Pacific NorthWest LNG
Information Request #3
Response Summary

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1.0 INTRODUCTION

The Pacific NorthWest LNG Limited Partnership (PNW LNG) is proposing to construct and operate a liquefied natural gas (LNG) facility on Lelu Island, within the District of Port Edward, British Columbia (BC) (Figure 1). The Pacific NorthWest LNG Project (the Project) will primarily be located on federal lands and waters under the jurisdiction of the Prince Rupert Port Authority (PRPA) and within Tsimshian territories. The Project will convert natural gas into LNG for export to Pacific Rim markets in Asia.

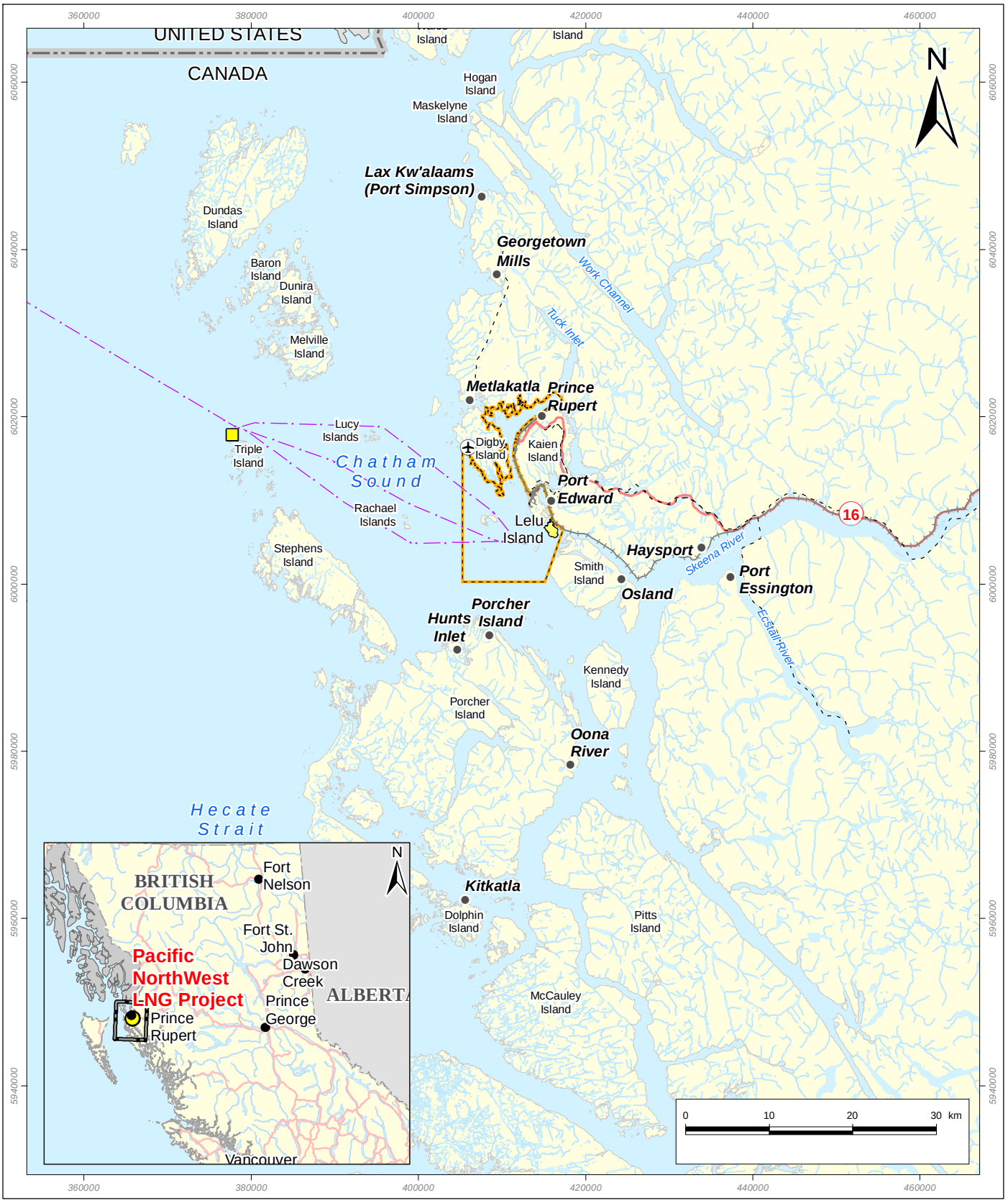
At full build-out (on completion of Phase 2, with three production trains), the facility will receive approximately 3.2 billion standard cubic feet per day, or 9.1 x 10^7 cubic metres per day, of pipeline grade natural gas, and produce up to 19.2 million tonnes per annum of LNG (up to one LNG carrier per day). The natural gas will be transported to the LNG facility by a new pipeline from northeast BC. The pipeline to the facility is the Prince Rupert Gas Transmission Project, which is being proposed by a third party (TransCanada Pipelines Ltd.) and has been assessed under a separate regulatory process.

The proposed marine structures for the Project's marine terminal include a long-span suspension bridge and a pipe pile supported trestle and berths (Figure 2 and Figure 3). The bridge spans approximately 1,600 m to the northwest of Flora Bank from Lelu Island to Agnew Bank. The suspension bridge is supported by two isolated in-water supporting structures – the tower and anchor blocks.

The trestle and berths are generally composed of widely spaced pile bents supporting a traffic deck. In hydrodynamic terms, the proposed marine structures (tower and anchor blocks) consist of two isolated individual "islands", 36 m x 20 m and 44 m x 45 m respectively, located northwest of Flora Bank. The trestle portion is modelled as an extended field of sparse support piles located approximately 50 m to 500 m northwest of Flora Bank.

In February 2014, PNW LNG submitted an Environmental Impact Statement and Environmental Assessment Certificate Application (EIS/Application) to the Canadian Environmental Assessment Agency (CEA Agency) and to the BC Environmental Assessment Office (BC EAO). The BC *Environmental Assessment Act* process concluded with the issuance of provincial environmental assessment certificate (EAC) on November 25, 2014.

In their review of the marine resources section of the EIS/Application, the CEA Agency, Fisheries and Oceans Canada (DFO), Natural Resources Canada (NRCan), and First Nations identified shortcomings with the level of site-specific seasonal data on fish and marine mammal use of the project area and the hydrodynamic modelling inputs to define local effects of project infrastructure on marine resources. PNW LNG took this feedback from federal agencies seriously and deployed extensive resources from Stantec Consulting Ltd., Hatch Ltd. and a number of other consultants and worked constantly over the past five months to deliver the major supplementary material for PNW LNG's response to the CEA Agency June 2, 2015 Information Request.



Airport
Pilotage Station
City or Town
Electrical Power Transmission Line
Highway
International Boundary
Potential Shipping Route
Railway
Watercourse
Project
Prince Rupert Port Authority Boundary
United States of America
Waterbody

Pacific NorthWest LNG

Project Location

IR 3 Response Summary

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

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FIGURE ID: 123110537-309	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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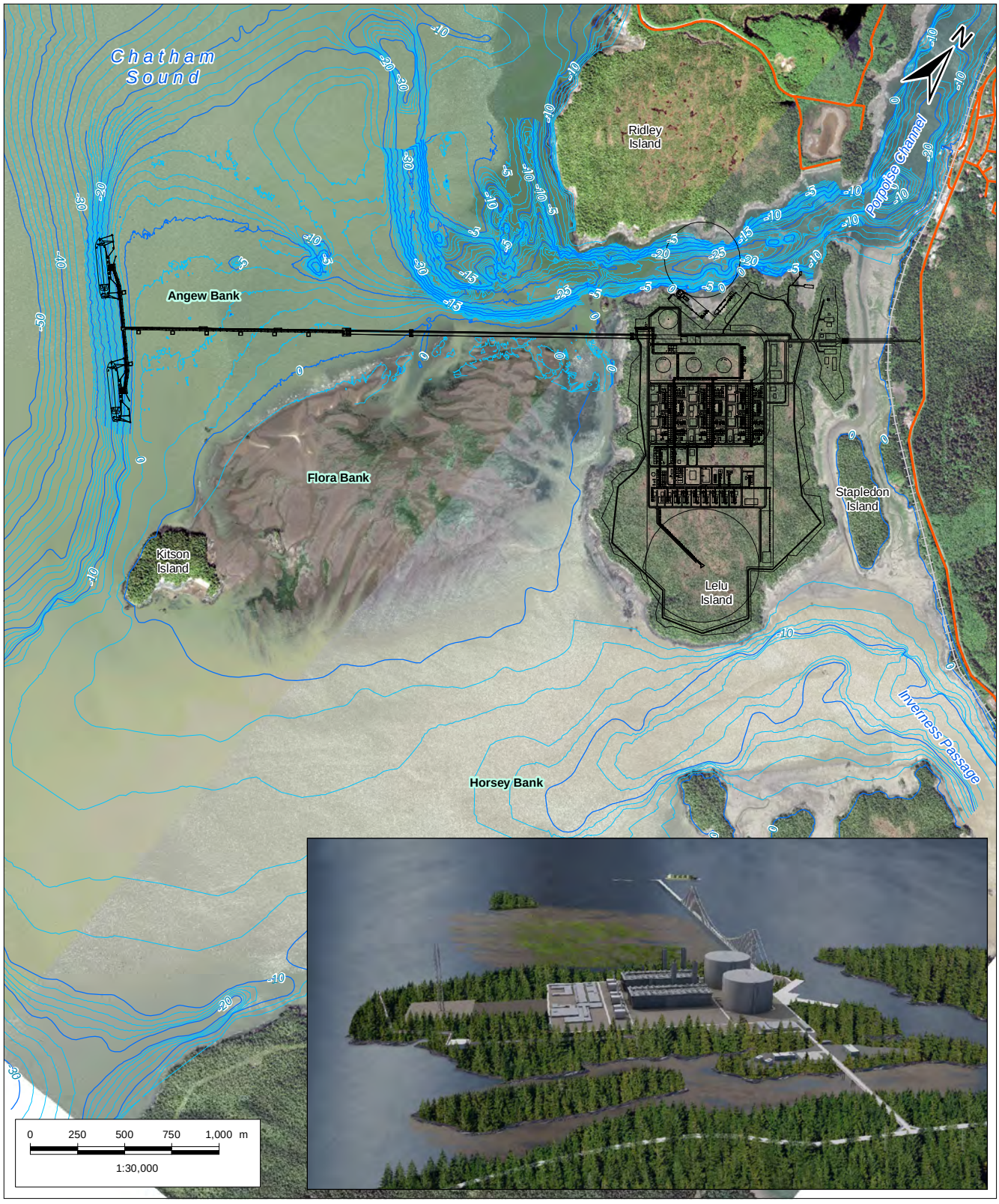

- Project Component
- Road
- Major Contour
- Minor Contour

Pacific NorthWest LNG

Project Layout

IR 3 Response Summary

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd. Worldview-2 satellite imagery, 2011.

