Technical Memorandum

To:	Catherine Ponsford, Project Manager Canadian Environmental Assessment Agency	From:	Mike Lambert, Head, Environmental and Regulatory Affairs Pacific NorthWest LNG
File:	123220020	Date:	November 10, 2015

Reference: June 2, 2015 Letter—Annex III—Outstanding Information from Information

This letter responds to the request for outstanding information received from the Canadian Environmental Assessment Agency (CEA Agency) on June 2, 2015.

QUESTION #2: EFFECTS ON MARINE MAMMALS

Issue and Information Requested: Limited baseline information was provided by the proponent on marine mammals. The Agency, informed by advice from DFO and comments received from Aboriginal groups and the public, requested that the proponent provide additional information regarding alternative suitable habitats:

"Marine mammals are known to be found in conjunction with concentrated prey. If marine mammals are deterred from feeding on the prey found within the PDA and LAA from noise or water quality, are there other abundant prey sources (suitable habitat) in the area that the species can feed on? Please describe this suitable alternative habitat (location, species of prey and timing)" (August 14, 2014 technical table, Marine Resources #5).

Information Provided: The proponent provided abundance estimates within the Queen Charlotte Basin for some species likely to be affected by the Project, making reference to some high density areas.

Remaining Information: The Agency requires information on alternative suitable habitat for marine mammals that includes by species: specific locations, species of prey, and expected timing of use, based on available information. In order to assess the residual effects to marine mammals from underwater noise and associated avoidance behaviours, explain how the availability and suitability of any alternative habitats reduces overall adverse effects to marine mammals.

RESPONSE TO QUESTION #2: EFFECTS ON MARINE MAMMALS

In response to the Information Request, additional information is provided below that broadly outlines potential areas of alternative suitable habitat in northern BC for marine mammal species likely to be found in the local assessment area (LAA) of the Project. Beyond the information that has been previously provided concerning distribution of prey species (i.e., suitable habitat), finer-scale, more detailed distributional and timing information for marine mammal prey sources in the LAA is not available. An ongoing marine mammal field program has been developed to help further understanding of marine mammal species presence, relative abundance, timing, and spatial distribution in the project development area (PDA) and LAA. The LAA includes the PDA, three potential shipping routes (between the terminal and Triple Island Pilot Boarding Station), and an approximate 10 km buffer on either side of the potential shipping routes that also extends further south into Arthur Pass (between Smith and Porcher islands). Monthly vessel-based surveys (from

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November 2014 to November 2015) have been and will continue to be used to assess variations in marine mammal species' distribution and density in this region. While surveys will not specifically target feeding habitats and associated prey species, it is reasonable to assume that repeated presence of marine mammals in an area indicates some level of habitat suitability and may also be indicative of reasonable concentrations of prey in that location.

Underwater noise from project activities has the potential to result in changes in behaviour of marine mammals. Project activities likely to generate underwater noise include blasting, pile installation, dredging, disposal at sea, construction-related vessel traffic, and shipping liquefied natural gas (LNG). Marine mammals rely on underwater sounds to communicate, orient, navigate, socialize, locate and detect mates, avoid predators, and capture prey. The introduction of anthropogenic sounds may affect any of these activities, although the exact way in which an individual marine mammal responds to elevated underwater noise levels is difficult to predict. Some of the possible outcomes of sensory disturbance(s) may include:

- Physiological responses, such as an increase in stress hormones (Rolland et al. 2012) or a change in respiration or heart rate
- Reduced ability to "hear" other sounds (i.e., masking or reductions in communication space [Clark et al. 2009]) resulting in changes in vocalization pattern, length, or volume to compensate for the increased background noise (e.g., Castellote et al. 2012, Foote et al. 2004, Holt et al. 2008)
- Deviations in swim direction, speed, surfacing pattern, or dive duration (e.g., Erbe 2002, Lusseau et al. 2009, Williams and Ashe 2007)
- Startle responses (more likely in response to impulsive sound sources)
- Habitat avoidance where very high levels of underwater noise occur (e.g., Dähne et al. 2013, Morton et al. 2002)

These may contribute to increased energy expenditure, altered activity budgets, reduced foraging efficiency, potential exclusion from important foraging or breeding areas, and increased risk of ship strike (e.g., Aguilar Soto et al. 2006, Lusseau et al. 2009, Morton et al. 2002, Nowacek et al. 2004, Williams et al. 2006).

