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TERMPOL Review Process on the KITIMAT LNG Project

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GLOSSARY

Aids to Navigation: External devices or systems that help mariners determine position and course. The aids warn of dangers or obstructions and often indicate the preferred route through a given waterway. The Canadian Coast Guard (CCG) is responsible for delivering operational aspects of navigation programs and services, including aids to navigation.

Automated Identification System (AIS): Vessels of 300 gross tonnes or more (other than fishing vessels) engaged on an international voyage and domestic vessels of 500 tonnes gross tonnage or more (other than fishing vessels) must be fitted with AIS. AIS automatically provides information, including the vessel identity, type, position, course, speed, navigational status and other safety-related information, to AIS-equipped shore stations, satellites, other vessels and aircraft. These vessels can automatically receive information from other similarly fitted vessels, as well. This improves a vessel's situational awareness and the ability of shore VTS to identify and monitor marine traffic. All CCG Marine Communication Traffic Services (MCTS) centres regulating vessel traffic are equipped with AIS infrastructure.

Ballast Water: Water on board a vessel to increase the draught and change the trim of the vessel to regulate stability or maintain stress loads within acceptable limits.

Ballast Water Control and Management Regulations: Under the *Canada Shipping Act, 2001*, the regulations apply to the management of ballast water on all ships entering waters under Canadian jurisdiction from beyond the Canadian exclusive economic zone.

Canada Marine Act: The principal legislation governing federal ports in Canada, including Canada Port Authorities and public ports. The *Canada Marine Act* includes federal ports' authorities to maintain safe navigation and environmental protection within port boundaries, including directing and controlling vessel traffic.

***Canada Shipping Act, 2001* (*CSA, 2001*):** The CSA, 2001 is one of the principal laws that govern safety in marine transportation (including the protection of the marine environment). The *CSA, 2001*:

- Seeks to balance shipping safety and marine environment protection while encouraging maritime commerce
- Applies to all vessels operating in Canadian waters and Canadian vessels worldwide and in some cases, to foreign vessels up to the Exclusive Economic Zone

Canadian Exclusive Economic Zone (EEZ): The Canadian Exclusive Economic Zone is an area of sea beyond and adjacent to the territorial sea of Canada, which extends to 200 nautical miles from the nearest point of the baselines. Within the EEZ, Canada has sovereign and jurisdictional rights for the purposes of exploration and economic exploitation. Canada has jurisdiction for conserving and managing the natural resources of the waters, seabed and subsoil.

Classification Societies: To help ensure vessel safety, organizations such as Lloyd's Register, the American Bureau of Shipping, and Det Norske Veritas certify that vessels are built, maintained and operated according to established and recognized rules, regulations and standards.

Collision Regulations: The *Collision Regulations* (CRC, c1416), which are created under *CSA, 2001*, set out the rules that vessels must follow to prevent collisions while in Canadian waters. These rules are based on the *Convention on the International Regulations for Preventing Collisions at Sea (COLREG).* The *COLREGs* provide uniform measures in regard to the safe conduct of vessels. The regulations describe rules of general conduct specific to the:

- Navigational, steering and sailing rules
- Navigational lights and shapes to be displayed
- Sound and light signals to be used by every vessel and pleasure craft in Canadian waters

Escort Tug: A ship capable of assisting or towing larger vessels. The scope and range of assistance capabilities can vary depending on the size and type of vessels tugs accompany. Some escort tugs can be tethered to the vessel to provide a different level of service.

Fisheries Act: The principal legislation that protects the sustainability and productivity of recreational, commercial and Indigenous fisheries. The *Act* and, more specifically, its fisheries protection provisions, establish authorities for the protection of recreational, commercial, and Indigenous fisheries. These authorities include the prohibition against carrying out projects that result in serious harm to fish and the powers related to fish passage and flow.

Flag State: Country of registry of a vessel, often a seagoing one. The Flag State sets the safety standards and pollution prevention requirements that apply to vessels flying its flag.

International Code for Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code): The code for the construction and equipment of ships carrying liquefied gases in bulk. This code has been developed to provide an international standard for the safe carriage of liquefied gases by prescribing the design and constructional features of ships, and the equipment they should carry as to minimize the risk to the ship, its crew, and the environment.

International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM): Adopted in 2004, this Convention aims to prevent the spread of harmful aquatic organisms from one region to another by:

- Establishing standards and procedures for managing and controlling ships' ballast water and sediments
- Requiring all ships in international traffic to manage ballast water and sediments to a certain standard, according to ship-specific ballast water management plans
- Requiring all ships to carry a ballast water record book and an international ballast water management certificate

***International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS Convention)*:** The International Maritime Organization (IMO) adopted the *International Convention on Liability and Compensation for Damage* in connection with the *Carriage of Hazardous and Noxious Substances by Sea* (2010 HNS Convention) in April 2010. This Convention is based on the model for pollution damage caused by spills of persistent oil from tankers. Once in force, it will have a two-tiered system for compensation to claimants in the event of a ship-source accident at sea involving HNS.

***International Convention for the Prevention of Pollution from Ships (MARPOL)*:** In Canada, discharges are governed under the *Vessel Pollution and Dangerous Chemicals Regulations.* These regulations implement requirements of the *International Convention for the Prevention of Pollution from Ships* (MARPOL), known as the MARPOL Convention. MARPOL is the primary international Convention aimed at preventing pollution of the marine environment by ships from operational or accidental causes.

***International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC Convention)*:** Adopted in 1990, the OPRC Convention aims to provide a global framework for international co-operation in combating major incidents or threats of marine pollution. Parties to this Convention, including Canada, must establish measures for dealing with pollution incidents, either nationally or in co-operation with other countries.

International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW): This Convention sets minimum standards for the training, certification and watchkeeping of vessel crews that countries must meet or exceed.

International Maritime Organization (IMO): Established in 1948, the *IMO* provides a forum for countries to negotiate their government's approved positions on

international standards for the safety, security and environmental performance of international shipping. The IMO's primary role is to develop and maintain a comprehensive regulatory framework for shipping. The IMO scope includes safety, environmental concerns, legal matters, technical cooperation, maritime security and the efficiency of shipping. Canada is one of 171 IMO member countries. When agreement is reached at the IMO, member countries (like Canada) then create regulatory domestic frameworks for the shipping industry. There are over 50 IMO conventions covering a range of topics. The conventions are reflected in Canada's marine safety and security system, including in the *CSA, 2001*. Canadian maritime laws apply to all vessels operating in Canadian waters and Canadian vessels worldwide.

Liquefied Natural Gas (LNG): LNG is natural gas in liquid state. When natural gas is chilled to approximately minus 160° Celsius (minus 260° Fahrenheit) at atmospheric pressure, it becomes a clear, colourless, and odourless liquid. LNG is non-corrosive, non-toxic and cryogenic, and is classified as a hazardous and noxious substance by the IMO. LNG is converted back to natural gas after its arrival to the destination.[1] In liquid form, LNG is approximately 1/600th the volume of natural gas, which allows for efficient transport in purpose-built ocean carriers.

Marine Communications and Traffic Services (MCTS): The MCTS program provides safety radio-communication and commercial marine telephone services, and vessel traffic information on a 24/7 basis. Management and operation of the MCTS is under the purview of the Minister of Fisheries and Oceans under Part 5 of the *CSA, 2001*. The CCG is the operational authority for the MCTS.

***Marine Liability Act* (MLA):** In force since August 2001, the MLA is the principal law dealing with shipowner and vessel operator liability for passengers, cargo, pollution and property damage. The Act sets limits of liability and establishes uniformity by balancing the interests of shipowners and other parties. The MLA gives many IMO Conventions the force of law.

Oil Companies International Marine Forum (OCIMF): The OCIMF is a voluntary association of oil companies that promote the safe design and operation of tankers and terminal operations related to crude oil, oil products, petrochemicals and gas. Formed in 1970 in response to growing public scrutiny of marine pollution, the association aims to be the authority on the safe and environmentally-responsible operation of oil tankers and terminals. The current membership includes every major oil company in the world along with the majority of national oil companies. The association regularly represents the views of industry at the IMO and has become an advocate for marine safety standards and regulations.

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[1] Natural Resources Canada. Liquefied Natural Gas – What is LNG? (2014). http://www.nrcan.gc.ca/energy/natural-gas/5679

Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances (OPRC–HNS Protocol): Established in 2000 by the IMO as an addition to the OPRC Convention, the OPRC-HNS Protocol follows similar principles. The intent is to make ships carrying HNS and HNS-handling facilities subject to a preparedness and response program similar to what is in place for oil incidents.

***Pacific Pilotage Regulations*:** Rules under the *Pilotage Act* for the operation, maintenance and administration of pilotage services in B.C. The regulations establish compulsory pilotage areas and describe minimum qualifications for holding licences and pilotage certificates within the Pacific Pilotage Authority's (PPA) region.

Paris Memorandum of Understanding (MOU): Aims to eliminate the operation of substandard ships through a harmonized system of Port State Control. Port State Control ensures vessels meet international safety, security and environmental standards, and that crew members have adequate living and working conditions. The agreement consists of 27 participating maritime administrations, including Canada, and covers the waters of the European coastal states and the North Atlantic basin from North America to Europe.

Place of Refuge: Marine location where a ship in need of assistance can take action to conduct repairs, reduce hazards to navigation, and protect human life and the environment.

Pilotage: The rules requiring vessels operating within specified waters to be under the conduct of a licensed Canadian marine pilot with local knowledge of the waterway to help guide the vessel safely to its destination.

***Pilotage Act*:** Enacted in 1972 and amended in 1998, the *Act* establishes Pilotage Authorities in four regions across Canada, including the Atlantic, the Laurentian, the Great Lakes and the Pacific. The Pilotage Authorities establish compulsory pilotage areas. In these areas, vessels of certain types, including all tankers, must take local marine pilots on board before they enter harbours or busy waterways. The local pilots must have expertise in navigation, the handling characteristics of the vessels they are guiding, as well as expertise in navigating the local waterways. They safely guide ships to port.

Port State Control: Inspection of foreign vessels in national ports to verify they meet major international conventions related to condition and equipment as well as crew and operations. Port State Control is Transport Canada's primary means for ensuring compliance with the CSA 2001, the *Marine Transportation and Security Act*, and applicable international conventions that have been implemented into Canadian legislation. This is a vessel inspection program established under the IMO, whereby countries sharing common waters agree to share inspection responsibilities and information. For example, Canada is a Port State for foreign vessels that enter Canadian waters and vessels are inspected according to international agreements. In

Canada, inspections determine compliance with conventions Canada has implemented.

***Response Organizations and Oil Handling Facilities Regulations*:** These regulations are created under the *CSA, 2001,* and set out the rules related to the procedures, equipment and resources of response organizations and oil handling facilities during an oil pollution incident.

Ship Inspection Report Programme (SIRE): Launched in 1993 by the Oil Companies International Marine Forum to address concerns about substandard shipping, SIRE is a unique tanker risk assessment tool of value to charterers, vessel operators, terminal operators and government bodies concerned with vessel safety. SIRE includes a large database of up-to-date information about tankers and barges.

International Convention for the Safety of Life at Sea *(SOLAS)*: SOLAS is an international maritime safety treaty that specifies minimum standards for the construction, equipment and operation of ships, compatible with their safety. SOLAS includes the *International Convention for the Safety of Life at Sea, 1974*, and the Protocol of 1988 relating to the Convention. It is generally seen as the most important international treaty on merchant ship safety. Canada is a signatory to SOLAS.

TERMPOL "Technical Review Process of Marine Terminal Systems and Transhipment Sites": The review originated in the 1970s when an interdepartmental committee reviewing marine pollution issues identified the need for a precise and reliable way to measure the navigational risks associated with placing and operating marine terminals for large oil tankers. The process was expanded in 1982 to include other cargos, and revised in 2001 and 2014 to reflect program and regulatory changes. TERMPOL is an extensive yet voluntary review process that a proponent who is involved in building and operating a marine terminal system for bulk handling of oil, chemicals and liquefied gases can request. It focuses on the marine transportation components of a project.

TERMPOL Review Committee (TRC): TC chairs the TRC for this Project. The following agencies and organizations have been involved in the TERMPOL Review Process: TC, Fisheries and Oceans Canada (DFO), CCG, Environment and Climate Change Canada (ECCC), Canadian Hydrographic Service (CHS), PPA and the BCCP.

Tokyo Memorandum of Understanding: Aims to eliminate the operation of substandard ships through a harmonized system of Port State Control. Port State Control ensures vessels meet international safety, security and environmental standards, and that crew members have adequate living and working conditions. The organization consists of 20 participating maritime administrations, including Canada, and covers the waters of the Asia-Pacific region.

Vessel Traffic Services (VTS): For the purpose of providing safe and efficient navigation and environmental protection, regulations have established Vessel Traffic Service (VTS) zones along Canada's east and west coasts out to the limit of the territorial sea. VTS is a means of exchanging information between vessels and a shore-based centre. Shipping in VTS zones is monitored by the CCG's Marine Communication Traffic Services (MCTS). Ships of 500 gross tonnes or more must report to an MCTS officer 24 hours before entering the VTS Zone and report prescribed information about the vessel and her intended route, including any pollutant cargoes and defects. Monitoring of vessel movements within a VTS Zone allows MCTS officers to provide navigational information and assistance that help on board navigational decision making.

Canada's VTS system is operated by certified MCTS officers who monitor vessel movements using VHF (very high frequency) radio and direction-finding equipment, AIS, tracking computers and, in areas of high traffic density, surveillance radar. The CCG Western Region has two MCTS centers which operate three Vessel Traffic Services zones in B.C.; Vancouver is regulated by MCTS Victoria, and Tofino and Prince Rupert are regulated by MCTS Prince Rupert.

***Vessel Pollution and Dangerous Chemicals Regulations* (VPDCR):** The VPDCR is created under the *CSA, 2001,* and sets out specific provisions for shipboard requirements and equipment to help prevent pollution from oil, noxious liquid substances, dangerous chemicals, sewage, garbage, and also include air emissions control for NOx and ozone-depleting substance.

***Vessel Traffic Services Zones Regulations* (VTSZR):** The VTSZR is created under the *CSA, 2001,* and outlines communication and reporting requirements for Canadian and foreign vessels in Canadian waters. Specific requirements are in place for vessels entering Canadian waters, operating within Canadian waters or leaving Canadian waters.

***VHF Radiotelephone Practices and Procedures Regulations* (VHR Regulations):** The VHF Regulations are created under the *CSA, 2001,* and set out the practices and procedures persons on board ships must follow when using bridge-to-bridge VHF radiotelephones to ensure safe navigation.

*The full text of any Canadian Act or Regulation can be found at http://www.laws-lois.justice.gc.ca.

ACRONYMS

AIS - Automatic Identification Systems
BC OGC – B.C. Oil and Gas Commission
CHS – Canadian Hydrographic Service
COLREG – Convention on the International Regulations for Preventing Collisions at Sea
DWT – Deadweight Tonnage
EEZ – Exclusive Economic Zone
GPS – Global Positioning System
HAZID – Hazard Identification
HNS – Hazardous and Noxious Substance
IMO – International Maritime Organization
IMDG – International Maritime Dangerous Goods Code
LNG – Liquefied Natural Gas
LNGC – Liquefied Natural Gas Carrier
MARCS – Marine Accident Risk Calculation System
MARPOL – International Convention for the Prevention of Pollution from Ships
MCTS – Marine Communications and Traffic Services
MLA – Marine Liability Act
MTPA – Million Tonnes per Annum
OCIMF – Oil Companies International Marine Forum
SIGTTO – Society of International Gas Tanker and Terminal Operators
SIRE – Ship Inspection Report Programme
SOLAS – International Convention for the Safety of Life at Sea
SOPF – Ship-Source Oil Pollution Fund
STCW – Standards for Training, Certification and Watchkeeping
TERMPOL – Technical Review Process of Marine Terminal Systems and Transshipment Sites
TRC – TERMPOL Review Committee
UKC – Underkeel Clearance
VTS – Vessel Traffic Services
WCMRC – Western Canada Marine Response Corporation

EXECUTIVE SUMMARY

Project overview

As a co-venture project, Chevron Canada Ltd and Woodside Energy (Canada) International Ltd are proposing to build and operate a liquefied natural gas (LNG) facility and marine terminal to the store and export LNG within the District of Kitimat, British Columbia.

Natural gas will arrive at the Kitimat LNG terminal via a pipeline to be liquefied and loaded onto LNG Carriers (LNGCs) for export overseas. The development of the Kitimat LNG project will proceed in two phases (LNG trains), the first train is expected to produce 5.5 million tons per annum (MTPA), and the second train will double the volume to 11 MTPA. The resulting increase in marine traffic will amount to 150 vessel calls per year for a fully executed two-train project. The terminal berth will be designed to accommodate LNGCs ranging in size from 125,000 cubic meters (m^3) to 217,000 m^3 with overall lengths between 270 m and 315 m and draughts of 11 m to 12.5 m.

Purpose of TERMPOL review

In addition to fulfilling mandatory provincial and federal requirements, Chevron Canada and Woodside Energy (the proponent) have requested to have a TERMPOL Review Committee (TRC) assess the marine transportation components of their proposed Kitimat LNG Terminal Project (the project) under the voluntary Technical Review Process of Marine Terminal Systems and Transshipments Sites (TERMPOL). The membership of TRC consist of experts from federal departments and authorities with responsibilities related to safe marine transportation who review proponents' submissions. It includes representatives from departments and agencies such as the Fisheries and Oceans Canada, the Canadian Coast Guard, the Pacific Pilotage Authority, and Environment and Climate Change Canada. The TERMPOL Secretariat at Transport Canada acts as the chair of the TRC.

The TERMPOL Review process aims to:

- Objectively appraise operational vessel safety, route safety and cargo transfer operations associated with a proposed marine terminal system, route or transshipment site
- Improve, where possible, those elements of a proposal which could, in certain circumstances, pose a risk to the integrity of a vessel's hull while navigating and/or the cargo transfer operations alongside the terminal
- Critically examine the effectiveness of proponent's plans and recommend additional potential marine safety mitigation measures where needed

TERMPOL recommendations and findings

As mandated by the TERMPOL process, in 2016, the proponent submitted a number of surveys and studies to Transport Canada (TC). The following suite of materials aims to show that:

i) Kitimat LNG complies with or exceeds regulatory marine safety measures in the context of transport of hazardous materials; and
ii) The proponent can prevent, manage and mitigate unintentional loss of LNG containment and the associated risks with loading, navigation and natural hazards.

The TRC urges the proponent to commit to implementing all 60 recommendations presented in the TERMPOL Report Appendix, including:

- LNGCs used for the Kitimat LNG project should limit their speed to a maximum of 12kn when accompanied by tug escort.
- Kitimat LNG should ensure all carriers that call at the terminal possess a SIRE certificate that is no more than six months old, as part of their Carrier Acceptance Program,
- Kitimat LNG should ensure that venting of boil-off gases does not occur when pilots are boarding project carriers or during pilot transfer by helicopter.
- The proponent should ensure that all tug operators used for the project have undergone T2 training.
- Kitimat LNG pursue full tug escort for both inbound and outbound vessels between the project terminal in the Douglas Channel and Browning Entrance, north of the Principe Channel.
- Kitimat LNG should continue its efforts to obtain information on concentrations of marine mammal populations, including Minke whales, to develop speed profiles and other mitigation measures for underwater vessel noise. This includes participation in regional initiatives, such as future Smart Oceans workshops, to obtain the best data available concerning marine mammals along the project route.

The Report also includes 41 findings that describe potential federal, provincial and marine authorities' actions to enhance the overall safety of the project:

- The proponent and its carrier companies would need to satisfy any Canadian amendments resulting from implementation of the International Maritime Organization's International Convention for the Control and Management of Ships' Ballast Water and Sediments.
- Recommendations from the Pilotage Act Review would modernize the services provided by marine pilots in Canada's compulsory pilotage areas, including the pilotage of vessels calling at the Kitimat LNG terminal.
- The CHS can update nautical charts with a pilot boarding symbol if helicopter boarding is re-introduced for the North Coast.
- Increased rescue towing capacity as a result of the stationing of two Emergency Towing Vessels at points along the West Coast has the potential to reduce the risk of drift grounding for LNGCs along the project route.
- In consultation with the B.C. Coast Pilots and Canadian Coast Guard, Environment and Climate Change Canada may assess the need for new smart buoys to provide meteorological data to inbound vessels.

A complete list of the TERMPOL Review Committee findings and recommendations in Appendix 1 can be found at the end of this document.

1. INTRODUCTION

1.1 PROJECT BACKGROUND AND DESCRIPTION

Kitimat LNG proposes to build and operate a liquefied natural gas (LNG) export facility in Bish Cove, near Kitimat, on the northwest coast of British Columbia. Bish Cove is located near the head of Douglas Channel, a fjord that penetrates approximately 130 nautical miles (241 kilometres) inland from the Pacific Ocean.

Kitimat LNG is a 50/50 joint venture between Chevron Canada Limited and Woodside Energy International. Originally, Apache Corporation was the lead investor in the Kitimat LNG project. However, in 2013, Chevron entered as an equal partner of the project, becoming the principal operator of the proposed marine facility.[2] In 2015, Apache sold its stake in the project to the Australian-based Woodside Energy, creating the existing arrangement. [3]

LNG definition and context

LNG is natural gas in its liquid state. While it is comprised primarily of methane, it also includes heavier hydrocarbons and trace amounts of other compounds. When natural gas is cooled to approximately -162° Celsius at atmospheric pressure it becomes a clear, colourless and odourless liquid. LNG is cryogenic, non-corrosive and non-toxic. The process of liquefaction removes any water, oxygen, carbon dioxide and sulfur compounds from the natural gas. In liquid form, LNG is approximately 1/600th the volume of natural gas, which allows for efficient transport in purpose-built ocean carriers. The LNG is reheated and converted back into gas at the destination.

The International Maritime Organization (IMO)[4] classifies LNG as a hazardous and noxious substance (HNS). The IMO defines HNS as "*any substance other than oil that if introduced into the marine environment would likely create hazards to human health, harm living resources and marine life, damage amenities or interfere with other legitimate uses of the sea*." The TRC accepts this IMO definition of LNG as a HNS, and uses this context throughout the Report. Under the International Maritime Dangerous Goods Code (IMDG), LNG is classified as a liquefied flammable gas under Section 2.1, Methane, Refrigerated, Liquid or Natural Gas, United Nations, number 1972.

Project overview

The Kitimat LNG marine terminal would be situated in Bish Cove, on the north side of the Douglas Channel near Kitimat, British Columbia. The terminal would consist of a single berth

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[2] http://www.chevron.ca/docs/default-source/publications/Kitimat/kitimat-lng-project-overview.pdf?sfvrsn=2
[3] http://investor.apachecorp.com/releasedetail.cfm?ReleaseID=905909
[4] Tanker Safety Expert Panel. A Review of Canada's Ship-Source Spill Preparedness and Response: Setting the Course for the Future, Phase II – Requirements for the Arctic and for Hazardous and Noxious Substances Nationally. (2014).

that could accommodate a range of LNG carriers (LNGCs) with cargo capacities between 125,000m^3 and 217,000m^3.[5] Natural gas would arrive to the export terminal via pipeline for liquefaction and then be loaded onto berthed LNGCs for export.

Project carriers would enter Canadian waters through Dixon Entrance, and use the Outside Passage for transiting to and from the terminal.[6] The route consists of the waters from Dixon Entrance north of Haida Gwaii through the Principe Channel to the Douglas Channel to berth at the proposed marine terminal. Tugs will also provide escort and berthing assistance to project vessels during their call.

The Kitimat LNG project would be delivered in two phases (LNG trains). The first LNG train would add 75 vessels to existing marine traffic in the Douglas Channel, with an additional 75 coming when the second train goes into operation. A fully executed, two-train Kitimat LNG project would export approximately 11 million tonnes per annum (MTPA).[7]

Early works at the proposed site began in 2011, however full construction operations will begin once a Final Investment Decision (FID) is made.

TERMPOL report assumptions

Kitimat LNG presented potential project impact and mitigation strategies within its submission. These are based on the full build scenario and maximum size carriers able to call at the terminal, specifically the 217,000 m^3 Q Flex carriers. The proponent's rationale is that this will sufficiently account for smaller LNGCs that could also potentially call at the terminal.

Project carriers will operate in waters under Canadian jurisdiction and must comply with Canada's regulatory regime for safe operation. Legislation, including the *Canada Shipping Act, 2001* (*CSA, 2001*) sets out the requirements and responsibilities for safe vessel operation, including monitoring and enforcement. Moreover, the *CSA*, 2001 implements certain international conventions in Canada. In addition to Canadian and international requirements, project carriers will also comply with Kitimat LNG's internal carrier vetting and terminal procedures, expressed in detail later in the report.

The TERMPOL report is based on existing traffic data and projections. It does not take into account the impact other potential projects would have on the Kitimat LNG project which would operate along the same waterway.

Environmental Assessment process

The Kitimat LNG project meets the requirements for an environmental assessment under the *Canadian Environmental Assessment Act*, 2012, and B.C.'s *Environmental Assessment Act*, 2002. The proponent's LNG facility was granted a Federal Environmental Assessment

[5] Kitimat LNG TERMPOL Submission – Element 3.2. Origin, Destination and Marine Traffic Volume Survey, pg 2
[6] Ibid.
[7] Ibid.

Certificate (EAC) in 2008, and the Government of B.C. issued a Provincial EAC in 2009. These certificates are subject to follow-up monitoring to verify accuracy of the assessment, and determine the effectiveness of mitigation measures.

1.2 TERMPOL PROCESS AND REVIEW REPORT

TERMPOL refers to the 'Technical Review Process of Marine Terminal Systems and Transshipment Sites' and is set out in TC's Technical Publication TP 743E, *TERMPOL Review Process 2001*[8].

TERMPOL is a voluntary review process for proponents proposing to build and operate marine terminal systems for bulk handling of oil, chemicals and liquefied gases. The process considers the marine transportation components of a project, including the movement of vessels through Canadian waters and channels, and approaches to marine terminal berths to load or unload oil or gas. The intent of the process is to improve, where possible, the elements of a proposal which could, in certain circumstances, threaten the integrity of a vessel's hull during navigation and/or cargo transfer operations at the terminal.

Throughout the process, the proponent works with the TRC. Committee members represent federal departments and authorities with applicable expertise or responsibilities. The TRC reviews the proponent's TERMPOL submission and provides a report with recommendations and findings. The report:

- offers technical feedback and TRC perspectives
- may propose improvements to enhance the marine safety of a project and/or address any site-specific circumstances

The success of the TERMPOL process is largely dependent on the proponent's adherence to the procedures described in the *TERMPOL Review Process 2001* guidelines TP 743E (Review Guidelines), and the quality of data and analysis it submits to the TRC. The proponent is responsible for ensuring its surveys and studies meet the highest industry and international standards.

The TERMPOL process is not a regulatory instrument. No approvals or permits are issued as a result of the TERMPOL review or report. As such, the TERMPOL report should not be interpreted as a statement of government policy or federal government endorsement. Although TERMPOL report findings and recommendations are not binding, a proponent may integrate the suggested improvements into their engineering, planning and design.

[8] The Technical Publication was revised in 2014 to clarify the scope and intent of TERMPOL and can be found at the following link: http://www.tc.gc.ca/eng/marinesafety/tp-menu-515.htm. The Technical Publication was revised in 2014 to reflect program and regulatory changes, and to clarify the scope and intent of TERMPOL. However, the Kitimat LNG submission was completed and received by the TRC prior to the publication of the new TERMPOL Review Process (TRP) and therefore follows the 2001 process.

The TERMPOL Review Process does not replace or reduce the safety, security, and environmental requirements of any Acts and/or Regulations that are in effect or subject to amendments. The process will not approve or reject the project. Kitimat LNG must obtain any such approvals from the appropriate regulatory authorities by following their own specific processes. The proponent and any associated carrier servicing an approved project would need to comply with all applicable legislation and regulations, including future amendments. TC and other agencies may also use the work and report of the TRC to identify potential regulatory improvements or special measures.

In addition to securing environmental assessment certificates, Kitimat LNG will need to obtain a suite of regulatory permits from the provincial government, including a LNG facility permit from the B.C. Oil and Gas Commission (BC OGC). Although an export license was granted by the National Energy Board in December 2013, Kitimat LNG must also obtain additional federal permits and approvals, such as *Navigation Protection Act* approval from TC.

1.3 SCOPE OF TERMPOL

The TERMPOL Review Guidelines set out a maximum possible scope of assessment for vessel safety and the risks associated with vessel manoeuvres and operations. The proponent, in consultation with the TRC, selected the most appropriate scope for the project after considering existing shipping activities in the area and/or unique circumstances. The TRC and the proponent agreed on the following scope for the TERMPOL Review of the project:

- Vessel operations in Canadian waters along the proposed shipping routes to and from the Kitimat LNG marine terminal.
    - The analysis area includes both approach routes, from the western point of Dixon Entrance and from the southern entrance of the Hecate Strait
- Project LNGC characteristics, navigability, vessel routes in Canadian waters, other waterway users, the marine terminal and cargo transfer operations

The TERMPOL report examines:

- studies, surveys and technical data provided by Kitimat LNG in support of the TERMPOL Review Guidelines
- existing national and international regulatory frameworks to ensure safe carrier operations

The report assesses the proposed project's marine transportation operations within the context of the existing marine regulatory regime, programs and services. The report does not examine land infrastructure such as natural gas receiving and LNG production facilities, or associated infrastructure such as power supply, water supply, and waste collection. The report notes that new measures, such as helicopter pilot boarding, could affect project operations. The appraisal allows the proponent to liaise with appropriate federal authorities to address new or changing issues, concerns, or priorities related to the project's marine transportation components.

As set out in the TERMPOL Review Guidelines, Kitimat LNG submitted the studies, surveys, and technical data identified in Table 1 for TRC review and analysis. The surveys and studies were presented in the following order:

Table 1 – Proponent's Surveys and Studies

Number	TERMPOL Survey/Study Title
3.1	Introduction
3.2	Origin, Destination and Marine Traffic Volume Survey
3.4	Offshore Exercise and Offshore Exploration and Exploitation Activities Survey
3.5 (including 3.12)	Route Analysis, Approach Characteristics and Navigability Survey
3.6	Special Under Keel Clearance Survey
3.7	Transit Time and Delay Survey
3.8	Casualty Data Survey
3.9	Ship Specifications
3.10	Site Plans and Technical Data
3.11	Cargo Ship Transfer
3.13	Berth Procedures and Provisions
3.15	General Risk Analysis and Intended Methods of Reducing Risks
3.18	Contingency Planning
3.20	Hazardous and Noxious Liquid Substances

The proponent and TRC jointly agreed with the omission of two studies that are not applicable to the project:

- (3.14) Single Point Mooring Provisions
- (3.19) Procedures and Oil Handling Facilities Requirements

As the proponent submitted the Fishery Resources Survey (3.3) as part of the Environmental Assessment process, it is not part of its TERMPOL Submission. The Port Information Book (3.16) and Terminal Operations Manual (3.17) will be submitted at a later date, as that level of detail is not available in the early planning stages of a project. The TRC has advised Kitimat LNG that they must submit each of these documents at least six months prior to the start of project operations.