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PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **2**

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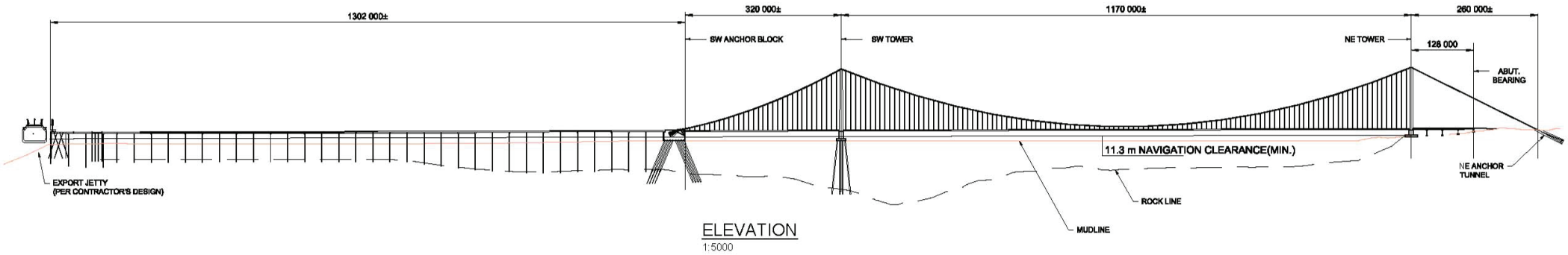


Figure 3 Marine Terminal (suspension bridge, trestle and berths)

Introduction
November 10, 2015

Key components of the supplementary material include:

- Collection of one additional year of marine mammal surveys, which started in November 2014 (the interim report submitted with this document summarizes the data up to June 11, 2015)
- Collection of one additional year of fish and fish habitat surveys, which started in December 2014 (the interim data reports submitted with this document summarizes the fish sampling data up the end of May and August 2015, respectively)
- Performance of additional two and three-dimensional hydrodynamic predictive modelling which further refined PNW LNG's understanding of the project site while addressing five key technical modelling issues raised by the CEA Agency

The primary objective of the additional field programs is to expand the scientific understanding of the seasonal variations of fish presence and life stages in the habitats around the proposed site, including marine areas near Lelu Island and Flora and Agnew banks. The intent of the refined modelling is to support previous PNW LNG submissions and increase the level of confidence in the predicted physical changes in sediment transport, currents, and water quality that would occur following construction of the marine structures on Agnew Bank.

This report has been prepared to briefly summarize and integrate the comprehensive and detailed information presented in the following documents prepared for the CEA Agency and the federal departments since May 2015:

- Supplemental Modelling Report and appendices
- Technical Memorandum: Marine Terminal – Environmental Effects Assessment
- Letter: Pacific NorthWest LNG Mitigation and Offsetting Commitments for Fish, Fish Habitat and Marine Mammals dated August 19, 2015
- Pacific NorthWest LNG Project Eelgrass Interim Data Report
- Pacific NorthWest LNG Project Marine Fish and Fish Habitat Program Interim Data Report
- Pacific NorthWest LNG Project Marine Fish and Fish Habitat Survey Results: December 2014 to August 2015 Interim Data Report
- Pacific NorthWest LNG Project Marine Mammal Program Interim Report
- Technical Memorandum: June 2, 2015 Letter—Annex III—Outstanding Information from Information Request #2 [Effects on current use of aboriginal fisheries for traditional purposes]
- Technical Memorandum: June 2, 2015 Letter—Annex III—Outstanding Information from Information Request #2 [Effects on marine mammals]
- Technical Memorandum: June 2, 2015 Letter—Annex III—Outstanding Information from Information Request #2 [Effects of dredged material disposal]

Collectively, this suite of documents constitutes a comprehensive response to the CEA Agency information requests from June 2, 2015. PNW LNG has carefully considered the results of these efforts, and these considerations have benefited from continuous ongoing engagement with federal and First Nations' technical experts, the Working Group and other stakeholders.

In summary, this information substantially builds on all previous environmental assessment work submitted to date and demonstrates that:

- Both the fish habitat and the potential effects of the marine terminal structures are well understood
- The potential impact pathways through which the proposed marine terminal structures might induce effects on fish and fish habitat are well understood
- The effects from the proposed marine terminal structures are limited and in close proximity to the proposed marine structures
- The Project does not threaten the stability of Flora Bank or the habitats it supports
- Precautionary mitigations and substantial habitat offset opportunities have been identified and have been committed to by PNW LNG and the offset opportunities exceed the potential effects
- Robust monitoring and follow-up programs are proposed

The analyses summarized herein have further increased our understanding of the site and our confidence in the likely effects of the proposed marine terminal structures. This work has confirmed that there is not likely to be a significant adverse environmental effect on fish and fish habitat as a result of the proposed marine works.

2.0 BACKGROUND

On February 23, 2015, the CEA Agency directed PNW LNG to complete three-dimensional (3D) modelling using the Delft3D modelling tool. The primary objective of the hydrodynamic and sediment transport modelling was to refine the two-dimensional (2D) modelling's predictions of potential changes in sediment transport, deposition and erosion on Flora Bank following the construction of marine structures on Agnew Bank.

A terms of reference for the 3D modelling was approved by the CEA Agency on March 19, 2015. On May 5, 2015, the 3D modelling results, accompanied by reports that summarized new fish and fish habitat information and related environmental assessment predictions, were submitted. The May 5 submission concluded that:

- The site is dynamic and the Project is not expected to result in changes to the natural conditions
- Small increases in erosion and deposition over Flora Bank are consistent in scale with naturally occurring variations on Flora Bank
- No net change in erosion or deposition patterns, no long term loss of sand and no increased sedimentation by fine silt materials is predicted

The CEA Agency and federal experts informed PNW LNG that these conclusions needed to be substantiated by further rigorous and thorough modelling results. The CEA Agency informed the PNW LNG that additional information was required before they could complete their environmental assessment report. Key concerns raised by the federal government in the June 2, 2015 correspondence can be described as follows:

1. Regarding 3D Modelling:
   a) Concerns around how the modelling uses wind and wave fields

   b) Concerns with wave, wind and current model inputs
   c) Concerns with the calculation of extreme storm values and overall application of Delft3D model procedures
   d) Concerns with the modelling of flows around the anchor and tower blocks
   e) Concerns regarding model outputs for Total Suspended Solids (TSS) and sediment transport
2. Regarding Annex III Information Gaps:
   a) Effects on Current Use of Aboriginal Fisheries for Traditional Purposes
   b) Effects on Marine Mammals
   c) Effects of Dredged Material Disposal
3. Concern that conclusions on the habitat value of Flora Bank were not supported by sufficient data

Substantial effort has been made to respond to all of these concerns. Responses to questions about the 3D modelling are summarized in this summary report. The matters raised in Annex III are addressed in specific Technical Memos submitted to the CEA Agency. Summaries of the conclusions of these responses are provided in Section 0. Finally, detailed monthly data on fish and fish habitat has been collected in all habitat types in the vicinity of Lelu Island since December 2014. Interim reports with factual summaries of the fish sampling data to May and August 2015, respectively, are provided.

During the development of this response, PNW LNG has undertaken substantial engagement with the federal government and Tsimshian Aboriginal Groups. Additional detail on engagement is provided in Section 10.1.

3.0 MODELLING REFINEMENTS

3.1 GENERAL

A series of modelling efforts have been undertaken to develop a strong understanding of Flora Bank. Several tools have been utilized in a range of broadly parallel efforts to explore the various processes relevant to understanding both Flora Bank and the potential effects of the proposed structures on hydrodynamics and morphology. Numerical modelling was performed to simulate coastal processes on both a large/regional scale (hundreds of kilometers down to tens of meters) and a highly localized scale (meters) to ensure accurate simulation of relevant physical processes.

These efforts build on previous work undertaken over the course of the project development to date, and have directly incorporated a wide range of relevant data sources, including Environment Canada and National Oceanic and Atmospheric Administration wind and wave data; data collected directly by PNW LNG; and sediment data collected by SedTrends during development of its Sediment Trend Analysis of the Port of Prince Rupert. Results from numerical modelling and supporting analyses have been compared with results of the Sediment Trend Analysis and indicate broad consistency.