The above list broadly captures the range of potential marine mammal responses to introduced underwater noise; however, the degree of sensory disturbance and exhibited response depends on a wide variety of factors. Source factors include the nature of the sound (e.g., impulsive vs. non-impulsive), frequency, sound pressure level, duration, attenuation rate, and proximity to the animal (Southall et al. 2007). Reported responses to underwater noise also vary dramatically by species. For example, schools of some dolphin species (e.g., spotted, spinner, and Atlantic white-sided) commonly swim rapidly away from approaching research vessels (Au and Perryman 1982, Palka and Hammond 2001), while others (e.g., white-beaked and Pacific white-sided dolphins) are frequently attracted to them (e.g., Buckland et al. 1993, Palka and Hammond 2001). Similar variability in responses is observed between porpoise species – while Dall's porpoise are often attracted to survey vessels (Turnock and Quinn 1991), harbour porpoise have been reported to avoid them at distances up to 1,000 m (Barlow 1988, Palka and Hammond 2001).

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Few studies have examined how whales react to closely approaching large commercial ships (such as tankers, bulk carriers, and container ships). Anecdotal reports suggest that startle responses to large vessels may only occur within a few hundred metres of oncoming ships, as whales take evasive action to avoid a collision (Laist et al. 2001, Nowacek et al. 2004). In contrast, exposure of North Atlantic right whales to playbacks of ship noise and approaches by transiting vessels did not elicit any behavioural response (Nowacek et al. 2004). A recent study of blue whales off California documented a shallow dive response in the path of oncoming ships for 55% of the ship passages, but this study also found no evidence for lateral avoidance (McKenna et al. 2015).

As illustrated above, the type and scale of disturbance response can vary substantially by species, and even individuals within a species may respond quite differently; however, current research suggests that the primary influence governing marine mammal reactions appears to be the context of the situation (Ellison, 2012). This is to say that the same individual may respond completely differently to the same sound under a different set of circumstances. Contextual factors may include: the animal's activity state (are they migrating, foraging, socializing, resting?); the geographical location and season (are they courting on the breeding grounds? replenishing fat reserves just prior to migration?); their social circumstances (are they alone? in a large pod? with a juvenile?); and the nature and novelty of the sound (have they been exposed to this type of sound before?). Differences in vessel factors (e.g., size, speed, design, upkeep) likely also influence response behaviour (Ellison et al. 2012).

The introduction of underwater noise from the increase in Project-related marine shipping will not be constant or continuous across the entire LAA, but instead, for a given marine mammal at any given location, each vessel passage will occur as an individual event, both increasing and then decreasing in sound level. Within the LAA, LNG carriers, tugs, and barges will travel at speeds ranging from 4 to 16 knots, and the zone of ensonification will vary based on the speed. Effects may also act cumulatively and in an additive fashion. For example, disturbances that reduce time available for or efficiency of foraging (e.g., Williams et al. 2006) may be of greater consequence to populations that are already prey-limited. The increase in vessel passage events could also increase overall day and night average ambient underwater sound levels.

The National Oceanic and Atmospheric Administration (NOAA)'s behavioural disruption threshold, which is the same for both pinnipeds and cetaceans, is 120 dB_{RMS} re: 1 µPa for continuous sounds (e.g., shipping). Although Southall et al. (2007) did not assign a threshold value for assessing behavioural disturbance, they did develop a quantitative 'severity scaling' that numerically ranks observed marine mammal behavioural responses to noise exposure. The scoring of the severity scale is meant to differentiate between minor and/or brief responses (0–3), those with higher potential to affect foraging, reproduction or survival (4–6), and those considered likely to affect vital rates (7–9) (Southall et al. 2007). A recent study by Williams et al. (2014) examined the behavioural responses of northern resident killer whales to the passage of three classes of large ships (i.e., cargo vessels, cruise ships, and ocean-going tugs)[1] and evaluated the reactions using the Southall severity scale. The authors found that 50% of the killer whales examined showed a response level ≥ 2 at received levels of approximately 130 dB re 1 µPa rms. This response score correlates to a 'brief or minor change in respiration rates' and is predicted at sound pressure levels 10 dB higher (i.e., more than twice as

[1] Note that while vessel size does influence sound output, beyond 100 m, ship length has less pronounced effects on source level than for smaller vessels (Erbe et al. 2012, McKenna et al. 2012).

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loud) as the NOAA behavioural disturbance threshold that was used in the effects assessment to evaluate behavioural change.

