dioxide (CO<sub>2</sub>) and hydrogen sulfide (H<sub>2</sub>S) (collectively referred to as acid gas) using an activated amine solvent. This treatment process is widely used in natural gas processing plants and LNG facilities. The treated gas will then be routed to the dehydration unit, and acid gases will be stripped from the solvent. Depending on H<sub>2</sub>S and CO<sub>2</sub> levels in the feed gas, the acid gases may be sent to a thermal oxidizer where H<sub>2</sub>S is oxidized to sulphur dioxide (SO<sub>2</sub>) and the residue hydrocarbon incinerated.
- **Gas Dehydration Unit**—The dehydration unit will remove water from the gas stream using a combination of refrigeration and molecular sieve to prevent ice (hydrates) from forming in the downstream liquefaction unit. Condensed wastewater from the sieve will be recovered back to the AGRU. Oily water discharge from the AGRU and dehydration system will be sent to the NGL unit.
- **NGL Extraction Unit**—The NGL extraction unit will cool the inlet gas stream, allowing for the condensation and recovery of NGLs prior to the liquefaction process. The NGLs will be stabilized in a debutanizer where the light ends will be removed and re-injected in the LNG or used as fuel. The NGL will be sent to onsite NGL storage tanks. Aurora LNG is considering the options of using the NGL for power generation or transporting the NGL to the railhead in Prince Rupert for transfer to markets. These options will be studied further in the Pre-FEED.

#### **9.7.1.4 Natural Gas Liquefaction Process**

Gas leaving the NGL extraction 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. A compressor will be located between the NGL extraction unit and the liquefaction unit to compress the gas into the optimal liquefaction pressure (6,000–7,000 kPaa) as the outlet pressure of the NGL recovery unit will be too low to allow for efficient liquefaction and sizing of the main refrigerant heat exchanger.

There are currently three main liquefaction processes being investigated for use at the Project: the Air Product and Chemicals Inc. (APCI) propane pre-cooled mixed refrigerant (C3MR) process, ConocoPhillips Optimized Cascade and Shell Dual Mixed Refrigerant (DMR) liquefaction process (Figure 9-9, Figure 9-10 and Figure 9-11). Both the C3MR and Optimized Cascade processes are well-proven technologies that are efficient in cold climates.

Each LNG train will have a heat transfer system with large banks of air-cooled heat exchangers.

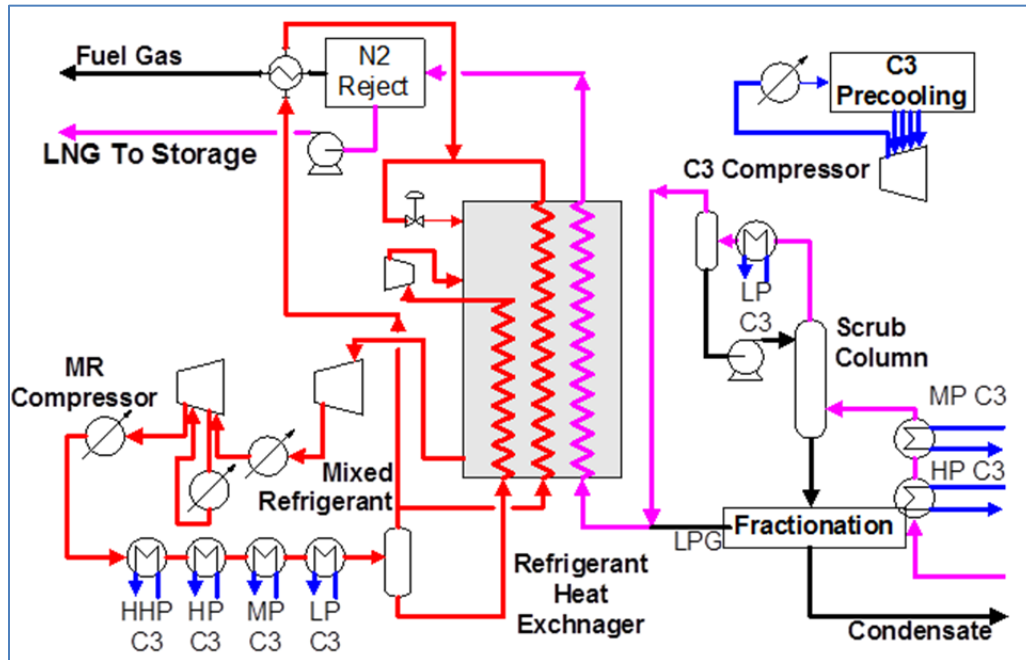


Figure 9-9 (APCI) Propane Pre-cooled Mixed Refrigerant (C3MR) Process, Typical Configuration Diagram

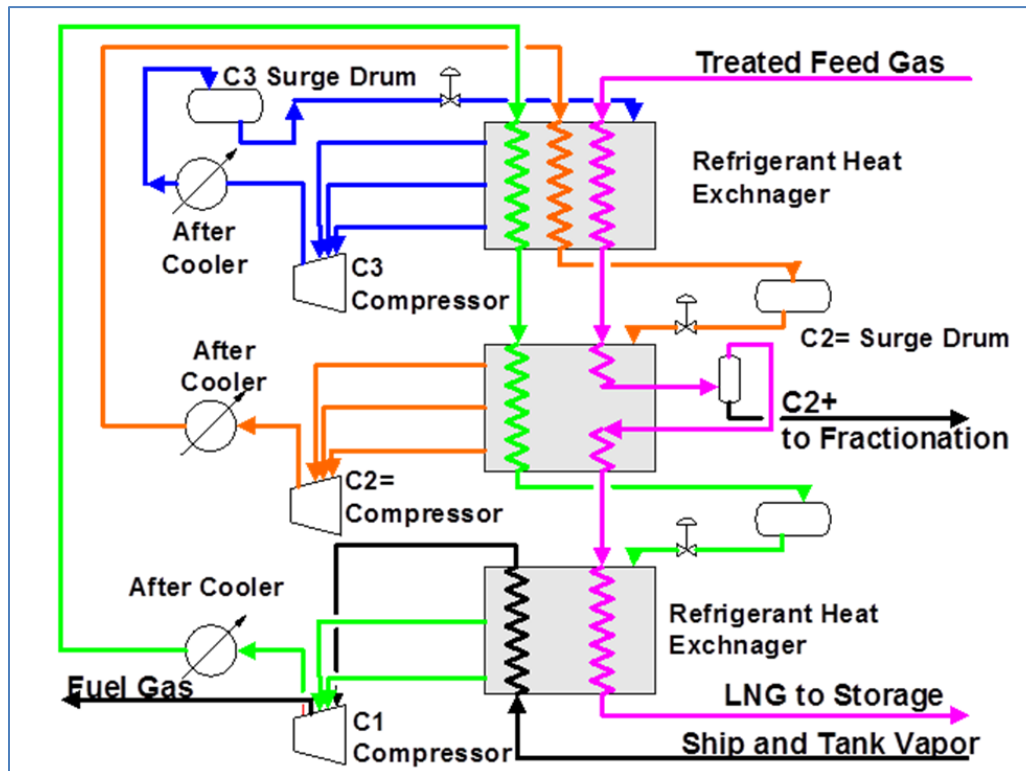
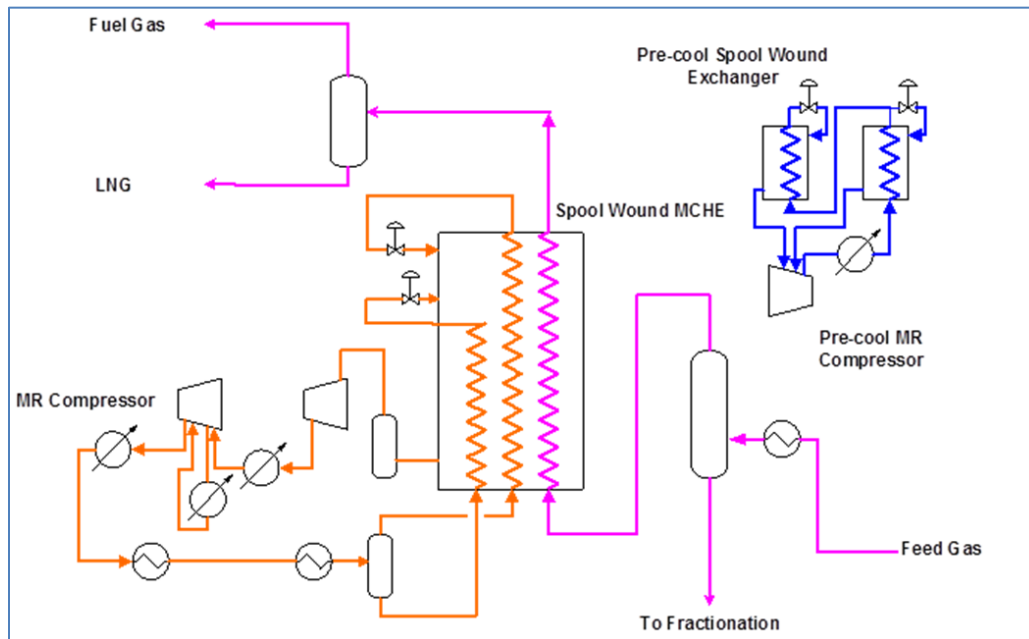


Figure 9-10 Optimized Cascade Liquefaction Process, Typical Configuration Diagram



**Figure 9-11 Dual Mixed Refrigerant (DMR) Liquefaction Process, Typical Configuration Diagram**

### 9.7.1.5 Storage Tanks

Once the LNG is produced, it will be stored at atmospheric pressure in one of three insulated LNG storage tanks located in the LNG tank area. Each tank will have a capacity of 180,000 m<sup>3</sup>. They will be up to 60 m in height and up to 95 m in diameter. The tanks will be full containment type with outer concrete walls and roof, or membrane type storage tanks. They will be placed on insulated pads to prevent heat ingress through the tank floor and to maintain an average temperature of -162°C.

The exact size, location and number of the tanks required for full site build out will be determined during Pre-FEED in the Shipping Logistics Analysis.

The NGL storage tanks will be located in the LNG tank area. The tank capacity for refrigerant components (ethane or ethylene and propane) will be sized based on the inventory in the liquefaction process. NGL will either be used for onsite power generation or will be transported offsite to market.

### 9.7.1.6 Process Heat System

A closed-loop, circulating process heating system will provide process heating requirements for the amine regeneration unit, feed gas heaters, tractionation 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.

### **9.7.1.7 Power Supply**

Power supply during construction will be provided by diesel-powered generators.

During operation, the Project will require a substantial amount of energy for the natural gas liquefaction process and to operate non-process related infrastructure. The LNG liquefaction trains will 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. At this point in facility design (Pre-FEED), it is estimated that approximately 120 MW to 300 MW of electrical power could be required for Phase 1 depending on the selected process and refrigerant compressor drivers. The total power consumption at full site build out could be between 200 MW and 550 MW.

It is likely that electricity for plant operations will be generated by on-site power generators driven by natural gas from the plant inlet. However, final decisions regarding the type of power generation and capacity will be studied and developed during feasibility study and engineering phases.

Diesel generators will be provided on site during startup, and in the event of emergencies.

### **9.7.1.8 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 flare stacks, shutdown and depressurization systems, fire protection, and safety flare systems.

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 ensure protection of 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 on site.

The flare system will 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. The flare system will include flare stacks and associated infrastructure.

### **9.7.1.9 Safety Spacing**

A no-fuel buffer zone of approximately 30 m will be established along the perimeter of the Project site to reduce the likelihood of loss of or damage to the LNG facilities 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 plant boundary to minimize damage and risk of an event escalating.

Safety spacing will also be established to accommodate lightweight construction offices to provide a buffer from operating units. This will be particularly important during the phased completion of LNG trains and when additional trains are built adjacent to the existing operating trains during the second phase of plant development.

#### **9.7.1.10 Water Supply**

Aurora LNG is intending to secure water for the Project from existing water supply infrastructure at the Port of Prince Rupert. However, onsite sources such as groundwater and desalinated seawater are also being investigated.

During construction, municipal water would be transported by barge from the Prince Rupert port to the MOF (see Figure 9-5), where it would be dispensed to a water storage tank. Untreated water will be used for general construction activities such as dust control. Treated water will be used for domestic uses and civil works. It is anticipated that construction activities will require one barge per day. During operations, municipal water would be barged to site and conveyed from the MOF through a pipeline as feed to water treatment systems providing potable water, demineralized water, utility water and firewater. The total projected water supply requirements for the Project are estimated to be approximately 875 m<sup>3</sup>/d during construction, and 50 m<sup>3</sup>/d during operations.

#### **9.7.1.11 Water Treatment**

### **SITE PREPARATION AND CONSTRUCTION**

The Project area will require clearing and grubbing, soil stabilization, backfill and grading activities prior to the installation of permanent plant infrastructure. During site preparation, a temporary drainage and stormwater system will be established to collect and control stormwater flows and runoff from the site to the marine environment. The system will include internal and perimeter ditches, and erosion and sediment control measures.

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 once it meets current waste discharge requirements. Location of the effluent point of discharge will be selected during the detailed design phase. Sewage sludge will be transported off site and disposed of at an approved landfill.

Prior to establishing the sewerage site facilities, portable toilets will be available on site with offsite disposal to a licensed facility.

### **OPERATIONS**

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

Liquid wastes generated during operation of the facility will include:

- Treated sanitary wastewater (sewage and grey water)
- Stormwater runoff from non-process areas
- Stormwater runoff or water contaminated in the LNG process
- Plant process drains system
- Water discharge from steam or condensate blowdown
- Reject water from the demineralized water unit

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 ensure that it meets all applicable federal and provincial regulatory requirements.

Runoff from roads and buildings will drain into a drainage ditch system and discharged via the stormwater outfall into marine waters. All contact water (i.e., runoff from the processing areas, process equipment and firewater system testing) will be directed to an oil separator where any oily residue will be skimmed off to a collection sump. The effluent will be treated and directed to the stormwater outfall. The location of the outfall will be selected during the detailed design phase.

#### **9.7.1.12 Buildings and Storage Facilities**

The location of supporting facilities and buildings will be selected based on consideration of safe distance, prevailing wind direction and access to LNG trains.

Buildings will house functions such as the central control room and spare parts warehouse. The option of providing administration support offsite is being considered.

Chemical storage facilities will house substances required by the liquefaction process, such as propane and ethylene, fuel, acid gas removal adsorbent storage, other chemicals, and waste products.

#### **9.7.1.13 Laydown Area**

The LNG plant area will encompass land for the laydown and storage of plant materials during the construction phase, train maintenance events, and for further expansion. Site configuration will ensure unencumbered access to the area for construction of future trains.

#### **9.7.1.14 LNG Tank Area**

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.

A flare system will be developed for upset conditions (e.g., BOG compressor trip) and for the disposal of inerts when a carrier comes back into service.

