Construction Marine Transportation Management and Monitoring Plan

Woodfibre LNG Project

September 15, 2023

123221624EN-RPT0027

Woodfibre LNG

Preamble

The Woodfibre Liquefied Natural Gas Project (the Project) is a liquefied natural gas export facility being constructed on the former Woodfibre Pulp and Paper Mill site in Átl'ḵa7tsem (Howe Sound), approximately seven kilometres south of Sḵwx̱wú7mesh (Squamish). The Project is on the historical location of a Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) village known as Swiy̓át. Swiy̓át and Átl'ḵ'a7tsem (Howe Sound) are tied to the cultural well-being of Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) members, their ancestors, and their descendants, and to other Indigenous groups as defined in the Project's Environmental Assessment Certificates. The Project is also operating within the traditional, ancestral, and unceded territory of the səlilwətaɬ (Tsleil-Waututh) Nation. Woodfibre LNG General Partner Inc. recognizes the importance of these areas to the Sḵwx̱wú7mesh stélmexw (Squamish People), and other Indigenous groups. Woodfibre LNG General Partner Inc. seeks to construct and operate the Project in a manner that is respectful of Indigenous values. This Construction Marine Transportation Management and Monitoring Plan) is primarily written in English with important place names, species, phrases, and passages provided in Sḵwx̱wú7mesh sníchim (the Squamish language).

Temíxwiy̓iḵw chet wa naantem chet ti temíxw Swiy̓át
Chet wa sméṅhemswit kwis ns7éyx̱nitas chet ti temíxw
We7ú chet kwis t'íchimwit iy íẇas chet eḵ' I tti.

Our ancient ancestors named this place Swiy̓át
We, as their descendants safeguard these lands
We will continue to swim and fish in these clear waters.

Limitations and Sign-off

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Reviewed by: Digitally signed by Geoff Rousseau, P.Ag., B.Sc. Date: 2023.09.15 11:04:51 -07'00'

Signature

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Approved by: Tso, Karen Digitally signed by Tso, Karen Date: 2023.09.15 11:10:21 -07'00'

Signature

Karen Tso, PMP, EP, B.Sc.

Printed Name

[1] A draft version of this Construction Marine Transportation Management and Monitoring Plan was prepared by Hemmera, a subsidiary of Ausenco. The draft version has been revised and updated by Stantec Consulting Limited (Stantec) at the request of Woodfibre LNG General Partner Inc.

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Squamish-English Translations

Squamish	English
Átl'ka7tsem	Howe Sound
aẏx	Dungeness crab
ch'áatl'am	hunting
cháyilhen	salmon
K'emk'emeɬáẏ	Vancouver
K'íkʼelxn	Port Mellon
Kwtsá7tsutsin	Darrell Bay
lháwichen	pink salmon
ínexwantas	monitoring
Mámxwem	Mamquam
Shisháyu7ay	Britannia Beach
shkweṅ	ocean
Skwxwú7mesh	Squamish
Skwxwú7mesh sníchim	Squamish Language
Skwxwú7mesh stélmexw	Squamish people
Skwxwú7mesh Úxwumixw	Squamish Nation
slhawt'	herring
St'a7mes	Squamish Harbour
Sts'íts'a7kin	Watts Point
sts'úkwi7	fish
Swiẏát	Woodfibre LNG site and historical Skwxwú7mesh Úxwumixw (Squamish Nation) village location
úxwumixw	village
Xwekw'ále7em	Porteau Cove

Abbreviations

AIS	Automatic Identification System
BC	British Columbia
BCEAA	British Columbia *Environmental Assessment Act*
BC EAO	BC Environmental Assessment Office
CCG	Canadian Coast Guard
CEMP	Construction Environmental Management Plan
CNWA	*Canadian Navigable Waters Act*
CPA	Certified Project Area
CSA	*Canada Shipping Act*
DFO	Fisheries and Oceans Canada
DoS	District of Squamish
EAC	Environmental Assessment Certificate
EMP	Environmental Management Plan
FDS	Federal Decision Statement
IMO	International Maritime Organization
km	kilometre
lbs	pounds
LNG	liquified natural gas
MCTS	Marine Communications and Traffic Services
MSZ	Marine Safety Zone
MTMMP	Marine Transport Management and Monitoring Plan
MUG	Marine Users Group
NPP	Navigation Protection Program (TC)
PFMA	Pacific Fisheries Management Area
the Project	Woodfibre Liquefied Natural Gas Project
RCA	Rockfish Conservation Area
SNEAA	Squamish Nation Environmental Assessment Agreement

SWS	Squamish Windsports Society
TERMPOL	Technical Review Process of Marine Terminal Systems and Transshipment Sites
TSB	Transportation Safety Board
VHF	Very High Frequency
VTS	Vessel Traffic Services
Woodfibre LNG	Woodfibre LNG General Partner Inc.

Glossary

Adaptive Management	A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs.
Adverse Effect	An effect that is detrimental to a specific valued component relative to baseline.
Application	The environmental assessment application filed by Woodfibre LNG with the BC Environmental Assessment Office in respect to the Project.
Construction	Upgrading, repairing, replacing, and removing any existing work or infrastructure, and building new infrastructure.
Emergency	A situation that calls for immediate and targeted action because it has resulted or may result in undue risk to the health and safety of Project personnel or the public, significant damage to property or equipment, significant damage to public property or equipment, and damage to the environment.
Floatel	A temporary self-contained floating worker accommodation.
Project Marine Access Route	The navigational route that a Project vessel, including passenger ferries, water taxis, and cargo vessels, is expected to transit when moving equipment, materials, or workers to and from the Certified Project Area during the construction phase of the Project.
West-Barr Lease	The West-Barr Lease, an industrial site located on the east side of Mamquam Blind Channel, in St'a7mes (Squamish Harbour) will provide worker transportation via water taxi and passenger ferry access to the site, and will accommodate parking requirements
Stakeholders	Persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively.
Reporting Metrics	Used to measure and track the effectiveness and/or implementation of mitigation objectives.
Rights and Title Holders	Indigenous peoples' rights and title that are protected under the Canadian Constitution.

Squamish Nation Environmental Assessment Agreement	The formal agreement entered Sḵwx̱wú7mesh Úxwumixw and Woodfibre LNG which establishes Sḵwx̱wú7mesh Úxwumixw Conditions applicable to the Project and describes the process by which the Conditions will be satisfied.

1.0 INTRODUCTION

1.1 OVERVIEW

Woodfibre LNG General Partner Inc. (Woodfibre LNG) will construct and operate the Woodfibre Liquefied Natural Gas Project (the Project), which is located on the former Woodfibre Pulp Mill site approximately seven kilometres (km) southwest of Sḵwx̱wú7mesh (Squamish), British Columbia (BC) (Figure 1). The Project will have capacity to liquefy up to 2.1 million tonnes per year of natural gas, have a storage capacity of 250,000 cubic metres (m^3), and export the liquefied natural gas (LNG) via tankers.

The Project underwent a comprehensive environmental assessment process from 2013 to 2015 and Woodfibre LNG received:

- an environmental assessment certificate (EAC) for the Certified Project Area (CPA) under the British Columbia *Environmental Assessment Act* (BCEAA; EAC #E15-02) in 2015;
- an environmental assessment approval from Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) through the Squamish Nation Environmental Assessment Agreement (SNEAA) in 2015, and;
- a positive federal Decision Statement under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) in 2016.

Two EAC amendments were granted by the BC Environmental Assessment Office (EAO) in 2017 and 2019, and the federal Decision Statement was reissued in 2018 in response to changes to the Designated Project. Woodfibre LNG also received an extension on EAC#15-02 from the BC EAO in October 2020. The provincial, Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), and federal environmental assessment processes have each yielded conditions of approval that Woodfibre LNG must address.

Most of the Project is on fee simple, industrially zoned, brownfield lands with more than 100 years of industrial use. There is no road access to the CPA, and all personnel, equipment, and supplies for the Project will be brought in by vessel via Átl'ḵa7tsem (Howe Sound). The Project will use electrical power sourced from BC Hydro, and gas will be supplied to the facility by Fortis BC.

The CPA and key project components are illustrated in Figure 2. Key project components are:

- land-based natural gas processing and liquefaction facilities
- a floating storage and offloading unit
- construction worker accommodation
- supporting infrastructure

The supporting infrastructure includes buildings (e.g., administration, control rooms, maintenance, dry storage and chemical, fire house, first aid, safety and guardhouse), fencing (temporary and permanent), material storage and laydown areas, utility and loading lines, and boil off gas vapour lines.

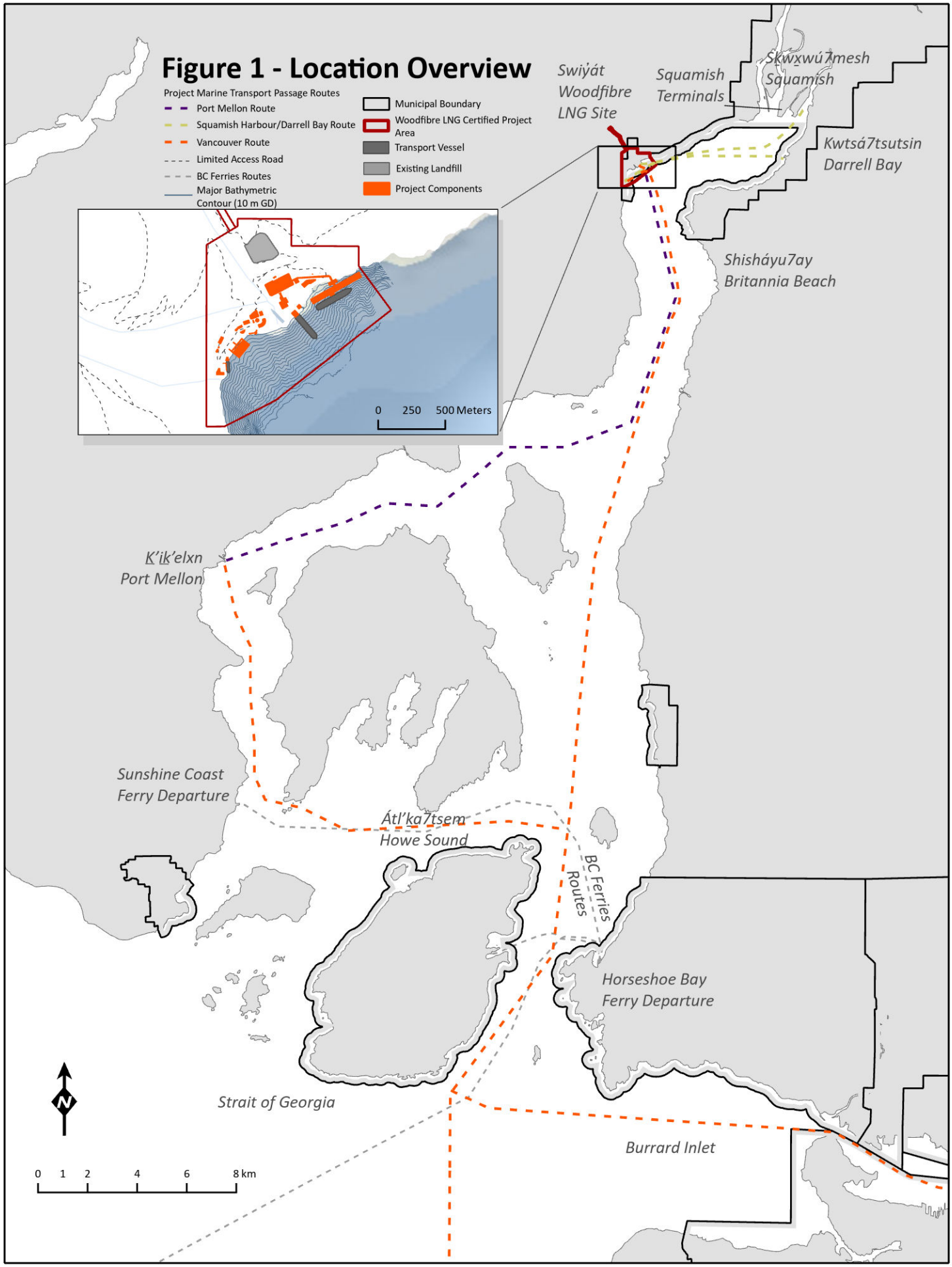
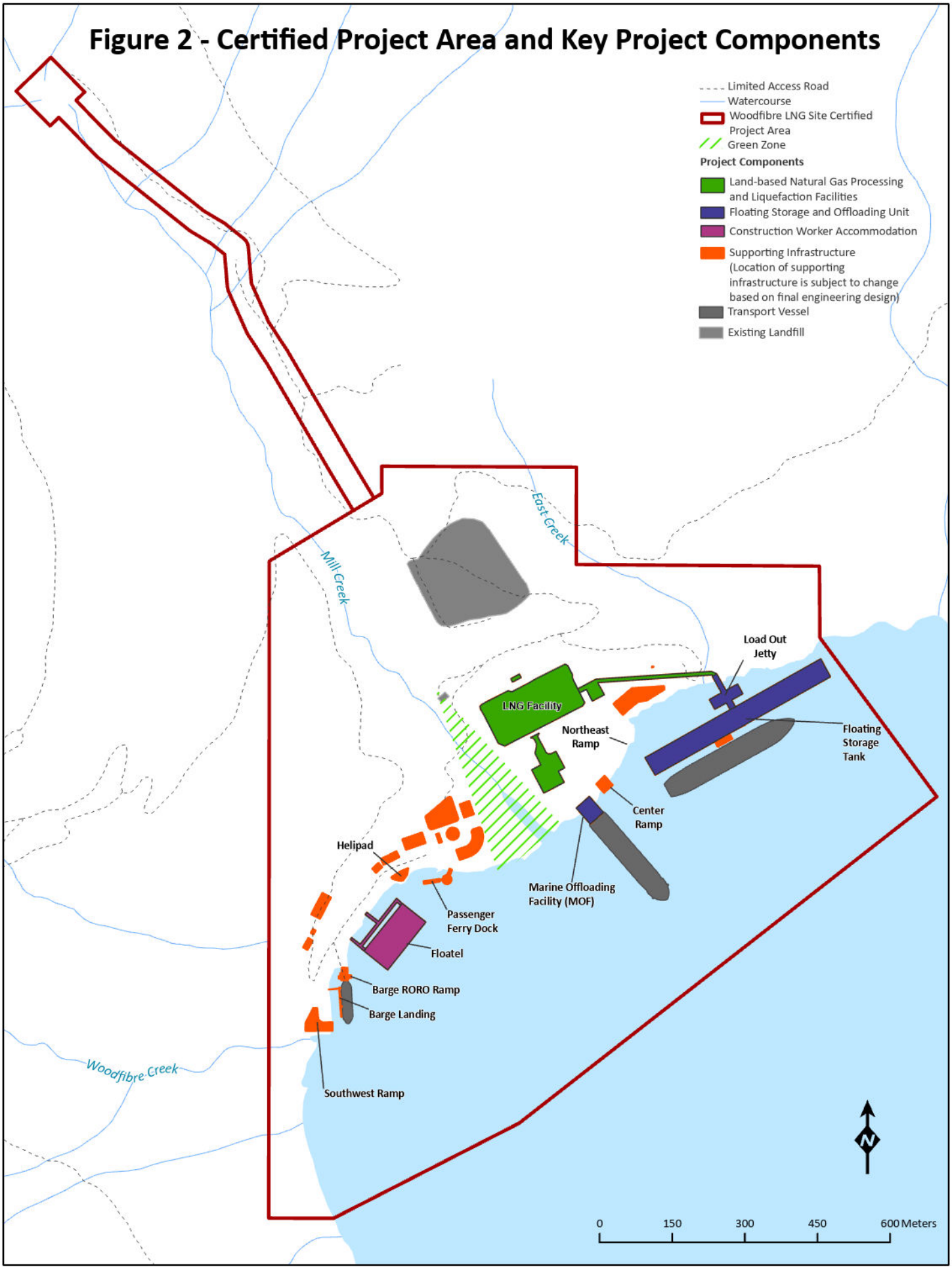


Figure 1 - Location Overview
Project Marine Transport Passage Routes
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Limited Access Road
BC Ferries Routes
Major Bathymetric Contour (10 m GD)
Municipal Boundary
Woodfibre LNG Certified Project Area
Transport Vessel
Existing Landfill
Project Components
0 250 500 Meters
Swiy̓át
Woodfibre
LNG Site
Squamish
Terminals
Sḵwx̱wú7mesh
Squamish
Kwtsá7tsutsin
Darrell Bay
Shisháyu7ay
Britannia Beach
K'ik'elxn
Port Mellon
Sunshine Coast
Ferry Departure
Át'ka7tsem
Howe Sound
BC Ferries
Routes
Horseshoe Bay
Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

Figure 2 - Certified Project Area and Key Project Components



The works and activities that will occur as part of construction include, but are not limited to:

- marine early works (e.g., shoreline improvements and armoring, dock replacement or repairs), including improvements to the existing in-service (east and south) barge landing
- clearing vegetation and grubbing
- stripping and grading
- drilling and blasting, including excavation, crushing, screening, and hauling
- grouting and rock stabilization
- road, culvert, and bridge works
- construction of land-based natural gas processing and liquefaction facility
- construction support structures, services, and equipment
- construction of the floating storage and offloading unit
- marine facility construction of mooring dolphin supports and connecting trestles and gangways
- dredging if required

1.2 OBJECTIVE

The objective of this Construction Marine Transportation Management and Monitoring Plan (Construction MTMMP) is to satisfy relevant EAC, FDS, and SNEAA conditions, as well as relevant mitigation commitments provided in Table 22-1 of the EAC Application.

Specifically, this Plan has been developed to address:

- EAC #15-02 Condition 16 (Marine Transportation and Monitoring Plan – Construction)
- FDS Condition 7.1
- Mitigation measures enabled by Condition 12 of SNEAA
- Relevant Table 22-1 EAC Application mitigation commitments

These conditions and mitigation measures are described further below. An Operations MTMMP will be prepared for the operations phase of the Project, which will include specific mitigation measures developed for the operation of LNG carriers and other vessels.

This Construction MTMMP is a living document and revisions will be made if relevant new information becomes available through the progression of the detailed engineering design of the Project, changes in legislation or regulation, if performance objectives are not met, or as required by Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), Tsleil-Waututh Nation, and/or regulatory agencies. If the Construction MTMMP requires updating, Woodfibre LNG will prepare a red-line version identifying the changes that are made. The red-line version will be issued to Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), Tsleil-Waututh Nation, and regulatory agencies for a 30-day review and comment period. After comments are received, the document will be updated and issued as a clean final revision for approval by Sḵwx̱wú7mesh Úxwumixw (Squamish Nation). As standard practice, the latest approved version of the Construction MTMMP will be implemented.

1.2.1 EAC Conditions

This Construction MTMMP has been developed to satisfy EAC Condition 16. Concordance of the sections of this Construction MTMMP with the specific requirements of EAC Condition 16 is provided in Table 1.

Table 1: EAC Condition Relevant to the Construction Marine Transportation Management and Monitoring Plan

Regulatory Instrument	Requirement	Cross-Reference
EAC Condition 16	The Holder must develop, in consultation with Transport Canada, Fisheries and Oceans Canada (DFO), Canadian Coast Guard (CCG), Pacific Pilotage Authority Canada, the District of Squamish (DoS), BC Ferries, Squamish Terminals, and Aboriginal groups a marine transport management and monitoring plan for the Project's construction phase.	Construction MTMMP
	Identify the means by which the marine transportation mitigation measures related to construction in the Application Table 22-1 under the heading "marine transport" (6.0, M7.3-1 to M7.3-17) will be implemented.	Section 6.0
	Identify construction activities that have the potential to interfere with marine navigation.	Section 4.0
	Identify existing and traditional navigational routes, fishing areas, habitat areas, harvesting areas, commercial shipping use, recreational and tourism use, Aboriginal groups' use, and any associated timing windows.	Section 5.0 Section 5.1 Section 0 Section 5.3 Appendix C
	Identify actions to inform affected stakeholders and Aboriginal groups of potential interference with marine navigation as a result of construction activities.	Section 7.0 Section 7.1
	Identify methods to coordinate activities with other marine users, including FortisBC.	Section 7.0 Section 7.1 Section 7.2
	Identify methods to minimize displacement of marine-based recreational activities.	Section 6.0 Section 6.1.5 Section 6.2.1 Section 6.2.3
	Identify mitigation measures to reduce disruption of marine navigation in Howe Sound as a result of construction activities.	Section 6.0 Section 6.1.5 Section 6.2.1 Section 6.2.3
	Identify methods to monitor the effects of the Holder's shipping activities on marine users during construction.	Section 8.0
	The Holder must provide the plan to EAO, Transport Canada, CCG, Pacific Pilotage Authority Canada, DFO, the DoS, BC Ferries, Squamish Terminals, and Aboriginal groups no less than 30 days prior to the Holder's planned date to commence construction. The Holder must implement the plan to the satisfaction of EAO.	Construction MTMMP

1.2.2 FDS Conditions

This Construction MTMMP has been developed to satisfy FDS Condition 7.1. Concordance of the sections of this Construction MTMMP with the specific requirements of FDS Condition 7.1 is provided in Table 2.

Table 2: FDS Conditions Relevant to the Construction Marine Transportation Management and Monitoring Plan

Regulatory Instrument	Requirement	Cross-Reference
FDS 7.1	The Proponent shall, in consultation with Aboriginal groups and other marine users, develop, prior to construction, and implement, during all phases of the Designated Project, a communication protocol related to marine transportation. The communication protocol shall include procedures and practices for sharing information between the Proponent and Aboriginal groups and other marine users.	Section 7.0
FDS 7.1.1	Identify the location and timing of the construction activities associated with the Designated Project-related location and timing of ferry and water taxi traffic associated with the Designated Project and location of the marine access route to be used by the LNG vessels associated with the Designated Project in Howe Sound.	Section 4.0 LNG Vessels Applicable to Operations
FDS 7.1.2	Identify the location and timing of traditional activities by Aboriginal groups and activities by other marine users.	Section 5.0
FDS 7.1.3	Identify Designated Project -related safety procedures such as navigation aids, updated navigation charts, and use of escort tugboats.	Section 6.0 Section 6.1.3 Section 6.1.4
FDS 7.1.4	Identify areas where navigation may be controlled for safety reasons.	Section 6.0 Section 6.1.1
FDS 7.1.5	Provide speed profiles and schedules applicable to the operation of LNG Carrier vessels associated with the Designated Project.	Applicable to Operations; not included in the Construction MTMMP
FDS 7.1.6	Identify the ways in which Aboriginal groups and other marine users can provide feedback to the Proponent about the adverse environmental effects related to navigation caused by the activities associated with the Designated Project, including construction activities and the operation of ferry, water taxi and LNG vessels.	Section 7.0

1.2.3 SNEAA Conditions

The Sḵwx̱wú7mesh Úxwumixw's (Squamish Nation's) environmental assessment process for the Project was designed to parallel the federal and provincial environmental assessment processes, whereby project effects on the Sḵwx̱wú7mesh stélmexw (Squamish people)'s rights and title interests are identified, understood, and properly avoided or mitigated. The process for the Project ultimately resulted in the Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) issuing an environmental assessment certificate (#2015-001), which includes conditions described in the SNEAA that was issued on October 14, 2015. Per SNEAA, "*Squamish Nation has agreed that Woodfibre may proceed with carrying out the Project, subject to Woodfibre LNG meeting, and (as applicable) continuing to meet, the Squamish Nation Conditions as provided for in this Agreement.*"

The SNEAA Condition 12, which has applicability to the Construction MTMMP, states:

4.12 Binding Mitigation Measures – Squamish Condition #12

(a) Woodfibre LNG identifies approximately 119 distinct mitigation measures in Table 22-1 of Woodfibre LNG's environmental assessment application. If Squamish Nation determines that it wishes to monitor any of the mitigation measures, then Squamish Nation will issue a notice to Woodfibre LNG identifying which mitigation measures it intends to monitor ("Monitored Mitigation Measures") and the manner it proposes to undertake such monitoring.

(b) Where Squamish Nation is of the opinion that any Monitored Mitigation Measure is not being followed, it will notify Woodfibre LNG. Woodfibre LNG will respond to the notification with one of the following (the "'Response"):

(i) Woodfibre LNG's explanation of how the mitigation measure is being followed;

(ii) a written explanation why the mitigation measure is not being followed, and the measure that replaces it (with an explanation of how the new measure provides equal or greater levels of environmental protection)

(iii) A written explanation of why the mitigation measure is not being followed, with justification for:

a. why it has not been replaced with another measure, or

b. why it has been replaced with a measure that provides less levels of environmental protection

(c) Woodfibre LNG will develop a Monitored Mitigation Measures plan with the Squamish Nation that will include the frequency of guided tours for the Squamish Nation during construction and operations and a budget to implement the plan, which plan will be fully funded by Woodfibre LNG.

(d) *Should Squamish Nation not be satisfied with the Response, then the Squamish Nation may submit the matter to the dispute resolution process set out in section 8.1 and if the reasonableness of the Response is at issue the expert or expert panel shall consider the following when making its decision: whether the mitigation measure has a material impact on constructability, cost, operability, safety, environment, or schedule; whether the mitigation measure creates unacceptable risk or legal liability for the Project; whether the mitigation measure conflicts with any legal, regulatory, or pre-existing contractual obligations of Woodfibre LNG; whether the Woodfibre LNG response to the proposed mitigation measure(s) conforms to Good Industry Practice; and any other information the expert or expert panel considers relevant.*

Per Condition 6 (Section 4.6) of the SNEAA, the Construction MTMMP is considered a Regulated Environmental Management Plan (EMP), meaning that it is an EMP requiring approval from Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) in accordance with Section 4.6(e) of the SNEAA.

1.2.4 EAC Application Table 22-1 Commitments

Table 3 cross-references the sections of this Construction MTMMP to construction marine transport commitments and mitigation measures named in Table 22-1 of the EAC Application. Table 22-1 mitigation measure descriptions are provided in Appendix A.

Table 3: Summary of Mitigation Measures Applicable to Construction and Associated Environmental Management Plans

Mitigation Number	Mitigation Name	Project Phase	Environmental Management Plan Containing Mitigation
M6.3-1	Squamish Harbour Vessel Plan	Construction	This Plan, 6.2.3
M7.3-1	Marine Transport Management Plan	Construction	This Plan, Construction MTMMP
M7.3-2	Navigational Aids and Lights	Construction	This Plan, 6.1.4
M7.3-3	Notices to Mariners and Notices to Shipping (now called NAVWARNs – Navigational Warnings)	Construction	This Plan, 6.1.3
M7.3-4	Update navigational charts and nautical publications	Construction	This Plan, 6.1.3
M7.3-5	Compliance with maritime regulations and legislation	Construction	This Plan, 2.1
M7.3-6	Consultation with BC Ferries and Squamish Terminals	Construction	This Plan, 7.0
M7.3-14	Consultation with recreational stakeholder groups in Howe Sound	Construction Operation	This Plan, 7.0
M7.4-2	Collaborate with Matthews Southwest and Bethel Lands Corporation and District of Squamish to minimize displacement of recreation activity	Construction Operation	This Plan, 7.0

2.0 REGULATORY FRAMEWORK

2.1 MARITIME REGULATORY FRAMEWORK

Transport Canada administers several Acts and regulations applicable to marine transportation, including:

- *Canada Shipping Act, 2001* (2019)
- *Canadian Navigable Waters Act* (2019)
- *Pilotage Act* (2001)
- *Transportation of Dangerous Goods Act, 1992* (2019)
- Transportation Safety Board Regulations (2018)
- *Marine Transportation Security Act,* including Marine Security Regulations (2004)

The *Canada Shipping Act* (CSA) incorporates International Maritime Organization (IMO) conventions into a framework that governs the operation of vessels in Canadian waters and establishes an umbrella framework for shipping regulations within Canada. Vessels that are Canadian flagged are, in most cases, exempt from IMO conventions that are also implemented through the CSA. Under the CSA, Project and other vessels transiting through Átl'ka7tsem (Howe Sound) must adhere to the requirements of the Collision Regulations. These regulations outline the requirements of safe navigation in marine waters.