The Delft3D coastal processes modelling system has the capability to simulate all coastal processes mentioned above and has pre-eminence in the coastal engineering industry for accurate simulation of morphological change under complex coastal conditions. The Delft3D model simulates average wave growth and transformation, and 3D

hydrodynamics, salinity transport, sediment transport, and morphological change. The Delft3D far-field model domain stretches beyond the west coast of Haida Gwaii, while the nested domain encompasses an area of approximately 80 km by 80 km centered on the Project site, including the lower 20 km of the Skeena River.

The MORPHO modelling system was selected to simulate fine-scale physical processes around the proposed tower and anchor blocks of the bridge structure. MORPHO is an unstructured, finite volume coastal processes modelling system that simulates fully nonlinear depth-averaged hydrodynamics, sediment transport and morphological change. The scale of the processes simulated in the MORPHO model spanned from hundreds of meters down to meter-scale resolution around the marine structures. The MORPHO model domain is approximately 3 km by 3 km and centered on Flora Bank. The MORPHO models used Delft3D-generated velocity and water level input conditions, but generated independent results.

3.2 RANGE OF COASTAL CONDITIONS EXAMINED

Many coastal processes play a role in the hydrodynamics, transport and morphology of Flora Bank. Important coastal processes evaluated at the project site and incorporated into the 3D regional scale modelling effort include:

- Tides (water levels)
- Tidal currents
- Winds and wind-driven currents
- Local wind-driven waves
- Offshore waves (swells)
- Skeena River discharge

Additionally, a range of frequent, seasonal and extreme events were considered in order to evaluate relative contributions of these processes in varying circumstances, including:

- Typically “daily” conditions over extended durations within a typical year
- Key seasonal periods (for example, the stormier winter months, and the Skeena River freshet season)
- Extreme (large and infrequent) storm events, including 50-year and 100-year return period events

Inputs for typical conditions modelling utilize time histories of backcast information from a combination of measurements and predictions as is common practice in the industry. Extreme storm events, in contrast, are typically not reflected in available data (due to their infrequent occurrence) and were synthetically generated. Recent efforts have included synthesized extreme events that are scaled up on the basis of actual data from measured storms and then exaggerated to extend the storms well beyond natural patterns of storm behavior.

3.3 KEY MODELLING CONCERNS EXPRESSED BY FEDERAL EXPERTS

A key focus of recent efforts has been to further refine these modelling efforts in order to respond to a set of five key concerns expressed by the CEA Agency and relevant federal agencies, including:

Modelling Refinements
November 10, 2015

1. **Refinement of wind and wave inputs to account for spatial variability of the wind fields (gridded winds) and offshore waves (gridded offshore waves), to determine whether variability of offshore inputs results in improved predictions of waves at the project site.** Gridded winds and waves were incorporated into modelling.

   Analysis of model outputs indicate that the gridded wind and wave inputs did not significantly affect the results (as compared with on-site measurements).

2. **Modifying the representation of extreme storm events to include synthetic longer-duration events, from a broader range of directions.** The refined modelling efforts have included development and modelling of extended duration, unidirectional storms with intensities appropriate for the relevant return periods, which will likely amplify modelled hydrodynamics and transport in comparison to "natural" records.

   Results show that the proposed structures have only a modest, and mildly attenuating, effect on the predicted changes associated with extreme storm events.

3. **Improving representation of the larger marine structures and their local effects.** Significant additional modelling of local effects has been conducted in the vicinity of the proposed tower and anchor block structures. This work has included development of a new high-resolution model driven by results from the regional Delft3D model, and examination of hydrodynamic and transport effects of these structures during typical, seasonal and extreme storm conditions.

   This additional high-resolution modelling has verified the presence of local, transient current variations in the immediate vicinity of each of the proposed structures, and confirmed that the structures induce limited local erosion and deposition patterns within tens of metres of the structures themselves.

4. **Performance of longer-period simulations with real continuous inputs (no input data averaging).** A wide range of time-series simulations have been completed with continuous real inputs and without any morphological acceleration in order to supplement insights gained through previously conducted time series studies and the five year MORFAC 13.5 results presented previously. Continuous time-series analysis have been completed for a representative of circumstances including both typical daily and seasonal periods, for the full range of extreme events discussed above, and over a series of extended time periods covering the full annual cycle.

   This refined modelling approach continues to support the conclusion that Flora Bank is a highly dissipative feature and morphologically stable environment. Except as noted otherwise, all discussions within this report are based on continuous time-series modelling runs.

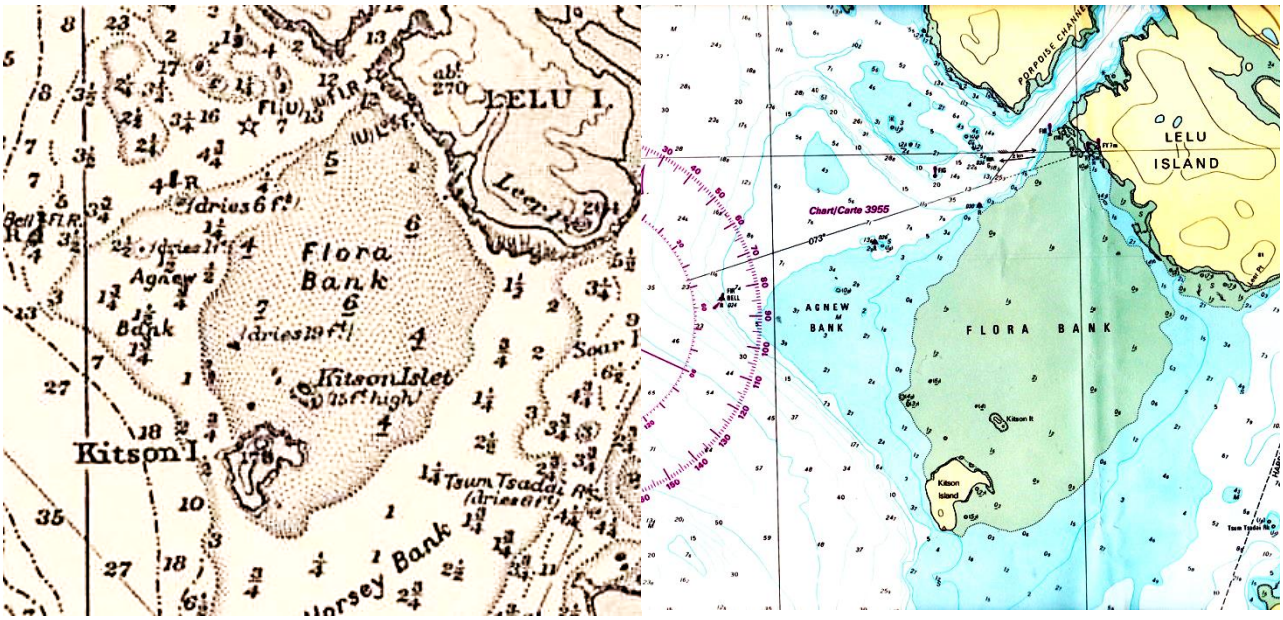
5. **Improved presentation of results to better convey the coastal processes being simulated.** Substantial efforts have been undertaken to quantitatively review and present model results, particularly sediment flux and net sediment transport across a wide range of modelled conditions.

> *Modelling results indicate large, wide and extremely homogeneous fields of transport (of primarily the finer materials) over Flora Bank. This clearly indicates why Flora Bank experiences little bed elevation change. The extremely low gradients in wave heights and current speeds results in low gradients in transport, and hence little bed elevation change.*

In addition, recent modelling efforts have refined a range of other inputs, including Skeena River freshwater discharge and salinity, to further enhance the detail with which the Skeena River inputs to the site area are represented in the model. Based on extensive modelling efforts it is evident that the Skeena River discharge plays a limited role in physical processes at the Project site, owing principally to: (1) the distance to the site; (2) the limited flow through Inverness Channel; and, (3) the fact that only extremely fine sediments—too fine to influence morphology at the site—are suspended in the Skeena River plume.

4.0 FLORA BANK

Flora Bank is large, flat, inter-tidal area, roughly 1.8 km by 1.8 km (325 ha in area) above lowest normal tide elevation (-3.8 m Chart Datum). Due to a relatively large tidal range (7.4 m), water depth varies considerably and there are two periods each day when the bank is exposed or covered by very shallow water. Flora Bank is believed to be a glacial relict formed during the most recent glacial retreat roughly 10,000 years ago. The geomorphologic features of Flora Bank and the adjacent Agnew and Horsey banks include stable islands and channels characterized by underlying bedrock at various elevations above the sea floor (e.g., ten individual intertidal/subtidal rock reefs found on the northwestern edge of Flora Bank). The shape and extent of Flora Bank have not changed significantly over a period of many years (Figure 4).



1907 **1986**

Figure 4 A comparison of the shape of Flora Bank between 1907 and 1986

Flora Bank's sediments consist of fine to medium sands, which are distinct from the clays and medium-coarse silt found in the deeper waters of Agnew and Horsey Banks, and the clays and fine to medium silts found in the deeper troughs of Chatham Sound. Sediment grain sizes and the SedTrends Analysis indicate that sediment transport and erosion/deposition patterns are spatially variable in this area of Chatham Sound, which includes many depositional deeper-water areas that likely receive fine sediments from the Skeena River plume.

The combination of coarser sandy material and very wide and flat configuration, results in very gradual dissipation of wave and current energy (which are relatively low at the site), infrequent transport due to mild conditions and exposure at low tide, low levels of net transport off of Flora Bank, and finally, low levels of bed erosion or deposition. The low levels of transport and erosion/deposition are consistent with the results of the SedTrends analysis, which was unable to discern any sediment transport trends over the vast majority of Flora Bank.