2. METHODOLOGY

On July 27, 2005, Kitimat LNG formally requested a TERMPOL review. TC approved the request and met with the proponent to discuss the scope of surveys and studies. Investor restructuring and uncertainty around the project's viability delayed the proponent's TERMPOL submission. However, on June 13, 2016, the proponent submitted its TERMPOL package of surveys, studies, technical data, and analysis related to the marine transportation components of the project. TC, as chair of the TRC, distributed copies of the package to committee members for review and comment.

The TRC is comprised of representatives from:

- Transport Canada (TC)
- Fisheries Oceans Canada (DFO), including:
    - Canadian Coast Guard (CCG)
    - Canadian Hydrographic Services (CHS)
- Environment and Climate Change Canada (ECCC)
- Pacific Pilotage Authority (PPA)
- British Columbia Coast Pilots (BCCP)

These member departments and authorities collaborate to deliver the federal government's comprehensive regulatory framework. This helps to ensure Canada's marine transportation system is safe, secure and environmentally responsible. The BC OGC and Natural Resources Canada also contribute input to the TRC, where necessary.

The TRC reviewed the proponent's TERMPOL Submission from the perspective of their individual mandates, regulatory authorities and expertise. After a thorough review, the relevant authorities contribute to and approve the TERMPOL Report, which contains a number of recommendations and findings. By definition:

- 'Recommendations' propose suggested actions for Kitimat LNG
- 'Findings' highlight observations about the project or actions that may be undertaken by appropriate authorities

The TRC bases the analysis and commentary in this report on the information, documentation, and technology available at the time it was written. The project could be subject to reanalysis if the scope or timeline changes significantly. It is recommended this report be read in conjunction with the TERMPOL Review Process 2001 guideline (TP 743E).

Recommendation 1: Kitimat LNG should provide relevant authorities with advance notice if changes are made to project commitments, operational parameters or characteristics.

3. ANALYSIS

The TERMPOL Submission (the submission) details the proponent's plans and mitigations as they relate to the marine transportation components of this project including attending carriers.

The TERMPOL Report (the report) reflects the TRC's analysis of the proponent's plans and mitigations. The report proposes recommendations and findings specific to the project that apply to project carriers, routing and terminal safety. Some recommendations can be implemented directly by the proponent, while others will involve working with appropriate authorities.

The TRC expects the proponent to deliver on the plans and mitigations it proposes within the submission because they are important elements of the TRC's assessment of project's safety. The proponent is encouraged to adopt and implement the recommendations included in this report. The TRC recognizes that adequate lead time and discussion will be required where formal enhancements to the current marine safety regime are proposed.

This section of the report reviews the project details examines the key commitments made by Kitimat LNG in their submission. Specifically, the report analyzes:

1. Vessel information
2. Route information
3. Terminal operations
4. LNG/oil spill preparedness and response

Finding 1: Implementation of TERMPOL Review Committee recommendations may require individual agreement between the proponent and the responsible authorities.

Quantitative risk assessment

TERMPOL Element 3.15 was prepared by marine risk assessment specialists DNV GL for Kitimat LNG as part of the TERMPOL Review Process. Scenarios were developed that analyze the frequency and consequence of a potential LNG release. The proponent's Transit Quantitative Risk Assessment describes incident frequencies and consequences of a loss of containment from a laden LNGC at points along the shipping route. The Terminal Quantitative Risk Assessment describes incident frequencies and consequences of a loss from a laden vessel berthed at the Kitimat LNG terminal in the Douglas Channel. Incident frequencies were calculated for the following events:

- Collision
- Powered grounding
- Drift grounding

The results were then combined in a single geospatial graphic to assess the potential safety risk from the proposed terminal sites. Results from the study have informed a suite of mitigation measures that have been proposed by Kitimat LNG. These include a number of specific mitigation measures to reduce the risks associated with collision, drift and powered grounding, as well as marine terminal operations. These measures are discussed in further detail in Section 3.2.4 of this report.

In calculating the frequency of all incident types, Kitimat LNG made the following assumptions:

- The design ship for this Project is a 217,000 m^3 Q-Flex membrane type with approximately 315 m length overall (LOA)
- Impact from very steep angles (less than 22.5^0 and greater than 157.5^0) will not penetrate the LNGC cargo tank
- The following size distribution of holes that would lead to a spill is: 23% of holes are 250 mm, 45% of holes are 750 mm and 32% of holes are 1100 mm
- All accident releases will ignite. Furthermore, 30% of collision incidents resulting in an accidental release will form a flammable gas cloud and ignite while the remaining 70% ignite immediately forming an LNG pool fire. The delayed ignition probability for grounding incidents that lead to an accidental release of LNG is 100%. Delayed ignition would allow a flammable gas cloud to reach its farthest extent prior to ignition and flash back source
- The terminal is built with good ignition controls based on the Atkins on-site ignition model

HAZID workshop

Hazard identification is the first step as part of the proponent's risk analysis. In April 2014, Kitimat LNG held a two-day Hazard Identification (HAZID) workshop to identify potential navigational and loading hazards, as well as to discuss safeguarding measures for the transit route and terminal operation. The HAZID workshop presented a systematic approach to the identification of hazards and risk associated with carrier routes and berthing at the project terminal. The workshop participants were able to provide the proponent with local knowledge about the route and terminal operations to be incorporated into the risk assessment.

Representatives from TC, PRPA, BCCP, CCG, Seaspan, Apache, as well as from the Gitga'at, Haisla, and Heiltsuk First Nations took part in the discussion.

The proposed project route was divided into eight nodes; safeguards and mitigation measures were discussed considering the following events:[9]

- Collision

[9] Kitimat LNG TERMPOL Submission – HAZID Report Workshop, pg 4.

- Drift grounding
- Powered grounding
- Striking the loading platform
- Striking the trestle
- Overfilling the cargo tank
- Striking the vessel while loading
- Release from the loading arms

The workshop highlighted several areas of concern for local residents and stakeholders, including:

- tug assistance strategies both along route and at the terminal
- additional navigational aids and new land-based radar
- traffic separation schemes and limiting passing and overtaking
- vetting processes

The proponent has advocated for solutions to the above suggestions within its TERMPOL submission. In some instances, members of the TRC have directly addressed these perceived gaps, while others are contained in the TERMPOL report in the form of findings and recommendations.

3.1 VESSEL INFORMATION

This section provides an overview of the Canadian and international laws and regulations that LNGCs must comply with. Three important *Acts* and pursuant regulations are:

The *Canada Shipping Act, 2001*
This is the main legislation that regulates safety in marine transportation and protects the marine environment from vessel-source pollution in Canada. The *CSA, 2001* implements several international conventions in whole or in part through its regulations and seeks to balance vessel safety and marine environment protection with the need for maritime commerce. It also provides authority to investigate and, if necessary, to prosecute using various tools and actions.

The *Pacific Pilotage Regulations* of the *Pilotage Act*
This establish marine zones along the B.C. coast where vessels are subject to mandatory pilotage.

The *Marine Transportation and Security Act* (MTSA)
This provides for the security of marine transportation and applies to prescribed vessels, ports and marine facilities in Canada, Canadian vessels outside of Canada, and marine installations and structures.

Each project carrier will have to meet the requirements of the IGC Code and hold a valid Certificate of Fitness for the Carriage of Liquefied Gases in Bulk. Project carriers will also be subject to other certifications while in Canadian waters, as required by TC, classification societies, and the IMO.

Modern carriers are equipped with the latest navigational systems and radar systems that provide timely information to facilitate safe navigation. Further, Kitimat LNG should ensure that all project carriers meet the Emergency Towing Procedures requirements of SOLAS *Regulation II-1/3-4.*

Carrier tank types

The Kitimat LNG terminal berth would accommodate two common types of double-hulled carriers with different tank types. Both tank types effectively maintain cryogenic temperatures needed for safe LNG storage and transport. Each tank type has unique characteristics:

Kvaerner-Moss spherical tank type
This is typical for smaller and mid-size carriers up to 140,000m^3, as larger-capacity spherical tanks would limit a vessel's external dimensions and prevent it from meeting port thresholds. Moss tank vessels are more susceptible to effects of high winds, which can pose challenges during berthing.

Membrane tank type
This vessel has a lower main deck profile and is less susceptible to high winds. These tanks are more common in vessels ranging from 140,000m^3 to 265,000m^3 in size.

Design vessels

The Kitimat LNG terminal plan features a single LNG loading berth that is able to accommodate both Moss tank LNGCs and Membrane tank LNGCs. Kitimat LNG plans for vessels with tank capacity between 125,000 m^3 to 217,000 m^3 to berth at the terminal (see Table 2). The overall length of the ships being considered is between 272 m and 315 m.

Although the proponent expects the Q Flex carrier to be the largest vessel to visit the terminal, other carriers of varying sizes may also call. Accordingly, the design vessels of the submission represent only a general range of the terminal's capabilities – what is referred to as the "*typical expected vessel.*"

Table 2 – Kitimat LNG Maximum and Minimum Fleet Dimensions (Projected)[10]

Description	Project Design Vessel Maximum	Project Design Vessel Minimum
Capacity, m^3	217,450	127,737
Length Overall, m	315	272
Ballast draught, m	9.7	9.0

[10] Kitimat LNG TERMPOL Submission – Element 3.9. Ship Specifications, pg. 17

Carrier speed

As part of their submission, Kitimat LNG has detailed the speed profile of a vessel calling at their proposed marine terminal. At all times, project carriers must maintain safe speed, as per Rule 6, Part B – Steering and Sailing Rules, found in Schedule 1 of the *Collision Regulations* created under the *CSA, 2001*. Kitimat LNG states that the average LNGC service speed at sea for its design vessels is between 18 to 21 knots, depending on hull form and installed engine power.[11] However, it is necessary for speed to be reduced for safe transit within Canadian waters.

To outline the approximate speed of a vessel at specific points along the route, Kitimat LNG has divided the route into two segments:

- The Open Water Section which includes the section from Dixon Entrance to Browning Entrance
- The Channel Section which includes Dixon Island, Otter Channel, Lewis Passage, Emilia Island, and Wright Sound

The proponent estimates that carriers will travel at speeds between 12 and 17 knots in the Open Water Section of the route, and 8 to 14 knots in the Channel Section. The estimated time for transit to the Kitimat LNG terminal is 11 to 18.2 hours.[12] In practice, however, the speed profile for carriers may differ because it will be dependent on factors such as environmental conditions (e.g. weather, sea state) as well as other marine traffic along the route.

In addition, vessel speed may be limited in sections where tugs are used in escort. Simulations revealed the maximum speed where a tug can be effective in case of an emergency is in the range of 10 to 12 knots. Escort at higher speeds would require a custom built tug.

Recommendation 2: LNGCs used for the Kitimat LNG project should travel at a safe speed that is mutually agreed upon by the Master and the Pilot, while taking into account the speed capability of tugs in escort.

Recommendation 3: If Kitimat LNG is inclined to pursue transit speeds faster than 12 knots within the Channel Section of the route, they should work with tugboat providers to develop a custom tug design that is still able to be effective in the event of an emergency at a higher speed.

Carrier manoeuvring

Industry best practices have established the appropriate timing for certain actions that must be taken at different points of a carrier transit, including:

- preparing the engine for immediate manoeuvre

[11] Kitimat LNG TERMPOL Submission – Element 3.7. Transit Time and Delay Survey, pg 1.
[12] Ibid, pg 5.

- manning the engine room
- readying the crew to respond to potential adjustments in carrier speed (i.e. stand-by mode)

The TRC notes that the crew should be in full attendance at the carrier's manoeuvring stations (i.e., bridge, engine control room and steering gears) at critical times, such as:

- at least one hour before arrival in Dixon Entrance, the crew must ensure the carrier is fully manoeuvrable to take appropriate action in the event of unforeseen scenarios
- manning the engine room to maintain schedule and berthing at the terminal as close to the estimated time of arrival as possible
- manning the engine room to ensure the vessel can depart unexpectedly if an emergency occurs while loading/unloading

Recommendation 4: The proponent should include in its Port Information Book that Masters must ensure project carriers are ready for immediate manoeuvring at all times, especially during critical points of transit. The engine room should also be fully manned at least one hour before arrival in Canadian waters, and remain manned until the vessel is alongside the marine terminal.

Canadian requirements and international conventions

Project carriers must comply with the safety and environmental protection requirements of:

- International conventions (such as the IMO)
- Canada's marine safety regulatory regime, notably the *CSA, 2001* and its regulations while in Canadian waters
- The International Code for the Construction and Equipment of Ships carrying Liquefied Gases in Bulk (IGC code)

Canadian and international requirements address areas such as:

- safe vessel design and construction
- safe manning
- crew qualifications and training
- working conditions
- safety management systems
- radio communications equipment and equipment for safe navigation including Electronic Chart Display Information System (ECDIS) and AIS
- voyage planning
- vessel reporting
- rules to prevent collisions

The International Convention for the Safety of Life at Sea (SOLAS) is the main international convention for vessel safety. The main objective of SOLAS is to set specific minimum standards for construction, equipment, and operation of ships compatible with their safety. Administrations certify and regularly inspect vessels trading internationally (including LNGCs) that fly their flags, as set out in the relevant international conventions.[13]

Flags and registries link each vessel with a nationality, or Flag State. Under the registries the vessels are required to follow the applicable regulations of the country where they are registered. The country where the vessel is registered is responsible for ensuring the vessel complies with applicable national laws and international conventions.

LNG carrier construction

The construction of a LNGC must comply with the requirements of the Flag State as well as the appropriate instruments of IMO conventions and codes. LNGCs must also comply with the version of the International Code for Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) in force at the time of their construction, and the guidelines of classification societies. Guidelines and recommendations are also issued by the Oil Company International Marine Forum (OCIMF) and the Society of International Gas Tanker and Terminal Operators (SIGTTO)

IGC Code includes requirements for the following items and controls:

- Cargo containment construction materials
- Cargo pressure and temperature control
- Environmental control
- Fire protection and extinguishment
- Personnel protection
- Capacity limits for cargo tanks[14]

If a carrier meets every requirement, the Flag State will issue a Certificate of Fitness for the Carriage of Liquefied Gases in Bulk. This certificate is valid for five years.

Shipping conventions

Carriers must comply with all shipping-related IMO conventions that Canada has ratified and adopted into legislation, including the:

- SOLAS Convention
- International Convention for the Prevention of Pollution from Ships (MARPOL)
- Standards for Training, Certification and Watchkeeping (STCW) Convention
- Maritime Labour Convention 2006

[13] "Administration" means the government of the state whose flag the vessel is entitled to fly.
[14] For a complete list of requirements refer to the IGC Code.

According to MARPOL Annex 1 Regulation 1(4), carriers must:

- have an International Oil Pollution Prevention Certificate
- possess a Shipboard Marine Pollution Emergency Plan (SMPEP), which incorporates the Shipboard Oil Pollution Emergency Plan (SOPEP)

Classification Societies

Classification Societies perform statutory inspection and certification functions on vessels around the world and have extensive expertise in the construction and operation of modern ships. TC has entered into formal agreements with certain Classification Societies, under the authority of section 12(1) of the *CSA, 2001*. These agreements delegate certain statutory inspection and certification functions. Seven Classification Societies are currently able to conduct vessel inspection and certification in Canada.

Through the Delegated Statutory Inspection Program (DSIP), vessel owners may enroll to have the third-party Classification Societies perform these functions on their vessels. The DSIP is mandatory for vessels 24 m in length and above in Canada.

TC conducts oversight audits of delegated vessels and the Recognized Organization in accordance with the DSIP. When a vessel is delegated to receive a statutory inspection and certification service from a Recognized Organization (RO), TC continues to monitor the performance of both vessel operators and the RO through planned and unplanned risk-based compliance inspections.

Port State Control

Canada has measures in place under *CSA, 2001,* which help ensure large foreign vessels (including project LNGCs) entering Canadian waters comply with international and Canadian requirements and do not pose an undue risk to safety or the environment.

Port State Control is TC's primary means for enforcing the *CSA 2001*, the *Marine Transportation and Security Act*, and applicable international conventions Canada has incorporated into its laws. This is a vessel inspection program established under the IMO, whereby countries sharing common waters agree to share inspection responsibilities and information. For example, Canada is a Port State for foreign vessels that enter our waters and we inspect them according to international agreements. Moreover, Canada is a member of:

- The Paris Memorandum of Understanding, an agreement between coastal countries of the North Atlantic
- The Tokyo Memorandum of Understanding governing the Asia-Pacific region

The IMO and the International Labour Organization provide the regulatory framework for the Port State Control program. The objective is to inspect foreign vessels of all types, including

tankers, against international standards to detect and eliminate sub-standard vessels and the threat that they pose to life, property, and the marine environment.

It is TC's policy to inspect or audit every foreign tanker vessel calling at a Canadian port on its first visit to Canada, and at least once a year thereafter. Canada considers LNGCs as tankers for inspection purposes, making them subject to this policy. TC specifically targets vessels that have previous history of non-compliance, a poor safety record, and which are generally more than 12 years old for more detailed or expanded inspections. Inspections may include:

- vessel certificates and documents (crew training, ballast water reports, etc.)
- confirmation of watertight/weather tight condition, stability, and loading or discharge plans
- determination as to whether deficiencies found by a Port State authority at a previous inspection have been corrected
- structural condition (exterior as well as inside ballast tanks)
- emergency system and emergency preparedness measures
- propulsion machinery
- pollution prevention measures

When inspectors find defects, TC may use a range of enforcement actions and depending on the severity of the infraction, can:

- require the vessel to perform repairs before sailing
- detain the vessel at port
- fine the ship owner
- prosecute the ship owner under the *CSA 2001*

Transport Canada publishes all defects on the Port State Control database. TC may also impose fines for non-compliance under *Administrative Monetary Penalties and Notices (CSA, 2001) Regulations*. Even minor defects have financial consequences for the vessel's owner or operator, as once defects are noted on the Port State Control database a vessel's risk profile may change leading to increased inspections at ports around the world. This makes Port State Control an effective incentive for ship owners to comply with international conventions and national regulations. TC would perform compliance inspections of project carriers as part of its regular inspection regime.

LNG carrier vetting criteria

Kitimat LNG will require vessels to gain approval through Chevron's 'LNG Carrier Acceptance Program' before being able to proceed to call at the Project terminal. The acceptance process is divided into two parts:

1. The **Compatibility Assessment**, which assesses a ship's physical particulars, including deck arrangement and cargo and mooring systems, in order for the vessel to be deemed adequate to conduct cargo transfer at the terminal

2. The **Quality Assessment**, which requires a quality assessment of the vessel, owner, and technical manager; some controls are internationally-accepted safety benchmarks introduced by independent bodies such as the Oil Companies International Marine Forum (OCIMF), while others are specific to Chevron's in-house LNG Carrier Acceptance Program

The OCIMF is a voluntary association of oil companies. It promotes the safe design and operation of tankers and terminal operations related to crude oil, oil products, petrochemicals and gas. The association regularly represents the views of industry at the IMO and has become an advocate for marine safety standards and regulation.

For instance, the Ship Inspection Report Programme (SIRE) is a voluntary inspection process OCIMF members that employ tankers/barges pay for as part of their business. The OCIMF member companies commission vessel inspections by an accredited SIRE inspector. The inspector then uploads the SIRE report to the SIRE database, which OCIMF members and partners can access for a small fee. Industry adherence to the SIRE programme promotes continuous improvement. It is standard that all carriers calling at the project terminal possess a SIRE certificate that is no more than six months old.

The OCIMF has also introduced the Tanker Management Self-Assessment Survey (TMSA) as best-practice guidance to help vessel operators assess, measure and improve their safety management systems. The guidance document allows operators to self-assess against 12 key performance indicators. The TRC recognizes the value of the TMSA as an added carrier safety measure.

Finding 2: The Ship Inspection Report Programme (SIRE) and Tanker Management Self-Assessment Survey (TMSA) are important tools terminals and energy companies use to enhance carrier safety and exceed minimum regulatory requirements.

Recommendation 5: As part of their Carrier Acceptance Program, Kitimat LNG should ensure all carriers that call at the terminal possess a SIRE certificate that is no more than six months old.

As part of the Quality Assessment, the proponent will require:

- results of the current TMSA to assess the technical manager's Safety Management System
- a Vessel Inspection Report (VIR) loaded on the SIRE website and reviewed to assess safe operations of LNGC. The review may require that a new VIR be performed if it is outside the age requirements for the validity of the VIR
- an Online Crew Matrix loaded on the SIRE website and reviewed to verify adequate experience, including STCW requirements and SIGTTO recommendations
- LNGC Class Status to be in accordance with Class rules and recommendations
- Port State Control Inspections and detentions, as well as casualty data to assess safe operation of the LNGC
- Terminal Feedback to assess safe operation at terminals

- Vessel Age and Condition Assessment Program certification to ensure it is within Kitimat LNG acceptance criteria
- compliance with International Ship and Port Facility Security Code

Additionally, LNGCs used for the Kitimat LNG project, will be subject to the following regulatory body inspections:

- Flag State
- Port State Control
- Class
- Owners
- Third-Party Vetting Companies

The proponent has not stated whether it will own and operate the LNGCs that call on the terminal. If the proponent charters from the open market, or acquires new vessels, it will be responsible for ensuring any carrier meets all required legislation and best-practice criteria.

Ballast water requirements

The project would involve project carriers up to 217,000 m^3 arriving ballasted with sea water. These carriers must comply with Canada's *Ballast Water Control and Management Regulations*, including and as applicable, the IMO's *International Convention for the Control and Management of Ships' Ballast Water and Sediments*. The *Ballast Water Control and Management Regulations* came into force in 2011, and require vessels to exchange their ballast water under the conditions set out by the regulations. Four management methods are permitted, as outlined in section 4(1) of the BWCM Regulations:

- Ballast water exchange
- Treatment using a ballast water management system (BWMS)
- Transfer to a reception facility
- Retention on board the ship

In 2010, Canada signed on to the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, which has reduced the risk of aquatic species invasions compared to Canada's existing regulations. Formerly, it was required that ballast water exchange take place at least 200 nautical miles from the shore where the water is at least 2,000 metres deep. Now, as of September 8, 2017, the Convention will require new ships to limit the number of viable organisms they discharge in ballast water through the use of a treatment system aboard the vessel. A ship-specific schedule aims to spread compliance by existing ships over the next seven years. As it will not be possible to use ballast water exchange to meet the Convention's standard, most ships are expected to fit BWMS to comply. TC is participating in ongoing efforts at the IMO to develop a roadmap for applying the Convention.

Vessels bound for a Canadian port, offshore terminal or anchorage must submit a Ballast Water Report to TC to demonstrate compliance with the regulations. Upon arrival, Ballast Water

Reports are processed by TC inspectors. If the vessel is flagged for having a poor compliance record, or carries a high environmental risk profile, the vessel may be subject to further inspection by TC inspectors. Vessels can also be randomly inspected to ensure compliance or for demonstration of salinity measurement methods.

> **Note:** Reports must include information on all ballast tanks, whether empty, ballasted, or have residuals.

In the event of non-compliance, TC may use a range of enforcement tools depending on the severity of the infraction. These include verbal advice, written warning, retention of ballast water, detention, and in certain cases, prosecution under the *CSA, 2001*.

Finding 3: The proponent and its carrier companies would need to satisfy any Canadian amendments resulting from implementation of the International Maritime Organization's International Convention for the Control and Management of Ships' Ballast Water and Sediments.

Vessel security requirements

Vessel security requirements are administered through national and international regulatory frameworks beyond the scope of the TERMPOL review. All vessels must comply with national legislation and international frameworks for vessel and terminal security such as the Canadian *Marine Transportation Security Regulations* (MTSR).

Recommendation 6: Kitimat LNG should liaise directly with Transport Canada's Marine Security Branch to ensure compliance with all aspects of the Marine Transportation Security Regulations.

Automatic Identification System (AIS)

The *Navigation Safety Regulations* created under the *CSA, 2001* and SOLAS requires vessels engaged on an international voyage of 300 gross tonnes or more, and domestic vessels of 500 gross tonnes or more, to be fitted with an AIS.[15] AIS automatically provides information, including the vessel's identity, type, position, course, speed, navigational status and other safety-related information, to AIS-equipped shore stations, other vessels, and aircraft. AIS improves a vessel's situational awareness and greatly enhances the traffic-monitoring capabilities of the CCG's AIS-equipped Marine Communications and Traffic Services (MCTS) centre, located in Price Rupert. The use of AIS would be mandatory for all project carriers.

> **Note:** These requirements do not apply to fishing vessels.

As of 2018, Prince Rupert MCTS is finalizing their AIS data capture and processing protocol. AIS is operational and 99% is integrated into the traffic management system. The CCG is

[15] Navigation Safety Regulations, SOR/2005-134, s. 65, http://laws-lois.justice.gc.ca/eng/regulations/sor-2005-134/page-11.html#h-41.

working to fill in dark spots, as well as determine areas for enhanced monitoring capability (radar) for the North Coast. This includes study into areas such as Whale Channel, south Douglas Channel and south Grenville Channel.

Finding 4: The Canadian Coast Guard will continue to improve upon the existing AIS system on the North Coast to enhance monitoring capability

Crew certification/manning

Project LNGCs must be equipped and manned to uniformly high industry standards. Kitimat LNG will ensure project carriers are staffed according to the SOLAS Safe Manning Document. The proponent expects shippers of its cargo to follow the LNG shipping practice of aligning certification and experience levels for deck and engineering officers with the Society of International Gas Tanker and Terminal Operators (SIGTTO) Office Experience Matrix. The SIGTTO Experience Matrix considers a number of factors, including length of sea service, experience by rank, and experience in LNG operations.

Kitimat LNG also understands project carriers must meet all required elements of the *Marine Personnel Regulations* (MPR) created under the *CSA, 2001,* which feature minimum experience and training requirements for LNGC crew. Under the MPR, officers must hold a valid Liquefied Gas Tanker Familiarization certificate or endorsement to work onboard a LNGC. To obtain this license or endorsement, the applicant must fulfill training and experience requirements.

Specifically, a new applicant must successfully complete approved training in LNG carrier familiarization. This includes spending at least three months onboard an LNG carrier as part of this mandatory training. Assigned duties relate to the loading, discharging or transferring of cargo, and the operation of cargo equipment. Further, the applicant would need to hold a certificate in basic marine first aid, in addition to a Marine Emergency Duties (MED) certificate with respect to the IMO STCW.

Canadian Marine Emergency Duties training courses are aligned with STCW Convention and STCW Code requirements to ensure adherence to international standards.

- MED training includes basic safety training, firefighting operations and use of survival craft in emergency situations
- The Liquefied Gas Tanker Familiarization certificate or endorsement renewal process features similar minimum requirements for emergency training

Finding 5: The TERMPOL Review Committee supports Kitimat LNG's commitment to adhere to Society of International Gas Tanker and Terminal Operators (SIGTTO) Officer Experience Matrix certification and experience levels.

3.2 ROUTE INFORMATION

3.2.1 OVERALL ROUTE

This section outlines the proponent's proposed shipping routes to the terminal berth at Bish Cove in the Douglas Channel, along with relevant background on marine activities and authorities in the area.

Carrier route overview

Kitimat LNG has proposed that project carriers transit through Canadian waters via two routes:

- The North Route, via Dixon Entrance north of Haida Gwaii
- The South Route by way of Hecate Strait, entering either at Browning Entrance or Caamano Sound

However, Kitimat LNG states in their submission that they will not use the South Route for project operations.[16] There are a number of reasons as to why the South Route is not viable, including:

- inclement weather and tidal conditions throughout the year
- the need for additional NavAids
- the need for a new pilot boarding station

Recommendation 7: The TRC supports Kitimat LNG's commitment to not use the South Route. Use of this route should not be attempted without consultation with the PPA, confirmation of adequacy of NavAids, and full mission bridge simulations.

[16] Kitimat LNG TERMPOL Submission – Element 3.5 & 3.12. Route Analysis, Approach Characteristics, and Navigability Survey and Channel, Manoeuvring and Anchorage Elements, pg 9.

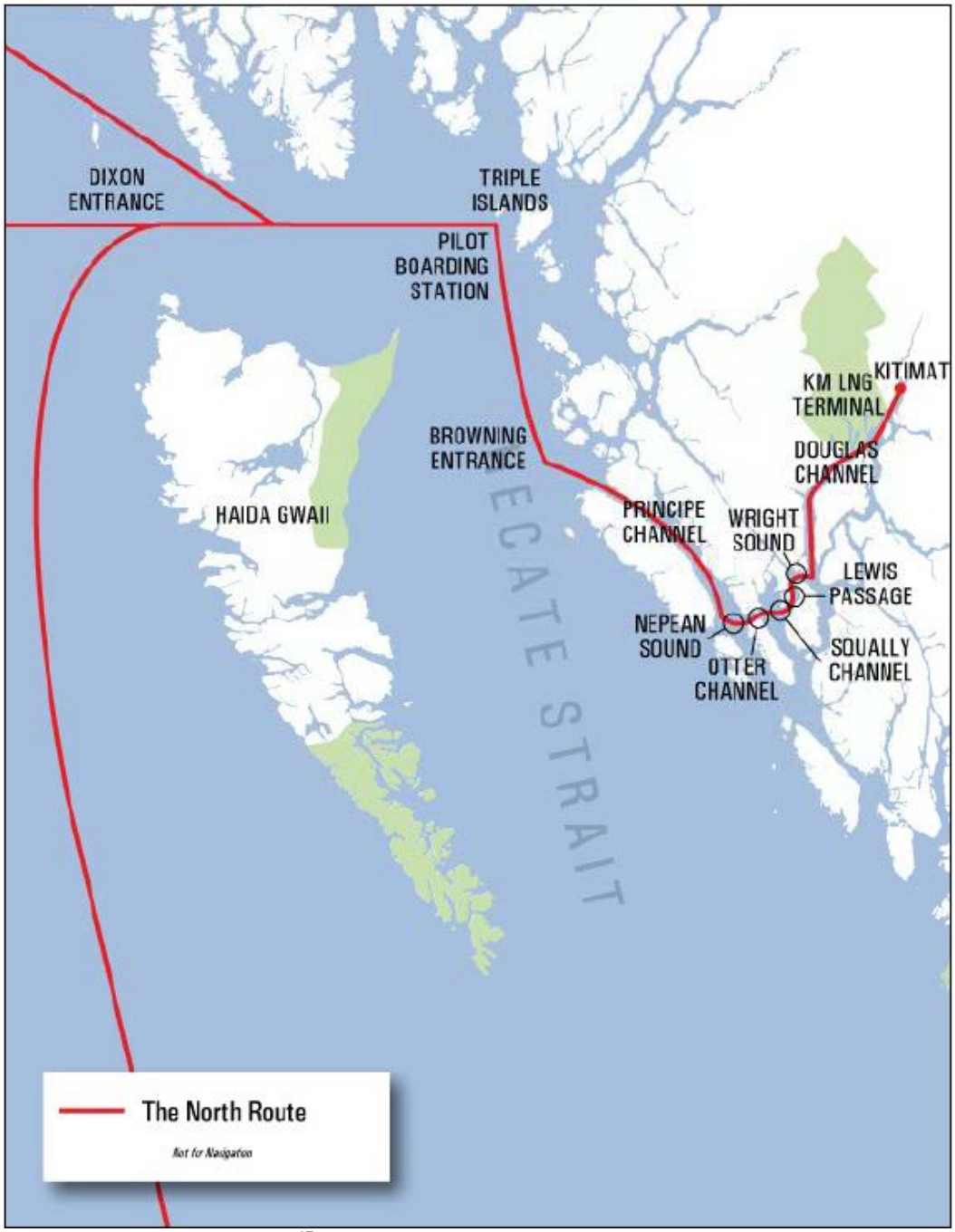

Figure 1 – The North Route:[17]

[17] Kitimat LNG TERMPOL Submission – Element 3.5 & 3.12. Route Analysis, Approach Characteristics, and Navigability Survey and Channel, Manoeuvring and Anchorage Elements, pg 3.