A number of mitigation measures have been identified in the EIS/Application and EIS Addendum to avoid or reduce potential effects. Residual behavioural effects caused by project-related underwater noise are anticipated to be more prominent during the construction phase compared to operations, as in-water construction activities (e.g., pile installation) are known to produce louder underwater noise levels than operational activities (e.g., vessel movements). As discussed in Appendix A: Marine Resources of the EIS, under the worst case scenario, individuals of some marine mammal species (e.g., harbour porpoise) may exhibit localized avoidance responses for the duration of the construction phase of the Project (i.e., three years). Mitigation and monitoring plans for the construction phase and shipping are presented in the Marine Mammal Monitoring Protection Plan.

Short-term behavioural changes and temporary displacement (i.e., for approximately 30 minutes to two hours) may also occur during shipping and berthing. Effects are expected to be similar to those associated with the movement of existing large vessel traffic in the Prince Rupert region. LNG carriers will travel through the LAA between the marine terminal and the Triple Island Pilot Boarding Station (accompanied by one escort tug during both inbound and outbound transits) during operations. At full capacity, one LNG carrier per day is expected to call on the marine terminal, and one carrier will depart from the marine terminal. Shipping is expected to result in only a temporary increase in underwater noise at a given location, resulting in the potential for highly localized, short-term behavioural effects (i.e., for less than half an hour with the passing of each individual vessel).

Project effects of underwater noise are also expected to overlap spatially and temporally with other projects, which could act cumulatively to affect behaviour over larger areas and for longer durations, particularly during construction. Concurrent cumulative effects with other projects could include pile driving, shipping and berthing; however, the duration and degree of overlap is uncertain at this time. However, given the variability of vessel types, sizes and speeds, it is not possible to provide a definitive prediction of the magnitude, spatial extent or temporal extent of potential cumulative or additive effects due to marine traffic. Mitigation measures implemented as part of this Project (e.g., enforcing a marine mammal safety exclusion zone during construction monitoring and use of bubble curtains for pile driving) are expected to reduce the magnitude of these effects on marine mammals. Other projects in the region have been or are likely to be required to mitigate for potential effects of underwater noise using similar measures to this Project. Given these mitigation measures, cumulative effects on marine mammal behaviour should be lessened. Overall, operational activities such as shipping and berthing are expected to increase underwater noise levels in the region; however, exposure of marine mammals to these increased noise levels are predicted to be short-term (i.e., for the period of berthing or the transit of vessels past a marine mammal or group of marine mammals). Temporary changes in behaviour and distribution are anticipated to recover to conditions prior to exposure, given that noise levels will attenuate with time and distance.

Suitable habitats have been identified in the local and regional areas that could provide alternative habitat in the event of potential short-term behavioural change and temporary displacement during construction and operations. Given the large geographic ranges of the species likely to be

affected, should short-term changes and displacement occur, these are not expected to result in mortality of individual marine mammals and no population-level effects are expected.

SARA-listed marine mammal species frequently observed in the LAA (i.e., humpback whale, northern resident and Bigg's killer whales, harbour porpoise, and Loughlin's northern sea lion) are discussed in detail below with suitable alternative habitats identified where available. These species have conservation significance in BC waters and are assessed in detail in the EIS.

As discussed in the Marine Resources Technical Data Report (TDR), humpback whale, northern resident and Bigg's killer whales, harbour porpoise, Dall's porpoise, Pacific white-sided dolphin, harbour seal and potentially Loughlin's northern sea lion are the most likely species to be observed in Chatham Sound based on frequency of previous sightings (Table 1 and Figure 1).

Sightings of fin whales, grey whales, and minke whales, are considered unlikely to occur in the LAA. Based on a review of available literature and opportunistic data collected by the BC Cetacean Sightings Network (2013) there have been no reported sightings of fin whales in the LAA and the most recent nearby sightings were in northern Hecate Strait, and west of Dundas and Melville Islands (COSEWIC 2005; Williams and Thomas 2007). Very few grey whales have been sighted by the BC Cetacean Sighting Network within the LAA. With the exception of one sighting to the west of Prince Rupert, all records were sighted north of Triple Island (BC Cetacean Sightings Network 2013). Minke whales usually occur in Hecate Strait and have been reported rarely (two sightings, BC Cetacean Sightings Network 2013) within the LAA (Best and Halpin 2011; Ford et al. 2010). Modelled suitable habitat for sea otters exists within the LAA (Gregr et al. 2008), although at present sea otters are not expected to occur in this area on a regular basis. A solitary sea otter was observed approximately 2.5 km SW of the Kinahan Islands during marine mammal surveys conducted for this Project on August 5, 2015. While the range of sea otters is likely to expand in the future, the currently reported northern limit of the BC population's range extends only somewhat north of Aristazabal Island (Nichol et al. 2009), while the southern extent of the Southeast Alaska stock extends to Dixon Entrance (United States Fish and Wildlife Service 2014). The above four species of marine mammal are included in Table 1 but are not considered further in this response.