#### **9.7.1.15 Pipe-Rack Corridor**

A corridor between the LNG plant area, the LNG 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.

#### **9.7.1.16 Haul Road**

To accommodate the potential for modular construction and allow receipt of large items of equipment and gas turbine/compressors, a haul road with a maximum slope of approximately 3% will be required. The road will extend from the MOF and the LNG plant area to the LNG tank area, and will enable the movement of modules or pre-assembled units from the MOF to the LNG tank area. The haul road will allow for the potential transport of modules weighing up to 6,000 tonnes with a width of up to 50 m. 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.

### **9.7.2 Marine Jetty and LNG Loading**

The Project will include a marine jetty and LNG loading facility capable of accommodating 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<sup>3</sup>. Initially, the facility will include two carrier berths, oriented to allow carrier approach, moorage and departure with the bow into the prevailing southeast wind and wave direction. Future expansion may include a third berth.

Water depths near the coast are relatively deep, which will minimize the length of the jetty. Water depths at the three proposed loading berth options (see Figure 9-7) range from approximately -7 m (relative to chart datum [CD]) to -30 m CD. 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 Q-Flex carriers. However, dredging will likely be required at the MOF as well as the berth pockets (see Figure 9-6)

The LNG will be delivered from the LNG tank area to the berth 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. The facility may allow concurrent loading of carriers at adjacent berths. There will be loading arms at each berth for transferring the LNG onto the carriers, and a vapour return arm for transferring BOG back to the liquefaction trains. It is anticipated that the LNG carriers will be loaded at a maximum loading rate of 12,000 m<sup>3</sup>/h, and will typically be at berth for approximately 24 hours.

Risk reduction features for the safe loading of LNG have been considered based on 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*.

### **9.7.3 Materials Offloading Facility**

The south end of Digby Island is currently being considered for the location of the MOF. The facility will provide for the safe berthing and transportation of large loads, modules from heavy lift and roll-on roll-off (ro-ro) vessels to land transportation units. It will also provide space for inspection of pre-assembled units, as well as an area to stow modules or packaged equipment and park shipments so they can be received out of the required path of the construction sequence.

The MOF area will also be used for the concrete batch plant, aggregate storage and water treatment plant for concrete production. The MOF area may continue to be used over the life of the Project to receive or dispatch shipments such as refrigerant, containers, rotating equipment and rotar transport canisters from ro-ro vessels.

### **9.7.4 Camp Facilities**

A construction camp will be provided onsite to accommodate up to 4,000 to 5,000 Project workers. The number of occupants is anticipated to be less than 1,000 during the initial 10 months of construction, and will peak at 4,000 to 5,000 people by month 20.

The camp will likely be constructed using pre-manufactured modular units shipped to site, which will allow for timely assembly of the camp once site preparation is completed and utilities are installed. Temporary utilities and facilities to support the construction camp will include maintenance buildings, power generation, potable water systems, sanitary facilities, waste treatment plant, a marine outfall and fuel supply.

During facility operation, the camp will continue to be used for permanent operations and maintenance personnel (up to 400), as well as those personnel required during plant turnaround (possibly in excess of 700). The camp may also be used to provide skills training and other capacity-building programs for the community.

The camp and associated infrastructure will comply with all applicable health and safety requirements of WorkSafeBC, the Northern Health Authority, the BC Construction Camp Rules and Regulations, the BC Ministry of Environment and any other local, Port, provincial or federal regulations.

### **9.7.5 Heliport Area**

A heliport is proposed to enable emergency evacuation of injured personnel to appropriate medical facilities. This will ensure that, in the rare event of an emergency, people with critical injuries can receive treatment at better equipped metropolitan hospitals, if required.



## 9.8 Project Activities

### 9.8.1 Construction

Site preparation and construction will commence once all required regulatory permits and approvals have been obtained.

Access to the site will be via a combination of boat and helicopter.

The construction phase will involve the following key activities:

- Pioneer activity of establishing facilities for site preparation
- Facility site preparation for Project components and staging areas, including:
  - Vegetation clearing and grubbing
  - Grading and levelling of the site using cut and fill of rock, overburden, and/or other materials. Depending on site specifics, this could include blasting activities
  - Compaction
  - Implementation of erosion control measures and
  - Potentially some paving in required areas
- Erection of temporary facilities such as maintenance buildings, sanitary facilities and potentially temporary water collection structures
- Construction of the MOF and haul road to allow materials required for construction to be transported to site via boat / barge and offloaded appropriately. Larger components such as LNG facility modules, construction materials, supplies, and equipment will then be shipped to site via barge.
- Installation of utilities required for the LNG facility and the marine terminal. This will include electrical power, industrial and potable water systems, wastewater collection and treatment systems, storm water collection, fire protection system, vehicle fueling stations, and an oil-water separator.
- Construction of temporary facilities such as trailers, sanitary facilities, the construction camp, and maintenance buildings on site to accommodate initial work. Construction workers will stay at the construction camp for the duration of their rotation. Prior to completion of the construction camp, workers will commute to site by boat and/or helicopter from Prince Rupert.
- Construction of suitable foundations, and installation of pilings
- Construction of major terrestrial and marine components, including:
  - Natural gas treatment, extraction, and storage facilities
  - Natural gas liquefaction trains, compressors and associated infrastructure
  - Storage tanks
  - Flare systems
  - Plant piping

- Administration buildings and storage areas and
- Access roads within the site
- Construction of the marine terminal and installation of:
  - Piles, decking, and other support infrastructure
  - Piping and electrical infrastructure
  - Containment structures
  - Cryogenic rundown and vapour return pipelines
  - A storage and loading flare system

Dredging of marine sediment within the proposed berth areas and the MOF area will entail the mechanical excavation of marine sediment, and may require subsea blasting. The volumes of dredgeate will be determined through further geotechnical and engineering design work.

The dredged material will be stored and/or disposed of at a regulatory-approved location. A suitable disposal area will be identified through consultation with regulatory authorities, First Nations, and stakeholders. Brown Passage, located approximately 40 km west of Prince Rupert, is the current designated marine disposal site within the Prince Rupert area. The suitability of this site will be evaluated.

### **9.8.2 Commissioning and Start-up**

The commission and start-up phase will involve controlled testing of the various Project components in a logical manner to ensure all systems handed over from construction are complete and functioning as per design. Piping and vessels will be pressure-tested. Once function testing is complete, the entire systems of completed project components and equipment will then be operationally tested and optimized (e.g., repeated starting and shutdowns, testing of emergency shutdown procedures and repeated facility flaring). Only once Aurora LNG is satisfied that the LNG facility and marine terminal is functioning optimally and safely, will operations begin.

### **9.8.3 Facility Operations and Maintenance**

Operation of the LNG facility and marine terminal is expected to occur over 25 years. The following activities will occur during regular operations:

- Shipment of supplies and equipment to the material offloading area
- Transportation of supplies and equipment to the LNG facility
- Maintenance of all infrastructure (LNG facility, marine terminal, wastewater outfall)
- Monitoring of all operations, including emissions
- Provision of camp and food services to employees
- Shipment of solid waste generated by the Project to a licensed waste receiver
- Storage and loading of LNG onto carriers

- Storage and possible loading of NGL for shipment to market
- Piloting of LNG carriers between Triple Island pilot boarding station and the Project site
- Operation of tugs
- Shipping of LNG to global markets

#### **9.8.4 Marine Shipping**

Shipping activities will include regular transit of LNG carriers to the Project. At full build-out, approximately 160 to 320 LNG carriers (up to Q-Flex in size) 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) and delivered at place (DAP) basis. The carriers will be powered by a combination of low sulphur fuel and boil-off gas. Escort and berthing tugs and pilot boat operations will support safe passage of the LNG, and the shipment of equipment and materials to the MOF.

LNG carriers will transit through Chatham Sound and Brown Passage within designated shipping zones. Operation 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 Marine Communication Traffic Services (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 is considering the option of entering into the Technical Review Process of Terminal Systems in Transshipment Sites (TERMPOL) for the marine shipping and marine terminal operations associated with the Project.

#### **9.8.5 Decommissioning and Reclamation**

At the end of its operation life, Aurora LNG will either sell the LNG facility and marine terminal, or decommission it and reclaim the land according to applicable legislation at that time. Decommissioning will include removal of all land-based LNG and storage components, the gas reception facilities, and the marine terminal and associated infrastructure.

## 9.9 Emissions, Wastes, Noise and Light

The LNG facility will generate various wastes, emissions, and effluents during the life of the Project. Construction, operation and decommissioning activities will be guided by site- specific and activity-specific management plans to manage emissions and discharges, which will be in compliance with the applicable regulatory regime and associated government requirements and conditions.

### 9.9.1 Air Emissions

Air emissions that will be generated by the Project include:

- NO<sub>x</sub> – nitrogen oxide
- CO – carbon monoxide
- SO<sub>2</sub> – sulfur dioxide
- PM<sub>2.5</sub> – particulate matter 2.5
- PM<sub>10</sub> – particulate matter 10
- VOC – volatile organic compound
- CO<sub>2</sub> – carbon dioxide
- CH<sub>4</sub> – methane
- N<sub>2</sub>O – nitrous oxide
- Fugitive hydrocarbons

Emission sources and quantities will vary during each of the Project phases (Table 9-4).

**Table 9-4 Anticipated Sources of Air Emissions**

	<b>Construction and Decommissioning</b>	<b>Operations</b>
Emission Sources	Diesel engines in trucks and barges used to transport materials to site, and in construction and dismantling of equipment Power generation during construction, commissioning, and dismantling Particulate matter emissions from vehicle traffic on roads and the construction site	Gas turbine generators Gas turbine drivers Gas treating equipment for the removal of trace contaminants from the gas-fired reboilers, heaters and incinerators Flare system used in upset and emergency, startup and maintenance situations Back-up generators (diesel) used during start-up, shut-down and in the case of emergencies Inert gas from dry-dock LNG carriers LNG vessels and other marine support vessels Fugitive emissions from the facility Exhaust from vehicle traffic on roads

During facility construction, the primary sources of air emissions will be diesel engines, power generation, vehicle traffic, and construction activities.

Sources of emissions during operation of the Project will include the gas turbines, the acid gas removal unit, the flare system and marine vessels.

- Gas Turbines - the majority of the facility's energy demands are likely to be met by electric power generated by on-site power generators driven from sources in the plant such as Boil-off Gas (BOG) from LNG storage. These gas turbine generators will be a major source of criteria air contaminant (CAC) emissions (NO<sub>x</sub>, CO, SO<sub>2</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, VOC), greenhouse gas emissions (GHG) (CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O) and, to a lesser extent, hazardous air pollutant emissions. Gas turbine drivers for the refrigerant compressors will also be a source of emissions.
- Acid Gas Removal Unit – the acid gas removal unit will extract CO<sub>2</sub> and trace levels of H<sub>2</sub>S from the natural gas. Depending on H<sub>2</sub>S and CO<sub>2</sub> levels in the feed gas, the acid gases may be sent to a thermal oxidizer where H<sub>2</sub>S is oxidized to sulphur dioxide (SO<sub>2</sub>) and the residue hydrocarbon incinerated.
- Flare System – the flare system will dispose of liquid and vapour hydrocarbons during facility startup, shutdown and emergency/upset events. Flaring will generate gaseous emissions of CO and NO<sub>x</sub>.
- Shipping – LNG carriers and support vessels used to transport equipment and materials will generate emissions of SO<sub>2</sub>, NO<sub>2</sub>, CO, CO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and GHG. Gaseous emissions of CO, CO<sub>2</sub> and NO<sub>x</sub> will also be generated during gassing up and cool down of LNG carriers returning from dry dock.

Air emissions during facility shutdown and decommissioning are expected to be similar to those generated by construction activities. The emissions will be predominantly from the use of diesel fuel in heavy equipment used to dismantle the plant and haul away materials for salvage.

Emissions management plans will be developed to minimize releases of GHGs, CACs, and hazardous air pollutants from Project activities and infrastructure, and ensure compliance with applicable guidelines and regulations during construction and operation of the Project.

### **9.9.2 Solid and Liquid Waste**

Design of the facility will include provision for the collection, segregation, treatment, discharge and monitoring of all effluent streams. Non-hazardous liquid effluents will be controlled and discharges treated to meet all applicable federal and provincial regulatory requirements. This includes process water from construction and operation activities, storm water, and ballast water.

A waste management plan will be developed prior to site construction and operations to ensure that solid wastes are managed in accordance with relevant legislation. Non-hazardous solid wastes will either be recycled or reused or collected in a central secure area on site, where they will be disposed of in a local landfill or other licensed waste receiver facility. Options for waste disposal are currently being evaluated.

All hazardous liquid and solid waste will be collected in a secure enclosed building and shipped offsite to an existing licensed hazardous waste facility.

Potential sources of solid and liquid wastes generated by the Project are listed in Table 9-5.

**Table 9-5 Anticipated Sources of Solid and Liquid Waste**

	<b>Construction and Decommissioning</b>	<b>Operations</b>
Solid Waste	Biomass (chipped vegetative material) Excavated overburden, organic material, large boulders Construction Waste (wood, scrap metal, concrete) Domestic waste Dredge materials Sand blast waste Empty containers	Domestic waste Paper/cardboard waste Wood Scrap Metal Municipal waste Waste absorbents and adsorbents Filter cartridges Spent demineralized water membranes and/or bed material
Liquid Waste	Sanitary waste water Storm water Hydrostatic test water Used oils or solvents	Sanitary wastewater Storm water Water discharged from blow-down Reject water from water demineralization unit
Hazardous Waste	Treated sewage and sludge Medical waste Contaminated soil	Mercury removed from the feed gas Medical waste Contaminated soil Waste water contaminated with hydrocarbons or solvents Waste absorbents Used oils or solvents Treated sewage and sludge Misc. wastes, including batteries, filters etc. Used methyl diethanolamine (MDEA) from acid gas removal

Aurora LNG will require that LNG carriers comply with all relevant national and international shipping requirements regarding disposal of waste and ballast water discharge.

### 9.9.3 Noise and Light Emissions

Table 9-6 lists the potential sources of noise and light at the Project. Noise and light emissions will be managed through best management practices incorporated into project design, and project-specific management plans.

**Table 9-6 Anticipated Sources of Noise and Light Emissions**

	<b>Construction and Decommissioning</b>	<b>Operations</b>
Noise Sources	Blasting Pile driving Facility assembly/disassembly Equipment movement Vehicle traffic Module offloading Pressure testing Aircraft	Flares Vessel traffic Air coolers Gas turbines Compressors and pipework Vehicle traffic LNG carrier loading LNG carriers and tugs Aircraft
Light Sources	Vehicles Construction Camp Lighting	Vehicles Vessels Facility Lighting Tugs, carriers, flares

During construction, the primary noise sources will be blasting and pile driving, moving of equipment and vehicle traffic, and assembly of the facility.