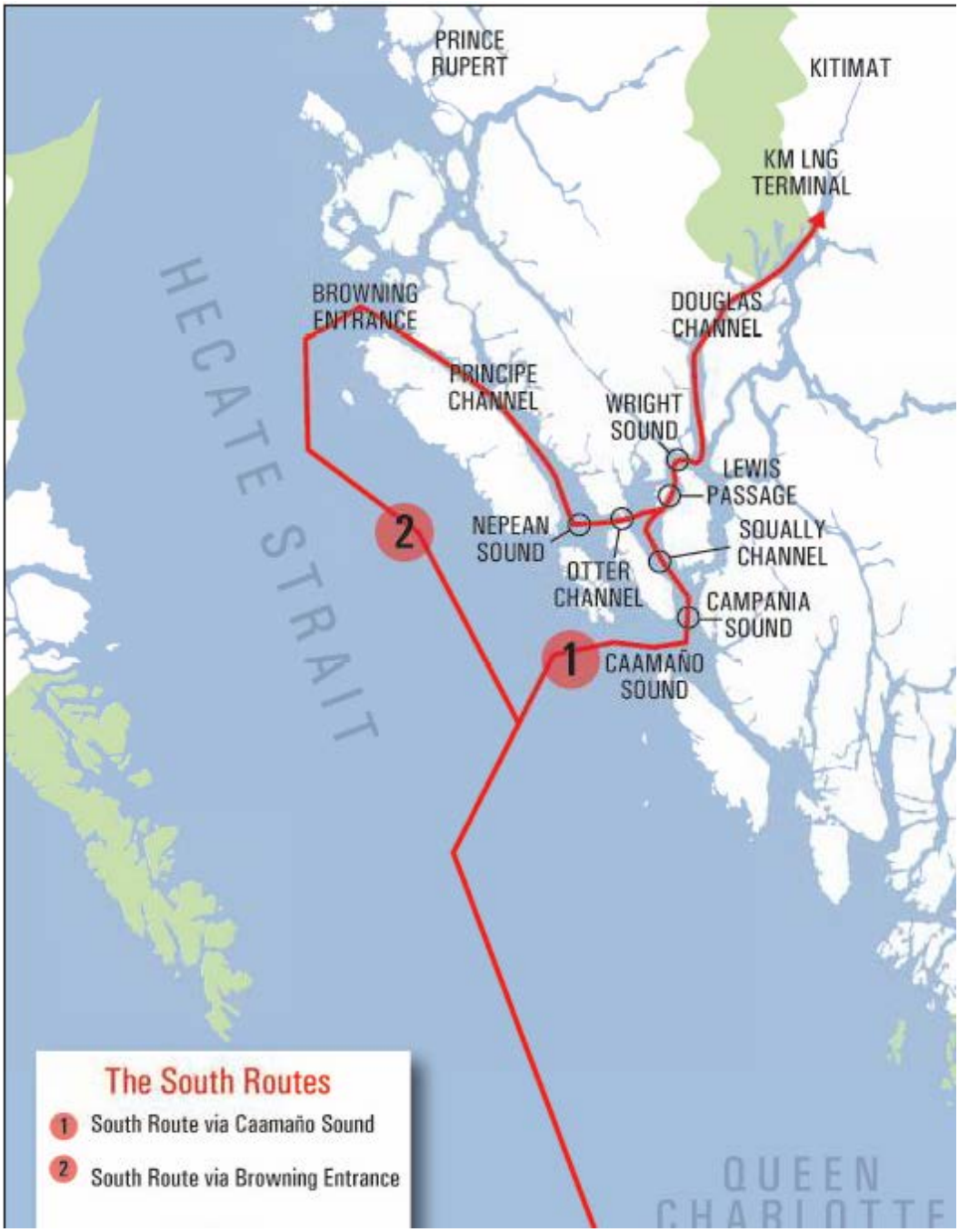

Figure 2 – The South Route:[18]

Kitimat LNG has stated it will use a passage plan and electronic navigation equipment to follow the best possible route, accounting for traffic, as well as weather and other navigational hazards that may be encountered. The proponent indicates that Project vessels will travel at mid-channel along the proposed route, unless there is a navigational safety reason not to do so.

[18] Kitimat LNG TERMPOL Submission – Element 3.5 & 3.12. Route Analysis, Approach Characteristics, and Navigability Survey and Channel, Manoeuvring and Anchorage Elements, pg 4.

The north route

LNGCs transiting via the north route will:

- arrive from the Pacific Ocean to enter the marine route through the Dixon Entrance
- take on a pilot near the Triple Island pilot boarding station, either by boat or by helicopter, before travelling south to Browning Entrance and into Principe Channel
- at the south point of Principe Channel, transit through Otter Passage, Squally Channel, Lewis Passage, and then across Wright Sound
- head north in Douglas Channel and enter Kitimat Arm to reach the Project marine terminal at Bish Cove

Kitimat LNG has stated it will use a passage plan and electronic navigation equipment to follow the best possible route, accounting for traffic, as well as weather and other navigational hazards that may be encountered. Kitimat LNG indicates that Project vessels will travel at mid-channel along the proposed route, unless there is a navigational safety reason not to do so.

The proponent must always comply with the Canadian *Collision Regulations* when in Canadian waters. Rule 9 of the COLREGS states that when a vessel is proceeding along the course of a narrow channel, it will keep as near to the outer limit which lies on the starboard side, as is safe and practicable.

Inbound LNGCs will initiate End of Sea Passage (EOSP), by slowing the vessel from full speed to a manoeuvring speed at a safe position to the west of Triple Island.[19] Before the marking of EOSP, a number of routine provisions and safety checks are done to prepare for passage through Canadian waters. The engine room should also be fully manned before the process is commenced. Kitimat LNG should ensure EOSP is made in time to accommodate pilot boarding from boat or by helicopter, outlined in the PPA "Notice to Industry" (08/2015) and described in more detail in the following section.

Pilotage

Pilotage involves licensed marine pilots boarding vessels in specific areas to navigate through difficult waterways to avoid local hazards. Pilots provide extensive expertise and knowledge of a local waterway for vessels travelling to and from Canadian ports. All coastal areas below the 60th parallel of the country fall under the jurisdiction of one of four Pilotage Authorities that are governed by the *Pilotage Act*:

1. Atlantic Pilotage Authority
2. Great Lakes Pilotage Authority
3. Laurentian Pilotage Authority
4. Pacific Pilotage Authority

[19] Ibid.

These authorities establish compulsory pilotage areas, in which every ship over 350 gross tons and every pleasure craft over 500 gross tons must take local marine pilots on board before they can enter harbours or busy waterways. The local pilots must have expertise in navigation of local waterways and the handling characteristics of the vessels they are guiding.

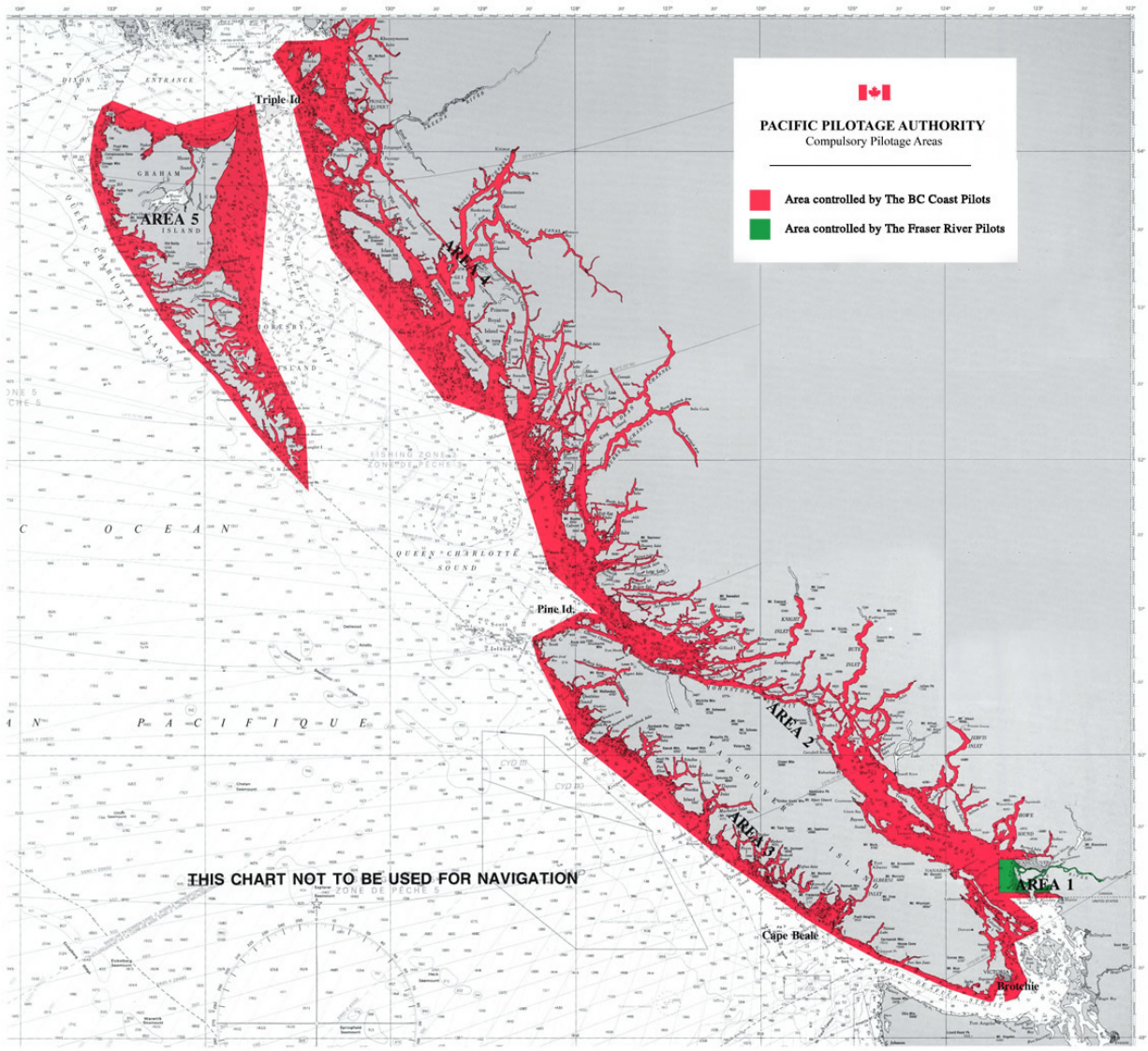

Figure 3 – Compulsory Pilotage Areas in British Columbia

The authorities also regulate the requirements for certain classes of vessels, including LNGCs. The *Pacific Pilotage Regulations* under the *Pilotage Act* govern pilotage activities in Canada's western waters. The PPA is a federal Crown corporation whose mandate is to administer marine pilotage service in Canadian waters off the B.C. coast.

In December of 2017, the Government of Canada announced a review of the *Pilotage Act*, through the *Ocean's Protection Plan.* Efforts will be made to modernize the *Pilotage Act* to align with the goal of creating a world-leading marine safety system.

Released in May of 2018, the *Pilotage Act* Review has provided a list of recommendations centered on modernising the services and the management approaches within Canada's compulsory pilotage areas. More specifically, the *Pilotage Act* reinstated its emphasis on safety and efficiency of delivery of pilotage services. The Review has also touched upon a variety of issues consisting of but not limited to:

- addressing regional inconsistencies in medical standards applied to pilots
- updating fine structures for elusion from pilotage services
- considering new, technology-augmented pilotage regimes
- expanding Transport Canada's role in safety regulatory-making powers to advance a safe and streamlined management regime

Finding 6: Recommendations from the Pilotage Act Review would modernize the services provided by marine pilots in Canada's compulsory pilotage areas, including the pilotage of vessels calling at the Kitimat LNG terminal.

Pilot boarding

Pilots will board the vessel either by a conventional boat transfer or by helicopter. Helicopter boarding was introduced in advance of the potential growth of the LNG industry in Prince Rupert and forecast growth in marine traffic. According to the PPA, about 20% of transfers during winter 2015-2016 were done by helicopter. The helicopter boarding program on the North Coast has since been postponed, however all marine pilots possess the necessary training required for helicopter boarding. If the program was to proceed, pilot transfers could occur 24/7, 365 days a year weather and operational conditions permitting.

Boarding by helicopter benefits existing marine operations in Prince Rupert and provides pilots with a safer boarding method. Helicopter boarding for project carriers would likely occur approximately 12 nm northwest from the Triple Island. The added distance would ensure LNGCs have two pilots on board prior to any interaction with other marine vessels in the vicinity of Triple Island. A pilot boarding symbol will also be added to update nautical charts in this area. Based on a risk assessment, Chevron has approved the use of pilot boarding by helicopter for their project.

Helicopter boarding will increase the safety and efficiency of boarding pilots to LNGCs in adverse weather conditions. It allows vessels to maintain safe transit speed, which is particularly beneficial for LNGCs. The need for slow steaming will decrease overall, except in particularly poor weather conditions or operational situations. Helicopter transfer also significantly reduces the pilot transfer distance time to and from vessels entering Canadian waters. Conventional launch by boat can take up to 1.5 hours, while the helicopter can travel the same distance in just 12 to 14 minutes.

Helicopter boarding operations must follow TC's Guidelines Respecting Helicopter Facilities on Ships (TP 4414), as well as operational limits and the International Chamber of Shipping Guide to Helicopter/Ship Operations.

Finding 7: The TERMPOL Review Committee supports pilot transfer by helicopter for project vessels

Finding 8: The CHS can update nautical charts with a pilot boarding symbol if helicopter boarding is re-introduced for the North Coast.

The TRC asserts that the venting of boil-off gases should not occur:

- during pilot boarding operations, especially during helicopter transfers
- when near land where ignition sources are possible, including a helicopter in the immediate vicinity of the LNGC

Recommendation 8: Kitimat LNG should ensure that venting of boil-off gases does not occur when pilots are boarding project carriers or during pilot transfer by helicopter.

Due to the length and time requirements of the project route, carriers will take on a minimum of two pilots onboard. Additional pilotage support enhances the monitoring and oversight of simultaneous navigation and escort tug processes. The second pilot also provides continuous and immediate back up in areas where two pilots are needed on the navigation bridge.

Finding 9: The Pacific Pilotage Authority will require two pilots to board every project carrier. This two-pilot condition is consistent with the Pacific Pilotage Authority's Notice to Industry (10/2015) for the south coast of B.C.

There is also special training for pilots, known as T2, to better handle large deep-sea vessels including LNGCs. T2 is a tug configuration where a tug is positioned along each side of the carrier, while a third tug is positioned at the stern. This gives greater steering and braking capability if required. There are plans for a training course open to all pilots and tug operators for April 2018.

Finding 10: T2 training would be beneficial for both pilots and tug operators involved in the Kitimat LNG project.

Recommendation 9: The proponent should ensure that all tug operators used for the project have undergone T2 training.

Escort tug program

The route to and from Dixon Entrance to the project terminal in Douglas Channel contains certain areas that an LNGCs may have difficulty navigating, especially in poor weather conditions. The use of escort tugs has been shown to provide considerable risk mitigation in areas with challenging navigation. In an emergency, such as loss of steering or power, tugs can help steer, brake, and stop vessels to reduce the risk of collision or grounding.

As part of the TERMPOL Review Process, Kitimat LNG has conducted two separate full mission bridge simulations:

- Force Technology Manoeuvring Study of LNG Carriers to Kitimat B.C., completed in 2012
- MITAGS-PMI Kitimat Waterway LNG Transit Simulation, completed in 2015

The simulations consider unique factors such as sea state, visibility, wind, and tug configurations. The simulations aimed to determine:

- Tug power level and use with specific environmental factors
- Navigational safety along the route, including potential for additional aids to navigation
- Overall level of challenge of pilotage for route segments
- Environmental limits of terminal operations

Key findings from these simulations include:

- There are four areas of reduced channel width: (1) Dixon Island, (2) Otter Channel, (3) Lewis Passage, and (4) Emilia Island.
- Both inbound and outbound transit can be carried out safely both at night and day with the assistance of typical modern equipment, such as radar and GPS.
- In certain sections of the route, pilots are able to leverage environmental conditions, such as wind, to guide a vessel to safe position if a rudder failure occurred.
- Escort tugs of 92-tonne bollard pull were able bring a vessel under control that had suffered from a rudder failure in wind speeds at 40 knots.

<u>Recommendation 10:</u> Kitimat LNG should ensure tugs used for escort take into account the findings and conclusions of the Manoeuvring Study of LNG Carriers to Kitimat B.C., and the Kitimat Waterway LNG Transit Simulation Study.

In June of 2016, Kitimat LNG submitted their Tug Escort Policy to the Pacific Pilotage Authority and the British Columbia Coastal Pilots. The results of their simulations informed their policy. As mentioned, Kitimat LNG no longer proposes to use the South Route to the project terminal via Hecate Strait. Therefore, their tug escort commitments only consider vessel calls via the North Route. Review of tugs used for berthing operations can be found in Section 3.2.4 – Proposed Mitigation Measures.

The proponent's Tug Escort Policy, as a result of the full mission bridge simulations, is as follows:[20]

- Two tugs will be stationed at Hartley Bay to be used for both escort and act as a vessel of opportunity in the event of an emergency.
- One tug will provide tethered escort for vessels between Wright Sound and Nepean Sound.
- Tugs used for escort in the simulations possessed 92-tonne bollard pull capability.

[20] Kitimat LNG Marine Operations, Kitimat LNG Tug Escort Policy, pg 4

- Tethering will be subject to an annual review in partnership with the PPA and BCCP.

Note: Kitimat LNG also supports the stationing of a rescue tug (by others) in Prince Rupert harbour.

Kitimat LNG states that these provisions give the greatest risk reduction while addressing the most challenging areas as identified by the pilots and local stakeholders. Designated one-way traffic areas in the narrowest areas of Principe Channel and Douglas Channel were also examined, but did not provide any significant reduction in incident frequency.[21]

The portion of the route between Wright Sound and Nepean Sound has been identified as a particularly challenging section of the route, therefore requiring the use of tethered escort.[22] Tethering a tug to a vessel provides a quicker response time in the event of an emergency. If a vessel's equipment were to malfunction, such as an engine or steering failure, tugs can apply corrective action without added delay. Tethering can also help maintain carrier heading in high wind conditions, and is particularly effective in narrow areas to help with the braking and steering of a vessel.

Finding 11: The TRC supports the use of tethered escort tugs for LNGCs during the Wright Sound to Nepean Sound portion of the route.

The TRC finds Kitimat LNG's proposed tug package inadequate. Notably, the passage around Emilia Island in Douglas Channel, and Wheeler Island in Principe Channel are left without escort tugs despite identifying these locations as challenging sections with reduced channel width.[23] From the perspective of the TRC, stationing rescue tugs by the proponent does not replace the need for tug escort of project carriers; the response time for a tug stationed at Hartley Bay or Prince Rupert to reach either of these two areas is not adequate if an emergency situation was to occur.

Recommendation 11: The TRC recommends that Kitimat LNG pursue full tug escort for both inbound and outbound vessels between the project terminal in the Douglas Channel and Browning Entrance, north of the Principe Channel.

Tethering should also be considered for other portions of the route. As noted by pilots during the simulation exercises, Wheeler Island in the Principe Channel and Emilia Island in the Douglas Channel are both considered 'choke points' in the waterway. Channel width in both of these areas are less than 1 nm across. While it has been demonstrated that LNGCs are able to manoeuvre this section successfully without escort, adverse weather conditions or additional vessel traffic may influence the ability to perform a successful save of the LNGC without a tethered tug in attendance.

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[21] Ibid, pg 9
[22] Ibid, pg 16
[23] Kitimat LNG TERMPOL Submission – Element 3.5 & 3.12. Route Analysis, Approach Characteristics and Navigability Survey, and Channel Manoeuvring and Anchorage Elements, pg 92

Finding 12: The need for tethering a tug to project vessels in the Principe Channel and Douglas Channel is dependent on the environmental and traffic conditions in the waterway and will be decided at the discretion of the pilot and the master.

The PPA is striving to standardize pilotage practices for LNGCs along the B.C. coast. This will serve in the interest of Kitimat LNG, as it will provide clarity on what is required for pilotage and for tug escort. It will also align their policy with other proposed LNG projects in the area.

The PPA will:

- Establish the standard for having two-pilots on the bridge for all LNGCs when a tug is tethered to the vessel
- Train pilots on the handling characteristics of LNGCs (e.g. windage) and tug escort procedures, including routine escort and emergency manoeuvres
- Develop a tug matrix for LNGCs navigating the North Coast of B.C.
- Develop a draft "Notice to Industry" describing escort tug requirements for oil and gas tankers on the North Coast

The requirements for tug escort will likely be harmonized with the procedures that apply to the South Coast of B.C. (Notice to Industry (10/2015). The decision on whether a particular type or size of vessel requires an escort tug is risk-based, and should be predicated on a risk assessment.

Recommendation 12: Kitimat LNG should ensure that there are an adequate number of pilots on board project vessels at all times to be in accordance with the PPA's forthcoming Notice to Industry

Finding 13: The Pacific Pilotage Authority, Prince Rupert Port Authority, and B.C. Coast Pilots will work together to develop a tug matrix for the North Coast of B.C., before any liquefied natural gas project operations begin in the area. Standardizing tug escort requirements for all liquefied natural gas carriers will likely reduce the need for overlapping full mission simulations of common marine areas.

Finding 14: Once an escort tug matrix for the North Coast of B.C. is developed, the Pacific Pilotage Authority may prepare a "Notice to Industry" outlining escort tug requirements. The Notice should include, in addition to other provisions, when and where tethered escort may be required.

Finally, Kitimat LNG should also ensure that escort tugs possess enough power to perform rescue manoeuvres if a vessel was to fail. In both simulation exercises, a tug possessing 92 tonnes of bollard pull capabilities was shown to have enough force to perform a save in an emergency. However in some situation runs, such as a rudder casualty near Emilia Island, tug adequacy was deemed to be minimal, as there was a delay in the time it took for the tug to respond.[24]

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[24] MITAGS-PMI Kitimat Waterway LNG Transit Simulation, pg 30.

Recommendation 13: Escort tugs used in project operations should possess bollard pull capabilities above 92 tonnes to ensure adequate reserve power in emergency situations.

The TRC also recommends that tugs be outfitted with a number of emergency provisions, including but not limited to:

- Standard firefighting capabilities, rated FiFi-1 at minimum
- Appropriate rescue equipment to assist LNGC's, including equipment for emergency towing and render/recover winches
- Load cells to measure pulling forces on the line when tethered to a vessel

Kitimat LNG should require that carriers are fit with equipment that ensure vessels can be safely towed. This includes a tow bitt that is positioned on the centreline of the vessel to accommodate the variability of tug positioning while in escort. All project carriers should also meet Emergency Towing Procedures requirements of SOLAS *Regulation II-1/3-4 (IMO resolution 258 (84).*

Recommendation 14: The proponent should ensure project tugs carry the required equipment to assist LNGCs in all emergency situations, including firefighting capabilities, rescue equipment, and load cells.

Recommendation 15: The proponent's LNG Carrier Acceptance Program should require that all vessels are equipped with a tow bitt that can withstand the forces generated by the tugs to ensure the vessel can be safely towed.

Recommendation 16: Kitimat LNG should submit its tug operations plan to Transport Canada, Pacific Pilotage Authority, Canadian Coast Guard, and the B.C. Coast Pilots at least six months before the start of project operations.

Emergency towing vessels

Beyond their proposal to station a rescue tug in Hartley Bay, Kitimat LNG supports stationing a rescue tug in Prince Rupert Harbour. This aligns with the Government of Canada's announcement in 2016 of its plan to station two Emergency Towing Vessels (ETVs) at points along the coast of B.C., as part of the Oceans Protection Plan.[25] ETVs are multi-purpose vessels, primarily used to tow disabled vessels on the high seas. Initially, ETVs will be leased for three years, with the first vessel expected to be in service in November 2018 and the second by early 2019. During this period, longer term options will be explored and a plan developed.

In January of 2018, Clear Seas Centre for Responsible Marine Shipping published a report analyzing the effect that the location of the two ETVs has on mitigation of drift grounding incidents. The report uses particular coastline and historical wind data to calculate a 'Zone-of-

[25]https://pm.gc.ca/eng/news/2016/11/07/canadas-ocean-protection-plan-world-leading-marine-safety-system-protects-canadas

No-Save' (ZONS) where a disabled vessel might drift before an ETV is able to arrive. The ETV's start location, mobilization time, travel speed, hook-up time, and route, are all factored into the response time for the vessel.

The findings of the report indicate that stationing both ETVs in select positions along the coast, such as in Port Hardy and Prince Rupert, contribute to a significant reduction in risk of drift grounding, including in areas along the project route.

Finding 15: Increased rescue towing capacity as a result of the stationing of two Emergency Towing Vessels at points along the West Coast has the potential to reduce the risk of drift grounding for LNGCs along the project route.

Finding 16: Rescue towing vessels will only be available for emergency situations, and do not replace the need for tug escort for project vessels.

Canadian Hydrographic Service charts

The Canadian Hydrographic Service (CHS) produces nautical charts and navigational products that capture water depths, geographical features, hazards to navigation, that aid navigation. Mariners consider these charts and surveys as the 'road maps' that help them travel safely from port to port. All vessels in Canada's waters must carry and use nautical charts and related publications from the Canadian Hydrographic Service.

In March 2013, the Government of Canada announced the World Class Tanker Safety System (WCTSS) initiative. A component of this initiative is to modernize Canada's marine navigation system to provide mariners with better information to help them identify high risk situations. The CHS was tasked with a comprehensive re-survey of navigation routes on the North Coast of B.C. In total, twenty-five new nautical charts were produced, including the publication of charts electronically. The final two charts are expected to be released in October of 2018.

Kitimat LNG suggests that the CHS revise the 2006 Pacific Coast Sailing Directions to more accurately depict project carrier routes to the terminal. Instead, the TRC favours revising nautical charts to include precautionary notes that communicate the presence of LNGC traffic along the project route. The CHS has agreed to work with TC and the PPA to consider the precautionary notes

Finding 17: The Canadian Hydrographic Service will work with Transport Canada and the Pacific Pilotage Authority to consider precautionary notes on charts for mariners in the area.

Canadian Coast Guard's Marine Communications and Traffic Services

Vessel Traffic Services (VTS) zones have been established along Canada's east and west coasts as far as the limit of its territorial sea. The CCG's Marine Communications and Traffic Services (MCTS) program monitors shipping in these zones.

The CCG's Prince Rupert MCTS Centre will monitor vessel traffic along the proposed route. Under the *CSA, 2001*, vessels of 500 gross tons or more must submit a VTS Offshore Report to MCTS 24 hours before entering a Canadian VTS zone from seaward.

The report contains information such as the vessel's position/course/speed, destination and intended route, dangerous goods or pollutants, any defects, discharge or threat of discharge into the water of a pollutant, and expiration dates of various required certificates. The vessel will need clearance from the MCTS before entering a VTS zone.

If MCTS believes a vessel is in violation of Canadian regulations, it can prevent that vessel from entering Canadian waters. When in Canadian waters, all large vessels, including LNGCs, must meet vessel reporting requirements and check-in regularly with MCTS at specified calling-in points.

The CCG completed a calling-in-point (CIP) review for the north coast of B.C. in 2013. The findings indicated that the existing network of CIPs were adequate along the planned project routes. However, if one or more of the energy projects proposed for the north coast of B.C. moves forward, the CCG, BCCP, and the PPA may reassess CIPs in the area.

Kitimat LNG has identified several locations along the project route where CIPs would be beneficial to the increased vessel traffic.[26] They suggest CIPs at:

- Nepean Sound
- Squally Channel
- Lewis Passage
- Whale Channel

The TRC believes there may be some value in a number of the potential CIPs identified by the proponent. Particularly, the Squally Channel CIP could be beneficial for southbound traffic that is preparing to make the turn in Wright Sound.

Finding 18: CCG and the appropriate authorities will explore the possibility of additional CIPs should one or more of the energy projects proposed for the north coast of British Columbia proceed.