The Collision Regulations establish the standards and procedures to reduce the likelihood of a collision and outline responsibilities of vessels underway, determining the craft with right-of-way, when two vessels are in an overtaking, crossing or head-on situation. Key requirements are included, pertaining to:

- always maintaining a look-out
- protocols for navigating narrow channels
- vessels under 20 m (65'7") in length and sailing ships yielding to larger vessels
- specific requirements for navigating near vessels with limited maneuverability (e.g., vessels under sail, fishing vessels, row boats and any other vessel with limited maneuverability)
- ensuring safe speed to stop the vessel within a distance appropriate to the prevailing circumstances
- crossing situations
- head-on situations
- overtaking situations

The *Canadian Navigable Waters Act* (CNWA) protects the public's right of navigation by regulating works that may interfere with navigation. Transport Canada administers the CNWA via the Navigation Protection Program (NPP). Woodfibre LNG or their Contractor will apply to the NPP for CNWA approval for Project components in navigable water and will provide information detailing the temporary construction works, profile drawings of temporary and permanent structures in water, locations of works, sequencing and staging, and lighting and signage to be used during construction. All components of the Project that may interfere with navigation will be screened under the CNWA; approval and a notice of works may be required, where necessary.

The *Pilotage Act* provides legislation for the establishment of four pilotage authorities in Canada. These Crown corporations have the responsibility of establishing, operating, and administering efficient pilotage services in their respective regions in Canada. The *Pilotage Act* is the enabling legislation for the Pacific Pilotage Regulations. These regulations outline the piloting requirements for the Project. It is expected that large construction vessels[2] and LNG carriers (during operations) transiting through Átl'ka7tsem(Howe Sound) will stop at the Fairway Buoy, Brotchie Ledge Pilot Boarding Station in Victoria, BC to pick up a BC Coast Pilot. The BC Coast Pilot will remain on board as the vessel transits through Átl'ka7tsem (Howe Sound) to the Project site. During operations, BC Coast Pilots are expected to be able to board LNG carriers along the marine shipping route in Victoria, Burrard Inlet, and at the Project site terminal itself.

The *Transportation of Dangerous Goods Act* promotes public safety when dangerous goods are being handled, offered for transport, or transported by water. It also establishes safety requirements for the transportation of dangerous goods. The *Transportation of Dangerous Goods Act* provides guidance regarding the reporting of any release or anticipated release (e.g., accidents or spills), in excess of a quantity or concentration specified by regulation from the means of containment, if it endangers, or could endanger, public safety.

The Transportation Safety Board Regulations, under the *Canadian Transportation Accident Investigation and Safety Board Act*, requires operators of vessels, other than pleasure craft, that have direct knowledge of a marine occurrence (e.g., capsizing, collision, grounding), to report marine occurrences to the Transportation Safety Board of Canada.

The *Marine Transportation Security Act,* like the *Transportation of Dangerous Goods Act,* is enforced by Transport Canada. The *Marine Transportation Security Act* applies to Canadian ships outside Canadian waters and to all ships and marine facilities within Canadian waters. This Act provides the framework for Canadian government participation in IMO conventions and standards. Under the *Marine Transportation Security Act*, Project and other vessels and facilities transiting through and/or operating in Átl'ka7tsem(Howe Sound) must adhere to the requirements of the Marine Security Regulations. The Marine Security Regulations provide a framework to detect security threats and take measures to prevent security incidents that could affect marine vessels and terminal facilities. These regulations outline the Project's requirement to develop and implement a security plan, which includes a means of ínexwantas (monitoring) and reporting out on its security plan's effectiveness.

[2] Local commercial vessels up to 10,000 gross register tonnage do not require a pilot, further local tug and barge companies can apply for annual pilotage waivers.

An overview of identified legislation and regulations applicable to marine transportation during the construction phase of the Project is provided in Appendix B.

2.2 TERMPOL

The Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) is a voluntary interdepartmental government review process that works to establish operational ship safety, route safety, management, and environmental concerns associated with the location and operation of a marine terminal system for large tankers handling oil, chemicals, liquefied gases, or other substances that may pose a risk to public safety or the environment. Transport Canada's Marine Safety division uses the outcomes of each TERMPOL to determine if regulations need to be written or modified for the safe operation of a marine terminal system or transshipment site. Woodfibre LNG prepared an initial TERMPOL that is currently being reviewed and updated. Ongoing work includes fast time simulation, traffic study and risk assessment review, and full mission bridge simulation. The construction phase of the Project does not require TERMPOL as it is applicable to the operations phase of the Project only.

3.0 ROLES AND RESPONSIBILITIES

Woodfibre LNG will develop and implement a shared responsibility framework recognizing that the management of marine transportation effects requires the involvement and cooperation of key Project entities, namely Woodfibre LNG, the Prime Contractor, and third-party vessel operators. An overview of key responsibilities as they pertain to marine transportation during the construction phase of the Project is provided in Table 4.

Table 4: Overview of Roles and Responsibilities

Entity	Role and Responsibility
Woodfibre LNG Marine Transportation Coordinator	Responsible for overall compliance with regulatory permits and approvals, including EAC conditions, FDS conditions, and SNEAA certificate conditions. Woodfibre LNG will appoint a Marine Transportation Coordinator, or a position to execute the duties outlined below, that will be accountable for the following activities during the construction phase of the Project: • Reviewing Contractor and Third-Party Vessel Operator compliance with management plans and applicable legislation • Reviewing Contractor's environmental orientation • Providing input into Contractor's permit applications, that may be required, and audit Contractor's environmental report compliance on an annual basis, or more frequently, as determined by Woodfibre LNG • External reporting and communications • Coordinating Project vessel traffic with other marine users of Átl'ka7tsem (Howe Sound) (i.e., FortisBC, Squamish Terminals, BC Ferries, and others), as outlined in this Construction MTMMP • Receiving inquiries from Átl'ka7tsem (Howe Sound) marine users, coordinating with the contractor and third-party marine transport operators, to resolve issues as practicable • Routinely providing Project vessel traffic information on the Project website • Responding to questions and concerns • Attending Marine User Group and vessel planning meetings and following up on action items
Contractor	Responsible for implementation of the Plan, including: • Undertaking work in compliance with management plans, environmental management plans, environmental approvals, permits, and authorizations. • Recording and reporting marine incidents to Marine Transportation Coordinator
Third-Party Vessel Operators (e.g., tug, water taxi, ferry, operators)	Responsible for compliance with the Plan, including: • Maintaining compliance with the applicable regulatory and safety requirements for the operation of watercraft • Adhering to relevant mitigation measures developed as part of this Plan • Recording and reporting any marine incidents to the Marine Transportation Coordinator.

Woodfibre LNG will establish a Marine User Group (MUG) that will meet twice during construction (or as necessary) to discuss construction milestones, identify areas of mutual concern, and inform further strategies to limit disruption to marine users resulting from construction activities. Additional mitigation and operating measures identified will be communicated to the Contractor and Third-Party Vessel operators, as necessary. Meetings will be advertised on the Project website.

It is expected that Indigenous groups and the stakeholders will be invited to attend MUG meetings[3]. Additional stakeholders that may be interested in attending MUG meetings will be able to express their interest through responding to meeting invites on the Project website.

[3] The EAC Application identified stakeholders that will be invited to attend MUG meeting including; Squamish Windsports Society, Squamish Paddleboarding Association, Squamish Yacht Club, Matthews Southwest, and Bethel Lands Corporation, FortisBC, Squamish Terminals and BC Ferries.

4.0 CONSTRUCTION ACTIVITIES THAT HAVE THE POTENTIAL TO INTERFERE WITH MARINE NAVIGATION

The Project's marine transportation and construction scope of work comprises the transportation of materials, equipment, and workers to and from the site along marine access routes, and the construction of marine-based Project components within the Project's marine CPA. The following sections provide a summary of these activities.

4.1 TRANSPORTATION OF MATERIALS, EQUIPMENT AND WORKERS

Project materials, equipment, and workers will be transported to and from the CPA by water, as the Project is not accessible by road. The primary Project marine access routes that will be used for marine transportation during construction are shown in Figure 3 and are:

- St'a7mes (Squamish Harbour) Route: passage from the West-Barr Lease[4] through Mamquam Blind Channel and St'a7mes (Squamish Harbour) to the CPA
- Vancouver Route: passage through Átl'ka7tsem (Howe Sound), including Queen Charlotte Channel, Passage Island between Point Cowan and Point Atkinson to Pam Rocks, Montagu Channel east of Anvil Island, continuing northeast of Defence Islands to the CPA
- Port Mellon Route: passage from K'íkelxn (Port Mellon) Átl'ka7tsem (Howe Sound), including Thornbrough Channel, north of Domett Point to St'a7mes (Squamish Harbour), and the CPA
- Darrell Bay Route[5]: passage from Darrell Bay to the CPA

A description of the main Project marine access routes and the construction phase is presented in Table 5.

[4] The West-Barr lease is a proposal from Indigenous owned businesses Harmony Group and Sko-mish Valley Security Services to provide marine transportation as an alternate to the use of Darrell Bay, a location that has the potential to impact the local tourism sector or other local recreational users.
[5] Darrel Bay Route to be used between September and November 2023.

Table 5: Marine Construction and Transportation Activities

Activity	Description	Marine Access Route	Approximate Distance
Transportation of Workers to/from the Project Site			
Early Works (pre-Floatel)	**Primary Route:** Workers will be transported via a passenger ferry from worker accommodation located at K̲'íḵ̲'elxn (Port Mellon) to the Site **Secondary Route:** Workers will be transported via water taxis departing from West-Barr Lease (only for daily workers). Darrell Bay will be used in the initial months of early works	K̲'íḵ̲'elxn (Port Mellon) Route St'a7mes (Squamish Harbour) Route Darrell Bay Route	28 km 9 km 6.5 km
Construction (Floatel in service) – Daily	**Primary Route:** Workers will be transported via a passenger ferry departing from West Barr Lease each day (ferry will have a capacity of approximately 100-200 passengers) **Secondary Route:** To handle periodic off-rotation and overflow, workers will be transported via a water taxi from K̲'emḵ̲'emel̓áy̓ (Vancouver)	St'a7mes (Squamish Harbour) Route/ K̲'emḵ̲'emel̓áy̓ (Vancouver) Route	9 km / 64 km
Construction (Floatel in service) Shift Changes	**Primary Route:** During shift changes workers will be transported via a passenger ferry from the Lower Mainland (ferry will have a capacity of approximately 100-200 passengers) **Secondary Route:** Workers will be transported via a passenger ferry departing from West-Barr Lease each day (ferry will have a capacity of approximately 100-200 passengers)	K̲'emḵ̲'emel̓áy̓ (Vancouver) Route/ St'a7mes (Squamish Harbour) Route	64 km / 9 km
Construction – As needed	Select local Contractor(s) or day visitors will be transported via water taxis departing from Mámxwem (Mamquam) West-Barr Lease, or a suitable alternative	St'a7mes (Squamish Harbour) Route	9 km
Transportation of Materials and Equipment to/from Project Site			
Construction – Mobilization	Cargo vessels departing from the Port of Vancouver will be used to transport heavy equipment (e.g., trucks, cranes, excavators) to site	K̲'emḵ̲'emel̓áy̓ (Vancouver) Route	64.1 km
Construction – Normal	Cargo vessels departing from the Port of Vancouver will be used to transport materials to site. Materials will be typically mounted on trailers, pallets, or loaded into containers. Materials may include pipe, steel, and supplies.	K̲'emḵ̲'emel̓áy̓ (Vancouver) Route	64.1 km
Construction – Modules	Deep sea cargo vessels departing from international ports will be used for transporting large, prefabricated modules, substructures, and floating storage tank vessels	K̲'emḵ̲'emel̓áy̓ (Vancouver) Route	TBD
Construction – Aggregates and wastes	Barges towed by tugs departing from K̲'emḵ̲'emel̓áy̓ (Vancouver) seaports will be used to haul aggregates to the site and waste materials away from the site for disposal at approved facilities	K̲'emḵ̲'emel̓áy̓ (Vancouver) Route	TBD

Example Project-related vessels that may be used during construction are presented in Table 6; vessels contracted may be subject to change depending on contractor requirements and availability.

Table 6: Project-related Vessels[1]

Vessel Type	Description					
	Example Vessel / MMSI[2]	Length (m)	Beam (m)	Deadweight Tonnage	AIS	Approximate Number of Passengers
Water Taxi	BCML VI	8.9	3.2	-	Class B	12
Barge	Seaspan 3100 Series	220	56	3,100	-	N/A
Passenger Ferry	Metal Shark Passenger Vessel	29.52	8.5	-	n/a	150-200
Cargo Vessel	BBC Michigan / 305460000	140	21	9,618	Class A	N/A
Deep Sea Cargo Vessel	White Marlin / 248750000	217	63	51,065	Class A	N/A

Note:

[1] For indicative purposes only; vessels presented are representative of the types of vessels that may be in operation during the construction phase of the Project, and do not necessarily represent the actual vessels that will be used. Vessels are subject to change depending on availability.

The Traffic Management and Monitoring Plan describes mitigation measures for the movement of materials, equipment, and personnel from designated laydown areas via the provincial highway network. Relevant mitigation measures identified for materials and equipment offloading, following the docking of vessels at site, are described in the Construction Environmental Management Plan (CEMP).

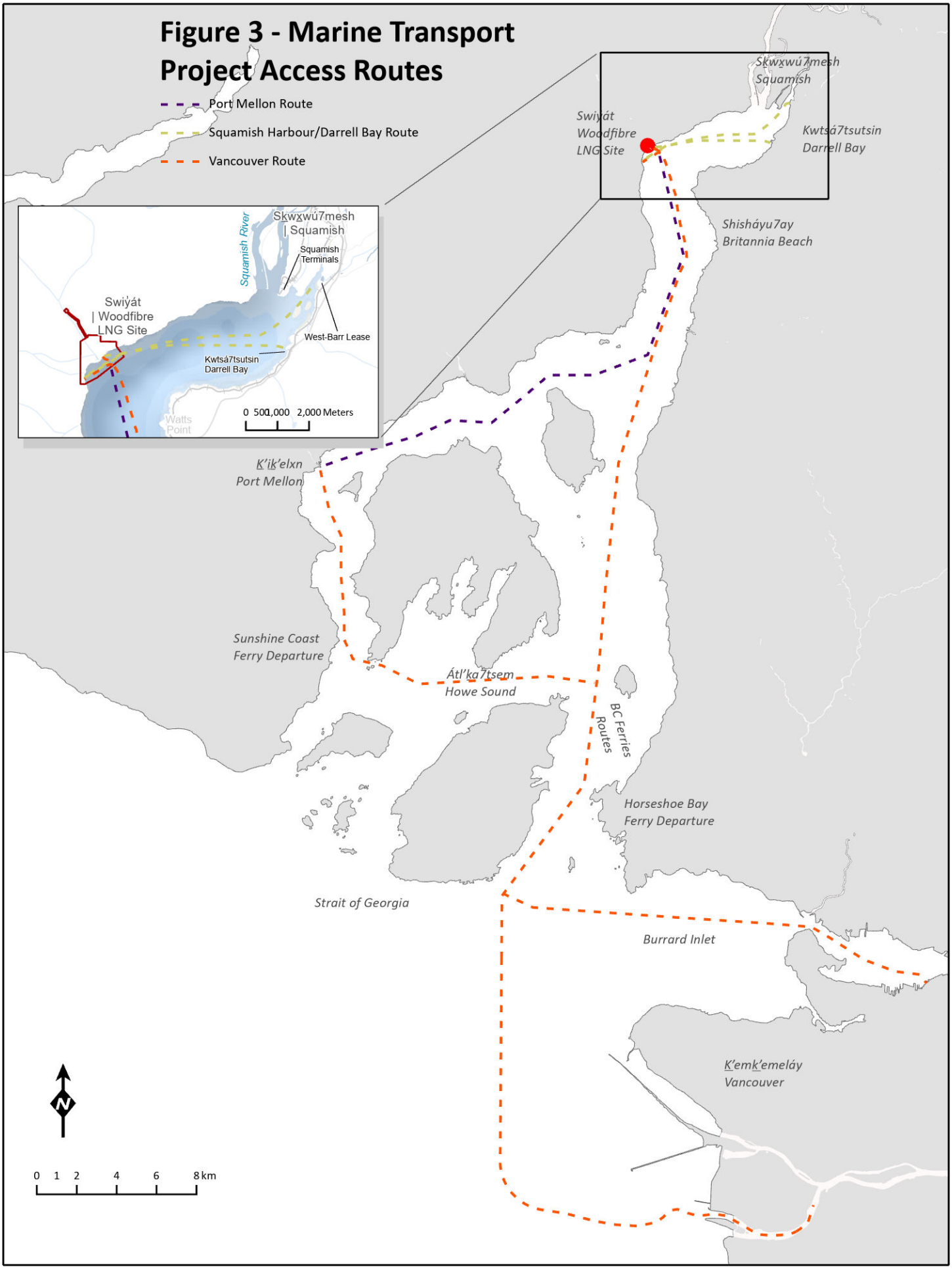


Figure 3 - Marine Transport Project Access Routes
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Skwxwú7mesh Squamish
Swiy̓át Woodfibre LNG Site
Kwtsá7tsutsin Darrell Bay
Shisháyu7ay Britannia Beach
Squamish River
Skwxwú7mesh | Squamish
Squamish Terminals
Swiy̓át | Woodfibre LNG Site
West-Barr Lease
Kwtsá7tsutsin Darrell Bay
Watts Point
0 500 1,000 2,000 Meters
K'ik'elxn Port Mellon
Sunshine Coast Ferry Departure
Átl'ka7tsem Howe Sound
BC Ferries Routes
Horseshoe Bay Ferry Departure
Strait of Georgia
Burrard Inlet
K'emk'emeláy Vancouver
N
0 1 2 4 6 8 km

4.2 MARINE INFRASTRUCTURE

Construction activities will include in-water and over-water works within the marine portion of the CPA. Marine construction equipment is expected to include marine construction vessels (e.g., barge cranes, barges, pilling vessels, tugboats) and those vessels will move around the marine portion of the CPA during construction.

The permanent Project infrastructure to be constructed within the marine portion of the CPA includes:

- Floating storage tanks
- LNG carrier platform
- Marine offloading facility
- Passenger ferry dock
- Passenger dock breakwater
- Floatel marine infrastructure (e.g., piles, walkways and access ramps) necessary to moor the floatel at the site during the construction phase
- West Barge Ramp
- Permanent outfall(s) into the marine environment or stormwater and other treated effluents
- Moorage pilling, shoreline remediation, associated demolition and east and central barge ramps

The construction of marine components (both temporary and permanent) has been, or will be, reviewed for approval through the CNWA's NPP. Authorizations from DFO will also be required for structures in the marine environment. Permits from the DoS will also be required for some structures that fall within DoS jurisdiction. Location of the above noted infrastructure is presented on Figure 4.

Mitigation measures described in the CEMP that are relevant to marine transportation during construction are:

- Spill prevention and response
- Fuel management
- Waste management

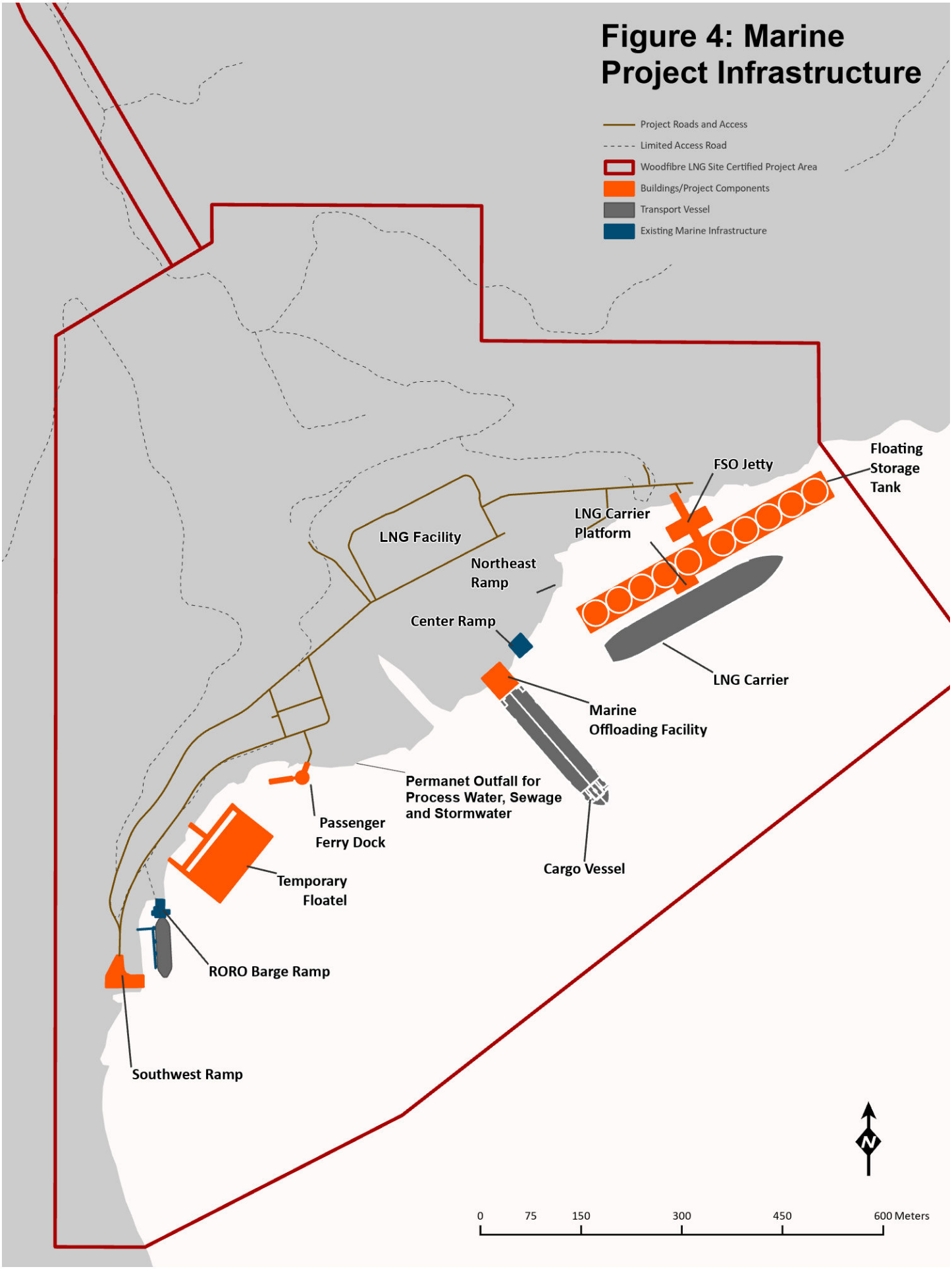


Figure 4: Marine Project Infrastructure
Project Roads and Access
Limited Access Road
Woodfibre LNG Site Certified Project Area
Buildings/Project Components
Transport Vessel
Existing Marine Infrastructure
Floating Storage Tank
FSO Jetty
LNG Carrier Platform
LNG Facility
Northeast Ramp
Center Ramp
LNG Carrier
Marine Offloading Facility
Permanet Outfall for Process Water, Sewage and Stormwater
Passenger Ferry Dock
Cargo Vessel
Temporary Floatel
RORO Barge Ramp
Southwest Ramp
N
0
75
150
300
450
600 Meters

5.0 MARINE TRANSPORTATION SETTING

The navigational channels in St'a7mes (Squamish Harbour) and Átl'ka7tsem (Howe Sound) are used by a wide variety of commercial, government, and recreational vessels, in addition to Indigenous, recreational, and tourist marine activities. Project vessels will transit the marine access routes identified in Figure 3. Baseline information describing marine traffic and marine-based activities in Átl'ka7tsem (Howe Sound) was presented in the Application for an EAC (Woodfibre LNG, 2015). The baseline information described navigational routes, fishing and harvesting areas, habitat areas, commercial shipping use, recreational, tourism use, and marine use by Indigenous groups in Átl'ka7tsem (Howe Sound). This baseline information has been reviewed and, where possible, has been updated to support development of this Plan. A high-level overview of the marine transportation setting is provided below and the updated baseline is presented in Appendix C.

5.1 INDIGENOUS MARINE USE

Indigenous marine use in the northern Átl'ka7tsem (Howe Sound) region was informed by the Occupation and Use Study completed by Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) in 2015 (Traditions, 2015). The Occupation and Use Study documents 87 distinct aquatic-themed sites of past and ongoing use by Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), although this represents a mixture of marine-based activities and freshwater activities. Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) marine harvesting activities that occur typically include cháyilhen (salmon), roe, prawns, crabs, cultural canoeing, recreational canoeing, and marine transportation across or along the shoreline of Átl'ka7tsem (Howe Sound). Additional information regarding the methods, analysis, and results of the Use and Occupancy Study is provided in Appendix C. The approximate location of Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) Canoe Journeys Summer Program route is outlined in Figure 5; canoeing by members of the Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) periodically occurs along these routes in Átl'ka7tsem (Howe Sound). Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) Canoe Journeys Summer Program route overlaps some of the Project's marine access routes on the eastern side of Átl'ka7tsem (Howe Sound), including the channels adjacent to Bowen Island and Anvil Island (Figure 5). Timing of Squamish Nation Canoe Journeys is typically in late summer. Throughout northern Átl'ka7tsem, Squamish Nation members and groups harvest ch'émesh (herring roe) predictably between mid-February and late March every year. Locations may vary but will include shorelines near swiýát and the worker ferry location(s). Navigation routes for harvest will overlap with project navigation at times.

A historical overview of Tsleil-Waututh Nation practices within Átl'ka7tsem (Howe Sound) are also provided in Appendix C. Specific information on Tsleil-Waututh Nation current use and locations of marine waterways and access to other heritage resources, or use and locations of culturally significant sites within Átl'ka7tsem (Howe Sound), has not been identified at this time.