During operations, the primary noise sources will include gas turbines and compressors, vehicle and vessel traffic, air coolers, loading of the LNG carriers, and flares.

### 9.10 Aboriginal Groups

Five First Nations and one Aboriginal Group could be affected by the Project and associated marine shipping activities. These are Gitxaala Nation, Kitselas Nation, Kitsumkalum First Nation, Lax Kw'alaams First Nation, Metlakatla First Nation and the Métis Nation of BC. The first five groups are part of a larger cultural group known historically and ethnographically as the Tsimshian. However, they represent distinct groups with different historical and cultural backgrounds.

The Metlakatla, Kitselas, and Kitsumkalum are in the BC Treaty process and are represented in their negotiations by the Tsimshian First Nations Treaty Society. Lax Kw'alaams is negotiating a treaty independently. Gitxaala Nation is currently not involved in the BC treaty process.

Figure 9-12 shows First Nations reserves in the Project area. Although there are no Métis settlements within the Project area, there are a number of Métis living in the Prince Rupert area. A brief summary of each of the Tsimshian groups and the Métis is provided below.

Table 9-7 summarizes potential overlap between Project components and identified First Nations interests, with terrestrial interests identified as "Facility" and marine interests identified as "Shipping Route".

**Table 9-7 Potential Overlap between First Nations' Interests and Aurora LNG Project Components and Activities at Digby Island Site**

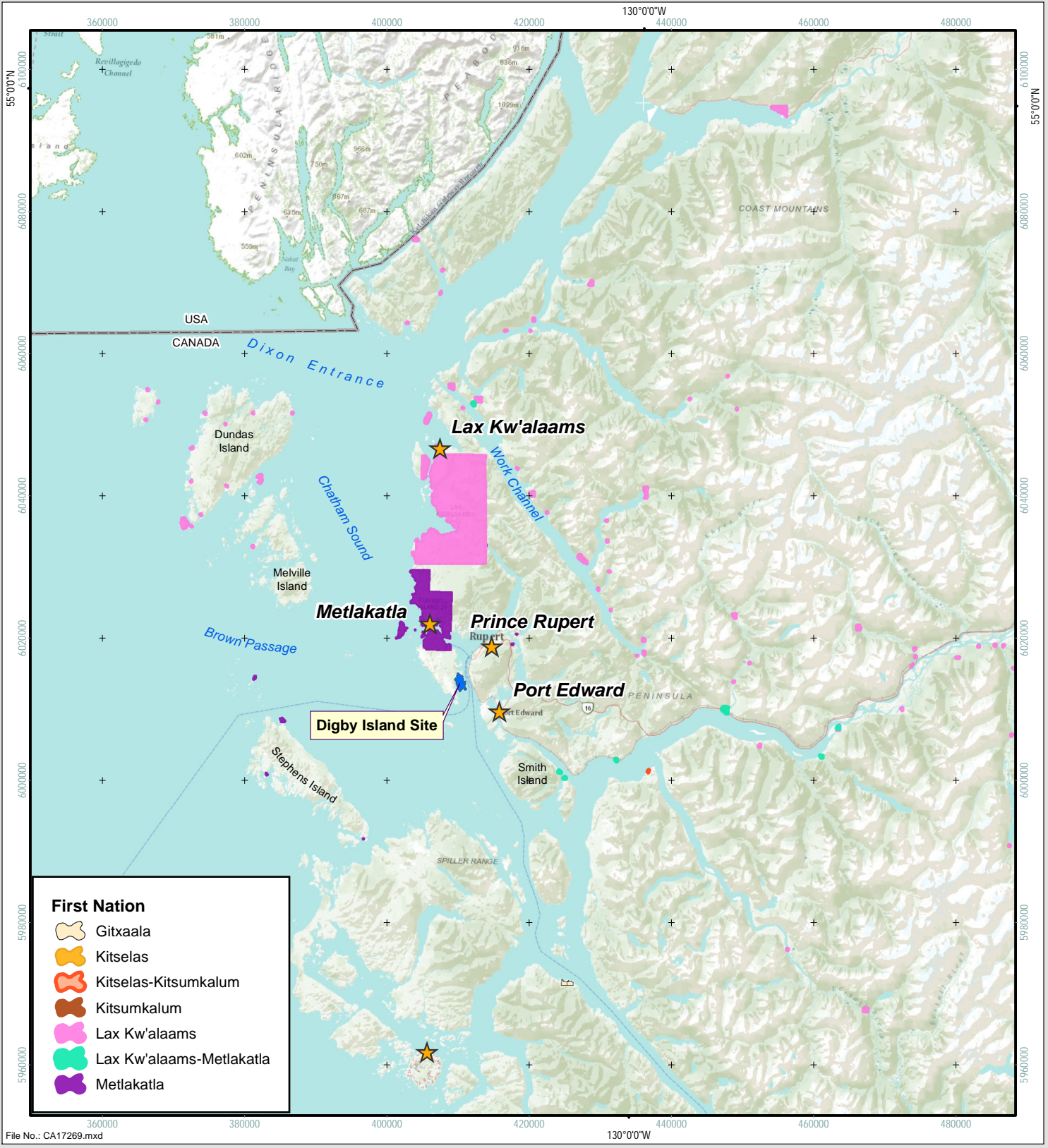
First Nation	Potential Overlap with Identified First Nations Interests	
	Facility	Shipping Route
Gitxaala Nation	X	X
Kitselas Nation		X
Kitsumkalum First Nation	X	X
Lax Kw'alaams First Nation	X	X
Metlakatla First Nation	X	X

### 9.10.1 Gitxaala Nation

Gitxaala Nation is located across the bay from Prince Rupert in the Village of Kitkatla on Dolphin Island in Kitkatla Channel. The Nation has approximately 2,000 members, 25% of which live on reserve. Including the village of Kitkatla, Gitxaala Nation has 21 reserves covering 1,885.2 ha. The Nation's asserted traditional territory covers just over 3,000 ha encompassing the northern extent of their fishing territory on the Nass River, stretching south to the coastal islands just north of Kitasu Bay (Figure 9-13)<sup>6</sup>. The western edge of their territory extends seaward abutting against the marine territories of the Haida Nation. To the east, the territory extends to the mainland shore of Grenville Channel, where it meets Haisla and Gitga'at territories.



<sup>6</sup> Gitxaala-British Columbia (2006). Sustainable Land Use Planning Agreement between Gitxaala Nation and the Province of British Columbia. Dated: October 2, 2006. Accessed on June 5, 2014 at: [http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central\\_north\\_coast/docs/Gitxaala\\_LUP\\_Final\\_signed.pdf](http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central_north_coast/docs/Gitxaala_LUP_Final_signed.pdf)



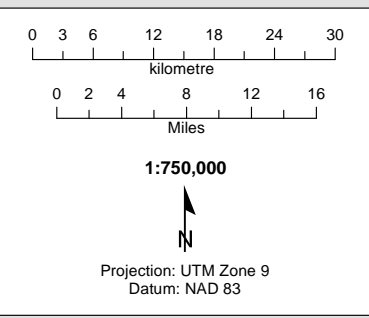


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**Legend**

-  Aurora LNG Site
-  Urban Centre

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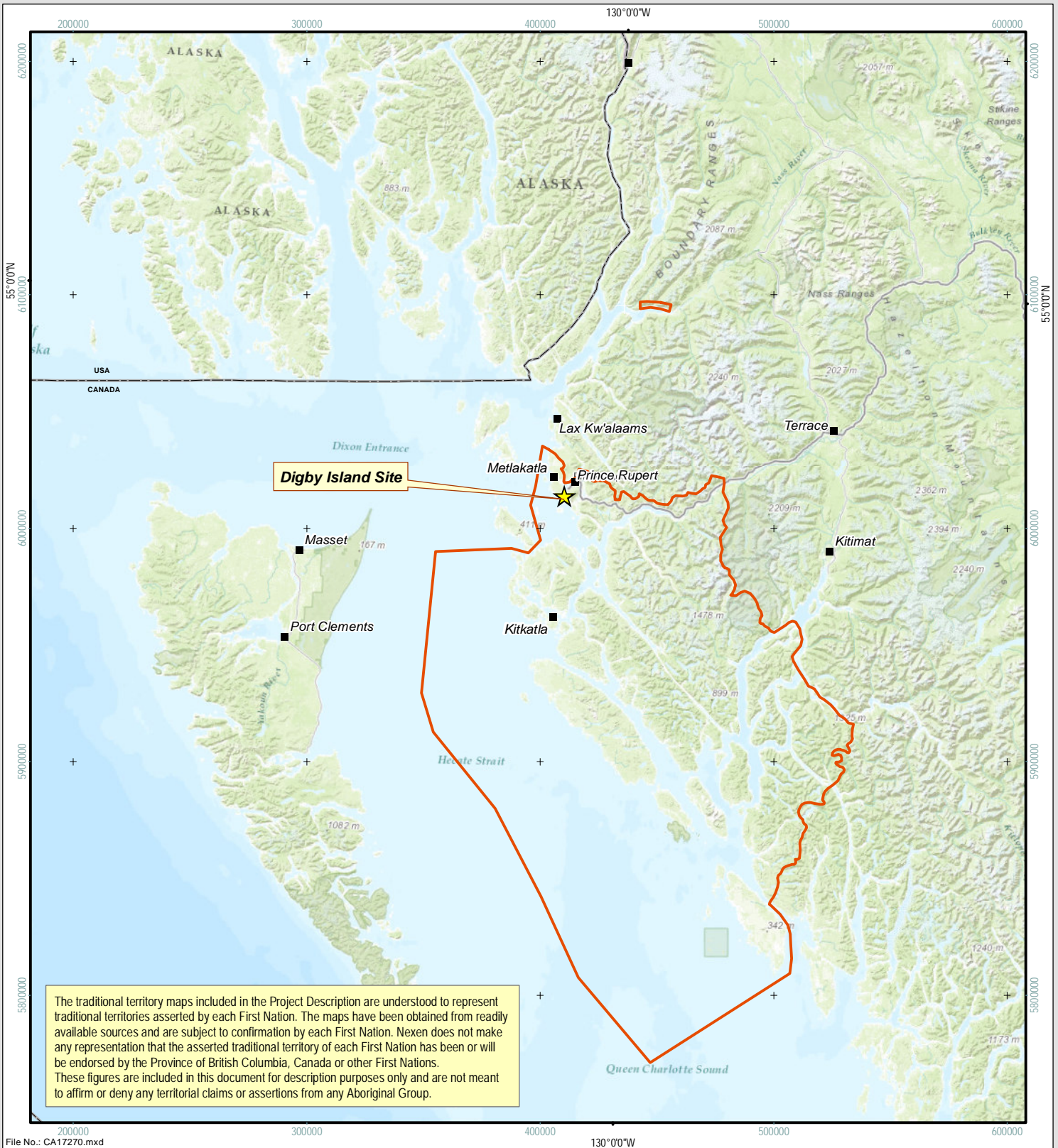


# AURORA LNG






**FIRST NATIONS RESERVES  
NEAR DIGBY ISLAND SITE**

Date: April 15, 2014	FIGURE 9 - 12
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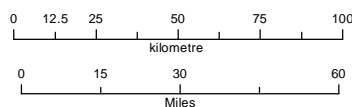


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### Legend

-  Aurora LNG - Digby Island Site
-  Urban Centre
-  Asserted Traditional Territory of the Gitxaala Nation  
Source: Gitxaala-British Columbia (2006).

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1:2,300,000



Projection: UTM Zone 10  
Datum: NAD 83

## AURORA LNG



### ASSERTED TRADITIONAL TERRITORY OF THE GITXAALA NATION

Date: June 5, 2014

FIGURE 9 - 13

### **9.10.1 Kitselas Nation**

Kitselas Nation has a registered population of approximately 615 members, of which approximately 50% live on two reserves: Kitselas IR 1 and Kulpai IR 6. These reserves are located along the Skeena River; IR 1 is just outside of Terrace, and IR 6 is located in the Kitselas Canyon to the east of Terrace. Kitselas First Nation has 10 reserves covering approximately 1070 ha; one reserve (Port Essington) is jointly administered with Kitsumkalum First Nation. The Kitselas Nation's asserted territory includes the watersheds of the Skeena and Kitimat rivers from Lorne Creek in the east to the Skeena and Kitimat estuaries (Figure 9-14)<sup>7</sup>. In addition to this, the Nation has previously stated that it has traditional harvesting areas in coastal areas of the Prince Rupert Port area, the lower Skeena River and its estuary, and in the Nass watershed.

### **9.10.1 Kitsumkalum First Nation**

Kitsumkalum First Nation is based near Terrace, and has a registered population of approximately 715 members. About 40% of its population lives on reserve land, primarily in the main community at Kitsumkalum IR 1. Kitsumkalum First Nation has four reserves, including the co-managed reserve at Port Essington. These reserves total approximately 600 ha of land. The Nation has identified its traditional territory as the areas surrounding the Kitsumkalum and Zymacord watersheds, as well as the Cedar River watershed (Figure 9-15)<sup>8</sup>. The Kitsumkalum has also asserted the use of areas outside these territories, including Lakelse River, Chewanlaw, Skeena River, Ecstall River and locations along Grenville Channel, Edy Pass, Stephens Island and Work Channel. Kitsumkalum First Nation also asserts shared territory down to Low Inlet in Grenville Channel and Cape George in the Hecate Strait, stretching north to the Alaska and Nisga'a Nation borders.

### **9.10.2 Lax Kw'alaams First Nation**

Lax Kw'alaams First Nation is based in Lax Kw'alaams (formally Port Simpson). They have approximately 3500 members, of which 20% live on reserve land. The Lax Kw'alaams First Nation has 78 reserves throughout its asserted traditional territory, covering approximately 11,900 ha. Their asserted traditional territory encompasses the lands and waters between tributaries of the Skeena River, the height of land east of the Zymoetz River, and the Kitsumkalum River (Figure 9-16)<sup>9</sup>. It includes Nass Bay and Nass River to the west, and Wales and Pearse Islands, the Dundas and Stephens Islands groups as well as lands and waters at the mouth of the Skeena River, stretching south along Grenville Channel to the north.