Table 1 summarizes areas of suitable habitat for marine mammal species potentially present in the marine resources LAA. For each marine mammal species, their primary prey type and predicted seasonal timing in BC waters is provided, with further specifics on marine mammal presence by area when available. Available data on areas of potential suitable alternative habitat within northern BC are listed, although it is recognized that many marine mammal species have high site fidelity to foraging areas. The areas identified in Table 1 as suitable habitat are based on areas where high concentrations of the species are known to occur or are predicted to occur in proximity to the LNG terminal or shipping route. Concentrations of these species are also known to occur in other areas. Listing of an area in this table is meant only to demonstrate the broad geographical coverage over which most of these species are found within the north coast waters, and is not meant to imply that individuals of any species would necessarily make use of all noted locations.

Reference: June 2, 2015 Letter—Annex III—Outstanding Information from Information

Table 1 Areas of Alternative Suitable Habitat in Northern BC, Expected Timing of Presence, and Common Prey Species for Marine Mammals Potentially Present within the LAA

Species and SARA status	Potential Areas of Suitable Alternative Habitat in Northern BC [a]	Expected Timing of Presence [a]	Common Prey Species
Fin whale *(Balaenoptera physlaus)* *Threatened,* Schedule 1	• Dixon Entrance[1,2] • Western to central area of Hecate Strait[2,3] • Nepean Sound[2]	• Highest probability of presence from June – September[3] • Feed in BC waters in summer[4]	• Primarily euphausiids and copepods[4] • Occasionally cephalopods and fish[4]
Humpback whale *(Megaptera novaeangliae)* *Threatened,* Schedule 1	• Dixon Entrance[2,5]/Langara Island (designated critical habitat)[6] • Hecate Strait[2,5] • West of Graham Island[5] • East of Haida Gwaii[7] • Southeast Moresby Island (designated critical habitat)[6] • Gil Island (designated critical habitat)[6]	• Found year-round in BC waters • Primarily in BC waters May – October[7] • Gil Island frequented primarily in late summer and fall[8]	• Euphausiids, copepods[6] • Small schooling fish (e.g., herring, sardine, sandlance, smelts, juvenile salmonids, cod, mackerel, anchovies)[6] • Pteropods[6] • Some cephalopods[6]
Minke whale *(Balaenoptera acutorostrata scammonii)* Not listed	• Western Hecate Strait[2]	• Found year-round in BC waters • Peak April – October[9]	• Large zooplankton[10]
Grey whale *(Eschrichtius robustus)* *Special concern,* Schedule 1	• Dixon Entrance[11] • Primarily central/eastern Hecate Strait[11]	• Spring (migration)[11] • Summer (small part of population for feeding)[12]	• Amphipods[12] • Ghost shrimp[12] • Mysid shrimp[12] • Crab larvae[12] • Herring eggs and larvae[12]
Northern resident killer whale *(Orcinus orca)* *Threatened,* Schedule 1	• Dixon Entrance to central Vancouver Island[13] • Chatham Sound[14] • Caamaño Sound[14]	• Primarily July through October in critical habitat[13] • May – July north coast/Queen Charlotte Islands[15] • Mid-July off Northeast Vancouver Island[15]	• Primarily Chinook salmon[15] • Other salmonids[15] • Other fish and cephalopods[13]

