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Controlled Document

LNG Canada Marine Mammal Management and Monitoring Plan (Operations)

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1. Introduction

1.1. Facility Background

LNG Canada Development Inc. (LNG Canada) is building a liquefied natural gas (LNG) export facility (the LNG Canada facility; Figure 1) in Kitimat, British Columbia (BC), Canada, in the traditional territory of the Haisla Nation. LNG Canada is a joint venture comprised of Shell Canada Energy (Shell), North Montney LNG Limited Partnership, PetroChina Kitimat LNG Partnership (CNPC), Diamond LNG Canada Partnership (Diamond), and KOGAS Canada LNG Partnership (KOGAS). The LNG Canada Export Terminal Project (Project) includes the design, construction, and operation of a natural gas liquefaction plant and facilities for the storage and export of LNG, including marine off-loading and shipping facilities (Figure 1).

A list of acronyms and abbreviations is provided in Appendix A.

1.1.1. Shipping Corridor

The spatial boundary for this Marine Mammal Management and Monitoring Plan (MMMMP) centers around the Marine Access Route (as described in the Certified Project Description of LNG Canada's Environmental Assessment Certificate [EAC]), referred to herein as the "shipping corridor". For the purposes of the MMMMP for Operations ('this Plan'), the shipping corridor includes the Certified Pilot Boarding Zone, which begins near the Triple Island Pilot Boarding Station, where two Pilots will board the LNG carrier. The route continues passage into Browning Entrance, south through Principe Channel, and angles east and then northeast into Douglas Channel to Kitimat Arm (Figure 2).

1.1.2. Scope – LNG Canada Marine Mammal Study Area

LNG Canada recognizes that some aspects of the Operations phase (e.g., introduction of underwater noise from LNG carriers) may extend beyond the direct confines of the shipping corridor. As such, the geographic scope of this Plan has been developed to align with the "marine resources' Shipping Regional Study Area (RSA)" that was developed and assessed as part of the EAC Application (see Section 1.4.1 below), hereafter referred to as the LNG Canada Marine Mammal Study Area. The LNG Canada Marine Mammal Study Area encompasses the extent of shipping activities and surrounding waters within the confined channels (e.g., Kitimat Arm, Douglas Channel, Squally Channel, Principe Channel), Whale Channel, Caamaño Sound, and marine waters along the Marine Access Route out to the Triple Island Pilot Boarding Station in the north. Where the Marine Access Route is not confined by geography, a buffer of 10 km is used on either side around the shipping corridor. This area overlaps with the traditional territories of Haisla Nation, Gitxaala Nation, Gitga'at First Nation, Metlakatla First Nation, Kitsumkalum First Nation, Lax Kw'alaams First Nation, and Kitselas First Nation.

1.2. Purpose

The purpose of the MMMMP is to outline how LNG Canada will implement requirements under EAC Condition 05 for the Operations phase (shipping) of the Project, in accordance with EAC #E15-01 (refer to Section 1.4.1).

As specified in EAC Condition 05, MMMMP objectives therefore include the following:

- To identify the geographic areas where, and periods of time when, Operations could cause behavioural change or injury to marine mammals;
- To specify the speed profiles to prevent or reduce the risks of collisions between the Holder's [LNG Canada's] LNG carriers and marine mammals and to prevent or reduce risk of marine mammal behavioural change caused by noise from the Holder's [LNG Canada's] LNG carriers;

- To specify the terms of a study during Operations to improve understanding of the behavioural disturbance or injury to marine mammals from shipping related to the Project;
- To specify an adaptive management plan to address the effects on marine mammals, if those effects are not mitigated to the extent identified in the Application or if unexpected effects occur.

The MMMMP also addresses requirements under the LNG Canada Impact Assessment Agency of Canada (IAAC; formerly the Canadian Environmental Assessment Agency) Decision Statement Issued under Section 54 of the *Canadian Environmental Assessment Act*, *2012*, Clause 3.10, which states "*LNG carriers associated with the Designated Project shall respect speed profiles applicable to the operation of the Designated Project, subject to navigational safety, to prevent or reduce the risks of collisions between LNG carriers and marine mammals and shall report any collision with marine mammals to Fisheries and Oceans Canada, and notify Aboriginal groups*"[1].

This Plan is subject to approval by the BC Environmental Assessment Office (EAO) prior to Operations in accordance with the EAC.

1.3. Document Structure

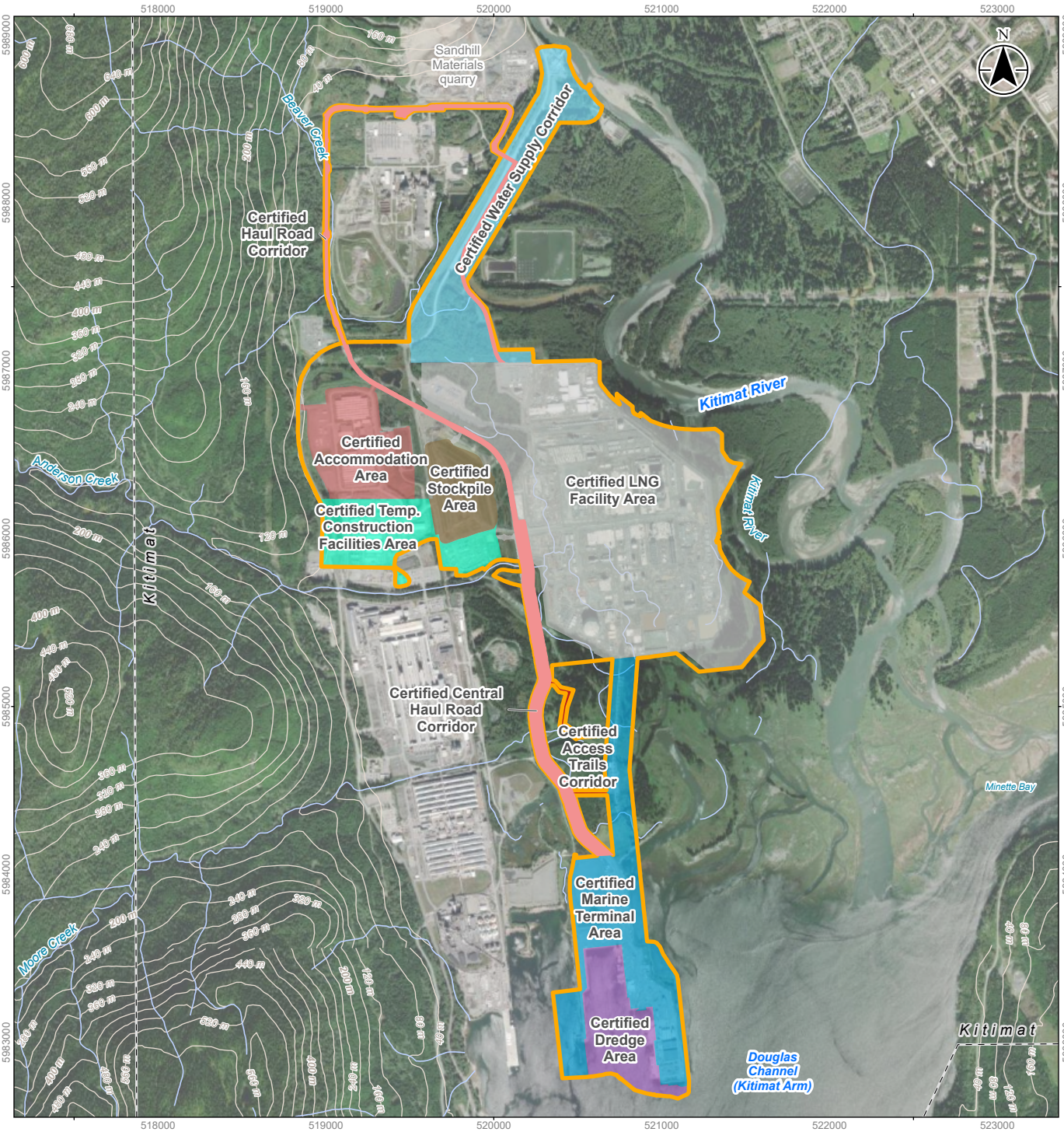
The following provides an overview of the contents of this Plan. Condition 05 concordance to the specific reference in this Plan is provided in Table 1.