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<sup>7</sup> Kitselas-British Columbia (2011). Forest and Range Consultation and Revenue Sharing Agreement (FCRSA) between the Kitselas Indian Band and Her Majesty the Queen in Right of the Province of British Columbia. Dated: March 29, 2011. Accessed on June 5, 2014 at: [http://www.newrelationship.gov.bc.ca/shared/downloads/Kitselas\\_April2011.pdf](http://www.newrelationship.gov.bc.ca/shared/downloads/Kitselas_April2011.pdf)

<sup>8</sup> Kitsumkalum-British Columbia (2011). Forest and Range Consultation and Revenue Sharing Agreement (FCRSA) Between the Kitsumkalum Indian Band and Her Majesty the Queen in Right of the Province of British Columbia. Dated March 31, 2011. Accessed on June 5, 2014 at: [http://www.newrelationship.gov.bc.ca/shared/downloads/Kitsumkalum\\_may\\_2011.pdf](http://www.newrelationship.gov.bc.ca/shared/downloads/Kitsumkalum_may_2011.pdf)

<sup>9</sup> Strategic Land Use Planning Agreement Between Lax Kw'alaams First Nation and the Province of British Columbia. Dated: May 9, 2008. Accessed on June 5, 2014 at: [http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central\\_north\\_coast/docs/SLUPA08May09FINAL\\_LAX%20Signed.pdf](http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central_north_coast/docs/SLUPA08May09FINAL_LAX%20Signed.pdf)

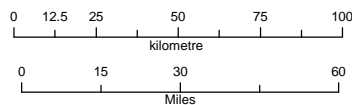


File No.: CA17271.mxd

**Legend**

- Aurora LNG - Digby Island Site
- Urban Centre
- Asserted Traditional Territory of the Kitseles Nation  
Source: Kitseles-British Columbia (2011)

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Projection: UTM Zone 10  
Datum: NAD 83

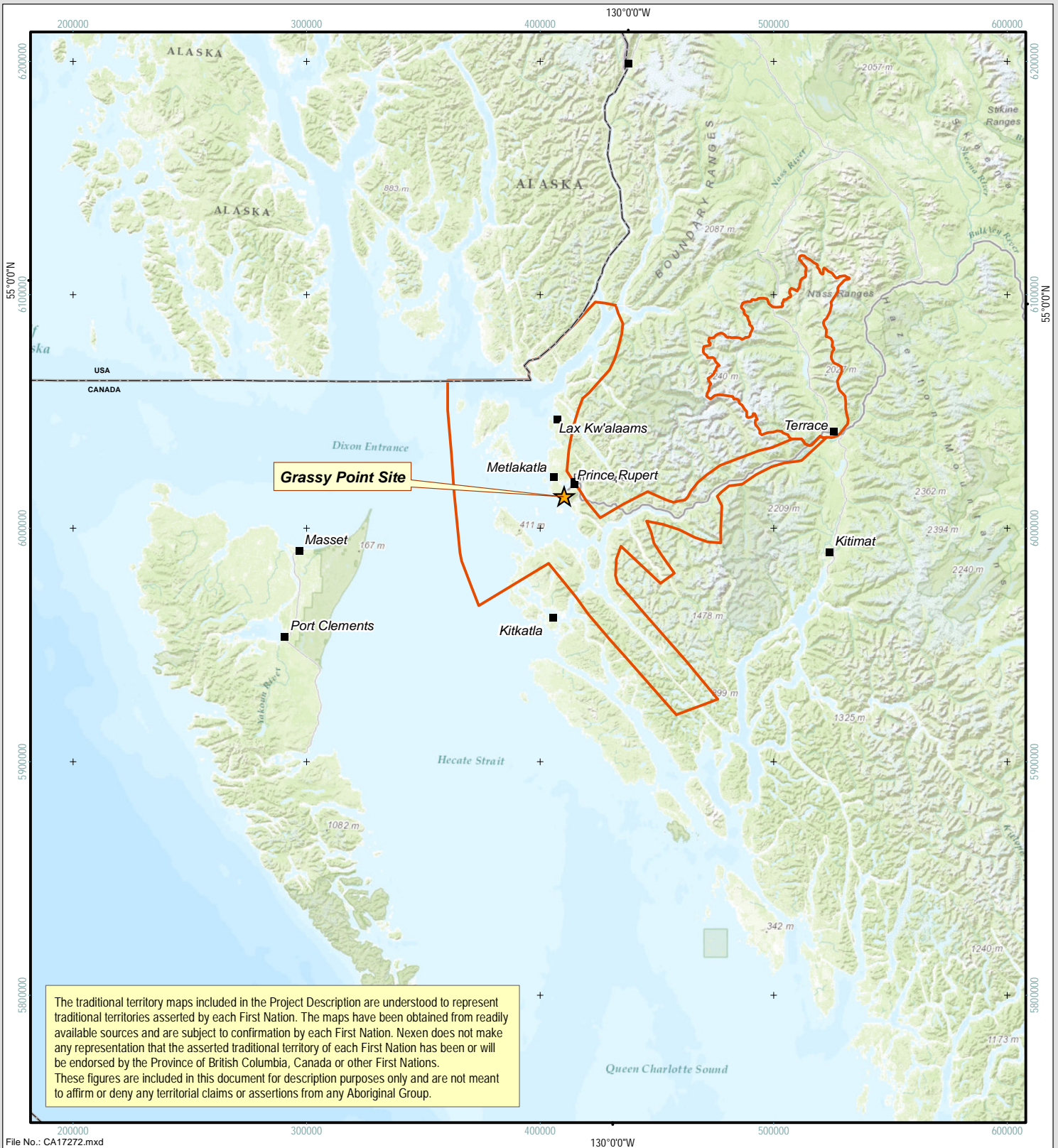
**AURORA LNG**



**ASSERTED TRADITIONAL TERRITORY  
OF THE  
KITSELES NATION**




Date: June 5, 2014

FIGURE 9 - 14

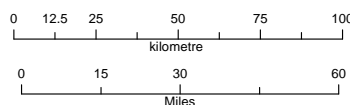


File No.: CA17272.mxd

**Legend**

-  Aurora LNG - Digby Island Site
-  Urban Centre
-  Asserted Traditional Territory of the Kitsumkalum First Nation  
Source: Kitsumkalum-British Columbia (2011)

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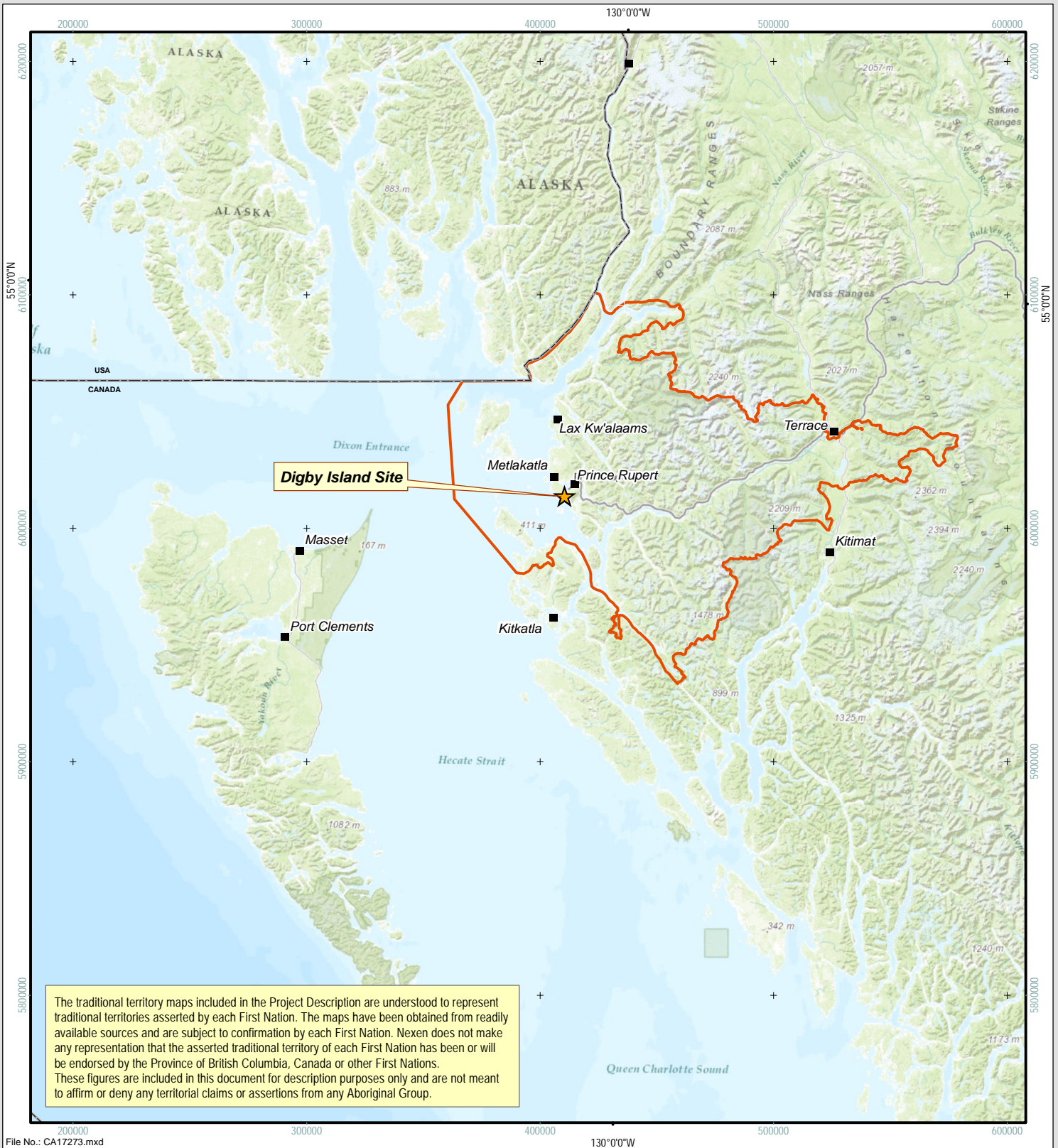
**AURORA LNG**



**ASSERTED TRADITIONAL TERRITORY OF THE KITSUMKALUM FIRST NATION**

Date: June 5, 2014

FIGURE 9 - 15

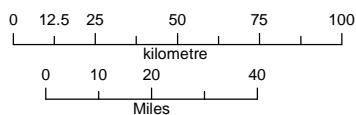


File No.: CA17273.mxd

### Legend

- Urban Centre
- ★ Aurora LNG - Digby Island Site
- ▭ Asserted Traditional Territory of the Lax Kw'alaams First Nation  
Source: Lax Kw'alaams-British Columbia (2014)

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Projection: UTM Zone 10  
Datum: NAD 83

## AURORA LNG



### ASSERTED TRADITIONAL TERRITORY OF THE LAX KW'ALAAMS FIRST NATION

Date: June 5, 2014

FIGURE 9 - 16

### **9.10.3 Metlakatla First Nation**

Metlakatla First Nation is based in Metlakatla, which is located on S1/2 Tsimpsean 2 reserve near Prince Rupert. The Nation has approximately 900 members, of which 10% live on reserve land in Metlakatla. The Metlakatla has 16 reserves, totaling 3,460 ha. Their asserted traditional territory extends from the coastal islands in eastern Hecate Strait to Lakelse Lake near Terrace (Figure 9-17)<sup>10</sup>. Portland Canal and Observatory Inlet mark the northern extent of the boundary, and the headwaters of the Ecstall River mark the southern borders. Their territory includes the lower portions and the mouth of the Skeena River and its tributaries.

### **9.10.4 Métis Nation BC**

The Métis Nation of BC (MNBC) represents Métis Citizens throughout BC. In total, there are 34 different Métis Chartered Communities, including one in Terrace, which helps represent Métis people throughout northwest BC. Engagement with MNBC and Métis Citizens is expected to occur as part of the Project's broader consultation program.

### **9.10.5 Coastal First Nations**

The Coastal First Nations (CFN) is an alliance of First Nations on BC's north and central coast, and Haida Gwaii. Member Nations include Metlakatla First Nation, Gitga'at First Nation, Haida Nation (Council of the Haida Nation, Sidegate, and Old Masset), Heiltsuk Nation, Kitasoo/Xaixais First Nation, Nuxalk Nation, and Wuikinuxv Nation. The CFN provides strategic regional administrative, planning and negotiation support to the member First Nations on environmental and economic issues. The CFN recently signed a Framework Agreement with the Province of BC to explore regional issues related to LNG development. The Framework Agreement commits the province to discuss air emissions, marine shipping, carbon offsets, regional renewable energy supply, and economic benefits.

## **9.11 Traditional and Current Land and Resource Use**

The Tsimshian cultural areas stretch from the lands and waters surrounding the Nass and Skeena watersheds and the coastal areas from the Nass River to Queen Charlotte Sound. Traditionally, groups have used the areas along the lower Skeena River from the Kitselas Canyon and Kitsumkalum (near Terrace) and the adjacent coast south to Milbanke Sound, including Port Simpson (Lax Kw'alaams) Metlakatla (in the Prince Rupert area), and Gitxaala (Kitkatla).

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<sup>10</sup> Metlakatla-British Columbia (2006). Strategic Land Use Planning Agreement – Dated March 20, 2006. Accessed on June 5, 2014 at: [http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central\\_north\\_coast/docs/Metlakatla\\_FN\\_Signed\\_SLUPA.pdf](http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/central_north_coast/docs/Metlakatla_FN_Signed_SLUPA.pdf)



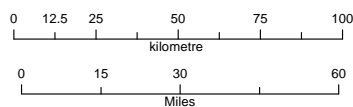
The traditional territory maps included in the Project Description are understood to represent traditional territories asserted by each First Nation. The maps have been obtained from readily available sources and are subject to confirmation by each First Nation. Nexen does not make any representation that the asserted traditional territory of each First Nation has been or will be endorsed by the Province of British Columbia, Canada or other First Nations. These figures are included in this document for description purposes only and are not meant to affirm or deny any territorial claims or assertions from any Aboriginal Group.

File No.: CA17274.mxd

**Legend**

-  Aurora LNG - Digby Island Site
-  Urban Centre
-  Asserted Traditional Territory of the Metlakatla First Nation  
Source: Metlakatla-British Columbia (2006)

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Projection: UTM Zone 10  
Datum: NAD 83

**AURORA LNG**



**ASSERTED TRADITIONAL TERRITORY OF THE METLAKATLA FIRST NATION**

Date: June 5, 2014

FIGURE 9 - 17



Findings through archaeological excavations and studies reveal villages dating back 5,000 years. The Tsimshian have one of the oldest continuous cultural heritages in the western hemisphere. Tsimshian groups possess a rich cultural heritage and ceremonial practices, such as the potlatch feast, continue to be undertaken. The Tsimshian are matrilineal, moiety, and each Tsimshian belongs to one of four tribes or totems: Frog or Raven, Wolf, Eagle, and Killer Whale. Today, hereditary chief titles are maintained for both traditional ceremonial and governance purposes.

Initial desktop research of publicly available sources and discussions with First Nations, to date, indicate that Tsimshian groups have used, and continue to use, the lands at the mouth of the Skeena River and the adjacent lands and marine areas for fishing, hunting, and marine and terrestrial food harvesting, as well as for ceremonial practices. Culturally modified trees are also common throughout the area. First Nation community members also use the marine area for commercial fishing purposes.

Traditionally, living off the land and sea, the Tsimshian typically established a permanent village where members lived during the winter months, as well as a temporary spring village and summer fishing camp. The latter were used during food harvesting seasons.