[26] Kitimat LNG TERMPOL Submission - Element 3.5 & 3.12. Route Analysis, Approach Characteristics and Navigability Survey, and Channel Manoeuvring and Anchorage Elements, pg 62

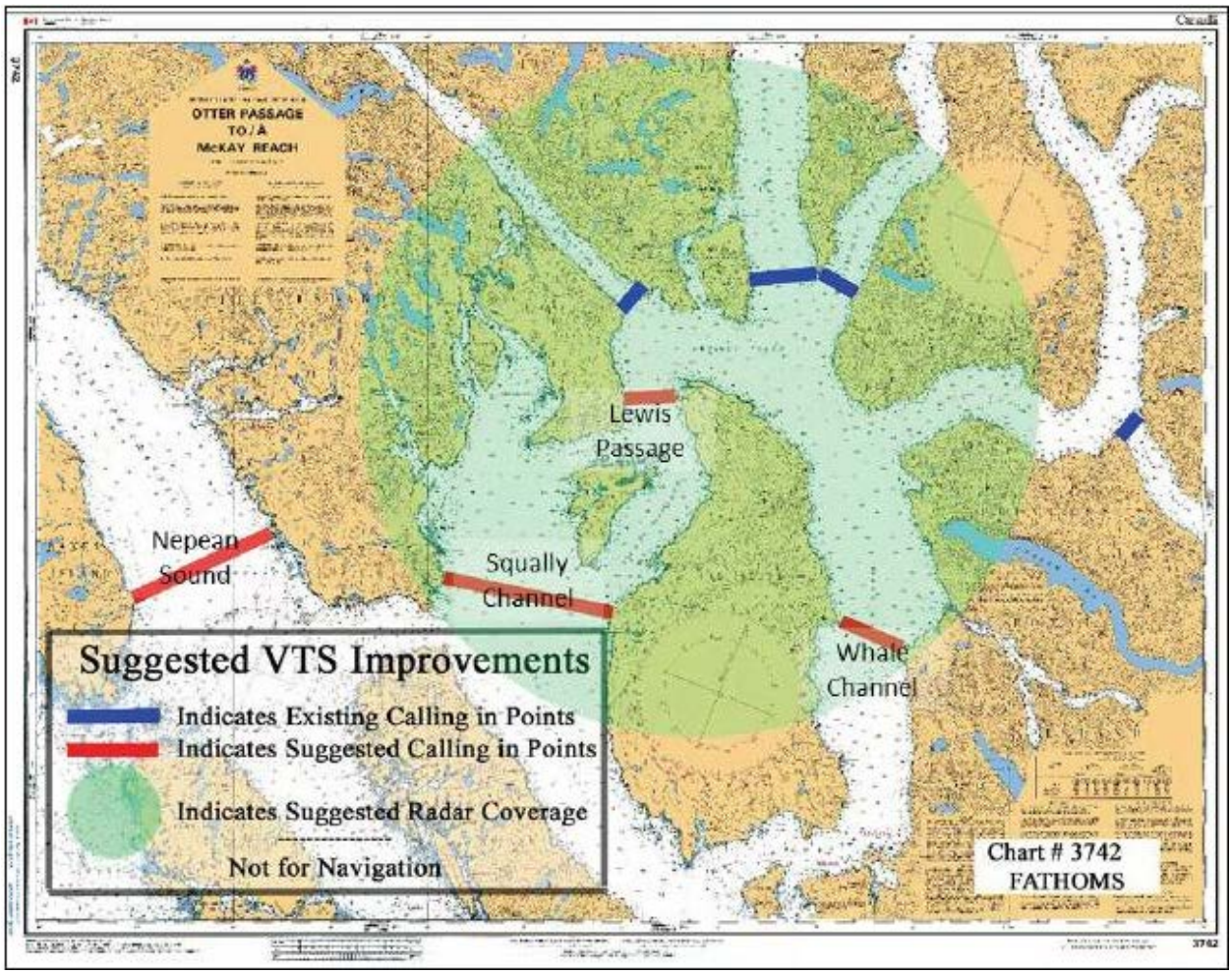

Figure 4 – Suggested VTS Improvements from Principe Channel to Douglas Channel

The TRC notes that GPS coverage can also be problematic along the route. Though the BCCP currently uses satellite positioning receivers that use GPS and Wide Area Augmentation System, they are planning to introduce receivers that use multiple global positioning satellite systems for navigation. This will enhance safe navigation for all large commercial vessels.

E-navigation

The IMO defines e-navigation as "*The harmonized collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment*."[27]

While the scope of e-navigation is not fully known, it will be far-reaching and affect the entire maritime navigation domain on a national and international level. In July 2008, the IMO Sub Committee on Safety of Navigation agreed on a strategy for developing and of adopting e-

[27] http://www.imo.org/en/OurWork/safety/navigation/pages/enavigation.aspx

navigation. As a member state of IMO, the Government of Canada has chosen to follow the guidance set out in the strategy and is working with members of the marine community at all levels to identify and adopt components of e-navigation.

The Government of Canada to date has undertaken several measures to contribute to an enhanced navigation safety system. For example, to modernize Canada's marine aids to navigation systems and introduce a national Marine Information Portal providing data such as weather. Eighteen e-navigation tools will provide accurate, real-time information and data on navigational hazards, as well as weather and ocean conditions to vessel operators and marine authorities to minimize the potential for collisions and accidents. In consideration of proposed increase in the volume of shipping on the North Coast and size of vessel associated with this project and other proposed energy projects, e-navigation will support safe navigation and protection of the environment.

Recommendation 17: The proponent should become familiar with e-navigation and participate where appropriate for its operations. This tool is important to the ongoing enhancement of safe navigation and protection of the environment.

Aids to navigation

Providing aids to navigation, including fixed structures or floating buoys, is guided by the CCG's mandate and advertised levels of service. Specifically, it provides aids to navigation as needed per the volume of traffic and degree of risk, as set out in program directives and the "Methodology for the Design and Review of Short Range Aids to Navigation Systems." In consultation with mariners, the CCG conducts reviews using national standards to determine the aids to navigation requirements for safe and efficient navigation in the area.

The CCG has completed a review of requirements for aids to navigation for northern B.C. resulting from the potential of proposed energy projects to increase marine traffic through northern shipping routes. The review, which began in 2013, includes consultation with marine partners such as the BCCP, and Council of Marine Carriers, commercial operators, and recreational and fishing users. Routes that were reviewed include the Douglas Channel, Browning Entrance, Principe Channel, and Dixon Entrance.

The review recommended improving existing aids and installation of new aids to support more and larger vessels along northern shipping routes, including the Kitimat LNG project route. Action is underway to deliver on the review findings. Enhanced services include installing AIS equipment on floating aids to broadcast buoy position and using "Virtual Aids to Navigation" in areas where it is not practical to install a physical aid.

The marine aids review recommended over 120 modifications to existing aids to navigation or installations of new fixed and floating aids to navigation. The CCG has completed a three-year installation project to refurbish fixed aids to navigation and install floating aids as of March 2018. A visual of all new and modified Aids to Navigation in waterways along the North Coast can be seen in Figure 6. Kitimat LNG has reviewed the Level of Service Review and found recommendations to be sufficient for the safe navigation of the waterway.

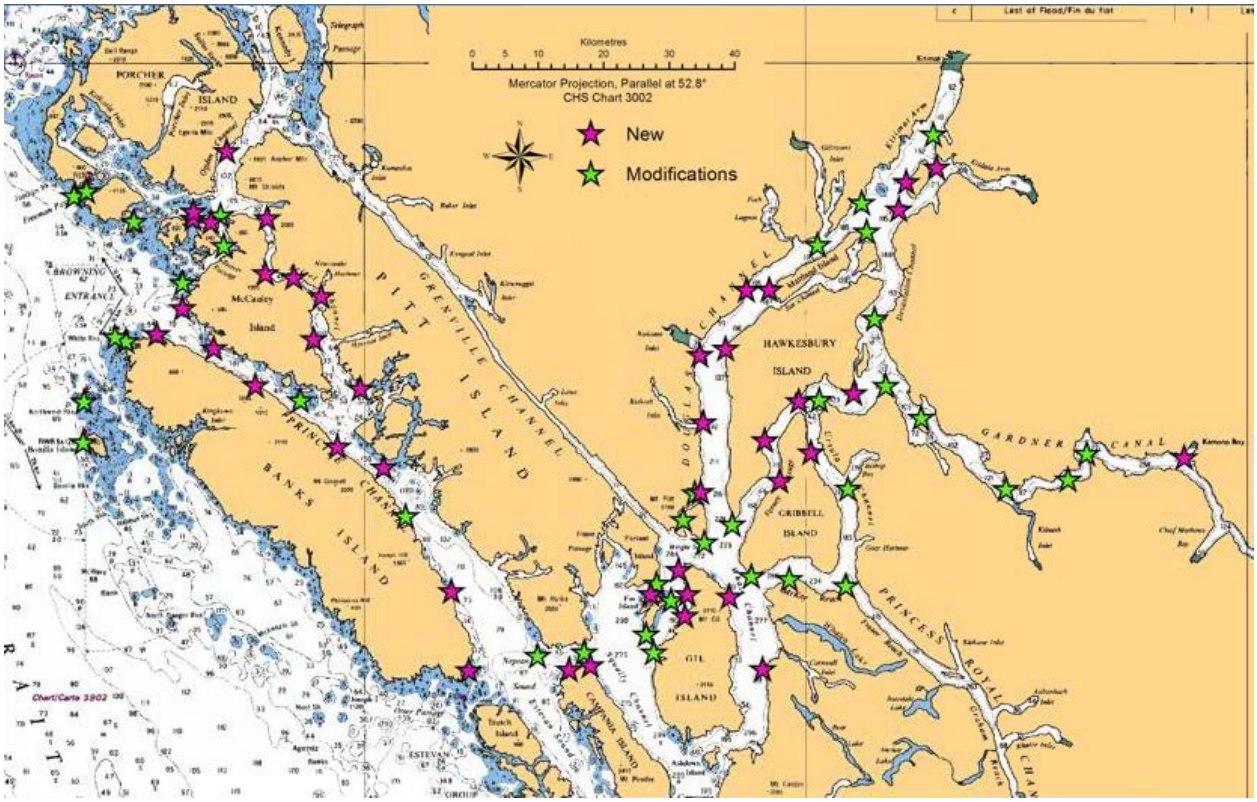

Figure 5 – New and Modified Aids to Navigation as of March 2018

The proponent has also committed to the installation of several project-specific navigational aids in and around the proposed terminal at Bish Cove. These will be designated "private" navigational aids on the marine charts. Kitimat LNG must ensure they are suitable for Canadian waters, including conforming to the IALA Buoyage System B standard. The proponent should work with the CCG, the pilots, and the Council of Marine Carriers to obtain technical expertise and guidance to ensure the terminal has the proper navigational aids, that comply with TP968 *The Canadian Aids to Navigation System.*

<u>Finding 19</u>: Kitimat LNG will work in consultation with TC, the BCCP and CCG on the development of private navigational aids at the proposed terminal site.

<u>Finding 20:</u> The proponent should be aware that any project specific NavAids that are installed are not made available on the Canadian Hydrographic Service's List of Lights, Buoys and Fog Signals.

<u>Potential traffic separation scheme – west of Triple Island</u>

In 2015, the Prince Rupert Port Authority (PRPA) commissioned Greenwood Maritime Solutions Ltd. to analyze the current and future marine traffic patterns in the Prince Rupert Area. The Greenwood Ship Routing Advisory Study (SRAS) examined whether additional ship routing measures are necessary to address potential increases in marine traffic due to LNG projects.

The consulting company also reached out to marine stakeholders in B.C. to obtain a more complete view of the operating environment. Accordingly, member organizations from the TRC contributed significant input to this study.

One recommendation made in the SRAS is a formal approach for the area west of Triple Island. The Triple Island entry is the focal point for marine traffic to Prince Rupert and the ports of Kitimat and Stewart, as well as vessels destined for Alaskan ports. About 850-900 movements of deep draught vessels occur near the Triple Island Pilot Station each year.

This area is particularly important for the proponent, as vessels calling at the Kitimat LNG terminal would be required to follow the TSS for movements in and out of Dixon Entrance. Given the increase in traffic through the Triple Island area, the TRC notes the SRAS recommendations regarding the potential for a Traffic Separation Scheme (TSS) to address challenges associated with a potential increase in traffic in the study area. Although the concept and location of a TSS for the eastern end of Dixon Entrance requires further evaluation by all partners, the TSS concept would provide clear, predictable interaction between participating vessels.

The PRPA has asked TC to review the merit of this TSS proposal. TC has committed to careful consideration of the proposal in partnership with TRC stakeholders. If any TSS is established in the area, CHS would add it to its charts and related publications.

Finding 21: The TERMPOL Review Committee supports the Prince Rupert Port Authority's notion to establish and chart a Traffic Separation Scheme west of the Triple Island boarding station. If it is found to be necessary, it could reasonably benefit all marine traffic transiting the area.

Fishing activities

Commercial, recreational, and traditional fishing activities take place throughout the coastal waters of B.C. It is reasonable to expect interaction between project carriers and other marine users, including fishing vessels, to occur along the shipping route.

A suite of safety measures are in place that guide interactions between vessels to avoid collisions and contribute to marine safety within Canadian waters. Specifically, the *Collision Regulations* set out rules vessels must follow to prevent collisions. They are familiar to both national and international mariners, as they follow the *Convention on the International Regulations for Preventing Collisions at Sea.*

The rules set out in Schedule 1 of the Collision Regulations include actions to take in head-on, crossing, and overtaking situations. All mariners must respect these "rules of the road." Rule 10 (i) and (j) require vessels under 20 m, sailing vessels, and fishing vessels not to impede power-driven vessels following a traffic lane. Additional rules are also outlined in Section 24 of the *Fisheries Act.* These rules relate to fishing nets, which fishermen may not use or place in a way that obstructs boat and vessel navigation.

The proponent should be aware of seasonal fishing periods and liaise closely with participants of this industry. Kitimat LNG acknowledges that the lack of data for smaller fishing vessels limits its understanding of fishing traffic patterns in the area. Canadian Fishing Vessels under 24 m LOA are not required to participate in VTS. In addition, AIS data for fishing vessels provides an incomplete record because many fishing vessels do not have AIS functionality, or only use it occasionally and instead depend on other means of communication for information.

In response, the proponent has provided information on fishing grounds, ports of origin, and traffic density along the route. Areas identified where fishing activities could interact with LNGCs include:

- Wright Sound
- Squally Channel
- Browning Entrance
- The border between Hecate Strait and Dixon Entrance

The proponent states that fishing operations are accustomed to shipping traffic of all sizes and therefore equipped to safely share the waterway with project LNGCs.[28]

The proponent should strive for open dialogue and communication with the local marine community by providing workshops on project operations. They should share information about carrier traffic, location, and type in advance of project operations. Information sharing between Kitimat LNG and local mariners should be proactive and persistent. Outreach should aim to educate and spread awareness of project traffic-related safety mitigations and procedures to all marine stakeholders in the area, including Indigenous and nearby communities.

<u>Finding 22:</u> The commitment to publicly posting and continually updating vessel schedules will serve in the interests of the proponent and all stakeholders in the area to alleviate potential interactions.

Kitimat LNG has indicated a willingness to place a priority on the interests and concerns of First Nations and local communities.[29] Specifically, this includes engagement with First Nations, local fishers, and recreational users to eliminate or minimize potential effects on environmental components of value that may arise from the project's operation.[30] In response, Transport Canada has developed a Parallel Aboriginal Engagement Process that details the various engagement procedures that both the proponent and relevant federal agencies will undertake. An overview of this engagement strategy is outlined in more detail in Section 4 of this report.

<u>Recommendation 18:</u> The TERMPOL Review Committee supports Kitimat LNG's commitment to engage local communities, Indigenous communities, marine users and stakeholders regarding specific project operations, timelines and accompanying mitigation measures. This engagement should be proactive and persistent.

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[28] Kitimat LNG TERMPOL Submission – Element 3.3. Fishery Resources Survey, pg 35
[29] Ibid.
[30] Kitimat LNG Terminal Project Assessment Report. Page 100.

Inner Passage traffic

The Inner Passage is the most common route for marine traffic transiting north-south along the British Columbia coastline. Vessels transiting south from Prince Rupert through the Inner Passage enter via Chatham Sound, then follow a series of narrow and sheltered waterways to reach the South Coast of B.C. The Inner Passage crosses the project route in Wright Sound, as vessels move between Grenville and Princess Royal Channel. Project LNGCs are required to make a sharp turn as they round Cape Farewell in Wright Sound, which could present some danger for crossing traffic.

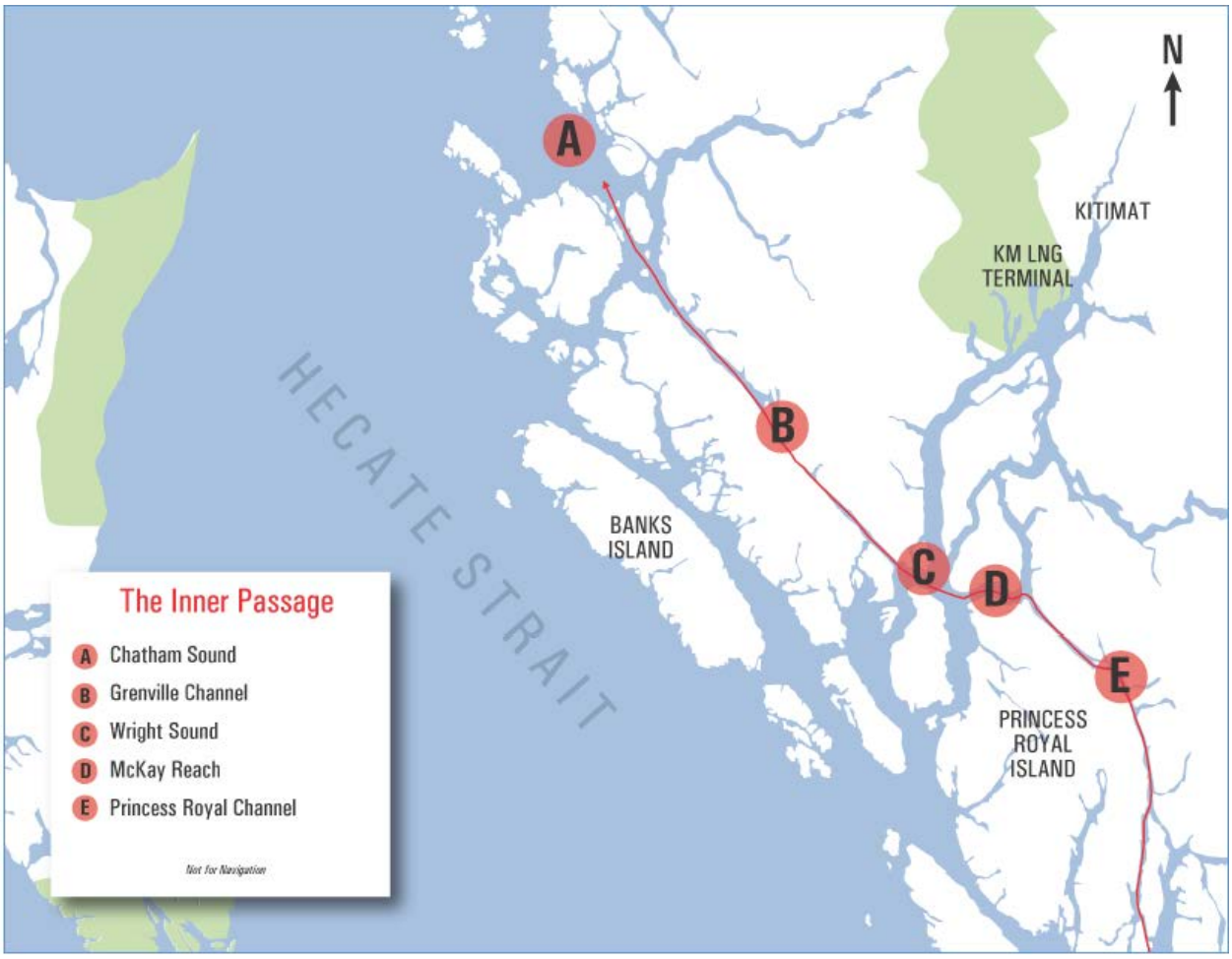

Figure 6 – The Inner Passage through Northern British Columbia

Vessel traffic on the Inner Passage including services provided by passenger ferries such as B.C. Ferries and Alaska State Ferries who make daily transits during the summer months of May to September. In the winter, B.C. Ferries reduces ferry runs from seven to two days a week, while Alaskan State Ferries only run once a week.

Kitimat LNG maintains that project LNGCs will remain in constant communication with Prince Rupert MCTS, and adjust their speed accordingly to accommodate crossing traffic from the Inner Passage traffic lane. Vessels may also alter their course within a 'manoeuvring zone' in Wright

Sound (see figure 8). This zone consists of two joined turning circles, with diameters of 3.7 km and 4.6 km, that extend about 11 km across the channel. Manoeuvring zones are areas used by pilots to avoid oncoming or crossing marine traffic. A manoeuvring zone applies to vessels of all classes, and is a procedure used in select areas on the South Coast of B.C. with high vessel traffic.

If marine traffic were to increase in the area, the CCG believe this section of Wright Sound may warrant an enhanced standard of care, including but not limited to restrictions on the number of vessels in the area, minimum following distances, and passing arrangements. This would harmonize safety procedures with those used in manoeuvring zones on the South Coast and include additional safety measures to accommodate increased vessel traffic in the area, such as enhanced AIS and radar capabilities.

<u>Recommendation 19:</u> *Kitimat LNG should be pro-active in sharing LNG carrier schedules with marine operators that use the Inner Passage through Wright Sound, including both B.C. and Alaska State Ferries.*

<u>Recommendation 20:</u> *Increased vessel traffic crossing Grenville Channel as a result of project operations may warrant an enhanced standard of care in the area. The proponent should work with the BCCP and CCG to develop the operational requirements specific to this location.*

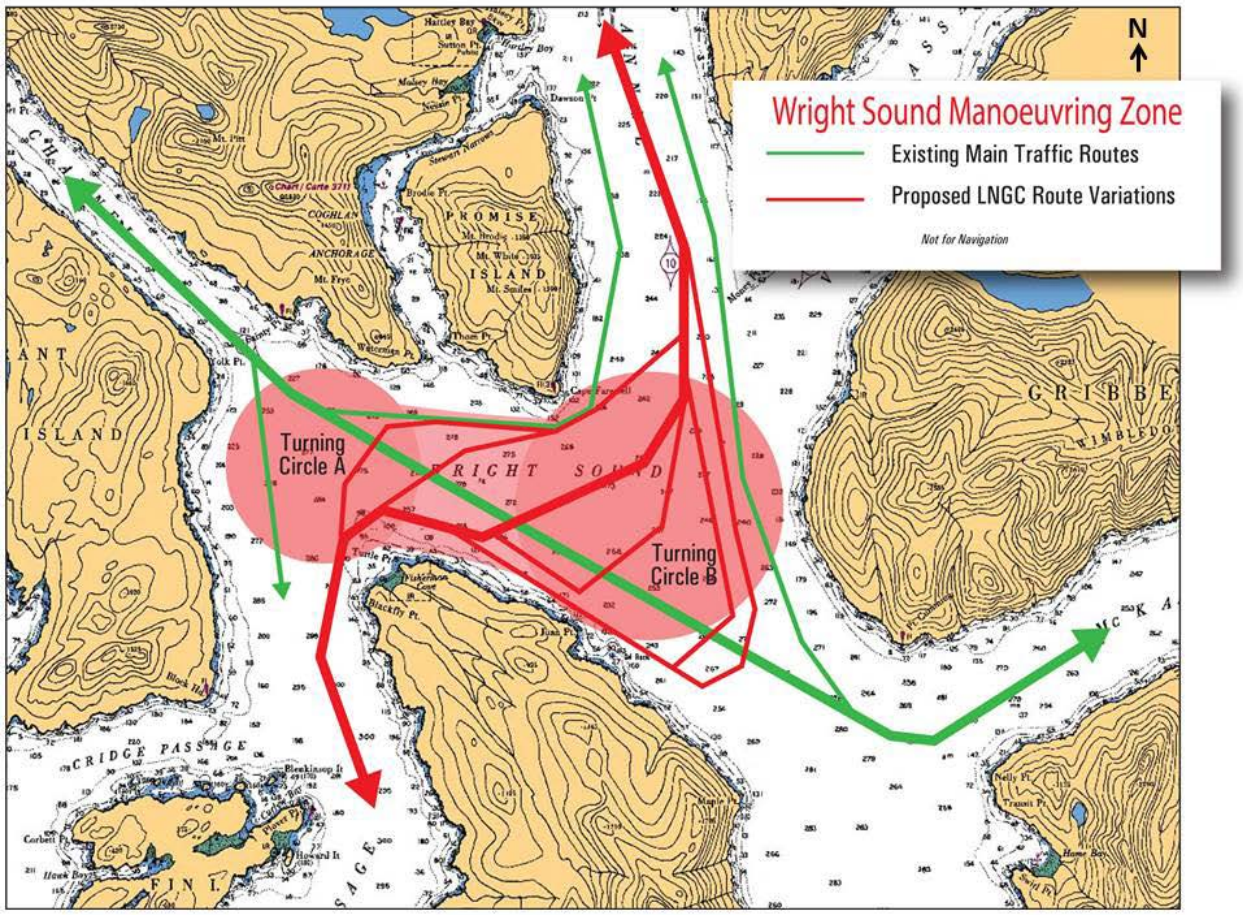

Figure 7 - Wright Sound Manoeuvring Zone and Main Traffic Network

Float plane services

Many communities on the northern coast of British Columbia are remote, and therefore are commonly accessible via floatplane services. Floatplanes use federally designated and approved marine aerodrome facilities, typically located close to port facilities.

The proponent has identified three aerodrome facilities that are situated along the project route:

- Kitimat – in Minette Bay at the head of the Douglas Channel
- Kitkatla – approximately 8 nm from the project route
- Hartley Bay – near the south end of Douglas Channel

Despite the presence of these three aerodromes, the proponent asserts that standard transit operations pose little risk to these facilities. The Minette Bay and Kitkatla aerodrome facilities are both located more than 13 km from the nearest point along the Kitimat LNG project route.

The aerodrome at Hartley Bay is located just 1.3 km from the nearest point along the project route. Inland Air has scheduled flights between Prince Rupert to Hartley Bay from September 5th to April 30th. Flights run Monday, Wednesday and Friday during the week. They arrive at Harley Bay at 11 a.m., and depart at noon.[31]

Recommendation 21: The proponent should be vigilant in the sharing of information concerning vessel movements with seaplane operators along the route. The proactive sharing of schedules should be a minimum expectation of both parties.

Other marine activities

The project route intersects with a Haida Gwaii Sub-Surface Operations' military exercise area. The Dixon Entrance and Hecate Strait surround the Haida Gwaii, and are considered 'Special Operations Areas' primarily for submarines. Typically, there is one week per year when non-military vessels must avoid these areas. Vessels receive daily broadcasts of Notices to Shipping about exercise details and precautions.

Recommendation 22: Kitimat LNG should ensure that project LNGCs are made aware of any military exercises that are taking place along the route. These areas are out of bounds for marine traffic.

There is a moratorium in place for offshore oil exploration in ocean waters on the B.C. coast. Project carriers would not encounter activities of this type while en route to the project terminal.

[31] http://inlandair.bc.ca/schedules-routes/prince-rupert-hartley-bay

3.2.2 NAVIGABILITY AND VESSEL OPERATIONS

Port of Kitimat

There is no established Port Authority that governs over the waters where the proposed Kitimat LNG terminal is situated in the Douglas Channel. However, on March 18, 2013, the Government of Canada announced its intention to designate the port of Kitimat as a public port as part of the World Class Tanker Safety initiative. This will allow the port to put better traffic control measures in place to promote the safe movement of vessels in the Douglas Channel.[32]

Once designated, the *Canada Marine Act*, the *Public Ports and Port Facilities Regulations*, as well as Practices and Procedures for Public Ports will apply. Section 56 of the *Canada Marine Act* covers activities such as:

- monitoring ships about to enter or within the waters of the port
- establishing traffic control practices and procedures to be followed by ships
- requiring ships to have the capacity to use specified radio frequencies
- requiring information to be given by ships about to enter the port or within the port for the purpose of obtaining a traffic clearance

Should one or more commercial projects be built in Kitimat, Transport Canada may choose to start the process of determining port boundaries, including consulting within the federal government and then with external users and stakeholders.

Channel width requirements

The TERMPOL Guidelines indicate that one-way channel width should be at least four times the design vessel's breadth and two-way channel width should be at least seven times the design vessel's breadth. Attending LNGCs could range from 125,000 m^3 to 217,000 m^3, with a maximum beam range of 50 m. For the largest design vessel, this translates to a minimum two-way channel width of 350 m or 0.2 nm.[33]

The proponent correctly states that the proposed routes for project traffic meet the specific requirements for one and two-way marine traffic contained in the TERMPOL Guidelines. The TRC finds that even the maximum design vessels would meet channel width guidelines at all points of the proposed carrier routes.

Table 3 – North Route Minimum Channel Width

Waterway	Width (m)	Width (nm)

[32] Government of Canada. "World-Class Tanker Safety" https://www.tc.gc.ca/media/documents/marinesafety/world-class-tanker-safety.pdf
[33] Kitimat LNG TERMPOL Submission – Element 3.5 & 3.12. Route Analysis, Approach Characteristics and Navigability Survey, and Channel Manoeuvring and Anchorage Elements, pg 68

Dixon Entrance – north channel	26,000	14
Dixon Entrance – south channel	16,000	8.6
Approach to Triple Island from Dixon Entrance	9,500	5.1
Off Butterworth Rocks	6,000	3.2
Narrowest section of Northern Hecate Strait	5,300	2.9
Browning Entrance	6,200	3.4
Principe Channel, Dixon Island narrows	1,430	0.8
Principe Channel, Despair Point narrows	1,800	1
Otter Channel	1,800	1
Lewis Passage off Plover Point	2,300	1.2
Lewis Passage, Blackfly Point	2,700	1.5
Douglas Channel, Money Point	3,500	1.9
Douglas Channel, Grant Point	2800	1.5
Douglas Channel, Emilia Island narrows	1400	0.8
Douglas Channel, Nanakwa Shoal to Coste Rocks	3600	1.9

Channel depth requirements

Underkeel clearance (UKC) is defined as the distance between the deepest underwater part of the vessel and the bottom of the waterway. The TERMPOL Guideline indicates a vessel's UKC should be 15% of its maximum permissible draught, or meet requirements established and published by the appropriate government authority for a specific waterway.