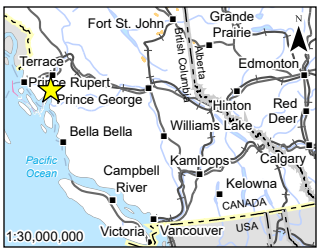
- The remainder of Section 1 outlines the regulatory framework, consultation undertaken with Indigenous groups and regulatory agencies during Plan development, roles and responsibilities for implementation, and a list of Plan exclusions.
- Section 2 outlines the related documents.
- Section 3 identifies relevant Project activities associated with marine shipping, and potential interactions with marine mammals, including geographic and temporal considerations.
- Section 4 highlights the importance of marine mammals to Indigenous groups.
- Section 5 presents LNG Canada mitigation measures and commitments related to marine mammals, including the LNG carrier speed profiles.
- Section 6 outlines the *EAC 05 LNG Canada Marine Mammal Study*.
- Section 7 describes the adaptive management process, including verification, follow-up monitoring, emerging science, incident reporting, and corrective actions.
- Section 8 outlines the approach for MMMMP implementation, reviews, and updates.
- Section 9 lists the references used in this Plan.

[1] The term 'Aboriginal groups' (now Indigenous groups) was that used in the conditions at the time of the EAC Application, and is used in this Plan only in instances where regulatory language is being used verbatim.

Table 1 EAC Condition Requirements – Concordance to Marine Mammal Management and Monitoring Plan

Condition	Condition Requirement	Section Reference
EAC Condition 05	The Holder must develop, in consultation with DFO, TC, and the Pacific Pilotage Authority, a marine mammal management and monitoring plan for Operations that must:	This Plan.
	Identify the geographic areas where, and periods of time when, Operations could cause behavioural change or injury to marine mammals;	Section 3.2.1
	Specify the speed profiles to prevent or reduce the risks of collisions between the Holder's LNG carriers and marine mammals and to prevent or reduce risk of marine mammal behavioural change caused by noise from the Holder's LNG carriers;	Section 5.1
	Specify the terms of a study during Operations to improve understanding of the behavioural disturbance or injury to marine mammals from shipping related to the Project; and	Section 6 and Appendix B
	Specify an adaptive management plan to address the effects on marine mammals, if those effects are not mitigated to the extent identified in the Application or if unexpected effects occur.	Section 7
	The Holder must demonstrate reasonable efforts to engage Aboriginal Groups in developing and sharing information regarding implementation of the plan.	Sections 1.5 and 9.3





Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
World Imagery: Earthstar Geographics
World Imagery: Maxar

- Topographic Contour
- Watercourse
- Municipal Boundary

- Certified Project Area (Amendment 4)
- Certified Haul Road Corridor
- Certified Water Supply Corridor
- Certified Stockpile Area
- Certified Temporary Construction Facilities Area
- Certified Dredge Area
- Certified Marine Terminal Area
- Certified Accommodation Area
- Certified LNG Facility Area
- Certified Access Trails Corridor

0 0.25 0.5 0.75 1 1.25 1.5 km

1:35,000 (at original document size of 8.5x11)

Stantec

Project Location:
Kitimat,
British Columbia

Project Number: 123221515
Prepared by LTRUDELL on 20240111
Requested by AAHRENS on 20240111
Reviewed by TCARDINAL on 20240215

Client/Project/Report
LNG Canada
LNG Canada Export Terminal
Marine Mammal Management and Monitoring Plan

Figure No.
1

Title
Certified Project Area and Key Project Components

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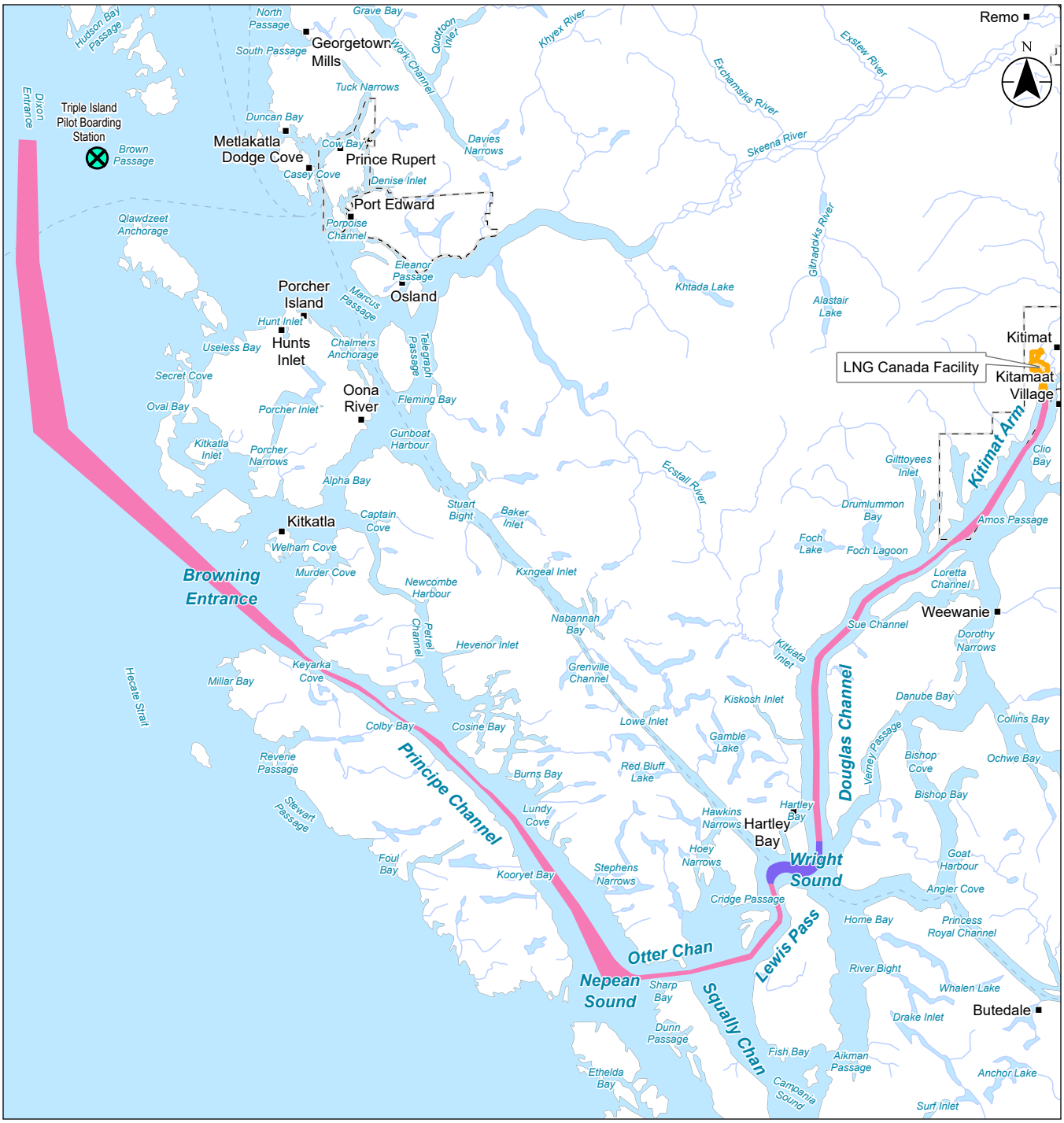

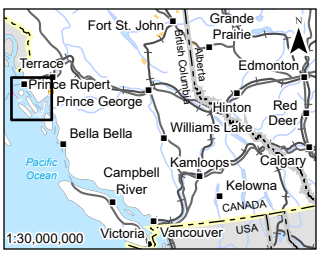

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

- Ferry Route
- Watercourse
- Waterbody
- Municipal Boundary
- LNG Canada Facility
- Shipping Corridor
- Wright Sound Special Operating Area
- Triple Island Pilot Boarding Station

0 10 20 30 40 km

1:900,000 (at original document size of 8.5x11)

Stantec

Project Location: Kitimat, British Columbia

Project Number: 123221515
Prepared by LTRUDELL on 20240111
Requested by AAHRENS on 20240111
Reviewed by TCARDINAL on 20240215

Client/Project/Report
LNG Canada
LNG Canada Export Terminal
Marine Mammal Management and Monitoring Plan

Figure No.
2

Title
Shipping Corridor - Overall Route

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1.4. Regulatory Framework

1.4.1. Environment Assessment Certificate

The Project underwent a comprehensive environmental assessment process from 2013 to 2015 under the *British Columbia Environmental Assessment Act* ([Statutes of British Columbia (SBC) 2018] Chapter 51).

In the EAC Application, "marine resources" was considered a valued component because: it has ecological importance; it has importance to Indigenous and non-Indigenous groups who depend on it; its consideration addresses legislative and regulatory requirements; and, its consideration addresses concerns raised during consultation with Indigenous groups, the EAO Working Group, and the public. The assessment of marine resources for the Project was divided into two sub-components: marine fish and fish habitat, and marine mammals. The marine mammal sub-component (i.e., the basis of this Plan) comprises cetaceans (i.e., whales, dolphins, and porpoises) and pinnipeds (i.e., seals and sea lions), with a focus on species commonly found in the study areas and surrounding waters, and in particular those designated as *extirpated*, *endangered*, *threatened*, or *special concern* under the federal *Species at Risk Act* (SARA) or by the Committee on the Status of Endangered Wildlife in Canada. Relevant mitigation measures and/or commitments from the EAC Application with respect to marine mammals and Project activities during Operations are discussed in Section 5; no further Operations phase activities were identified as presenting a risk to marine mammal populations. A thorough review of anticipated marine mammal species, seasonal timing, and potential Project interactions was undertaken for the EAC Application and supporting Marine Resources Technical Data Report, upon which the MMMMP is based. The MMMMP has not endeavored to repeat the effort of the EAC Application; however, Section 3.2 provides a brief synopsis of that work.