4.1 COASTAL CONDITIONS

The supplementary modelling and accompanying analyses confirm that the coastal processes surrounding Flora Bank include tidal currents, wind driven waves and storm events. Due to shelter provided by offshore islands, ocean swells and offshore waves are significantly attenuated and have only a modest presence at Flora Bank. Flora Bank is located within the Skeena River estuary, but due to the distance from the mouth of the river and the intervening channel geometry, the annual freshet cycle has limited effect on the morphology of Flora Bank.

Tidal currents are generally mild, with flood and ebb current velocities typically less than 0.25 m/s (0.5 knots). Significant wave heights under typical conditions are usually less than 0.3 m to 0.5 m, as wave heights are gradually attenuated during the approach to and travel over Flora Bank. Very little wave breaking occurs on Flora Bank except during extreme events and during low water levels.

Direct sediment transport analysis using multiple methods (mobility analysis, 1D profile modelling and 3D Delft3D modelling) indicates that sand on Flora Bank is typically mobilized where current velocities exceed approximately 0.3 m/s and/or wave action is significant. Given both the relatively low duration of most periods when these conditions are exceeded and the large flat extent of Flora Bank, transport distances are generally limited with relatively little material transported off Flora Bank.

A range of extreme storm events have also been analyzed to understand the effect of infrequent large events on Flora Bank. Generally, patterns evidenced in typical conditions are amplified by extreme events (since “typical” conditions include smaller storms), though even in very large events actual bed changes occur only during a portion of the storm and transport of fine to medium sand off Flora Bank is limited.

Owing in large part to the combination of coarser sediments, flat and gradual configuration and relatively benign typical coastal conditions, sediment transport on Flora Bank occurs principally during storm events. The synthetic extreme events that were created in this modelling effort represent an exaggeration of what typically occurs during real extreme events, and even within the synthetic storm events, relatively little bed elevation change occurs.

4.2 MARINE HABITAT

4.2.1 Marine Habitat Overview

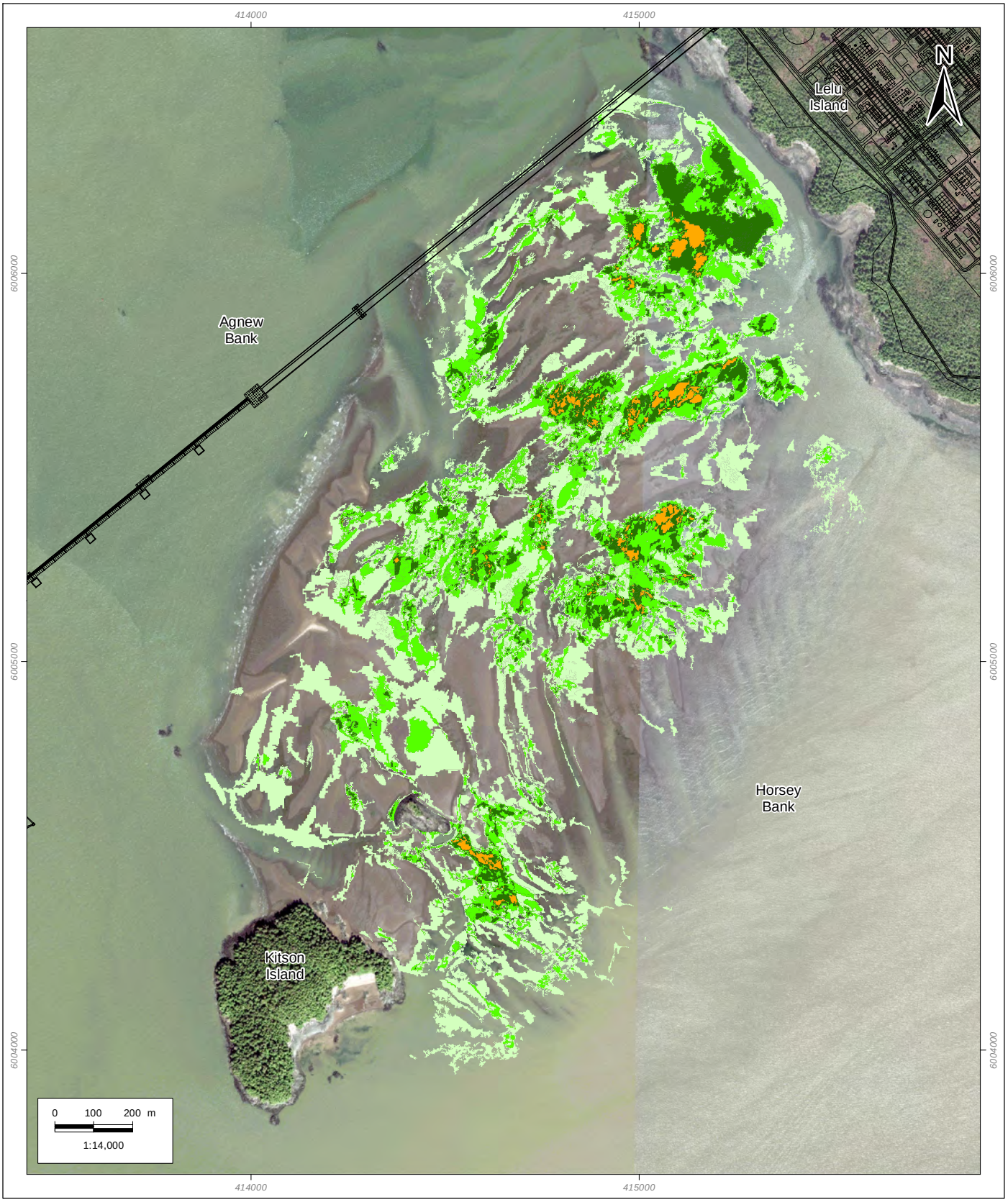
Marine habitats in the vicinity of Lelu Island and Port of Prince Rupert are representative of marine ecosystems throughout the north coast of British Columbia. The distinguishing feature of this area is the confluence of the Skeena River with Chatham Sound. Freshwater discharges from the river affect salinity and turbidity of the water, with the influence decreasing with distance from the river mouth. This is most pronounced in late spring and early summer during freshet, which discharges high volumes of water into Chatham Sound. Two of the unique biological characteristics of the Skeena River estuary include the size of the eelgrass beds on Flora Bank and the annual migratory passage of important salmon stocks originating from the Skeena River. Overall, the physical oceanography, seabed composition, and habitat characteristics are consistent with those found in outer portions of estuaries from the northern tip of Vancouver Island to central Alaska.

The habitats located around the project are broadly grouped into rocky shorelines of Lelu Island, soft bottom substrates of Agnew and Horsey banks, intertidal sand and eelgrass beds on Flora Bank, and hard bottom substrates in Porpoise Channel. The coast shorelines in the Port of Prince Rupert, including Lelu Island, reflect the local coastal conditions with a large tidal range (>7.4 m), the associated tidal currents, and exposure to storm-driven waves.

These conditions have resulted in shoreline areas that include a mix of exposed bedrock, large boulders, cobble and gravel beds that support subtidal and intertidal seaweed community. The intertidal marine vegetation communities in these areas are dominated by rockweed, sea lettuce, Turkish washcloth, sea sac, and kelps. Invertebrate communities on rocky shores include barnacles, limpets, and periwinkles. Rocky subtidal areas seaward of these shorelines habitats support seaweed communities, including numerous species of kelp. These plants provide food and shelter for mobile and sessile invertebrates and fish. Soft sediments are found in protected/sheltered embayments and provide habitat for burrowing invertebrates, crabs, flatfish, and out-migrating juvenile salmon.

Field surveys show Agnew Bank and Horsey Bank are generally flat areas dominated by finer sediments. Remotely operated vehicle and dive surveys show both banks have relatively low species diversity, with the main fauna consisting of sparsely distributed invertebrates, such as orange sea pens, shrimp, tunicates, sponges, and various mollusc species.

A major focus of the effects assessment for the PNW LNG project has been on the potential impacts to fish dependent on the eelgrass habitat on Flora Bank. Flora Bank and its eelgrass beds have been examined by various organizations since the early 1970s. Building on this past work, an understanding of distribution and natural variation of the eelgrass beds on Flora Bank has been established through a combination of field surveys and remote sensing data. The extent, density, and inter-annual variation of the eelgrass has been established using remote sensing data from 2007, 2009, 2011, and 2015 and calibrated using field surveys. From the remote sensing data, an eelgrass composite map (Figure 5) has been prepared to identify the core areas of eelgrass on Flora Bank (i.e., those areas where eelgrass was present in three or more years) as well as areas where it has been present in only one or two years. This inter-annual variability is a function of a number of factors including length of the growing season, number of sunny days during the growing season (which affects photosynthesis), turbidity of the Skeena River plume (which affects light penetration through the water column to the plants), and exposure to storms and sub-zero temperatures.



Project Component

Eelgrass

Number of Times Present

1
2
3
4

Eelgrass Number of Times Present	Area (ha)
1	62.3
2	28.2
3	11.5
4	2.2

Note:
Eelgrass extents from 4 different time periods were combined into 1 layer.
The number of times present represents a count of how many eelgrass extents overlap.
(2007, 2009, 2011 and 2015)

Pacific NorthWest LNG

Eelgrass Extent, Number of Times Present

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Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd. Worldview-2 satellite imagery, 2011.

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DATE: 15-SEP-15
FIGURE ID: 123110537
DRAWN BY: S. PARKER
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: M. JOHANNES

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **5**

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4.2.2 Marine Fish Overview

Many of the marine fish present in the Prince Rupert area support commercial, recreational and Aboriginal (CRA) fisheries. For the purposes of this report, these are placed into three broad groups: anadromous fishes (i.e., those that spawn in freshwater and migrate to the ocean), marine fishes (i.e., those that live their full life-cycle in the ocean), and shellfish. Information on their life histories, habitat requirements, and periods when they are present in the waters around Lelu Island and Flora Bank has been documented through a comprehensive literature review and a wide range of field surveys that were completed between 2013 and September 2015.