The TRC acknowledges that depth guidelines are met along all portions of the proposed route. The Pacific Pilotage Authority and the B.C. Coast Pilot guidelines require 10% UKC of the vessel's maximum permissible draught at a terminal. However, as recommended in the TERMPOL Guidelines, because the turning basin is directly adjacent to the berth, and the seabed consists of a rock bottom, a more conservative minimum UKC should be used. The minimum water depths at the Kitimat LNG project berths are as follows:[34]

Table 4 – Minimum Water Depths at Project Berth

Summer draught of largest LNGC	12.5 m
Recommended underkeel clearance	1.9 m (15% draught)
Contingency	0.5 m
Minimum water depth	14.9 m

[34] Kitimat LNG TERMPOL Submission – Element 3.6. Special Underkeel Clearance Survey, pg 14

As part of the TERMPOL Review Process, the proponent reviewed a series of depth surveys that consider applicable factors for water depth, including chart datum, draught conditions, tidal height and surge, and climatic and related depth anomalies. Kitimat LNG states the maximum draught of vessels that will call at the proposed terminal is 12.5 m, which is similar to the vessels currently navigating the route, and well within the safe limits of the route.[35]

Water depths along the proposed route are generally in excess of 90 m, with depths charted as deep as 365 m. These depths greatly exceed minimum UKC for LNGCs. The TRC agrees that the minimum charted depths along the marine access route surpasses the depths required for the largest project vessels to transit coastal waters and marine channels to the proposed marine terminal. However, there are shallower areas for LNGCs to avoid or exercise caution while transiting.

At Dixon Entrance, the depths over Learmonth Bank between Langara Island and Cape Muzon are uneven, with a least depth of 37 m. The CHS conducted a full multi-beam survey of Learmonth Bank in 2008 and incorporated this data into the 2011 edition of Chart 3800. The proponent states that while navigation directly over Learmonth Bank is achievable, using deeper channels to either the north or south is preferred.[36] Masters are made aware of the conditions at Learmonth Banks through the Pacific Coast Sailing Directions.

The proponent notes that the waters to the north and south of Triple Island have extensive shoaling and are not preferred by BCCP for boarding deep draught vessels. Navigation towards Browning Entrance, at the mouth of the Principe Channel, is limited to the deep water channel on the east side of Hecate Strait. The TRC supports Kitimat LNG's commitment to maintain navigation through the deep-water channel in Hecate Strait.

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[35] Ibid, pg 1.

[36] Kitimat LNG TERMPOL Submission – Element 3.5 & 3.12. Route Analysis, Approach Characteristics and Navigability Survey and Channel, Manoeuvring and Anchorage Elements, pg 5

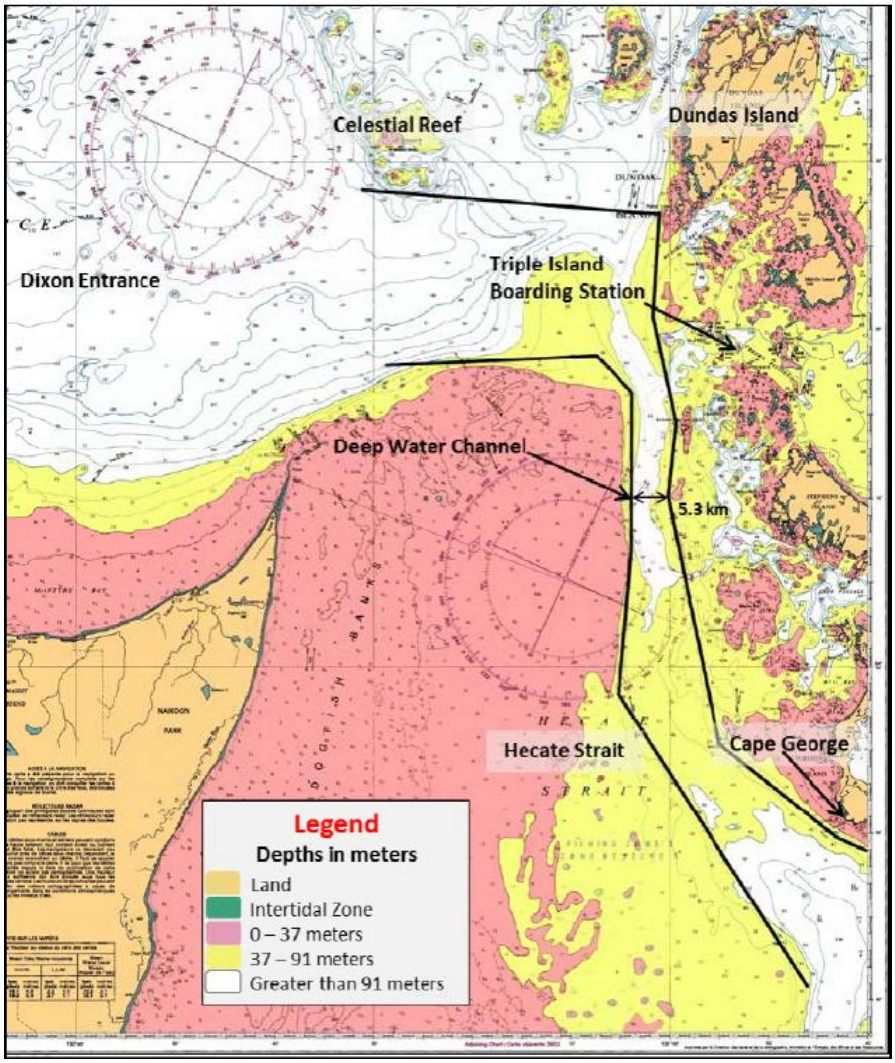

Figure 8 - Water Depths from Dixon Entrance to Principe Channel

Kitimat LNG also identified two areas in the Principe Channel where the channel depth is between 11 and37 m:

- The waters between Dixon and Wheeler Island
- Nesbitt Rock and Swell Islet in Mink Trap Bay

Principe Channel was resurveyed by the CHS in 2006 using multi-beam technology, and these areas of special consideration have been incorporated into the latest navigational charts.

<u>Finding 23:</u> The depths along the Northern Route and approaches to the terminal of the proposed Kitimat LNG project provide sufficient underkeel clearance for project carriers.

<u>Vertical clearance restrictions</u>

The TRC finds that there are no vertical clearance restrictions along the proposed route.

Safe operating speeds

The safe operating range of speed for LNGCs depends on many factors including location, interaction with other marine traffic, weather conditions, and/or the presence of marine mammals. The Master is ultimately responsible for navigation of a project carrier at a safe speed, with advice from the two on-board pilots.

Speed estimates discussed in this section represent transit in normal, expected conditions. Unexpected weather or marine scenarios may result in temporary deviation from these estimates to maintain safe transit. The expertise of the attending two pilots is critical to managing LNGC manoeuvring and speed.

The proponent expects carriers to travel at speeds between 14 and 16 knots on approach to the conventional pilot boarding station at Triple Island or the proposed helicopter pilot boarding station west of Triple Island. The helicopter pilot or the pilot boat skipper will direct LNGC speed and direction during pilot transfer.

Upon entrance to the Principe Channel, Kitimat LNG predicts LNGCs will slow to a speed between 8 and 14 knots until carriers reach their destination in the Douglas Channel. Carriers will likely transit at a speed of about 12 to 14 knots, or the operational speed of the attending tug. On all points of the route, project carriers must maintain "Safe Speed" as described in Rule 6 of the *Collision Regulations.*

Recommendation 23: Kitimat LNG should include carrier speed profiles within its Port Information Book. The proponent must publish this book at least six months in advance of project operations.

Sea life considerations and underwater vessel noise

Transport Canada supports reducing carrier speed if a high concentration of marine mammals is present in the area. That being said, more clarity is needed in several areas to:

- develop a consistent definition of what constitutes a 'high concentration' of whales
- develop or decide on technology that will credibly account for mammal population and concentration levels
- translate collected data into spatial data that electronic navigation equipment and portable pilot units can read
- determine which organization will be responsible of providing this type of data on a regular and consistent basis

In their submission, Kitimat LNG recognizes the potential for project operations to interact with marine mammals. The proponent identifies two areas considered critical killer whale habitat in the vicinity of the project route:[37]

[37] 'Critical' habitat is used for feeding, resting, socializing and mating (DFO, 2008; Refer to Fishery Resources Survey, Appendix B-2, B-3)

- Stretches of channel north of the study area near Dixon Entrance and Triple Island
- From Caamano Sound to southern Douglas Channel around Gil Island

Note: Harbour porpoise habitats also exist throughout the inland waters of northern B.C.

Commercial shipping is a major contributor to anthropogenic (human-caused) underwater noise. The continuous, low-frequency sounds that emanate from ships add to the 'background noise' within large geographical areas. Quantifying the impacts of anthropogenic noise is complex, however it is believed to be a risk to marine mammals in the area. Areas of concern include inducing behavioral changes, causing hearing loss, and increasing stress levels for mammals. Therefore, cooperation and support from proponents is important to better understand the effects of underwater vessel noise on marine life.

Kitimat LNG is aware of the potential risks that project LNGCs pose to underwater life, especially marine mammals. While killer whales use an auditory range below the sound frequency of vessel traffic, baleen whales are more sensitive to the low-frequency sound that emanates from LNGCs. Humpback whales are said to be present along the route during the summer months and Minke whales, although poorly documented, could also be impacted by the project.[38]

Kitimat LNG states that added precaution will be taken in key habitat areas by Masters and Pilots of project vessels in order for interactions with killer whales and harbour porpoises to be mitigated. In the submission, the proponent has put forward a number of recommendations to reduce the impact of underwater noise from project vessels on mammals along the route. Recommendations are to:[39]

- develop seasonal speed management plan for tugs and LNGCs
- adhere to established shipping channels
- discuss mammal sighting, reporting, and avoidance best practices with pilots to create standard operating procedures
- develop a brochure for LNGC operators and pilots that includes critical areas to avoid, mammal identification information, and relevant requirements from the *Fisheries Act Marine Mammal Regulations*

There are programs in place to monitor marine mammal movements. Ocean Networks Canada's Smart Oceans program aims to enhance marine safety though real-time monitoring and alerts on marine mammals in select areas on the North Coast, including Kitamaat Village at the head of the Douglas Channel. TC has provided $20 million for this initiative from 2014 to 2017. Its data serve a wide range of stakeholders for the purposes of marine safety, environmental monitoring and protection, and public safety. Communication and outreach products are also part of the

[38] Kitimat LNG TERMPOL Submission – Element 3.3 Addendum. Assessment of Underwater Noise and Marine Mammal Impacts and Mitigations, pg 7.
[39] Ibid, pg 10.

initiative's deliverables, including the hosting of an annual workshop and regular information sessions over the next three years.

Additionally, the Vancouver Fraser Port Authority implemented the Enhancing Cetacean Habitat and Observation (ECHO) program. The ECHO program has instituted a number of trial measures to monitor the impact of marine shipping on at-risk whales, including slowing down vessels, and repositioning them in the shipping lanes. The goal of the ECHO program is to develop sustainable mitigation measures that will lead to a quantifiable reduction in potential threats to whales as a result of shipping activities. Currently, the Government of British Columbia is crafting regulation, informed through the ECHO program, which will detail the specific measures for interactions with whales.

Finding 24: The TRC supports the proponent's mitigations to limit potential impacts of underwater noise and will promote the harmonization of requirements with operations in the South Coast.

Recommendation 24: The proponent should provide guidance on marine mammals to project carriers through the Port Information Book.

Finding 25: Participation in regional initiatives such as the Ocean Networks Canada Smart Oceans project is beneficial to stakeholders such as the B.C. Coast Pilots and Pacific Pilotage Authority as data collected helps better understand marine mammal populations and their interaction with underwater vessel noise.

Recommendation 25: Kitimat LNG should continue its efforts to obtain information on concentrations of marine mammal populations, including Minke whales, to develop speed profiles and other mitigation measures for underwater vessel noise. This includes participation in regional initiatives, such as future Smart Oceans workshops, to obtain the best data available concerning marine mammals along the project route.

Anchorage for project carriers

Commercial shipping anchorages feature anchor-holding ground, shelter from winds, and proximity to shipping routes and port logistics. These criteria ensure the safety of vessels and crew, and the safety of other users of the water space and surrounding environment. Kitimat LNG states that LNGCs calling to their terminal will only anchor in the event of an emergency. As an alternative to anchoring, the TRC notes that Project vessels can use escort tugs to help maintain vessel position, if needed.

The TERMPOL Guidelines recommend that anchorages:[40]

- are located as close as is practicable to the channels they serve and relate to site-specific conditions

[40] TP743E: TERMPOL Review Process 2001 Appendix 2 Channel, Manoeuvring and Anchorage Guidelines

- have bottoms that provide good holding ground
- have a depth that is no less than the maximum draught of the design ship, plus 15% and not more than 100 m
- have a berth radius no less than one half nautical mile (926 m)

The largest vessel to call at the Kitimat LNG terminal, the Q Flex tanker, has a maximum draught of 12.5 m, therefore requiring an anchorage with a depth of at least 13.4 m. Anger Anchorage is the only advertised anchorage along the project route that meets the criteria outlined in the TERMPOL Guidelines. The anchorage is located off of the Principe Channel, at the junction with the Petrel Channel. It has water depths of 44 m to 90 m, and covers an area of 2.8 km by 1.8 km. Anger Anchorage can accommodate up to three ocean going vessels.

If the vessel were to be unable to anchor at Anger Anchorage, Kitimat LNG has assessed a number of other locations that offer sufficient bottom area and depth to accommodate emergency anchorage.

Possible emergency anchorages, as outlined by Kitimat LNG, are as follows:

- Approaches to the Triple Island Pilot Boarding Station
- North Hecate Strait
- Browning Entrance
- Nepean Sound

Recommendation 26: The proposed anchorages identified by the proponent should only be considered temporary anchorages to be used in the event of an emergency.

Recommendation 27: For non-emergency situations, LNGCs should maintain their position in safe waters by making circular turns or using a tethered tug to hold the vessel instead of anchoring.

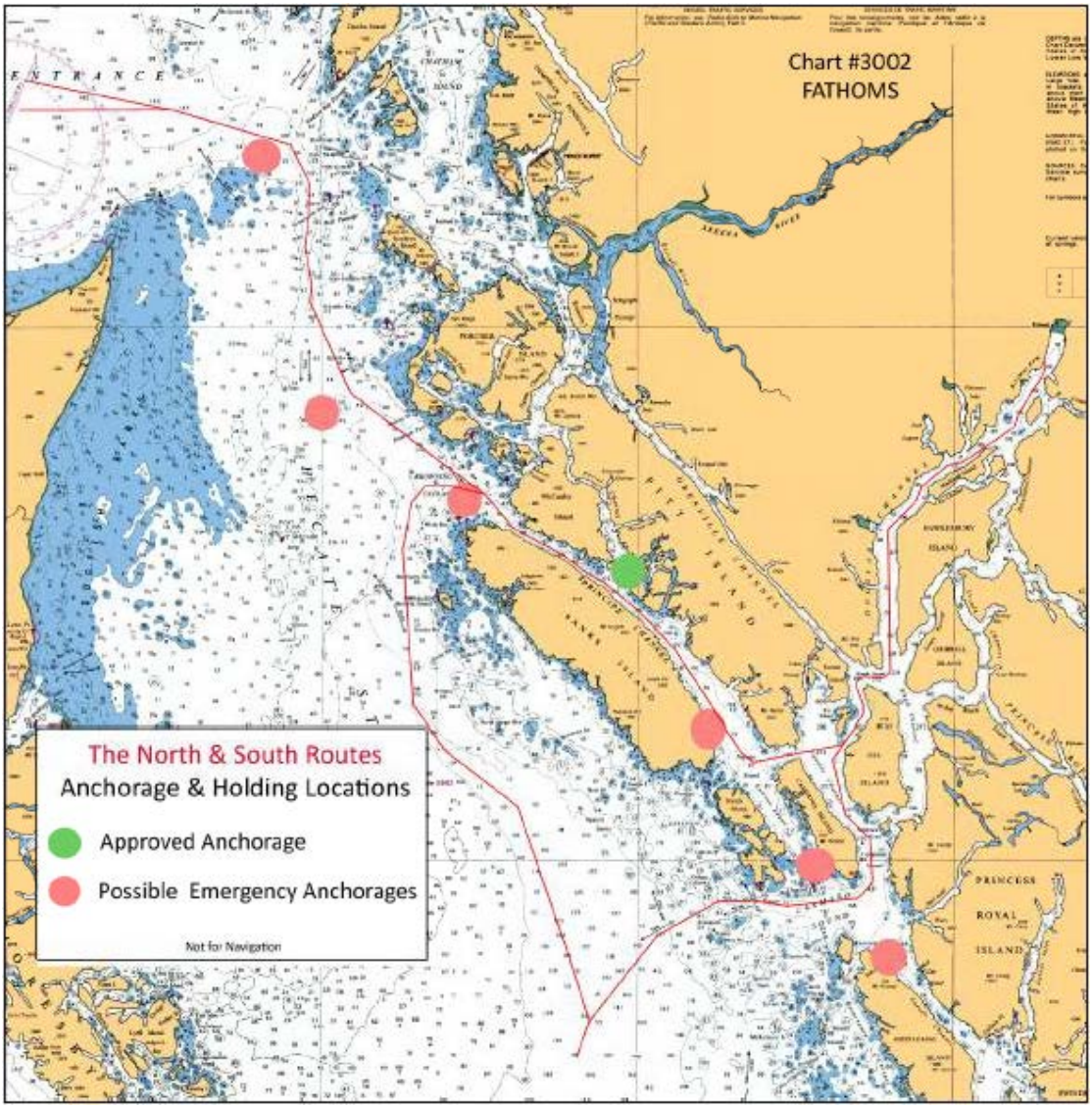

Figure 9 – Designated and Potential Anchorages Identified Along the Project Route

The proponent also notes of the anchorage area in Kitimat Harbour close to the project. While the natural outflowing current normally keeps vessels away from the shallows, the anchorage does not meet the minimum swing circle requirements of the TERMPOL Review Process Guidelines.[41] Therefore, the proponent has committed to scheduling the arrival and departure of LNGCs such that there is no need for anchorage in the Kitimat area.

<u>Finding 26:</u> The TRC agrees with the proponent that the anchorages in Kitimat Harbour do not meet the minimum swing circle requirements of the TERMPOL Guidelines. Anchorage in Kitimat Harbour should therefore be avoided unless the anchorage area is redesigned.

<u>Weather and sea conditions</u>

[41] TP743E: TERMPOL Review Process 2001 Appendix 2 Channel, Manoeuvring and Anchorage Guidelines

An LNGC's crew considers a number of factors when dealing with poor weather conditions and rough seas, including:

- the vessel's performance characteristics
- the shipping route's navigation characteristics
- long-term weather forecasts
- real-time weather
- vessel owner requirements
- vessel operator requirements
- terminal operator requirements
- Pilot and Vessel Traffic services advice and guidance

Establishing weather and environmental restrictions on vessel operations can help ensure vessels do not exceed safe operating limits or take undue risks as wind, visibility, and sea conditions deteriorate. The proponent will ensure carriers' Masters consider these factors as part of their standard operating procedures and rely on the pilots' knowledge and discretion to navigate safely in abnormal weather events.

Recommendation 28: The proponent should utilize best available weather reports and sea data so that LNGCs can safely navigate within a good weather window.

Meteorological buoys

Environment and Climate Change Canada (ECCC), in partnership with Fisheries and Oceans Canada (DFO) and the Canadian Coast Guard (CCG), has established a system of moored meteorological buoys and coastal weather stations to provide information on weather conditions in Canadian waters. The system's guiding principles are to:

- meet a minimum requirement of one data point (buoy or coastal automatic weather station) per marine forecast region
- integrate with the U.S. National Weather Service Buoy Network
- determine feasible location, taking into account water depth, currents, weather, etc.
- correspond with grid points for meteorological modelling

The buoys and weather stations monitor weather conditions in open ocean areas and major straits, as well as selected higher-traffic channels and sounds. Based on data gathered, ECCC provides regularly updated information on current conditions and forecasts on its website and by VHF radio. Along the proposed route, there are a number of buoys and coastal observations stations, including buoys at North Hecate Strait (46183) and at Nanakwa Shoal (46181) in the Douglas Channel.

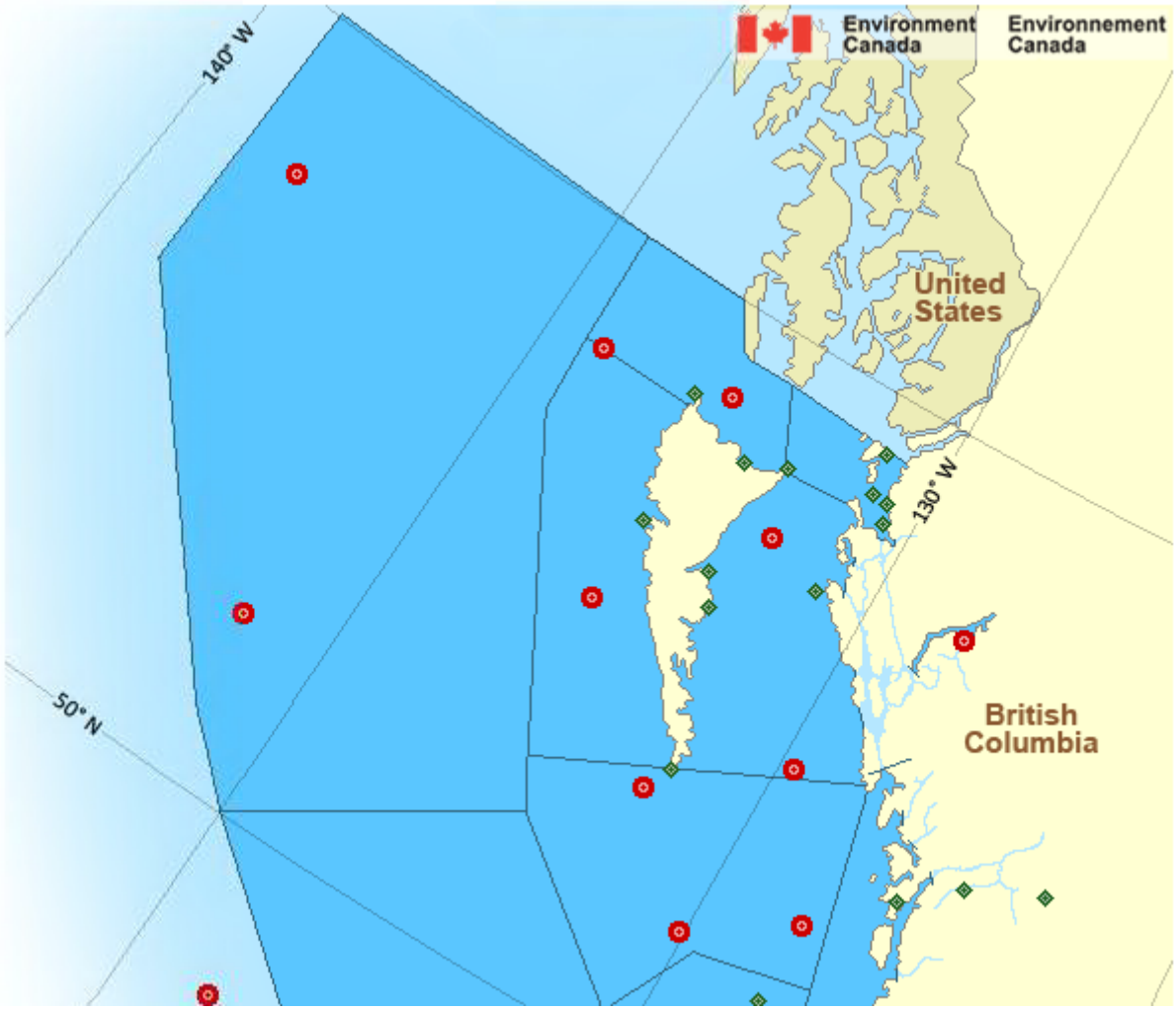

Figure 10 – Meteorological Buoys in Northern B.C. Coastal Waters

As part of the federal government's commitment to increasing marine safety, ECCC is receiving targeted funding to improve marine monitoring infrastructure. In 2015, ECCC began to deploy new meteorological buoys in major coastal shipping or port areas in Canada. The Department will determine locations based on its guiding principles and assist marine pilots and port authorities in the safe movement of vessels through Canadian waters. The improvements in marine monitoring infrastructure will also likely benefit any potential increase in marine shipping on the North Coast.

The BCCP are advocating for the installation of a smart buoy at the Triple Island pilot station. Sea conditions affect critical pilot boarding decision, and therefore more accurate weather information would serve in the interest of marine shipping activities in the area. The buoy should meet IMO Circular 289 and provide real-time information on:

- wind speed direction
- average wind
- wave heights/swells
- period and direction of swells

- seasonal trends
- atmospheric pressure

It has been noted that there is a lack of reliable weather information in the vicinity of Hartley Bay. The Canadian Coast Guard has explored the possibility of installing a weather buoy near Hartley Bay, to relay updated environmental conditions to passing marine traffic.

Finding 27: The TRC supports the installation of a weather buoy near Hartley Bay to provide more accurate and reliable weather information in the area.

Finding 28: In consultation with the B.C. Coast Pilots and Canadian Coast Guard, Environment and Climate Change Canada may assess the need for new smart buoys to provide meteorological data to inbound vessels.

Maximum operating parameters

The proponent's provisional maximum operating parameters for environmental conditions have been established through information obtained from the Force Technology's "Manoeuvring Study of LNG Carriers to Kitimat," as well as through adherence to industry best practices. Simulations take into account that all LNGCs berthing at the Kitimat LNG marine terminal will be tug assisted. Maximum operating parameters are as follows:[42]

Table 5 – Maximum Parameters of Kitimat LNG Project Carriers

Parameter	Maximum
Maximum wind speed, tug assisted berthing	18 m/s (35 knots)
Maximum wind speed for vessel to leave the berth	18 m/s (35 knots)
Minimum visibility, tug assisted berthing	.93 km (0.5 nm)
Maximum wind speed, loading shutdown	18 m/s (35 knots) – sustained
Maximum wind speed, loading arm disconnect	20 m/s (40 knots) – sustained

Loading of LNG at berth will stop:

- If weather conditions exceed the limits established in the operating procedures
- In the event of electrical storms or fire near the terminal
- A leak occurs at the berth or aboard the LNGC

These operational limits would affect when and how carriers proceed to the terminal. For example, under certain adverse weather conditions, pilots may wait for the weather to improve before boarding carriers in the Dixon Entrance. Pilots are able to consult the MCTS Continuous Marine Broadcast service and ECCC weather information to anticipate conditions for carriers

[42] Kitimat LNG TERMPOL Submission - Element 3.10. Site Plans and Technical Data, pg 24

approaching the Dixon Entrance. If LNGCs are at berth, pilots in consultation with the master of the vessel, will determine if they should delay departure.

Developing navigational criteria is an evolving process, involving the BCCP, PPA, and the proponent. Operating parameters are dependent on the final configuration of the berth, and the maximum operating parameters should be determined through simulations when the final plans are submitted.

Recommendation 29: The proponent should support the efforts of the Pacific Pilotage Authority and the B.C. Coast Pilots to develop operational limits for liquefied natural gas vessel, informed through simulations.

Navigational incidents

As part of the Force Technology Manoeuvring Study of LNG Carriers to Kitimat, B.C. risk assessment, the proponent estimated annual transit incidents involving project carriers for three potential incidents:

- Collision
- Drift grounding
- Powered grounding

The assessment, conducted by DNV GL, considered three separate transit sensitivity cases. Case A was modelled with a standard level of risk controls while Case B and C were modelled with additional risk controls. The specifics of each case is explained in more detail in Table 6**.** All tugs considered in the three cases possessed 92 tonne bollard pull, were available 100% of the time, and travelled between 5 and 14 knots.[43]

Table 6 – Risk controls for Three Cases

Case	Risk controls
Case A	Tethered tug present for final 5nm to/from Kitimat LNG terminal
Case B	Rescue tug stationed at Prince Rupert
	Escort tug present along the inland route, and tethered near Dixon Island, Hartley Bay, Emilia Island and 5nm to/from terminal
	One-way traffic for 6nm passing Emilia Island as well as Dixon Island
Case C	Rescue tug stationed at Prince Rupert
	Rescue tug stationed at Hartley Bay
	Tethered tug present for final 5nm to/from Kitimat LNG terminal
	One-way traffic for 6nm passing Emilia Island as well as Dixon Island

[43] Kitimat LNG TERMPOL Submission - Element 3.15. General Risk Analysis and Intended Methods of Reducing Risks, pg 75.

Using the MARCS model, the proponent estimated annual transit incidents in all three cases. The proponent calculated the frequency of critical situations from ship traffic and navigation data, then applied a probability value for an accident. The proponent compared the findings to Transportation Safety Board (TSB) data to ascertain whether the estimates are reasonable.

The proponent assessed the three incident types across six route segments and identified the expected frequency per 1,000 carrier movements. Incident frequencies are presented as the total frequency of each incident type in all three cases. While this approach does show the greatest contribution from longer sections, it takes into account other factors that contribute to higher or lower risk (e.g. sea room, shoreline type, navigational difficulty, etc.).

While each case is further analyzed below, none of the three cases apply the same risk controls that are proposed by Kitimat LNG in their final Tug Escort Policy. Furthermore, as previously stated, the TRC does not find Kitimat LNG's proposed tug package adequately provides enough mitigation of risk to ensure safe transit of vessels in Canadian waters. However, for the sake of prudence, the simulations submitted as part of Element 3.15 of Kitimat LNG's TERMPOL submission are reviewed below.

Grounding

Table 7 – Grounding Frequency in Case A, B, and C

Incident Type	Case A	Case B	Case C
Drift Grounding	1 in every 63 years	1 in every 3,448 years	1 in every 3,571 years
Powered Grounding	1 in every 76 years	1 in every 83 years	1 in every 76 years

In Case A, drift grounding risks contributed the most to the overall risk while powered grounding is the biggest contributor in Cases B and C. Additional risk controls such as tug escort and tethering reduce the frequency of drift grounding. Rescue tugs also are shown to significantly reduce the frequency of drift grounding; wind patterns along the route encourage LNGCs to drift along the waterway rather than directly to shore, and the quick mobilization time increases the likelihood that tugs are able to reach vessels before they ground.

Tug support however, be it in the form of escort or rescue tug, does not significantly lessen the frequency of a powered grounding. Risk of powered grounding is highest as the vessel navigates through the narrow waterways and frequent course changes to and from the project terminal to the mouth of the Principe Channel.

Collision

Table 8 – Collision Frequency in Case A, B, and C

Incident Type	Case A	Case B	Case C
Collision	1 in every 1,754	1 in every 1,887 years	1 in every 1,887 years

Risk of collision is low across all three cases due to minimal traffic along the route. Additional tug support did not lead to significantly improved mitigation against collision along the route.

However, it is notable that when navigating through the Principe Channel, the risk of collision increases, as a result of the increased presence of other marine traffic.[44]

Unintentional loss of containment

To date, there has never been an incident that has resulted in a loss of LNG from a carrier's cargo tank. This is why estimating the probability of a LNGC incident that results in a loss of containment requires an examination of theoretical scenarios, not historical figures. The proponent considers the same three potential incident scenarios stated above that could result in a release of LNG.