On June 17, 2015, the EAO issued EAC #E15-01 for the LNG Canada Export Terminal Project. Since issuance of the EAC, four amendments have been issued on August 5, 2016, October 18, 2019, February 24, 2021, and March 31, 2022. In Schedule B, Condition 05 of the EAC, LNG Canada, as the Permit Holder, must develop an MMMMP for Operations. This Plan has been developed to fulfill that requirement.

1.4.2. Other Regulatory Permits and Approvals

Various other regulatory approvals and permits have been obtained or will be obtained throughout the life of LNG Canada. Relevant information and/or conditions from other regulatory approvals and permits are referenced in the MMMMP, where applicable to the purpose of this plan for completeness only.

Relevant information and/or conditions outlined in the [Amended] Federal Decision Statement (FDS) issued by the IAAC on April 6, 2021, are referenced where applicable to the purpose of this plan for completeness only. FDS conditions relevant to this Plan include the following:

- LNG carriers associated with the Designated Project shall respect speed profiles applicable to the operation of the Designated Project, subject to navigational safety, to prevent or reduce the risks of collisions between LNG carriers and marine mammals and shall report any collision with marine mammals to Fisheries and Oceans Canada, and notify Aboriginal groups [FDS Condition 3.10].
- The Proponent shall participate in regional initiatives relating to cumulative effects monitoring and the management of marine shipping, should there be any such initiatives during the construction and operation phases of the Designated Project [FDS Condition 3.15].

1.4.3. Regulatory Framework

LNG carriers that utilize the LNG Canada facility are neither owned, operated, nor managed by LNG Canada. However, all vessels foreign and domestic transiting Canadian waterways, including those using the LNG Canada facility, are under Canada's federal jurisdiction, which includes any compulsory requirements related to marine mammal

protections and reporting. In addition, all LNG carriers using the LNG Canada facility are subject to the *Pilotage Act* and the *Canada Shipping Act, 2001* (CSA 2001) and their associated regulations. As such, the vessel Master has the responsibility and full authority to make any decision necessary to ensure the safety of the vessel and to protect people and the marine environment. Vessels operating in Canadian waters are also subject to marine mammal protection measures as defined under various Acts and regulations. Fisheries and Oceans Canada (DFO) and Transport Canada (TC) help to protect the safety of marine mammals in Canada through various regulatory regimes, including but not limited to the following acts and associated regulations:

- *Canada Shipping Act, 2001,* (CSA) SC 2001, c 26, including the *Collision Regulations* , c 1416
- *Pilotage Act,* RSC 1985, c P-14, including the *General Pilotage Regulations*, SOR/2000-132
- *Fisheries Act*, RSC 1985, c F-14, including the *Marine Mammal Regulations* (MMRs), SOR/93-56
- *Species at Risk Act* (SARA)*,* SC 2002, c 29.

1.4.3.1. Canada Shipping Act, 2001

The CSA and its supporting regulations incorporate International Maritime Organization (IMO) conventions to which Canada is a signatory, into a legal framework that governs the operation of maritime vessels in Canadian waters (and Canadian vessels in any waters) and establishes the umbrella framework for shipping regulations within Canada. Vessels under 500 gross tonnage that are Canadian flagged and not on international voyages are, in most cases, exempt from IMO conventions that are also implemented through the CSA. Under the CSA, LNG carriers transiting to the LNG Canada terminal (and Canadian vessels in any waters) must adhere to various regulations that provide the standards, procedures, and guidelines to reduce the likelihood and severity of marine incidents, and to limit impacts to the marine environment from navigation and shipping activities in Canadian waters.

1.4.3.2. Pilotage Act

The *Pilotage Act* provides the framework for the regulation and provision of marine pilotage services in Canada. The *Pilotage Act* establishes four pilotage authorities in Canada with specific responsibility for establishing, operating, and administering efficient pilotage services in their respective regions in Canada.

The Pacific Pilotage Authority (PPA) is a federal Crown corporation with a mandate to administrate marine pilotage service in Canadian internal waters off BC's coastline. The *General Pilotage Regulations* establish compulsory pilotage areas on the west coast of Canada and prescribe the classes of vessel subject to compulsory pilotage, as well as the circumstances under which compulsory pilotage may be waived for a vessel. Vessels of 350 tonnes or more (except as mentioned in the regulations) must use pilotage services when transiting the coastal Compulsory Pilotage Area. The shipping corridor is within PPA Compulsory Pilotage Area Four, with the closest Pilot boarding station located at Triple Island, west of the Port of Prince Rupert.

BC Coast Pilots are under contract to the PPA and, through the Compulsory Pilotage Area, have the navigation conduct of the vessel as per the regulations. To ensure the safety of the vessel, the vessel Master, with the Pilot's advice, has full local control and authority to execute any decision necessary for the safety of people and protection of the environment, including marine mammals. All LNG carriers will be subject to compulsory pilotage between the Triple Island Pilot Boarding Station and the LNG Canada facility.

1.4.3.3. Fisheries Act

The *Fisheries Act* is administered by DFO and is the primary federal legislation to manage and protect Canada's fisheries resources. Section 2(1) of the *Fisheries Act* classifies marine mammals [marine animals] as "fish" for regulatory purposes.

1.4.3.3.1. Marine Mammal Regulations

The MMRs of the *Fisheries Act* apply to the management and control of fishing for marine mammals and related activities in Canada. Section 7 of the MMRs prohibits the disturbance of marine mammals except in specific authorized circumstances, including when carrying on a work, undertaking or activity that is authorized or otherwise permitted under the *Fisheries Act,* and when fishing for marine mammals under the authority of the MMRs. The MMRs also require marine users to respect specified approach distances to marine mammals. LNG carriers will adhere to all applicable regulatory limits and will not divert course to approach a marine mammal. Further, all accidental contact must be reported in accordance with the MMRs.

1.4.3.4. Species at Risk Act

SARA is a federal Act that applies to certain wildlife species in Canada. The Act establishes Schedule 1 as Canada's official list of wildlife species at risk, and classifies those species as being either extirpated, endangered, threatened, or of special concern. Once a species is added to Schedule 1, it benefits from all the legal protection afforded, and the mandatory recovery planning (or management planning in the case of species of special concern), under SARA. For example, under Section 32(1) of SARA, no person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species. Schedule 1 species at risk, including marine mammals, are officially listed at: Species at Risk Act (justice.gc.ca) or are searchable on the Species at Risk Public Registry at: Species at risk public registry - Canada.ca.

The Government of Canada's Species at Risk (SAR) Program is responsible for carrying out DFO's mandate under the SAR to protect, recover and conserve all listed aquatic SAR in Canada. This includes identifying critical habitat for species listed as endangered or threatened.

1.4.4. North Coast Waterway Management Guidelines

The British Columbia North Coast Waterway Management Guidelines (NCWMG)[2] are voluntary guidelines that aim to improve safety on the water by reducing conflicts between Indigenous groups' marine use activities and commercial navigation between Kitimat and Browning Entrance on BC's North Coast. The NCWMG are applicable to all vessels, with specific guidelines for large commercial ships and tugs and barges. The NCWMG were developed through a collaborative consensus-based process that included representatives from the Gitga'at and Gitxaala First Nations, Government of Canada, Pilots and associated maritime authorities, commercial shipping industry associations, and other waterway stakeholders, which made up the North Coast Proactive Vessel Management Pilot Project Committee. The NCWMG have been endorsed by the agencies, organizations, and companies participating in the process, including LNG Canada. The NCWMG came into effect on September 1, 2022, and its Appendix 1 (expected nighttime low-tide and harvest times) was updated in September 2023. Participants will review the NCWMG and make adjustments to them as may be needed to improve their effectiveness.

A Gitga'at Area of Concern (AOC) has been introduced in Lower Douglas Channel to Otter Channel, and a Gitxaala AOC has been identified in Principe Channel to heighten awareness by mariners of increased local activity and potential high seasonal abundance of whales. A Wright Sound Special Operating Area (SOA) is also in place due to the presence of whales, particularly humpback whales. These areas overlap with the area identified by LNG Canada for additional mitigation measures during seasonal periods of high whale density (see Section 5).