In December 2014 PNW LNG initiated one additional year of fish and fish habitat surveys. For the December 2014 to August 2015 portion of the survey program, a total of 82 species (including 61 fish [ichthyes] species) were positively identified. No species of conservation concern, as listed by the British Columbia Ministry of Environment or on Schedule 1 of the *Species at Risk Act*, were identified during the sampling.

Photograph 1 Trawl surveys around Flora Bank

Flora Bank
November 10, 2015

Photograph 2 Seine netting on Flora Bank

Anadromous fish that migrate through the Skeena River estuary include all five species of Pacific salmon species (i.e., sockeye, Chinook, coho, pink and chum salmon), Dolly Varden char, steelhead, and eulachon. The relatively shallow waters around Lelu Island and Flora Bank are used by juvenile salmon during their out-migration and to a lesser extent by adults during their in-migration. The seasonality of these movements varies among species and local movements often coincide with south to north ebb tides.

Generally, juveniles migrate from the Skeena River to the deep "green" clear waters of northern Chatham Sound, Dixon Entrance and the North Pacific from April through to July; adults return to their natal streams to spawn from June through to November. Sampling by PNW LNG has confirmed the presence of sockeye, Chinook, coho, pink, chum and Dolly Varden during spring and early summer migrations in the waters around Lelu Island and Flora Bank.

In addition to the anadromous species, there are a wide range of marine fishes that use the coastal waters of British Columbia. Some of the more important fishery species in the vicinity of Prince Rupert include Pacific herring, Pacific halibut, flatfishes, and rock fishes. The sampling program completed by PNW LNG positively identified 61 fish (ichthyes) species by the end of August 2015. Key species of interest included Pacific herring, English/lemon sole, rock and whitespotted greenling, sand sole, sandlance, starry flounder and yellowtail flounder.

The presence of these species and the absence of halibut, eulachon, and rock fish are attributed to the water depths and dominance of soft bottom (sand/silt) substrates in the waters around Lelu Island. Three points of interest from the field program are: (1) Pacific herring were abundant throughout the study area and are likely present year-round—in late May / early June 2015 Pacific herring eggs were observed on several local patches of eelgrass at the southwestern edge of Flora Bank near Kitson Island and on the northeastern corner of Flora Bank near Lelu Island; (2) surf smelt were the most abundant species captured and were present throughout the study

program; and, (3) flatfish, needlefish and other bottom oriented species were captured in the local soft sediment areas of Agnew Bank.

The final group of fish is the shellfish. A crab sampling program has been underway since mid-December 2014 and will continue until November 2015. A prawn test sampling program was completed between late February and late April 2015. During these sampling programs seven shellfish species were captured:

- Crab trapping: Dungeness, Tanner, and decorator crab
- Prawn trapping: Humpback, sidestripe, and coonstripe shrimp as well as Pacific spot prawn

The crab sampling program followed DFO standards and included characterization of Dungeness crab distribution, sex, size and shell hardness as a test of moulting. Male crab moulting was noted in deeper areas of Agnew Bank in late May and June 2015.

Overall, the sampling program has provided some refinement of juvenile salmon outmigration timing and identified local patterns of salmon smolt migration through the Lelu Island and Flora Bank area to open water areas of Chatham Sound. The fish distribution observations from the field programs are consistent with the aggregated data from past DFO, academic and industry studies in the Skeena River estuary and the Port of Prince Rupert.

5.0 POTENTIAL EFFECTS PATHWAYS

5.1 PATHWAYS

PNW LNG has worked with Fisheries and Oceans Canada (DFO) and the CEA Agency on how to update the marine resources effects assessment (with a focus on fish and fish habitats) supported by the supplementary modeling effort. The outcome of this engagement was an alignment between PNW LNG, DFO and the CEA Agency on the four distinct impact pathways that have been identified that may be induced by the marine infrastructure and lead to potential adverse effects on fish and fish habitat.

These include:

i. Direct harmful alteration or loss of fish habitat in Porpoise Channel from development of the materials offloading facility (MOF) and on Agnew Bank from construction of the marine terminal structures and associated erosion protection
ii. Potential for indirect harmful alteration or loss of eelgrass due to induced erosion and/or deposition on Flora Bank
iii. Potential for an increase in total suspended solids (TSS) that may directly affect fish or their ability to feed (the threshold for TSS concentrations is based on Canadian Council of Ministers of Environment guidelines)
iv. Potential for a material increase in currents around the tower and anchor blocks that affects the ability of CRA species to move through the water and use the habitat

The footprint of the infrastructure, pathway (i), has been updated based on the most current understanding of the marine infrastructure and anticipated armouring to prevent erosion. Pathways (ii), (iii), and (iv) are informed by the new hydrodynamic predictive modelling outputs.

5.2 EFFECTS FROM THE PROPOSED MARINE STRUCTURES

Generally speaking, the effects of the proposed structures within the environment discussed above are best understood by stepping progressively outward from the structures.

The direct physical footprint of the marine structures includes the footprint of the proposed tower and anchor blocks, the trestle and berth support piles, and an allowance for scour protection intended to prevent erosion of the seabed immediately adjacent to the structures. The potential for local scour is well understood and the extent of likely protection has been estimated in previous studies. Direct impact of the proposed marine structures and the associated erosion protection constitutes permanent alteration or loss of 21,505 m^2 of subtidal soft substrate habitats used by Dungeness crab and local flatfish species (Figure 6).

High-resolution modelling has permitted examination of local currents and vortex shedding (eddying) effects arising in the immediate vicinity of the marine structures, under both typical conditions and extreme storm events. Model results predict vortex formation and dissipation consistent with established literature, and localized and transient instantaneous velocity changes in the vicinity of the marine structures. This result is consistent with known processes around relatively small (relative to the flow field) and isolated structures in relatively homogeneous flow conditions.

Peak current velocities during both ebb and flood conditions typically remain below 0.3 m/s, and are of the same order as transient current velocities observed elsewhere on Flora Bank during typical tidal conditions. Over extended periods, local hydrodynamic effects are likely to gradually lead to local bedform changes within the immediate vicinity of the marine structures, but the predicted areas of erosion and deposition around the structures does not overlap the mapped eelgrass on Flora Bank. Elevated levels of TSS within the water column are found only over very short periods of time (tidal cycles), and only shortly after construction whereas the local erosion and deposition patterns develop over longer time periods.

Habitats around marine structures consist of soft sediment substrates in shallow subtidal waters. As a result of large tides, tidal currents, shallow depths and soft sediments, the area around the proposed marine structures often has naturally low levels of water clarity (higher turbidity and TSS) relative to nearby Porpoise Channel and deeper waters in Chatham Sound. Salmon species have been observed in these habitats during spring smolt migration (May to June) for short periods defined through systematic net catches (trawl and seines) and hydroacoustic transects over minutes and hours during northerly flowing ebb tides. Dungeness crab and benthic fish species (e.g., flounder and sole) are found here year-round. Resident fish and crabs use soft sediment habitats at and around the marine structures for feeding and crab moulting. Resident species are well adapted to these local conditions and are additionally able to move to similar nearby habitat that is commonly available. Migratory fish species will also use similar commonly available open-water habitats around proposed marine structures. The

anticipated erosion and deposition around the structures is not predicted to have significant adverse effects on resident fish and invertebrate species, or on migratory fish species.

Hydrodynamic effects that generate erosion and deposition or TSS changes dissipate within tens of meters of the marine structures. High-resolution modelling has been performed using conservative, rectangular-shaped marine structures that have not benefited from final engineering design refinement. A preliminary sensitivity analysis using larger, but circular, structures indicates that a substantial reduction in the predicted hydrodynamic and erosion/deposition effects are likely following design refinement.

Regional-scale modelling was performed using the continuous time-series simulations within the refined Delft3D model for the full range of conditions described in Section 3.0. Analysis results indicate that in all circumstances evaluated, the marine structures have a limited effect on the background coastal conditions, and generally have a mild attenuating effect on the predicted erosion and deposition patterns. This is due primarily due to the trestle pile field's slight wave attenuation effects during west and northwest winds.

Neither the modelling results nor previous work undertaken by SedTrends indicate significant transport of fine to medium sand onto or off of Flora Bank. For sand similar to that found on Flora Bank, this indicates there are limited natural sediment transport processes on and around Flora Bank that can be appreciably affected by the proposed marine structures.

Our study concludes that the proposed marine structures will cause no potential material alteration to overall Flora Bank stability and will not generate changes in erosion and deposition which effect the eelgrass habitats that occupy portions of Flora Bank (shown on the composite map—Figure 5).