The proponent's consultant:

- based its findings and estimates on the current understanding of the energy required to accidentally penetrate a carrier hull and cargo tank far enough to result in a loss of containment
- based its assessments on the Membrane tank type, as its tanks are closer to the surface side of the hull
- assumes that a 2 m indentation depth from a collision or grounding incident would result in a loss of containment

The assessment again considered three separate cases, each with varied levels of risk controls. The results for each incident type are as follows:

Table 9 – Risk of a Loss of Containment from Grounding and Collision in Cases A, B, and C

Incident Type	Case A	Case B	Case C
Drift Grounding	1 in every 172 years	1 in every 7,692 years	1 in every 7,692 years
Powered Grounding	1 in every 417 years	1 in every 435 years	1 in every 417 years
Collision	1 in every 58,824 years	1 in every 58,824 years	1 in every 58,824 years

Except for Case A, which included only minimal risk controls, results show that powered grounding is the largest contributor to the risk of an unintentional loss of containment. Additional mitigations, such as tug support, did little to minimize the risk of powered grounding in Cases B and C. However, a drift grounding incident that resulted in a loss of containment would be considerably less prevalent. Collision risk has an equally low frequency due to the low level of marine traffic.

It should also be noted that these results are skewed by the extremely low risk of a loss of containment near the Kitimat LNG terminal due to the relative size of the section analyzed compared to other segments of the route. The risk of a spill along other portions of the route is much higher.

[44] Ibid, pg 86.

Intentional acts that could result in a loss of containment

Although the TERMPOL Guidelines do not consider intentional acts that could cause a release of cargo, the federal government has in place an effective, risk-based approach to threats that affect marine vessels and their facilities. The *Marine Transportation Security Regulations* (MTSR) came into force in 2004, and was created under the *Marine Transportation Security Act* (MTSA).

Through the MTSR, federal agencies assess security threats, prevent incidents and enforce compliance. The MTSR sets out security procedures for access control and defines the responsibilities of certain individuals. For example, the MTSR require every vessel to submit a Pre Arrival Information Report to TC before entering Canadian waters. The report includes information such as, but not limited to the vessel's identity, description of cargo, destination, deficiencies and record of the vessel's last 10 marine facilities visited. It allows TC, together with its partners at the Department of National Defence, Canada Border Services Agency, Canadian Coast Guard, and Royal Canadian Mounted Police, to identify and address any potential threats to Canadian shores.

The MTSR also ensure that marine facilities and vessel security plans address risks identified within their security assessments. The MTSA and MTSR fulfill Canada's obligations under the International Ship and Port Facility Security Code (ISPS), which is part of SOLAS. The ISPS Code, which was created as a direct result of the events of September 11, 2001, sets minimum security arrangements for ships, ports and government agencies.

To satisfy the MTSR, LNG marine facilities that intend to receive ships to which Part 2 apply must have a Marine Facility Security Plan approved by the Minister. This in turn leads to the issuance of a Statement of Compliance following a satisfactory marine security inspection by a fully credentialed transportation security inspector. Likewise, the LNG tankers that plan to interface with the LNG marine facilities are required to have a valid International Ship Security Certificate, which includes an approved Vessel Security Plan from the appropriate flag administration. Marine security inspections of foreign-flagged vessels are performed. Additionally, if law enforcement officials identify a specific threat to safety or security, legislative tools exist that could enable the Minister to establish items such as security zones via security measures under the *Marine Transportation Security Act* (MTSA).

The Minister sets levels of security requirements (MARSEC levels) to reflect the threat environment for vessels, marine facilities and ports. TC may raise or lower MARSEC levels according to each individual threat. Below is an outline of each threat level:

- MARSEC Level 1 - the level for which minimum appropriate security measures shall be maintained at all times.
- MARSEC Level 2 - the level for which appropriate additional protective security measures shall be maintained for a period of time as a result of heightened risk of a transportation security incident.
- MARSEC Level 3 - the level for which further specific protective security measures shall be maintained for a limited period of time when a transportation security incident is

probable, imminent, or has occurred although it may not be possible to identify the specific target

Finding 29: The TERMPOL Review Committee recognizes that while the TERMPOL Report does not consider intentional acts that could result in the release of cargo, the Government of Canada has in place a system under the Marine Transportation Security Regulations to detect and prevent intentional acts that could threaten a project vessel's cargo or operations.

Loss of containment at the terminal

Kitimat LNG also provided a risk assessment of potential events that could lead to a loss of containment at the terminal. The proponent notes that there is no public exposure to risks greater than 1 in 100,000 years as a result of a loss of containment at the Kitimat LNG terminal.[45]

Table 10 – Risk Frequency of Events at the Terminal

Terminal Event	Risk
Rupture of loading arm with isolation success	1 in every 8,333 years
Large rupture of loading arm with isolation success	1 in every 10,638 years
Rupture of loading arm with isolation failure	1 in every 66,667 years
Rupture of piping to LNG arm with isolation success	1 in every 90,909 years
Very large rupture of piping to LNG arm with isolation success	1 in every 83,333 years
All others	1 in every 38,462 years
Total	1 in every 5,263 years

3.2.3 MARINE TRAFFIC CONSIDERATIONS AND ADDITIONAL TRAFFIC CONTROLS

LNGCs calling at the Kitimat LNG terminal in Bish Cove will interact with many types of marine traffic transiting the B.C. coast. Fishing vessels, tugs, cargo ships, passenger vessels, and recreational vessels all use the waters near the proposed shipping route. The proponent quantified the existing marine traffic in the study area using data obtained from a number of sources, including the Prince Rupert MCTS, the PPA, and the regional ports. Data was provided from vessel call-ins from January 2008 through to June 2010. Additional insights on traffic patterns were provided through informal discussions with individual B.C. Coast Pilots with experience in the region.

[45] TERMPOL Element 3.15 Section 10.2 Page 124

Specific waterways used in the study are:

- Wright Sound
- Principe Channel
- Douglas Channel

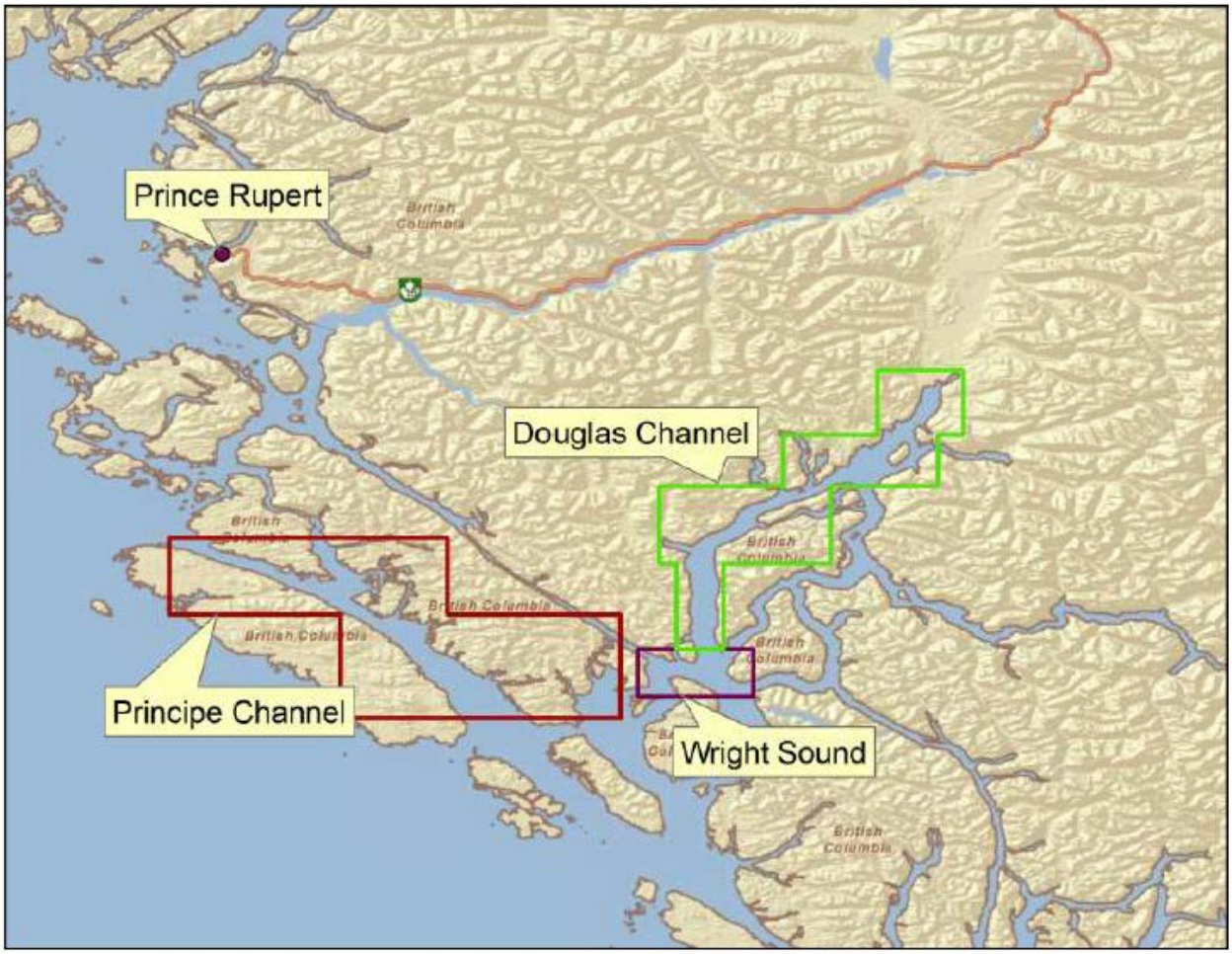

Figure 11 – Area of Study for Vessel Transits along Project Route

Kitimat LNG identified a number of types of vessels that can be found along the route at certain points during the year:

- Tugs (both with and without barges in tow)
- General, bulk, and container cargo vessels
- Oil, gas, and chemical tankers
- Cruise ships
- Pleasure craft
- Government vessels and warships
- Commercial and passenger ferries
- Commercial fishing vessels

Based on estimates from MCTS, the proponent estimates that 50% of existing marine traffic using the region's waterway is 'non-reporting' – that is, vessels under certain sizes that are not required to make any reports to VTS.[46]

Tugs with tow accounted for about 60% of reporting traffic, with 500 to 600 movements in the project region every month from 2008 to 2010. Cargo vessels make roughly 96 transits per month, the majority of which are made by dry-bulk carriers. Many container cargo vessels recorded by VTS are in transit from Asia to container terminals in the Vancouver area, and therefore do not call on regional ports. Project LNGCs would only encounter these vessels when sailing to the Pilot boarding station at Triple Island.

Several cruise lines operate within the study area, mainly during the summer months from May to September. The proponent estimates cruise ship transits vary between 1 and 50 per week depending on the time of year.[47]. It would be prudent for the proponent and the relevant authorities to open dialogue with the cruise ship companies directly, concerning routing and the potential for route overlap with LNGCs.

Passenger ferries use the Inner Passage to navigate up and down the North Coast of B.C., crossing the project route in Wright Sound. B.C. Ferries runs daily ferry trips during the summer months, and operates twice a week in the winter. Alaska State Ferries also use the Inner Passage for weekly service from Bellingham to Alaska throughout the year. Finally, Metlakatla Ferries operates a 45-passenger ferry service, on a bi-weekly basis, from Prince Rupert to the communities of Hartley Bay, Kitkatla, and Metlakatla.

Canadian fishing vessels over 24 m LOA must participate in the VTS, except when actively fishing. Smaller fishing vessels are not required to participate in the VTS. Fishing season openings may occur two to four times per week from April to September, however they are not seasonally restricted. As a result, data on fishing vessels in the project area is difficult to observe. The proponent estimates that up to 750 U.S. fishing vessels transit the North Coast of B.C., comprising 9% of total traffic.

Introducing shore radar will help improve the management of the study area, and represents a major mitigation for increased vessel traffic associated with this project and other planned projects in the area. The ongoing move to helicopter pilot boarding has also reduced congestion at the conventional pilot boarding station.

Finding 30: The TRC agrees that there is enough traffic capacity along the route to accommodate future growth.

3.2.4 PROPOSED MITIGATION MEASURES

[46] Kitimat LNG TERMPOL Submission – Element 3.2. Origin, Destination, and Marine Traffic Volume Survey, pg 28
[47] Ibid, pg 31.

Quantitative risk assessment mitigation measures

Kitimat LNG has proposed a number of mitigation measures for berthing operations, including the required tug package. As per their Tug Escort Policy, Kitimat LNG is proposing the use of three harbour tugs to assist in berthing and unberthing operations.[48] One tug with firefighting capability will also remain on standby when vessels are alongside the terminal berth, and the LNGC's engines will be manned throughout the entire loading process.

Recommendation 30: The proponent should ensure it has enough tugs and crew personnel on standby at the terminal site to facilitate the safe arrival and departure of project carriers.

Recommendation 31: The proponent should make arrangements with the B.C. Coast Pilots so that a pilot can be available at minimal notice in case a LNGC leaves the berth in the event of an emergency.

Recommendation 32: The proponent should submit its draft tug operations plan to Transport Canada, Pacific Pilotage Authority, Canadian Coast Guard and B.C. Coast Pilots six months before project operations begin.

Berthing simulations conducted in the Force Technologies "Manoeuvring Study of LNG Carriers to Kitimat" assessed the ability of a tug to assist a carrier in emergency scenarios. The simulation's key findings are:[49]

- Four ASD type tugs of 80 tonne bollard pull are sufficient to handle the largest LNGCs berthing at the marine terminal
- Four ASD type tugs of 70 tonne bollard pull are sufficient to handle the smallest LNGCs berthing at the marine terminal
- LNGCs were safely berthed at both the port side and starboard side of the vessel
- However, unberthing manoeuvres were easier when the LNGC were portside alongside
- Berthing and unberthing conditions were safely conducted during day and night
- Bish Cove provides good protection from the wind and the waves are relative calm with very short periods

Recommendation 33: Kitimat LNG should take into consideration the findings of the Force Technologies "Manoeuvring Study of LNG Carriers to Kitimat" to inform the project's berthing requirements.

Tugs must also have escort class notification, and meet every *CSA 2001* requirement for registration, crewing and certification. Marine Safety's Delegated Statutory Inspection Program (DSIP) will also apply, which would subject the tugs to possible inspection through one of the Recognized Organizations, which is subject to audit by TC Marine Safety and Security. The

[48] Kitimat LNG Marine Operations Kitimat LNG Tug Escort Policy, pg 17
[49] Force Technologies "Manoeuvring Study of LNG Carriers to Kitimat" pg 8.

TRC also agrees tug design should be standardized to allow for seamless tug substitution and interchangeable critical parts and equipment to ensure adequate tug availability at all times.

All tugs must maintain Near Coastal Class 2 or better Voyage classification requirements to conform to TC's registration, crewing and inspection regime. Tug owners can do this through TC, Marine Safety directly, or through the DSIP via a Recognized Organization.

Communication between tug Masters and project carriers is essential. The STCW Convention, through *Regulation VIII/2*, outlines the minimum qualification standard for training, certification and watch-keeping arrangements and principles for masters, officers and watch personnel on seagoing merchant ships and large yachts. Compliance will ensure safe continuous watches appropriate to the prevailing circumstances and that these conditions are maintained on vessels at all times.

The BCCP conduct simulator training with pilots and tug masters to ensure appropriate bridge management. The TC recommends that BCCP training align with guidance in the STCW Code Section A-VIII/2 and the MPR created under the *CSA, 2001*, which outline standards for watchkeeping and marine personnel. Personnel operating communication equipment must also abide by the regulations enacted under the *CSA, 2001*, including the *VHF Radiotelephone Practices and Procedures Regulations*; the *Ship Station (Radio) Regulations*; and the *and Ship Station (Radio) Technical Regulations.*

Recommendation 34: Kitimat LNG should liaise with the B.C. Coast Pilots to confirm operational limits for berthing tugs prior to the start of project operations.

3.2.5 GAS CLOUD DISPERSION RISKS AND MITIGATIONS

LNG is natural gas cooled to minus 162 degrees Celsius at atmospheric pressure and reduced to a liquid state. Materials not designed to withstand such cold temperatures can fracture if they come in contact with LNG. As a result, handling LNG requires special equipment and facilities.

As a liquid, LNG cannot explode and is not flammable.[50] However, if LNG is released and warmed, it can become flammable as a gas. This gas can ignite in the presence of an ignition source only at a range of 5% (Lower Flammable Limit) to 15% (Upper Flammable Limit) vapour in the air (by volume). While this narrow range reduces overall risk, the safe handling and transfer of LNG remains critical to maintaining public safety.

The TERMPOL Report examines credible scenarios involving the accidental release of cargo. Through this lens, the TRC considers the potential for collisions and groundings that could lead to a release of cargo over a short period of time. There has never been a major spill of LNG from an LNGC anywhere in the world, therefore risk assessments and simulation models are critical to identifying the frequency and possible consequences for any accidental release. Industry can then

[50] Natural Resources Canada web page: http://www.nrcan.gc.ca/energy/natural-gas/5681

develop mitigation measures based on the outcomes of these risk assessments and simulation models.[51]

Site-specific gas cloud modeling is the most effective method to understand the hazard of flammable cloud dispersion. Kitimat LNG's consultant, DNV-GL, conducted a suite of gas cloud modeling simulations using its proprietary software Phast Risk v6.7 to better determine the risk frequency and consequence for an accidental release of LNG. This software, also known as 'Safeti,' as cited by the TERMPOL Guide is an accredited gas cloud modeling program.

The proponent applied worst-case factors (atmospheric conditions and cargo tank hole-size) into PHAST to produce worst-case gas cloud dispersion distances at critical locations along the route. The simulations examine accident frequency and consequence at three locations:

- Hartley Bay
- Kitkatla
- The project terminal site

The results find that a release due to grounding near Hartley Bay that has the potential to reach a populated area. The pool fire hazard zones from an equivalent hole diameter of 1100 mm extends 518 m inland from the coastline, reaching the community of Hartley Bay.

Additionally, the LFL dispersion extends 1445 m inland from the coastline. While the proponent states that this is a conservative assumption, the proponent should demonstrate that all mitigations have been implemented to reduce the risk in the area surrounding Hartley Bay to as low as reasonably practicable.

Simulations run at the terminal consider site-specific operational and mechanical contributors, including another vessel striking the LNGC at berth and the LNGC striking the jetty structure. Potential consequences are generated using parameters such as released material, release condition, duration, wind speed, wind stability, atmospheric condition, and surface roughness.[52] The simulation outcomes evaluate the individual risk posed by these potential accidental LNG releases.

The B.C. Oil and Gas Commission (BC OGC) is the responsible authority for issuing criteria for risk tolerability for LNG facilities, including Kitimat LNG. As per BC OGC requirements, the proponent expresses risk to the public in terms of a Location Specific Individual Risk (LSIR). This risk is defined as the risk that a single person present at the site 24 hours per day, 365 days per year could theoretically experience. The risk to the public is typically assessed on land that is outside the care and control of the proponent. It does not consider the total number of people present.

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[51] TP 743E: 3.15 General Risk Analysis and Intended Methods of Reducing Risks
[52] Kitimat LNG TERMPOL Submission – Element 3.15. General Risk Analysis and Intended Methods of Reducing Risks, pg 63

According to the Liquefied Natural Gas Facility Permit Application and Operations Manual, acceptable LSIR to the public is defined as less than or equal to 1×10^{-6} per year (1 in 1 million), with intolerable risk to the public set at greater than or equal to 1×10^{-4} per year (1 in 10,000).

For LSIR levels to the public that fall between $1x10^{-4}$ and $1x10^{-6}$, the proponent must demonstrate they have reduced the risk level to "as low as reasonably practicable" (ALARP) to satisfy the BC OGC. The risk is estimated for an LNG release during loading at the terminal.

The proponent states an LSIR of $1.9x10^{-4}$ which falls within the BC OGC's conditionally tolerable risk region and would satisfy their risk criteria if the risks in this region are demonstrated to be low as reasonably practicable.

Recommendation 35: The TERMPOL Review Committee recommends that Kitimat LNG engage with municipalities, Indigenous communities and stakeholders along the route to raise general understanding of liquefied natural gas, including associated risks, mitigations in place, and emergency preparedness plans.

Recommendation 36: The TERMPOL Review Committee recommends Kitimat LNG liaise directly with municipalities, Indigenous communities and stakeholders to develop a comprehensive response and contingency plan for accidental or intentional release of liquefied natural gas from the project terminal or carriers while at berth. This plan should be in place before the terminal is commissioned and operations begin.

3.3 TERMINAL OPERATIONS

3.3.1 MARINE TERMINAL

Kitimat LNG submitted marine terminal site plans and accompanying technical data, cargo transfer and transshipment systems, and berth procedures and provisions to the TRC as part of its TERMPOL submission. Although environmental concerns related to the location and construction of the terminal are outside the scope of the TERMPOL Review Process, the TRC believes it to be prudent to analyze the marine safety components of LNG terminal operations. For that reason, this section analyzes Kitimat LNG's proposed site plans based on the following principles:

- The terminal must meet all federal, provincial, and local spill planning, preparedness and response requirements.
- Before operations can begin at the project terminal, the terminal operator must comply with Canadian and International regulatory frameworks for marine terminal security.

The B.C. Oil and Gas Commission (BC OGC) is the responsible authority for regulating operational requirements for LNG marine terminals in British Columbia. The BC OGC has jurisdiction over the design, construction, operation, maintenance and enforcement of LNG facilities and LNG transfer equipment on the shore side of the ship-to-shore interface. The BC

OGC requires adherence to CSA Z276, and views the British Standard Institutes BS EN 1474-1 as suitable design standard for LNG transfer systems.

The proponent must apply to the BC OGC for a LNG facility permit, and, if the permit is issued, must submit to the satisfaction of the BC OGC documents prior to receiving a leave to construct and leave to operate a LNG facility. If the project proceeds, the BC OGC will monitor the proponent's ongoing compliance with several regulations under the *Oil and Gas Activities Act.* Specifically, the proponent would need to adhere to CSAZ276 and provide:

- Design and safety studies respecting the siting of the proposed LNG facility and all of its equipment
- A hazard identification study
- A process hazard analysis
- A safety integrity level study

The proponent is also subject to the BC OGC's Safety and Loss Management Program (SLMP) requirements, which is part of the province's *Liquefied Natural Gas Facility Regulation*. This program provides the administrative, maintenance and operating controls that would supplement the risk mitigations the proponent has proposed. The facility must put an SLMP in place that includes integrity management, emergency response plans, security plans, fugitive emissions management, and management of change. The SLMP must be in place before operations begin.

The BC OGC also requires emergency response and management plans to be updated annually, or more often as required by the proponents change management processes. The BC OGC has an audit system to ensure regular review and compliance of the proponent's operations. Terminal permit holders are also required to conduct an emergency management exercise every year, with a full scale exercise every three years. The BC OGC attends all full scale exercises and will assess table top exercises based on previous exercise evaluations and other risk factors the commission identifies.

Finding 31: As a BC OGC terminal permit holder, Kitimat LNG would be required to conduct an emergency management exercise every year, and full-scale exercise every three years with a BC OGC representative in attendance.

The TRC agrees terminal operations must meet the applicable standards, codes and industry best practices. This includes proper and thorough training of terminal staff. Additionally, the construction of the terminal to be in accordance with industry standards for LNG terminal design and Canadian code, including the National Building Code of Canada, Canadian Standards Association, and International Safety Guide for Oil Tankers and Terminals. The proponent's studies include a comprehensive list of applicable standards it will meet.[53]

[53] Kitimat LNG TERMPOL Submission – TERMPOL 3.10 Site Plans and Technical data, 4.18 Operational Safety Procedures and Facilities, pg 40

The proponent conducted preliminary berthing analysis as part of their TERMPOL submission. An in-depth analysis of the final design loads for the terminal will be determined and verified during the final design stage. This includes wind and wave thresholds for when the terminal would suspend loading operations. All aspects of berthing and berthing equipment will be tested before operations begin.

Ensuring compatibility between the project carriers and terminal is another crucial aspect to safe facility operation. Development of new natural gas projects worldwide has increased demand for higher capacity carriers. As a result, it is important to assess terminal navigation compatibility, berthing and mooring compatibility, marine loading arm compatibility, storage capacity compatibility, and personal access compatibility. Before operations begin, the proponent will complete a Ship-Shore Compatibility Study to ensure carriers are appropriately configured to the terminal.

Recommendation 37: Kitimat LNG should complete and submit a Ship-Shore Compatibility Study for its terminal operations to the TRC prior to the terminal commencing operations.

Recommendation 38: The proponent should provide a "Formal Safety Assessment" of the cargo transfer system and ship-shore interface to the TRC prior to the terminal commencing operations.

Before operations begin, the proponent must also complete the PPA's 'New Terminal Checklist.' The checklist helps ensure:

- The proponent understands the pilotage requirements for the safe transit of project carriers to and from the terminal.
- The project's design vessels can safely negotiate approaches to and from terminals/loading areas in compulsory pilotage areas.

Six months before operations begin, the proponent should also ensure the availability of:

- Bathymetry data for terminal/loading areas and approaches
- Adequately-scaled charts for the terminal/loading areas and approaches
- Plans of the proposed facility and safe pilot access routes via e-navigation charts suitable for loading to a portable pilot unit

Recommendation 39: Kitimat LNG should complete and submit the new terminal checklist to the Pacific Pilotage Authority within the identified timeline prior to commencing operations.

Recommendation 40: The proponent should incorporate safety checklists outlined in the most current version of the SIGTTO publication "Liquefied Gas Handling Principles on Ships and in Terminals" into their operational procedures.

Recommendation 41: Kitimat LNG, should develop a training program for everyone involved with terminal operations. The training program should include criteria from clauses 13.2 to 13.6 of the CSA Z276-18 and chapter 14 of the Standard for the Production, Storage, and Handling of

Liquefied Natural Gas (59A) regarding the minimum standards for safe operations and maintenance of liquefied natural gas terminals and for personnel training.

Safety zone

Kitimat LNG has proposed to establish a 'safety zone' surrounding their marine terminal facility.[54] A safety zone could protect individuals from hazards present at the LNG terminal, while also providing a secure barrier preventing disruption from outside influence. The proponent states the safety zone will be determined based on the final design of the facility and in accordance with relevant requirements.

Existing Canadian legislation offers little guidance in regards to control zones at Canadian LNG terminals, making them an uncommon mitigation measure for LNG operations in Canada. Currently, only the Canaport LNG terminal, located at Port Saint John in New Brunswick, has a designated safety zone. However, Canaport LNG terminal operates within a Federal Port Authority, unlike the proposed Kitimat terminal. As a result, the Saint John Port Authority has the ability to establish such control zones. When there is no designated Port Authority presiding over the terminal, establishing a marine control zone is much more challenging.

However, as previously mentioned, on March 18th 2013, Government of Canada announced its intention to designate the port of Kitimat as a public port as part of the World Class Tanker Safety initiative. Once designated, the newly created port authority will have the authority to put better traffic control measures, including safety zones, in place to promote the safe movement of vessels in the Douglas Channel.[55]

Finding 32: In the absence of a designated Port Authority, Transport Canada and other appropriate authorities should review the issue of safety zones for liquefied natural gas terminals with the aim of establishing a consistent approach that account for specific circumstances of each marine terminal, whether under the jurisdiction of a Port Authority or not.

Operation during construction of the project terminal

As mentioned, the Kitimat LNG project will be delivered in two phases; phase one will consist of 75 vessel calls, with an additional 75 coming during phase two as the project reaches its full build scenario. The simultaneous phase one operation of project terminal and construction of the phase two terminal creates a unique risk profile for onsite construction workers. Kitimat LNG must address this risk through commitments to industry best practices to lessen risk.

The Chevron Corporation is a member of the American Petroleum Institute (API) whose mission is to promote safety across the oil and natural gas industry globally. API has published a number of process safety recommendations and practices that address the concerns of major hazards

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[54] Kitimat LNG TERMPOL Submission - Element 3.15. General Risk Analysis and Intended Methods of Reducing Risks, pg 159

[55] Government of Canada. "World-Class Tanker Safety" https://www.tc.gc.ca/media/documents/marinesafety/world-class-tanker-safety.pdf

impacting safety, environmental damage, and business losses. They state that while permanent buildings located near processing areas are usually constructed to be blast and fire resistant, portable buildings used during construction phases may not offer the same level of protection if an accident were to occur. As a result, personnel occupying portable buildings are more susceptible to injuries from structures failures, building collapse, and building debris and projectiles.

API's Recommended Practice 753 (RP-753) provides guidance for reducing the risk to personnel located in portable buildings from potential explosion, fire, and toxic release hazards.[56] Guidance is provided based on the following principles:

- Locate personnel away from covered process areas consistent with safe and effective operations
- Minimize the use of occupied portable buildings in close proximity to covered process areas
- Manage the occupancy of portable buildings especially during periods of increased risk including unit start up or planned shutdown operations
- Design, construct, install, and maintain occupied portable buildings to protect occupants against potential hazards
- Manage the use of portable buildings as an integral part of the design, construction and maintenance operation of a facility

Finding 33: The TRC finds the American Petroleum Institute's Recommended Practice 753: Management of Hazards Associated with Location of Process Plant Portable Buildings an adequate practice to follow during the simultaneous operation of the project terminal in phase one and construction of phase two.

Recommendation 42: The proponent should commit to following API's RP-753 during the simultaneous operation of the project terminal in phase one and construction of phase two.

Fire protection systems and first responder training

Fire proofing for some of the structure and storage tank skirts will minimize the likelihood of fire-induced equipment failure. The proponent's systems will be included in the final design.

The proponent has committed to:

- Installation of a Fire and Gas System (FGS) for detection and protection in the event of a fire or leak
- Installation of an Emergency Shutdown System and Emergency De-pressuring Equipment

The FGS will provide detection and mitigation actions in response to a loss of containment or fire. In the event of a fire or leak, the FGS will detect potentially hazardous conditions. It will

[56] http://www.api.org/oil-and-natural-gas/health-and-safety/process-safety/process-safety-standards/rp-753

then sound operator and plant alarms and provide signals to activate fire suppression systems while closing heating, ventilation, and air conditioning intakes if necessary. The FGS systems will be designed in accordance with the relevant National Fire Protection Association and Canadian codes, standards and regulations. Fire hydrants will be stationed throughout the facility as to allow at least two hose streams to reach all areas of the process area.