The recommendations specified in the NCWMG do not supersede or alter the requirements of applicable Canadian and international laws and regulations, including the *Collision Regulations*. The NCWMG do not prevent or restrict the vessel Master and Pilots from taking or executing any decision, which in the vessel Master's and/or Pilot's professional

[2] Notice to Industry 03-2022 - British Columbia North Coast Waterway Management Guidelines_1.pdf (ppa.gc.ca)

judgement, is necessary to ensure the safety of life at sea and the protection of the marine environment. LNG Canada will use the marine Automatic Identification System (AIS) and any contract supporting information to conduct reviews of LNG carriers' vessel transit speeds and observance of the NCWMG (see Section 7.1). LNG Canada will review mitigations in the NCWMG annually to ensure the most recent technical information is being used in the MMMMP. See the link below for the 2023 guidelines, including mapping products detailing vessel speed profiles, the SOA, and AOCs.

https://www.notmar.gc.ca/publications/monthly/documents/NorthCoastWaterwayManagementGuidelines_Sept2023.pdf

1.5. Management Plan Development Consultation

In accordance with EAC Condition 05, this Plan was developed in consultation with DFO, PPA, TC and Indigenous groups. The EAC states "*The Holder must demonstrate reasonable efforts to engage Aboriginal Groups in developing and sharing information regarding implementation of the plan".* This consultation has been an ongoing process since March 2023 through regular meetings with both the listed Agencies and Indigenous groups to facilitate collaboration on the Condition 05 management plan and associated study development. There were several milestones as a result of the process including but not limited to:

- Development of the Revision 1 Success Criteria to create "guidelines" to allow for Study Terms that meet the intent of EAC Condition 05 (Q3, 2023).
- Development of the Revision 2 Success Criteria after gaining feedback throughout the consultation process focused around Revision 1 (Q3-Q4, 2023).
- After approval of the Revision 2 Success Criteria, 'Strawdog' study ideas (study concept and methodology outlines) were developed as a reflection of the limitations within the established Success Criteria. (Q4, 2023).
- Concept 2 was selected from the draft 'Strawdog' study ideas with the understanding that items from Concept 1 were likely to be incorporated within the execution of Concept 2 and other portions of the management plan. (Q4 2023- Q1 2024)
- MMMMP Revision D released for consultation February 16, 2024.
- MMMMP Revision 0 submitted to EAO August 01, 2024.

From these meetings a Consultation Comment Tracker was created to track comments, responses and actions that were gained throughout the consultation. This document will be publicly available via the EAO website. Future consultation during the implementation period for the Plan is described in Section 8.3.

1.6. Roles and Responsibilities

An overview of key roles and responsibilities as they pertain to the Plan is provided in Table 2.

Table 2 Overview of Roles and Responsibilities

Entity	Role and Responsibility
LNG Canada	Responsible for overall compliance with EAC Condition 05, regulatory requirements and other marine mammal management and monitoring commitments, including: • Conducting oversight and verifying LNG carrier adherence to the NCWMG and Operations speed mitigations as per the MMMMP • Taking accountability for communicating expectations related to the MMMMP to LNG carrier owners, vessel Masters, and Pilots • Coordinating marine mammal data collection and reporting • Verifying the environmental assessment's underwater noise modelling assumptions and predictions • Supporting complaint review and follow-up related to marine mammals • Verifying reporting mechanisms are in place for LNG Canada-related marine mammal incidents to Indigenous groups, IAAC, and DFO
LNG carrier Master	Masters of the LNG carriers using the LNG Canada facility are responsible for the safe transportation of their vessel, people, and cargo while navigating in Canadian waters, including while transiting the shipping corridor, and are accountable for: • Taking or executing any decision which is necessary to maintain the safety of life at sea, the vessel and protection of the marine environment • Maintaining full compliance with all maritime laws, regulations (including the *Collision Regulations* and *Marine Mammal Regulations*), and rules • Maintaining applicable records • Planning, preparing, executing, and monitoring the vessel passage plan (voyage plan) for the route to and from the LNG Canada facility • Overseeing emergency operations • Adhering to mitigation measures identified in this Plan, and procedures outlined in the NCWMG (unless navigational safety is being compromised) • Recording and reporting marine mammal strike incidents to DFO and LNG Canada
Pilots	Pilots are responsible for determining appropriate navigation, including speed profiles in recognition of NCWMG, and are accountable to that decision making process.
Transport Canada	Transport Canada is responsible and accountable for oversight of marine shipping in Canadian waters.

1.7. Plan Exclusions

The MMMMP is applicable to marine mammal management and mitigations for the Operations phase only; any marine construction activities are excluded from this Plan and addressed in construction specific plans.

The EAC defines Operations as "*the phase of the Project commencing on the date on which at least one train of the Project has completed commissioning and has commenced commercial production of liquefying natural gas*." The EAC defines Commissioning as "*the period within the Construction phase of the Project when LNG processing units are brought into operation and tested for safe and reliable operation*."

Further, the MMMMP excludes:

- Any activities of LNG carriers outside of the shipping corridor;
- Activities outside of the Project's spatial or temporal (i.e., Operations phase) boundaries.

Further, the Plan does not:

- Supersede any Acts, Regulations or requirements that mandate vessel operations, controls and safety considerations, including but not limited to those under the CSA 2001 and *Pilotage Act*;
- Absolve an LNG carrier vessel Master and/or Pilots from taking or executing on any decision necessary to ensure the safety of the vessel and to protect the marine environment as governed by Canadian regulatory requirements; or
- Absolve contractors or subcontractors from undertaking their own due diligence in relation to regulatory requirements.

2. Related Documents and Systems

Table 3 presents a list of related Project documents referenced within the Plan. Relevant changes to these documents will be incorporated into the MMMMP during the regular review and update as outlined in Section 8.

Table 3 Related Project Documents

Document Name	Document Number
LNG Canada Strategy for Communicating Accidents or Malfunctions (Operations)	L001-00000-HE-0702-0300

3. Relevant Activities and Potential Interactions with Marine Mammals

3.1. Marine Shipping Activities throughout Operations

During Operations, LNG carriers using the LNG Canada facility will transport LNG along the established shipping corridor (Figure 2).

3.1.1. LNG Carrier Activities

LNG carriers will routinely transit the shipping corridor to and from the LNG Canada facility. At full build-out, it is estimated that there will be 170 to 350 LNG carriers calling at the marine terminal per year, resulting, on average, in two LNG carrier transits per day (one inbound [in-heel] and one outbound [in-product]).

LNG carriers using the shipping corridor will have a professional crew, led by an experienced Master mariner (captain) and supported by two licensed Pilots who will retain the navigation conduct of the vessel for the entire passage, both inbound and outbound. Pilots enhance the look-out capacity of the bridge team during transits in the channels. Pilotage requirements under the *Pilotage Act* are applicable to LNG carriers using the LNG Canada facility.

There are currently no designated anchorages available for large vessels at the head of Douglas Channel. Arrival times for LNG carriers at or near the Triple Island pilotage station will be managed so that berths are available upon arrival at the marine terminal, eliminating any need for waiting in the channel of the harbour.

LNG Canada-related vessel operational measures that will be implemented and that may also have secondary benefits to marine mammals include the following:

<u>Vessel Passage</u>

- On-board Pilots will advise all LNG carrier passing situations through bridge-to-bridge communication and not overtake other deep-sea vessels in narrow areas unless the prevailing circumstances warrant. Narrow areas could include Emilia Island, the bend at Blackfly, Lewis Passage, Otter Channel, and where Principe Channel and Dixon Entrance converge [NCWMG 2023; Section 1.3. – Guidelines for Passing and Meeting].
- The LNG carrier will also have two Pilots accompanying all LNG carriers when travelling between Triple Island and the Port of Kitimat, enhancing the capacity of the bridge team during transits in the channels. [LNG Canada Export Terminal Project Assessment Report – Effects and Mitigation – Injury or Mortality of Fish and Marine Mammals]
- The Wright Sound Special Operating Area requires vessels to minimize wash and wake, limit speed to 8-10 knots (applicable to tethered escorted energy vessels) and overtake only when there is no opposing piloted deep-sea traffic [NCWMG 2023; Section – 1.4. Wright Sound SOA Guidelines]
- Subject to navigational safety LNG carriers are expected to travel at 12 knots along the marine access route [shipping corridor], and that from July through October, from the north end of Campania Island to the southern end of Hawkesbury Island, LNG carriers are expected to travel at no greater than 10 knots [EAC Mitigation 5.8-12].
- LNG carriers using the shipping corridor will have a professional crew, led by an experienced Master mariner (captain) and supported by two licensed Pilots for the entire passage, both inbound and outbound. Pilotage requirements under the Pilotage Act are applicable to LNG carriers using the LNG Canada facility. LNG carriers will proceed under low visibility conditions enacting the applicable safety processes appropriate for the given environmental challenges.