Only one of the potential fish and fish habitat impact pathways is induced by the proposed structure: the direct impacts from the placement of the marine structures on Agnew Bank. In summary, based on the four impact pathways:

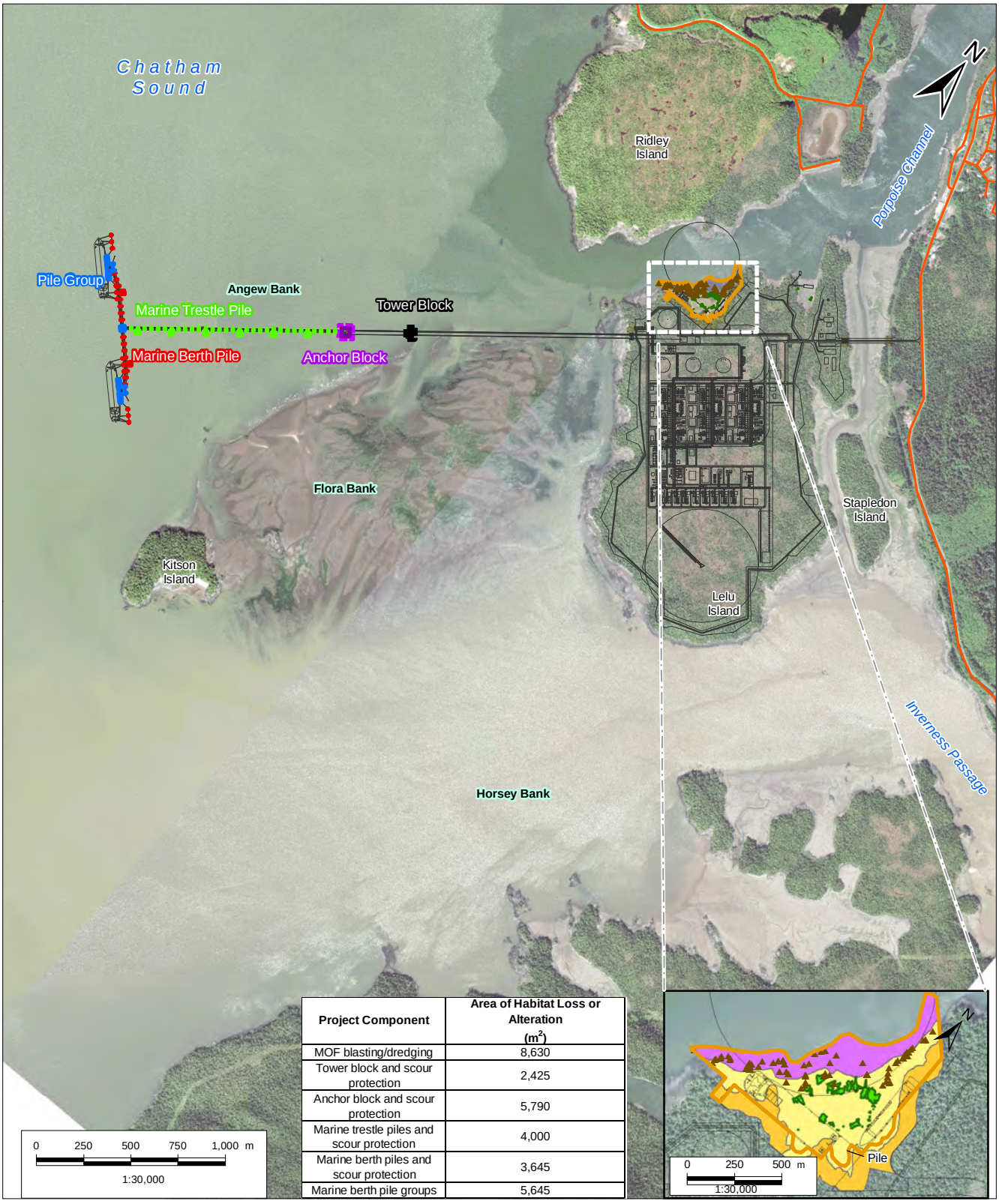
i. Direct harmful alteration or loss of fish on Agnew Bank from construction of the marine structures and associated erosion protection will be 21,505 m^2 of soft sediments (this area is equivalent to less than 0.3% of the total area of Agnew and Horsey banks)
ii. There is no potential for indirect harmful alteration or loss of eelgrass due to erosion and/or deposition on Flora Bank that is induced by the proposed marine infrastructure
iii. There is no potential for an increase in total suspended solids (TSS) that may directly affect fish or limit a fish's ability to feed beyond occasional, local, transient changes within the immediate vicinity of the proposed tower and anchor block structures during storm events
iv. There is no potential for a material increase in currents around the tower and anchor blocks that affects the ability of CRA species to move through the water and use the habitat beyond occasional, local, transient changes within the immediate vicinity of the proposed marine structures

5.3 EFFECTS FROM THE MATERIALS OFFLOADING FACILITY

In addition to effects from the proposed marine structures on Agnew Bank, residual serious harm to fish habitat is predicted to occur as a result of constructing the materials offloading facility (MOF) in Porpoise Channel (Figure 6). The specific predicted habitat impacts have been described in detail in a letter from PNW LNG to DFO on August 19, 2015. These habitats are used by juvenile salmonids, herring, surf smelt, sandlance and crab.

From the relevant impact pathway:

i. Direct harmful alteration or loss of fish habitat in Porpoise Channel from development of the materials offloading facility (MOF) results in the alteration and loss of 8,630 m^2 (less than 1 ha) of eelgrass beds and brown algae patches.



Project Component	Area of Habitat Loss or Alteration (m^2)
MOF blasting/dredging	8,630
Tower block and scour protection	2,425
Anchor block and scour protection	5,790
Marine trestle piles and scour protection	4,000
Marine berth piles and scour protection	3,645
Marine berth pile groups	5,645

- Brown Algae
- Project Component
- Dredge Boundary
- Eelgrass Bed
- Intertidal Alteration
- Pile - Intertidal Loss
- Riparian Loss
- Subtidal Temporary Disruption
- Tower Block
- Anchor Block
- Marine trestle pile
- Marine berth pile
- Pile Group

Pacific NorthWest LNG

Habitat Impacts

IR 3 Response Summary

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd. Worldview-2 satellite imagery, 2011.

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: 16-SEP-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: T.McInnes	CHECKED BY: M. JOHANNES

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **6**

6.0 MITIGATIONS AND OFFSETTING

In the Environmental Impact Statement (EIS) submitted in February 2014, PNW LNG identified the following potential adverse effects on marine resources:

- Permanent alteration or destruction of fish habitat
- Direct mortality or physical injury to fish or marine mammals
- Change in behaviour of fish or marine mammals
- Change in sediment and water quality

Marine infrastructure to be constructed for the project includes a: vehicle bridge from Port Edward to Lelu Island; pioneer dock; MOF; suspension bridge and its sub-structures, pipe pile supported trestle and LNG berths. In-water activities associated with construction of this infrastructure will occur year-round for approximately four years and the facility is expected to be in operation for over 30 years.

PNW LNG has identified and committed to a number of mitigation measures intended to eliminate, reduce or control potential adverse environmental effects on marine resources within the EIS/Application, the EIS Addendum (December 2014), the response to Information Request No. 3 (May 2015) and lastly, in a letter from PNW LNG to DFO dated August 19, 2015.

The objectives of these mitigation measures are to:

- Prevent potential significant adverse environmental effects
- Avoid mortality or physical injury to fish or marine mammals in accordance with section 35(1) of the *Fisheries Act* and section 7 of the Marine Mammal Regulations
- Prevent degradation of sediment and water quality and thereby maintain compliance with section 36 of the *Fisheries Act*
- Offset permanent alteration or destruction of fish habitat that support commercial, recreational and/or Aboriginal (CRA) fisheries in accordance with Fisheries and Oceans Canada's Federal Fisheries Protection Policy Statement (2013) and Fisheries Productivity Investment Policy (2013) within the context of a paragraph 35(2)(b) *Fisheries Act* authorization

The mitigation measures that will be employed to avoid mortality or physical injury to marine life and protect water quality during the construction and operations phases of the project have been summarized and committed to in the August 19, 2015 letter to DFO. Generally, these include:

- Trapping and relocating Dungeness crab from the MOF development area before dredging
- Sub-tidal blasting (high risk blasting works) will be conducted within federal guidelines and at times only within least-risk timing windows (November 30 to February 15)
- Use of specific blasting techniques and equipment to reduce underwater noise
- Use of specific pile installation techniques and equipment to reduce underwater noise

- Implementing a marine mammal observer program during blasting, pile installation and dredging to avoid risk to animals that move into safety zones
- Sediment transport reduction equipment and construction methods
- Total suspended solids (TSS) and turbidity monitoring
- Use of tugs with Voith-Schneider propulsion systems
- Use of shielded and directed lighting on marine structures
- Implementation of a fish habitat offsetting program
- PNW LNG participation in regional fish science and habitat enhancement projects

With respect to fish habitat offsets, all work will be undertaken in accordance with DFO's Fisheries Productivity Investment Policy (2013), and under a paragraph 35(2)(b) *Fisheries Act* authorization, and in collaboration with Tsimshian aboriginal groups who are working with PNW LNG. Habitat offsets being considered include habitat enhancements within three sites around the west and south perimeter of Lelu Island and two other sites in the area (Figure 7), nearshore anthropogenic debris cleanup (e.g., abandoned derelict vessels, marine batteries, abandoned gillnets, logging boom debris and dolfins).

With respect to the habitat enhancements, there are more than 120,000 m^2 of lower productivity habitats present within five identified offsetting sites in the immediate vicinity, of which 90,000 m^3 could be modified to increase the productivity of CRA fisheries. The potential offset enhancements in these locations include creation of eelgrass habitats; intertidal and subtidal reefs; and intertidal gravel and cobble benches. These habitats would benefit a range of fish including juvenile salmon, flatfish, forage fish and invertebrates.

These mitigation and habitat offsetting measures will protect and enhance the productivity of the fish habitats in the vicinity of Lelu Island and support the long term sustainability of CRA fisheries in the area. As such, they will allow development of the marine terminal in a manner that is not likely to cause significant adverse environmental effects on marine resources.

PNW LNG re-iterates its commitment to continue to work with DFO, Tsimshian aboriginal groups and other parties to refine the calculations of serious harm to fish based on the final engineering designs of the marine structures and to finalize the fish habitat offset plan accordingly.