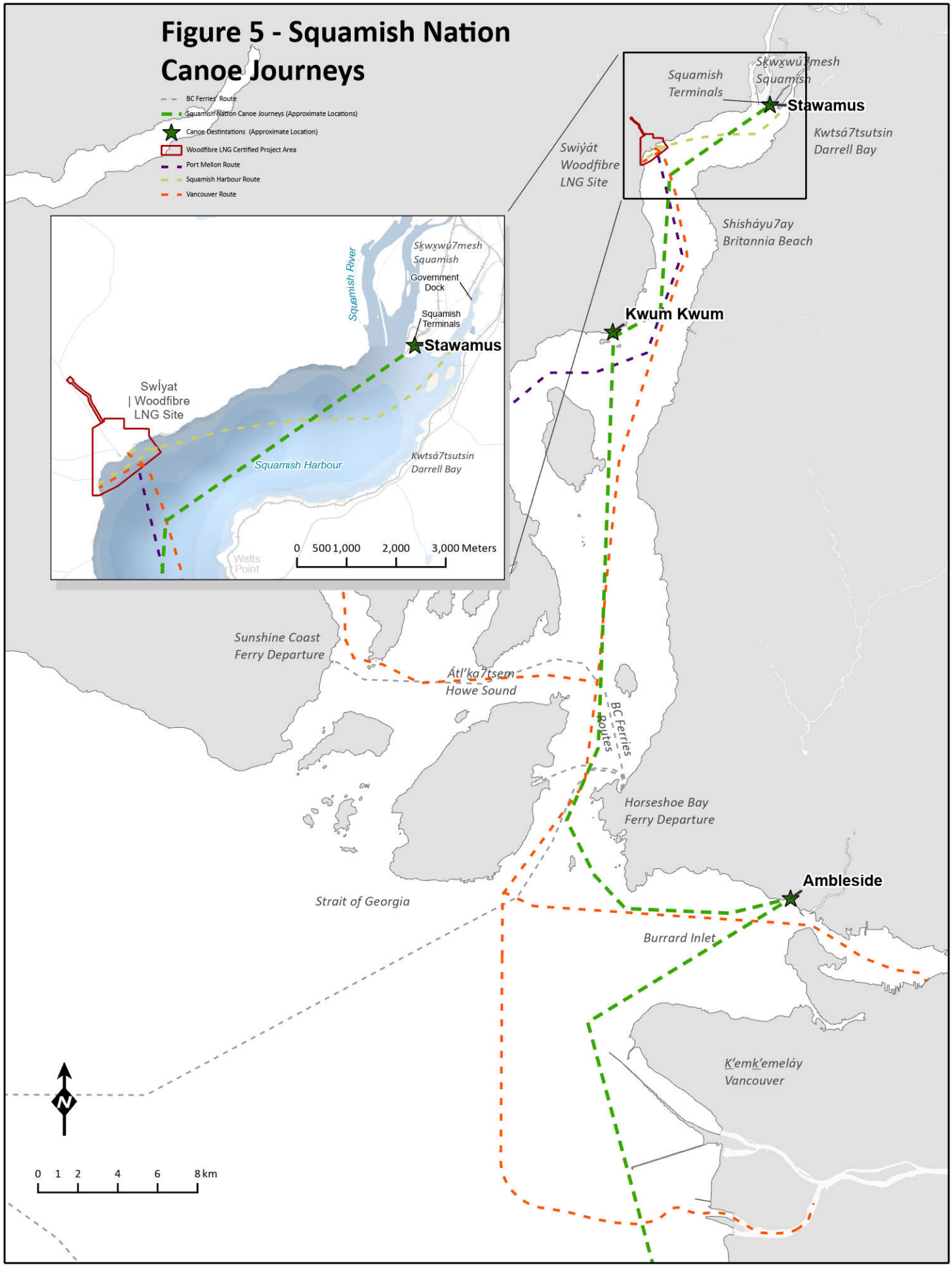


Figure 5 - Squamish Nation Canoe Journeys
BC Ferries' Route
Squamish Nation Canoe Journeys (Approximate Locations)
Canoe Destintations (Approximate Location)
Woodfibre LNG Certified Project Area
Port Mellon Route
Squamish Harbour Route
Vancouver Route
Squamish Terminals
Skwxwú7mesh Squamish
Stawamus
Kwtsá7tsutsin Darrell Bay
Swíyát Woodfibre LNG Site
Shisháyu7ay Britannia Beach
Kwum Kwum
Government Dock
Squamish River
Swíyat | Woodfibre LNG Site
Squamish Harbour
0 500 1,000 2,000 3,000 Meters
Watts Point
Sunshine Coast Ferry Departure
Átl'ka7tsem Howe Sound
BC Ferries Routes
Horseshoe Bay Ferry Departure
Ambleside
Strait of Georgia
Burrard Inlet
K'emk'emeláy Vancouver
N
0 1 2 4 6 8 km

Specific information regarding other Indigenous uses, the location of marine waterways, access to other heritage resources, and locations of culturally significant sites within Átl'ḵa7tsem (Howe Sound) is limited (Woodfibre LNG, 2015a,b,c,d,e,f,g). Musqueam Indian Band identified harvesting areas at Point Atkinson, Cowan Point, the southern shore of Bowen Island, and Cape Roger Curtis. There is no publicly available information regarding specific locations of use within Átl'ḵa7tsem (Howe Sound) by Cowichan Tribes First Nation, Halalt First Nation, Lake Cowichan First Nation, Lyackson First Nation, Musqueam Indian Band, Penelakut Tribe, Stz'uminus Nation, and Métis Nation British Columbia.

Information contained in this section is presented with a focus on the Project and is not meant to reflect the entirety of Indigenous groups' exercise of Indigenous rights within a given territory or occupancy area, nor is it a complete depiction of the dynamic way of life and systems of knowledge maintained by Indigenous groups engaged on the Project. Accordingly, ongoing engagement with interested Indigenous groups may identify additional areas of use, locations of marine waterways, access to other heritage resources, and locations of culturally significant sites within Átl'ḵa7tsem (Howe Sound) that should be considered within the Plan. Woodfibre LNG's Marine Communication Protocol describes mechanisms that Indigenous groups and other marine users can use to provide feedback regarding disruption or changes to their marine use activity caused by Project activities, including construction activities and operation of Project vessels. Refer to Section 7.0 of the Plan for additional information.

5.2 COMMERCIAL SHIPPING AND PASSENGER FERRY USE

Large vessel traffic within Átl'ḵa7tsem (Howe Sound) primarily consists of BC Ferries movements along scheduled ferry routes and deep-sea vessel traffic to deep-water ports at Squamish Terminals and K'íḵ'elxn (Port Mellon). Between 2016 and 2020, there was an average of 303 deep-sea vessel movements in Átl'ḵa7tsem (Howe Sound) per year (Section C.4).

BC Ferries vessels account for 98.8% (25,779) of large vessel movements in Átl'ḵa7tsem (Howe Sound). BC Ferries' Horseshoe Bay terminal in West Vancouver (Figure 3) provides passenger and vehicle ferry services across the Strait of Georgia to Departure Bay (Nanaimo–Vancouver Island, Route 2) and across Átl'ḵa7tsem (Howe Sound) to both Langdale (Gibsons–Sunshine Coast, Route 3) and Snug Cove (Bowen Island–Metro Vancouver, Route 8) (BC Ferries, n.d.,). On average, during weekdays in the summer months, there can be 82 ferry arrivals and departures calling at Horseshoe Bay daily. Typically, ferries depart and arrive at Horseshoe Bay between 5:40 a.m. and 10:00 p.m. PST, seven days per week.

Small vessel commercial traffic in Átl'ḵa7tsem (Howe Sound) includes tugs and towed barges, fishing vessels, and water taxis movements. Átl'ḵa7tsem (Howe Sound) is located within DFO's Pacific Fisheries Management Area (PFMA) 28. This area includes Indian Arm, K'emḵ'emeĺáẏ̓ (Vancouver), Bowen Island, and Sḵwx̱wú7mesh (Squamish) (DFO, 2022; Figure 6). The PFMA 28 sub-areas that intersect with Project marine access routes are 28-2 (from Queen Charlotte Channel to Irby Point on Anvil Island), 28-4 (from Irby Point to Furry Creek), and 28-5 (from Furry Creek to Sḵwx̱wú7mesh [Squamish]) (Figure 3). Based on data received on commercial cháyilhen (salmon) and invertebrate fisheries within these sub-areas, commercial fishing vessel movements may have been declining in recent years.

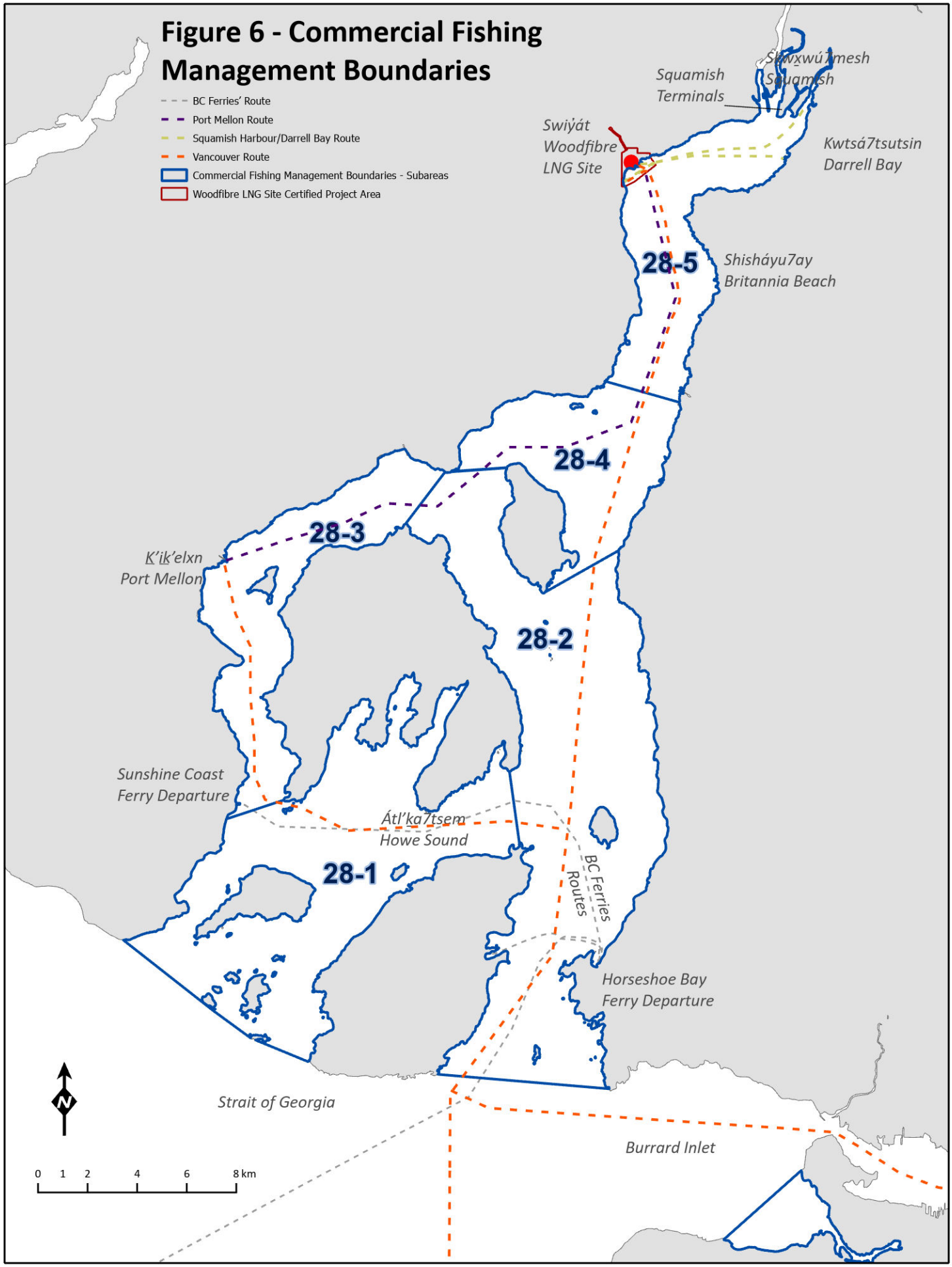


Figure 6 - Commercial Fishing Management Boundaries
BC Ferries' Route
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Commercial Fishing Management Boundaries - Subareas
Woodfibre LNG Site Certified Project Area
Squamish Terminals
Sḵwx̱wú7mesh Squamish
Swiy̓át Woodfibre LNG Site
Kwtsá7tsutsin Darrell Bay
28-5
Shisháyu7ay Britannia Beach
28-4
28-3
K'ik'elxn Port Mellon
28-2
Sunshine Coast Ferry Departure
Átl'ka7tsem Howe Sound
28-1
BC Ferries Routes
Horseshoe Bay Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

5.3 RECREATIONAL AND TOURISM USE

Recreational boating activity (motorized and non-motorized) in Átl'ḵa7tsem (Howe Sound) occurs year-round (Liquiline, 2014). Recreational boating routes are shown in Figure 6. The main recreational boating season coincides with favorable marine weather in Átl'ḵa7tsem (Howe Sound) and runs from May until September, with July and August historically being the busiest two months. Popular recreational boating destinations, with recreational boating routes that intersect the Project's marine access routes, include the various bays on Gambier Island (e.g., West Bay, Centre Bay and Port Graves, and Halkett Bay), Plumper Cove on Keats Island, Xwemḵw'ále7em (Porteau Cove), Bowen Island, Collingwood Channel, and Barfleur Passage (Figure 7).

Marine-based recreational activities in Átl'ḵa7tsem (Howe Sound) include fishing, boating, waterskiing, wakeboarding, windsports (kiteboarding and windsurfing), kayaking, stand-up paddle boarding, and diving. St'a7mes (Squamish Harbour) is a popular area for sea-kayaking, paddle-boarding, and windsports, with majority of windsport activities concentrated in waters adjacent to Squamish Spit and Nexen Beach. Windsports do occur west of Kwtsá7tsutsin (Darrell Bay), but to a lesser extent. Popular recreational fishing locations along the Project marine access routes include the Defence Islands, Pam Rock, a local area known as Hole in the Wall (approximately one km north of the Horseshoe Bay ferry terminal), and waters around Bowen Island (e.g., Hutt Islands, Tunstall Bay, Curtis Point). Around K̲'emḵ'emel̓áy̓ (Vancouver), some of the better and busier cháyilhen (salmon) recreational fishing areas are along the eastern shoreline of Átl'ḵa7tsem (Howe Sound), as well as south of Bowen Island (Liquiline, 2014). Dive sites are concentrated around Britannia Beach, Pam Rocks, Bowyer Island, Lions Bay, Porteau Cove Park, Anvil Island, and West Vancouver (Howe Sound Guide, 2020). Many of the dive sites accessed by boat only likely use similar routes as those used by other recreational marine users.

Seaplane charter services and tours are popular amongst recreationalists and tourists visiting Sḵwx̱wú7mesh (Squamish). The Squamish Municipal Airport (i.e., Don Patrick Field), which is owned and operated by the DoS, is a registered aerodrome. Sea to Sky Air, one of the airport's tenants, operates seaplane charter services out of the Squamish Municipal Airport (Sea to Sky Air, 2022). Harbour Air, another seaplane company that operates out of Sḵwx̱wú7mesh (Squamish), is currently available for private charter services but plans to operate regularly scheduled flights between downtown K̲'emḵ'emel̓áy̓ (Vancouver) and Sḵwx̱wú7mesh (Squamish) once the Squamish Oceanfront Development is complete (Harbour Air Seaplanes, 2022). The new Harbour Air dock is located on the east side of the new Oceanfront Squamish Development, 1.5 km from downtown Sḵwx̱wú7mesh (Squamish), on the Mamquam Blind Channel (Harbour Air Seaplanes, 2022).

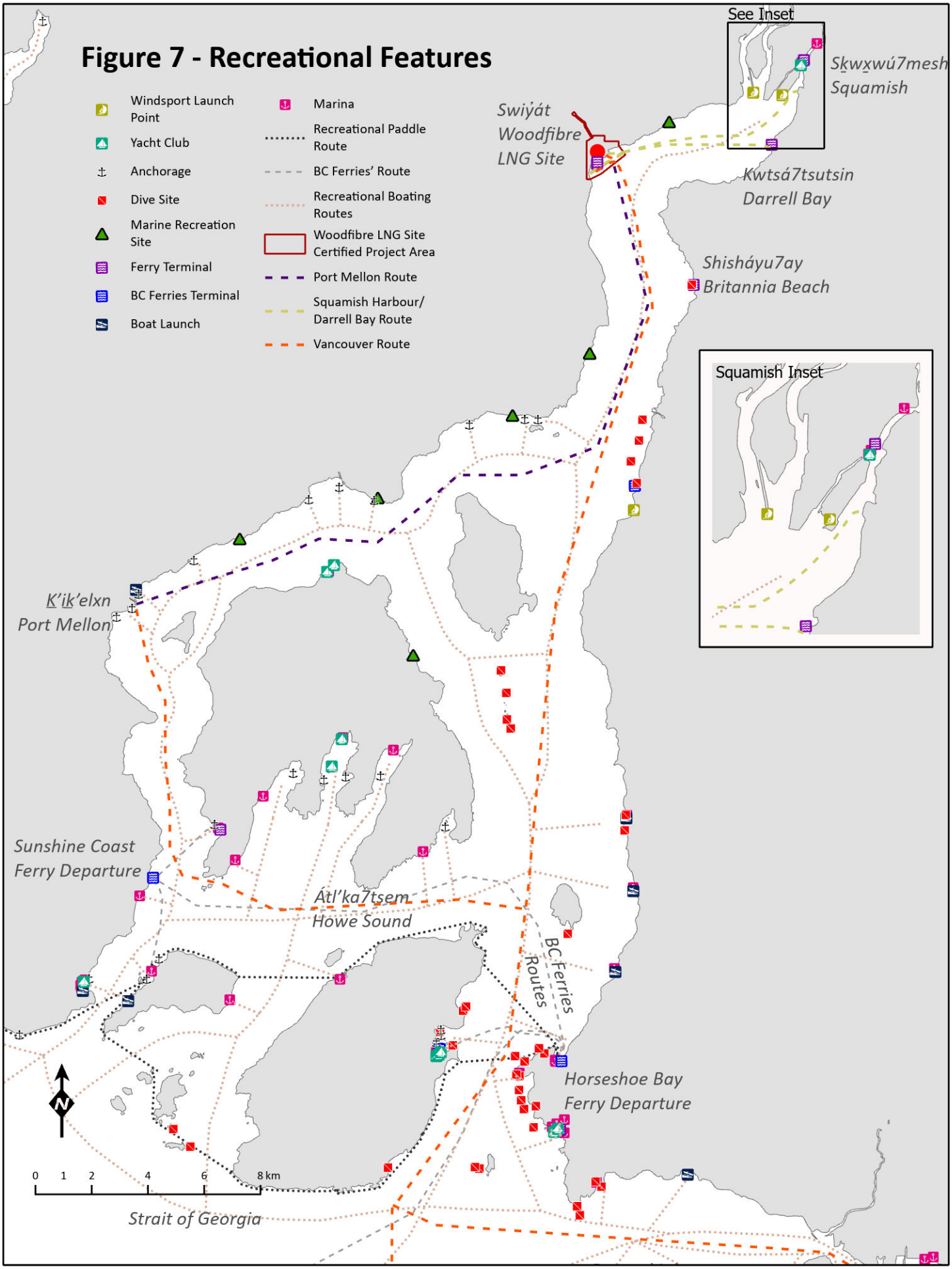


Figure 7 - Recreational Features
Windsport Launch Point
Yacht Club
Anchorage
Dive Site
Marine Recreation Site
Ferry Terminal
BC Ferries Terminal
Boat Launch
Marina
Recreational Paddle Route
BC Ferries' Route
Recreational Boating Routes
Woodfibre LNG Site Certified Project Area
Port Mellon Route
Squamish Harbour/ Darrell Bay Route
Vancouver Route
See Inset
Sḵwx̱wú7mesh Squamish
Swiy̓át Woodfibre LNG Site
Kwtsá7tsutsin Darrell Bay
Shisháyu7ay Britannia Beach
Squamish Inset
K'ik'elxn Port Mellon
Sunshine Coast Ferry Departure
Átl'ka7tsem Howe Sound
BC Ferries Routes
Horseshoe Bay Ferry Departure
N
0 1 2 4 6 8 km
Strait of Georgia

5.4 AREAS OF INTERSECTING MARINE USE

Project related vessels transiting marine access routes (Figure 3) will occasionally intersect with other marine users in St'a7mes (Squamish Harbour) and elsewhere along routes in Átl'ka7tsem (Howe Sound). Vessels are likely to intersect for a short time intermittently during vessel passage described in Section 4.1.

5.4.1 Potential Areas of Intersecting Marine Use along the Project's Primary Shipping Route

The Project's primary shipping route intersects the ferry routes, which connect BC Ferries' Horseshoe Bay terminal with routes to and from Nanaimo, Gibsons, and Bowen Island (Figure 3). Interaction between Project-related vessels and BC Ferries is most likely to occur between the Horseshoe Bay terminal and Bowen Island. However, Woodfibre LNG will notify BC Ferries of the intended Project marine access routes prior to commencing construction and Project construction vessel schedules may be altered if potential interferences are deemed not safe or are otherwise identified as presenting challenges between BC Ferries and the Project. Interaction between Project-related vessels and commercial and/or recreational vessels along the Project's primary shipping route is most likely to occur near Oliver's Landing and Xwekw'ále7em (Porteau Cove), where vessels navigate in the middle of the channel (Moffatt and Nichol, 2015). Estimated distances from shore range from around 800 m to 1,800 m (Moffatt and Nichol, 2015).

5.4.2 Potential Areas of Intersecting Marine Use in St'a7mes (Squamish Harbour)

Other commercial vessels travelling to St'a7mes (Squamish Harbour) navigate along a route similar to the Project's primary shipping route (Figure 3).

As discussed in Section 5.3, recreational activity takes place around St'a7mes (Squamish Harbour) and intersects the Project's ferry and water taxi routes from St'a7mes (Squamish Harbour). Interaction between Project-related vessels and recreational vessels in these areas are more likely to occur in the summer months when recreational activity is highest.

Project marine construction activities may interact with marine harvesting activities of Indigenous groups, including the harvesting of cháyilhen (salmon), roe, prawns, and crabs. In addition, Project marine construction activities may interact with cultural and recreational canoeing and marine transportation within Átl'ka7tsem (Howe Sound). This is based on Woodfibre LNG's current understanding of the relative frequency of these activities versus other forms of marine use and does not rule out the need for continued engagement with Indigenous groups on other forms of use.

The established navigational channels identified for the Project marine access routes (Figure 3) are wide enough to accommodate both Project construction vessels and other marine users. Crews operating Project construction vessels will follow the established regulatory operating and safety requirements, including applicable requirements under the federal Collison Regulations.

Marine construction activities will occur within the marine portion of the CPA (Figure 4). The Project does not anticipate material interference between Project marine transportation and the navigation of other Átl'ka7tsem (Howe Sound) marine users within the main channel in St'a7mes (Squamish Harbour) between the CPA and Sts'íts'a7kin (Watts Point). This channel has an approximate navigable width of 2.5 km at its narrowest point.

6.0 MARINE TRANSPORTATION MANAGEMENT AND MITIGATION MEASURES

The Project design measures and construction procedures described in Section 6.1, and the additional mitigation measures described in Section 6.2, will be implemented to limit potential disruption to other Átl'ka7tsem (Howe Sound) marine users from Project construction marine transportation activities in St'a7mes (Squamish Harbour) and Átl'ka7tsem (Howe Sound).

6.1 PROJECT DESIGN MEASURES AND CONSTRUCTION PROCEDURE MITIGATIONS

6.1.1 Construction Marine Safety Zone

A Marine Safety Zone (MSZ) will be established by Woodfibre LNG surrounding the marine portion of the CPA to maintain public safety and site security during Project construction (Figure 3).

Woodfibre LNG will consult with Transport Canada and other professional maritime stakeholders to confirm the requirements for temporary buoys and lights demarcating and delineating the MSZ. The MSZ will be identified as required in marine navigational charts. Information regarding the MSZ is included on the Project's website[6]. The MSZ will be monitored by Woodfibre LNG and its Contractor's personnel.

6.1.2 Project Vessel Operation

Project-specific operational procedures to be implemented include:

- The Woodfibre LNG contractor(s) will verify qualifications and maintain records of the operator's qualifications and will make documentation available upon request
- Woodfibre LNG will contract licensed vessels operated by suitably qualified crew that have the appropriate level of training and accreditation to relevant provincial and federal regulations
- Project vessels will carry required safety equipment and meet or exceed domestic vessel standards
- Construction deep-sea vessels under contract to Woodfibre LNG subject to navigational safety will not exceed 10 knots when operating in the Átl'ka7tsem (Howe Sound) marine corridor and will be directed not to exceed 6 knots within the CPA
- Project vessels will safely follow established shipping lanes and navigational routes typically used in Átl'ka7tsem (Howe Sound). It is understood and recognized that construction marine access routes may change slightly on occasion from those represented on Figure 3 in response to weather and other factors

[6] https://woodfibrelng.ca/about-woodfibre/regulatory/marine-transportation/

- Project vessels will safely maintain a constant course and speed and maintain situational awareness, whilst effectively ínexwantas (monitoring) and predicting local weather to maintain marine safety
- Near misses and incidents will be reported though Woodfibre LNG's Health Safety, Security and Environment system including, when necessary, the requirements for incident investigation
- All third-party vessel operators will monitor weather conditions and only transit to and from site when it is safe to do so, to ensure it is safe to disembark passenger vessels, a passenger ferry dock breakwater will be constructed to provide protection from waves and inclement weather (Figure 4)
- Construction vessel speeds in the Mámxwem (Mamquam) Channel will be controlled such that wakes above ambient wave height are limited. Wakes in Howe Sound extending from deep sea vessels are addressed in the Wake Verification Plan (Attached as Appendix D)

6.1.3 Notices and Navigational Warnings

Woodfibre LNG will adhere to Project navigation approval conditions when they are issued by Transport Canada. It is anticipated that weekly preparation of a construction vessel traffic notice (known as a NAVWARN) will be required from Woodfibre LNG for submission to the Marine Communications and Traffic Services (MCTS), a division of the CCG. The CCG posts relevant information of navigation warnings on their website. St'a7mes (Squamish Harbour) Authority will be issued a notice of planned Project construction vessel movement schedules and planned marine access routes in advance of construction activities. This notice is posted on the Project's website[7] and will be updated as required.

Prior to commencing construction of marine works, Woodfibre LNG Contractor(s) will notify the CCG of marine activities that may result in navigational hazards. This information will allow the CCG to issue navigational warnings, as appropriate.

Woodfibre LNG will notify BC Ferries of the intended Project marine access routes prior to commencing construction. Project construction vessel schedules may be altered if potential interferences are not safe or if other constraints between BC Ferries and the Project are identified.

Upon completion of marine construction, Woodfibre LNG will notify the Canadian Hydrographic Service that work is complete and provide design build information (e.g., berth locations) to allow the Canadian Hydrographic Service to update navigational charts and other nautical publications as they deem appropriate.

6.1.4 Aids to Navigation

The Project requires review and approval under the *Canadian Navigable Waters Act*; work will be approved through Transport Canada's Navigation Protection Program. Following construction, and with due consideration of navigation aid recommendations from the TERMPOL management committee following their review and acceptance of the Project's TERMPOL report, Woodfibre LNG will assess need and install aids and navigational lights, as necessary, for safe navigation within the marine portion of the Project's CPA.

[7] https://woodfibrelng.ca/about-woodfibre/regulatory/marine-transportation/

6.1.5 Ballast Water Management, Anchoring and Propellor Wash

Project construction vessels that use ballast water to stabilize vessels and create safe operating conditions will be managed in accordance with requirements under the *Ballast Water Regulations* to reduce the risk of introducing and spreading aquatic invasive species. The regulations require that Canadian vessels and other vessels entering Canadian waters:

- Develop and put in place an approved Ballast Water Management Plan
- Follow standards that limit the number of organisms released
- Be regularly surveyed and inspected by an authorized organization
- Keep records
- Carry a valid certificate that allows inspectors to confirm that the vessel complies with the convention

A Ballast Water Management Plan has been by prepared by Woodfibre LNG in line with applicable guidance that sets out operating procedures and the specific duties of personnel on board for carrying out ballast operations, and sampling and treatment methods. This plan will be adhered to by Project construction vessels that use ballast water. Specific operational requirements for Project vessel anchoring and propellor wash sediment control will be outlined in the Marine Water Quality Monitoring and Mitigation Plan. Operators will be informed of the Howe Sound Glass Sponge Reef Closures or other restrictions for anchoring that are shown on online-linked nautical charts and updated by DFO.