3.1.2. Shipping Corridor

LNG carriers will transit along the shipping corridor to arrive at the LNG Canada facility. Specifically, LNG carriers will:

- Arrive from the Pacific Ocean to enter the shipping corridor through Dixon Entrance
- Take on Pilots in the vicinity of Triple Island, prior to transiting south through Hecate Strait and entering the Compulsory Pilotage Area just before Browning Entrance, and then into Principe Channel
- At the southern point of Principe Channel, vessels will transit through Otter Channel, Squally Channel, Lewis Passage, and then across Wright Sound towards the entrance to Douglas Channel
- Head north in Douglas Channel and enter Kitimat Arm to reach the LNG Canada facility at the Port of Kitimat
- When departing the LNG Canada facility, LNG carriers will follow the reciprocal route to international waters.

3.1.3. Supporting Marine Vessels

One escort tug will support LNG carriers along the shipping corridor and will either be tethered or untethered to LNG carriers, depending on requirements for the specific portion of the route, at the discretion of the vessel Master and Pilots. In emergency situations, tugs can assist vessels in steering and stopping, reducing the probability of a collision, grounding, or other incidents.

Each LNG carrier will be assisted by up to three dedicated harbour tugs while maneuvering and berthing/unberthing in the Port of Kitimat at the LNG Canada marine terminal in Kitimat Harbour. At least one harbour tug will be on standby during loading operations.

Project tugs are equally committed to maintaining compliance with all applicable laws and regulations. This would entail reporting a strike incident if it were to occur (Section 7.5), along with adhering to the various speed restrictions (Section 5.1). Noise modelling that was conducted during the environmental assessment phase incorporated three harbour tugs into the berthing/unberthing scenario and one escort tug into the shipping corridor transit scenarios.

3.2. Potential Interactions with Marine Mammals

LNG carriers and associated vessels may interact with marine mammals that are transiting the same channels at the same time. Potential interactions are outlined in Table 4 and were assessed in detail in the EAC Application. Mitigation measures to reduce potential adverse effects associated with these interactions are discussed in Section 5.

Table 4 Activities that may have Potential Interactions with Marine Mammals

Activity	→	**Potential Interaction with Marine Mammals**
LNG Carrier Vessel Operations	→	Behavioural disturbance (noise)
LNG Carrier Vessel Operations	→	Injury (vessel strike)
Note: The EAC Application applied a broad interpretation of these generalized potential interaction categories, and the same is intended here. Physical injury from vessel strikes would be considered inclusive of bodily injuries of any kind, including those resulting in mortality. Behavioural changes include temporary or permanent physical responses or changes in activity, and range from small startle movements to changes in life cycle processes. A thorough review of these interactions, potential anticipated species, and anticipated seasonal timing was undertaken for the EAC Application upon which the MMMMP is based.		

LNG Canada-related shipping operations will produce underwater noise that could result in behavioural changes (e.g., physical responses or changes in activity) to marine mammals. Underwater noise from vessels stems from a variety of sources, including engine roar and on-board equipment and activities, but is dominated by propeller cavitation (Ross 1976), with larger vessels generally creating louder and lower frequency sound than smaller vessels. Acoustic modelling undertaken during the environmental assessment supporting the EAC Application indicated a substantial decrease in noise levels and areal extent of sound for LNG carriers travelling at 10 knots, as compared to 12 knots (Stantec Consulting Ltd. 2014). While the MMMMP has not endeavored to repeat the effort of the EAC Application, for clarity, LNG Canada presents the following information, upon which some of the mitigation measures and effect conclusions were based. To estimate the number of individual exposures to noise above the behavioural disruption threshold for marine mammals along the marine access route, the EAC Application considered the most conservative (i.e., the largest) extent of underwater noise predicted by Project-specific acoustic modelling, applied this to the marine access route, and calculated a zone of influence for a passing LNG carrier (with escort tugs). A speed reduction from 12 to 10 knots was determined to reduce the potential radius of behavioural threshold exceedance by 52 to 60%, depending on location along the marine access route. These radii were then used to predict potential exposure times. This predictive analysis suggested that a stationary animal next to the marine access route would be exposed to underwater noise above the behavioural disruption threshold from the vessel for approximately 40 minutes to 108 minutes if the vessel were travelling at 12 knots; and between 28 minutes and 62 minutes if the vessel were travelling at 10 knots (exact exposure times varied by location). Further details are presented in Section 5.8.6.2.3 of the EAC Application, including calculated reductions in radii of potential behavioural threshold exceedances (see EAC Application Table 5.8-12). The primary mitigation measure for behavioral change owing to underwater noise is therefore reduction in vessel travel speeds (Section 5). A reduction in vessel speed is expected to decrease the amount of underwater noise produced, thus limiting the spatial extent over which noise exceeds the behavioural threshold, and reducing both the number of marine mammals potentially exposed, and their period of exposure. While considered an unplanned, accidental event, LNG Canada-related vessel-marine mammal strikes are also possible during Operations, and were assessed under accidents or malfunctions in Section 10 of the EAC Application. Reducing the potential for marine mammal-vessel strikes will primarily rely on slower vessel speeds as the most effective method to reduce the probability of striking marine mammals, as well as the probability of a fatal outcome (e.g., Vanderlaan and Taggart 2007; Wiley et al. 2011).

3.2.1. Geographic and Temporal Considerations

Marine mammals are abundant in the North Coast of BC. Many species are found seasonally or year-round, with specific species' density and distribution influenced by seasonal changes related to migratory patterns and the timing and distribution of prey. While the seasonal and spatial distribution of marine mammals are useful predictors of the potential for marine mammal interactions, interactions may occur at any time during the Operations phase. During the baseline work associated with the EAC Application, LNG Canada completed 12 marine mammal surveys (January to October 2013) along the shipping corridor and surrounding waters (i.e., referred to in the EAC Application as the marine resources' shipping RSA), as well as underwater acoustic recording (April to September 2013), and a review of relevant scientific literature to provide information on marine mammal occurrence in this region. The following provides a brief synopsis of that work; additional information is available in the EAC Application.

Baleen whales that frequent the shipping corridor include humpback (*Megaptera novaeangliae*; special concern), fin (*Balaenoptera physalus*; threatened), minke (*Balaenoptera acutorostrata*; not at risk), and grey whales (*Eschrichtius robustus*; special concern). Toothed whales commonly observed include Bigg's (transient; threatened) and northern resident killer whales (*Orcinus orca*; threatened), Dall's porpoise (*Phocoenoides dalli*; not at risk), harbour porpoise (*Phocoena phocoena*; special concern), and Pacific white-sided dolphins (*Lagenorhynchus obliquidens*; not at risk). Pinnipeds include Steller sea lions (*Eumetopias jubatus*; special concern), harbour seals (*Phoca vitulina richardii*; not at risk), and northern elephant seals (*Mirounga angustirostris*; not at risk).

Of the baleen whales commonly observed, humpback whales are the most abundant. They have been seen year-round in the shipping RSA north of Browning Entrance, with numbers peaking in the late summer survey period (August) in Caamaño Sound and around Gil Island (Stantec Consulting Ltd. 2014). The designated critical habitat for humpback whales, and a DFO Important Areas for humpback whales, overlap with portions of the shipping RSA around Gil Island (DFO 2013; Clarke 2006). Grey and fin whales exhibit more seasonal use of the area. Grey whale presence is more frequently associated with the open waters of the shipping RSA during their spring migration, and fin whale observations peak in the mid-summer survey period, particularly in the southern portion of Squally Channel and in Caamaño Sound. Minke whales have been observed year-round in BC waters in low numbers.

Toothed whales are also abundant within the shipping RSA, with the potential for large groups (i.e., hundreds) of Pacific white-sided dolphins, primarily in the fall and winter, as well as year-round sightings of Dall's porpoise and harbour porpoise. Bigg's killer whales are present year-round and northern resident killer whale distribution, which is strongly associated with prey abundance, peaks in the early summer. DFO Important Areas and potential northern resident killer whale critical habitat have been identified in the shipping RSA (Ford, 2006; Clarke 2006).

Harbour seals and Steller sea lions are present within the shipping RSA throughout the year. No Steller sea lion rookeries are located within the RSA, but there is a year-round haulout at Warrior Rocks and a major winter haulout on Ashdown Island. Sea otters have been sighted within the shipping RSA, but infrequently; the area currently extends beyond what is considered their northern-most range.

The geographic areas where Operations could cause behavioral change (from vessel noise) or injury (from vessel collisions) to marine mammals include the entirety of the shipping corridor (i.e., marine mammal and vessel interactions are considered possible anywhere along the route). However, at any given moment in time, interactions are only possible within a finite area around the moving vessel (i.e., immediately in its path for a strike, or within a variable and transient area of ensonification around the sound source) and must co-occur with marine mammal presence in that area and at that time. Since the LNG carrier movements will be broadly predictable (i.e., follow a set path, schedule, and speed profile), the primary determinant of geographic areas and temporal periods where marine mammal-shipping interactions may occur is the seasonal and spatial distribution of marine mammals. In recognition of this, at the time of the EAC Application, LNG Canada developed their primary marine mammal mitigation (i.e., speed restrictions; Section 5) to highlight the higher density areas and months within which potential for marine mammal interactions might be deemed most likely. At the time of the EAC Application, and based on the focused surveys within the shipping RSA, LNG Canada conservatively designated 'areas of high whale density' as occurring between the northern end of Campania Island and the southern end of Hawkesbury Island, with high whale occurrence from July through October.