- City or Town
- Project Component
- Proposed Sites

Pacific NorthWest LNG

Proposed Marine Fish Habitat Offsetting Locations

IR 3 Response Summary

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd. Worldview-2 satellite imagery, 2011.

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: 30-OCT-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: T.McInnes	CHECKED BY: M. JOHANNES

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: 7

10/30/2015 - 10:42:12 AM \\cd1186-f04\work\group\active\1231105371\gis\figures\information_requests\IR_Summary\Fig_7_Proposed_Marine_Fish_Habitat_Offsetting_Locations.mxd

7.0 FOLLOW-UP AND MONITORING PROGRAM

7.1 PROGRAM OVERVIEW

Follow-up programs verify the accuracy of effects predictions and determine the effectiveness of mitigation measures. Compliance monitoring and reporting verifies implementation of required mitigation measures. In order to implement the overall Project follow-up framework, an environmental management team, co-led by PNW LNG and Tsimshian aboriginal group representatives will be assembled for each phase of the Project: construction, commissioning and operations.

This team will:

- Consist of professionals that may include project engineers, environmental compliance monitors, and other environmental professionals
- Ensure the Project is constructed, commissioned, operated, and eventually decommissioned in compliance with the conditions of environmental assessment approvals, environmental management plans and required regulatory permits
- Be transparent in support of PNW LNG's commitment to ongoing engagement with relevant government agencies, Tsimshian aboriginal groups, stakeholders and local/regional government organizations during the implementation of the follow-up program

7.2 MARINE FISH AND FISH HABITAT FOLLOW-UP PROGRAM

The Marine Fish and Fish Habitat Follow-Up Program (MFFHFP) will verify the predicted effects to marine fish and fish habitat and assess the effectiveness of mitigation and habitat offsetting measures. Details of the MFFHFP will be developed in consultation with DFO, the CEA Agency and interested Tsimshian aboriginal groups. It is expected that the components of the plan will encompass three types of monitoring:

- Compliance monitoring to evaluate compliance with conditions set forth as conditions to environmental assessment approvals, permits, licenses or authorizations issued for the Project
- Effectiveness monitoring to evaluate the success of prescribed mitigation and offsetting measures to reduce, mitigate, and offset for Project effects
- Response monitoring to determine if the Project is having any long-term effects on the environment. This program typically collects data on specific environmental indicators to determine trends over time

The MFFHFP will consist of three monitoring phases: construction monitoring, *Fisheries Act* authorization monitoring, and long term follow-up monitoring.

Table 1 Monitoring Parameters and their Associated Baseline Data Requirements, Frequency and Duration for the MFFHFP

Parameter	Monitoring Type	Baseline Requirements		Monitoring Requirements	
		Frequency	Duration	Frequency	Duration
Fish Habitat Offsetting	Compliance	n/a	n/a	Once	Immediately post-construction
	Effectiveness	Annually	Two Years	Annually	Operations Years 1, 2, 3, 5, and up to 10
Marine Fish and Fish Habitats	Response	Annually	Two Years	Annually	Operations Years 1, 2, 3, 5, and up to 10

Post-construction monitoring may include both physical habitat assessment as well as biological assessment of fish habitat use. Quality and functional state of habitats surrounding and adjacent to the marine terminal, MOF, pioneer dock and Lelu Island bridge will be monitored over a period of 5 to10 years (determined in consultation with DFO, the CEA Agency and Tsimshian First Nations) with the following objectives:

- Assess marine fish, invertebrate and marine mammal relative abundance, and spatial and temporal habitat use on Horsey, Agnew and Flora banks and reference sites
- Provide post-construction baseline marine resource information around the constructed project infrastructure, with a focus to provide further information and verify temporal and spatial distribution and habitat use of key fisheries and marine mammals and their sensitive life history habitat dependence
- Confirm and/or refine construction and operations mitigation measures and provide information to measure their effectiveness

The fish and fish habitat monitoring program will use a range of methods to quantify the relative abundance, distribution and habitat use of CRA species and marine mammals that are identified as important, including, Pacific salmon, crab, shrimp, herring, eulachon, and flatfish (flounder, sole), forage fish species (surf smelt, sandlance) and marine mammals. Where appropriate, the monitoring program will integrate survey methods potentially including:

- Hydroacoustic surveys paired with mid-trawl surveys to assess and characterize the abundance and distribution of pelagic fish species, including juvenile salmon, herring, eulachon, surf smelt and sandlance
- Beach seining to assess and characterize the abundance and distribution of intertidal and subtidal fishes
- Intertidal and subtidal trapping to assess and characterize the abundance and distribution of crab and prawn/shrimp
- Collection of oceanographic water property data and physical habitat information in parallel with biological surveys
- Habitat surveys at a reconnaissance level by site
- Vessel-based line-transect surveys to assess and characterize the relative abundance and distribution of marine mammals

7.3 FISH HABITAT OFFSET MONITORING

Post-construction monitoring of the habitat offsetting measures may include both physical assessment and biological assessment of fish habitat use. Quality of the offsetting habitat will be monitored after 1, 2, 3, 5 and up to 10 years following project commissioning. Ongoing monitoring will be dependent on the performance of the offsetting habitat.

Objectives of the habitat offsetting monitoring are to:

- Collect additional baseline data within the offsetting areas
- Assess the geomorphic stability of the works over time
- Assess the functionality of fish habitat
- Assess the use of the habitat by CRA fish species

A detailed follow-up monitoring program will be developed as a component of the final Detailed Habitat Offsetting Plan. The *Fisheries Act* authorization will detail the conditions required for the habitat offsetting measures to be deemed functional. Upon receipt of the authorization, these conditions will be incorporated into the final fish habitat offsetting follow-up monitoring program.

7.4 REPORTING AND ADAPTIVE MANAGEMENT

PNW LNG will report the results of the follow-up programs to Tsimshian aboriginal groups, the public, the CEA Agency and other applicable regulatory agencies. All data collected for each fish and fish habitat follow-up monitoring program will be compiled into a single standalone report for review by relevant regulatory agencies, Tsimshian aboriginal groups and the general public by March 31 of the year following completion of construction.

In subsequent years, an annual monitoring report will document the findings of the previous year's monitoring program and provide comment on any changes relative baseline conditions established between 2012 and 2015 during the environmental assessment process. Monitoring parameters that are not assessed annually will only be included where appropriate.

Annual monitoring reports will detail the methods, results, comparative analysis to baseline conditions and/or appropriate *Fisheries Act* authorization and regulatory conditions and recommendations for future assessments (as per the adaptive management approach). Any changes to the follow-up program will be documented and submitted to the agencies for review and approval.

8.0 CONCLUSIONS

8.1 SUMMARY OF RESIDUAL EFFECTS

The results of the hydrodynamic modelling in conjunction with the additional fish and fish habitat data collected since December 2014 has provided a stronger understanding of the physical impacts, affected habitats, and subsequent potential for significant adverse effects of the Project. This in turn has resulted in a higher level of confidence in the conclusions presented in the EIS and EIS Addendum. Based on the pathways of effects identified in Section 5.1 and the mitigation and offset measures identified in Section 6.0, the following residual effects have been identified:

- Permanent alteration and loss of fish habitat in Porpoise Channel and on Agnew Bank; however, there will be no reduction in the productivity of fisheries due to the implementation of a fish habitat offsetting program
- Short term and local elevated TSS concentrations during specific construction periods and activities. These conditions will be monitored (e.g., during construction) in real time with appropriate measures taken if monitoring indicates TSS concentrations are nearing unacceptable thresholds

In both cases, the effects are predicted to be low magnitude, short term in duration, and reversible.

8.2 SIGNIFICANCE DETERMINATION

In February 2015 the CEA Agency posed three questions to DFO and NRCan regarding significance of potential environmental effects, additional mitigation measures, and follow-up and monitoring requirements. PNW LNG acknowledges that the questions posed to the federal departments were not specifically directed to the company. However, they provide a framework for providing an opinion on the significance of the residual environmental effects. In light of the information presented in the accompanying reports and summarized herein, a brief response to each question has been provided below.

Question 1: Based on the new information presented in the documents comprising the Project team's response to the February 23, 2015 Information Request as expanded on June 2, 2015 regarding potential hydrodynamic and sediment deposition effects on Flora Bank, what is your advice to the Agency regarding the likelihood of significant adverse effects to fish and fish habitat?

Response: The technical work completed to date indicates that the project is not likely to cause significant adverse environmental effects on fish and fish habitat. This response is based on:

- Both the fish habitat and the potential effects of the marine structures are well understood
- The potential impact pathways through which the proposed structures might induce effects on fish and fish habitat are well understood
- The effects from the proposed marine structures are limited and in close proximity to the proposed marine structures

- The Project does not threaten the stability of Flora Bank or the habitats it supports
- Precautionary mitigations and substantial habitat offset opportunities have been identified and have been committed to by PNW LNG and the offset opportunities exceed the potential effects
- Robust monitoring and follow-up programs are proposed

Question 2: Are there any mitigation measures that you would suggest to avoid significant adverse environmental effects due to hydrodynamic changes and sediment deposition? If yes, please describe such measures and why they are important?

Response: The effects assessment process has characterized the pathways for potential adverse effects on the marine environment and PNW LNG has identified the mitigation and offset measures that will be implemented to avoid or reduce the likelihood of significant adverse effects. Please see Section 6.0 of this report. PNW LNG is committed to developing an environmentally responsible project and will continue to work with our engineering team to design the tower and anchor blocks in a manner that further reduces the potential for induced erosion of sediments on Agnew Bank.