6.2 ADDITIONAL MITIGATION MEASURES

6.2.1 Coordinating Construction Activities with Other Operations

Woodfibre LNG and their Contractor(s) will coordinate with marine-based stakeholders, including Squamish Terminals, FortisBC, and the owners of other construction projects occurring near Sḵwx̱wú7mesh (Squamish), in Átl’ḵa7tsem (Howe Sound), to safely navigate Project construction marine vessels. The Project aims to limit potential unsafe interactions and conflicts associated with cumulative vessel traffic through the Marine Communication Protocol described in Section 7.0. Information to be shared will include:

- Water taxi routes and schedules
- Passenger ferry timetable
- Anticipated schedule for cargo vessel movements
- Anticipated number of transits and vessel types and sizes

6.2.2 Traditional Use and Indigenous Harvesting

Project construction vessel traffic could interfere with Indigenous groups' abilities to pursue traditional, cultural, or other activities in the areas along marine access routes in St'a7mes (Squamish Harbour) and Átl'ka7tsem (Howe Sound), as described in Section 4.0 and in Appendix C. Implementation of the Project's Communications Protocol, described in Section 7.0, will provide Indigenous groups with an understanding of the timing and location of Project marine construction activities and how these activities may have the potential to interact with their marine uses in Átl'ka7tsem (Howe Sound). Communication by Woodfibre LNG will inform Átl'ka7tsem (Howe Sound) marine users about potential interactions with the objective of identifying potential disruptions ahead of time and maintaining navigation safety. WLNG will coordinate their own marine traffic plans to accommodate Squamish Nation marine users when and where notified.

In 2014, Woodfibre LNG engaged Moffatt & Nichol to perform a vessel wake assessment. The assessment was conducted to better understand the potential effects of Project-related vessels' wake wash on shorelines and infrastructure. The results of the vessel wake assessment are available on the Woodfibre LNG website[8]. A vessel wake verification study for the Project, which will be used to verify the results of the vessel wake assessment, is currently being undertaken by Woodfibre LNG. The Wake Verification Plan is attached as Appendix D. The buoys deployed in this wake verification assessment are exposed to the tidal cycle range as well as the range of marine vessels transiting Átl'ka7tsem (Howe Sound) Howe Sound. If wakes are observed potentially affecting traditional use or harvest, mitigation measures such as limiting vessel transit speeds or others discussed through the Marine Users Group and/or the Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) environmental working group can be implemented during construction.

6.2.3 St'a7mes (Squamish Harbour) Vessel Traffic Plan

Project construction marine access routes for the transportation of materials, equipment, and crew to site that may intersect with other marine uses in St'a7mes (Squamish Harbour) are described in Section 4.0 and Table 5 and referenced in Appendix C. The West Barr Lease in St'a7mes (Squamish Harbour) will provide access for worker transportation via water taxi and passenger ferry, and will accommodate the required parking. To limit the potential for unsafe interactions with marine users, Woodfibre LNG will communicate marine construction activities, vessel schedules, and routes to other marine users through the Project's Marine Communications Protocol, described in Section 7.0. The Communications Protocol also includes routine engagement with Indigenous groups and Woodfibre LNG's MUG. Additional measures to be implemented to reduce the potential for unsafe interactions and disruptions in St'a7mes (Squamish Harbour) include:

- Project vessels will avoid extensive use of St'a7mes (Squamish Harbour) - the K̲'emk̲'emeĺáẏ̓ (Vancouver) access route to the south will be used as the primary route for transporting equipment, materials, and workers on rotational shift changes directly to the site, limiting potential interactions with and disruptions to marine users in St'a7mes (Squamish Harbour)

[8] https://woodfibrelng.ca/report-on-wake-study/

- Woodfibre LNG will hold a vessel passage planning session with MUG members to discuss the vessel routes and to identify the potential for interactions with other marine users (including recreational users); feedback from this session may inform the implementation of additional mitigation measures, as required
- Woodfibre LNG will hold a training session with third-party vessel operators to inform them of the vessel routes in St'a7mes (Squamish Harbour) based on the feedback from the vessel passage planning session
- Project vessels will make reasonable efforts to avoid high use recreational areas when transiting from St'a7mes (Squamish Harbour) to and from the site, where possible
- Woodfibre LNG will consider and make commercial efforts to limit Project marine construction traffic by using larger vessels when transporting crew and materials and operating vessels at or near full capacity, where practical. In addition, vessels will be scheduled to avoid high-traffic periods, when practicable (e.g., weekends during the summer months)
- The Woodfibre LNG Marine Transportation Coordinator, as described in Section 3.0, will be appointed to coordinate Project vessel traffic with other marine users in St'a7mes (Squamish Harbour); this role will include receiving inquiries and resolving issues, as practical
- As part of the Marine Communication Protocol described in Section 7.0, Woodfibre LNG will introduce marine construction vessel plans, including predicted timing and schedules, with the MUG and advise stakeholders and marine users of construction activities (including collaboration with Matthews Southwest and Bethel Lands Corporation and DoS)[9]
- The Marine Communication Protocol, described in Section 7.0, provides a procedure for marine stakeholders to consult with Woodfibre LNG, regarding special events such as yacht races, regattas, and marine-based festivals, to allow for the review of additional passage planning and scheduling

[9] Matthews Southwest and Bethel Lands Corporation are developing lands along the shore in Squamish.

7.0 MARINE COMMUNICATIONS PROTOCOL

Woodfibre LNG has developed a Marine Communications Protocol to communicate Project marine construction activities to Indigenous groups and other Átl'ka7tsem (Howe Sound) marine users during Project construction. The protocol includes mechanisms that Indigenous groups and other marine users can use to provide feedback regarding potential interactions with the Project's marine construction transportation with other Átl'ka7tsem (Howe Sound) marine users. WLNG will collaborate with Squamish Nation on effective means of disseminating the information outlined in Section 7.1.

7.1 MARINE ACTIVITY INFORMATION: VESSEL ROUTES, SCHEDULES, AND COORDINATING ACTIVITIES

Woodfibre LNG is committed to providing timely Project marine construction activity information to Indigenous groups and the other marine users of Átl'ka7tsem (Howe Sound) and will communicate this information through the Woodfibre LNG website[10]. This webpage includes information describing:

- Marine access routes (e.g., the St'a7mes [Squamish Harbour] route and K'emk'emeláy̓ [Vancouver] route)
- Weekly arrivals and departures associated with Project activities
- Marine safety considerations, such as information on the MSZ, Project vessel operation, the CCG's Notice to Mariners and Navigational Warnings (also known as NOTMARs and NAVWARNs), navigational aids, navigational charts, and BC Ferries.

A map on the website shows the marine access routes in use during the construction phase.

Woodfibre LNG, their Contractor(s), and Third-Party Vessel Operators will also use existing marine communication tools, which are shared on the website under 'resources.' Vessels carrying a BC Coast Pilot, travelling to and from the Woodfibre LNG site, can be tracked by other marine users on the Pacific Pilotage Authority website[11]. Automatic Identification System (AIS) information for vessels travelling to and from the Woodfibre LNG site is also publicly available and can be tracked by other marine users through the CCG's Victoria MCTS Centre via Very High Frequency (VHF) radio or by telephone and/or on the MarineTraffic website[12]. Woodfibre LNG (commercial) vessels greater than 8 m in length or carrying a passenger are subject to *Navigation Safety Regulations* and required to have either Class A or Class B AIS enabled. As shown in Table 6, this requirement captures the anticipated Project marine traffic. Vessel operators will contact the CCG through the Victoria MCTS Centre, using VHF radio, to provide their vessel information (e.g., real time vessel course, speed, and Estimated Time of Arrival/Departure) and intentions to Vessel Traffic Services (VTS). Project vessels with AIS transceivers will automatically communicate their own vessel information to other vessels and shore stations that are also fitted with AIS transceivers (so long as those vessels are within their VHF radio range).

[10] https://woodfibrelng.ca/about-woodfibre/regulatory/marine-transportation/
[11] https://pilot.kleinsystems.com/public/PPA/PPA_CurrentTraffic.aspx
[12] https://www.marinetraffic.com/en/ais/home/centerx:-123.4/centery:49.5/zoom:10

In the event of a marine occurrence, vessels associated with Project marine construction will be required to report occurrences to the Transportation Safety Board (TSB) of Canada through CCG coastal radio stations. In the event of an emergency requiring marine Search and Rescue, these vessels may also contact the Joint Rescue Coordination Centre in Victoria and the Victoria MCTS Centre to initiate and coordinate a response.

Woodfibre LNG will distribute a weekly/monthly marine construction activity update to Indigenous groups, as required by the EAO/Impact Assessment Agency, who request this information, the DoS, the Woodfibre LNG MUG, and FortisBC. Woodfibre LNG may also use established social media channels to communicate key messages related to the Project's marine construction activities.

As described in Section 3.0, the Woodfibre LNG Marine Transportation Coordinator will be appointed to respond to questions and concerns and limit potential negative or unsafe interactions related to the Project's marine construction traffic and activities. Marine stakeholders holding special events, such as yacht races, regattas, and marine-based festivals, should contact the Woodfibre LNG Marine Transportation Coordinator. In reviewing event information provided, Woodfibre LNG will determine if additional Project vessel passage planning and scheduling may be required.

Indigenous groups, Squamish Terminals, and the Woodfibre LNG MUG are anticipated to identify a primary contact to receive routine and ad-hoc updates from Woodfibre LNG.

7.2 ENGAGEMENT WITH INDIGENOUS GROUPS AND THE MARINE USERS GROUP (MUG)

Woodfibre LNG will continue to undertake regular engagement with Indigenous groups, per the Project commitments (EAC M6.3-1), the DoS, and the Woodfibre LNG MUG to provide updates on Project marine construction activity and discuss concerns raised with respect to negative or unsafe interactions with other Átl'ka7tsem (Howe Sound) users resulting from marine activities.

7.3 PROJECT CONCERNS AND COMPLAINTS FEEDBACK MECHANISM

Woodfibre LNG has developed a process to track, investigate, and respond to community concerns and complaints regarding Project activities, including potential negative or unsafe interactions between Project marine construction vessels and other Átl'ka7tsem (Howe Sound) marine users.

Local and regional governments, provincial agencies, Indigenous groups, local service providers, and potentially affected individuals have the opportunity to share information, raise questions or concerns, and/or share feedback with Woodfibre LNG through its feedback mechanism (i.e., concerns and complaints received through multiple engagement mechanisms). For example, the Woodfibre LNG website has a 'contact us' page to raise concerns and/or complaints to Woodfibre LNG. Information received through its feedback mechanism will be documented and addressed by Woodfibre LNG.

Any feedback received will be digitally filed and reviewed by Woodfibre LNG. Actions may be taken to address the feedback, or the feedback provider may be contacted by Woodfibre LNG for further discussion. Feedback will be considered throughout the construction phase of the Project.

8.0 ÍNEXWANTAS (MONITORING) AND REPORTING

Project marine construction work within the CPA will be monitored in accordance with requirements identified in the CEMP, the Marine Water Quality Management and Monitoring Plan, and the Marine Mammal Management and Monitoring Plan.

Woodfibre LNG will monitor marine transportation interactions with other Átl'ka7tsem (Howe Sound) marine users in St'a7mes (Squamish Harbour) and Átl'ka7tsem (Howe Sound) the feedback mechanism described in Section 7.3. Concerns identified through the feedback mechanism will be recorded, reviewed, and addressed. As identified in Sections 3 and 7 a MUG will be developed by Woodfibre LNG to coordinate and communicate about marine activities and establish collaborative protocols for use by Project and community mariners. The appointed secretariate of this group will record action items as they are identified and resolved and this will provide qualitative means of tracking the effectiveness and success of the MUG.

Potential negative or unsafe interactions between Project marine construction vessels and other marine users of Átl'ka7tsem (Howe Sound) will be monitored through tracking of Project construction vessel movements. In addition, Project construction vessel operators will be required to observe and record incidents and near misses that occur. Operators will also record observations that can assist with additional vessel movement planning to avoid or reduce potential risks or reduce potential negative or unsafe interactions with other marine users in Átl'ka7tsem (Howe Sound). Observed and reported incidents will be reviewed by Woodfibre LNG and used to inform corrective actions required.

In accordance with the TSB, reportable marine accidents or incidents must be reported to the TSB as soon as possible. Reportable marine occurrences that involve Project marine construction vessels will be submitted directly via the TSB website (http://www.tsb.gc.ca/eng/incidents-occurrence/index.html).

At least annually, Woodfibre LNG will review data collected regarding marine transportation and determine if the mitigation measures are functioning as intended and if revised or additional mitigations are required. Woodfibre LNG will develop ínexwantas (monitoring) performance measures (e.g., targets, thresholds, and site objectives) to evaluate effectiveness of mitigations during construction. This will form the marine transportation ínexwantas (monitoring) program.

As part of Condition 1 of the Schedule B Table of Conditions to EAC #15-02, Woodfibre LNG will prepare internal monthly reports on compliance with the EAC. Reports will present summaries of the ínexwantas (monitoring) data collected in accordance with the MTMMP, the conclusions of the evaluation, and the results of any additional mitigations implemented. Prepared reports will be retained by Woodfibre LNG through the construction phase of the Project and for five years after commencing the operational phase of the Project.

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APPENDIX A

Environmental Assessment Certificate Application Mitigation Measures

APPENDIX A ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION MITIGATION MEASURES

Environmental Assessment Mitigation #	Mitigation Title	Mitigation	Environmental Management Plan/ Section Containing Mitigation
M6.3-1	Squamish Harbour Vessel Plan	Woodfibre LNG will develop and implement strategies, best management practices, and guidelines to avoid and minimize Project-related disruption of marine-based recreational activities in the Squamish Harbour area during construction and operation. In developing this plan, Woodfibre LNG will consult with key marine user groups (e.g., Squamish Terminals, yacht clubs, kiteboard clubs, and kayaking operators) to identify the routes of all Project-associated marine traffic (e.g., ferries and water taxis) and discuss strategies to manage the interaction of Project vessel traffic with recreational and tourism areas during the high season months. Woodfibre LNG Limited's use of the Darrell Bay terminal for the worker ferry is part of this plan as it minimizes interaction with recreationists and tourists who are using the marine waters of Squamish Harbour and the head of Howe Sound. This traffic plan will include a procedure for marine stakeholders to consult with Woodfibre LNG regarding special events such as yacht races, regattas, and marine-based festivals to ensure that additional passage planning, and scheduling can be reviewed.	This Plan, 6.2.3
M7.3-1	Develop Marine Transport Management Plan	Woodfibre LNG will prepare and implement a marine transport management plan prior to construction activities or as outlined through TERMPOL. This plan will outline measures to ensure all vessel traffic is aware of Project activities. The plan will also provide details of the communication channels to be used and the Project-related safety procedures to be followed.	This Plan, Construction MTMMP
M.7.3-2	Use Navigational Aids and Lights	Woodfibre LNG will install aids and navigational lights based on recommendations following the NPP review process.	This Plan, Section 6.1.4
M.7.3-3	Prepare Notices to Mariners and Notices to Shipping	Woodfibre LNG will notify the relevant authorities, including the CCG, so that Notices to Mariners and Notices to Shipping (now called NAVWARNs—Navigational Warnings) can be issued.	This Plan, Section 6.1.3
M.7.3-4	Update navigational charts and nautical publications	Woodfibre LNG will ensure Canadian Hydrographic Service navigational charts and other appropriate nautical publications are updated to show the terminal and other marine features, where appropriate.	This Plan, Section 6.1.3

Environmental Assessment Mitigation #	Mitigation Title	Mitigation	Environmental Management Plan/ Section Containing Mitigation
M.7.3-5	Compliance with maritime regulations and legislation	Woodfibre LNG will conduct all Project shipping and transportation of passengers in accordance with the requirements of the *Canada Shipping Act*, in compliance with the CCG and Pacific Pilotage Authority Canada. Maritime legislation and other requirements are outlined in Section 2.1. In addition, shipping activities will also comply with all other applicable national and international safety regulations that have not been listed, such as requirements established by the IMO. Where applicable, consideration will also be given to best practice criteria for the safe operation of LNG vessels presented by the Society of International Gas Tanker and Terminal Operators, and the World Association for Waterborne Transport Infrastructure.	This Plan, Section 2.1
M7.3-6	Consult with BC Ferries and Squamish Terminals	Woodfibre LNG commits to further consult with BC Ferries and Squamish Terminals regarding potential interference, vessel routes, and current operating practices.	This Plan, Section 7.0
M7.3-14	Consultation with recreational stakeholder groups in Howe Sound	Woodfibre LNG commits to further consultation with recreational stakeholder groups in Howe Sound to identify areas of concerns and where practicable, to identify additional mitigation that can be implemented to reduce effects.	This Plan, Section 7.0
M7.4-2	Collaborate with Matthews Southwest and Bethel Lands Corporation and District of Squamish to minimize displacement of recreation activity	As discussed, Woodfibre LNG will develop a Squamish Harbour Vessel Traffic Plan (M6.3-1) to identify strategies to minimize effects to marine-based recreational activities. Its development will incorporate consultations with Squamish Harbour users. To help avoid cumulative effects, as a component of the Squamish Harbour Vessel Traffic Plan, Woodfibre LNG will also work with Matthews Southwest and Bethel Lands Corporation and District of Squamish to minimize displacement of recreation activity by Project-associated ferry and water taxi traffic that travels to the Project site.	This Plan, Section 7.0

APPENDIX B

Maritime Regulatory Framework

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APPENDIX B MARITIME REGULATORY FRAMEWORK

Table B.1: Regulatory Framework for Marine Transportation

Act	Jurisdiction	Summary
Canada Shipping Act, 2001 (S.C. 2001, c. 26) (2019)	Federal	The principal statute governing safety in marine transportation and recreational boating; applies to all Canadian vessels operating in all Canadian waters. Project marine activities must be undertaken in accordance with all applicable parts of this Act, which is enabling legislation for the following regulations: • Ballast Water Regulations (SOR/2021-120) • Collision Regulations (CRC, c. 1416) • Life Saving Equipment Regulations (C.R.C., c.1436) • Navigation Safety Regulations, 2020 (SOR/2020-216) • Steering Appliances and Equipment Regulations (SOR/83-810) • Vessel Pollution and Dangerous Chemicals Regulations (SOR/2012-69) • Vessel Operation Restriction Regulations (SOR/2008-120) • Vessel Traffic Services Zones Regulations (SOR/89-98)
Marine Liability Act (S.C. 2001, c.6) (2001)	Federal	Makes the owners or operators of vessels liable for that vessel and the specific consequences of its operation.
Canadian Navigable Waters Act (R.S.C., 1985, c. N-22) (2019)	Federal	Protects the public's right of navigation by regulating works that may interfere with navigation. Ministerial approval is required for any major work that interferes with navigation on any navigable water, including Scheduled and non-Scheduled waters. The Major Works Order designates dams, bridges, causeways, and aquaculture facilities. Minor works, including docks and boat ramps, when built in accordance with established criteria (the Minor Works Order), are pre-approved on any navigable water.

Table B.1: Regulatory Framework for Marine Transportation

Act	Jurisdiction	Summary
Marine Transportation Security Act (S.C. 1994, c. 40) (2008)	Federal	Applies to Canadian ships outside Canadian waters and to all ships and marine facilities within Canadian waters. Additionally, this Act provides the framework for Canadian government participation in the following international conventions and standards: • International Maritime Organization and Safety of Navigation (IMO, 2019a) • Convention on the International Regulations for Preventing Collisions at Sea (IMO, 2019b) • Global Maritime Distress and Safety System (IMO, 2019c) • International Code of Safety for High-speed Craft (IMO, 2019d) • International Convention for the Safety of Life at Sea – Chapter IV and V (as amended) (IMO, 2019e) • International Convention on Standards of Training, Certification and Watch keeping for Seafarers, as amended, including the 1995 and 2010 Manila Amendments (IMO, 2019f) • Torremolinos International Convention for the Safety of Fishing Vessels (IMO, 2019g) • United Nations Convention on the Law of the Sea (UNCLOS, 1982).
Pilotage Act (R.S.C., 1985, c. P-14) (2001)	Federal	Provides legislation for the establishment of four pilotage authorities in Canada. These Crown corporations have the responsibility of establishing, operating, and administering efficient pilotage services in their respective regions in Canada. The *Pilotage Act* is the enabling legislation for the Pacific Pilotage Regulations (C.R.C., c. 1270).
Fisheries Act (R.S.C., 1985, c. F-14) (2019)	Federal	Prohibits the death of sts'úḵwi7 (fish) by means other than fishing and the harmful alteration, disruption, or destruction of sts'úḵwi7 (fish) habitat. Project-related works, undertakings, or activities that would result in death to sts'úḵwi7 (fish) or harmful alteration, disruption, or destruction of sts'úḵwi7 (fish) habitat require an authorization under paragraph 34(2)(b) and paragraph 35(2)(b), respectively.
Marine Transportation Security Act (S.C. 1994, C. 40) (2008), Marine Transportation Security Regulations (SOR/2004-144)	Federal	Provides a framework to detect security threats and take measures to prevent security incidents that could affect marine vessels and terminal facilities. The Regulations: • Include responsibilities for developing security plans and putting them in action • Include means to conduct security assessments to establish adequate security protocols and reporting • Provide Transport Canada with means to oversee compliance of the marine transportation security system • Provide a mechanism for Canada to address obligations to implement the *International Ship and Port Facility Security Code*

APPENDIX C

Marine Transportation Setting

Woodfibre LNG

APPENDIX C MARINE TRANSPORTATION SETTING

C.1 INDIGENOUS MARINE USE

C.1.1 Sḵwx̱wú7mesh Úxwumixw (Squamish Nation)

Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) completed an Occupation and Use Study in 2015 (Traditions, 2015) of the northern Átl'ḵa7tsem (Howe Sound) region (generally north of Anvil Island), as part of the Nation's independent evaluation of the Project's impacts on Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) interests.

I. The focus of this summary is on traditional individual, family, or community activities; it is not intended to capture commercial or recreational activities that may engage Squamish Nation members or businesses. Woodfibre LNG intends to report on such activities during mitigation planning for those categories of marine activities identified in Section 5.2 and Section 5.3 of this Plan.

II. The information compiled through the Occupation and Use Study reflects what information was gleaned from written documentation available to the authors and information shared by interviewees in that study.

III. Regardless of marine activities documented or planned as existing, Squamish Nation members retain unextinguished rights to pursue any traditional marine-based activity in northern Átl'ḵa7tsem (Howe Sound). The Occupation and Use Study results unequivocally acknowledges that Squamish Nation ancestors have used and relied upon the marine and upland sections of northern Átl'ḵa7tsem (Howe Sound) since time immemorial. The existing intensity of marine use for such activities as resource harvesting and canoeing is more difficult and hazardous with the increase in larger ships in Átl'ḵa7tsem (Howe Sound) and does not reflect the desired intensity of future use.

IV. Squamish Nation use of northern Átl'ḵa7tsem (Howe Sound) is broader than simply physical occupation and navigation of marine areas. Use "may also refer to particular connections and uses of the lands and resources related to ceremonies, customs, cultural practices, traditional governance, trade or stories […] Intangible values are often linked with spiritual, artistic, aesthetic and educational elements that are often associated with the identity of Aboriginal groups" (CEAA, 2015).

Classes of marine activities documented in the Use and Occupancy Study are listed in Table C.1. Moreover, marine travel is an intermediate activity to support the classes of activity listed in Table C.2, highlighting the interconnectedness of northern Átl'ka7tsem (Howe Sound) with the broader terrestrial portions of Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory. Included in both lists of activities are sites or features that are not themselves "activities" but are necessary attributes to support activities. The Use and Occupancy Study documents 87 distinct aquatic-themed sites of past and ongoing use by Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) in Átl'ka7tsem (Howe Sound), although this represents a mixture of marine-based activities and freshwater activities.

Table C.1: Marine-based Activities Pursued by Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) Members in Northern Átl'ka7tsem (Howe Sound)

Activity	Definition
Archaeological Site	Locations in Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory as formally recorded archaeological sites with the Archaeology Branch, Province of BC, or described in an interview as including physical remains of Aboriginal activities dating to 1846 or before
Ceremonial/scared site	Locations described by Sḵwx̱wú7mesh stélmexw (Squamish people) as having sacred qualities or used for traditional ceremonies or rites
Conflict	Locations in Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory where battles or activities associated with conflict (e.g., display of slain enemies) occurred
Environmental Habitat	Locations in Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory known to be important or preferred habitat for plant and animal species (aquatic) that are important traditionally to Sḵwx̱wú7mesh stélmexw (Squamish people)
Fishing	Locations used by Sḵwx̱wú7mesh stélmexw (Squamish people) for harvesting sts'úḵwi7 (fish)
Legendary Being	Locations described by Sḵwx̱wú7mesh stélmexw (Squamish people) where supernatural or legendary creatures reside or frequent
Named Place	Locations that have Sḵwx̱wú7mesh (Squamish) names, or have names associated with Sḵwx̱wú7mesh (Squamish) history
Seafood Gathering	Locations used for harvesting seafood (e.g., crab, shrimp, slhawt' [herring], roe, shellfish)
Trails /travel	Canoe or motorized watercraft routes used by Sḵwx̱wú7mesh stélmexw (Squamish people) for transportation

Source: Adapted from Traditions, 2015

Timing of Squamish Nation Canoe Journeys is typically in late summer (currently only the routes are shown). Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) Canoe Journeys Summer Program route overlaps some of the Project's marine access routes on the eastern side of Átl'ka7tsem (Howe Sound),

Throughout northern Átl'ka7tsem, Squamish Nation members and groups harvest ch'émesh (herring roe) predictably between mid February and late March every year. Locations may vary but will include shorelines near swíýát and the worker ferry location(s). Navigation routes for harvest will overlap with project navigation at times.