Examples of marine resources traditionally used by the local First Nations include: seaweed, halibut, salmon, eulachon, shellfish, fish roe, seal, sea lions, and sea otter. Terrestrial resources are also traditionally harvested and include: tree bark, planks, berries, bird eggs, deer, elk, bear, and other animals. As well, Aurora LNG understands that the Project may be located nearby areas of potential cultural and spiritual significance for these groups.

Aurora LNG has initiated consultations and will continue work with each of the five First Nations to understand their current and historic uses of the Grassy Point area and surrounding marine environment for the purpose of assessing the potential effects of the Project on their respective interests.

## **9.12 Environmental Setting**

### **9.12.1 Climate**

The main climatic processes in the northwest coastal area are driven by a high frequency of frontal systems arriving from the Pacific Ocean. Constant streams of oceanic low pressure systems bring mild, moist air and create cloudy, wet weather conditions during the winter. The climate of Digby Island is dominated by fog, cloud, and drizzle. Annual precipitation varies but can exceed 2,500 mm. In general, October through to December are the wettest months. The island receives very little precipitation in the form of snow.

The Pacific Ocean moderates temperatures in the area, with average temperatures ranging from 2°C in winter to 15°C in summer. Winds blow predominantly from the southeast, ranging from 10 km/h to 20 km/h (Ministry of the Environment 2013).

### **9.12.2 Air Quality**

The closest air quality monitoring stations to the Project site that provide continuous ambient air quality data are located in Prince Rupert and Port Edward.

Sulphur dioxide (SO<sub>2</sub>) is monitored continuously at the Prince Rupert Galloway Rapids and Port Edward Pacific monitoring stations. Over the period of record (1998-2002), the average one-hour SO<sub>2</sub> concentrations and maximum one-hour concentrations were well below the provincial Level A ambient air quality objectives. Inhalable particulate matter (PM<sub>10</sub>) values were also below ambient air quality objectives; however, hydrogen sulphide (H<sub>2</sub>S) exceedances were found at the Port Edward site primarily due to the Skeena Cellulose pulp mill, which closed in 2006.

More recent data collected by the BC MoE Mobile Air Monitoring Laboratory (MAML) in 2013 at Westview Terminal indicates that Criteria Air Contaminant (CAC) parameters of PM<sub>10</sub>, respirable particulate matter (PM<sub>2.5</sub>), SO<sub>2</sub>, nitrogen oxides (NO<sub>2</sub>), ozone (O<sub>3</sub>) and carbon monoxide (CO) are all below British Columbia ambient air quality objectives.

### **9.12.3 Acoustic Environment**

The existing ambient acoustic environment near the Digby Island site is characterized primarily by sounds from the natural environment such as birds, wind, rain and waves along the coast. Given its distance from Prince Rupert and the local communities of Dodge Cove and Crippen Cove, the acoustic environment is not influenced by human activities.

### **9.12.4 Geology and Geomorphology**

Digby Island is located within the Hecate Lowlands located immediate west of the Coast Mountains. This area is characterized as coastal lowlands with elevations generally less than 75 m above sea level (Clague 1984).

The Geological Survey of Canada (1983) described the surficial geology of Digby Island as generally comprised of an organic veneer (i.e., 0.5 m to 1.0 m thick) of peat on gentle slopes (i.e., <15 degrees) with occurrences of glaciomarine (e.g., silt and clay) veneer deposits and bedrock outcrops.

Bedrock geologic mapping by Hutchinson (1982) indicates two pre-dominant early Mesozoic and/or Paleozoic metamorphic rock packages on Digby Island. Approximately two-thirds of western Digby Island is generally comprised of lower grade (i.e., greenschist facies) meta-sedimentary black to dark grey graphite schist with chlorite and sericite schist. These meta-sedimentary rocks are oriented in a north-northwest to south-southeast direction and are in contact with higher grade (i.e., amphibolite facies) metamorphic rock located on the eastern one-third of the island. These higher grade metamorphic rocks consist of black to dark grey graphite schist with local interbedded conglomerate, greywacke, and marble in the north, and muscovite schist with minor amphibolite and micaceous quartzite in the south (e.g., the area of the Project site). Mapping indicates that the southeastern shoreline area contains higher grade metamorphic feldspathic schist with impure quartzite and hornblende schist. In addition, there is a third metamorphic rock package that is relatively small in occurrence and is located at the northwestern most

portion of the island. It consists of weakly metamorphosed volcanic rhyolite tuff and flows. A small northwest-southeast trending inferred fault separates this rock package from the lower grade meta-sedimentary rock package.

A local inferred eastward thrust fault identified by Hutchinson (1982) is located between Digby and Kaien islands within the Prince Rupert Harbour. This thrust fault generally separates muscovite schist on Digby Island from the feldspathic schist with impure quartzite on Kaien Island.

The Prince Rupert region is influenced by the Queen Charlotte Fairweather fault system. It is within seismic zone #3, which means that the peak ground acceleration in excess of 6%g has an annual probability of 1% (Clague 1984). Earthquakes have occurred in this region; the most recent occurred in October 2012.

### 9.12.5 Hydrology

Digby Island is located in the Central Coast Mountains hydrologic zone (Ahmed and Jackson 2013). Stream flow is maintained throughout the year in all but the smallest and highest elevation creeks. The proximity of the Pacific Ocean regulates temperatures, leading to cool summers and mild winters. There are eight first order streams mapped within the Digby Island site, which range from approximately 300 m to 900 m in total mapped length. The Project site is located near Delusion Creek and its tributaries. Peak annual flows in these creeks likely occur in the winter in response to rain storms off the Pacific Ocean. There is one small lake situated within the proposed Project footprint.

### 9.12.6 Vegetation and Wetland Resources

The Digby Island site lies within the Hecate Lowland Ecoregion of the Coastal Gap Ecoregion, which is located within the larger Coast and Mountains Ecoprovince (Demarchi 2011). It is situated within the North Coast Forest District of the Coast Forest Region.

The Biogeoclimatic Ecosystem Classification (BEC) system is used in BC to describe the ecological communities that reflect the climate and elevation environment. The Project site is located entirely within the Central Very Wet Hypermaritime Coastal Western Hemlock (CWHvh2) BEC unit. The CWHvh2 biogeoclimatic zone occupies the outer coastal areas, usually less than 25 km from salt water, and ranges in elevation from 0 to 600 m.

The natural vegetation of the Digby Island site is primarily forest interspersed with low-lying wetlands. Productive forests are restricted to well-drained soils on moderate and steep slopes. It is dominated by western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and Sitka spruce (*Picea sitchensis*). Yellow-cedar (*Chamaecyparis nootkatensis*), lodgepole pine (*Pinus contorta*), and red alder (*Alnus rubra*) are abundant on the outer coast where scrubby forests grow on organic soils over bedrock. Because fires occur rarely, seral stands were uncommon before clearcut logging began (Meidinger and Pojar 1991; Banner et al. 1993).

The characteristic understory species are salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), deer fern (*Blechnum spicant*), false lily-of-the-valley (*Maianthemum dilatatum*), fern-leaved

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**PART C - DIGBY ISLAND SITE OPTION**

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goldthread (*Coptis aspleniifolia*), skunk cabbage (*Lysichiton americanum*), and various bryophyte species (*Rhytidiadelphus loreus*, *Mnium* spp., *Sphagnum girgensohnii*, *Eurhynchium oreganum*, *Scapania bolanderi*, etc.) (Banner et al. 1993).

According to information contained in the BC Conservation Data Centre (CDC), 32 plant species of conservation concern, including 25 blue-listed species and seven red-listed species, potentially occur within 4 km of the Project area (Table 9-8). This includes 15 vascular plant species (14 flowering plants and a fern), 15 bryophyte species (11 true mosses (Bryopsida) and four peat-mosses (Sphagnopsida), and a lichen species (*Pseudocyphellaria rainierensis*). This lichen is listed as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the SARA.

Thirteen blue-listed and four red-listed ecosystems potentially occur within approximately 4 km of the Project area (Table 9-9). This includes 12 forest ecosystems and five wetland ecosystems (three fens, one marsh, and one swamp). Four ecosystems are defined as red- or blue-listed ecological communities (i.e., legally designated) in the Central and North Coast Land Use Objectives Order for Ecosystem Based Management (EBM) Implementation.

**Table 9-8 Plant Species of Conservation Concern (Listed Species) with the Potential to Occur in the Project Area**

Class	Common Name	Scientific Name	Prov Status <sup>1</sup>	BC List	SARA Status
Bryopsida		<i>Bryhnia hultenii</i>	S1S2	Red	
Dicotyledoneae	two-edged water-starwort	<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	S2S3	Blue	
Dicotyledoneae	yellow marsh-marigold	<i>Caltha palustris</i> var. <i>radicans</i>	S2S3	Blue	
Monocotyledoneae	lesser saltmarsh sedge	<i>Carex glareosa</i> var. <i>amphigena</i>	S2S3	Blue	
Monocotyledoneae	Gmelin's sedge	<i>Carex gmelinii</i>	S2S3	Blue	3 - Sensitive (2010)
Dicotyledoneae	dwarf bog bunchberry	<i>Cornus suecica</i>	S1S3	Red	4 - Secure (2010)
Bryopsida		<i>Dicranodontium asperulum</i>	S3	Blue	
Bryopsida		<i>Didymodon leskeoides</i>	S1	Red	
Bryopsida		<i>Diphyscium foliosum</i>	S3?	Blue	
Monocotyledoneae	Kamchatka spike-rush	<i>Eleocharis kamtschatica</i>	S2S3	Blue	3 - Sensitive (2010)
Bryopsida		<i>Entodon concinnus</i>	S3	Blue	
Bryopsida		<i>Hageniella micans</i>	S2S3	Blue	
Bryopsida		<i>Isopterygiopsis muelleriana</i>	S1S2	Red	
Monocotyledoneae	arctic rush	<i>Juncus arcticus</i> ssp. <i>Alaskanus</i>	S2S3	Blue	

Class	Common Name	Scientific Name	Prov Status <sup>1</sup>	BC List	SARA Status
Monocotyledoneae	bog rush	<i>Juncus stygius</i>	S2S3	Blue	4 - Secure (2010)
Monocotyledoneae	flowering quillwort	<i>Lilaea scilloides</i>	S2S3	Blue	3 - Sensitive (2010)
Monocotyledoneae	white adder's-mouth orchid	<i>Malaxis brachypoda</i>	S2S3	Blue	
Monocotyledoneae	bog adder's-mouth orchid	<i>Malaxis paludosa</i> <sup>2</sup>	S2S3	Blue	3 - Sensitive (2010)
Dicotyledoneae	dotted saxifrage	<i>Micranthes nelsoniana</i> <i>var. carlottae</i>	S3	Blue	
Bryopsida		<i>Philonotis yezoana</i>	S2S3	Blue	
Monocotyledoneae	white-lip rein orchid	<i>Piperia candida</i>	S2	Red	2 - May be at risk (2010)
Bryopsida		<i>Pleuroziopsis ruthenica</i>	S2S3	Blue	
Bryopsida		<i>Pohlia columbica</i>	S3	Blue	
Filicopsida	Alaska holly fern	<i>Polystichum setigerum</i>	S2S3	Blue	3 - Sensitive (2010)
<b>Ascomycetes</b>	oldgrowth specklebelly	<i>Pseudocyphellaria rainierensis</i>	S2S3	Blue	
Dicotyledoneae	Menzies' burnet	<i>Sanguisorba menziesii</i>	S2S3	Blue	3 - Sensitive (2010)
Sphagnopsida		<i>Sphagnum aongstroemii</i>	S2S3	Blue	
Sphagnopsida		<i>Sphagnum contortum</i>	S3	Blue	
Sphagnopsida		<i>Sphagnum obtusum</i>	S1	Red	
Sphagnopsida		<i>Sphagnum subobesum</i>	S2S3	Blue	
Bryopsida		<i>Tetradontium brownianum</i>	S3	Blue	
Monocotyledoneae	graceful arrow-grass	<i>Triglochin concinna</i>	S2	Red	

**NOTES:**

<sup>1</sup> Provincial Conservation Status applies to a species' conservation status in BC. The ranks have the following meanings: S1 – critically imperiled because of extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province; S2 – imperiled because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province; S3 – special concern, vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

<sup>2</sup> Species recorded on Digby Island (BC CDC 2014).

**Table 9-9 Ecological Communities of Conservation Concern (Listed Ecosystems) with the Potential to Occur in the Project Area**

<b>Ecosystem Group</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>Prov Status</b>	<b>BC List</b>
Wetland Fen (Wf)	northern mannagrass Fen	<i>Glyceria borealis</i> Fen	S3	Blue
Flood Lowbench (Fl)	red alder / salmonberry / common horsetail	<i>Alnus rubra</i> / <i>Rubus spectabilis</i> / <i>Equisetum arvense</i>	S3	Blue
Wetland Marsh (Wm)	Sitka sedge - Pacific water-parsley	<i>Carex sitchensis</i> - <i>Oenanthe sarmentosa</i>	S3	Blue
Wetland Fen (Wf)	Sitka sedge / peat-mosses	<i>Carex sitchensis</i> / <i>Sphagnum</i> spp.	S2	Red
Coniferous Forest (mesic), Flood Highbench (Fh)	Sitka spruce / false lily-of-the-valley <sup>4</sup>	<i>Picea sitchensis</i> / <i>Maianthemum dilatatum</i>	S2	Red
Coniferous Forest (dry)	Sitka spruce / Oregon beaked-moss	<i>Picea sitchensis</i> / <i>Eurhynchium oreganum</i>	S3	Blue
Coniferous Forest (moist/wet)	Sitka spruce / Pacific crab apple	<i>Picea sitchensis</i> / <i>Malus fusca</i>	S3	Blue
Coniferous Forest (dry)	Sitka spruce / Pacific reedgrass	<i>Picea sitchensis</i> / <i>Calamagrostis nutkaensis</i>	S3	Blue
Coniferous Forest (dry)	Sitka spruce / salal	<i>Picea sitchensis</i> / <i>Gaultheria shallon</i>	S3	Blue
Coniferous Forest (moist/wet)	Sitka spruce / slough sedge	<i>Picea sitchensis</i> / <i>Carex obnupta</i>	S2S3	Blue
Coniferous Forest (moist/wet)	Sitka spruce / sword fern	<i>Picea sitchensis</i> / <i>Polystichum munitum</i>	S3	Blue
Coniferous Forest (moist/wet), Flood Highbench (Fh)	Sitka spruce / tall trisetum <sup>4</sup>	<i>Picea sitchensis</i> / <i>Trisetum canescens</i>	S1S2	Red
Wetland Fen (Wf)	sweet gale / Sitka sedge	<i>Myrica gale</i> / <i>Carex sitchensis</i>	S2	Red
Coniferous Forest (mesic)	western hemlock - Sitka spruce / lanky moss	<i>Tsuga heterophylla</i> - <i>Picea sitchensis</i> / <i>Rhytidiadelphus loreus</i>	S3	Blue
Coniferous Forest (moist/wet)	western redcedar - Sitka spruce / devil's club <sup>4</sup>	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Oplopanax horridus</i>	S3	Blue
Wetland Swamp (Ws)	western redcedar - Sitka spruce / skunk cabbage <sup>4</sup>	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	S3?	Blue
Coniferous Forest (mesic)	western redcedar - Sitka spruce / sword fern	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Polystichum munitum</i>	S2S3	Blue

**NOTES:**

<sup>1</sup> Provincial Conservation Status applies to an ecological community's conservation status in BC. The ranks have the following meanings: S1 = critically imperiled because of extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province; S2 = imperiled because of rarity due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province; S3 = special concern, vulnerable in the province due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

<sup>2</sup> Ecosystems explicitly defined as red- or blue-listed ecological communities in the Central and North Coast LUO (Land Use Objectives) Order for Ecosystem Based Management (EBM) Implementation.