In developing the NCWMG, the First Nation Areas of Concern also highlighted months where various activities (including whale presence) are typically heightened. The Gitga'at AOC identified a period of high whale use from May through November. The Gitxaala AOC identified high whale use from July through August, with moderate activity from March through November, and presence year-round. In recognition of the importance of the whale-specific vessel speed mitigation measure [EAC Mitigation 5.8-12; see Section 5], and the time elapsed since the last marine mammal survey of the full shipping corridor, LNG Canada is proposing to repeat the original baseline survey program, and pending results, update the geographical and temporal bounds of their vessel speed mitigation measure. The terms of this study (the *EAC 05 LNG Canada Marine Mammal Study*) are described in Section 6 and further in Appendix B.

4. Cultural Significance of Marine Mammals to Indigenous Groups

Seven Indigenous groups that utilize the shipping corridor were identified in the EAC Application: Gitga’at First Nation, Gitxaala Nation, Haisla Nation, Kitselas First Nation, Kitsumkalum First Nation, Lax Kw’alaams Band, and Metlakatla First Nation. Marine mammals are culturally important to many of the Indigenous groups whose territory overlaps the shipping corridor. Many Indigenous groups have been collecting traditional knowledge since time immemorial and continue to study individuals and population dynamics.

The NCWMG identify Gitga'at First Nation and Gitxaala Nation areas of interest and concern, which exist between Kitimat and Browning Entrance via Douglas Channel, Wright Sound, Lewis Passage, Otter Channel, Nepean Sound, and Principe Channel, all of which overlap portions of the shipping corridor. LNG Canada will voluntarily adhere to any future applicable and feasible changes to the NCWMG.

5. Mitigation Measures

LNG Canada will implement mitigation measures to reduce potential for adverse impacts to marine mammals along the shipping corridor. Mitigation measures for LNG Canada that were identified during the environmental assessment process are outlined in Table 5 and Table 6.

Table 5 LNG Canada's Mitigation Measures for Marine Mammals (Operations) in the EAC Application

Number	Mitigation Measure
5.8-12	Subject to navigational safety, LNG carriers are expected to travel at 12 knots along the marine access route, and that from July through October, from the north end of Campania Island to the southern end of Hawkesbury Island, LNG carriers are expected to travel at no greater than 10 knots.

Table 6 Conditions related to Marine Mammals (Operations) in the Federal Decision Statement

Number	Condition
3.10	LNG carriers associated with the Designated Project shall respect speed profiles applicable to the operation of the Designated Project, subject to navigational safety, to prevent or reduce the risks of collisions between LNG carriers and marine mammals and shall report any collision with marine mammals to Fisheries and Oceans Canada, and notify Aboriginal groups.

LNG Canada considered many different mitigation measures throughout both the environmental assessment phase, and in development of the MMMMP, and has presented those deemed technically and commercially feasible. LNG Canada does not own or operate the LNG carriers, which are under pilotage from Triple Island to the LNG Canada facility.

LNG Canada is committed to assessing and considering implementation of additional mitigation measures throughout Operations. Additional mitigation measures may arise through lessons learned, investigations, adaptive management, changing legislation or emerging science and technology.

LNG Canada has also adopted a Vessel Quality Assurance Program vetting system that will ensure compliance with applicable IMO regulations for LNG carriers, including those for noise.

5.1. Speed Profiles

Throughout Operations, LNG Canada-related shipping activities will involve the transit of LNG carriers and supporting marine vessels along the established shipping corridor to and from the LNG Canada marine terminal (Figure 2). Safe operating speeds for LNG carriers are estimated to vary between 4 knots and 19.5 knots, depending on the location, weather conditions, marine mammal presence, and are subject to the safe navigation of vessels as determined by the Master of the vessel that is under the navigation conduct of Pilots onboard. Subject to navigational safety, LNG carriers are expected to travel at 12 knots within the shipping corridor; the exact speed will be determined based on the judgment of an experienced Master and the local advice from the Pilots on board and will be subject to the necessity to maintain navigational safety at all times, taking into consideration location and marine mammal presence. As per EAC Mitigation 5.8-12, in areas of high whale density between the northern end of Campania Island and the southern

end of Hawkesbury Island, LNG carriers will travel at speeds of no greater than 10 knots from July through October (recognizing time periods of high use by marine mammals) (Table 5).

Additionally, LNG Canada has committed to following the NCWMG. These designate a Wright Sound SOA, in which speed is restricted to 8 to 10 knots for tethered escorted “energy vessels”. Following the NCWMG aligns well with LNG Canada’s EAC Mitigation 5.8-12, but would extend the seasonal timing of this mitigation (July through October) to the full year within this SOA. The NCWMG also defines the Gitga’at AOC and the Gitxaala AOC, which identify the need for speed reductions when whales are in these areas.

The LNG carriers' crew and the Pilots will maintain a proper lookout at all times during the passage. The mitigative, slower speeds in designated areas and seasons of high marine mammal density will increase the potential early detection of a whale, and reduce both the likelihood of a collision (Gende et al. 2011), and its potential severity (Vanderlaan and Taggart 2007). A reduction in vessel speed also decreases the amount of underwater noise produced, thus limiting the spatial extent over which noise exceeds behavioural disruption thresholds, and reducing both the number of marine mammals potentially exposed, and their period of exposure.

6. EAC 05 LNG Canada Marine Mammal Study

EAC Condition 05 requires that LNG Canada specify the terms of a study during Operations to improve understanding of the behavioural disturbance or injury to marine mammals from shipping related to the Project. Study concepts were developed in consultation with DFO, TC, PPA, and Indigenous groups. This consultation process led to the identification of two primary study objectives:

1. Marine Mammal Baseline Update:

   To update the original EAC Application marine mammal baseline survey program. An updated understanding of the geographical and temporal occurrence of marine mammals along the shipping corridor will allow for refinement (pending results) of the timing and location of vessel speed mitigation measures, which are considered the most effective means of reducing potential for both behavioral change and injury.

2. Technology Effectiveness:

   To improve understanding of the effectiveness of technology to detect marine mammals in advance of LNG carrier arrival. Early detection of marine mammals may reduce ship strike risk and improve detection reporting. Results could also inform other industry and government mitigation initiatives (Section 7.5).

These objectives have been combined into a single program – the *EAC 05 LNG Canada Marine Mammal Study*. Specific terms of this study are described further in Appendix B.

7. Verification, Adaptive Management, and Corrective Actions

In accordance with Condition 05, LNG Canada is required to specify an adaptive management plan to address the effects on marine mammals, if those effects are not mitigated to the extent identified in the EAC Application or if unexpected effects occur. The adaptive management plan follows a proactive planning approach, according to the Hierarchy of Mitigations, as follows:

- **Avoid** impacts through effective planning.
- **Reduce / Minimize** impacts through implementation of the mitigations related to Operations to reduce effects to marine mammals.
- **Assess** effectiveness of mitigation measures through monitoring and evaluation of incidents and investigations, and compliance auditing and assurance; evaluate trends in data.
- **Adapt / Adjust** based on the results of verification programs, emerging science (including LNG Canada proposed studies), follow-up monitoring, regional initiatives, and incident reports.. These are described in the subsections that follow.

7.1. LNG Carrier Vessel Speed and NCWMG Verification Program

LNG Canada's primary mitigation for marine mammals relates to vessel speed restrictions, including through adherence to the NCWMG. LNG Canada will use the marine AIS and any contract supporting information to conduct quarterly reviews of LNG carriers' vessel transit speeds and observance of the NCWMG. The objective of this program is not to evaluate the effectiveness of the measure itself, but to monitor adherence, and improve understandings of situations that reduce implementability. LNG Canada will support the vessel owners and LNG carrier owners using the LNG Canada facility, in reviewing any learnings, identifying opportunities for improvement, and applying those learnings to adaptive management. LNG Canada will review mitigation measures in the NCWMG annually to ensure the most recent technical information is being used in the MMMMP. LNG Canada will also provide participation rates for vessel slowdowns and average vessel speed annually.