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Species and SARA status	Potential Areas of Suitable Alternative Habitat in Northern BC [a]	Expected Timing of Presence [a]	Common Prey Species
		• June – October off southern Vancouver Island[15] • Found year-round in BC waters[13]	
Bigg's (transient) killer whale *(Orcinus orca)* *Threatened,* Schedule 1	• Ranges widely in coastal BC waters following prey species[16,17]	• Found year-round in BC waters[16, 17]	• Primarily harbour seals[16] • Loughlin's northern sea lion[16] • Dall's porpoise[16] • Harbour porpoise[16] • Occasionally minke whales and grey whale calves[16]
Dall's porpoise *(Phocoenoides dalli)* Not listed	• Dixon Entrance[2] • Western Hecate Strait[2] • Around Stephens Island[2]	• Found year-round in BC waters	• Juvenile blackbelly eelpout[18] • Pacific herring[18,19] • Eulachon[18] • Walleye pollock[18,19] • Pacific hake[18,19] • Pacific sandlance[18] • Marked squid[18] • Lanternfish[18] • Bathylagidae[19] • Pyschrolutidae[19] • California headlight fish[19] • Myctophidae[19]
Harbour porpoise *(Phocoena phocoena)* *Special concern,* Schedule 1	• Western Hecate Strait[2] • Around Smith Island[2] • Around Porcher Island and Goschen Island[3]	• Found year-round in BC waters	• Pacific herring[18,19] • Pacific sardine[19] • Pacific hake[18,19] • Walleye pollock[18,19] • Pyschrolutidae spp.[19] • Shiner perch[19] • Northern anchovy[19] • Myctophidae[19] • Eulachon[18]

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Table 1 Areas of Alternative Suitable Habitat in Northern BC, Expected Timing of Presence, and Common Prey Species for Marine Mammals Potentially Present within the LAA

Species and SARA status	Potential Areas of Suitable Alternative Habitat in Northern BC [a]	Expected Timing of Presence [a]	Common Prey Species
			• Plainfin midshipmen[18] • Juvenile blackbelly eelpout[18] • Pacific sandlance[18,19] • Juvenile rockfish[18] • Northern sculpin[18] • Pacific sanddab[18] • Stichaeidae[19] • Polychaeta[18,19] • Cephalopoda[18,19] • Crustacea[18]
Pacific white-sided dolphin *(Lagenorhynchus obliquidens)* Not listed	• Southwestern Hecate Strait[2]	• Found year-round in BC waters	• Pacific herring[20] • Capelin[20] • Pacific sardine[20] • Eulachon (likely) [20]
Sea otter *(Enhydra lutris)* *Special concern,* Schedule 1	• West side of Aristazabal Island[21] • Waters between Hecate Island and Price Island[21] • Areas of predicted optimum sea otter habitat extend to many areas of central and northern coast of BC[22]	• Found year-round in BC waters	• Benthic invertebrates[21] • Clams[23] • Sea urchin[23] • Snails[23] • Chitons[23] • Crabs[23] • Sea stars[23] • Some fish[23]
Harbour seal *(Phoca vitulina richardsi)* Not listed	• Numerous haulouts on BC coast[24] • Large haulouts east of Porcher Island, north east tip of Graham Island[24]	• Found year-round in BC waters	• Preferred prey small or medium-sized schooling fish (including Pacific herring, Pacific hake, sandlance, salmon, eulachon, sardines)[24] • Bottom fish (such as flounder, sole, skate) [24]