### 9.12.7 Wildlife Resources

In the CWH zone, common large mammal species include black bear (*Ursus americanus*), grizzly bear (*Ursus arctos*), gray wolf (*Canis lupus*), and black-tailed deer (*Odocoileus hemionus*) (Meidinger and Pojar 1991).

Four amphibian species and two reptile species are expected to occur in the region: western toad (*Anaxyrus boreas*), rough skinned newt (*Taricha granulosa*), long-toed salamander (*Ambystoma macrodactylum*), northwestern salamander (*Ambystoma macrodactylum*), common garter snake (*Thamnophis sirtalis*), and western garter snake (*Thamnophis elegans*). Coastal tailed frog could occur in the Project area, but current information suggests the species is absent.

Common birds expected to occur on Digby Island include bald eagle (*Haliaeetus leucocephalus*), common raven (*Corvus corax*), dark-eyed junco (*Junco hyemalis*), and glaucous-winged gull (*Larus glaucescens*). There are two Important Bird Areas (IBA) within the vicinity of Digby Island: BC 124 and BC 122. BC124 extends from Big Bay south to Delusion Bay, and has been designated as nationally significant. Birds such as black turnstone (*Arenaria melanocephala*), brant (*Branta bernicla*), colonial water birds and seabirds, dunlin (*Calidris alpina*), surf scoter (*Melanitta perspicillata*), and other waterfowl are known to congregate in large numbers in this area (Birdlife International; Bird Studies Canada, and Nature Canada 2012). BC122 includes Lucy Islands and has been designated globally and nationally significant. Birds such as bald eagle, black oystercatcher (*Haematopus bachmani*), glaucous-winged gull, pigeon guillemot (*Cephus columba*), and rhinoceros auklet (*Cerorhinca monocerata*) are known to occur in large numbers (Birdlife International; Bird Studies Canada, and Nature Canada 2012).

There are 24 wildlife species of conservation concern that are known or likely to occur in the Prince Rupert region (BC CDC 2014) (Table 9-10).

**Table 9-10 Species of Conservation Concern within the Prince Rupert Region**

Common Name	Scientific Name	SARA Status	COSEWIC Status	BC Status
<b>Mammals</b>				
Grizzly Bear	<i>Ursus arctos</i>		SC	Blue
Wolverine	<i>Gulo gulo luscus</i>		SC	Blue
Fisher	<i>Pekania pennanti</i>			Blue
Keen's Myotis	<i>Myotis keenii</i>	SC (Schedule 3)	DD	Red
Little Brown Myotis	<i>Myotis lucifugus</i>		E	Yellow
<b>Amphibians</b>				
Western Toad	<i>Anaxyrus boreas</i>	SC (Schedule 1)	SC	Blue
Coastal Tailed Frog	<i>Ascaphus truei</i>	SC (Schedule 1)		Blue
<b>Birds</b>				
Surf Scoter (M)	<i>Melanitta perspicillata</i>			Blue
Ancient Murrelet (M)	<i>Synthliboramphus antiquus</i>	SC (Schedule 1)	SC	Blue

Common Name	Scientific Name	SARA Status	COSEWIC Status	BC Status
California Gull (M)	<i>Larus californicus</i>			Blue
Cassin's Auklet (M)	<i>Ptychoramphus aleuticus</i>			Blue
Common Murre (M)	<i>Uria aalge</i>			Red
Marbled Murrelet (M)	<i>Brachyramphus marmoratus</i>	T (Schedule 1)	T	Blue
Red-necked Phalarope (M)	<i>Phalaropus lobatus</i>			Blue
Tufted Puffin (M)	<i>Fratercula cirrhata</i>			Blue
Band-tailed Pigeon (M)	<i>Patagioenas fasciata</i>	SC (Schedule 1)	SC	Blue
Peregrine Falcon	<i>Falco peregrinus pealei</i>	T (Schedule 1)	SC	Blue
Northern Goshawk	<i>Accipiter gentilis laingi</i>	T (Schedule 1)	T	Red
Sooty Grouse	<i>Dendragapus fuliginosus</i>			Blue
Barn Swallow (M)	<i>Hirundo rustica</i>		T	Blue
Olive-sided Flycatcher (M)	<i>Contopus cooperi</i>	T (Schedule 1)	T	Blue
Great Blue Heron (M)	<i>Ardea herodias fannini</i>	SC (Schedule 1)	SC	Blue
Western Screech-Owl	<i>Megascops kennicottii kennicottii</i>	SC (Schedule 1)	T	Blue
Short-eared Owl	<i>Asio flammeus</i>	SC (Schedule 1)		Blue

**NOTES:**

DD = Data Deficient  
E = Endangered  
T = Threatened  
SC = Special Concern  
M = Migratory

**9.12.8 Aquatic Resources**

**9.12.8.1 Marine Aquatic Resources**

Chatham Sound is recognized by Fisheries and Oceans Canada (DFO) as an ecologically and biologically significant area (EBSA). Intertidal and subtidal habitats in this area support a diverse assemblage of marine algae, invertebrates and fish, as well as numerous species of marine mammals.

Marine intertidal and subtidal habitats in the area are characterized by rock, sand and gravel beaches; and sand flats, and support a wealth of algal and invertebrate species (BC MFLNRO 2005). Algal species including rockweed (*Fucus gardneri*), sea lettuce (*Ulva* spp.) and a variety of canopy-forming and understory kelp species (e.g., *Laminaria* spp.) are likely present in the area. Eelgrass beds may also be present in the area and invertebrates such as barnacles likely inhabit the foreshore environment. Eelgrass and kelp beds provide essential feeding and rearing habitat for an array of species including juvenile salmon, Pacific herring (*Clupea pallasii*) and Dungeness crabs (*Metacarcinus magister*).



Marine waters surrounding Digby Island are within DFO Important Areas (IAs) for Dungeness crab (*Metacarcinus magister*), tanner crab (*Cancer baerdi*), green sea urchin (*Strongylocentrotus droebachiensis*), and Pacific herring (*Clupea pallasii*). All five species of Pacific salmon (*Onchorhynchus* spp.) are abundant in the waters surrounding Digby Island, especially during the migration of juvenile and adult salmon to and from the Skeena River. These and other fish and invertebrate species support important commercial, recreational and Aboriginal fisheries in the area.

The productive waters of Chatham Sound are also home to numerous species of marine mammals, including harbour porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), killer whale (*Orcinus orca*), grey whale (*Eschrichtius robustus*), minke whale (*Balaenoptera acutorostrata*), humpback whale (*Megaptera novaeangliae*), harbour seal (*Phoca vitulina*) and Steller sea lion (*Eumetopias jubatus*). A DFO IA for humpback whale is located just west of Digby Island.

Table 9-11 lists key marine species with the potential to occur in Chatham Sound, and indicates those that are listed as species of conservation concern by the COSEWIC or SARA.

**Table 9-11 Key Marine Species with the Potential to Occur in Chatham Sound**

Species Type	Common Name	Scientific Name	COSEWIC Status	SARA Status
Invertebrate	Dungeness crab	<i>Metacarcinus magister</i>	Not listed	Not listed
Invertebrate	Prawn/Shrimp	<i>Pandalidae</i>	Not listed	Not listed
Invertebrate	Tanner crab	<i>Chionoecetes spp.</i>	Not listed	Not listed
Invertebrate	Sea urchin	<i>Strongylocentrotus spp.</i>	Not listed	Not listed
Invertebrate	Geoduck	<i>Panopea abrupta</i>	Not listed	Not listed
Invertebrate	Northern abalone	<i>Haliotis kamtschatkana</i>	Endangered	Schedule 1, Endangered
Invertebrate	Octopus	<i>Octopoda</i>	Not listed	Not listed
Invertebrate	Sea cucumber	<i>Holothuroidea</i>	Not listed	Not listed
Fish	Pacific salmon	<i>Oncorhynchus spp.</i>	Not listed	Not listed
Fish	Halibut	<i>Hippoglosses stenolepis</i>	Not listed	Not listed
Fish	Pacific herring	<i>Clupea pallasii</i>	Not listed	Not listed
Fish	Eulachon	<i>Thaleichthys pacificus</i>	Endangered	No Schedule, No Status
Fish	Pacific sand lance	<i>Ammodytes hexapterus</i>	Not listed	Not listed
Fish	Copper rockfish	<i>Sebastes caurinus</i>	Not listed	Not listed
Fish	Quillback rockfish	<i>Sebastes maliger</i>	Threatened	No Schedule, No Status
Fish	Yelloweye rockfish	<i>Sebastes ruberrimus</i>	Special Concern	Schedule 1, Special Concern
Fish	Canary rockfish	<i>Sebastes pinniger</i>	Threatened	No Schedule, No Status
Fish	Bocaccio	<i>Sebastes paucispinis</i>	Endangered	No Schedule, No Status
Fish	Lingcod	<i>Ophiodon elongates</i>	Not listed	Not listed

Species Type	Common Name	Scientific Name	COSEWIC Status	SARA Status
Fish	Spiny dogfish	<i>Squalus suckleyi</i>	Special Concern	No Schedule, No Status
Fish	Bluntnose sixgill shark	<i>Hexanchus griseus</i>	Special Concern	Schedule 1, Special Concern
Mammal	Harbour seal	<i>Phoca vitulina richardsi</i>	Not at Risk	Not Listed
Mammal	Steller sea lion	<i>Eumetopias jubatus</i>	Special Concern	Schedule 1, Special Concern
Mammal	Harbour porpoise	<i>Phocoena phocoena</i>	Special Concern	Schedule 1, Special Concern
Mammal	Dall's porpoise	<i>Phocoenoides dalli</i>	Not at Risk	Not Listed
Mammal	Northern Resident Killer whale	<i>Orcinus orca</i>	Threatened	Schedule 1, Threatened
Mammal	Bigg's (Transient) Killer whale	<i>Orcinus orca</i>	Threatened	Schedule 1, Threatened
Mammal	Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>	Not at Risk	Not Listed
Mammal	Minke whale	<i>Balaenoptera acutorostrata scammonii</i>	Not at Risk	Not Listed
Mammal	Gray whale	<i>Eschrichtius robustus</i>	Special Concern	Schedule 1, Special Concern
Mammal	Humpback whale	<i>Megaptera novaeangliae</i>	Not at Risk	Threatened
Mammal	Sei whale	<i>Balaenoptera borealis</i>	Endangered	Schedule 1, Endangered
Mammal	Fin whale	<i>Balaenoptera physalus</i>	Threatened	Schedule 1, Threatened
Mammal	Blue whale	<i>Balaenoptera musculus</i>	Endangered	Schedule 1, Endangered

**Sources:** Community Mapping Network 2013; Fisheries and Oceans Canada 2013; Government of Canada 2014; Williams and Thomas 2012.

### 9.12.8.2 Freshwater Aquatic Resources

Several watercourses are located within or adjacent to the proposed Digby Island site. These include, but are not limited to, Delusion Creek and its tributaries, and eight ocean tributaries on the east and south side of Digby Island.

Anadromous and resident fish species important for commercial, recreational, and/or aboriginal fisheries that could be present within the Digby Island watercourses are listed in Table 9-12. Historical fish capture information is not available for the majority of these watercourses.

**Table 9-12 Freshwater Fish with the Potential to Occur in Watercourses within the Digby Island Site**

Common Name	Latin Name	Species at Risk	Supports CRA Fisheries
Coho Salmon	<i>Oncorhynchus kisutch</i>	N	Y
Pink Salmon	<i>O. gorbuscha</i>	N	Y
Chum Salmon	<i>O. keta</i>	N	Y
Cutthroat Trout	<i>O. clarki</i>	N	Y
Rainbow Trout/Steelhead	<i>O. mykiss</i>	N	Y
Dolly Varden	<i>Salvelinus malma</i>	N (Blue Listed in BC)	Y

### 9.13 Anticipated Scope of the Project and Environmental Assessment

#### 9.13.1 Scope of Project

The physical works and activities to be performed in relation to the Project for construction, operations and decommissioning are collectively referred to as the Project scope. Details relating to the components and activities are discussed in Sections 7.5 to 7.7.

The major components of the Project include:

- LNG facility
  - Natural gas inlet station
  - Natural gas treatment equipment
  - LNG production facilities
  - LNG and NGL storage facilities
  - Pipe-rack corridor(s), including cryogenic rundown and vapor return pipelines between LNG production facility and marine jetty
- Marine terminal
  - Marine jetty and LNG loading infrastructure
  - LNG carrier berths
  - Materials offloading facility
  - Flare systems
  - LNG carriers and other support vessels along the marine access route
- Supporting infrastructure and facilities
  - Administration and maintenance buildings, and offices
  - Water supply, storage and pipelines
  - Wastewater collection, treatment, and disposal infrastructure

- Stormwater management system
- Firewater systems
- Waste management (collection, storage, and disposal)
- Workforce accommodations
- Storage and laydown areas
- Heliport
- Haul road and vehicle traffic
- Power infrastructure
- Power generation
- Medical services

Key construction activities include:

- Pioneer site establishment
- Clearing vegetation
- Blasting and grading
- Removing soil and overburden
- Constructing roads within the site and marine berth
- Underwater blasting and/or dredging of marine sediments
- Pile driving
- Transporting equipment and modules to site
- Transporting workforce to and from site
- Installing utilities
- Installing infrastructure related to the facility and terminal
- Pressure testing.

Key operational activities include:

- Receiving and processing inlet gas
- LNG liquefaction
- LNG and refrigerant storage
- Loading carriers
- Carrier marine traffic
- Shipping supplies and equipment to site
- Maintenance activities

- Monitoring
- Waste generation.

Expected concurrent activities that are not within the scope of the Project but would be considered in a cumulative effects assessment include:

- Construction and operation of a third-party gas supply pipeline to deliver feed gas to the Project
- Marine traffic associated with construction of a gas supply pipeline

### **9.13.2 Scope of Environmental Assessment**

Under CEAA 2012, the Project Description must address the potential for the Project to cause changes to:

- Fish and fish habitat
- Aquatic species
- Migratory birds
- Federal and other lands
- Aboriginal peoples

The BC EAO guidelines require the Project Description to address potential environmental, economic, social, heritage, and health effects of the Project.