7.2. LNG Carrier Sound Pressure Level Hydroacoustic Verification Program

LNG Canada will conduct a one-time hydroacoustic verification program to validate the EA underwater noise modelling assumptions and predictions regarding LNG carrier sound pressure levels (SPLs). This will improve understanding of LNG carrier source levels and better inform understanding of potential Project effects on marine mammals. In addition to information on ambient underwater noise conditions, and noise from transiting vessels, this program will report on detected marine mammal vocalizations, and will therefore also contribute to understanding of marine mammal occurrence for vocalizing species.

The hydroacoustic verification program will take place once LNG Canada-related shipping operations are stabilized, for an accurate representation of consistent LNG shipping. Based on similar facilities, this is typically around 2 years after start of operations. Planning and design for program execution will commence upon EAO approval of the MMMMP. LNG Canada will actively seek involvement from Indigenous groups and other hydrophone programs and acoustic initiatives in the region. A final summary report of the verification program's findings will be provided to the listed Agencies and Indigenous groups.

Of note, the purpose of the LNG carrier hydroacoustic verification program is not to serve as a mitigation measure or research study. Its purpose is to support LNG Canada's \commitment to undertake a marine mammal follow-up program (as defined above), by verifying the accuracy of the EAC Application's underwater noise modelling assumptions (i.e., LNG carrier source levels) and resultant predictions concerning potential spatial and temporal exposure of whales to sound levels above behavioural disturbance thresholds. Findings of this program can also be used by the broader scientific community to improve their underwater noise modelling input parameters.

7.3. EAC 05 LNG Canada Marine Mammal Study Learnings

One of the primary tenets of the *EAC 05 LNG Canada Marine Mammal Study* (terms of which are described further in Appendix B) is to improve understanding of potential for marine mammal and Project-related shipping interactions; learnings from this study will, therefore, also be evaluated through the lens of potential adaptive management actions. Vessel speed mitigation measures are considered the most effective means of reducing potential for both behavioral change and injury to marine mammals, and an updated understanding of where and when marine mammals occur along the shipping corridor will allow LNG Canada to explore refinement (pending results) of the seasonal timing and geographical boundaries of these measures. Should the technology trials prove effective, LNG Canada will also assess the potential extension of the use of this (or similar) systems to longer-term early detection/advance warning programs. LNG Canada will make the final report from this study, as well as the QA/QC'd data, available to interested parties to further contribute to scientific knowledge. LNG Canada will set up meetings with listed agencies and Indigenous Groups to communicate the data and interpreted results. Data would be provided via email or other requested avenue.

7.4. Follow-up Monitoring

LNG Canada, with input from regional research groups and consultees, will undertake and/or support a follow-up monitoring program with the objective of evaluating the effectiveness of marine mammal mitigation measures related to LNG carrier operations within a pre-determined focal study area along the shipping corridor. This section and the bulleted program terms are intended to act as a placeholder to facilitate further consultation and engagement. The focal study area will be defined to best inform the selected monitoring objectives, but will take into consideration factors such as whale density, habitat, and representativity. Details concerning objectives and methodology of this program will be developed and refined through engagement, and in consideration of any future regional initiatives relating to cumulative effects monitoring and the management of marine shipping (Section 7.5). Planning and design for program execution will commence following EAO approval of the MMMMP, and the finalized terms of this program will be integrated into a future revision of the MMMMP. Should results of the follow-up program suggest that effects to marine mammals during Operations are not mitigated to the extent identified in the Application, or if unexpected effects occur, additional adaptive management steps will be taken.

LNG Canada will consider, and where feasible integrate, feedback from Indigenous groups such as the Gitga'at First Nation with respect to monitoring program design criteria. While the exact nature of the focal study follow-up monitoring program will be developed collaboratively, potential terms for such a program are presented below:

- **Objectives:** Assess mitigation measures related to LNG carrier operations (i.e., speed restrictions) and all observed species of marine mammal within the pre-determined shipping corridor focal study area. Monitoring activities may include, for example, additional density surveys, behavioural focal-follows, documentation of vessel transit interactions, or other relevant targeted studies.
- **Rationale:** Should results of this additional follow-up program suggest that effects to marine mammals during Operations are not mitigated to the extent identified in the Application, or if unexpected effects occur, additional adaptive management steps will be taken, as outlined in Section 7.6.

- **Methods:** TBD. The program methods will be tailored to address the selected objectives and could involve both visual and acoustic, or other monitoring techniques. The program Detailed methodology would be externally peer-reviewed and approved by both LNG Canada and consultees prior to the onset of the monitoring program. LNG Canada would accept third-party input and work collaboratively to develop the methodology supporting the folllow-up monitoring.
- **Implementation Timing**: To commence within the first two years of Operations and to be informed through consultation and engagement with stakeholders, and on the advice of Qualified Professionals.
- **Duration:** TBD. Level of effort for follow-up monitoring during Operations would depend on the actual parameters and methodology required to answer monitoring objective.
- **Coverage:** TBD. The focal study area will be defined to best inform the selected monitoring objectives, and will take into consideration factors such as whale density, habitat, and representativity
- **Analysis:** LNG Canada will allow third-party advisory of data analysis.
- **Deliverable:** LNG Canada will make the the QA/QC'd data available to interested parties (e.g., Gitga'at First Nation) at the end of each year of the program and reports on the status and findings of the program will be published on an agreed-to interval.

7.5. Regional Initiatives

EAC Condition 05 requires that LNG Canada participate in provincial or federal government initiative(s) that seek to manage or monitor the cumulative effects of shipping on marine mammals in areas overlapping the Certified Marine Route or Certified Pilot Boarding Zone.

LNG Canada stays informed of various initiatives along the west coast to help inform marine mammal mitigations and adaptive management (e.g., developments in various whale sighting platforms, such as the Whale Report Alert System, Coast Guard Marine Communications, and the Traffic Services Centre) and will participate in regional initiatives relating to cumulative effects monitoring and the management of marine shipping, where requested or invited to do so. LNG Canada will use the information learned through current and future initiatives, including Indigenous knowledge and DFO science programs, to inform and support recommendations for changes to mitigations and operations.

7.6. Marine Mammal Incident Reporting

LNG Canada-related vessel collisions with marine mammals will be reported to the British Columbia Marine Mammal Response Network (Observe, Record, Report) under DFO by LNG carrier Pilots/Masters in accordance with regulatory requirements. This Program works with partners to track and respond to marine mammal entanglements, strandings, vessel strikes, contaminated animals, and other threats. Personnel working on LNG Canada-related marine activities will be required to observe, document, and report any incidents of vessel strikes to the DFO 24-hour hotline (1-800-465-4336) and through completion of DFO's Marine Mammal Interaction Form. Incidents will also be reported by LNG Canada to Indigenous groups in a timely manner (i.e., within 24 hours).

Indigenous groups and members of the public may also submit marine concerns (e.g., observed vessel speeds, or marine mammal interactions) to LNG Canada via Info@LNGCanada.ca or their reporting hotline at 1-833-632-LNGC (5642).

7.7. Incident Investigation Learnings

In the event of a marine mammal–Project-related shipping incident or complaint, beyond reporting the occurrence (Section 7.6), LNG Canada will investigate the circumstances, identify any lessons learned, and examine the potential

for adaptive measures to reduce the likelihood of a repeat occurrence. LNG Canada will investigate incidents using a reliable incident investigation process. Incidents are risk ranked, and potential severity of the incident dictates the level of investigation that is typically implemented. Investigations will use a rigorous causal analysis methodology. Learnings from investigations will be summarized and any actions taken will be shared with listed authorities and Indigenous groups after the investigation is complete.

LNG Canada has an expectation that LNG carriers that utilize the facility will comply with any rules, procedures and regulations of any applicable Governmental Authorities and maintain the speed reduction zones where safe to do so. Operating speeds above those outlined in the MMMMP will be investigated to identify lessons learned and any appropriate actions, such as increased communication to promote conformance to specified speeds. LNG Canada will continue to participate in programs such as the Proactive Vessel Management (PVM) program, to support these efforts.

7.8. Corrective Actions

LNG Canada will use the framework of the Hierarchy of Mitigations (as described in Section 7) to guide adaptive management and select approriate corrective actions, with the priority to avoid adverse impacts to marine mammals. LNG Canada actively participates alongside other industry groups, NGO's and Coastal communities in the PVM co-led by Transport Canada and Indigenous groups. LNG Canada recognizes their responsibility for adherence to required mitigations, while being limited in accountability or control of vessels themselves, and within the legal obligations outlined in the Pilotage Act and other legislation, whereby the control and decision making for vessel control falls to the vessel Master and/or Pilot. To that end, LNG Canada commits to:

- Assuring the accuracy of EA assumptions related to hydroacoustics as outlined in Section 7.2
- Assuring and assessing the adherence to speed profiles as outlined in the MMMMP and reflected in EAC mitigations via AIS assessment described in Section 7.1
- Assuring and assessing the adherence to NCWMG as it relates to speed profiles via AIS assessment as described in Section 7.1
- Investigating instances of non-conformance to speed profiles resulting from AIS assessments (Section7.7)
- Investigating instances of complaint and concern raised related to LNG carriers calling to port at the LNG Canada facility (Section 7.7).