Table C.2: Terrestrial-based Activities with Marine Travel as an Incidental Activity

Activity	Definition
Berry/plant gathering	Locations used by Sḵwx̱wú7mesh stélmexw (Squamish people) for collecting plants and berries
Burial	Locations where remains of Sḵwx̱wú7mesh stélmexw (Squamish people) are buried
Dwelling	Locations where Sḵwx̱wú7mesh stélmexw (Squamish people) reside(d) on a permanent or temporary basis, including úxwumixw (villages), houses, cabins, tents, lean-tos, and campsites
Environmental feature	Locations of landforms or other geographical features (e.g., waterfall) in Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory that are important to traditional activities such as settlement, resources (land or aquatic), or travel
Environmental Habitat	Locations in Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory known to be important or preferred habitat for plant and animal species (terrestrial) that are important traditionally to Sḵwx̱wú7mesh stélmexw (Squamish people)
Forestry	Locations used by Sḵwx̱wú7mesh stélmexw (Squamish people) for harvesting wood or tree bark, culturally modified tree sites, and arborglyph sites
Hunting	Locations used by Sḵwx̱wú7mesh stélmexw (Squamish people) for ch'áatl'am (hunting) animals or birds
Indian Reserve	Locations and/or extent of existing or former Indian Reserves
Lands Acquired	Lands acquired by Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) (agreement or purchase)
Legendary Being	Locations described by Sḵwx̱wú7mesh stélmexw (Squamish people) where supernatural or legendary creatures reside or frequent
Lithics	Locations in Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory where stone artifacts or evidence of lithic manufacture (e.g., quarry) have been located
Manufacture	Locations used by Sḵwx̱wú7mesh stélmexw (Squamish people) for the manufacture of traditional goods
Medicinal/ Therapeutic Site	Locations Sḵwx̱wú7mesh stélmexw (Squamish people) used for therapeutic purposes (e.g., hot springs, solitude) or where medicinal plants are collected
Named Place	Locations that have Sḵwx̱wú7mesh (Squamish) names or have names associated with Sḵwx̱wú7mesh (Squamish) history
Pictograph/Rock Art	Locations in Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) territory where rock art has been located
Preparation Site	Locations where resources are customarily prepared by Sḵwx̱wú7mesh stélmexw (Squamish people)
Resource Material	Locations where rocks, earth, or minerals (e.g., ochre, obsidian) or other materials (e.g., mountain goat hair) are collected by Sḵwx̱wú7mesh stélmexw (Squamish people)
Trading	Locations used for trade by Sḵwx̱wú7mesh stélmexw (Squamish people)
Trails/Travel	Access paths used by Sḵwx̱wú7mesh stélmexw (Squamish people) for transportation
Trapping	Locations used by trapping by Sḵwx̱wú7mesh stélmexw (Squamish people)

Source: Adapted from Traditions, 2015

C.1.2 Tsleil-Waututh Nation

Historically, Tsleil-Waututh Nation had a specific and complex cycle of harvesting resources and engaging in spiritual and cultural activities. Tsleil-Waututh people were dependent on the foreshore and marine waters of their traditional territory for subsistence (Donatuto, J., J. Konovsky and E. Grossman 2013). Cháyilhen (salmon) was a staple food for the Tsleil-Waututh people, as it was for other Coast Salish peoples. Tsleil-Waututh Nation also harvested halibut, cod, slhawt' (herring), sturgeon, and clams. Sea mammals such as seals, porpoises, and sea lions were hunted because the flesh of these animals was regarded as a delicacy, and their body oil was used for dipping dried roe, berries, and roots prior to consumption (Barnett, 1938, 1955; Fediuk and Thom, 2003; Tsleil-Waututh Nation, n.d.). Tsleil-Waututh Nation used protected harbours and inlets as favoured waterways for travel by canoe. Habitation sites were located on the water's edge and Tsleil-Waututh people used canoes to transport planks from their winter house for use in constructing their summer camp houses. It was from these camps that Tsleil-Waututh Nation traveled to their fishing, ch'áatl'am (hunting), and gathering locations (Tsleil Waututh Nation, n.d.). Waterways still serve as important travel corridors, including for the harvest of marine resources. Specific information on Tsleil-Waututh Nation use and locations of marine waterways and access to other heritage resources or use and locations of culturally significant sites within Átl'ka7tsem (Howe Sound) has not been provided to Woodfibre LNG at this time.

C.1.3 Other Indigenous Uses and Activities within Átl'ka7tsem (Howe Sound)

Specific information regarding other Indigenous uses, the location of marine waterways, access to other heritage resources, and locations of culturally significant sites within Átl'ka7tsem (Howe Sound) is limited (Woodfibre LNG 2015a,b,c,d,e,f,g). Musqueam Indian Band identified harvesting areas at Point Atkinson, Cowan Point, the southern shore of Bowen Island, and Cape Roger Curtis. There is no publicly available information regarding specific locations of use within Átl'ka7tsem (Howe Sound) by Cowichan Tribes First Nation, Halalt First Nation, Lake Cowichan First Nation, Lyackson First Nation, Musqueam Indian Band, Penelakut Tribe, Stz'uminus Nation, and Métis Nation British Columbia.

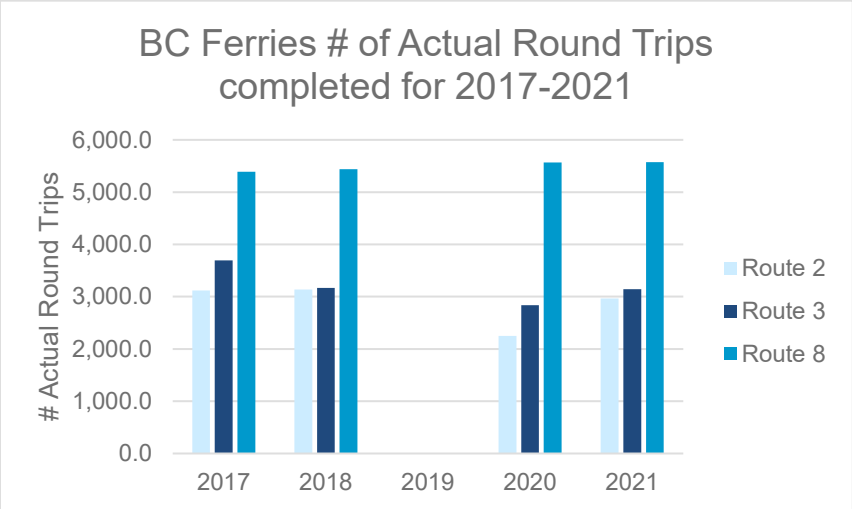
C.2 COMMERCIAL SHIPPING USE

C.2.1 BC Ferries

BC Ferries' Horseshoe Bay terminal in West Vancouver provides passenger and vehicle ferry services across the Strait of Georgia to Departure Bay (Nanaimo–Vancouver Island, Route 2) and across Átl'ka7tsem (Howe Sound) to both Langdale (Gibsons–Sunshine Coast, Route 3) and Snug Cove (Bowen Island–Metro Vancouver, Route 8) (BC Ferries n.d.,). From 2017 to 2021, BC Ferries completed an average of 2,869 round trip sailings annually for Route 2, 3,211 round trip sailings annually for Route 3, and 5,492 round trip sailings for Route 8 (an average of approximately 23,144 one-way vessel movements per year) (Figure 1). Additional sailings are added in the busier summer months (e.g., July to September) to satisfy demand (BC Ferries, 2022a). From 2016 to 2020, AIS data indicates that BC Ferries had an average of approximately 25,779 one-way BC Ferries vessel movements per year in Átl'ka7tsem (Howe Sound) (Section C.4; Figure C.2.2).

In mid-March 2020, traffic levels across most routes began to decline significantly because of the COVID-19 pandemic (BC Ferries, 2022a). BC Ferries has also recently noticed a trend of people looking to increase their travel following two years of COVID-19 pandemic restrictions, which has placed additional pressure on BC Ferries to increase their services (BC Ferries, 2022b).

From 2017 to 2021, there was an average of 4,744 round trip services provided per year for Route 13 (Table C.3). Route 13 is a passenger ferry which services the Sunshine Coast, with sailings travel between Gibsons (Sunshine Coast), New Brighton (Gambier Island), and Keats Landing (Keats Island West) (BC Ferries, 2022a). Sailings on Route 13 are independently operated by Kona Winds Charters (BC Ferries, 2022a; Kona Winds Charters, 2022). Gibsons Harbour Ferry also provides passenger services for services to and from Gibsons, Langdale, Horseshoe Bay, and the surrounding islands (Gibsons Harbour Ferry, n.d.).



Note:
Missing data for 2019
Source: BC Ferries, 2022a

Figure C.2.1: BC Ferries Round Trips completed for Routes 2, 3, and 8 from 2017–2021

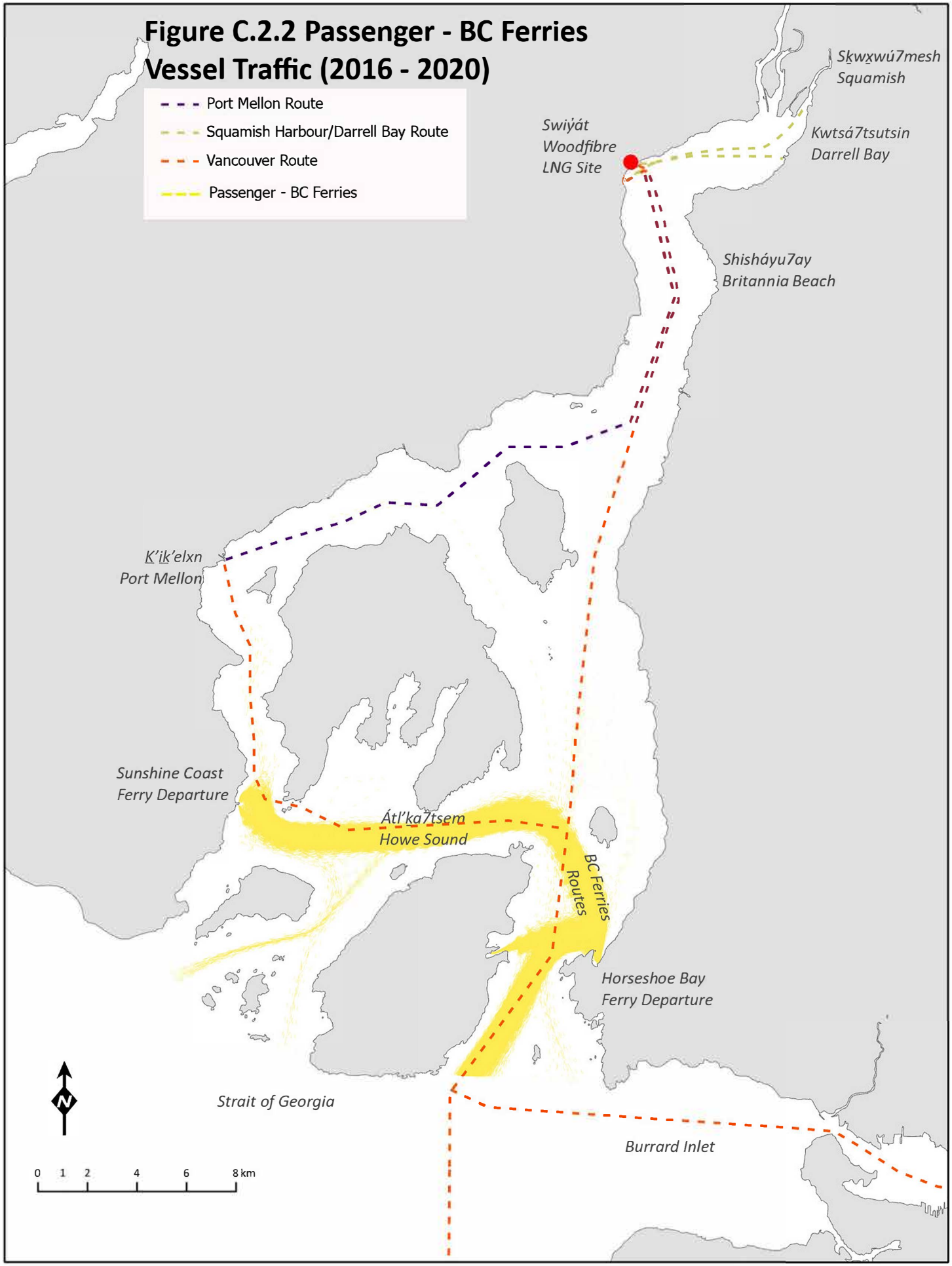


Figure C.2.2 Passenger - BC Ferries Vessel Traffic (2016 - 2020)
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Passenger - BC Ferries
Sḵwx̱wú7mesh Squamish
Swiy̓át Woodfibre LNG Site
Kwtsá7tsutsin Darrell Bay
Shisháyu7ay Britannia Beach
K'ik̲'elxn Port Mellon
Sunshine Coast Ferry Departure
Átl'ka7tsem Howe Sound
BC Ferries Routes
Horseshoe Bay Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

Table C.3: BC Ferries Route 13, Actual Round Trips, 2017–2021

Year	Quarter				Total
	Q1	Q2	Q3	Q4	
2017	926	1,027	1,109	1,040	4,102
2018	1,048	1,139	1,182	1,130	4,499
2019	*	1,228	1,280	1,216	*
2020	1,136	1,227	1,354	1,283	5,000
2021	1,266	1,396	1,390	1,323	5,375

Notes:
Q1 ends March 31, Q2 ends June 30, Q3 ends September 30, Q4 ends December 31
* Missing data for Q1 2019

Source: BC Ferries, 2022a

C.2.2 Deep Sea Bulk Carriers and Cargo Ships

There are two deep-water ports in Átl'ka7tsem (Howe Sound), located at Squamish Terminals and K'íkelxn (Port Mellon). Squamish Terminals, located approximately 5.8 km east of the CPA within St'a7mes (Squamish Harbour), was established in 1972 and is a break-bulk terminal located in Skwxwú7mesh (Squamish) (situated at the north end of Átl'ka7tsem (Howe Sound), approximately 32 nautical miles north of the Port of Vancouver [BC Marine Terminal Operators Association, 2022]). Squamish Terminals has a west berth that was constructed in 1988 and a newer east berth that was constructed in 2016 (Squamish Terminals, n.d.). The terminal handles approximately 54 piloted vessel calls per year (Table C.4). Typically, between one and two tugs are used to assist vessels with berthing and de-berthing, and a short-term anchorage is situated southwest of the St'a7mes (Squamish Harbour) approach light (Liquiline, 2014). K'íkelxn (Port Mellon), located within Átl'ka7tsem (Howe Sound) in the north Thornbrough Channel, has a deep seaport facility that handles approximately 46 vessel calls per year (Table C.4). It is a major pulp port for Howe Sound Pulp and Paper (Chamber of Shipping, n.d.). Finished pulp and paper products are shipped from the terminal using specialized carrier vessels.

In 2021, there were 143 piloted vessel calls to Átl'ka7tsem (Howe Sound), of which 66 vessel calls were to K'íkelxn (Port Mellon) and 77 were to Squamish Terminals (Table C.4). Piloted vessel movements to Squamish Terminals and K'íkelxn (Port Mellon) have increased from 2018 to 2021 (Table C.4). From 2016 to 2020, AIS data indicates that there was an average of approximately 303 one-way commercial vessel movements[13] per year in Átl'ka7tsem (Howe Sound) (Section C.4; Figure C.2.3).

[13] Commercial – Deep-sea vessels: inclusive of cargo vessels (general cargo, container vessels), tanker vessels, oil/chemical tanker vessels.

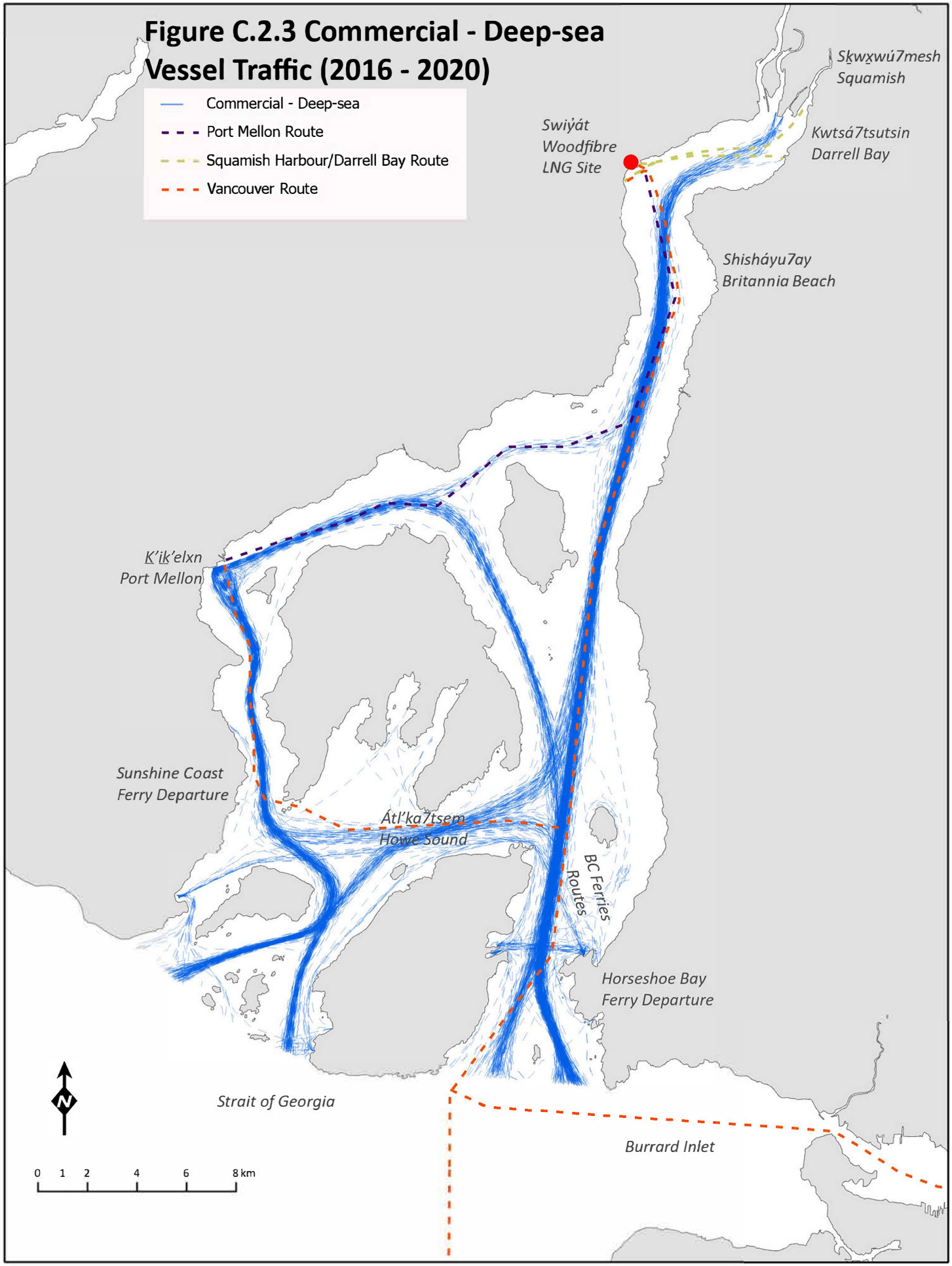


Figure C.2.3 Commercial - Deep-sea Vessel Traffic (2016 - 2020)
Commercial - Deep-sea
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Sḵwx̱wú7mesh
Squamish
Swiy̓át
Woodfibre
LNG Site
Kwtsá7tsutsin
Darrell Bay
Shisháyu7ay
Britannia Beach
K'ik̲'elxn
Port Mellon
Sunshine Coast
Ferry Departure
Átl'ka7tsem
Howe Sound
BC Ferries
Routes
Horseshoe Bay
Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

Table C.4: Piloted Vessel Movements to Port Facilities in Átl'ḵa7tsem (Howe Sound) (Squamish Terminals and K̲'íḵ'elxn [Port Mellon]) from 2018 to 2021

Year	Vessel Movements to Port Mellon	Vessel Movements to Squamish Terminals		Total Vessel Movements to Howe Sound
		Squamish 1	Squamish 2	
2018	39	20	24	83
2019	37	23	28	88
2020	40	20	24	84
2021	66	50	27	143
Average Vessel Movements	**45.5**	**28.3**	**25.8**	**99.5**

Notes:
Inclusive of bulk carriers, general cargo vessels, and large oceangoing vessels (e.g., roll-on/roll-off)
A vessel movement is defined as a one-way transit.

Source: PPA, 2022

C.2.3 Small Commercial Vessels

Small commercial vessel movements in Átl'ḵa7tsem (Howe Sound) are connected to tug and tow movements, water taxis, and fishing vessels. The majority of tug and barge vessel movements within Átl'ḵa7tsem (Howe Sound) are connected to forestry operations, such as the movement of logs to and from sorting booms and movement of wood chips and pulp. Wood chips are shipped to K̲'íḵ'elxn (Port Mellon) in open, flat-decked barges that are towed by tugs. Within the upper reaches of Átl'ḵa7tsem (Howe Sound) there are log storage areas located near the CPA, east of the CPA, at Sts'íts'a7ḵin (Watts Point), and east of Nexen Beach in St'a7mes (Squamish Harbour). From 2016 to 2020, AIS data indicates that there was an average of approximately 3,733 one-way tug and barge vessel movements per year in Átl'ḵa7tsem (Howe Sound) (Section C.4; Figure C.2.4).

Tug and barge operators located within Átl'ḵa7tsem (Howe Sound) include Squamish Marine Services in Sḵwx̱wú7mesh (Squamish), Mercury Transport in Horseshoe Bay, Crosby Marine Services in Gibsons, and Cormorant Tug and Barge in Snug Cove (Squamish Marine Services Ltd., 2021; Mercury Transport Inc., 2022; Crosby Marine Services, 2022; Cormorant Tug and Barge, n.d.). Some of the tugs and barges in Átl'ḵa7tsem (Howe Sound) are operated by the Ledcor Group and Seaspan Marine, based in K̲'emḵ'emel̓áy̓ (Vancouver) (Ledcor Group, 2022; Seaspan Marine, 2022). Tugs are used when assisting vessels in berthing at Squamish Terminals and K̲'íḵ'elxn (Port Mellon) (Chamber of Shipping, n.d.).

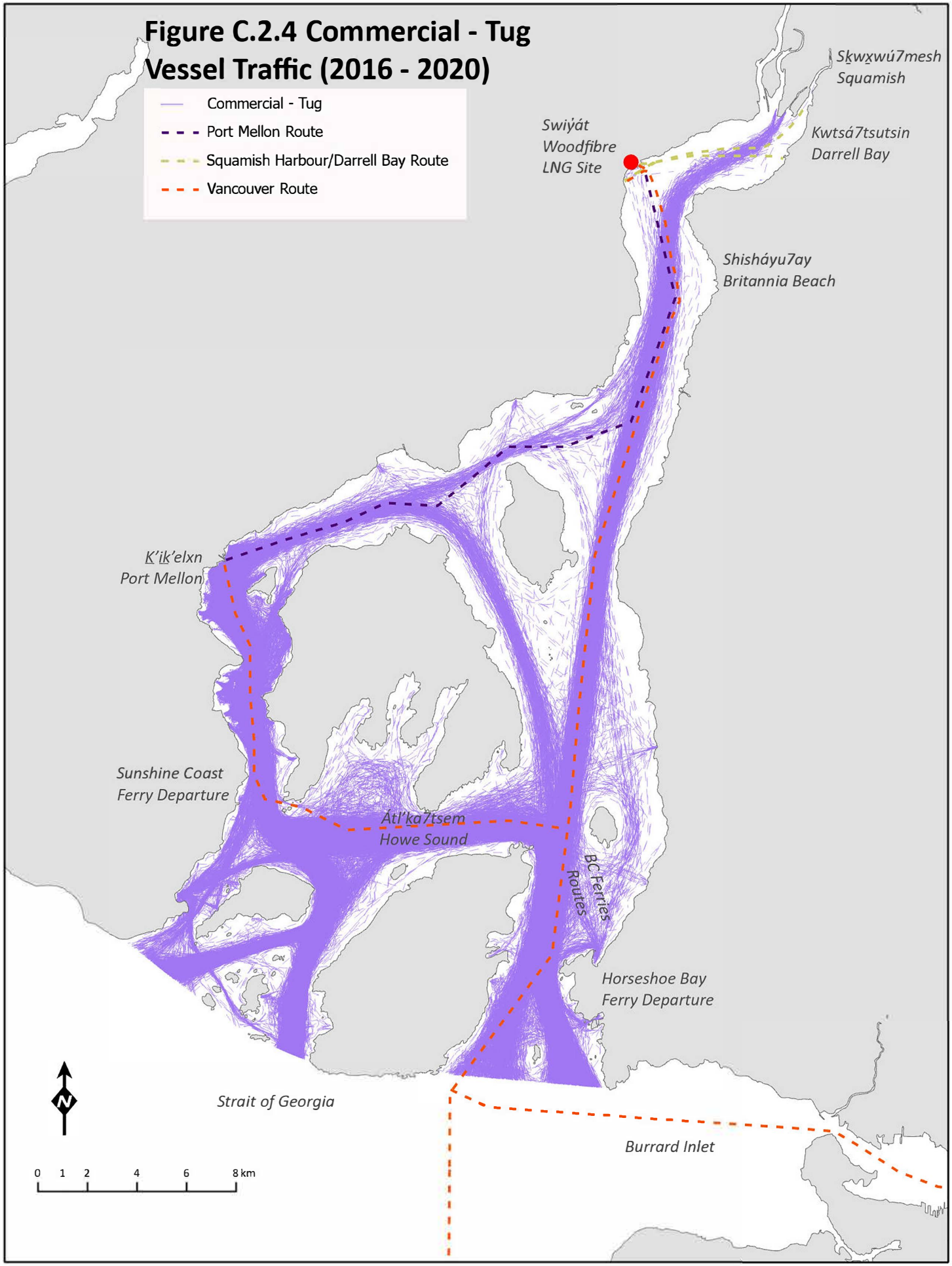


Figure C.2.4 Commercial - Tug Vessel Traffic (2016 - 2020)
Commercial - Tug
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Sḵwx̱wú7mesh
Squamish
Swiy̓át
Woodfibre
LNG Site
Kwtsá7tsutsin
Darrell Bay
Shisháyu7ay
Britannia Beach
K'ik̲'elxn
Port Mellon
Sunshine Coast
Ferry Departure
Át̓l'ka7tsem
Howe Sound
BC Ferries
Routes
Horseshoe Bay
Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

Private water taxi services are offered between Sḵwx̱wú7mesh (Squamish), West Vancouver, the Sunshine Coast, and islands in Átl'ḵa7tsem (Howe Sound). Water taxi providers in Átl'ḵa7tsem (Howe Sound) include:

- Squamish Marine Services, located in Sḵwx̱wú7mesh (Squamish) (Squamish Marine Services Ltd., 2021)
- Bowen Land and Sea Taxi and Cormorant Marine Water Taxi, located in Snug Cove on Bowen Island (Bowen Land and Sea Taxi, 2022; Cormorant Marine, 2022)
- Mercury Water Taxi, located in West Vancouver (Mercury Transport Inc., 2022)
- Gambier Island Water Taxi, Kona Winds Charters, and Sunshine Coast Water Taxi, located in Gibsons (Kona Winds Charters, 2022; Sunshine Coast Water Taxi, 2020)

From 2016 to 2020, AIS data indicates that there was an average of approximately 1,018 one-way commercial passenger vessel movements[14] per year in Átl'ḵa7tsem (Howe Sound) (Section C.4 AIS; Figure C.2.5).

C.2.4 Commercial Fisheries

Between 1996 and 2021, there were two commercial cháyilhen (salmon) fisheries openings in Átl'ḵa7tsem (Howe Sound), both for commercial cháyilhen (salmon) seine fisheries (DFO, 2022a). The two commercial cháyilhen (salmon) fisheries openings occurred in 2013 and 2015, respectively. There were no troll or gill net fishing opportunities during that period (DFO, 2022a). In PFMA 28, in 2013, there were seven vessels and six boat days, and 282,400 lháwichen (pink salmon) (*Oncorhynchus gorbuscha*) were landed (DFO, 2022a). In 2015, there were four vessels, which had six boat days, and 100,051 lháwichen (pink salmon) were landed (DFO, 2022a).

Commercial invertebrate fisheries within PFMA 28 includes prawn (*Dendrobranchiata*), shrimp (*Caridea*), and crab (*Brachyura*). Traps, which are set and retrieved, are used to harvest prawn, shrimp, and crab. Shrimp are also caught using trawling fishing gear (DFO, 2021a). The number of shell fishing vessels operating in each sub-area per year between 2018 and 2021 is presented in Table C.5. There are 11 Rockfish Conservation Areas (RCAs) located within Átl'ḵa7tsem (Howe Sound) (DFO, 2015). These areas are closed to a range of recreational and commercial fisheries to protect inshore rockfish and their habitat (DFO, 2015). In 2015, nine areas were closed to commercial, recreational, and Aboriginal Food, Social, and Ceremonial bottom-contact fishing activities for prawn, shrimp, crab, groundfish, and cháyilhen (salmon) (downrigger gear for recreational cháyilhen (salmon) trolling) in the Strait of Georgia and Átl'ḵa7tsem (Howe Sound) to protect glass sponge reefs (DFO, 2022c). On April 1, 2019, an additional eight closures were added to bottom-contact fishing activities within portions of sub-areas 28-2 and 28-4 (DFO, 2022c). The prohibition of bottom-contact fishing activities was implemented to protect nine Átl'ḵa7tsem (Howe Sound) glass sponge reefs as marine refuges (DFO, 2022c).