Based on the existing biophysical and socio-economic environments of the Digby Island area and the requirements of BCEAA and CEAA 2012, it is anticipated that the EA will focus on the following aspects of the environment.

- Biophysical environmental effects (air quality, noise, vegetation, wildlife resources including migratory birds, marine and freshwater resources)
- Social effects
- Health effects
- Economic effects
- Heritage effects
- First Nations or other Aboriginal Group interests
- Cumulative effects
- Transboundary effects
- Federal and other lands

These are discussed in more detail in Section 9.13.

## **9.14 Potential Project Effects**

### **9.14.1 Natural Environment**

#### **9.14.1.1 Air Quality**

Key Project activities that could cause a change in air quality include those that involve emissions of criteria air contaminants (CAC). The primary substances of concern include gaseous compounds (SO<sub>2</sub>, NO<sub>x</sub>, CO), particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>), and GHGs. Anticipated sources of air emissions include:

- Construction: land clearing, blasting, grading, hauling, material handling, fuel combustion, power generation
- Operations: vehicle traffic, power generation, fuel combustion, LNG vessels and other marine support vessels, and fugitive emissions from the LNG facility
- Decommissioning: fuel combustion, removal of infrastructure, backfilling and contouring

#### **9.14.1.2 Climate (GHG Management)**

The Project will result in the emission of greenhouse gases, including CO<sub>2</sub> and methane, which will contribute to global climate change. GHG emissions of concern will be related primarily to the operational phase, although some emissions are also expected to occur during site preparation (i.e., clearing of vegetation to accommodate the facility footprint) and construction.

#### **9.14.1.3 Acoustic Environment**

The Project has the potential to affect the acoustic environment of the surrounding area as a result of noise emissions generated by equipment and vehicles during site preparation and onshore construction activities, and operation of the LNG facility and marine terminal. In-water activities such as construction of the trestle and marine terminal and operation of marine vessels could also generate underwater noise, which could adversely affect the marine acoustic environment. Increased noise levels could result in human health effects (annoyance, sleep disturbance) and/or wildlife effects (displacement and disturbance).

#### **9.14.1.4 Vegetation and Wetland Resources**

The Project has the potential to cause changes in vegetation and wetland resources due to a direct loss of these resources from vegetation clearing and surface disturbance, as well as air emissions and dust deposition. Site clearing and preparation will remove vegetation from the footprint and may affect surrounding vegetation indirectly through changes in environmental conditions.

The potential direct and indirect effects on vegetation and wetland resources could include:

- Change in abundance of plant species of interest, including at-risk species, species of cultural significance, and invasive species

- Change in abundance or condition of ecological communities, including those of conservation interest (e.g., old forest and provincially at-risk)
- Change in wetland function (this may be subject to the “no net loss of wetland functions” of the Federal Policy on Wetland Conservation (Government of Canada 1991).

#### **9.14.1.5 Wildlife Resources**

Construction and operation of the facility has the potential to affect terrestrial wildlife and marine birds, including migratory birds as defined in the *Migratory Birds Convention Act, 1994*. The key potential effects on wildlife resources include:

- Change in habitat: loss or alteration of terrestrial habitat directly due to vegetation clearing during site preparation and indirectly due to sensory disturbance during construction and operation, and atmospheric noise and lighting
- Change in movement: alteration of movement patterns during construction and operation, including displacement of marine birds, due to noise, human activity and vessel activity
- Change in mortality risk: alteration of mortality risk during construction and operation of the facility, including risk of collisions for marine birds.

#### **9.14.1.6 Marine Aquatic Resources**

The *Fisheries Act*, the *Species at Risk Act*, and supporting regulations and policies define the marine species that need to be considered during a federal environmental assessment. This includes all fish, fish habitat, and aquatic species as defined in the *Fisheries Act*.

Certain Project-related activities such as construction of the marine terminal infrastructure, dredging and disposal at sea, wastewater discharges, and LNG vessel operations could adversely affect marine fish and fish habitat, including marine mammals and marine plants. The key potential effects on marine resources include:

- Permanent alteration or destruction of marine fish habitat (i.e., marine riparian habitat, intertidal habitat, and/or subtidal habitat, including marine plants) during construction as a result of dredging, pile driving, and disposal of dredgeate
- Injury or mortality of marine fish, invertebrates and/or marine mammals due to underwater noise created by in-water construction activities
- Injury or mortality of marine mammals due to marine vessel strikes
- Change in marine sediment or water quality due to increased turbidity, resuspension of existing contaminants during in-water construction, and operations (i.e., stormwater/wastewater discharge)
- Behavioural disturbance to marine fish and marine mammals due to underwater noise generated by construction and operation-related activities.

### **9.14.1.7 Freshwater Resources**

The Project has the potential to cause changes in freshwater fish and fish habitat. Key potential effects include:

- Permanent alteration or loss of fish habitat from clearing of riparian forest, and construction of the LNG facility, haul road, marine terminal, material offloading ramp, and temporary construction infrastructure and facilities
- Reduced habitat quality due to changes in surface water quality and sediment quality from sediment releases and introduction of nutrients and metals from blasting (potential effect dependent upon site geology)

### **9.14.2 Social Environment**

#### **9.14.2.1 Infrastructure and Services**

The in-migration of workers, their spouses and dependents as well as an increase in the number of transient workers during construction and operation of the Project has the potential to increase local and regional populations and alter demographics. Changes in population and demographics could, in turn, increase demand on community infrastructure and services (e.g., utilities, transportation, education, emergency services, and social and recreational services) and cause a change in housing availability in the City of Prince Rupert, the District of Port Edward, and nearby First Nations communities.

#### **9.14.2.2 Land and Marine Use**

The proposed Project site on Digby Island falls within provincial Crown Land. Waters to the south, east and west of Digby Island fall under the jurisdiction of the PRPA.

Construction and operation of the LNG facility and marine terminal could affect other tenured and non-tenured land and resources uses, including forestry, trapping, guide outfitting, and recreation activities, currently occurring on or near the proposed Project footprint. Fishing and marine harvesting are important activities in the SQRD, and it is possible that the marine terminal, exclusion zones, and vessel traffic could affect marine navigation in waters used for commercial, recreational, and subsistence fishing and other marine uses.

### **9.14.3 Economic Environment**

The Project will create approximately 4,000 to 5,000 short-term jobs during the five-year construction period, and an estimated 400 long-term jobs during Project operations. Substantial indirect investments into the community will also occur in the form of additional goods and services required by the Project itself and employees drawn to the area. Potential adverse effects to the local and regional economies are also expected to occur as a result of competition for limited labour supply and changes in the economic activity of other sectors (i.e., cost of living, availability of goods and services).



#### **9.14.4 Human Health**

The Project has the potential to interact with human health through various pathways. Emissions of contaminants from facility construction and operation, and from vessels berthed at the facility could degrade ambient air quality, resulting in inhalation health risks. The primary air contaminants of interest are SO<sub>2</sub>, NO<sub>2</sub>, CO, respirable particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and H<sub>2</sub>S. Human health could also be affected by emissions to both the terrestrial and marine environments, as well as noise emissions, which could lead to elevated stress and annoyance levels.

The potential presence of historic contaminants in marine sediments and soils may pose a risk to human health if contaminants are re-introduced to the environment during Project construction activities. These contaminants could be taken up by terrestrial or marine biota, and subsequently ingested by humans through consumption of traditional foods.

#### **9.14.5 Heritage Environment**

Potential effects on heritage and archaeological resources, if they are present, are likely to occur as a result of site preparation activities during Project construction. In particular, the clearing of vegetation and any excavation works that disturb native sediments have the potential to disturb archaeological and heritage resources. It is anticipated that any adverse effects on heritage resources will be mitigated through data recovery or other standard acceptable approaches to mitigation.

Operational activities could also cause damage to archaeological and heritage sites even if they have been mitigated by data recovery. For example, a large lithic site may be sample excavated and monitored during construction, but individual artifacts could be exposed by vehicle traffic, pipeline monitoring or accessing service sites.

#### **9.14.6 Cumulative Effects and Transboundary Effects**

The scope of the environmental assessment will consider the potential for direct and indirect effects of the Project on the biophysical and human environments, as well as potential cumulative effects, and trans-boundary effects. The cumulative effect assessment may include:

- Past projects (e.g., Canpotex, Fairview Terminals 2)
- Current and planned marine terminal infrastructure and industrial facilities in Prince Rupert and Port Edward
- Development of other proposed LNG projects in the area (e.g., Pacific Northwest LNG, Prince Rupert LNG, Woodside, LNG Canada, Kitimat LNG)
- Development of gas pipelines associated with the Project and other proposed LNG projects
- Marine traffic associated with current and reasonably foreseeable projects and activities between Triple Island and the Port of Prince Rupert

### **9.14.7 Aboriginal Communities**

The Project could potentially affect traditional land and marine-based activities of Aboriginal people such as hunting, fishing, gathering, and tree harvesting as a result of changes in land use, restricted access and increased marine traffic. Examples of marine resources traditionally used by Aboriginal people in the area include: seaweed, halibut, salmon, eulachon, shellfish, fish roe, seal, sea lions, and sea otter. Terrestrial resources include: tree bark, planks, berries, bird eggs, deer, elk, bear, and other animals.

Traditional activities of Aboriginal people could also be affected indirectly as a result of potential changes to the biophysical environment, including effects on freshwater and marine fish, fish habitat and aquatic species, vegetation resources and wildlife resources, including marine birds, which could affect harvesting patterns and/or harvesting success.

Aurora LNG anticipates that the Project could also adversely affect Aboriginal people through human health effects, social and cultural effects and effects on heritage resources. The following is a list of potential adverse effects that may be included in the assessment. The list will be refined based on the results of on-going discussions with First Nations.

- Human health effects
- Degradation of air quality as a result of air emissions generated by construction equipment and activities (e.g., blasting) and operation of the LNG facility and marine vessels
- Sensory disturbance due to noise exposure during construction and operation activities
- Social effects
- Sensory disturbances that affect traditional lifestyle values
- Heritage effects
- Damage or destruction of archaeological or heritage sites from site preparation and ground disturbances
- Cultural effects
- Changes in spiritually or culturally important areas
- Changes in traditional use areas

Through ongoing collaboration with the five Nations and support for traditional use studies, Aurora LNG will continue to advance its understanding of the traditional use and practices of the Nations, the cultural values of the communities, and the potential effects of the proposed Project on these activities, and potential mitigation strategies.

### **9.14.8 Federal Land and Other Lands**

Land-based environmental effects are anticipated to be localized to the Project area, which will be located within provincial Crown lands. Marine-based environmental effects are expected to occur within waters controlled by the PRPA. Due to the proximity of the Project site to the US border (50 km), there is

potential that trans-boundary air quality effects could occur. However, based on previous experience, air emissions are not expected to affect air quality more than 25 km from the Project site.

The following provides an overview of the key potential environmental effects of the Project that could occur as a result of carrying out the Project in federal lands. As defined in the *CEAA 2012*, federal lands include all waters on and airspace above lands belonging to or controlled by the federal government.

#### **9.14.8.1 Air Quality**

Construction and operation of the marine terminal and operation of LNG carriers and support vessels will generate air emissions that have the potential to affect air quality. The primary substances of concern include gaseous compounds (SO<sub>2</sub>, NO<sub>x</sub>, CO), particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>), and GHGs. Anticipated sources of air emissions include:

- Construction: land clearing, blasting, grading, hauling, material handling, fuel combustion, power generation
- Operations: fuel combustion, LNG vessels and other marine support vessels
- Decommissioning: fuel combustion, removal of in-water infrastructure

#### **9.14.8.2 Acoustic Environment**

The underwater acoustic environment could be affected by construction of the marine terminal, installation of piles, blasting, dredging of the berth pockets and MOF, disposal of dredgeate, and marine vessels delivering equipment and materials to site. During operation, LNG carriers and support vessels will be the primary source of underwater noise from the Project.

#### **9.14.8.3 Navigable Waters**

Construction of the trestle and marine terminal and operation of marine vessels could affect interfere with navigation in nearshore waters. Lighting at the terminal may also affect nighttime navigational aids.

#### **9.14.8.4 Marine Resources**

Construction and operation of the marine terminal, and operation of marine vessels could affect fish and fish habitat, as well as marine birds. The primary pathways of potential effects include:

- Permanent alteration or destruction of marine fish habitat (i.e., marine riparian habitat, intertidal habitat, and/or subtidal habitat) as a result of dredging, blasting, piling, and disposal of dredgeate
- Injury or mortality of marine fish, invertebrates and/or marine mammals due to underwater noise generated by in-water construction activities
- Injury or mortality of marine mammals during in-water construction and operation of vessels (i.e., vessel strikes)

- Change in marine sediment or water quality (e.g., increased turbidity, resuspension of existing contaminants) during in-water construction, and operations (i.e., stormwater/wastewater discharge)
- Behavioural disturbance to marine fish and marine mammals due to underwater noise generated by construction and operation-related activities
- Change in mortality risk of marine birds due to collisions with infrastructure
- Displacement of marine birds due to vessel activity

**PART D - ABORIGINAL, STAKEHOLDER AND AGENCY  
ENGAGEMENT**

## **10 ABORIGINAL, STAKEHOLDER AND AGENCY ENGAGEMENT**

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### **10.1 Aboriginal Engagement**

#### **10.1.1 Principles of Aboriginal Engagement**

Aurora LNG believes that meaningful consultation with First Nations begins with building solid relationships based on mutual trust and respect of customs and culture, a shared understanding of issues, transparency, inclusiveness, open communication, and collaborative problem-solving approach to achieve mutually satisfactory outcomes. Engaging and building relationships with First Nation communities is an important component of earning Aurora LNG's social license to operate. First Nation communities have a right to know about proposed activities of the Project that have the potential to adversely affect their interests. Aurora LNG will endeavor to provide opportunities for engagement that will meet all reasonable expectations of First Nations as well as those of the Project.

#### **10.1.2 Approach to Aboriginal Engagement and Consultation**

Early and ongoing engagement and consultation is key factor in building respectful relationships as well as limiting or avoiding challenges and delays in advancing the Project development. Cultivating meaningful relationships with First Nations people takes time. Through early and ongoing engagement with potentially affected First Nations, Aurora LNG is seeking to build its knowledge of the values and goals, as well as the social, cultural, economic, and political structures of each community.