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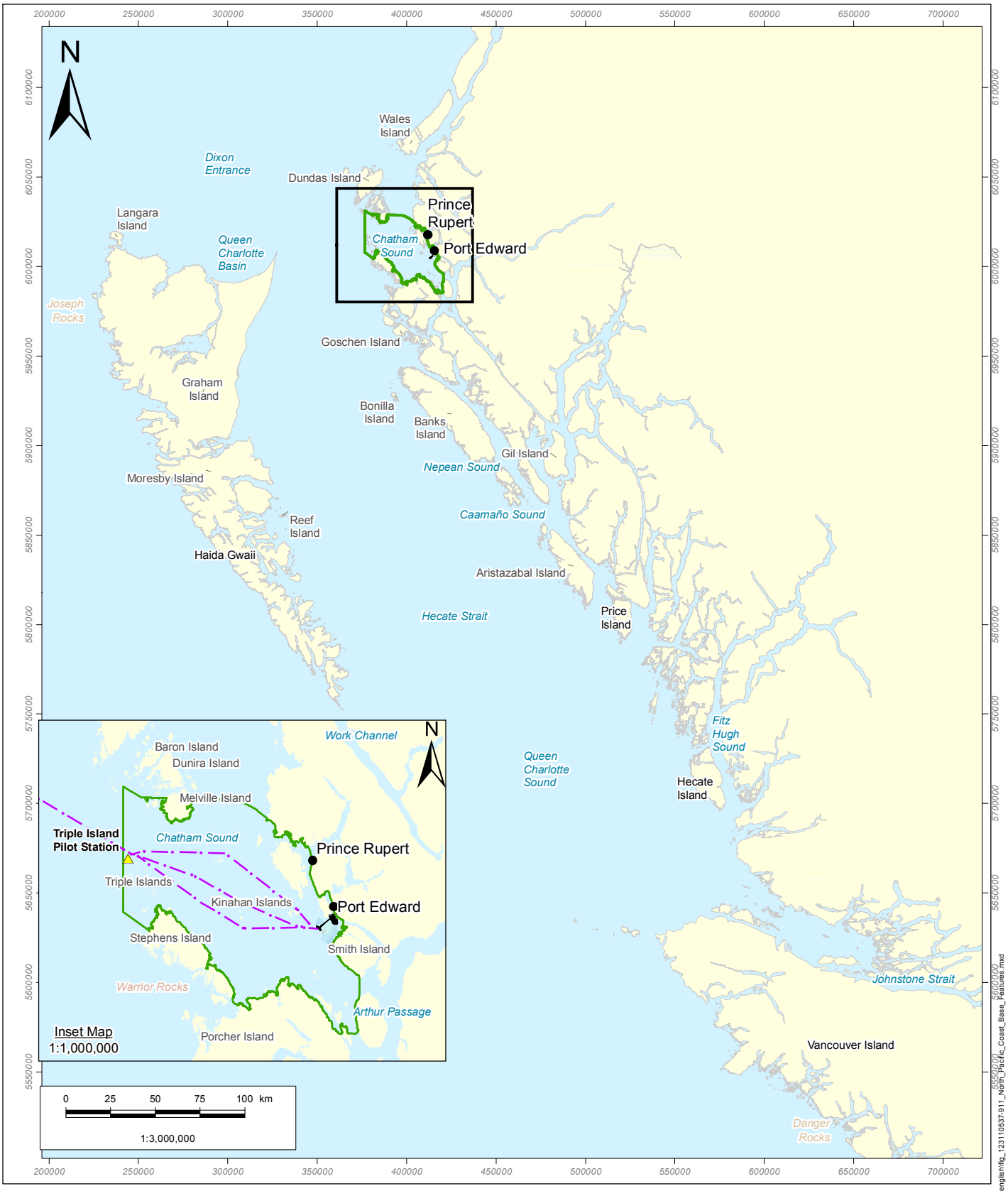
Species and SARA status	Potential Areas of Suitable Alternative Habitat in Northern BC [a]	Expected Timing of Presence [a]	Common Prey Species
			• Squid[24] • Octopus[24]
Loughlin's northern sea lion *(*Previously Steller sea lion; *Eumetopias jubatus monteriensis)* *Special concern,* Schedule 1	• Rookery: Danger Rocks[25] • Year-round haulout sites – Warrior Rocks, Langara Island, Joseph Rocks, Bonilla Island, and Reef Island[25]	• Haulouts used only in winter or year round[25] • Rookeries used May-August[25]	• Preferred prey small or medium-sized schooling fish (such as Pacific herring, Pacific hake, sandlance, salmon, dogfish, eulachon, sardines)[25] • Bottom fish (rockfish, flounder, skate) [25] • Squid[25] • Octopus[25]
NOTES: [a] Based on reported presence. Species presence can vary and possible sightings outside of the reported periods can occur.			
SOURCES: [1]Williams and O'Hara (2009), [2]Best and Halpin (2011), [3]Gregr and Trites (2001), [4]Flinn et al. (2002), [5]Dalla Rosa et al. (2012), [6]DFO (2013a), [7]Ford et al. (2009), [8]Nichol et al. (2010), [9]Towers et al. (2013), [10]summarized in Pauly et al. (1998), [11]Ford et al. (2012), [12]DFO (2010c), [13]DFO (2011), [14]Ford (2006), [15]Ford and Ellis (2006), [16]Ford et al. (2007),[17]DFO (2013b) [18]Walker et al. (1998), [19]Nichol et al. (2013), [20]Morton (2000), [21]DFO (2014), [22]Gregr et al. (2008), [23]COSEWIC (2007), [24]DFO (2010a), [25]summarized in DFO (2010b)		



Triple Island Pilot Station

Potential Shipping Route

Project Component

Marine Resources Local and Regional Assessment Area

Pacific NorthWest LNG

Marine Mammal Habitat Areas

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.; Canadian Hydrological Service (CHS), 1995.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

DATE: 09-OCT-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537-394	DATUM: NAD 83
DRAWN BY: T.McInnes	CHECKED BY: B. BYRD