The Emergency Shutdown System (ESD) protect the mechanical integrity of equipment and piping systems, while the Emergency De-pressuring Equipment reduces incident severity and risk of escalation. Valves will be installed in strategic locations throughout the plant to isolate hydrocarbon sources in the event of a breach.

The following steps outline the procedure followed for an emergency shutdown of the loading system:

1. Send ESD signal to the ship
2. Trip all shore pumps
3. Open all shore pump kickback valves
4. Close shore main LNG header shutdown valve
5. Close loading arms isolation

The following steps outline the emergency shutdown of marine systems if the loading arm motion exceeds the allowable operating parameters:

1. Send ESD signal to the ship
2. Trip all shore pumps
3. Open all shore pump kickback valves
4. Close main LNG header shutdown valve
5. Close loading arms isolation valves
6. Close Powered Emergency Release Couplings' double ball valves and activate the Emergency Release Coupler

The proponent should also commit to stationing a properly equipped firefighting tug on standby at the terminal 24/7 when a carrier is present. The tug is necessary for immediate emergency response at the terminal, including incidents during loading arm operations, and on the bridge/trestle structure. The tug should be rated FiFi-1 at minimum.

<u>Recommendation 43:</u> A tug with firefighting capabilities should be stationed 24/7 at the project terminal for the duration of the operation to increase fire prevention and protection.

Additionally, the BC OGC is supporting the development of LNG-specific training for first responders at the terminal. In partnership with industry, the Justice Institute of B.C. is designing a course to meet the needs of both industrial incident response personnel and those of communities where LNG activities may occur.

<u>Finding 34:</u> LNG specific training for emergency first responders would greatly benefit the proponent's emergency preparedness for project operations

General education and awareness efforts for the study area

The TRC recognizes the need for Kitimat LNG to conduct meaningful engagement with marine stakeholders and small vessel owners on a range of marine issues, including vessel interactions near the project terminal and along the project route.

The proponent should work to promote greater understanding of vessel interactions in the context of LNG shipping. The TRC recognizes there are concerns related to interactions between small vessel traffic and project carriers. Increasing education about safe boating practices around large vessels, which have limited manoeuvrability and sight, will be beneficial.

The TRC also recommends that Kitimat LNG work with appropriate authorities to develop an engagement and awareness strategy with respect to safe navigation and preventing collisions. The strategy should target recreational boaters, fishing vessel operators, and operators of small vessels. To minimize interactions with fisher and recreational boaters, the proponent will communicate tug and carrier schedules to make other waterway users aware of approximate times when project vessels will be in the area.

The TRC notes the success of the collaborative Voyage of a Vessel presentation, which is led by Transport Canada and features participation from the PPA, CCG and other marine partners. This presentation seeks to provide clarity regarding the roles of each agency, while highlighting the effectiveness of existing regulations and controls. The TRC strongly advocates for this kind of engagement, believing it raises awareness of Canada's joint efforts in this critical area

Recommendation 44: The proponent should regularly communicate with marine users, including recreationalists, commercial tourism operators, and commercial, recreational and Indigenous fishers, as well as TC, DFO, and other relevant authorities to promote safe boating practices around LNGCs.

Recommendation 45: Kitimat LNG should provide input to the appropriate authorities for the development of an engagement and awareness strategy in regard to safety of navigation and prevention of collisions targeting recreational boaters, fishing vessel operators, and operators of small vessels and shipping/agents.

3.3.2 BERTHING AND MOORING PROCEDURES

Before the Master or pilot brings a vessel into berth, they must be confident that the facility is suitable for the vessel. Kitimat LNG submitted detailed information on:

- The berthing facility and its location, including appropriate water depth and area for manoeuvrability for vessels
- Appropriate environmental and marine conditions for LNGCs, which will be confirmed during the design phase of the project

The proponent notes the selected berth location was chosen to optimize key criteria such as, navigational approach and departure conditions, adequate water depth, and suitable foundation conditions. There is sufficient UKC around the berth face for project carriers and construction support vessels, and the placement of the berths would not require dredging. Additionally, the Douglas Channel is approximately 3,000 m wide in the vicinity of the terminal, providing ample space to manoeuvre vessels into berth.

Geotechnical investigation of the terminal site

Offshore geotechnical investigations of the terminal site in Bish Cove have been done in 1997, 2006, and most recently in 2011 by Stantec on behalf of the proponent. Findings reveal that the proposed berth area sits on an area of soft silt, sand, and clay varying from 5 m to 30 m below the seabed. Strong granitic bedrock lies below that.[57]

The reports conclude that liquefaction of the soil could occur during a seismic event, making it unsuitable to support significant vertical loads. The proponent states that all structural piles for the LNG jetty will be driven into the firm bedrock below the soil, and that possible liquefaction will be taken into consideration during the detailed design phase. Mitigations may include densifying the existing soils or designing structures to withstand liquefaction.[58]

Recommendation 46: The proponent should provide the TRC with an updated version of the Marine Foundation Design during the detailed design phase of the project. It should take into consideration the potential liquefaction of soils in Bish Cove, and provide mitigation in case of a seismic event.

Marine structures and safety systems

The berth at the Kitimat LNG terminal will be equipped with breasting and mooring dolphins that absorb the kinetic energy of the berthing vessel and secure the bow and stern lines to shore. Some prominent safety features include:

- The fender system on each breasting dolphin is specifically designed to absorb the contact energy of the carrier on arrival.
- The quick release mooring hooks, which are standard equipment for marine terminals handling bulk liquids, ensure carriers are secured to the berth through a series of anchor points to hook to mooring lines. Each set of hooks includes a local alarm and failure light to indicate load limit overload.
- The Vessel Docking Assistance System measures and displays in real-time the distance to berth, angle and speed of approach, as well as the direction of a vessel from up to 200 m off the berth.[59]

[57] Kitimat LNG TERMPOL 3.10 Site Plans and Technical Data. Page 11.

[58] Kitimat LNG TERMPOL Submission - Element 3.10. Site Plans and Technical Data, pg 12.
[59] Ibid, pg 8.

- The Metocean Monitoring System will assist the Master, pilot, and attending tug by transmitting real-time wind, wave, current, and tide information to the pilot's Portable Pilot Unit.[60]
- The Mooring Load Monitoring System monitors and displays load levels for each individual mooring load line.

The design of the terminal allows for worker access to the berthing dolphin catwalks, and sufficient manoeuvring access for service vehicles. The proponent will also staff a control room in the Marine Terminal Building used to monitor the cargo transfer and control some of the ship to shore interface.

There is value in having an on-site, fully-staffed and trained control room dedicated to monitoring terminal operations. Consistent communication between vessel crew, terminal operators, tug crew, and all parties involved in loading or unloading of cargo is critical while a carrier is at berth. Having a working, dedicated Local Area Network integrated into all information systems would be beneficial in maintaining communication.

Recommendation 47: Kitimat LNG should ensure the control room is fully staffed when a vessel is at the berth to maintain consistent communication between all parties involved in the loading or unloading of cargo to prevent emergency situations.

Aids to navigation – terminal/jetty

The proponent has committed to the installation of navigational lights on the outer berthing and mooring dolphins. Sector lights were recommended by the BCCP to assist with vessel manoeuvring. Lights will have a minimum visibility of five nautical miles at night, and conform to IALA recommendations.

These lights must be independently powered, and not interfere with existing CCG navigational lights or aids, or with the visibility of mariners transiting the area. Transport Canada has authority for approving any proposed private aids to navigation on the terminal under the *Navigation Protection Act*, and will do so based on advice from the Aids to Navigation branch of the CCG.

Finding 35: Transport Canada and the Canadian Coast Guard will review the proponent's final terminal design to determine the potential for additional private aids to navigation.

Clearances and minimum distance between berth and centre of the channel

The location of the jetty and terminal provides sufficient depth for berthing the project's largest design carriers. The TERMPOL Guidelines recommend that the minimum distance between the berth and the centre of the channel exceed six times the beam of the design vessel. The Q Flex beam is 50 m, which puts the minimum recommended distances at 300 m. The terminal berth is

[60] Kitimat LNG TERMPOL Submission - Element 3.13. Berth Procedures and Provisions, Page 23.

in the sheltered waters of Bish Cove, and sits a minimum distance of approximately 1,500 m from the centreline of the Douglas Channel.[61]

Finding 36: The location of the project berth and jetty provides sufficient distance between berth and the centre of the channel and sufficient manoeuvrability area for project carriers to and from the berth.

3.3.3 CARGO TRANSFER OPERATIONS

While in Canadian waters, vessels transferring LNG to terminals must comply with the *Vessel Pollution and Dangerous Chemicals Regulations* enacted under the *CSA, 2001*.

As part of the TERMPOL Review Process, the proponent must prepare both a Port Information Book, and a Terminal Operations Manual, and provide copies of both to the TRC before terminal operations begin. The Port Information Book outlines specific route details for carriers calling at the marine terminal, including but not limited to:

- Berthing strategies and operational limits
- Pilot and escort tug assistance details
- Designated anchorages
- Emergency measures

As per Section 3.14.2 of the TERMPOL Guidelines, the Port Information Book should also include a schedule of the communications that the Master of the vessel must initiate, as vessel personnel and the terminal's cargo transfer staff have little communication during the preparatory phase of a cargo transfer operation.[62]

The Terminal Operations Manual informs a project vessel's crew of important subject matters that affect the safety of the vessel, the terminal, and the efficiency of the cargo transfer operation. There are a number of subject matters that are required to be in the terminal Operations Manual:[63]

- Inspections, testing and preventative maintenance of terminal berth equipment used by vessels
- Pre-arrival and departure operational tests and checks of vessel's machinery and equipment
- Cargo pre-transfer inspections, checklists, and conferences
- Vessel-terminal hose-manifold connections, vessel-terminal communications and chain of authority

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[61] Kitimat LNG TERMPOL Submission – Element 3.10. Site Plans and Technical Data, pg 4

[62] TP743E: TERMPOL Review Process 3.14 Port Information Book
[63] TP743E" TERMPOL Review Process 3.15 Terminal Operations Manual Section

- Cargo handling procedures, including emergency shut-down procedures, safety precautions and vessel-oriented emergency procedures that would be included in the terminal's contingency plans
- Receiving facilities for waste oil, ballast, dirty ballast, slops and garbage

Finding 37: The proponent will provide copies of its Port Information Book and Terminal Operations Manual to the TRC for information six months prior to the first cargo loading.

Recommendation 48: Kitimat LNG should ensure its Port Information Book and Terminal Operations Manual are available to liquefied natural gas shippers and their agents to ensure understanding and compliance with their contents.

All terminal operations, including loading, would be monitored in real-time by the control room staff. As referenced in Section 3.3.2, the proponent's terminal design includes a two-stage Emergency Shutdown system that would stop the flow of LNG should systems malfunction. LNG transfer would stop if carriers exceed operating limits, or sudden carrier movements occur due to wind or mooring failure. While the system is designed to operate electronically, the proponent will ensure controls exist for manual operations, as needed.

The proponent must also ensure redundancy and isolation capability to allow for loading arm maintenance and loading operations to occur simultaneously.

3.4 LNG RELEASE/OIL SPILL PREPAREDNESS AND RESPONSE

This section discusses regulatory requirements, best practices, and Kitimat LNG's actions to address two key pillars in Canada's approach to dealing with ship-source spills:

1. Preparedness and response
2. Liability and compensation

LNG spill preparedness and response regulations and frameworks

The Emergency Management Act outlines the responsibilities of the federal government and Public Safety Canada during an emergency. Public Safety Canada is responsible for:

- Leading emergency management in Canada by coordinating emergency management activities among government institutions, provinces, and any other pertinent entities
- Establishing policies, programs, and other measures for emergency management plans
- Providing advice to government institutions on the subject

Federal agencies provide assistance in the event of a spill, with a designated lead for every type of environmental emergency. Section 180(1) of the *CSA, 2001*, along with the *Oceans Act*, make the CCG the lead federal response agency responsible for ensuring an appropriate response is provided either by the responsible party (or polluter) or by the CCG to all vessel-source and unknown source pollution incidents in waters under Canadian jurisdiction.

When the polluter is known and is willing and able to respond, the CCG will advise the polluter of its responsibilities under the *CSA, 2001*. However, in cases where the polluter is unknown, unwilling or unable to respond, the CCG will assume the overall management of the incident. In all cases, CCG Environmental Response will ensure an appropriate response.

The Tanker Safety Expert Panel Phase II Report (TSEP II) reviewed preparedness and response requirements for ship-source HNS releases and recommends an HNS program be established to augment Canada's preparedness and response capacity for HNS incidents. An HNS program would be designed to foster capacity across industry to prepare for and respond to ship-source HNS incidents and releases of HNS when vessels are interfacing with land-based facilities. The Panel's recommendations will serve to inform the Government in its policy work and planning of further actions to continue improving marine safety across the country.

TC and the CCG are engaging with stakeholders and Indigenous groups to put in place a more formal approach to prepare for and respond to hazardous and noxious substance releases, including releases of LNG. Through the *Oceans Protection Plan, the Government of Canada is considering an approach that takes action in three phases over several years:*

- Phase 1 will strengthen the foundation of hazardous and noxious substances preparedness and response by clarifying the current system
- Phase II will make step-by-step improvements to strengthen industry and government preparedness
- Phase II will evaluate and improve the national program to reflect changing conditions.

International treaties

The IMO focuses on improving safety at sea and preventing pollution from vessels. Canada is a signatory to several of its international conventions pertinent to preparedness and response all LNG carriers (LNGCs) operating in Canadian waters must follow. Two such conventions are the SOLAS and MARPOL. The International Safety Management Code (ISM) establishes an international standard for the safe operation of ships and pollution prevention.

SOLAS outlines the requirements for fire protection, fire detection, and fire extinction as part of a vessel's contingency plans. SOLAS also dictates three emergency preparedness measures required onboard vessels. They include:

- Identifying potential shipboard situations and establishing procedures for response
- Establishing programs for drills and exercises to prepare for emergencies
- Ensuring that the vessel's crew can respond at any time to hazards, accidents, and emergency situations involving its ship; the safety management system should provide these measures

The IMO has also established the Protocol on Preparedness, Response, and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol) as an addition to the International Convention on Oil Pollution, Preparedness, and Co-operation (OPRC Convention). It is designed to follow similar principles to the OPRC Convention and

subjects ships carrying HNS and HNS handling facilities involved in transfer activities to or from a ship to preparedness and response programs generally similar to those in place for oil incidents.

The IMO has developed the International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC). The code provides an international standard for the safe transport by sea in bulk of liquefied gases and certain other substances, by prescribing the design and construction standards of ships involved in such transport and the equipment they should carry. This helps minimize the risk the products involved pose to the ship, its crew and to the environment.

International guidance

SIGTTO publications serve as industry best practices in addition to IMO requirements. The IMO and SIGTTO have published guidelines on creating a single Shipboard Marine Pollution Emergency Plan (SMPEP) for gas carriers: *Guidelines for the Development of SMPEP's of Oil and/or Noxious Liquid Substances* (Resolution MEPC.85 [44], as amended by resolution MEPC.137 [53]).

The International Chamber of Shipping has published the *Tanker Safety Guide* (Liquefied Gas) that outlines the properties of LNG, precautions, hazards, and emergency procedures.

Domestic frameworks

At the domestic level, Canada has a number of existing requirements for reducing the risk of HNS incidents at sea. The *Vessel Pollution and Dangerous Chemicals Regulations* created under the *CSA 2001* restrict the discharge of certain substances and chemicals, and impose construction/equipment standards for gas carriers in waters under Canadian jurisdiction and for Canadian vessels everywhere. Project carriers must meet terminal operators' emergency prevention and preparedness requirements.

Liability and compensation

The International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996 (1996 HNS Convention) establishes a two-tier liability and compensation regime based on the 'polluter pay' principle in the event of an accident at sea involving HNS substances.

- Tier one is the ship owner's strict liability, backed by insurance, depending on the gross tonnage of the vessel, which can be as high as $209 million per incident. With strict liability, vessel owners will be held strictly liable. Insurance coverage will therefore be mandatory under the Convention.
- Tier two is an HNS Fund, paid into by receivers of HNS, will provide compensation up to a maximum of approximately $454 million, including any amount under the first tier.

In 2010, the HNS Protocol was adopted as an amendment to the 1996 HNS Convention. Canada signed the Protocol on October 25, 2011 and incorporated the Convention by amending the

Marine Liability Act in 2014. In April of 2018, the Government of Canada announced its ratification of the 2010 Hazardous and Noxious Substances Protocol. Once the Protocol comes into force, a new global compensation fund to compensate affected individuals and communities will be established.

Oil spill preparedness and response regulations and frameworks

LNGCs that call at the Kitimat LNG marine terminal will be considered a "prescribed vessel" under Canada's Marine Oil Spill Preparedness and Response Regime due to their size. In the event of a release of oil Transport Canada, as the lead federal regulatory agency for the Regime, is responsible for:

- Providing regime management and oversight
- Developing regulations and standards related to the *CSA, 2001,* Part 8
- Ensuring compliance and enforcing the *CSA, 2001* and its applicable regulations
- Overseeing an appropriate level of preparedness, through the Certification of Response Organizations (ROs)

The Regime took effect in 1995 using the 'polluter pay' principle and is a partnership between government and industry. It is governed under the *CSA, 2001,* Part 8 and its regulations and standards.

Industry, as the generator of the risk, bears the liability and responsibility to respond to a marine incident in Canadian waters and, therefore, is charged with the operational elements of the Regime. Industry-funded and government-certified ROs maintain a level of preparedness, according to Canadian regulations and standards, to response to oil spills. Prescribed vessels entering Canadian waters must have an arrangement with appropriate certified Response Organizations for spill response. On the west coast, this is the Western Canadian Marine Response Corporation (WCMRC).

The CCG and ECCC also have roles in oil pollution planning and preparedness. For example, the CCG regularly conducts or participates in emergency response exercises with partners and stakeholders to ensure rapid response to incidents or potential incidents.

Kitimat LNG will also require project vessels to maintain emergency response plans for accidental release of cargo (LNG) or oil. These plans will place emphasis on human safety, LNG and oil spill source containment, as well as fire and explosion prevention and protection.

On-board emergency response is the obligation of the LNG carrier operators.

3.4.1 POLLUTION PREVENTION AND RESPONSE DURING TRANSIT

As part of the TERMPOL Review Process, proponents must submit a preliminary outline of a contingency planning manual that demonstrates the preparedness and response responsibilities of

a project. Included in the outline provided by Kitimat LNG is contingency planning as it relates to a ship in transit to and from the project terminal, such as:[64]

- Ship-Specific Emergency Plans
- Ship Oil Pollution Emergency Plans (SOPEP)
- Towage
- Anchorages and Holding Grounds

While emergency response is the obligation of the LNGC operators, Kitimat LNG has indicated that it will require all ships to provide the applicable sections of their Emergency Plans that will address topics such as cargo release, fire and explosions, groundings and collision, and loss of power.

Additionally, ships calling at the Kitimat LNG terminal will have to provide the proponent with the applicable sections of their SOPEP for the transit inside Canadian waters. It should outline the procedures taken in the event of an oil spill and contain a contact list for Canadian authorities, oil clean up teams, Port State Control, along with instructions on how to report events to the nearest Coast Guard Station.

The proponent has stated that they will provide a completed contingency planning manual to Transport Canada six months prior to the first cargo loading.

As previously discussed, the Government of Canada is developing an enhanced tanker safety system, including identifying opportunities to enhance Canada's prevention, preparedness, and response requirements related to HNS. In addition to compliance with future regulatory requirements, Kitimat LNG must require project carriers to follow LNG-specific operational procedures for safe cargo management onboard the ship. The proponent's LNGC safety regime should match SIGTTO requirements for "Liquefied Gas Handling Principles on Ships and in Terminals, and LNG Operations in Port Areas."

<u>Finding 38:</u> Matching the requirements of SIGTTO's "Liquefied Gas Handing Principles on Ships and in Terminals, and LNG Operations in Port areas" ensures Kitimat LNG will go above and beyond the compliance of regulatory requirements in Canadian waters.

Kitimat LNG must also ensure that onboard Emergency Response Plans are regularly integrated and tested in partnership with local first responders, such as the Western Canada Marine Response Organization (WCMRC).

The proponent's vetting criteria should ensure personnel are adequately trained in LNG safety, cargo, and emergency response operations, such as Incident Command System (ICS) training. The system, adopted by many emergency response organizations around the world, requires formal training to achieve competency and certification in applying the ICS methodology.

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[64] Kitimat LNG TERMPOL Submission – Element 3.18. Contingency Planning, Table of Contents

Masters, senior crew officers, terminal managers and key staff at the terminal should possess high-level ICS certification.

In addition to ensuring all staff are adequately accredited, the proponent should encourage or sponsor participants and stakeholders to enrol in this training. In particular, the proponent should apply particular focus to increasing the role of Indigenous communities in this process. The proponent can be inclusive, and work to formalize outreach and training for stakeholders along the carrier route.

Recommendation 49: *The TRC recommends that Kitimat LNG personnel receive formal, accredited Incident Command System training before operations begin.*

Recommendation 50: *The proponent should identify opportunities for enhanced engagement of Indigenous coastal communities along the project route, and various levels of government that may have a role in the Incident Command System.*

In general, the proponent should continue with a cooperative and inclusive approach to contingency planning. Many events can occur simultaneously during an emergency response, and each partner has unique responsibilities.

For instance, TC is the lead regulatory and governance agency for all ship-source spills and the overall response regime while ECCC remains the lead for land based spills from federally-owned facilities. The CCG, through DFO, has the powers, duties and functions set out in section 180(1) of the *CSA 2001* and therefore is the lead response agency in case of ship-source pollution spills.

The proponent should work directly with stakeholders to ensure that roles and responsibilities are well-defined ahead of any potential incident.

Places of refuge

TC is responsible for developing and managing the National and Regional Places of Refuge Contingency Plan, which provides the framework for ships in need of assistance seeking refuge in Canadian waters. In the event that a vessel pollutes or could possibly pollute the marine environment, the Vessel Pollution and Dangerous Chemicals Regulations set out the steps a Master or owner or marine facility operators must take. TC is the lead department for decisions related to vessels requesting assistance and place of refuge. The Places of Refuge Contingency Plan applies:

- To all situations where a ship in need of assistance requests a place of refuge within Canadian waters, including Canada's internal waters, territorial sea and the Exclusive Economic Zone
- Where a ship is destined for Canada has reported a problem (defect, deficiency or casualty)

The Pacific Region Places of Refuge Contingency Plan[65] complements the national plan by establishing a framework to respond to requests for assistance within the region. These plans provide a national framework that includes B.C.-specific measures that ensure an effective and efficient response to requests from ships seeking a place of refuge in Canadian waters. If a carrier requests assistance in the Dixon Entrance or Hecate Strait, the Places of Refuge Contingency Plan exists to:

- Stabilize vessel condition
- Reduce hazards to navigation
- Protect human life, the environment, and other socio-economic and cultural interests

This plan is based on the IMO's Guidelines on Places of Refuge for Ships in Need of Assistance. In this type of scenario, TC and the CCG cooperate along with Indigenous communities, industry partners and other authorities, to optimize the response to the request or need for refuge. If a vessel discharged or is likely to discharge pollution, authorities would follow the plan, response procedures and contingency plans.

Responders follow the plan to the extent possible given the time available for making decisions and the environmental conditions.

Canada's marine safety and security system is built on a foundation of cooperation with many of the departments, agencies, other levels of government, marine industries and Indigenous communities. By example, Transport Canada understands the benefit of engaging Indigenous communities to improve the Places of Pacific Refuge Contingency Plan, building on observations and lessons learned from past incidents.

3.4.2 POLLUTION PREPAREDNESS AND RESPONSE AT THE TERMINAL

The terminal's preparedness and response capabilities fall under land-specific regulations. Kitimat LNG will develop appropriate contingency plans in the event of releases of LNG or oil occur. The BC OGC confirms that the LNG Emergency Management Manual provides further detail on the expectations for developing such plans.

As per the B.C. *Liquefied Natural Gas Facility Regulation* and B.C. *Emergency Management Regulation*, an LNG facility permit holder must develop a safety and loss management program, which must satisfy the BC OGC, comply with CSA Z276, and include the development of an emergency response plan.[66] The *Emergency Management Regulation* requires that an LNG facility permit holder comply with the *Emergency Preparedness and Response for Petroleum and Natural Gas Industry Systems (CSA Z246.2).*

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[65] https://www.tc.gc.ca/eng/marinesafety/tp-tp14707-pacific-menu-3046.htm

[66] Liquefied Natural Gas Facility Regulations. BC Oil and Gas Activities Act. B.C. Reg. 146/2014. Part 4. Division 1. http://www.bclaws.ca/civix/document/id/complete/statreg/146_2014

Kitimat LNG's Emergency Response Plan will incorporate a specific marine plan that covers marine oil spill response and marine rescue response for the waters adjacent to the terminal as well as along the proposed marine route. The plan will include the different types of vessels with different response needs during the construction and operational phases of the project.

The Emergency Response Plan must include:

- procedures for responding to emergencies within the LNG terminal
- procedures for responding to emergencies that could affect the public
- methods for notifying agencies if an emergency was to occur
- training and exercises for emergency situations

The proponent must also establish agreements with various spill response organizations before operations begin. The plan would have to align with the BC OGC's Emergency Management Regulation.

Kitimat LNG's terminal contingency planning manual will include the following elements:[67]

- Security
- Inspections and Testing
- Monitoring Systems
- Safety Systems

The proponent should align emergency planning with the B.C. Ministry of Environment's Guidelines for Industry Emergency Response Plans. They should also make every visiting LNGC aware of the emergency procedures outlined in the project terminal contingency plan. LNGCs must meet emergency prevention and preparedness requirements under the *CSA, 2001* through its LNG Carrier Acceptance Program.

Recommendation 51: Kitimat LNG should refer to the most current version of CSA-Z276 and CSA-Z246, to inform its facility contingency planning requirements.

Recommendation 52: Before operations begin, Kitimat LNG should engage with the communities along the route and near the terminal to raise general understanding of liquefied natural gas and its production.

Recommendation 53: Kitimat LNG should submit emergency plans to the relevant authorities, including Transport Canada, for review six months before operations begin.

Recommendation 54: The proponent will ensure that all possible hazards are identified and that training is provided to all emergency responders, including coordination, communication, drills, and exercises.

[67] Kitimat LNG TERMPOL Submission - Element 3.18. Contingency Planning, Table of Contents

4. INDIGENOUS ENGAGEMENT

Indigenous communities living along established shipping routes on the West Coast have expressed interest in participating in TERMPOL Review Processes for projects that are proposed near their area.

Prior to the start of any TERMPOL Review Process, the TRC encourages proponents to engage directly with Indigenous groups (and other marine users and stakeholders) during the development of TERMPOL surveys and studies. The proponent's surveys and studies may examine or assess subjects of interest and importance to Indigenous groups, and should reflect local and traditional Indigenous knowledge to enhance the technical assessment of marine safety.

As part of the Kitimat LNG TERMPOL Review, The Government of Canada, as well as the proponent, are committed to a Parallel Aboriginal Engagement Process. This process is a condition established in 2006 through the Environmental Assessment of the Kitimat LNG project. The resulting 20 step work plan outlines the engagement process with Indigenous groups for both the federal government and proponent. The work plan is also consistent with the commitments made by Transport Canada and Kitimat LNG during the project's Environmental Assessment.

Engagement actions

At the start of the Kitimat LNG TERMPOL Review Process, Transport Canada, as Chair of the TRC, sent letters to ten Indigenous groups situated near the project route (see Figure 13). These letters included information on the proponent's request for a TERMPOL Review as well as general information about the process.

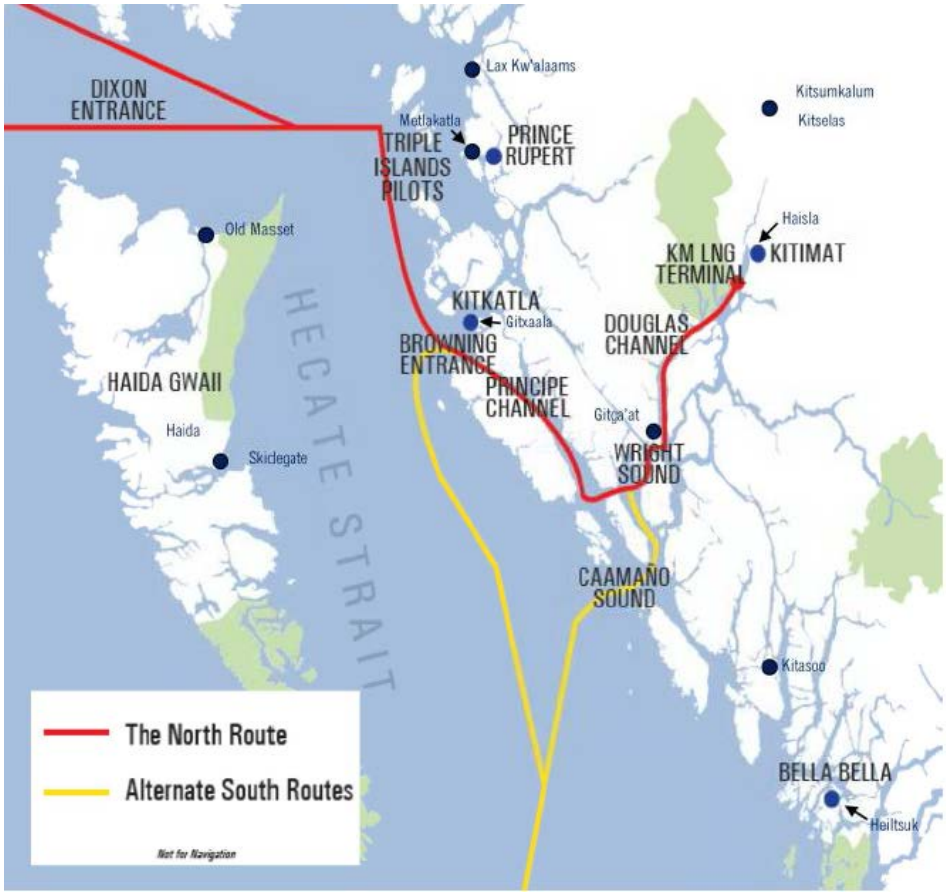

Figure 12 – Proposed Kitimat LNG Shipping Routes and Involved First Nations

A number of Indigenous groups were also invited to the proponent's Hazard Identification (HAZID) workshop held in 2015. Representatives from Gitga'at, Haisla, Kitselas, Gitxaala, Old Masset Village Council and Heiltsuk Nation took part in the two-day workshop, alongside representatives from TC, PRPA, BCCP, CCG, Seaspan, and Apache.