Investigation includes:

- Determination of cause and reasoning related to speed decisions by Pilots and/or vessel Masters
- Identification of any potential opportunities for improvement, such as increased communication to LNG carrier vessel Masters or Pilots

Investigation and resulting causation outcomes will consider metocean conditions and the Pilots obligations to maintain vessel safety, which may result in appropriate decisions to exceed recommended speeds based on those conditions.

Resulting from these assessments, LNG Canada will undertake any adaptive management possible. The application of adaptive management is dependent on several key factors, including but not limited to the ability to influence behaviors of those in control of vessel operation in accordance with regulatory requirements. LNG Canada continues to be committed to adapting to changing regulatory requirements and expectations around marine mammal mitigations and controls for shipping in Canadian waters.

Actions that LNG Canada will take to support adaptive management include, but may not be limited to:

1. Influence conformance through increased communication to Vessel Master and Pilots related to any speed concerns.
2. Engage with PPA and TC regarding conformance to speed profiles, where appropriate, and any actions resulting from those engagements.
3. Participate in programs intended to mitigate impacts such as the PVM program.
4. Remain aware of areas of higher marine mammal abundance or critical habitat, which will be raised for discussion within the available processes and programs (including but not limited to means of sharing whale presence information, such as through the PVM initiative, or as provided by local communities and Indigenous groups not involved in the PVM initiative [e.g., Haisla Nation]).
5. Identification of potential additional speed restrictions along the shipping corridor, in conjunction with regulatory agencies and in consideration of commercial obligations; and potential discussion of these considerations within the existing regulatory mechanisms, processes and programs.

Verification and reporting measures outlined in Section 7 will form the basis for evaluating the need for adaptive management over time. LNG Canada will also investigate marine incidents or complaints, evaluate potential for integrating learnings from the *EAC 05 LNG Canada Marine Mammal Study*, and keep abreast of current research and opportunities for participation in regional initiatives, as outlined below. As noted in Section 5, LNG Canada is committed to assessing and considering implementation of additional mitigation measures throughout Operations. Additional mitigation measures may arise through lessons learned, investigations, adaptive management, changing legislation or emerging science and technology.

8. MMMMP Implementation and Review

8.1. Implementation

In accordance with EAC Condition 05, LNG Canada must not commence Operations until the MMMMP is approved by the EAO; and LNG Canada is required to implement the Plan to the satisfaction of the EAO.

8.2. Scheduled Reviews

A scheduled annual review of the MMMMP will be undertaken. Should any required revisions be identified during the scheduled reviews, the update process outlined below will be initiated.

8.3. Consultation and Engagement of Review Changes

In accordance with the EAC Condition 05, LNG Canada must "*demonstrate reasonable efforts to engage Aboriginal Groups developing and sharing information regarding implementation of the plan.*" Three regulatory bodies (i.e., TC, DFO, and PPA) were also named, to be consulted with during the development of the Plan. The EAO will be consulted regarding all proposed non-administrative changes to the MMMMP.

Should any required revision to the MMMMP be identified, the following update process will be initiated:

- Administrative/minor changes: This includes updates to names/titles (i.e., of regulatory agencies), grammar where the intent of the language is not changed or a change to the language in the Acts and Regulations quoted herein. MMMMP will be updated and re-issued to TC, DFO, PPA, listed Indigenous groups and EAO for awareness, with a summary of the changes provided (as a clean version and a red-line version). The updated MMMMP will be effective for implementation. If EAO determines that the changes have more substantive impacts to the plan, then EAO will contact LNG Canada to establish the next steps.
- Significant change: Significant changes represent any change to the WLMP where there is a proposed change to how the management, monitoring or reporting components are implemented. TC, DFO, PPA, Indigenous groups and EAO will be consulted on the proposed change(s). After the consultation activities are completed, the MMMMP will be updated and re-issued to TC, DFO, PPA, Indigenous groups and EAO, with a summary of the changes provided (as a clean version and a red-line version). The updated MMMMP will then be effective for implementation.

9. References

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Appendix A Acronyms and Abbreviations

AOC	Area of Concern
BC	British Columbia
CSA 2001	*Canada Shipping Act, 2001*
DFO	Fisheries and Oceans Canada
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
FDS	Federal Decision Statement
HSSE	Health, Safety, Security and Environment
IAAC	Impact Assessment Agency of Canada
IMO	International Maritime Organization
LNG	Liquefied Natural Gas
LNG Canada	LNG Canada Development Inc.
MMMMP	Marine Mammal Management and Monitoring Plan
NCWMG	North Coast Waterway Management Guidelines
PPA	Pacific Pilotage Authority
Project	LNG Canada Export Terminal Project
PVM	Proactive Vessel Management
RSA	Regional Study Area
R.S.C.	Revised Statutes of Canada
SARA	*Species at Risk Act*
SOA	Special Operating Area
TC	Transport Canada

Appendix B EAC 05 LNG Canada Marine Mammal Study Terms

EAC Condition 05 requires that LNG Canada specify the terms of a study during Operations to improve understanding of the behavioural disturbance or injury to marine mammals from shipping related to the Project.

Study concepts were developed in consultation with DFO, TC, PPA, and Indigenous groups. This consultation process led to the identification of two primary study objectives. The first of these is to update the original EAC Application marine mammal baseline survey program. An updated understanding of the geographical and temporal occurrence of marine mammals along the shipping corridor will allow for refinement (pending results) of the timing and location of vessel speed mitigation measures, which are considered the most effective means of reducing potential for both behavioral change and injury. The second study objective will be to improve understanding of the effectiveness of technology to detect marine mammals in advance of LNG carrier arrival. These objectives have been combined into a single program – the *EAC 05 LNG Canada Marine Mammal Study*.

The *EAC 05 LNG Canada Marine Mammal Study* will be undertaken by LNG Canada with support from Qualified Professionals in the marine mammal space, and will be informed by regulatory requirements and Indigenous knowledge.

Specific terms of this study are described below.

Study Terms:

- **Objectives:**
    1. Improve understanding of spatial and temporal occurrence of marine mammals along the shipping corridor.
    2. Improve understanding of the effectiveness of technology to detect marine mammals in advance of LNG carrier arrival.
- **Rationale:**
    1. Delineation of temporal and geographic distributions will aid in refining mitigation measures and support adaptive management.
    2. Early detection of marine mammals may reduce ship strike risk and improve detection reporting. Results could also inform other industry and government mitigation initiatives.
- **Method:** Statistically designed line transect surveys undertaken by trained marine mammal observers (objective 1), supplemented with trials of infrared imagery camera equipment deployed onboard the research vessel (objective 2).
- **Duration:** One year program, consisting of 12 field surveys/equipment trials (roughly one survey per month) to cover seasonal changes in marine mammal density as well as test equipment in variable weather conditions.
- **Implementation Timing**: to take place once LNG Canada-related shipping operations are stabilized, for an accurate representation of consistent LNG shipping. Planning for Study execution will commence upon EAO approval of the MMMMP.
- **Coverage:** Field surveys and associated equipment trials will cover the entire shipping corridor between the Project terminal and the Pilot boarding station. The LNG Canada Marine Mammal Study Area encompasses the extent of shipping activities and surrounding waters within the confined channels (e.g., Kitimat Arm,

Douglas Channel, Squally Channel, Principe Channel), Whale Channel, Caamaño Sound, and marine waters along the Marine Access Route out to the Triple Island Pilot Boarding Station in the north. Where the Marine Access Route is not confined by geography, a buffer of 10 km is used on either side around the shipping corridor.

- **Anticipated Analysis:** Objective 1: Marine mammal visual observations will be analyzed using standard Distance line transect protocols. Objective 2: Post-hoc analysis of infrared imagery will be undertaken and compared to the blind visual observations collected simultaneously from the same platform. Reporting will assess whether technology is able to detect marine mammals earlier, further away, or at higher frequencies than human observers alone.
- **Adaptive Management:** As this study is being undertaken, in part, to assess effectiveness of technology, modifications to the technology trial program, with respect to equipment, deployment, or analysis, may be made following each field trial, to improve upon or test different variables. When executing the Objective 2 trials, LNG Canada will adapt if a particular piece of equipment is deemed ineffective to meet the Study Terms as described. Once the effectiveness of the technology has been determined, its potential applicability to Project shipping management applications will be explored.

  Any modifications made to the Objective 2 program will not alter the statistical rigour of the Objective 1 Distance sampling program.
- **Deliverable:** LNG Canada will make the final report from this study, as well as the QA/QC'd data, available to interested parties to further contribute to scientific knowledge. LNG Canada will set up meetings with listed agencies and Indigenous Groups to communicate the data and interpreted results. Data would be provided via email or other requested avenue.