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **1**

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Humpback Whale

The North Pacific humpback whale population has been increasing with an estimated annual growth rate of 4.9–6.8% (Calambokidis et al. 2008). Approximately 18,000–21,000 humpback whales are believed to occur in the North Pacific (Barlow et al. 2011; Calambokidis et al. 2008; Ford et al. 2009). In BC, humpback whale population estimates range from 1,541 individuals (Best and Halpin 2011) to a maximum of over 3,500 whales (Rambeau 2008). Predictions of humpback whale occurrence or hotspots do not identify the LAA as an area of high humpback whale density (Best and Halpin 2011) or as an area where there would be high predicted encounter rates (Dalla Rosa et al. 2012).

Four areas in BC have been designated as critical habitat for humpback whales, all of which are located outside of the LAA: Langara Island, Southeast Moresby Island, Gil Island and Southwest Vancouver Island (DFO 2013a). These areas were identified as critical habitat based on humpback whale presence and historically used areas (Nichol et al. 2010). Feeding behaviour has been observed in all four designated critical habitats and almost three-quarters of the humpback whales photo-identified in BC have been sighted in these critical habitats (DFO 2013a). Other areas nearby to the LAA that have been recorded to have high frequency of humpback whale presence include the waters near Triple Island and Work Channel (Ford et al. 2009), and west of Stephens Island and east and west of Baron, Dunira and Melville Islands (Dalla Rosa et al. 2012). Although humpback whales exhibit high levels of site-fidelity to foraging areas (Rambeau 2008), the high encounter rates observed in the designated critical habitat areas outside the LAA, as well as the documented use of these critical habitats by a substantial portion of the photo-identified animals, suggest that these areas can be considered alternative suitable habitat to maintain critical life history functions (such as foraging) for this population.

Northern Resident Killer Whale

The northern resident killer whale population is made up of three acoustic clans (A, G, and R). Clans are not restricted to specific areas within their range, although the R clan is most frequently sighted in the northern part of their range along the northern BC coast (DFO 2011). Population census of the species shows an 11% increase between 1997 and 2006, with 244 individuals in 2006 (COSEWIC 2008). Population estimates for the Queen Charlotte Sound area suggest there are 128 whales in the region, based on data collected in 2004 and 2005 (Williams and Thomas 2007) (more recent population estimates for this area do not exist).

Sightings of northern resident killer whales occur all along the BC coast. Their distribution is strongly tied to the seasonal presence of salmonids along the coast (Ford 2006; Ford and Ellis 2006). On the north and central coast of BC, areas identified as potential critical habitat for northern resident killer whales are Fitz Hugh Sound, and Caamaño Sound (Ford 2006). Both areas may provide seasonally important foraging habitat for this species prior to their summer/fall use of Johnstone Strait. Chatham Sound has also been identified as an important area for foraging, with northern resident killer whales feeding on the Skeena and Nass River Chinook salmon run and the early chum salmon run, from May to mid-July. Higher numbers of sightings have been recorded in areas just outside the LAA (relative to within the LAA); these areas include around Dundas Island, between Dundas Island and Wales Island, and in Work Channel (Ford 2006).

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Northern resident killer whale critical habitat has been designated in Johnstone Strait and southeastern Queen Charlotte Strait (DFO 2011) because it may provide 'unparalleled' conditions for foraging in summer and fall when compared to other areas for this species' range (Ford 2006). Critical habitat was selected based on the consistent high number of encounters in this area from July to October, although they do use the area year-round.

Areas outside of the LAA are frequently used for foraging activities by northern resident killer whales (Ford 2006), suggesting they are suitable alternative habitat. Large numbers of sightings have been recorded in areas just north of the LAA (e.g., near Dundas Island, Ford 2006). The seasonal use of the waters of Chatham Sound by northern resident killer whales, including the LAA, would temporally limit the exposure of this population to underwater noise that may result in changes in behaviour as a result of the Project. With the availability of suitable alternative habitat and the seasonal use of the region, it is anticipated that the Project would not affect the population viability of this species and adverse effects to northern resident killer whales could be minimized.