[14] Passenger – Other: inclusive of cruise ship vessels, water taxis, whale watching vessels, other commercial passenger vessels.

This data provides the number of vessels that are likely to be active in each sub-area at any one time. Between 2018 and 2021, there was an average of 2,450 crab traps hauled in sub-area 28-2, 527 in sub-area 28-4, and 1,781 in sub-area 28-5. During the same period there was an average of 16,135 prawn traps hauled in sub-area 28-2, 2,395 in sub-area 28-4, and 1,726 in sub-area 28-5 (DFO, 2022b). The weight of prawn landed between 2018 and 2021 was estimated to be around 26,537 pounds (lbs.) in sub-area 28-2, 8,950 lbs. in sub-area 28-4, and 3,380 lbs. in sub-area 28-5 (DFO, 2022b). From 2016 to 2020, AIS data indicates that there was an average of approximately 26 one-way fishing vessel movements per year in Átl'ka7tsem (Howe Sound) (Section C.4 AIS; Figure C.2.6).

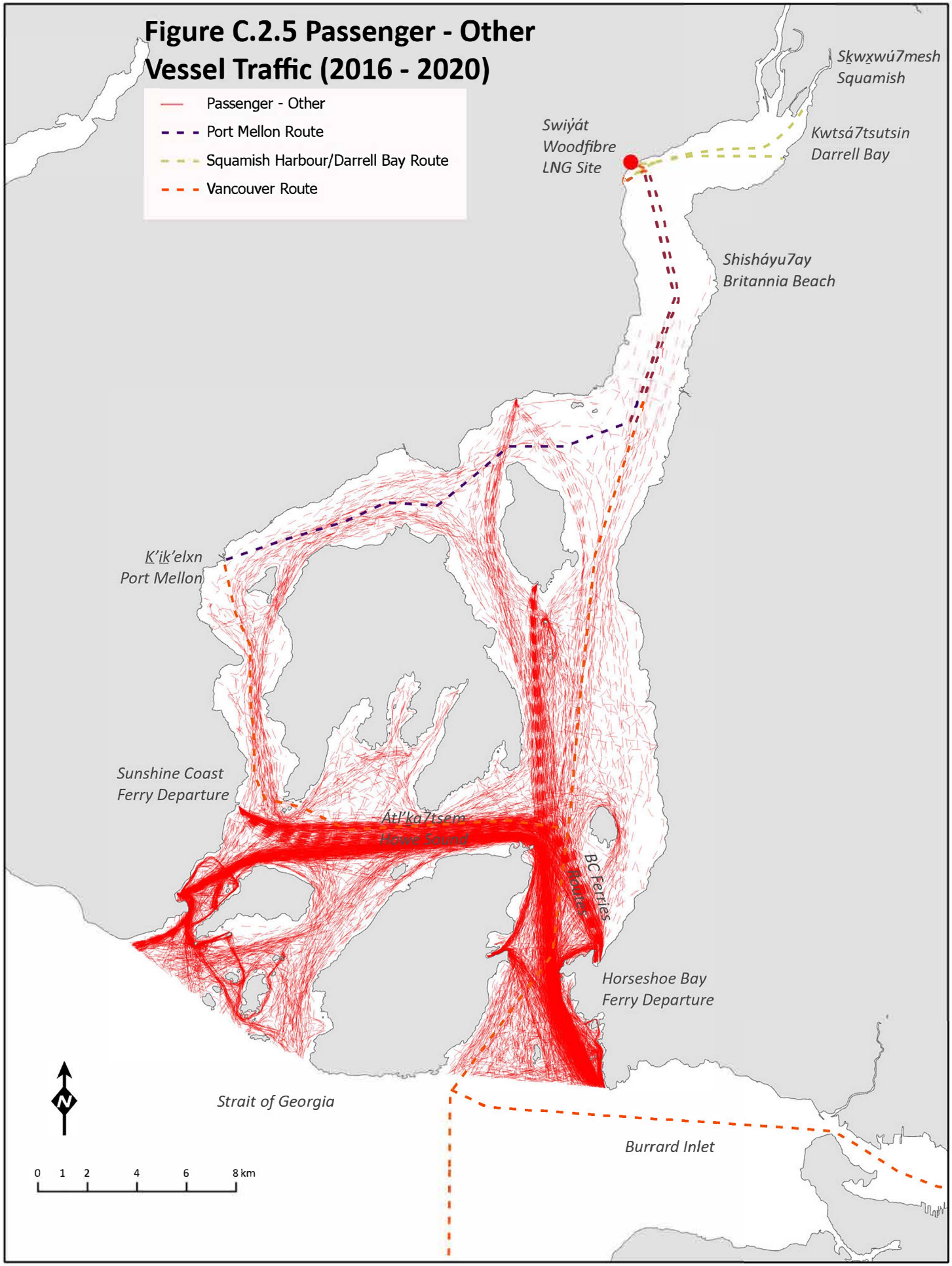


Figure C.2.5 Passenger - Other Vessel Traffic (2016 - 2020)
Passenger - Other
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Sḵwx̱wú7mesh
Squamish
Swiy̓át
Woodfibre
LNG Site
Kwtsá7tsutsin
Darrell Bay
Shisháyu7ay
Britannia Beach
K'ik̲'elxn
Port Mellon
Sunshine Coast
Ferry Departure
Át'ka7tsem
Howe Sound
BC Ferries
Routes
Horseshoe Bay
Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

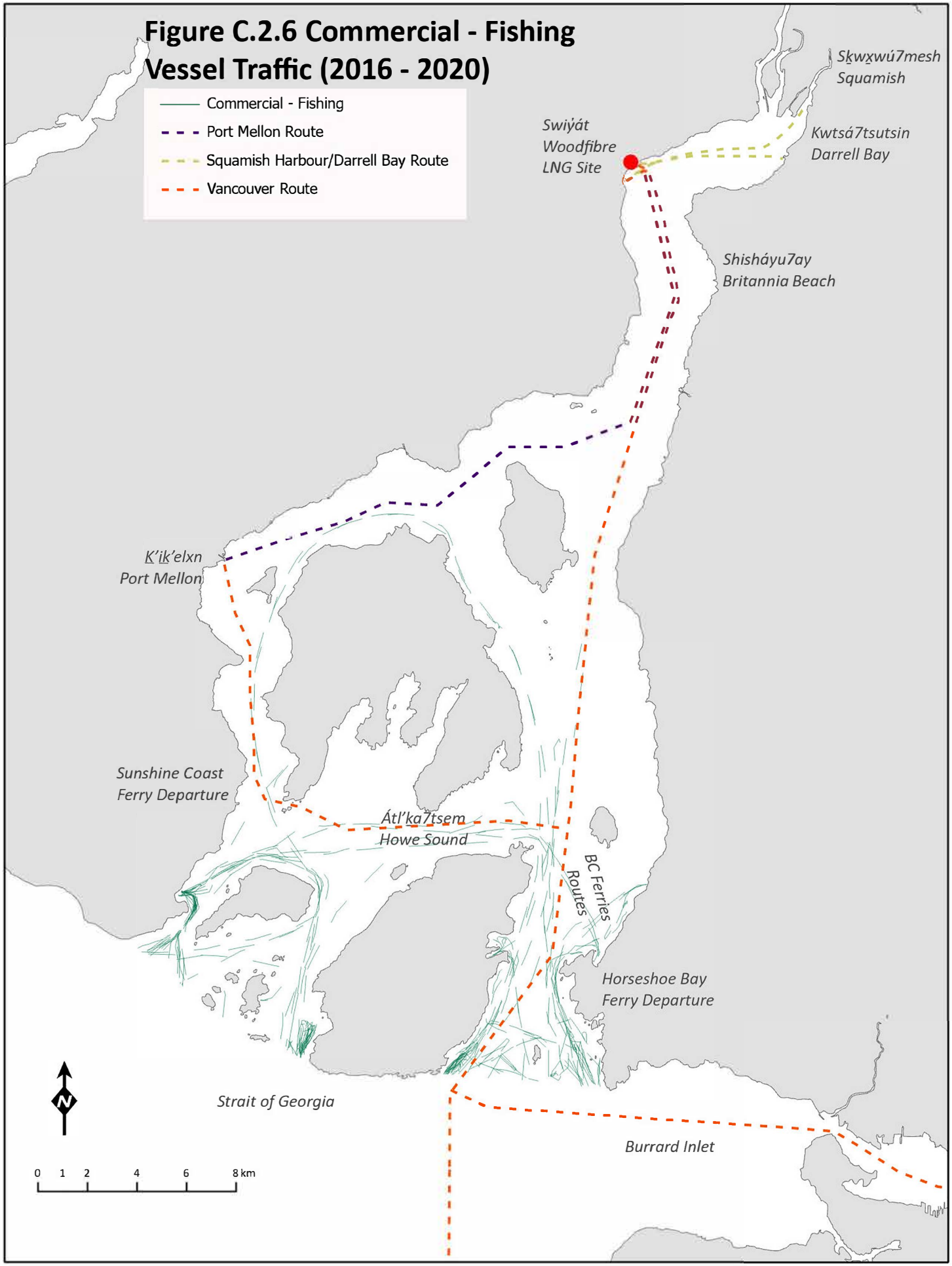


Figure C.2.6 Commercial - Fishing Vessel Traffic (2016 - 2020)
Commercial - Fishing
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Sḵwx̱wú7mesh
Squamish
Swiy̓át
Woodfibre
LNG Site
Kwtsá7tsutsin
Darrell Bay
Shisháyu7ay
Britannia Beach
K'ik̲'elxn
Port Mellon
Sunshine Coast
Ferry Departure
Átl'ka7tsem
Howe Sound
BC Ferries
Routes
Horseshoe Bay
Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

There are 11 Rockfish Conservation Areas (RCAs) located within Átl'ḵa7tsem (Howe Sound) (DFO, 2015). These areas are closed to a range of recreational and commercial fisheries to protect inshore rockfish and their habitat (DFO, 2015). In 2015, nine areas were closed to commercial, recreational, and Aboriginal Food, Social, and Ceremonial bottom-contact fishing activities for prawn, shrimp, crab, groundfish, and cháyilhen (salmon) (downrigger gear for recreational cháyilhen (salmon) trolling) in the Strait of Georgia and Átl'ḵa7tsem (Howe Sound) to protect glass sponge reefs (DFO, 2022c). On April 1, 2019, an additional eight closures were added to bottom-contact fishing activities within portions of sub-areas 28-2 and 28-4 (DFO, 2022c). The prohibition of bottom-contact fishing activities was implemented to protect nine Átl'ḵa7tsem (Howe Sound) glass sponge reefs as marine refuges (DFO, 2022c).

Table C.5: Average Fishing Vessel Count in Sub-areas 28-2, 28-4, and 28-5 from 2018 to 2021

Fishery	Opening Period	DFO Sub-area	Vessel Count per Year[1]	Length of Marine Access Route in Sub-area (km)	Vessel Count per km of Maine Access Route in Sub-area during the Opening Period
Prawn[2]	May[3] to the end of June[4]. In-season commercial prawn fishery closure are announced as spawner indices in those areas drop to a level 25% above the monthly index.	28-2	12	22	0.5
		28-4	9	8	1.1
		28-5	6	10	0.6
Shrimp	June 1 until the harvest quotas are reached or the closing date is reached (March 31 the following year).	28-2	N/A	22	N/A
		28-4	N/A	8	N/A
		28-5	N/A	10	N/A
Crab[5]	June 15 to November 30 (daylight only, not to exceed once per day).	28-2	2	22	0.1
		28-4	2	8	0.3
		28-5	2	10	0.2
Total Vessels		**28-2**	**14**		
		28-4	**11**		
		28-5	**8**		

Table C.5: Average Fishing Vessel Count in Sub-areas 28-2, 28-4, and 28-5 from 2018 to 2021

Fishery	Opening Period	DFO Sub-area	Vessel Count per Year[1]	Length of Marine Access Route in Sub-area (km)	Vessel Count per km of Maine Access Route in Sub-area during the Opening Period

Notes:

[1] Vessel Count per Year is based on the number of vessels recorded per year for each sub-area for recent fisheries (2018-2021). Data also only reflects where gear is placed and therefore would not record fishing vessels crossing a sub-area.

[2] Includes Prawn (or Pacific Spot Prawn) (*Pandalus platyceros*)

[3] In 2020, the commercial prawn fishery was scheduled to open no earlier than May 7, 2020, but was delayed due to COVID-19.

[4] Based on recent prawn fishery seasons (2016-2020), the commercial prawn fishery, which generally occurs from May to June, is anticipated to be about 40 days long in 2021/22.

[5] Includes aẏx̱ (Dungeness Crabs) (*Metacarcinus magister*)

The following invertebrate fisheries have not occurred from 2018-2021: Urchin, Geoduck or Sea Cucumber by Dive, Shrimp Trawl, Scallop Trawl, or Euphausiid Trawl.

Sources: DFO, 2021a, 2021b, 2021c, 2022b

C.3 MARINE BASED RECREATION AND TOURISM

C.3.1 Recreational Fisheries

Fisheries and Oceans Canada (DFO) estimates recreational effort and catch in the marine waters of southern BC using an annual creel survey. Data on Átl'ka7tsem (Howe Sound) is collected under the South Coast creel survey, in the Strait of Georgia jurisdiction. Creel surveys in the Strait of Georgia are active from June to September (DFO, 2021d). There were 225 creel survey conducted in 2020 in PFMA 28 (DFO, 2021d). It was estimated that there were 6,522 boat trips (i.e., effort estimate) in 2020 in PFMA 28 (DFO, 2021d). There has been a decline in recreational fishing boat trips (i.e., effort) and catches in PFMA 28 from the early 2000s (Golder Associates, 2015; DFO, 2021d). Table C.6 presents catch estimates of recreational fishing effort and finfish catch in PFMA 28 in 2020.

Table C.6: Recreational Fishing Finfish Catch Estimates in PFMA in 2020

Species	Kept	Released	Total
Chinook	497	1,554	2,051
Coho	744	753	1,497
Chum	74*	37*	111
Pink	2,570*	3,914*	6,484
Sockeye	0	38*	38
Halibut	10	0	10
Lingcod	113*	0	113
Rockfish[1]	22	0	22
Rockfish[2]	46	215	261

Notes:

* where data had not yet been entered; the 5-year average was used.

[1] Includes China rockfish (*Sebastes nebulosus*), Copper rockfish (*Sebastes caurinus*), Quillback rockfish (*Sebastes maliger*), Tiger rockfish (*Sebastes nigrocinctus*), Yelloweye rockfish (*Sebastes ruberrimus*)

[2] Includes other species of rockfish

Estimates are generated from data collected by DFO's South Coast Creel Survey, paper and electronic logbooks, and lodge manifests.

Source: DFO, 2021d

There are 11 RCAs located within Átl'ka7tsem (Howe Sound). The Domett Point, Pam Rock, Lions Bay, Bowyer Island, Passage Island, and West Vancouver RCAs are located on the eastern side of Átl'ka7tsem (Howe Sound) (DFO, 2015). These areas are closed to a range of recreational and commercial fishing activities to protect inshore rockfish and their habitat (DFO, 2015) and as a result, marine traffic has reduced. Effective April 1, 2019, commercial, recreational, and Indigenous Food, Social, and Ceremonial bottom-contact fishing activities for prawn, shrimp, crab, groundfish, and cháyilhen (salmon) (downrigger gear for recreational cháyilhen [salmon] trolling) are prohibited within portions of sub-areas 28-2 and 28-4 to protect nine Átl'ka7tsem (Howe Sound) glass sponge reefs as marine refuges (DFO, 2022c). Marine biotoxin contamination closures for bivalve species are also in place for the sub-areas of PFMA 28 and sanitary contamination closures (from April 1 to March 31) are in place for sub- of PFMA 28, including 28-2, 28-4, and 28-5. In addition to the previously mentioned closures, the waters around Point Atkinson, Xwekw'ále7em (Porteau Cove), and Whytecliff Park are closed to marine harvesting year-round for the preservation of the marine habitat (DFO, 2022d).

C.3.2 Recreational and Tourism Use

Recreational boating activity (motorized and non-motorized) in Átl'ka7tsem (Howe Sound) occurs year-round (Liquiline, 2014); recreational boating routes are presented on Figure 7. The main recreational boating season runs from May until September, with July and August the busiest period. Popular recreational boating destinations with recreational boating routes that intersect the Project marine access routes include the various bays on Gambier Island (e.g., West Bay, Centre Bay and Port Graves, and Halkett Bay), Plumper Cove on Keats Island, Xwekw'ále7em (Porteau Cove), Bowen Island, Collingwood Channel, and Barfleur Passage (Figure C.2.6). It is not mandatory for commercial vessels under 20 m, pleasure craft less than 30 m, or fishing vessels less than 24 m to either participate in VTS or install AIS; therefore, most recreational craft does not get captured in the AIS data. From 2016 to 2020, AIS data indicates that there was an average of approximately 6,149 one-way pleasure craft movements[15] and 1,824 government vessel movements[16] per year in Átl'ka7tsem (Howe Sound) (Section C.4; Figure C.2.7).

[15] Recreational – Pleasure craft: inclusive of sailing vessels, pleasure craft, and yachts.
[16] Government: inclusive of diving operations vessels, military operations vessels, search and rescue vessels, port tender vessels, anti-pollution equipment, law enforcement vessels, and research/survey vessels.

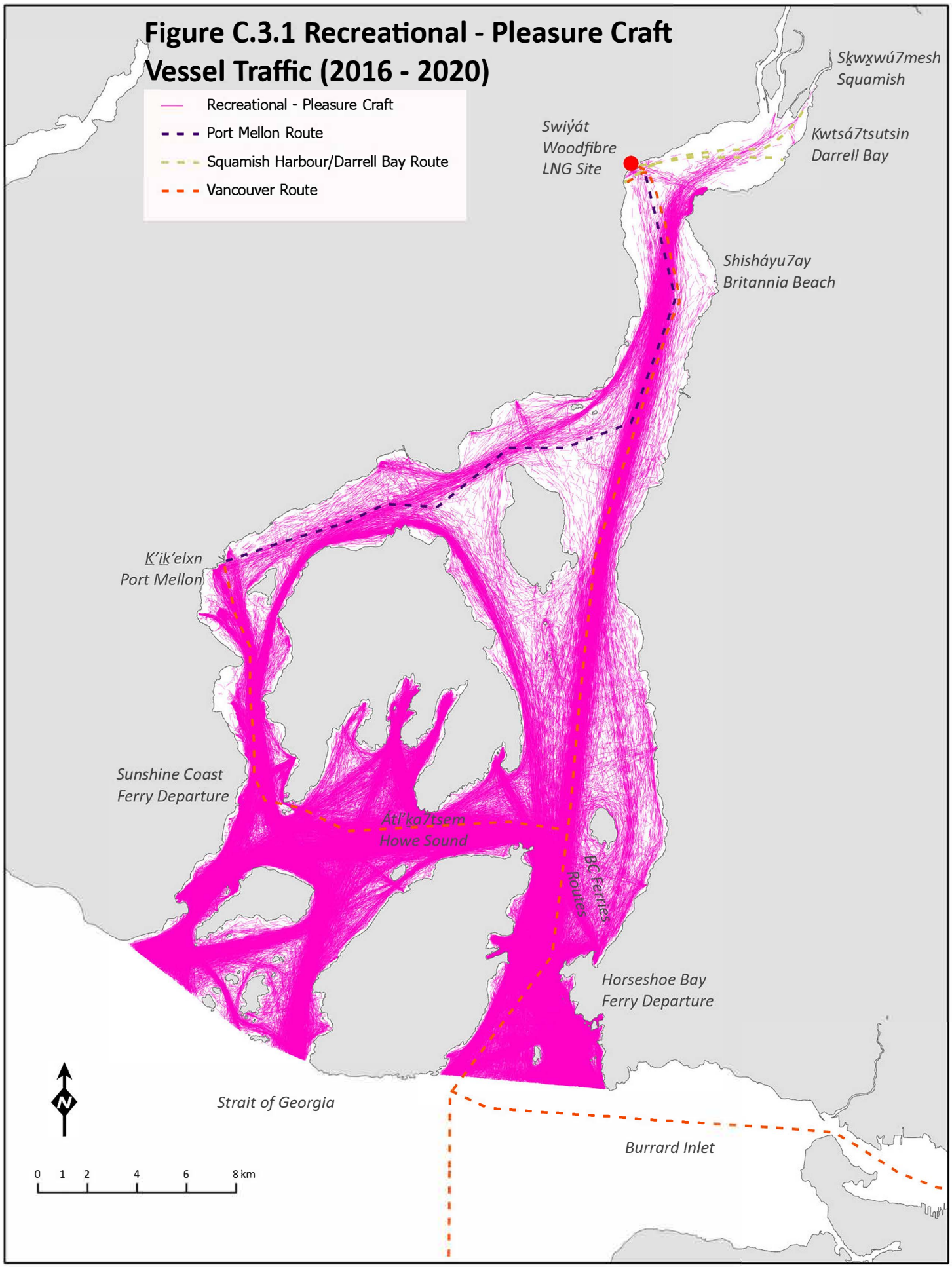


Figure C.3.1 Recreational - Pleasure Craft Vessel Traffic (2016 - 2020)
Recreational - Pleasure Craft
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Sḵwx̱wú7mesh
Squamish
Swiy̓át
Woodfibre
LNG Site
Kwtsá7tsutsin
Darrell Bay
Shisháyu7ay
Britannia Beach
K'ik'elxn
Port Mellon
Sunshine Coast
Ferry Departure
Át'ḵa7tsem
Howe Sound
BC Ferries
Routes
Horseshoe Bay
Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

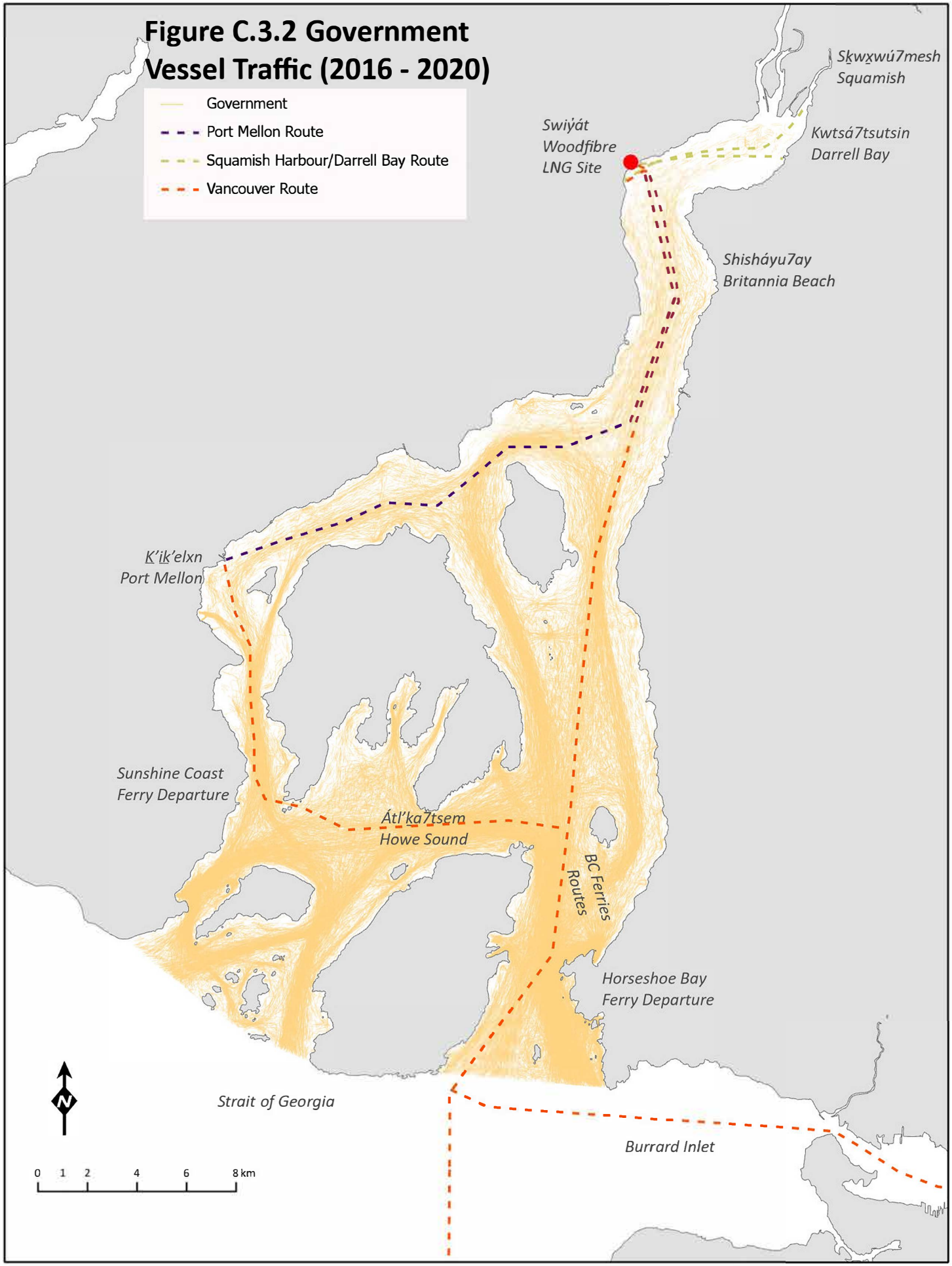


Figure C.3.2 Government Vessel Traffic (2016 - 2020)
Government
Port Mellon Route
Squamish Harbour/Darrell Bay Route
Vancouver Route
Sḵwx̱wú7mesh
Squamish
Swiy̓át
Woodfibre
LNG Site
Kwtsá7tsutsin
Darrell Bay
Shisháyu7ay
Britannia Beach
K'ik̲'elxn
Port Mellon
Sunshine Coast
Ferry Departure
Átl'ka7tsem
Howe Sound
BC Ferries
Routes
Horseshoe Bay
Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

There are three marinas with overnight moorage in St'a7mes (Squamish Harbour); restrooms and power are available (Table C.7; Tourism Squamish, 2019a).