Throughout the TERMPOL Review Process, Kitimat LNG has maintained contact with Indigenous communities and provided updated information about their project proposal. In 2014, communities were notified of the completion of their TERMPOL Submission in a letter that summarized its content.

The proponent also developed a First Nations Engagement Report that details concerns raised by individual Indigenous groups, and planned mitigation measures to address these concerns. A draft copy of this report was shared with Indigenous representatives and Transport Canada in February 2018. The proponent also extended an offer to meet with relevant communities to discuss the details of the First Nations Engagement Report prior to the completion of the TERMPOL Review Process.

<u>Finding 39</u>: Kitimat LNG has expressed a willingness to engage with First Nations communities along the project route to discuss specific issues related to the increase in marine traffic from project operations.

In March of 2018, TC followed up with additional letters to Indigenous groups that are located along the project's North Route. Engagement with the Heiltsuk, and Kitasoo nations ceased when the decision was made by the proponent that LNGCs would not use the South Route for project operations. As a result, letters were sent to the following eight Indigenous groups:

- The Council of Haida Nation
- Gitga'at First Nation
- Gitxaala Nation
- Haisla Nation
- Kitselas First Nation
- Kitsumkalum First Nation
- Lax'Kwalaams Band
- Metlakatla First Nation

Letters were sent to validate aspects of Kitimat LNG's TERMPOL submission, and gather any additional views for consideration by the TRC and federal departments with regulatory responsibilities related to the project. Subsequent engagement meetings informed the TRC of various concerns that Indigenous groups had with the Kitimat LNG project. Between May and October of 2018, meetings were held with representatives from the following six Indigenous organizations:

- The Council of Haida Nation
- Gitxaala Environmental Monitoring
- Gitga'at Nation
- Haisla Nation
- Kitselas First Nation
- The Metlakatla Stewardship Society

Engagement outcomes

The engagement sessions demonstrated the importance of adequate risk mitigation for marine shipping projects for coastal Indigenous communities, as well as a desire to increase involvement in the TERMPOL Review Process and other Transport Canada marine safety initiatives. Generally, concerns can be divided into three broad categories:

- Project-specific concerns
- The use of traditional environmental knowledge
- The cumulative impacts of marine shipping traffic

Project-specific concerns

A number of Indigenous groups along the shipping route have expressed concern over the wake generated by project vessels and attending tugs on their coastal communities. As a result of the expanded scope of the project's Environmental Assessment, Kitimat LNG submitted a Vessel Wake Study as an appendix to their TERMPOL submission. The study finds that waves created by LNG carriers and tugs, when operating under normal conditions, are comparable to natural wave conditions of the Douglas Channel. Wave heights from LNG carriers travelling at speeds

up to 16 knots are estimated to be in the order of 0.1 m within the shore region, while tugs travelling at 12 to 16 knots are estimated to generate 0.2 to 0.3 m at the shoreline.

Despite the conclusions made in the Vessel Wake Study, wake from project traffic is of particular concern to Indigenous communities. This is especially the case during marine harvesting seasons as vessels and tugs may pass marine harvesters at a much closer distance than is considered in the Vessel Wake Study.

The proponent, along with coastal Indigenous communities, should develop strong communication channels to share information during key marine harvesting periods. Masters entering Canadian waters should be made aware of any seasonal fishery opens along the route, either through MCTS, or through information packages provided by pilots that come aboard. Communication between First Nations and the proponent should offer the opportunity for communities to raise issues, as well as the ability to monitor situations to see if the problem has been alleviated.

Kitimat LNG has committed to establishing a First Nations Communication Protocol that will outline procedures for the exchange of timely information on vessel and marine wildlife activity. The protocol will provide forward notice of transits as well as real time information about vessel activity. Additionally, the proponent will also establish a Complaint Protocol that will describe the process that communities should use to submit any complaints regarding shipping activities related to the project.

Recommendation 55: Kitimat LNG should confirm the results of their Vessel Wake Study in real world conditions through a wake verification program designed with the input from affected Indigenous groups.

Finding 40: Involving Indigenous groups early in the development and design of protocols, such as the First Nations Communication Protocol and the Complaint Protocol will foster greater two-way communication between the proponent and Indigenous marine users.

Recommendation 56: The proponent's First Nations Communication and Complaint Protocol should be finalized and shared with all Indigenous communities sixty days prior to the project's Final Investment Decision (FID).

Particular attention should be given to the impact of project operations on population centres near the project route, including Indigenous coastal communities. Passing LNGCs should be prudent in ensuring safety of community members. This includes:

- the sharing of schedules with marine operators in the communities, such as float plane services;
- managing vessel speeds when near coastal communities
- refraining from the venting of boil-off gas when passing population centres

Recommendation 57: The proponent should be mindful of the impact that project vessels have on Indigenous groups along the route and take necessary precautions to ensure safety when passing coastal communities.

There was also concern over the project's impact on the traditional territories of many Indigenous groups. This includes the impact of project operations on critical habitats for sea life, such as marine mammals, that are important to the history and culture of Indigenous groups. Kitimat LNG has committed to addressing potential impacts on marine life and the surrounding environment through the development of a Marine Mammal and Marine Environment Protection Plans. These plans will ensure that all regulatory requirements and best practices are followed and processes are identified to minimize impacts on the marine environment. This should include using best management practices for invasive species, implementing speed management plans, and developing monitoring programs where appropriate.

Recommendation 58: Kitimat LNG's marine mammal and marine environment protocols should include detailed information about the project's invasive management plan, and should be finalized 60 days prior to the project's Final Investment Decision (FID).

The use of traditional knowledge

Some nations emphasized the importance of incorporating traditional knowledge into the design of mitigation measures for project operations. Traditional knowledge refers to knowledge that is held by a specific group of people concerning their cultural and physical environments. Traditional knowledge has been passed down from one generation to the next through oral and written traditions and can be used to better understand the relationship Indigenous communities have with their traditional territory.

For example, the Haida Marine Traditional Knowledge Study used a series of semi-structured interviews to document Haida traditional knowledge of past and present marine features, resources and activities. Data from these interviews was projected onto a series of maps that detail culturally significant marine areas surrounding Haida Gwaii. This information can be useful to proponents like Kitimat LNG, who can use these studies to inform the development of their project operations.

Finding 41: Indigenous traditional knowledge, such as the Haida Marine Traditional Knowledge Study is both useful and important to understand the risks vessel traffic poses in culturally sensitive areas.

Recommendation 59: Kitimat LNG should be prudent in using the best available data to monitor environmental conditions along the route and mitigate potential impacts. This should include engagement with relevant authorities and Indigenous groups as to how data collection can be enhanced.

Cumulative impacts of marine shipping traffic

The focus of the TERMPOL Review Process is to address how project-specific marine transportation activities would change existing regional shipping activities. However, a number of Indigenous groups have raised concerns over the additional risks presented by multiple project proposals moving ahead, such as an increased risk of grounding in their territory. The TRC recognizes the importance of regional and cumulative impact assessment on the North Coast, where multiple marine terminal proposals are currently being developed.

As part of the *Ocean's Protection Plan*, the Government of Canada is collecting data from coastal communities, Indigenous partners, industry, provincial and municipal governments, and non-governmental organizations to develop a national Cumulative Effects framework. Work is also underway to develop a framework for proactive vessel management, that would facilitate collaboration between these parties to develop cooperative measures that could address cumulative effects. Through these initiatives, the Government of Canada will better understand the potential effects of regional marine vessel activity on the environment and help guide the design of future mitigation measures to prevent navigational incidents, such as groundings.

Some Indigenous communities have also developed specific programs to manage cumulative impacts. For example, The Metlakatla Cumulative Effects Management (CEM) Initiative tracks and manages the condition of specific values to the community, such as butter clams, economic self-sufficiency, and personal safety, that could be impacted by project development on Metlakatla territory. Ten values were ranked and prioritized in the first phase of the program, while subsequent phases have collected data to establish management benchmarks for monitoring programs.

Recommendation 60: Kitimat LNG should support Indigenous monitoring programs as a way to make positive contributions towards cultural programming that addresses cumulative impacts of marine shipping.

Following the release of the TERMPOL report, Transport Canada will offer all interested First Nations a technical briefing on the report's contents. These briefings will give Indigenous groups the opportunity to discuss the report's recommendations and findings and provide feedback on additional issues regarding the project, as well as their future involvement in the TERMPOL Review Process.

5. CONCLUSION

The TERMPOL Review Process examined the marine safety and accident prevention regime for the Kitimat LNG proposal. The goal of the TERMPOL Review Process is to assess if the project could reasonably proceed within risk levels consistent with Canada's regulatory regime and marine safety standards, and industry best practices.

Through TERMPOL, the proponent is responsible for ensuring the studies and surveys it provides meet the highest industry and international standards, including the risk assessment methodology and modeling. In the TRC's view, the proponent and their consultant, DNV-GL, submitted a credible set of studies and simulations for the Kitimat LNG project.

The report represents specific mitigations that target the project route, site and attending vessels, while others suggest improvement actions for departments, agencies and authorities with oversight of different aspects of the project. The aim is to improve, where possible, marine transportation elements of the Kitimat LNG proposal.

The TRC has developed a series of project-specific, targeted recommendations that the proponent could follow to enhance marine safety and prevent accidents in the shipping route, and at the terminal. The report represents consensus of participant agencies, departments and authorities responsible for governing and regulating marine shipping.

The TRC understands the potential introduction of LNG export on the west coast demands cooperative and continuous improvement from all relevant departments, agencies and authorities. For example, the PPA and BCCP are working to develop standardized pilotage and tug requirements for B.C.'s north coast. This type of initiative demonstrates the commitment of marine partners to safety on the water and at the terminal.

The fully built, two-train Kitimat LNG project would add 150 vessel calls per year, and export approximately 11 million tonnes per annum (MTPA). The proponent submitted their Tug Escort Policy, which includes the escort for project carriers at select locations along the route as well as the stationing of a rescue tug in Hartley Bay. The TRC does not find Kitimat LNG's proposed tug package provides enough mitigation of risk to ensure safe transit of vessels in and out of Canadian waters. Thus, the TRC recommends that a tug escort LNGCs between the project terminal and Browning Entrance. This includes tethered tug escort between Wright Sound and Nepean Sound. This will ensure adequate tug support to mitigate risk in all passages along the route with reduced channel width, including passing Emilia Island and Wheeler Island.

At the terminal, the proponent states that the terminal facility design will conform to CSA Z276. The BC OGC, the principal regulatory agency responsible for overseeing the construction, operation, and maintenance of the project terminal, will review design and safety studies upon submission of an LNG facility application. The proponent will have to demonstrate that the risks at the facility do not exceed the thresholds defined by the Liquefied Natural Gas Facility Permit Application and Operations Manual. As per the BC OGC, the proponent will also have to

demonstrate at a later date that the project will not exceed the *Liquefied Natural Gas Facility Regulation* thresholds.

TRC members recognize the importance of community and stakeholder awareness and participation. The proponent should seek to engage relevant communities, Indigenous groups, and marine stakeholders to develop a greater understanding and awareness of project impacts on water and on shore.

In closing, the TRC finds that the current regulatory regime would provide effective oversight for the marine transportation components of this project. The proponent has fairly represented the navigation and operational risks that could result in an accidental loss of containment of cargo and key mitigations to reduce these risks.

If aspects of the project design, vessel routing, marine construction and cargo loading operations change, the TRC may revisit the findings and recommendations of this report.

APPENDICES

APPENDIX 1 – LIST OF RECOMMENDATIONS AND FINDINGS

Recommendations

Recommendation 1: Kitimat LNG should provide relevant authorities with advance notice if changes are made to project commitments, operational parameters or characteristics.

Recommendation 2: LNGCs used for the Kitimat LNG project should travel at a safe speed that is mutually agreed upon by the Master and the Pilot, while taking into account the speed capability of tugs in escort.

Recommendation 3: If Kitimat LNG is inclined to pursue transit speeds faster than 12 knots within the Channel Section of the route, they should work with tugboat providers to develop a custom tug design that is still able to be effective in the event of an emergency at a higher speed.

Recommendation 4: The proponent should include in its Port Information Book that Masters must ensure project carriers are ready for immediate manoeuvring at all times, especially during critical points of transit. The engine room should also be fully manned at least one hour before arrival in Canadian waters, and remain manned until the vessel is alongside the marine terminal.

Recommendation 5: As part of their Carrier Acceptance Program, Kitimat LNG should ensure all carriers that call at the terminal possess a SIRE certificate that is no more than six months old.

Recommendation 6: Kitimat LNG should liaise directly with Transport Canada's Marine Security Branch to ensure compliance with all aspects of the Marine Transportation Security Regulations.

Recommendation 7: The TRC supports Kitimat LNG's commitment to not use the South Route. Use of this route should not be attempted without consultation with the PPA, confirmation of adequacy of NavAids, and full mission bridge simulations.

Recommendation 8: Kitimat LNG should ensure that venting of boil-off gases does not occur when pilots are boarding project carriers or during pilot transfer by helicopter.

Recommendation 9: The proponent should ensure that all tug operators used for the project have undergone T2 training.

Recommendation 10: Kitimat LNG should ensure tugs used for project operations take into account the findings and conclusions of the Manoeuvring Study of LNG Carriers to Kitimat B.C., and the Kitimat Waterway LNG Transit Simulation Study.

Recommendation 11: The TRC recommends that Kitimat LNG pursue full tug escort for both inbound and outbound vessels between the project terminal in the Douglas Channel and Browning Entrance, north of the Principe Channel.

Recommendation 12: Kitimat LNG should ensure that there are an adequate number of pilots on board project vessels at all times to be in accordance with the PPA's forthcoming Notice to Industry.

Recommendation 13: Escort tugs used in project operations should possess bollard pull capabilities above 92-tonnes to ensure adequate reserve power in emergency situations.

Recommendation 14: The proponent should ensure project tugs carry the required equipment to assist LNGCs in all emergency situations, including firefighting capabilities, rescue equipment, and load cells.

Recommendation 15: The proponent's LNG Carrier Acceptance Program should require that all vessels are equipped with a tow bitt that can withstand the forces generated by the tugs to ensure the vessel can be safely towed.

Recommendation 16: Kitimat LNG should submit its tug operations plan to Transport Canada, Pacific Pilotage Authority, Canadian Coast Guard, and the B.C. Coast Pilots at least six months before the start of project operations.

Recommendation 17: The proponent should become familiar with e-navigation and participate where appropriate for its operations. This tool is important to the ongoing enhancement of safe navigation and protection of the environment.

Recommendation 18: The TERMPOL Review Committee supports Kitimat LNG's commitment to engage local communities, Indigenous communities, marine users and stakeholders regarding specific project operations, timelines and accompanying mitigation measures. This engagement should be proactive and persistent.

Recommendation 19: Kitimat LNG should be pro-active in sharing LNG carrier schedules with marine operators that use the Inner Passage through Wright Sound, including both B.C. and Alaska State Ferries.

Recommendation 20: Increased vessel traffic crossing Grenville Channel as a result of project operations may warrant an enhanced standard of care in the area. The proponent should work with the BCCP and CCG to develop the operational requirements specific to this location.

<u>Recommendation 21:</u> The proponent should be vigilant in the sharing of information concerning vessel movements with seaplane operators along the route. The proactive sharing of schedules should be a minimum expectation of both parties.

<u>Recommendation 22:</u> Kitimat LNG should ensure that project LNGCs are made aware of any military exercises that are taking place along the route. These areas are out of bounds for marine traffic.

<u>Recommendation 23:</u> Kitimat LNG should include carrier speed profiles within its Port Information Book. The proponent must publish this book at least six months in advance of project operations.

<u>Recommendation 24:</u> The proponent should provide guidance on marine mammals to project carriers through the Port Information Book.

<u>Recommendation 25:</u> Kitimat LNG should continue its efforts to obtain information on concentrations of marine mammal populations, including Minke whales, to develop speed profiles and other mitigation measures for underwater vessel noise. This includes participation in regional initiatives, such as future Smart Oceans workshops, to obtain the best data available concerning marine mammals along the project route.

<u>Recommendation 26:</u> The proposed anchorages identified by the proponent should only be considered temporary anchorages to be used in the event of an emergency.

<u>Recommendation 27:</u> For non-emergency situations, LNGCs should maintain their position in safe waters by making circular turns or using a tethered tug to hold the vessel instead of anchoring.

<u>Recommendation 28:</u> The proponent should utilize best available weather reports and sea data so that LNGCs can safely navigate within a good weather window.

<u>Recommendation 29:</u> The proponent should support the efforts of the Pacific Pilotage Authority and the B.C. Coast Pilots to develop operational limits for liquefied natural gas vessel, informed through simulations.

<u>Recommendation 30:</u> The proponent should ensure it has enough tugs and crew personnel on standby at the terminal site to facilitate the safe arrival and departure of project carriers.

<u>Recommendation 31:</u> The proponent should make arrangements with the B.C. Coast Pilots so that a pilot can be available at minimal notice in case a LNGC leaves the berth in the event of an emergency.

<u>Recommendation 32:</u> The proponent should submit its draft tug operations plan to Transport Canada, Pacific Pilotage Authority, Canadian Coast Guard and B.C. Coast Pilots six months before project operations begin.

Recommendation 33: Kitimat LNG should take into consideration the findings of the Force Technologies "Manoeuvring Study of LNG Carriers to Kitimat" to inform the project's berthing requirements.

Recommendation 34: Kitimat LNG should liaise with the B.C. Coast Pilots to confirm operational limits for berthing tugs prior to the start of project operations.

Recommendation 35: The TERMPOL Review Committee recommends that Kitimat LNG engage with municipalities, Indigenous communities and stakeholders along the route to raise general understanding of liquefied natural gas, including associated risks, mitigations in place, and emergency preparedness plans.

Recommendation 36: The TERMPOL Review Committee recommends Kitimat LNG liaise directly with municipalities, Indigenous communities and stakeholders to develop a comprehensive response and contingency plan for accidental or intentional release of liquefied natural gas from the project terminal or carriers while at berth. This plan should be in place before the terminal is commissioned and operations begin.

Recommendation 37: Kitimat LNG should complete and submit a Ship-Shore Compatibility Study for its terminal operations to the TRC prior to the terminal commencing operations.

Recommendation 38: The proponent should provide a "Formal Safety Assessment" of the cargo transfer system and ship-shore interface to the TRC prior to the terminal commencing operations.

Recommendation 39: Kitimat LNG should complete and submit the new terminal checklist to the Pacific Pilotage Authority within the identified timeline prior to commencing operations.

Recommendation 40: The proponent should incorporate safety checklists outlined in the most current version of the SIGTTO publication "Liquefied Gas Handling Principles on Ships and in Terminals" into their operational procedures.

Recommendation 41: Kitimat LNG, should develop a training program for everyone involved with terminal operations. The training program should include criteria from clauses 13.2 to 13.6 of the CSA Z276-18 and chapter 14 of the Standard for the Production, Storage, and Handling of Liquefied Natural Gas (59A) regarding the minimum standards for safe operations and maintenance of liquefied natural gas terminals and for personnel training.

Recommendation 42: The proponent should commit to following API's RP-753 during the simultaneous operation of the project terminal in phase one and construction of phase two.

Recommendation 43: A tug with firefighting capabilities should be stationed 24/7 at the project terminal for the duration of the operation to increase fire prevention and protection.

Recommendation 44: The proponent should regularly communicate with marine users, including recreationalists, commercial tourism operators, and commercial, recreational and Indigenous

fishers, as well as TC, DFO, and other relevant authorities to promote safe boating practices around LNGCs.

Recommendation 45: Kitimat LNG should provide input to the appropriate authorities for the development of an engagement and awareness strategy in regard to safety of navigation and prevention of collisions targeting recreational boaters, fishing vessel operators, and operators of small vessels and shipping/agents.

Recommendation 46: The proponent should provide the TRC with an updated version of the Marine Foundation Design during the detailed design phase of the project. It should take into consideration the potential liquefaction of soils in Bish Cove, and provide mitigation in case of a seismic event.

Recommendation 47: Kitimat LNG should ensure the control room is fully staffed when a vessel is at the berth to maintain consistent communication between all parties involved in the loading or unloading of cargo to prevent emergency situations.

Recommendation 48: Kitimat LNG should ensure its Port Information Book and Terminal Operations Manual are available to liquefied natural gas shippers and their agents to ensure understanding and compliance with their contents.

Recommendation 49: The TRC recommends that Kitimat LNG personnel receive formal, accredited Incident Command System training before operations begin.

Recommendation 50: The proponent should identify opportunities for enhanced engagement of Indigenous coastal communities along the project route, and various levels of government that may have a role in the Incident Command System.

Recommendation 51: Kitimat LNG should refer to the most current version of CSA-Z276 and CSA-Z246.2, to inform its facility contingency planning requirements.

Recommendation 52: Before operations begin, Kitimat LNG should engage with the communities along the route and near the terminal to raise general understanding of liquefied natural gas and its production.

Recommendation 53: Kitimat LNG should submit emergency plans to the relevant authorities, including Transport Canada, for review six months before operations begin.

Recommendation 54: The proponent will ensure that all potential hazards are identified and that training is provided to all emergency responders, including coordination, communication, drills, and exercises.

Recommendation 55: Kitimat LNG should confirm the results of their Vessel Wake Study in real world conditions through a wake verification program designed with the input from affected Indigenous groups.

Recommendation 56: The proponent's First Nations Communication and Complaint Protocol should be finalized and shared with all Indigenous communities sixty days prior to the project's Final Investment Decision (FID).

Recommendation 57: The proponent should be mindful of the impact that project vessels have on Indigenous groups along the route and take necessary precautions to ensure safety when passing coastal communities

Recommendation 58: Kitimat LNG's marine mammal and marine environment protocols should include detailed information about the project's invasive management plan, and should be finalized 60 days prior to the project's Final Investment Decision (FID).

Recommendation 59: Kitimat LNG should be prudent in using the best available data to monitor environmental conditions along the route and mitigate potential impacts. This should include engagement with relevant authorities and Indigenous groups as to how data collection can be enhanced.

Recommendation 60: Kitimat LNG should support Indigenous monitoring programs as a way to make positive contributions towards cultural programming that addresses cumulative impacts of marine shipping.

Findings

Finding 1: Implementation of TERMPOL Review Committee recommendations require individual agreement between the proponent and the responsible authorities.

Finding 2: The Ship Inspection Report Programme (SIRE) and Tanker Management Self-Assessment Survey (TMSA) are important tools terminals and energy companies use to enhance carrier safety and exceed minimum regulatory requirements.

Finding 3: The proponent and its carrier companies would need to satisfy any Canadian amendments resulting from implementation of the International Maritime Organization's International Convention for the Control and Management of Ships' Ballast Water and Sediments.

Finding 4: The Canadian Coast Guard will continue to improve upon the existing AIS system on the North Coast to enhance monitoring capability.

Finding 5: The TERMPOL Review Committee supports Kitimat LNG's commitment to adhere to Society of International Gas Tanker and Terminal Operators (SIGTTO) Officer Experience Matrix certification and experience levels.

Finding 6: Recommendations from the Pilotage Act Review would modernize the services provided by marine pilots in Canada's compulsory pilotage areas, including the pilotage of vessels calling at the Kitimat LNG terminal.

Finding 7: The TERMPOL Review Committee supports pilot transfer by helicopter for project vessels.

Finding 8: The CHS can update nautical charts with a pilot boarding symbol if helicopter boarding is re-introduced for the North Coast.

Finding 9: The Pacific Pilotage Authority will require two pilots to board every project carrier. This two-pilot condition is consistent with the Pacific Pilotage Authority's Notice to Industry (10/2015) for the south coast of B.C.

Finding 10: T2 training would be beneficial for both pilots and tug operators involved in the Kitimat LNG project.

Finding 11: The TRC supports the use of tethered escort tugs for LNGCs during the Wright Sound to Nepean Sound portion of the route.

Finding 12: The need for tethering a tug to project vessels in the Principe Channel and Douglas Channel is dependent on the environmental and traffic conditions in the waterway and will be decided at the discretion of the pilot and the master.

Finding 13: The Pacific Pilotage Authority, Prince Rupert Port Authority, and B.C. Coast Pilots will work together to develop a tug matrix for the North Coast of B.C., before any liquefied natural gas project operations begin in the area. Standardizing tug escort requirements for all liquefied natural gas carriers will likely reduce the need for overlapping full mission simulations of common marine areas.

Finding 14: Once an escort tug matrix for the North Coast of B.C. is developed, the Pacific Pilotage Authority may prepare a "Notice to Industry" outlining escort tug requirements. The Notice should include, in addition to other provisions, when and where tethered escort may be required.

Finding 15: Increased rescue towing capacity as a result of the stationing of two Emergency Towing Vessels at points along the West Coast has the potential to reduce the risk of drift grounding for LNGCs along the project route.

Finding 16: Rescue towing vessels will only be available for emergency situations, and do not replace the need for tug escort for project vessels.

Finding 17: The Canadian Hydrographic Service will work with Transport Canada and the Pacific Pilotage Authority to consider precautionary notes on charts for mariners in the area.

Finding 18: CCG and the appropriate authorities will explore the possibility of additional CIPs should one or more of the energy projects proposed for the north coast of British Columbia proceed.

Finding 19: Kitimat LNG will work in consultation with TC, the BCCP and CCG on the development of private navigational aids at the proposed terminal site.

Finding 20: The proponent should be aware that any project specific NavAids that are installed are not made available on the Canadian Hydrographic Service's List of Lights, Buoys and Fog Signals.

Finding 21: The TERMPOL Review Committee supports the Prince Rupert Port Authority's notion to establish and chart a Traffic Separation Scheme west of the Triple Island boarding station. If it is found to be necessary, it could reasonably benefit all marine traffic transiting the area.

Finding 22: The commitment to publicly posting and continually updating vessel schedules will serve in the interest of the proponent, and all stakeholders in the area to alleviate potential interactions.

Finding 23: The depths along the Northern Route and approaches to the terminal of the proposed Kitimat LNG project provide sufficient underkeel clearance for project carriers.

Finding 24: The TRC supports the proponent's mitigations to limit potential impacts of underwater noise and will promote the harmonization of requirements with operations in the South Coast.

Finding 25: Participation in regional initiatives such as the Ocean Networks Canada Smart Oceans project is beneficial to stakeholders such as the B.C. Coast Pilots and Pacific Pilotage Authority as data collected helps better understand marine mammal populations and their interaction with underwater vessel noise.

Finding 26: The TRC agrees with the proponent that the anchorages in Kitimat Harbour do not meet the minimum swing circle requirements of the TERMPOL Guidelines. Anchorage in Kitimat Harbour should therefore be avoided unless the anchorage area is redesigned.

Finding 27: The TRC supports the installation of a weather buoy near Hartley Bay to provide more accurate and reliable weather information in the area.

Finding 28: In consultation with the B.C. Coast Pilots and Canadian Coast Guard, Environment and Climate Change Canada may assess the need for new smart buoys to provide meteorological data to inbound vessels.

Finding 29: The TERMPOL Review Committee recognizes that while the TERMPOL Report does not consider intentional acts that could result in the release of cargo, the Government of Canada has in place a system under the Marine Transportation Security Regulations to detect and prevent intentional acts that could threaten a project vessel's cargo or operations.

Finding 30: The TRC agrees that there is enough traffic capacity along the route to accommodate future growth.

Finding 31: As a BC OGC terminal permit holder, Kitimat LNG would be required to conduct an emergency management exercise every year, and full-scale exercise every three years with a BC OGC representative in attendance.

Finding 32: In the absence of a designated Port Authority, Transport Canada and other appropriate authorities should review the issue of safety zones for liquefied natural gas terminals with the aim of establishing a consistent approach that account for specific circumstances of each marine terminal, whether under the jurisdiction of a Port Authority or not.

Finding 33: The TRC finds the American Petroleum Institute's Standard Recommended Practice 753: Management of Hazards Associated with Location of Process Plant Portable Buildings an adequate practice to follow during the simultaneous operation of the project terminal in phase one and construction of phase two.

Finding 34: LNG specific training for emergency first responders would greatly benefit the proponent's emergency preparedness for project operations.

Finding 35: Transport Canada and the Canadian Coast Guard will review the proponent's final terminal design to determine the potential for additional private aids to navigation.

Finding 36: The location of the project berth and jetty provides sufficient distance between berth and the centre of the channel and sufficient manoeuvrability area for project carriers to and from the berth.

Finding 37: The proponent will provide copies of its Port Information Book and Terminal Operations Manual to the TRC for information six months prior to the first cargo loading.

Finding 38: Matching the requirements of SIGTTO's "Liquefied Gas Handing Principles on Ships and in Terminals, and LNG Operations in Port areas" ensures Kitimat LNG will go above and beyond the compliance of regulatory requirements in Canadian waters.

Finding 39: Kitimat LNG has expressed a willingness to engage with First Nations communities along the project route to discuss specific issues related to the increase in marine traffic from project operations.

Finding 40: Involving Indigenous groups early in the development and design of protocols, such as the First Nations Communication Protocol and the Complaint Protocol will foster greater two-way communication between the proponent and Indigenous marine users.

Finding 41: Indigenous traditional knowledge, such as the Haida Marine Traditional Knowledge Study is both useful and important to understand the risks vessel traffic poses in culturally sensitive areas.

APPENDIX 2 – DESIGN VESSELS

Parameters of LNGCs Capable of Berthing at the Proposed Kitimat LNG Marine Terminal[68]

Description	Project Design Vessel Maximum	Project Design Vessel Minimum
Capacity, m^3	217,450	127,373
Length overall, m	315	272
Length between perpendiculars, m	304	262
Beam, m	52	43.3
Moulded depth, m	28	25.4
Ballast draught, m	9.7	9.0
Air draught	64.7	51.0
Height of main deck above waterline at ballast or loaded draft respectively, m	18.5	13.4
Height above manifold above keel, m	32.5	30.5
Net tonnage	45.524	N/A
Gross tonnage	141,136	N/A
Summer load line		
Summer draught, mt	12.5	N/A
Summer deadweight, mt	121,935	N/A
Summer displacement, mt	164,600	N/A
Winter load line		
Winter draught, mt	12.26	N/A
Winter deadweight, mt	118,079	N/A
Winter displacement, mt	160,743	N/A
Maximum Manifold Offset from LBP/2		
Forward offset, m	15.6	N/A
Aft offset, m	15.6	N/A
Wind Areas		
Longitudinal wind area (ballast draught), m^2	2,140	N/A
Transverse wind area (ballast draught), m^2	9,300	N/A
Longitudinal wind area above deck, m^2	1,178	N/A
Transverse wind area above	4,000	N/A

[68] Kitimat LNG TERMPOL Submission – Element 3.9. Ship Specifications, pg 17

deck, m^2		

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