Bigg's Killer Whale

Bigg's killer whales can be found throughout BC coastal waters. They tend to move through areas quickly but may have preferential areas or "home ranges" where they prefer to hunt (Ford and Ellis 1999). Critical or important habitat has yet to be identified, although recent scientific advice from DFO has indicated that waters within three nautical miles of the Pacific coast are necessary habitat to meet the recovery objectives for Bigg's killer whale (DFO 2013b). Although their distribution is broad, and movement models show that individuals are likely to only remain in an area for a week or two, they do have high site fidelity (DFO 2013b) (i.e., they tend to return to the same places over time). Bigg's killer whales can travel 75–150 km per day and tend to be found in small groups (DFO 2013b).

Given that the species is highly mobile and feed opportunistically in open waters or along the coast (DFO 2013b), many areas along the coast of BC could be considered available suitable habitat. Their prey (e.g., harbour seals) is widely available in many areas along the coast. Given the combination of these factors, it is anticipated that the population viability of this species would remain unaffected by the Project.

Harbour Porpoise

Current population estimates for the Queen Charlotte Basin suggest there are 2,806 to 3,647 individuals, with an estimated average of 6,631 in BC waters (Best and Halpin 2011). Preliminary research suggests it is likely that individuals that inhabit BC waters and northern Washington waters are a single population, with individuals travelling all along the coast (Crossman et al. 2014).

Harbour porpoise are observed throughout BC coastal waters, with areas of higher densities predicted near the LAA (e.g., around Porcher Island and Goschen Island), Hecate Strait and areas closer to Vancouver Island (Best and Halpin 2011). The high use of areas outside of the LAA indicates these areas are likely suitable habitat for the species. Ford (2010) reported that the majority of harbour porpoise sightings occurred within 20 km of shore, with sightings occurring all along the coast of BC. Harbour porpoise can travel up to 60–100 km per day (Read and Westgate 1997, Sveegaard et al. 2011), which suggests that areas outside of the LAA would be available to individuals that frequent areas within the LAA.

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Given the potential for individuals that frequent areas within the LAA to access other suitable habitat, potential changes in harbour porpoise behaviour as a result of Project activities are not expected to affect the viability of the population.

Loughlin's Northern Sea Lion

Loughlin's northern sea lion (previously known as Steller sea lion) can occur within the LAA, but do not have any identified major haul-outs or rookeries (i.e., breeding and pupping areas) in the LAA (DFO 2010b). Two major winter haul-outs are located just west and northwest of the LAA, and year-round haul-outs have been identified on Langara Island and on Warrior Rocks. Steller sea lions exhibit high site fidelity to rookeries, with the closest rookery to the LAA located at Danger Rocks, east of Banks Island. Multiple haul-outs can be utilized over the course of a few weeks or months as they are a highly mobile species that ranges widely along the BC coast (DFO 2010b). Movement of the species during the breeding season tends to be more localized around rookeries, while movements during the non-breeding period are more likely associated with the distribution of forage fish (COSEWIC 2003).

Loughlin's northern sea lions that utilize the LAA are likely to have access to other suitable habitat, with two major winter haulouts located close to the LAA. Given that they are a highly mobile species it is anticipated that they are able to access other suitable habitat outside of the LAA.

SUMMARY

Data on marine mammal species presence, relative abundance, timing and spatial distribution in the PDA and LAA are currently being collected by the marine mammal field program to help identify habitat use, and will continue until November 2015. Preliminary results of the marine mammal surveys are consistent with the literature and BC Cetacean Sightings Network data and show wide use of the waters in the LAA and RAA by all species. Although specific fine-scale prey distributional data are limited, it is expected that consistent sighting of marine mammals in an area is indicative of suitable foraging habitat. This Information Response uses available published literature and data to assess availability and locations of alternative suitable habitat for marine mammal species that are expected to be present in the LAA.

It is anticipated that individual marine mammals in the LAA may exhibit localized behavioural change in the LAA for the duration of the construction phase of the Project and for short periods of time (i.e., 30 minutes to two hours) during shipping and berthing. Cumulative operations and construction activity from concurrent projects will increase the spatial extent over which marine mammal behaviour could be affected. Cumulative effects on potential marine mammals in the area are expected to be short-term and temporary. These effects are not expected to result in mortality to species at risk and are not expected to affect population viability of any marine species, especially given the large geographic ranges of those species likely to be affected. Suitable alternative habitat has been identified for marine mammal species present within the LAA in the event of short-term small-scale displacement.

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CLOSURE

This letter provides the outstanding information requested by the Government of Canada. If you have any questions, please contact Pacific NorthWest LNG.

Pacific NorthWest LNG

<Signature Removed>

Mike Lambert
Head, Environmental and Regulatory Affairs

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