Table C.7: Marina and Yacht Club Features in Átl'ka7tsem (Howe Sound)

Name	Location	Facilities	Approximate Number of Slips / Members (where available)
Marinas			
Lions Bay Marina	Lions Bay	Dry-stack storage	-
Bowen Island Marina	Snug Cove, Bowen Island	Moorage	45 slips
Squamish Harbour Authority	St'a7mes (Squamish Harbour)	Moorage	65 slips
Gibsons Landing Harbour Authority	Gibsons	Moorage	20 slips
Gibsons Marina	Gibsons	Moorage	400 slips
Union Steamship Co. Marina	Snug Cove, Bowen Island	Moorage	200 slips
Sewell's Marina	Horseshoe Bay	Moorage	350 slips
Sunset Marina	West Vancouver, Queen Charlotte Channel	Moorage	110 slips (March 1 to October 15); 68 slips (February 16 to November 15)
Thunderbird Marina	Fisherman's Cove, West Vancouver	Moorage	600 slips
Sea to Sky Marina	St'a7mes (Squamish Harbour)	Moorage	32 slips
Squamish Marine Services	St'a7mes (Squamish Harbour)	Moorage	40 slips
Yacht Clubs			
Thunderbird Yacht Club	Bowen Island and Gibsons Outstations	Moorage	125 members
Burrard Yacht Club/ Ekins Point	North Gambier, Thornrough Channel	Moorage	300 members
Squamish Yacht Club	St'a7mes (Squamish Harbour)	Moorage	100 slips; 200 members
West Vancouver Yacht Club/ Elliot Bay	Fisherman's Cove, West Vancouver	Moorage	700 members
Centre Bay Yacht Station	Centre Bay, Gambier Island	Moorage	100 members
Royal Vancouver Yacht Club/Centre Bay	Alexandra Island, in Centre Bay, Gambier Island	Moorage	-
Bowen Island Yacht Club	Bowen Island	Moorage	-

Table C.7: Marina and Yacht Club Features in Átl'ḵa7tsem (Howe Sound)

Name	Location	Facilities	Approximate Number of Slips / Members (where available)
False Creek Yacht Club/ Union Steamship Outstation	Snug Cove, Bowen Island	Moorage	250 members
Vancouver Rowing Club/ Union Steamship Outstation	Snug Cove, Bowen Island	Moorage	200 members
Gibsons Yacht Club	Gibsons	Moorage	140 members
Eagle Harbour Yacht Club	Fisherman's Cove, West Vancouver	Moorage	95 slips; 125 active members and 43 members in other categories

Sources: Lions Bay Marina, n.d.; Bowen Island Marina, 2022; Boaters Blue Pages and Marinas Guide, 2022a; Gibsons Landing Harbour Authority, 2021; Boaters Blue Pages and Marinas Guide, 2022b; Union Steamship Co. Marina, 2020; Sewell's Marina, 2022; Sunset Marina, 2022; Thunderbird Marina, 2022; Sea-to-Sky Marina, 2016; Thunderbird Yacht Club, n.d.; Burrard Yacht Club, 2021; Squamish Yacht Club, 2021; 2Yachts, 2022; CBYS, 2022; Royal Vancouver Yacht Club, 2018; FCYC, 2022; Vancouver Rowing Club 2017; Gibsons Yacht Club, n.d.; EHYC, 2022

Table C.8: Key Anchorages and Public Dock Features in Átl'ḵa7tsem (Howe Sound)

Name	Location	Facilities
Mount Gardner Wharf	Galbraith Bay, Bowen Island	Temporary moorage
Snug Cove Wharf	Snug Cove, Bowen Island	Temporary moorage
Horseshoe Bay Pier	Horseshoe Bay	Temporary moorage
New Brighton Public Dock	Thornbrough Bay, Gambier Island	Walk-on public ferry dock
West Bay Anchorage	West Bay, Gambier Island	Anchorage
Centre Bay Anchorage	Centre Bay, Gambier Island	Anchorage
Port Graves Anchorage	Port Graves, Gambier Island	Anchorage
Brigade Bay Anchorage	Brigade Bay, Gambier Island	Anchorage
Mannion Bay Anchorage	Snug Cove, Bowen Island	Anchorage
Halkett Bay Anchorage	Halkett Bay, Gambier Island	Anchorage
Porteau Cove Anchorage	Xwekw'ále7em (Porteau Cove), Sḵwx̱wú7mesh (Squamish)	Short-term Anchorage
Plumber Cove Anchorage	Plumber Cove, Gambier Island	Short-term Anchorage

Sources: Bowen Island Municipality, 2010; Gambier Island Community, 2021; Victoria International Marina, 2019; Howe Sound Marine, 2020; BC Adventure, 2018

In 2015, the Sea to Sky Marine Trail became operational (BC Marine Trails, n.d.) as part of two major trail networks that include the BC Marine Trails Network and the TransCanada Trail. The creation of the Sea to Sky Marine Trail led to an additional six recreation sites, which marine users can access. It also connects to three pre-existing provincial sites: Halkett Bay Marine Provincial Park, Plumper Cove Marine Provincial Park, and Porteau Cove Provincial Park. Dive sites are concentrated around Britannia Beach, Pam Rocks, Bowyer Island, Lions Bay, Porteau Cove Park, Anvil Island, and West Vancouver (Howe Sound Guide, 2020). Many of the dive sites are accessed by boat only, and dive boats likely use the same boating routes as those used by other recreational craft.

The wind conditions in St'a7mes (Squamish Harbour) are highly conducive to kiteboarding and windsurfing (windsports) The majority of windsurfers and kiteboarders launch from the Squamish Spit (the Spit), which is maintained by the Squamish Windsports Society (SWS). The Spit, or training berm, was constructed in the early 1970s by BC Rail and was originally intended to train the Squamish River along the western edge to facilitate the construction of a coal port in the estuary (SRWS, 2021). The SWS created secure access to the southern tip of the Squamish River training berm for recreational users (SWS, 2022a). The SWS require individuals to have a SWS membership to access the Spit for the season, which runs between May 15 and September 15. In 2021, the SWS had almost 1,000 members, an all-time high for the society. It is estimated that during peak season approximately 100 kiteboarders and 30 windsurfers could be on the water on a weekend day and 80 windsport recreationalists on a weekday (Woodfibre LNG, 2015). The Spit, which separates the mouth of the Squamish River from the Squamish River estuary, is currently being removed to improve the estuarine habitat (Chua, 2022). The 2021/2022 plan is to remove the 1.1 km portion of the lower Spit between the yellow gate and the turn-around at the south end of the Spit (SRWS, 2021). Approximately 300 metres of the training berm will be removed in early 2022, leaving the remaining "Spit Island" launch site available for windsports (SRWS, 2021). An additional 600 metres of the training berm will be removed, dependent on the effects that the first 300 metres has on the nearby port (SRWS, 2021). The SWS is currently exploring options to transport members to the Spit Island launch site, including the use of a boat ferry service in the short-term and a cable ferry, pedestrian boardwalk, or bridge in the longer term to provide members with access (SWS, 2022b).

The Squamish Community Tourism Plan, developed by representatives from local tourism businesses and organization, was created in 2006 (Tourism Squamish, 2019b). As a result of these efforts, Tourism Squamish Society was established in 2007 as a Destination Marketing Organization (Tourism Squamish, 2019b). Tourism Squamish represents more than 110 businesses that comprise the local tourism economy (Tourism Squamish, 2019b). Its primary business functions include destination marketing, visitor services, and destination development (Tourism Squamish, 2019b). The peak season for the tourism industry in Átl'ka7tsem (Howe Sound) occurs between April and October.

Boat rentals (motorized and non-motorized) are available, as well as motorized and non-motorized boat tours and guides. Rentals for shkwe̓n (ocean) kayakers, canoeists, and stand-up paddle boarders are available at Sea to Sky Adventure Company, Squamish Adventure Inn, and Valhalla Pure Outfitters and tours are available at Sea to Sky Adventure Company (Tourism Squamish, 2019a). Guided fishing is another popular marine-based tourism activity, which occurs close to the Defence Islands. Other key guided fishing areas area described in Section C.3.1.

The Squamish Oceanfront peninsula, adjacent to Squamish Terminals in Átl'ḵa7tsem (Howe Sound), is currently being developed by Newport Beach Developments (District of Squamish, n.d.). The site, which was formerly an industrial use and log sorting area, will be redeveloped into a residential and general commercial and mixed-use area. The total anticipated residential population will be approximately 6,500 people (District of Squamish, 2015). The Squamish Oceanfront Sub Area Plan outlines several projects and actions that would foster and increase marine-based tourism and recreation opportunities in Átl'ḵa7tsem (Howe Sound), including the development of a windsports beach, two boat launch areas, a sailing centre, and a waterfront public walkway on the entire perimeter (District of Squamish, 2016).

C.4 AUTOMATIC IDENTIFICATION SYSTEM (AIS) DATA

Table C.9: Automatic Identification System (AIS) Data for Átl'ḵa7tsem (Howe Sound), 2016-2020

Vessel Type Category	Number of Vessel Movements	Average Number of Vessel Movements per Year
Passenger - BC Ferries	128,896	25,779
Commercial – Deep-sea vessels	1,514	303
Commercial – Tugs and tows	18,664	3,733
Passenger – Other	5,088	1,018
Commercial – Fishing vessels	128	26
Recreational – Pleasure craft	30,747	6,149
Government	9,118	1,824

Notes:

Commercial – Deep-sea vessels: Inclusive of cargo vessels (general cargo, container vessels), tanker vessels, oil/chemical tanker vessels

Passenger – Other: Inclusive of cruise ship vessels, water taxis, whale watching vessels, other commercial passenger vessels

Recreational – Pleasure Craft: Inclusive of sailing vessels, pleasure craft, and yacht

Government: Inclusive of diving operations vessels, military operations vessels, search and rescue vessels, port tender vessels, anti-pollution equipment, law enforcement vessels, and research/survey vessels.

It is not mandatory for commercial vessels under 20 m or pleasure craft less than 30 m to either participate in VTS or install AIS; therefore, most recreational craft does not get captured in the AIS data.

Source: Marine Cadastre, 2021

Photo 1 through Photo 7 present examples of vessels from each vessel type category presented in Table C.9.

Source: MarineTraffic, 2022

Photo 1: Commercial – BC Ferries

Source: MarineTraffic, 2022

Photo 2: Commercial – Deep-Sea Vessels

Source: MarineTraffic, 2022

Photo 3: Commercial – Tugs and Tows

Source: MarineTraffic, 2022

Photo 4: Passenger – Other

Source: MarineTraffic, 2022

Photo 5: Commercial – Fishing Vessels

Source: MarineTraffic, 2022

Photo 6: Recreational – Pleasure Craft

Source: MarineTraffic, 2022

Photo 7: Government

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APPENDIX D CONSTRUCTION WAKE VERIFICATION PLAN

Construction Wake Verification Plan

Woodfibre LNG Project: WLNG-W0001-CM-PLN-0018 Rev 1

July 31, 2023

123221624EN-RPT0017

Woodfibre LNG

Preamble

The Woodfibre Liquefied Natural Gas Project (the Project) is a liquefied natural gas export facility being constructed on the former Woodfibre Pulp and Paper Mill site in Átl'ḵa7tsem (Howe Sound), approximately seven kilometres south of Sḵwx̱wú7mesh (Squamish). The Project is on the historical location of a Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) village known as Swiẏát. Swiẏát and Átl'ḵa7tsem (Howe Sound) are tied to the cultural well-being of Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) members, their ancestors, and their descendants, and to other Indigenous groups as defined in the Project's Environmental Assessment Certificates. Woodfibre LNG General Partner Inc. (Woodfibre LNG) recognizes the importance of these areas to the Sḵwx̱wú7mesh stélmexw (Squamish People), and other Indigenous groups. Woodfibre LNG seeks to construct and operate the Project in a manner that is respectful of Indigenous values. This Construction Wake Verification Plan is primarily written in English with important place names, species, phrases, and passages provided in Sḵwx̱wú7mesh sníchim (the Squamish language).

Temíxwiẏiḵw chet wa naantem chet ti temíxw Swiẏát
Chet wa sméṅhemswit kwis ns7éyx̱nitas chet ti temíxw
We7ú chet kwis t'íchimwit iy íẇas chet eḵ' I tti.

Our ancient ancestors named this place Swiẏát
We, as their descendants safeguard these lands
We will continue to swim and fish in these clear waters.

Limitations and Signoff

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Signature

Brent Kadler, P.Eng.

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Squamish-English Translation

Squamish	English
Átl'ka7tsem	Howe Sound
ch'émesh	herring roe or spawn
ínexwantas	monitoring
K'íkelxn	Port Mellon
Kw'emkw'em	Defence Island
Kwtsá7tsutsin	Darrell Bay
Shisháyu7ay	Britannia Beach
Skwxwú7mesh	Squamish
Skwxwú7mesh sníchim	Squamish language
Skwxwú7mesh stélmexw	Squamish people
Skwxwú7mesh Úxwumixw	Squamish Nation
slhawt'	herring
Sts'its'a7kin	Foulger Creek
Swiẏát	Historic Squamish Nation village located at Woodfibre Site
Xwekw'ále7em	Porteau Cove

Abbreviations

ADCP	acoustic Doppler current profiler
AIS	automatic identification system
BC	British Columbia
BCEAA	British Columbia *Environmental Assessment Act*
BC EAO	British Columbia Environmental Assessment Office
CD	chart datum
CEAA	*Canadian Environmental Assessment Act*
cm	centimetre
CPA	Certified Project Area
DFO	Fisheries and Oceans Canada
EAC	environmental assessment certificate
FDS	Federal Decision Statement
km	kilometre
LNG	liquefied natural gas
m	metre
m^3	cubic metres
MarineLabs	MarineLabs Data Systems Inc.
NOTMAR	Notice to Mariners
NWR	Navigational Warning Request
the Plan	Construction Wake Verification Plan
the Project	Woodfibre Liquefied Natural Gas Project
SNEAA	Squamish Nation Environmental Assessment Agreement
the Terminal	Project's terminal
Woodfibre LNG	Woodfibre LNG General Partner Inc.

1.0 INTRODUCTION

Woodfibre LNG General Partner Inc. (Woodfibre LNG) will construct and operate the Woodfibre Liquefied Natural Gas Project (the Project), which is located on the former Woodfibre Pulp Mill site approximately seven kilometres (km) southwest of Sḵwx̱wú7mesh (Squamish), British Columbia (BC) (Figure 1). The Project will have capacity to liquefy up to 2.1 million tonnes per year of natural gas and a storage capacity of 250,000 cubic metres (m^3). The Project will export the liquefied natural gas (LNG) via tankers.

The Project underwent a comprehensive environmental assessment process from 2013 to 2015 and Woodfibre LNG received:

- an environmental assessment certificate (EAC) for the Certified Project Area (CPA) under the British Columbia *Environmental Assessment Act* (BCEAA; EAC #E15-02) in 2015;
- an environmental assessment approval from Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) through the Squamish Nation Environmental Assessment Agreement (SNEAA) in 2015; and
- a positive federal Decision Statement (FDS) under the *Canadian Environmental Assessment Act, 2012* (CEAA, 2012) in 2016.

Two EAC amendments were granted by the BC Environmental Assessment Office (BC EAO) in 2017 and 2019, and the FDS was reissued in 2018 in response to changes to the Designated Project. Woodfibre LNG also received an extension on EAC#15-02 from the BC EAO in October 2020. The provincial, Sḵwx̱wú7mesh Úxwumixw (Squamish Nation), and federal environmental assessment processes have each yielded conditions of approval that Woodfibre LNG must address.

Most of the Project is on fee simple, industrially zoned, brownfield lands with more than 100 years of industrial use. There is no road access to the CPA, and all personnel, equipment, and supplies for the Project will be brought in by vessel via Átl'ḵa7tsem (Howe Sound). The Project will use electrical power sourced from BC Hydro and gas will be supplied to the facility by Fortis BC.

The CPA and key Project components are illustrated in Figure 2. Key Project components are:

- Land-based natural gas processing and liquefaction facilities;
- A floating storage and offloading unit;
- Construction worker accommodation; and
- Supporting infrastructure.

The supporting infrastructure includes buildings (e.g., administration, control rooms, maintenance, dry storage and chemical, fire house, first aid, safety and guardhouse), fencing (temporary and permanent), material storage and laydown areas, utility and loading lines, and boil off gas vapour lines.

The works and activities that will occur as part of construction include, but are not limited to:

- marine early works (e.g., shoreline improvements and armoring, dock replacement or repairs), including improvements to the existing in-service (east and south) barge landing
- clearing vegetation and grubbing
- stripping and grading
- drilling and blasting, including excavation, crushing, screening, and hauling
- grouting and rock stabilization
- road, culvert, and bridge works
- construction of land-based natural gas processing and liquefaction facility
- construction support structures, services, and equipment
- construction of the floating storage and offloading unit
- marine facility construction of mooring dolphin supports and connecting trestles and gangways
- dredging, if required

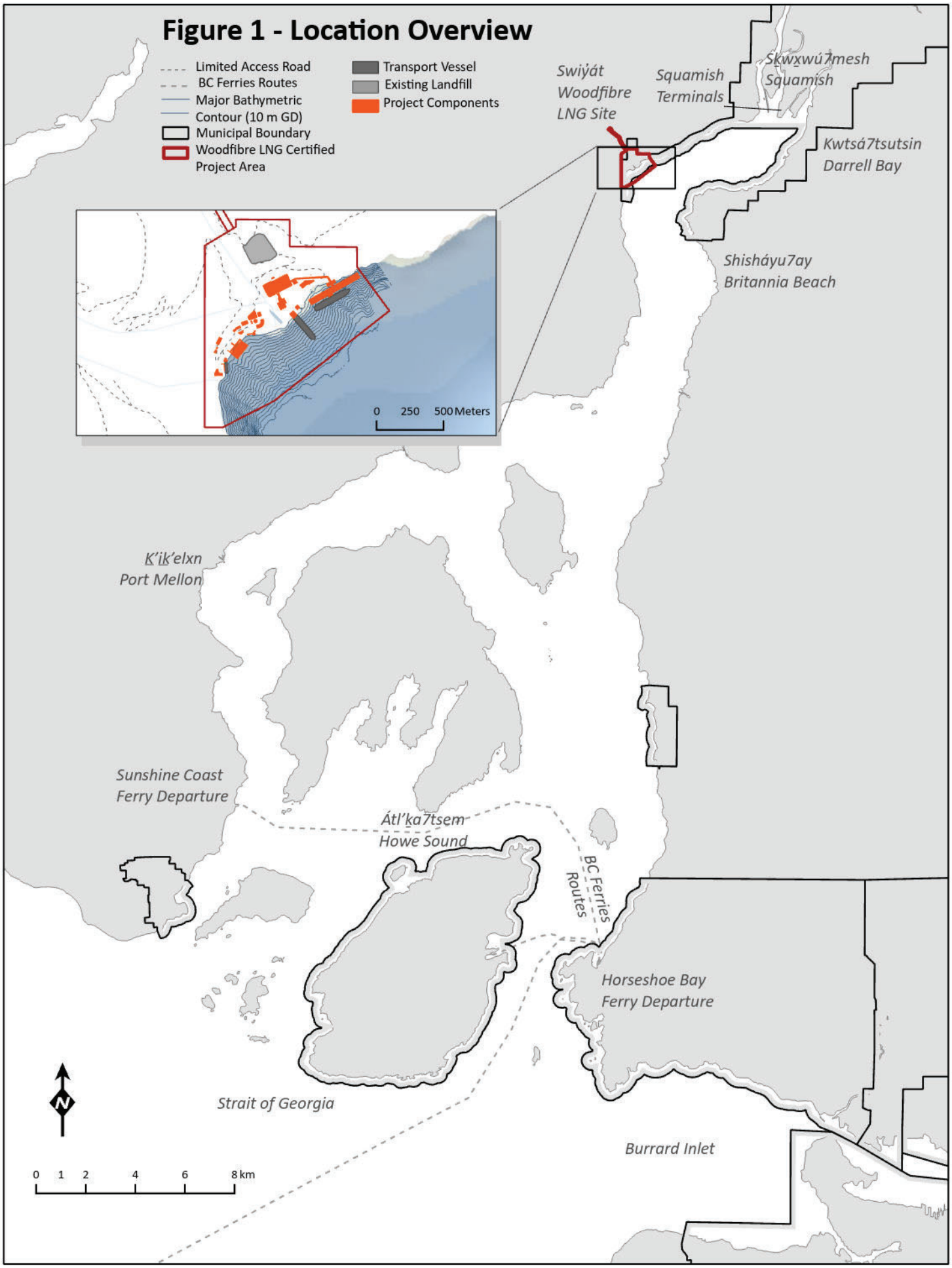
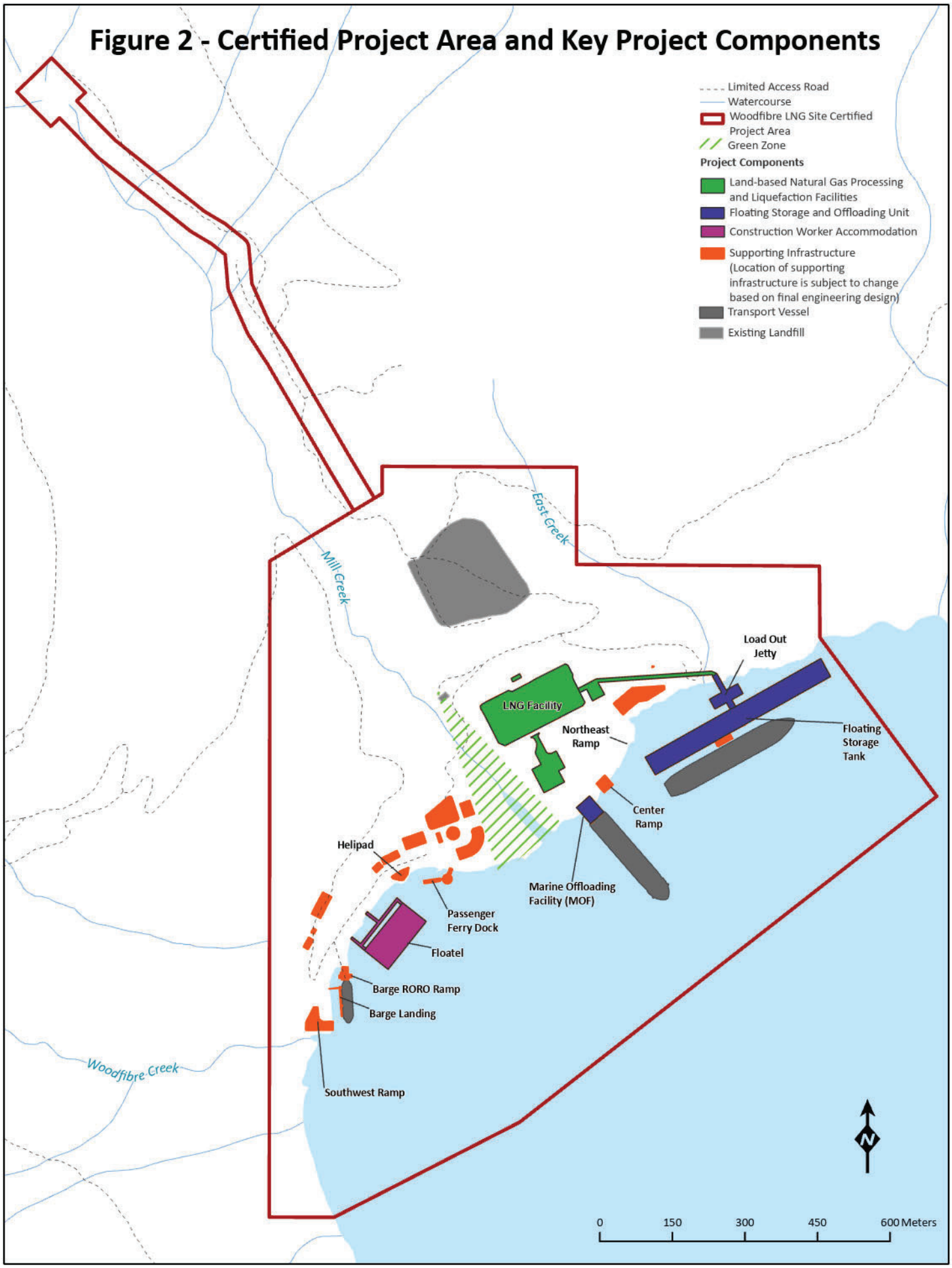


Figure 1 - Location Overview
Limited Access Road
BC Ferries Routes
Major Bathymetric Contour (10 m GD)
Municipal Boundary
Woodfibre LNG Certified Project Area
Transport Vessel
Existing Landfill
Project Components
Swiy̓át
Woodfibre LNG Site
Squamish Terminals
Sḵwx̱wú7mesh Squamish
Kwtsá7tsutsin Darrell Bay
Shishá̓yu7ay Britannia Beach
0 250 500 Meters
K'ik'elxn Port Mellon
Sunshine Coast Ferry Departure
Átl'ka7tsem Howe Sound
BC Ferries Routes
Horseshoe Bay Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 1 2 4 6 8 km

Figure 2 - Certified Project Area and Key Project Components



1.1 OBJECTIVE

The objective of this Construction Wake Verification Plan (the Plan) is to describe how the accuracy of the modelling predictions completed during the environmental assessment will be verified. The Plan focuses on the construction phase of the Project, but has linkages to the operations phase that will be expanded upon in a separate Operations Wake Verification Plan. The Plan outlines the ínexwantas (monitoring) methods, locations, data analysis, and verification reporting to satisfy data collection requirements to support EAC and FDS conditions (Section 1.2). Consultation with Pacific Pilotage will be undertaken prior to completing the Operations Wake Verification Plan, which will be used to satisfy the EAC and FDS conditions during the operations phase.

1.2 PROJECT APPROVAL AND CONDITIONS

During the environmental assessment process, potential safety considerations and effects from vessel wake generated by LNG carriers along the vessel route were discussed with Indigenous communities. Woodfibre LNG contracted Moffatt & Nichol to undertake a vessel wake assessment, using numerical modeling and analyses, to assess wave heights generated from three scenarios of vessels passing through Átl'ka7tsem (Howe Sound) (Moffatt & Nichol, 2015). Empirical data was requested by stakeholders to verify model results and to further address concerns of large wake interactions, resulting in EAC Condition 18 and FDS Condition 7.2.

Condition 18 of the EAC states that:

> *The Holder must develop, in consultation with Pacific Pilotage Authority and Aboriginal Groups, a wake verification plan for Operations along the Certified Marine Route. The plan must at a minimum:*
>
> - *Identify monitoring areas within Howe Sound, at shorelines and in the waters of Howe Sound, and periods for monitoring wake;*
> - *Describe the methodology for the selection of the focus areas and periods, including how information from marine users and Aboriginal Groups informed their identification and selection;*
> - *Specify a methodology for monitoring the wake of the Holder's LNG carriers within the marine environment and at shorelines along the Certified Marine Route, particularly in relation to potential safety hazards to marine and shoreline users;*
> - *Specify a process for reporting the results of the wake verification plan;*
> - *Include options for complaint reporting, recording, and responding to wake interactions between the Holder's LNG carriers and marine and shoreline users; and*
> - *Specify an adaptive management plan to address the effects of Project wake on marine and shoreline users in the event (i) those effects on marine and shoreline users are not mitigated to the extent identified in the Application, or (ii) effects on marine and shoreline users occur that were not predicted in the Application.*

Condition 7.2 of the FDS states that:

> *The Proponent shall, in consultation with Aboriginal groups, develop, prior to construction, and implement, during the construction and operation phases of the Designated Project, a follow-up program to verify the accuracy of the predictions made during the environmental assessment in relation to the effects of the wake generated by Designated Project-related vessels on the current use of lands and resources for traditional purposes and on physical and cultural heritage and structures, sites or things of historical, archaeological, paleontological or architectural significance. The follow-up program shall include:*
>
> *7.2.1 monitoring during the construction period and the first two years of operation of the degree of wake generated by Designated Project-related vessels and of adverse environmental effects on harvesters caused by vessel wake attributable to Designated Project-related vessels at key harvest sites and during key harvest periods for Aboriginal groups and on physical and cultural heritage and structures, sites or things of historical, archaeological, paleontological or architectural significance located on or near the shoreline and identified in consultation with Aboriginal groups; and*
>
> *7.2.2 providing the results of the follow-up program and details of any additional mitigation measures implemented as a result of the follow-up program to Aboriginal groups.*

2.0 CONSTRUCTION WAKE VERIFICATION PLAN

The Plan comprises the following:

- Identify focus areas, at shorelines and in Montagu channel, and periods for ínexwantas (monitoring) wake from Project vessels.
- Methods for selecting the focus areas and periods, including how marine users and Indigenous communities inform their identification and selection of focus areas.
- Methods for ínexwantas (monitoring) wake from Project vessels within the marine environment and at shorelines to determine the accuracy of model predictions in the environmental assessment, particularly in relation to potential safety hazards to marine and shoreline users.