Aurora LNG began engagement early with First Nation communities to build a solid foundation on which to establish long-term, respectful and mutually beneficial relationships. Aurora LNG's commitment to First Nation engagement is guided not only by its commitment to responsible development but also its Indigenous Peoples Policy, Aboriginal Guidelines and Guiding Principles. Through these exchanges, Aurora LNG seeks to:

- Ensure engagement respects the rights and cultural traditions of First Nations
- Build and sustain long-term mutually beneficial relationships with First Nations communities
- Facilitate the open exchange of information and ideas
- Foster shared understanding and management of expectations
- Develop an understanding of how the proposed Project might affect Aboriginal interests and discuss concerns regarding these potential effects
- Manage expectations, especially regarding the potential for Project timelines to shift, which can affect benefit-sharing opportunities
- Provide capacity funding to ensure meaningful participation in Aurora LNG's engagement and consultation process

- Initiate negotiations of early stage protocols to deliver early benefits to potentially affected First Nations
- Identify opportunities for First Nations people to participate in the industry
- Ensure the Project meets all provincial and regulatory requirements.

Aurora LNG’s engagement approach reflects its belief that it takes time and consistent effort to develop relationships with First Nation community leaders and members, and to identify issues and opportunities over the lifecycle of the Project.

### 10.1.3 First Nations Communities

Aurora LNG determined which First Nations to engage using the BC Consultative Areas Database (CAD). According to the CAD, both the proposed Digby Island and Grassy Point sites are on the asserted traditional territory of several First Nations.

The Project footprint at the Grassy Point site overlaps with the asserted traditional territory of three First Nations (Lax Kw’alaams, Metlakatla, and Kitsumkalum). The proposed shipping route overlaps with marine interests of these three Nations, as well as the Gitxaala Nation and Kitselas Nation. The Project footprint at the Digby Island site overlaps with the asserted traditional territory of the Lax Kw’alaams, Metlakatla, Kitsumkalum and Gitxaala. The proposed shipping route overlaps with marine interests of these four Nations, as well as the Kitselas Nation.

Contact information of First Nations communities identified for engagement is provided in Table 10-1.

**Table 10-1 Contact Information for First Nations with Potential Interests in the Project**

First Nation	Contact information
Gitxaala Nation	Location: Kitkatla, BC Website: <a href="http://www.gitxaalanation.com">www.gitxaalanation.com</a> Mailing Address: PO Box 149 Kitkatla, BC V0V 1C0 Phone: 250-848-2215 Fax: 250-848-2238
Kitselas Nation	Name: Kitselas Administration Location: Terrace, BC Website: <a href="http://www.kitselas.com">www.kitselas.com</a> Address: 2225 Gitaus Rd Terrace, BC V8G 0A9 Phone: 250-635-5084 Fax: 250-635-5335
Kitsumkalum First Nation	Name: Kitsumkalum Treaty Location: Terrace Website: <a href="http://www.kitsumkalum.com">www.kitsumkalum.com</a> Address: P BOX 544 Terrace BC V8G 4B5 Phone: 250-635-1718 Fax: 250-635-6196

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First Nation	Contact information
Lax Kw'alaams First Nation	Address: 206 Shashaak Street, Lax Kw'alaams, BC V0V 1H0 Phone: 250-625-3293 Fax: 250-625-3246
Metlakatla First Nation	Location: Prince Rupert Website: www.metlakatla.ca Address: PO Box 224, Prince Rupert, V8J 3P6 Phone: 250-628-3315 Fax: 250-628-9259
Coastal First Nations – Great Bear Initiative	Location: Central and North Coast District, and Haida Gwaii Website: www.coastalfirstnations.ca

#### 10.1.4 Meetings to Date

Aurora LNG began engagement with the five Tsimshian First Nations in January 2013. The purpose of these meetings was to initiate information sharing and relationship building. Engagement activities have focused mainly on one-on-one meetings with leadership and technicians. As well, advanced notifications have been provided to First Nation representatives when Aurora LNG intended to conduct initial non-invasive investigative activities. During the early engagement phase, the Aurora LNG participants included senior leadership, environmental technicians, an engagement advisor and a negotiator.

Table 10-2 summarizes the number of one-on-one meetings that have been held between Aurora LNG and each of the five First Nations. In addition to meetings, Aurora LNG representatives have also had telephone and email exchanges with representatives of the First Nations' regarding various aspects of the proposed Project, including discussions regarding the preparation of initial permit applications.

The Aurora LNG site evaluation team has also engaged with the First Nations as it began developing the work plan for investigative activities. Such meetings are not reflected in Table 10-2.

Prior to directly engaging with the broader community, Aurora LNG will take direction and seek the support of each First Nation's respective leadership. Given the very early stages of the proposed Project and initial phases of determining site viability, Aurora LNG has not yet formally held community meetings with any of the First Nations.

**Table 10-2 Summary of Aboriginal Engagement January 1, 2013 to May 15, 2014**

First Nation	No. of Meetings
Lax Kw'alaams	6
Metlakatla	12
Gitxaala	4
Kitselas	6
Kitsumkalum	6
Coastal First Nations	4



### 10.1.5 Key Issues Identified by First Nations to Date

Table 10-3 provides a high-level overview of comments and concerns expressed by First Nations through engagement efforts to date.

**Table 10-3 Concerns and Interests Identified by First Nations**

Area of Interest and/or Concern	Concern and/or Interest Identified
Emissions	Potential effects on air quality Increased greenhouse gases Potential effects of dust, noise and light emissions
Freshwater Resources	Potential effects on freshwater quality, fisheries habitat and aquatic species Concern over demands for freshwater during construction and operations
Marine Resources	Potential effects on marine habitat and species fisheries values Potential effects on marine fisheries Protection of marine harvesting areas for traditional use Potential effects on aquaculture
Shipping	Increased measures to prevent accidents, manage shipping traffic, emergency response, spill response and establish higher ship standards Potential effects on commercial aquaculture and fisheries Potential effects on anchorage sites Marine pollution due to waste water and bilge water disposal Restricted access zones
Land	Potential effects on vegetation and wildlife Potential effects on viewscales
Archaeological Resources	Potential effects on archaeological resources and historic sites
Governance/Rights and Title	Historic lack of recognition by government and proponents of First Nation aboriginal rights and title Potential effect on exercise of traditional and current uses, food supply and aboriginal rights and title Increased role for First Nations in stewardship of lands and resources, management of spill response etc.
Benefits	Historic lack of acceptable benefits Fair share of long-term benefits and profits Preferred access to business opportunities along the value chain Full access to training, education and employment opportunities Need for green energy to offset greenhouse gas emissions
Cumulative Impacts	Effective mitigation and compensation strategies required to offset the potential cumulative effects of a high number of proposed industrial development projects in Prince Rupert area

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Area of Interest and/or Concern	Concern and/or Interest Identified
Historic Remediation Issues	Past industrial sites have not been properly cleaned up (e.g., Watson Island) Past problems in clean up after marine accidents (e.g., Queen of the North)
EA Process /Project Reviews	Concern about rigor of historical environmental process generally and specifically in assessing effects of projects on Aboriginal rights and interests Historical inadequacy of assessments of regional and cumulative effects Historical inadequacy in funding for project reviews Concern for adequate traditional use studies and baseline studies Concern for adequate assessment of socio-cultural effects
Health	Potential effects on First Nation communities health and well-being
Access	Need for improved access for coastal communities – road access where feasible, improved infrastructure

#### 10.1.6 Ongoing Aboriginal Engagement and Consultation

Through ongoing engagement and consultation with each First Nation, Aurora LNG's goals are to enhance the leadership's and community's understandings of the proposed Project, and to identify and advance our understanding of the interests and views of the leadership and community members regarding potential effects of the development on their communities and culture. These exchanges will continue to inform proposed Project planning, and provide the basis for developing mitigation strategies to minimize potential effects on Aboriginal interests.

Specifically, the objectives of Aurora LNG's engagement and consultation program include the following.

- Develop an agreed upon engagement schedule to share information with the First Nation leadership and communities regarding the proposed Project
- Conduct a range of engagement activities to facilitate the inclusion of all interested and affected Aboriginal peoples
- Ensure adequate capacity funding for participation in consultation activities
- Engage in negotiations to develop agreements to deliver community benefits
- Fund and /or support Traditional Use Studies to support the Project environmental assessment and to identify measures to mitigate adverse effects on Aboriginal interests, including areas or resources of cultural or ecological importance, Project design and reduce the likelihood of disturbing culturally and ecologically significant areas
- Collaborate to identify opportunities for Nations' participation in environmental studies
- Collaborate to determine areas of particular interest, and organize technical meetings and/or workshops to advance the mutual understanding of these issues (e.g., marine safety, marine and land use, air quality)
- Identify opportunities to assist in building the knowledge, capacity and skills necessary to engage more fully in the direct and indirect benefits of Project development.

### **10.1.7 Ongoing Engagement and Consultation Methods – June 2014 onwards**

Aurora LNG will continue to work with the First Nation leadership and community representatives to identify the most appropriate methods of engagement (e.g., meetings, open houses, world cafés) and communication materials (e.g., displays, handouts) to support engagement activities, and ensure that First Nation communities have an opportunity to offer their input and feedback on the proposed Project. Aurora LNG will use various communication tools to foster understanding across a range of ages and literacies, such as poster boards, maps, flow charts, presentations, hand-outs and open discussions. Notices for community meetings will be distributed through various media well in advance to maximize community participation.

Ongoing exchanges at the Project conceptual stage are intended to help establish and build trust with the leadership and community members by being open and transparent. Aurora LNG will continue to track and document engagement activities and build a list of the First Nations' concerns and specific issues. Aurora LNG will promptly respond to requests by First Nation community members regarding Project activities, prepare briefings as necessary, and will ensure that information is presented in a manner that is understandable to the community members. Through this process, Aurora LNG will also work with the Nations to ensure issues requiring follow-up are identified, actioned, and tracked to ensure a timely response. To facilitate effective communication during field work and ongoing consultation, Aurora LNG will work with First Nation representatives to develop protocols to ensure the timely exchange of information.

Engagement and consultation methods may include the following:

- One-on-one meetings with Chief and Council, Band Economic Development Officers, Land and Resource Officers, and other Band-based office representatives
- Formal meetings with community groups such as Elder and youth committees
- Workshops
- World cafés
- Community Advisory Committee
- Open Houses in communities
- Issue-specific information sessions
- Technical meetings
- Tours and site visits
- School presentations
- Career fairs and trade shows
- Advertisements in community newsletters and local radio stations

In addition to scheduled engagement activities, Aurora LNG project members will participate, whenever possible, in community events and identify opportunities to support First Nations community celebrations and cultural events.

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## 10.2 Government Engagement

Over the last two years, Aurora LNG has met with various municipal, provincial, and federal agencies. These include the following:

### Municipal and Regional Government

- City of Prince Rupert
- Skeena Queen Charlotte Regional District

### Provincial Government

- BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO)
- BC Ministry of Aboriginal Relations and Reconciliation (MARR)
- BC Ministry of Transportation and Infrastructure (MOTI)
- BC Ministry of Environment (MOE)
- BC Ministry of Jobs, Tourism and Innovation (MJTI)
- BC Environmental Assessment Office (EAO)
- BC Oil and Gas Commission (OGC)

### Federal Government

- Canadian Environmental Assessment Agency (CEAA)
- Environment Canada (EC)
- Fisheries and Oceans Canada (DFO)
- Natural Resources Canada (NRCan)
- Transport Canada
- Prince Rupert Port Authority

During these meetings, Aurora LNG introduced the joint venture and the Aurora LNG Project to the agencies, and began preliminary discussions regarding their concerns and potential social, economic, environmental and regulatory issues regarding the Project.

Ongoing consultation with government is planned to continue throughout the planning, construction and operations of the Project.

## 10.3 Stakeholder and Public Engagement

Early engagement with key stakeholders and the public is integral to the success of the Project and earning the Aurora LNG's social license to operate. As with First Nations communities, solid relationships develop through building mutual trust and a shared understanding of issues.

Aurora LNG will ensure engagement and consultation processes are inclusive, and provide stakeholders and the public with opportunities to identify their concerns and provide their input to inform Project

planning and the regulatory process. The goals of the stakeholder engagement and consultation program are to:

- Introduce Aurora LNG and the proposed Project at the conceptual stage
- Facilitate stakeholders' and communities' understanding of the potential effects of the Project
- Establish dialogue to understand the views and perceptions of stakeholders and communities, and provide opportunities for them to influence Project planning
- Identify how Aurora LNG can work with stakeholders and communities to address issues (e.g., social and environmental effects, business development, training) and develop possible mitigation strategies.

Aurora LNG has yet to initiate consultation and engagement with stakeholders and the public. When the formal consultation phase commences, activities will involve a broad range of stakeholders in the Prince Rupert, Port Edward and surrounding areas who could be affected or has an interest in the Project. The main stakeholder groups include:

- Residents, individuals, and landowners
- Municipal, provincial and national governments representatives, and regulatory bodies
- Elected officials
- Non-governmental organizations (NGOs), environmental NGOs (ENGOs), and civil society organizations (e.g., Chamber of Commerce)
- Educational institutions (e.g., public, secondary, post-secondary, vocational)
- Emergency and medical services
- Media (e.g., local and regional radio stations, newspapers)
- Industry partners and peers
- Other business and industry sectors (e.g., recreational and commercial fishing, forestry, tourism, outfitting, guiding, hospitality)
- Contractors and suppliers.

### **10.3.1 Stakeholder and Public Engagement and Consultation Methods**

Aurora LNG will use various media to notify stakeholders and community members of engagement activities planned for the Project. Public consultation will focus on timely sharing of information about the Project and providing opportunities for the public to identify their interests and concerns. Information gained through the stakeholder and public engagement and consultation program will assist in informing key issues related to the Project, integration of local knowledge into Project planning, and development of mitigation strategies.

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The following activities are integral to the successful delivery of Aurora LNG's stakeholder and public engagement and consultation program.

- Confirming individuals and organizations to be engaged and consulted
- Developing communication plans to ensure timely sharing of Project information with the public, stakeholders and local communities
- Ensuring information sessions and communication plans are tailored to meet the needs of the event participants
- Organizing activities that engage diverse populations and ensuring all participants' voices and concerns are heard
- Employing a variety of communication tools and media (e.g., handouts, display panels, fact sheets, advertisements, web-based discussion forums, and PowerPoint presentations) to address diverse audiences and in accessible language
- Gathering information and identifying concerns and issues of the public and stakeholders to help inform Project design and the regulatory process
- Implementing and maintaining a stakeholder tracking database for documenting engagement activities and communications with the public, stakeholders and communities; logging issues and concerns, tracking commitments and monitoring follow-up.

Engagement and consultation activities may include the following.

- One-on-one meetings
- Community and public information sessions
- Feedback cards
- Open houses
- World cafés
- Focus groups
- Workshops and issue-specific information sessions and technical meetings
- Tours and site visits
- School presentations
- Career fairs, trade shows and conferences.

In addition to scheduled engagement activities, the Aurora LNG engagement team will also participate, whenever possible, in community events.

## **PART E - REFERENCES**

## 11 REFERENCES

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