Question 3: Would you suggest any follow-up program elements to verify predictions regarding the hydrodynamic and sediment effects of the marine terminal? If yes, please describe the follow-up program elements and how they would help to verify the accuracy of the assessment or the effectiveness of mitigation measures to avoid significant adverse environmental effects?

Response: PNW LNG outlined a recommended marine fish and fish habitat follow-up program in section 30.4.7 of the December 2014 Addendum to the Environmental Impact Statement. A summary is also provided in Section 7.0 of this report. This program included compliance monitoring, effectiveness monitoring, and response monitoring. In conjunction with the anticipated monitoring program that would accompany a paragraph 35(2)(b) Fisheries Act authorization, PNW LNG believes this is a comprehensive program that will confirm the predicted effects and document implementation and effectiveness of the mitigation measures. In summary, follow-up elements would include:

- Future data collection and analysis (fish and fish habitat, geotechnical, hydrodynamic)
- Engineering design refinements for the marine structures
- Additional modelling of final marine structure designs
- Fulsome, robust and collaborative and monitoring program

9.0 ANNEX III INFORMATION REQUESTS

The following sections summarize the conclusions of the responses to the three Annex III information requests.

9.1 EFFECTS ON CURRENT USE OF ABORIGINAL FISHERIES FOR TRADITIONAL PURPOSES

The updated assessment of effects on access to lands, waters, and resources for traditional purposes, and fish and fish habitat (based on the refined 3D modelling), as well as the additional information pertaining to suitable alternative habitats for marine mammals, and the disposal of dredged sediment on Lelu Island, does not result in any new effects, including cumulative effects, on the current use of lands and resources for traditional purposes. Consequently, the residual effects on current use by Metlakatla First Nation, Lax Kw'alaams First Nation, Gitxaala Nation, Kitsumkalum First Nation, Kitselas First Nation and Gitga'at First Nation remain as described in the EIS Addendum.

9.2 EFFECTS ON MARINE MAMMALS

Data on marine mammal species presence, relative abundance, timing and spatial distribution in the project development area and marine local assessment area are currently being collected by the marine mammal field program to help identify habitat use, and will continue until December 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 marine local and regional assessment areas 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 response to the information request 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 marine local assessment area.

It is anticipated that individual marine mammals in the marine local assessment area may exhibit localized behavioural change in the local assessment area 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 marine local assessment area in the event of short-term small-scale displacement.

9.3 EFFECTS OF DREDGED MATERIAL DISPOSAL

The disposal of sediment on Lelu Island will not result in any new disturbances or new effects from what has been considered in the EIS/Application and EIS Addendum. The storage area is within the project development area, and

this area will be cleared and leveled for construction of the facility (with or without the on-land disposal of marine sediments). Effects from the clearing have been assessed in the EIS/Addendum and remain unchanged. A review of the dioxin and furan concentrations in the sediments shows they are below the most conservative standards (sensitive marine environments) set out in the provincial Contaminated Sites Regulation. The PRPA's permitting process will provide oversight for land disposal of sediment and will require discharge water to be managed to applicable provincial water quality guidelines. All water discharges will also comply with other relevant regulations (e.g., the *Fisheries Act* prohibition again the deposition of deleterious substances). Further, disposal of the sediments on Lelu Island will eliminate the risk of adverse effects related to dioxins and furans at the Brown Passage disposal site. Based on this analysis, residual and cumulative effects on the biophysical valued components and the current use of land and resources for traditional purposes remain not significant.

10.0 ACKNOWLEDGEMENT

The PNW LNG Project Team would like to express its thanks to all of the people involved in helping craft the response to the outstanding information as it was communicated to PNW LNG on June 2, 2015 by the CEA Agency.

10.1 ENGAGEMENT WITH THE FEDERAL GOVERNMENT AND TSIMSHIAN ABORIGINAL GROUPS

The Project team has collaborated extensively with the CEA Agency and the federal experts at DFO and NRCan over the summer of 2015. In addition, key meetings were held with Tsimshian aboriginal groups.

Critical project activities and federal government and Tsimshian aboriginal groups' engagement and interactions from June 2 through to October 16, 2015 are summarized as follows:

1. June 4: Project team met with federal (the CEA Agency, NRCan, MPMO and DFO) and provincial officials to discuss the June 2 correspondence to PNW LNG. *CEAA provided copies of a presentation given at the meeting that summarized and discussed information required to complete the environmental assessment*.
2. June 5: The Project team supported the CEA Agency in briefing available Tsimshian aboriginal group members of the Technical Working Group.
3. June 8: Project convened with the CEA Agency and representatives from NRCan, MPMO and DFO to discuss modelling issues and begin to chart a path forward to fulfilling the information request*. Meeting notes from the June 8th meeting summarized the deliberations*.
4. June 10: The Project team supported the CEA Agency in briefing those members Tsimshian aboriginal group members that were unavailable on June 5.
5. June 15: Project team met with the CEA Agency to discuss outstanding information for the assessment of "Current Use of Lands and Resources for Traditional Purposes". *PNW LNG has assembled notes from this meeting*.
6. June 17: The CEA Agency convened key representatives of DFO, NRCan and MPMO and the PNW LNG Project team to discuss the draft supplementary 3D modelling workplan. *No meeting notes*.

7. June 22: Project team met with DFO and representatives from the CEA Agency to discuss fish and fish habitat aspects of the environmental assessment. The purpose of the meeting was to endeavor to achieve "alignment" with DFO on:
    a. Surveys and baseline collection programs
    b. Impact pathways
    c. CRA fisheries to be considered
    d. Annex III question related to alternative habitats for marine mammals
    e. Effects assessment approaches
    f. Mitigations and offsetting strategies.

    Meeting concluded with the Project team to follow up with DFO and representatives of the CEA Agency with drafts of documents that provide definition to the project's effects pathways and to the Project's habitat mitigation and offsetting strategy. *Meeting notes were taken by PNW LNG summarizing the discussions.*
8. June 24: The CEA Agency convened key representatives of DFO, NRCan and MPMO and the PNW LNG Project team to discuss the draft supplementary 3D modelling workplan. *No meeting notes*.
9. June 26: Project team met with DFO Science and representatives from the CEA Agency to further discuss wind inputs. *Meeting notes were taken by PNW LNG summarizing the discussions*.
10. July 3: The PNW LNG Project team submits the Supplementary 3D Modelling Workplan to the CEA Agency. *The Pacific Northwest LNG – Updated 3D Modelling Work Plan, July 3, 2015 is on file with the CEA Agency*.
11. July 6: Project team met with NRCan and representatives from the CEA Agency to discuss 3D modelling outputs and long term trends. *Meeting notes were taken by PNW LNG summarizing the discussions*.
12. July 7: Project team met with DFO and representatives from the CEA Agency to discuss fish and fish habitat aspects of the environmental assessment. The discussions focused on fish and fish habitat survey efforts, effects pathways document and mitigations and offsetting strategies and memo to DFO. *Meeting notes were taken by PNW LNG summarizing the discussions*.
13. July 8: The CEA Agency convened a meeting focused on "interim" supplementary modelling results. It was attended by the Project team, representatives of the CEA Agency, MPMO, DFO and NRCan. *Detailed CEA Agency meeting notes are available for this meeting*.
14. July 16: Two meetings were held on this date. One meeting was hosted at DFO Nanaimo to have further discussions between the Project team and DFO with respect to the mitigations and offsets memo which was undergoing revision. *The final version of this memo dated August 19, 2015 was submitted to DFO and the CEA Agency on or about that date*. The second meeting was held with NRCan, the Major Projects Management Office and PNW LNG to discuss early results from modelling efforts.
15. July 21: Project team met with DFO Science to discuss high resolution modelling at the tower suspension bridge support and anchor block. *Meeting notes were taken by PNW LNG summarizing the discussions*.
16. July 27: The Project team met with technical representatives of the Lax Kw'alaams (Dr. McLaren of SedTrends and Ian Townend) to have a technical discussion with respect to the ongoing supplementary 3D modelling. *No meeting notes or summary*.
17. July 28: CEAA hosted a Technical Working Group meeting in Prince Rupert. All Tsimshian aboriginal groups had representatives in attendance. A fulsome presentation was provided by the Project team that outlined all of the Project team efforts underway to respond to the June 2, 2015 letter from the CEA Agency. *The CEA Agency has prepared notes for this meeting and they are available. The presentations and background reports were made available to the participants*.

18. July 31: The Project team met with technical representatives of the Lax Kw'alaams (Dr. McLaren of SedTrends and Ian Townend) to have a technical discussion with respect to the ongoing supplementary 3D modelling. *Meeting notes were taken by the Project team summarizing the discussions*.
19. August 10: Dr. McLaren of SedTrends informs the Project team and the federal regulatory family that there are substantive errors in his sediment grain size data. New data is provided and incorporated into the revisions to the 3D modelling exercise.
20. September 16: Draft interim response to the June 2 Information Request were submitted to CEAA, NRCan and DFO for early review.
21. September 18: A summary of the 3D modelling outputs and new fish and fish habitat information and analyses was presented to the federal regulatory family.
22. September 30: A presentation and discussion of the interim 3D modelling and fish and fish habitat survey and analysis results occurred with non-Lax Kw'alaams Tsimshian aboriginal groups.
23. October 16: The federal regulatory family concluded its review of the interim draft response materials submitted on September 16.

11.0 CLOSURE

PNW LNG trusts that the information in this summary response to information request #3 and the accompanying technical reports provide the CEA Agency and federal departments with the information required to prepare the environmental assessment report for the Project. If you require any additional information, please contact me at (778) 372-4705.

Regards

PACIFIC NORTHWEST LNG

<Signature Removed>

Michael Lambert

Head, Environmental and Regulatory Affairs