The implementation of this Plan will commence in advance of the construction phase to assess the viability of the proposed ínexwantas (monitoring) methods. If refinements to the ínexwantas (monitoring) methods are needed, these will be made during construction.

This Plan was developed with feedback received during consultation and engagement with Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) and Tsleil-Waututh Nation.

The vessel wake modeling that was completed for the EAC Application (Moffatt & Nichol, 2015) reported that LNG carriers accompanied by escort tugs would have larger wake waves than the crew ferry (based on the interpretation of water surface elevations). Therefore, the pre-construction phase of the wake verification follow-up program focuses on the main shipping route for pre-construction and construction vessels, which will follow the same vessel route as the LNG carriers during the operations phase. The larger vessel verification is anticipated to serve as a representative surrogate for smaller vessels, such as worker ferries.

2.1 EXISTING DATA

The following sections summarize information gathered or developed during the environmental assessment process as well as existing wave and wake ínexwantas (monitoring) information in the Átl’ḵa7tsem (Howe Sound) area.

2.1.1 Environmental Assessment Studies

During the environmental assessment process, Indigenous communities and stakeholders expressed concern about vessel wake along the marine access route. Concerns included effects on shoreline harvesting, small craft safety, and shoreline erosion.

As described in Section 1.2, Woodfibre LNG commissioned a numerical modeling study (Moffatt & Nichol, 2015) to calculate vessel wake generated by LNG carriers and accompanying escort tugs expected to be calling at the Project's terminal (the Terminal) as well as worker ferries and existing passenger ferries. This study analyzed different parameters to evaluate vessel wake (e.g., vessel velocities, distance from the LNG carrier during the vessel track to the point of interest, and multiple vessel configurations). The outcomes of the modeling from Moffatt & Nichol (2015) were:

- *Wakes from project vessels are found to be comparable to naturally occurring waves within Howe Sound in typical summer breeze conditions (wind speed ≤ 9 knots).*
- *Project related vessel traffic volumes will be small relative to existing traffic levels and project wakes will not appreciably increase the existing vessel wake environment.*
- *Wakes from project vessels transiting to the Woodfibre site are projected to be smaller than the wakes generated by the existing BC Ferries because project vessels will transit at lower speeds and will travel as far removed from shore as practicable.*
- *Wakes from vessels transiting to the Woodfibre site will be less than wakes generated by existing vessels transiting to Squamish Terminals, because project vessels will transit at substantially lower speed.*
- *To the extent that the present study is accurate, it is not envisaged that wake waves would heighten exposure of the public, contribute to shoreline erosion, or have any appreciable effect on existing infrastructure within Howe Sound.*
- *It is concluded that no additional wake mitigation measures are necessary for project-related vessel traffic beyond those considered within this study.*

Stakeholders requested follow-up wake ínexwantas (monitoring) to verify the results of the modeling, thus resulting in the EAC and FDS conditions.

2.1.2 Current Wave and Wake Ínexwantas (Monitoring) in the Átl'ḵa7tsem (Howe Sound) Area

Publicly available measured data for the certified shipping route was reviewed to establish relative baseline wave conditions. Based on the expected vessel track for the LNG carriers calling at the Terminal (Figure 3), there is no directly comparable data available.

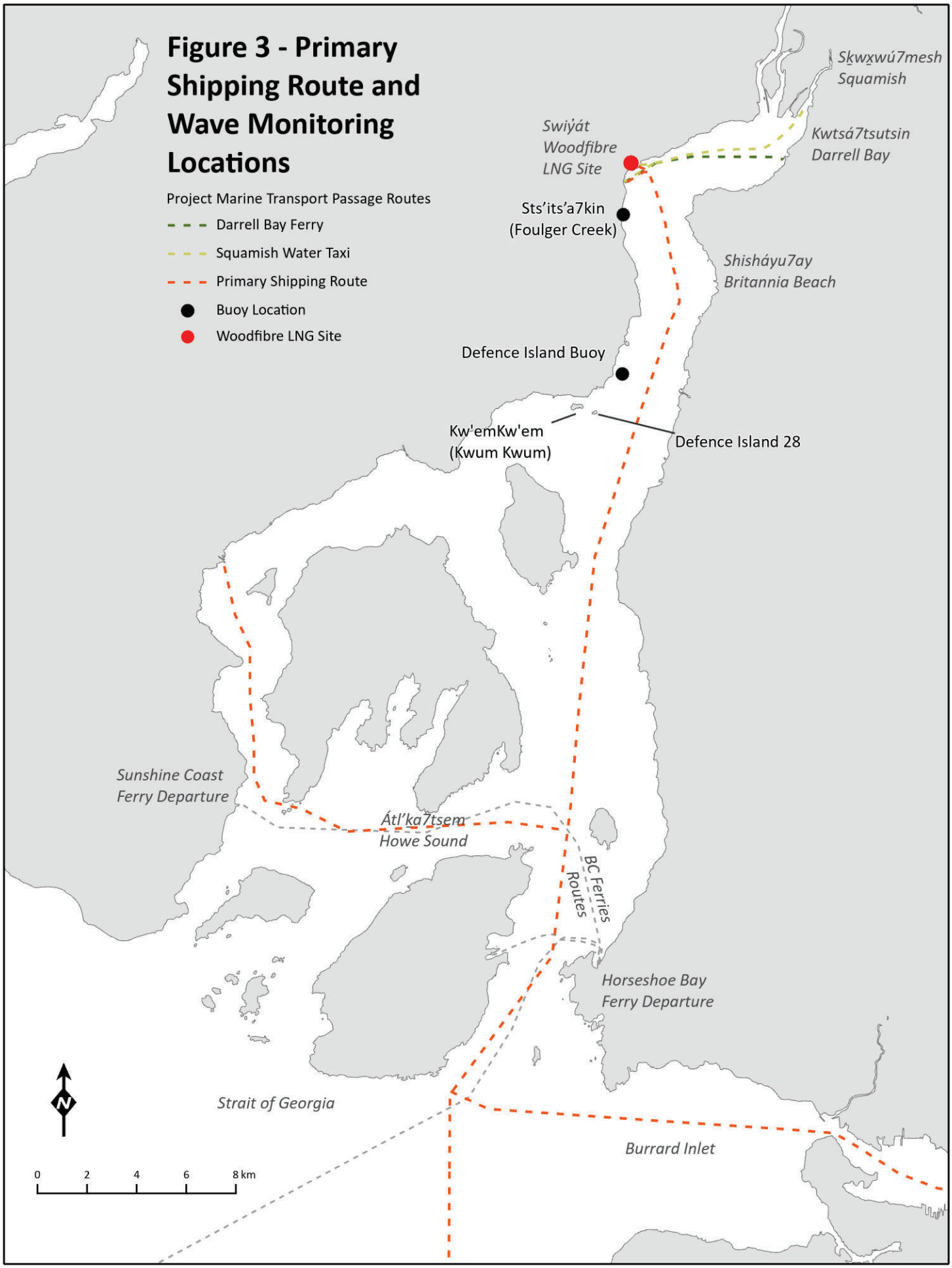


Figure 3 - Primary Shipping Route and Wave Monitoring Locations
Project Marine Transport Passage Routes
Darrell Bay Ferry
Squamish Water Taxi
Primary Shipping Route
Buoy Location
Woodfibre LNG Site
Sḵwx̱wú7mesh Squamish
Swiy̓át Woodfibre LNG Site
Kwtsá7tsutsin Darrell Bay
Sts'its'a7kin (Foulger Creek)
Shisháyu7ay Britannia Beach
Defence Island Buoy
Kw'emKw'em (Kwum Kwum)
Defence Island 28
Sunshine Coast Ferry Departure
Átl'ka7tsem Howe Sound
BC Ferries Routes
Horseshoe Bay Ferry Departure
Strait of Georgia
Burrard Inlet
N
0 2 4 6 8 km

2.2 ÍNEXWANTAS (MONITORING) EQUIPMENT

An initial review and options analysis of potential techniques and equipment available for ínexwantas (monitoring) vessel wake along the LNG carrier shipping passage was completed. This equipment included acoustic Doppler current profilers (ADCPs), pressure sensors, ínexwantas (monitoring) buoys, and remote sensing. As the main concern identified during the environmental assessment was vessel wakes at the shoreline, instrumentation will be deployed near the shore, in locations at least 3 metres (m) deep with respect to Chart Datum (CD). Criteria for the options analysis included a review and evaluation of:

- **Fit for purpose** – Suitable instruments capable of measuring vessel wakes expected to have relatively small wave heights (modeled to be less than 0.1 m) and short periods (2 to 4 seconds) were evaluated. These criteria limit the range of instruments that can be deployed at ínexwantas (monitoring) locations. Some options for instruments to measure vessel wakes include:
  - ADCPs mounted to the seabed. These instruments are normally deployed using tripods or frames holding the instrument's sensor facing upwards in a fixed position to collect wave data. These instruments measure the wave orbital velocity throughout the water column.
  - Pressure sensors mounted to the seabed. These instruments measure differences in the water column pressure ("weight") above the sensors, converting them to wave heights. These instruments do not determine wave direction unless configured in a multi-sensor array.
  - Ínexwantas (Monitoring) buoys deployed at the water surface. These instruments have accelerometers that measure wave height and direction as the buoys rise and fall with a passing wave.
- **Availability** – Instruments are available from suppliers and are summarized in Section 2.2.2.
- **Data collection, maintenance, and retrieval** – For the instruments evaluated, the estimated storage capacity, requirements for maintenance, and opportunity for partial data recovery before instrument retrieval (remotely or locally) has been identified.
- **Safety** – Safety is a primary consideration for Woodfibre LNG, its contractors, Indigenous communities and people, and the public. For each equipment option, successful execution of deployment, maintenance, data collection, and final closure will require a safety plan outlining the scope of work, equipment, training, and qualifications of personnel required to do the work, anticipated hazards and associated mitigations for those hazards, and emergency planning and communications.

2.2.1 Vessel Wake Criteria

Results from Moffatt & Nichol (2015) were used to define the following criteria for wave ínexwantas (monitoring) deployments:

- **Sensitivity** – Based on modeled vessel wake wave heights, the equipment will need to detect vessel wake wave heights that are expected to be relatively small (less than 0.1 m) and with short wave periods (on the order of 2 to 4 seconds).
- **Measurement Frequency** – Measurement instruments will need to operate continuously during deployment as vessel wake may occur at any time. As well, continuous measurement will be necessary to capture the entirety of potential wake characteristics over the duration that they occur.

2.2.2 Ínexwantas (Monitoring) Buoys

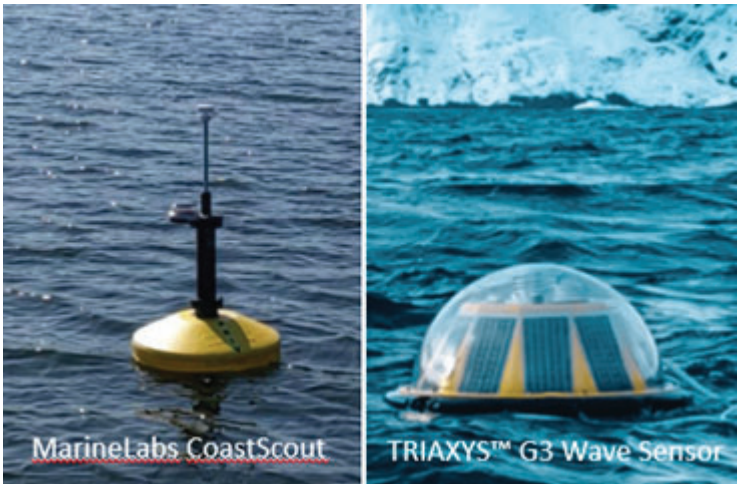
2.2.2.1 Fit for Purpose

Two service suppliers in BC, MarineLabs Data Systems Inc. (MarineLabs) and AXYS, were identified that can deploy ínexwantas (monitoring) buoys capable of measuring wind waves and vessel wake at different locations and provide access to the data that the instruments are collecting. The MarineLabs system is a data service, whereby MarineLabs owns and is responsible for the equipment. Its equipment was recently used in a similar application that measured vessel wakes within Burrard Inlet (KWL, 2021). AXYS provides equipment with a 'for-a-cost' maintenance plan, where required; otherwise, the owner is responsible for data processing and routine maintenance.

Key attributes of the equipment assessment were:

- ínexwantas (monitoring) buoys, such as MarineLabs CoastScout buoy and the AXYS TRIAXYS directional ínexwantas (monitoring) buoy, are deployed at the water surface and contain accelerometers that measure motion acceleration, which is then analyzed to estimate wave heights, periods, and direction as the buoys rise and fall with each passing wave (Figure 4). The accuracy is sufficient with the requirements for the follow-up program (e.g., wave heights as small as 2 centimetres [cm] and wave periods from 1 to 25 seconds). The buoys have approximate diameters of 0.60 m (MarineLabs) to 1.1 m (AXYS), weigh from 20 kilograms (MarineLabs) to 235 kilograms (AXYS), and feature navigation lights. Both buoys can be configured to also measure wind data (e.g., wind speed, direction, and gust).
- For the follow-up program, and for operations, the (monitoring) buoys will need to measure waves (generated by wind and vessels) continuously. The buoys can be powered by solar panels with back-up batteries that can provide enough power to collect data continuously.
- Other equipment options provide raw data for the owner to process and analyze for other purposes.

Figure 4: MarineLabs (left) and AXYS (right) Ínexwantas (Monitoring) Buoys



2.2.2.2 Availability

The lead time to deploy buoys was determined to be approximately eight weeks. For multiple sensor deployments, suppliers indicated that a staggered delivery schedule could be possible by focussing initial deployments on higher priority areas.

2.2.2.3 Deployment, Data Collection, Maintenance, and Retrieval

Results from discussions with suppliers concerning deployment, data collection, maintenance, and retrieval are summarized as follows:

- **Deployment** – The effort associated with instrument deployment is provided directly by the supplier. Potential weather delays can also affect deployment.
- **Maintenance** – Scheduled and unscheduled maintenance responsibilities depend on the supplier. For example, MarineLabs includes all maintenance responsibilities within its contract, whereas AXYS maintenance and repair is provided at additional cost.
- **Local Logistics Support** – Engagement with Indigenous communities to provide local boat rentals will be investigated.
- **Data Collection/Transfer** – The buoy systems can transfer data in real-time, providing Woodfibre LNG (and other potentially interested parties) with access to data in real-time (see an example of the MarineLabs data access interface here: https://marinelabs.io/services/). Real-time data transfer would require cellular coverage at each deployment location. Other options for data transfer include physical data retrieval or satellite connectivity.
- **Data Disclaimers/Access** – MarineLabs CoastAware subscription does not provide exclusivity in the use of the data. Other users may have access to the information through MarineLabs subscription services.

2.2.3 Equipment Deployment

Equipment was deployed at the identified locations (Figure 3; Appendix A) and anchored in water that is at least 3 m deep at 0 m Chart Datum. The mooring was configured for the location depending on buoy, water depth, atmospheric and metocean conditions, and environmental considerations. Buoy mooring typically consists of an anchor weight and a mooring line comprised of rope, chain, or bungee. A Fisheries and Oceans Canada (DFO) Notice to Mariners was issued in advance of deployment by the owner of the buoy. The NOTMAR is initiated by a Navigational Warning Request (NWR) to DFO, submitted by the buoy owner, and includes information such as: owner contact information, date of deployment, location, brief description, and hours of operation. An example NWR form is provided in Appendix A.

2.3 ÍNEXWANTAS (MONITORING) LOCATIONS

Candidate ínexwantas (monitoring) locations were evaluated based upon selection criteria provided in Section 2.3.1, and in consultation with Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) and Tsleil Waututh Nation. The ínexwantas (monitoring) locations that were selected are a result of consultation feedback and alignment with the selection criteria.

2.3.1 Selection Criteria

Potential ínexwantas (monitoring) locations were evaluated using the following criteria:

- Site use (e.g., clam harvesting, seaweed harvesting, and/or small vessel passage);
- Site exposure to vessel wakes;
- Site proximity to the shipping lane (closer versus further); and
- Reaches of the navigation route where vessels are anticipated to cruise at consistent speed.

2.3.2 Kw’emkw’em (Defence Island)

A ínexwantas (monitoring) buoy was installed on the north of the eastern shore of Kw’emkw’em (Defence Island) (49.590184°, -123.259443°) for construction wake ínexwantas (monitoring) by MarineLabs on November 25, 2022. The location was chosen based on the following alignment with the selection criteria:

- **Site Use** – The wake ínexwantas (monitoring) location is on the eastern shore of Kw’emkw’em (Defence Island). The location is known to be a slhawt’ (herring) and ch’émesh (herring roe or spawn) harvest location and is frequented by boaters and outdoor enthusiasts.
- **Site Exposure to Vessel Wakes** – The location is exposed to vessel wakes because the proposed shipping lane is directly east of Kw’emkw’em (Defence Island) and without physical obstructions to the wake’s direct path to the ínexwantas (monitoring) location.

- **Site Proximity to Shipping Lane** – The shortest distance between Kw'emkw'em (Defence Island) and the mainland is approximately 3.3 km. Therefore, if the vessel path is directly through the middle, the vessel would be approximately 1.65 km from the ínexwantas (monitoring) location. The planned ínexwantas (monitoring) location is thus much closer to vessels than when vessels would pass Gambier Island (approximately 2.5 km) and similar to other areas north of Xwe̲kw'ále7em (Porteau Cove) (approximately 1.4 km to 1.6 km).
- **Relative Wake Size (Vessel Speed)** – The ínexwantas (monitoring) location is at a point where pre-construction vessels will be passing at a higher speed than further north in Átl'ka̲7tsem (Howe Sound), where it is assumed that vessels will begin to slow down in preparation for berthing. Conversely, the location is at a point where vessels leaving the Woodfibre LNG facility will have reached a consistent cruising speed, thus ínexwantas (monitoring) vessel wake waves generated at a point where they would be largest.

2.3.3 Sts'its'a7kin (Foulger Creek)

A ínexwantas (monitoring) buoy was installed on the shore of Sts'its'a7kin (Foulger Creek) (49.646721°, -123.260363°) for wake ínexwantas (monitoring) by MarineLabs on January 27, 2023. The location was chosen based on the following alignment with the selection criteria:

- **Site Use** – The proposed wake ínexwantas (monitoring) location is on the western shore of Átl'ka̲7tsem (Howe Sound), south of the Project site. The location was identified by Sḵwx̲wú7mesh Úxwumixw (Squamish Nation) as a location of interest.
- **Site Exposure to Vessel Wakes** – The location is exposed to vessel wakes as the proposed shipping lane is directly east of Sts'its'a7kin (Foulger Creek) and without physical obstruction to the wake's direct path to the ínexwantas (monitoring) location.
- **Site Proximity to Shipping Lane** – The shortest distance between Sts'its'a7kin (Foulger Creek) and the opposite shore is approximately 2.6 km. Therefore, if the vessel path is directly through the middle, the vessel would be approximately 1.3 km from the ínexwantas (monitoring) location.
- **Relative Wake Size (Vessel Speed)** – The ínexwantas (monitoring) location is at a point where pre-construction vessels will be passing at a diminished speed than further south in Átl'ka̲7tsem (Howe Sound), as it is assumed that vessels will begin to slow down in preparation for berthing near Sts'its'a7kin (Foulger Creek).

2.4 DATA

The following sections describe the equipment data collection (including field measurements) and vessel tracking processes. Data collection is based upon the equipment recommendations provided in Section 2.2.

2.4.1 Equipment Data Collection

FDS Condition 7.2 requires that the follow-up program include specifications of methods for ínexwantas (monitoring) the wake of Project construction vessels, within the marine environment and at shorelines, to verify the accuracy of modeling predictions made during the environmental assessment process, particularly in relation to potential safety hazards to marine and shoreline users. However, as the initial modeling completed to support the environmental assessment process did not include construction vessels, the follow-up program includes ínexwantas (monitoring) the southern vessel route (from Burrard Inlet north into Átl'ka7tsem [Howe Sound]) for comparison with the results of the modeling for the LNG carriers. To undertake this ínexwantas (monitoring), physical data that characterizes waves, including wave heights, wave periods, wave directions, number of waves in a wake, duration of wakes, location, and water depth, are being collected during the pre-construction timeline. This data will also establish ambient/background wave conditions for comparison with wake conditions generated by construction vessels.

Ínexwantas (Monitoring) buoys were deployed for physical measurement of waves (and for determining relevant characteristics). Data measured by the equipment will be stored within the equipment itself (e.g., SD cards or flash drives) and/or transmitted by one of several means depending on prevailing conditions at each location (i.e., cellular, radio frequency, or satellite).

Data collected will include:

- **Motion** – acceleration, velocity, position, rotational position, and rotational velocities
- **Measurements** – post-processed time series of wave height, period, and direction
- **Metocean** – wind speed, direction, gusts, and air temperature
- **Global Positioning System Location** – latitude and longitude
- **Date/Time** – continuous time series of measurements
- **Sensitivity** – wave height of 10 cm or better
- **Monitoring Interval** – continuous (1 second)

2.4.2 Data Analysis

The analysis of the data collected by the buoy will consist of two primary components: 1) analysis of the ambient sea state (influenced primarily by the local winds), and 2) analysis of vessel wakes.

The ambient sea state conditions will be derived from the buoy measurements by calculating statistics of the waves, specifically the significant wave height (highest 1/3 of the waves), peak wave period (the wave period at the peak of the energy spectrum), and mean wave direction. Time series of the significant wave height and peak wave period, as well as significant wave height and peak wave period roses, will be developed to easily examine range of wave heights and periods, as well as dominant wave directions.

A vessel wake does not represent a sea state but an isolated event; therefore, vessel wakes will be characterized using the classical definitions of wave height and period, as determined from a zero-crossing analysis of the water surface elevation. Time stamps between the buoy GPS and the Project vessel's automatic identification system (AIS) GPS as a vessel passes the buoy will be analyzed to identify wakes. Time intervals will be determined based upon AIS information and identifying Project vessel sailings.

The results of both analyses will be compared and used to verify the accuracy of the predictions made during the environmental assessment process. Comparisons will address the following elements or questions:

- The difference between ambient and vessel wake wave heights and periods (magnitude and percentage differences).
- How well (e.g., over-predict or under-predict) does the numerical model predict waves compared with actual measured wave heights for the same types of vessels?
- Which vessels produce the smallest and largest waves?
- How many waves occur within a vessel wake for each type of vessel?
- What percentage of ambient and vessel wakes are above/below a threshold or percentile?
- The travel time and duration of a vessel's wake waves from inception to the location of the buoy, which could be further extrapolated to nearby shorelines based on the speed of the wake and additional distance to the shoreline.

Ambient sea state conditions are expected to vary throughout the year, in accordance with the wind conditions. Data analysis will be carried out annually to capture seasonal changes in wind conditions and variability in vessel cruising speed and sailing distance from the buoy (which will result in a range of vessel wakes), which will improve the reliability of the comparison between vessel wakes and ambient sea state conditions.

2.5 ADAPTIVE MANAGEMENT

To meet Condition 18 of the EAC and Condition 7.2 of the FDS, Woodfibre LNG will use an adaptive management process to evaluate performance objectives and to guide management actions.

The adaptive management process is comprised of multiple steps and are described as follows:

1. **Assess**: Assessing Project vessel wakes compared with the model results.
2. **Design**: Developing the Wake Verification Plan for construction and operations.
3. **Implement**: Implementing the Construction Wake Verification Plan and subsequently the Wake Verification Plan during operations.
4. **Monitor**: Collecting, reviewing, and analysing data obtained from the implementation of the Construction Wake Verification Plan and the Wake Verification Plan during operations.

5. **Evaluate**: Reviewing results of ínexwantas (monitoring) to inform whether initial modeling results were accurate and if wakes are larger or smaller than anticipated. If wake is larger than predicted, a review of additional mitigation measures and the need to implement them will be undertaken.
6. **Adapt**: The primary technique for reducing wake wave height is a reduction in vessel speed. In the event of wake waves coming ashore at heights that cause erosion or adversely affect Indigenous harvesting activities, Woodfibre LNG will consult with Transport Canada, the Pacific Pilotage Authority, British Columbia Coast Pilots Ltd., operators of the LNG carriers, and Indigenous communities to discuss opportunities to implement slower vessel transit speeds in areas affected by vessel wake. Additionally, Section 7.3 of the Marine Transportation Management and Mitigation Plan (MTMMP) outlines the mechanism for feedback and or complaints. The following link can be used to submit a complaint to WoodFibre LNG during the construction of the Project: Concerns and Complaints - Woodfibre LNG.

As necessary, based on outcomes from the adaptive management process, updates to this Plan, or inclusion of applicable content in the forthcoming Operations Wake Verification Plan, will be accommodated.

3.0 REPORTING

Reporting on the implementation of the Construction Wake Verification Plan will be included in annual FDS reporting. This report will be compiled once per year. The report will compare the monitored wake data against predictions and assess whether changes are needed to the prediction methods. The report will also highlight if there are construction vessel-related wakes that could cause an adverse environmental effect, per the FDS conditions.

Woodfibre LNG will continue to engage with Indigenous communities and the Pacific Pilotage Authority on the results of ínexwantas (monitoring).

4.0 SCHEDULE

These milestones outline Woodfibre LNG's schedule to administer the wake verification activities described in this plan:

- Q4 2022 – Pre-construction verification ínexwantas (monitoring);
- Q3 2023 – Pre-construction verification completion;
- Q3 2023 – Construction wake verification ínexwantas (monitoring);
- Q4 2024 – submission to EAO the Wake Verification Plan (will include final components to satisfy; EAC Condition 18 and FDS Condition 7.2 for operations); and
- 2025–2027 – Operations wake verification ínexwantas (monitoring).

5.0 REFERENCES

KWL (Kerr Wood Leidal). (2021). *Burrard Inlet Cumulative Effects Monitoring Initiative - Central Harbour Wave Climate Study - Summary and Discussion of Findings prepared for Tsleil-Waututh Nation.*

Moffatt & Nichol. (2015). *Woodfibre LNG Project Vessel Wake Assessment.*

APPENDIX A

Navigation Warning Request

Woodfibre LNG

APPENDIX A NAVIGATION WARNING REQUEST

Fisheries and Oceans Canada | Pêches et Océans Canada
Canadian Coast Guard | Garde côtière canadienne

Canada

Canadian Coast Guard
www.ccg-gcc.gc.ca

MCTS Western NAVWARN Issuing Desk

Website: nis.ccg-gcc.gc.ca

Phone: 250-627-3070

Email: NAVWARN.MCTSPrinceRupert@innav.gc.ca

Navigational Warning Request

Organization Name and Contact Number:

Site Name and Contact Number:

Start Date and Time:
Requests for Navwarnings sent in more than 1 business day before activity start will not be actioned and a copy will not be kept on hand.

End Date and Time:
Works that will be long term or with no end date must update request once every 30 days until completion

Location of Activity: *geographic*

latitude/longitude in DDM or DMS; if encompassing a large area, provide boundary positions

Brief Description of Work:

Hours of Operation:

Vessels on Site:

VHF Channel Monitored:

Special Requests or Additional Information: