Pacific NorthWest LNG Project
Marine Fish and Fish Habitat Program
Interim Data Report

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Abbreviations

CRA	Commercial, Recreational and Aboriginal
CTD	Conductivity-Temperature-Depth
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
EIS	Environmental Impact Statement
FTU	Formazin Turbidity Units
LNG	liquefied natural gas
nMDS	non-metric Multidimensional Scaling
PDA	Project Development Area
PNW LNG	Pacific NorthWest LNG Limited Partnership
PRPA	Prince Rupert Port Authority
SD	standard deviation
TS	target strength
UTM	universal transverse mercator

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) is proposing to construct and operate a liquefied natural gas (LNG) facility (the Project) on Lelu Island within the District of Port Edward, British Columbia and a marine terminal within Chatham Sound off Lelu Island. The Project would be located on federal lands and waters under the jurisdiction of the Prince Rupert Port Authority (PRPA). A Marine Fish and Fish Habitat Follow-up Monitoring Program (the Program) has been developed to meet the pre-construction requirements for a follow-up program under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), and addresses information requests from the Canadian Environmental Assessment Agency (CEA Agency) regarding information provided in the Marine Resources Sections of the Environmental Impact Statement (EIS) for the Project (Stantec Consulting Ltd. 2014) and EIS Addendum (Pacific NorthWest LNG Limited Partnership, 2014).

The Program includes a variety of monthly marine fish and fish habitat surveys and is intended to provide pre-construction information on the monthly distribution of commercial, recreational and aboriginal (CRA) fish species within the vicinity of the project development area (PDA, see Section 2.0). More specifically, the objectives of this Program are to:

- Identify which species of marine fish are present in the survey area
- Identify whether there are certain times of year that species may be more or less prevalent
- Identify spatial and temporal distribution patterns and habitat use between December 2014 and November 2015 for CRA species with a focus on Pacific salmon (*Oncorhynchus* sp.) (smolt stage), Dungeness crab (*Metacarcinus magister*), Pacific herring (*Clupea pallasi*), and the forage fish species surf smelt (*Hypomesus pretiosus*) and sandlance (*Ammodytes hexapterus*)

1.1 SUMMARY OF EFFORT AND FUTURE SCHEDULE

Marine fish and fish habitat surveys have been completed monthly from December 2014 through to the present, and will continue until the end of November 2015. This interim report summarizes data to the end of May 2015 (6-month period). Each monthly survey requires approximately five field days and is completed by two Stantec biologists and one First Nation technician. In addition, bi-weekly to weekly targeted smolt surveys (conducted from dusk until dawn) were initiated on April 30, 2015 and will continue until mid-July 2015. Table 1 summarizes the survey dates, participants and research vessels associated with each survey completed to date.

Table 1 Completed Marine Fish and Fish Habitat Survey Summary

Survey Number	Survey Date	First Nation Technician	Vessel
F1	December 15 – 20, 2014	Kitsumkalum First Nation	Metlakatla vessel: *Ocean Star*
F2	January 26 – February 1, 2015	Kitsumkalum First Nation	Metlakatla vessel: *Ocean Star*
F3	February 18 – 23, 2015	Gitxaala First Nation	Metlakatla vessel: *Big Red*
F4	March 19 – 25, 2015	Gitxaala First Nation	18 foot Aluminum Skiff
F5	April 23 – 27, 2015	Gitxaala First Nation	18 foot Aluminum Skiff – HMV *Pacific Coast*
S1	April 30 – May 3[a], 2015	Gitxaala First Nation	*Active Pass* Skiff
S2	May 12 – 16, 2015	Gitxaala First Nation	*Active Pass* Skiff
F6	May 19 – 24, 2015	Gitxaala First Nation	18 foot Aluminum Skiff – HMV *Pacific Coast*
S3	May 25 – 29, 2015	Kitsumkalum First Nation	*Active Pass* Skiff

NOTE:

F Fish and Fish Habitat Survey (daytime)

S Targeted Smolt Survey (nighttime)

NA Not available

[a] For targeted smolt surveys, the end date indicates the morning of completion

June data has not been presented in this interim repot

An additional nine surveys are planned between June and the end of November 2015. This includes two extra daytime surveys for June and July to collect additional data during salmon smolt outmigration from the Skeena River (for a total of two daytime surveys each in June and July, rather than one). Targeted salmon smolt surveys (dusk until dawn) are approximately seven days long and occur over 10 weeks (May until mid-July). Surveys occurred every other week in May, and then were increased to weekly in June. Planned surveys through to the end of November 2015 are identified in Table 2.

Table 2 Scheduled Fish and Fish Habitat Surveys

Survey Number	Survey Date	Vessel
S4	June 3 – 9, 2015[a]	Metlakatla vessel: *Big Red*
F7	June 7 – 15, 2015	Metlakatla vessel: *Big Red*
S5	June 9 – 15, 2015	*Active Pass* Skiff
F8	June 17 – 24, 2015	*Active Pass*
S6	June 15 – 23, 2015	Metlakatla vessel: *Big Red*
F9	June 16 – 23, 2015	*Active Pass*
S7	June 24 – 30, 2015	*Active Pass*
S8	July 1 – 7, 2015	Metlakatla vessel: *Big Red*
S9	July 8 – 15, 2015	Metlakatla vessel: *Big Red*
F10	July 1 – 9, 2015	Metlakatla vessel: *Big Red*
F11	July 16 – 24, 2015	TBD
F12	August 12 – 16, 2015	TBD
F13	September 13 – 17, 2015	TBD
F14	October 28 – November 1, 2015	TBD
F15	November 27 – December 1, 2015	TBD

NOTE:

[a] Dates were chosen for monthly surveys to target periods of low tide levels ranging from 0.4 – 0.8 m chart datum; tide levels greater than 0.8 m chart datum limits access to Flora Bank and limits the time available to sample.

F Fish and Fish Habitat Survey (daytime)

S Targeted Smolt Survey (nighttime)

TBD To be determined

1.2 INTERIM REPORT OBJECTIVES

The objectives of this Marine Fish and Fish Habitat interim report are to:

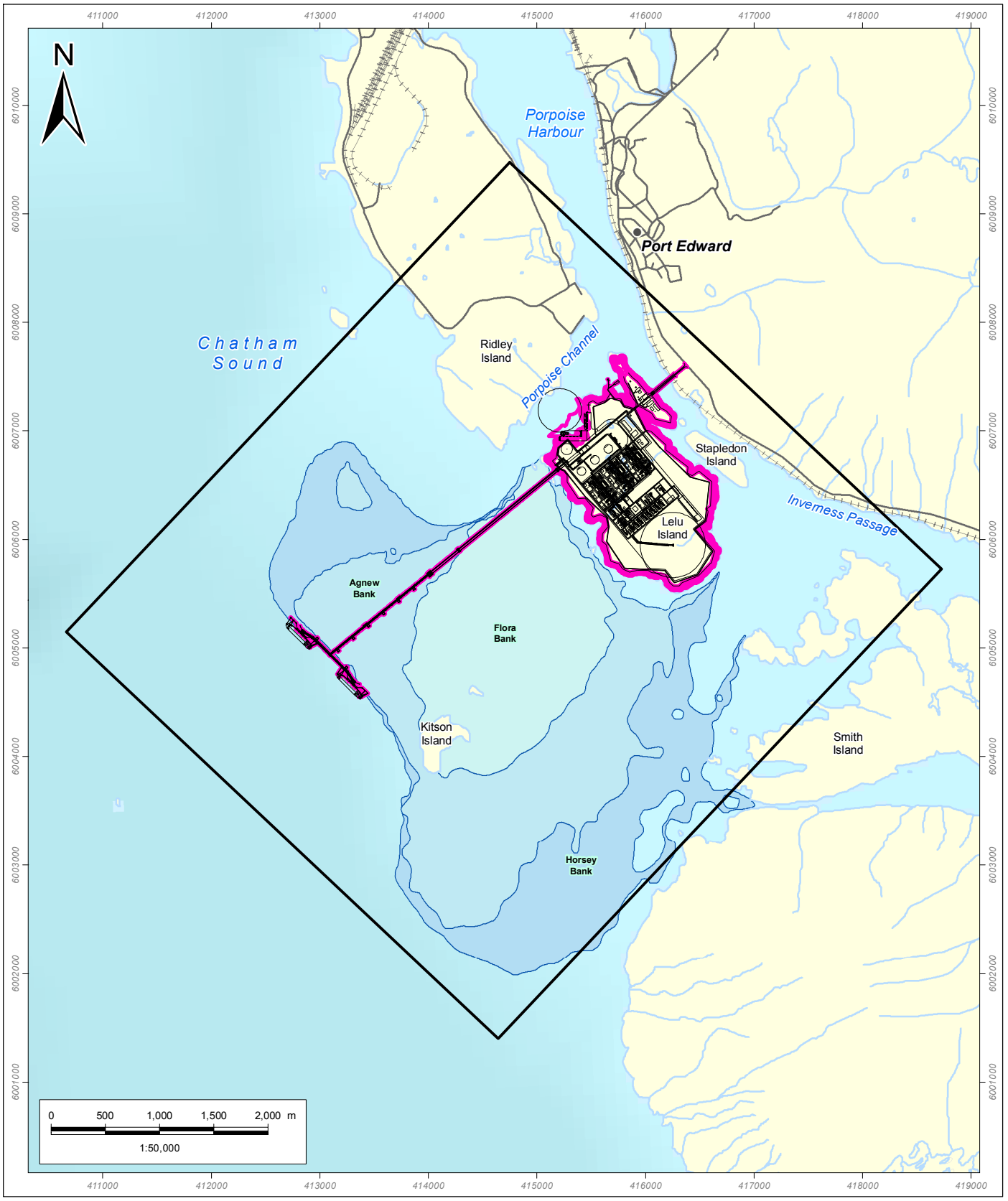
- Describe survey methods used for the field program
- Summarize sampling effort to date
- Summarize preliminary observations of marine fish from December 2014 and through the end of May 2015

This report does not provide in-depth analyses, discussion or interpretation of data collected to date as the program is not yet complete. A comprehensive analysis will be completed as a component of the final report.

2.0 STUDY AREA

The spatial boundaries (study area) for the Program were based on the PDA defined in the EIS (Environmental Impact Statement) (Stantec Consulting Ltd. 2014). This includes the areas within the alignment for the proposed marine infrastructure and the materials offloading facility on and around Flora Bank, Porpoise Channel and the western edge of Lelu Island. More specifically, the field work was conducted throughout Porpoise Channel, Flora, Agnew, and Horsey banks, and the deeper waters around the banks (Figure 1).

The marine environment in the Port of Prince Rupert is characterized by large tides, with sea levels ranging between -0.25 m and 7.87 m (DFO 2013), temporarily exposing large, otherwise semi-submerged areas (e.g., Flora Bank). Water turbidity in this portion of Chatham Sound is variable, but can be high (Fissel 2014, Stantec 2015) due to the interaction of dynamic ocean currents, winds averaging 5.8 m/s (Holland Rock meteorological station, 5 km southwest of Lelu Island; Stantec 2014 Appendix C-3), strong seasonal sediment laden outflow of the Skeena River (largest annual peak flows exceeding, on average, 2000 m^3/s from mid-May through June; Fissel 2014), and soft bottom substrates. Taken together, these environmental factors create challenging conditions to effectively sample fish to achieve the study objectives.



City or Town
Project Component
Railway
Road
Secondary Road
Watercourse
Waterbody
Shoal
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal
Bathymetry (m)
High : 1
Low : -300
Marine Fish and Fish Habitat Program Survey Area
Project Development Area

Pacific NorthWest LNG

Marine Fish and Fish Habitat Program Survey Area

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 29-JUN-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: M. JOHANNES

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **1**

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3.0 METHODS

The study design integrates a range of methods to identify the species present within the study area, the time of year species are more prevalent, and the spatial and temporal distribution patterns of fish species that support a CRA fishery and the forage fish that support these populations. These include Pacific salmon, crab, shrimp, herring and flatfish (flounder, sole), surf smelt, and sandlance. Due to the physical characteristics of the study area (littoral and pelagic habitats, intertidal nature of Flora Bank, intertidal bays in Porpoise Channel, etc.), multiple sample techniques were incorporated into the study design, including:

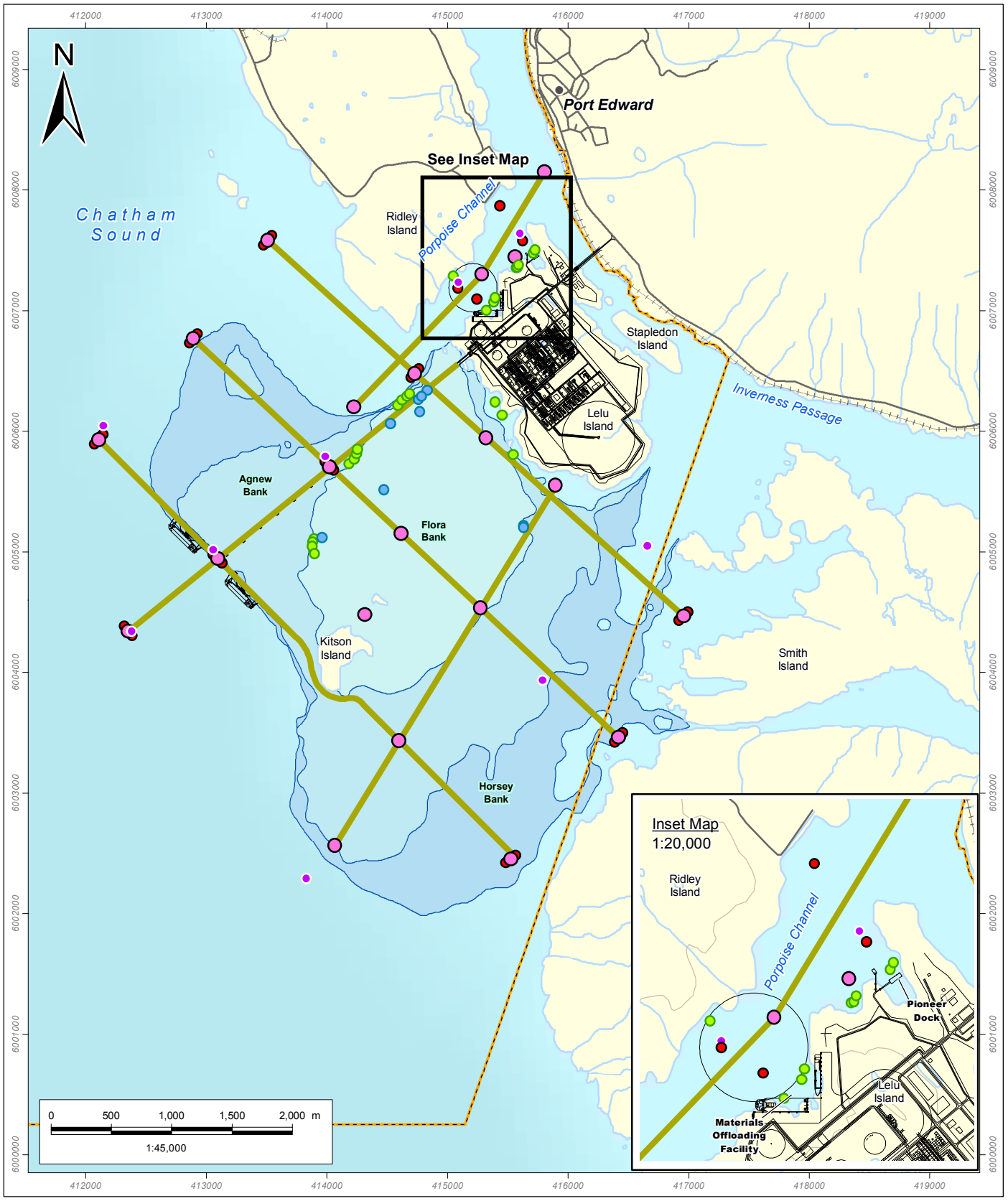
- Use of hydroacoustic and trawl surveys to assess and characterize the abundance and distribution of pelagic fish species, including juvenile salmon, herring, surf smelt and sandlance
- Beach seining to assess and characterize the abundance and distribution of intertidal and subtidal fishes between tidal cycles
- Crab trapping surveys to assess and characterize the abundance and distribution of crab
- Oceanographic water property data collection

Execution of the Program required an adaptive management approach to reflect the challenges of working safely within physical conditions. In addition, as experience and knowledge of the study area increased, the initial sampling methods (e.g., field equipment specifications, sampling locations, sampling intensity) were adapted to meet the overall intent of the study objectives. Adaptions to the initial sampling methods are listed below and discussed in detail in the applicable methods section:

- Expansion of beach seine surveys to include two different sampling nets (12 m by 1.5 m and 22 m by 3 m) and increased sample sites
- Increased number of hydroacoustic transects (from 4 to 6 transects)
- Expansion of trawl surveys to include two different sampling nets (2 m by 2 m tucker trawl and 5 m by 4.6 m Otter trawl) and increased number of transects (4 to 6 transects)
- Initiated a program for prawn trapping in February 2015
- Addition of Fyke net surveys on Flora Bank
- Addition of a Pacific salmon smolt survey to conduct hydroacoustic and trawl surveys from dusk to dawn, collect oceanographic water property data, and zooplankton assessments

The location of sampling sites by method for the daytime surveys is shown in Figure 2. Sample sites and methods for the nighttime targeted smolt survey are identified in Figure 3.

The following sections provide a detailed discussion on the purpose, study design and methods for each sampling method.



City or Town
Project Component
Railway
Road
Secondary Road
Watercourse
Prince Rupert Port Authority Boundary
Waterbody
Shoal
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal
Bathymetry (m)
High : 1
Low : -300
CTD Site
Fyke Net
Beach Seine Site
Crab Trap
Prawn Trap
Hydroacoustic and Trawl Transect

Pacific NorthWest LNG

Marine Fish and Fish Habitat
Daytime Survey Locations (2014-2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 09-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: M. JOHANNES

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **2**

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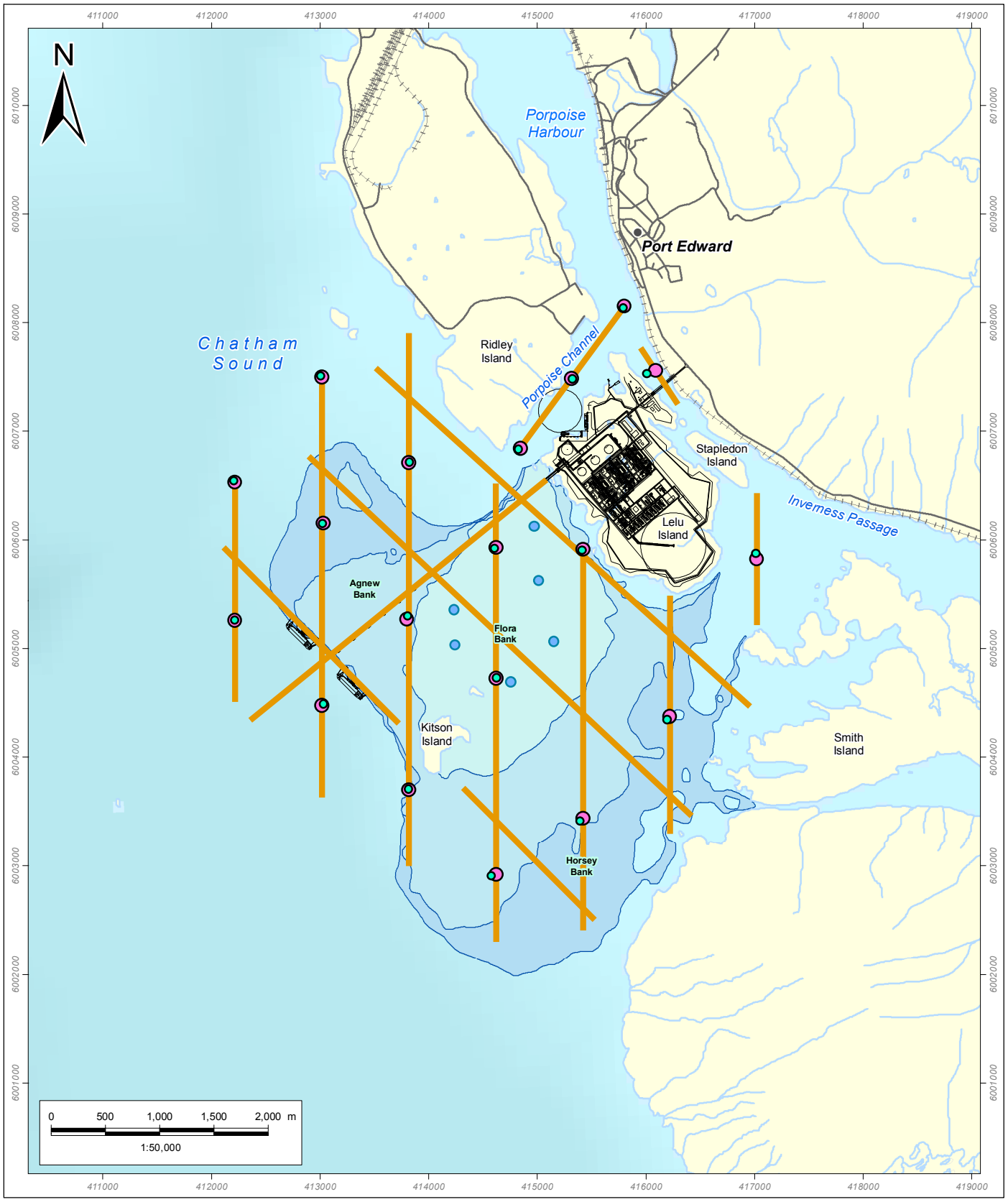

City or Town
Project Component
Railway
Road
Secondary Road
Watercourse
Waterbody
Shoal
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal
Bathymetry (m)
High : 1
Low : -300
CTD Site
Fyke Net
Zooplankton Site
Hydroacoustic and Trawl Transect

Pacific NorthWest LNG

Targeted Salmon Smolt Nighttime Survey Locations (May-July 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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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PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **3**

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3.1 BEACH SEINE

Purpose

Beach seining is considered an effective method to catch and characterize nearshore fish communities (Conlin and Tutty, 1979; Johnson et al., 2007), and was employed in this program to determine the abundance and distribution of nearshore fish (intertidal and subtidal) between tidal cycles.

Sample Design

Beach seines were conducted monthly during the daytime within Porpoise Channel and on Flora Bank. Beach seine sites could not be chosen based on a randomized design as sampling was limited by accessibility, available shoreline to haul beach seines onto and process fish, safety, and practicality (Figure 2). The focus of the initial study design was to prioritize sample efforts to the areas of greatest potential Project related impacts. Based on Project infrastructure and sediment modelling reports (Sayao and Absalonsen 2014), the western side of Flora Bank was identified as an area of key concern. The initial study designed focused on sampling four areas: Porpoise Channel, the northwest corner of Flora Bank, central western corner of Flora Bank, and southwest corner of Flora Bank (as illustrated by the seine site locations in Figure 2). Within the Porpoise Channel sample area nine beach seine sample sites were targeted. Within the three Flora Bank sample areas, four beach seine sample sites were targeted. Therefore, a total of 21 monthly beach seines were targeted within the study area.

Due to the flat topography of Flora Bank, beach seine sites could only be established along the northwestern edge of the bank; beach seining was not possible in the middle of Flora Bank due to safety considerations. As tide levels rose from 1.5 m to 1.9 m chart datum, water levels rose over Flora Bank. At tide levels greater than 1.9 m chart datum, it was not safe to work on Flora Bank and there was insufficient shoreline available to haul beach seine sets and process fish (Flora Bank is 100% intertidal). As a result, beach seines in this area were typically carried out at tides below 1.5 m. Within each of the sample areas on Flora Bank, beach seine sites were shallow, flat, dominated by compact sands, and had limited structural complexity; these characteristics allowed for high sampling efficiency.

Four beach seines sample sites were targeted in each of the three sample areas on Flora Bank (Figure 2); however, more/less sampling was conducted based on tide, weather and time. Overall, each monthly survey targeted 12 sample sites but actual effort ranged from 6 to 13 sets per monthly survey. Consistent sample sites within each sample area were not established on Flora Bank as access to sites was affected by tide levels.

Within Porpoise Channel beach seining was also constrained by tide level. At high level tides, the bottom type (large angular boulders) and shore complexity (roots, debris) resulted in snags or hang-ups while towing the net, reducing the overall efficiency of the set. Due to this constraint, beach seining at all sites within Porpoise Channel was conducted during low tide. Nine beach seine sites were established within Porpoise Channel (Figure 2) and were sampled during each monthly daytime survey.

In May 2015, the beach seine survey was expanded to include an additional sample area within a small channel between Lelu Island and Flora Bank (Figure 2). This area was added because it was identified as a potential holding area for juvenile salmon during low-tide events and because it was recognized that no sampling had occurred on the eastern edge of Flora Bank up to that point (primarily related to time constraints in the field). During the May 2015 survey, three beach seines added to the Program at this new site and all sites within will be surveyed during subsequent monthly efforts (e.g., July 2015 to the end of the Program).

Methods

Two beach seine sampling techniques were used to conduct beach seine surveys. In shallow waters (< 1.2 m), which encompassed all sites outside of the channel between Lelu Island and Flora Bank (approximately 85 % of all sites), a 12 m long by 1.5 m deep seine net with 6 mm mesh at the tow ends and 4 mm mesh at the bunt was used. Each sampling event consisted of a single set, in which two biologists towed the net approximately 20 m along the shoreline. UTM coordinates (start point and finish point) and water depth (at the deepest point) was recorded for each set. At deeper sites (greater than 1.2 m depths and limited to the sample sites to the channel between Lelu Island and Flora Bank), a 22 m long by 3 m deep net with 13 mm mesh at the tow ends and 6 mm mesh at the bunt was set from a vessel (18 foot aluminum skiff). The beach seine was deployed from an anchor on the shoreline and towed down-current (as currents within the channel were too strong to adequately haul and maneuver the skiff into the current). UTM coordinates and water depth were recorded similar to the shore sets. At the commencement of the Program (e.g., December 2014, January 2015), the larger 22 m long by 3 m deep net was tested at a number of shallow water sites; however, the net was too heavy to safely haul and many sites were too shallow to use a boat. As such, after January 2015 the 22 m long by 3 m deep net was limited to use at deep water sites (>1.2 m).

All fish captured were identified in the field to the lowest possible taxonomic group (ideally to species), measured (fork and total length in mm), enumerated and assessed visually for injuries and abnormalities. In an effort to minimize fish handling and stress, only the first 10 chosen individuals of each species caught per seine set were measured. All fish were live-released at the location of capture.

3.2 HYDROACOUSTICS AND TRAWLS

Purpose

Hydroacoustic surveys coupled with trawls allows for a broad characterization of the abundance and distribution of fish along survey transects (Koslow 2009). This information, when collected in conjunction with water column properties (e.g., temperature, salinity) and bathymetry, can be used to characterize habitat and habitat use.

During hydroacoustic surveys, high frequency sound pulses ("pings") sent through the water column by a transducer; the transducer then detects and characterizes the echoes returning from objects in the water. Echo intensity is the most important characteristic measured, and is commonly referred to as target strength (TS). Targets (e.g., fish) that are larger will have a greater TS value. The pattern of echoes along a survey transect is visually displayed by depth on an echogram. Net tows carried out in concert with the hydroacoustics provide information regarding fish distribution as well provide information (ground-truthing) for interpretation of the targets observed.

Hydroacoustics alone can be used to discriminate between broad functional groups with a distinct size difference (e.g., plankton versus fish) with some overlap, but not between similar size classes of fish (e.g., between small bodied fish such as herring and salmon smolts). However, the ability for hydroacoustics alone to identify fish to species is limited. Moreover, the ability for hydroacoustics to detect targets is proportional to water depth; in shallow water, the cone-shaped acoustic beam is relatively narrow and is therefore less likely to pass over fish than in deeper water where the beam is wider, and less likely in shallow water to scan an entire school of fish if one is encountered. Another practical limitation of the use of hydroacoustics in shallow waters is the possibility of fish avoidance of the vessel. Both of these limitations must be considered when interpreting patterns of fish detection over the shallow regions of the study area including Flora Bank.

Sample Design

The initial study design implemented in November 2014 hydroacoustic and trawl transects in 4 locations to examine fish presence over the area with the potential for project effects. Additional transects were added within Porpoise Channel in February 2015 and to the east of Flora Bank in May 2015 (Figure 2 to provide greater coverage of habitats surrounding the Project site).

Nighttime transects followed the same transects conducted in the daytime, as well as some additional areas where out-migrating smolts were believed to potentially use Flora Bank and surrounding habitat (Figure 3).

Methods

Either a modified Otter trawl net 18 m long with an opening 5 m wide and 4.6 m deep, a 2 m by 2 m Tucker trawl net, or a 1 m by 1 m Tucker trawl net were towed to survey fish and to provide information to interpret the identity of the targets identified by the echo sounder[1]. These nets are able to catch a range of taxa, including salmon smolts, surf smelt, and herring, although the modified Otter trawl is considered more effective (more fish caught) (Schwinghamer et al. 1998).

Trawls were conducted from the surface to 4.6 m with the modified Otter trawl, from 0.5 m to 2.5 m with the 2 m by 2 m Tucker trawl, and 5 m to 20 m with the 1 m by 1 m Tucker trawl net. The modified Otter trawl has a baffled holding box specifically designed for live capture, and is only used in water deeper than 10 m due to the draft requirements of the research vessel. The Otter trawl was deployed from a fishing vessel and the Tucker trawl nets were deployed from a 5.5 m aluminum skiff. Experience fishing each trawl net within the study area indicates the most efficient method of trawling consists of a combination of the Otter trawl in deeper habitat (>10 m) areas along transects and the 2 m by 2 m Tucker trawl over Flora Bank and shallower habitat (<10 m) areas (Jason Cote, pers. comm.). After evaluation of the catch numbers with the 1 m by 1 m Tucker trawl, this net was not deemed as an efficient sample technique for the study area and was removed from the Program in February 2015.

Hydroacoustic surveys were completed with a 120 kHz DT-X digital echosounder (Biosonics Inc., Seattle, WA) mounted to an aluminum pole attached over the side of the 5.5 m aluminum skiff. The echosounder was positioned downward looking through the water column while the boat travelled at 3 – 4 knots along each transect (Figure 2 and Figure 3). Effort was made to survey the shallowest areas during the highest possible tide to minimize potential fish avoidance of the research vessel. Hydroacoustic surveys were carried out simultaneously with surface trawls with the 2 m x 2 m Tucker trawl net. A defined set of transects 0.6 km to 5 km in length were traveled and the net contents examined at the end of each transect. During the nighttime surveys, only the Tucker trawl was used due to safety concerns of deploying the larger net after dark. Fish captured were identified in the field, counted, measured, and assessed visually for injuries and abnormalities. Salmonids were retained for stomach content analysis (see Section 3.7). All other species were released.

[1] The 1 x 1 m Tucker trawl was initially used because it was the only net available. The daytime surveys use both the Otter trawl and the 2 x 2 Tucker trawl of nets depending on depth. The nighttime trawls only use the 2 x 2 Tucker trawl.

3.3 FYKE NET

Purpose

Fyke nets were used to document fish species distribution over areas of Flora Bank that could not be sampled as a component of the beach seine survey (insufficient shoreline to conduct beach seines). Such areas constitute roughly 90% of Flora Bank.

Sample Design

The use of Fyke nets was initiated in March 2015 with the intent of providing additional information of fish species presence and distribution across Flora Bank, specifically flatfish and crab that are not easily captured/identified from hydroacoustic or trawl surveys. Fyke nets are an effective method for sampling migratory species in estuarine habitats, and allowed for passive fish sampling of habitats across Flora Bank (Conlin and Tutty, 1979; Shreffler et al., 1990; Portt et al., 2006; Johnson et al., 2007).

Initial study design was to set Fyke nets under high-tide conditions from the research vessel; however, attaching the nets to the channel bottom was difficult due to lack of visibility within the water column. Under such conditions, there was no certainty the net was effectively fishing until retrieved. As a result, Fyke nets were deployed under low-tide conditions when Flora Bank was exposed. Under these circumstances, field crews were required to carry the net, anchors, and associated lines and floats to the sample site locations (no boat access). Fyke net sample sites on the exposed Flora Bank were determined by the field crew on site and focused on areas with habitat complexity (e.g., eelgrass presence), within shallow dendritic channels, and taking into account safe access (e.g., exposed areas, ease of boat access to shore) with limited walking/carrying distance (Figure 2). Consistent sample sites were therefore not established on Flora Bank as access to sites is variable and limited by tide levels.

Frequency of sampling was limited by availability of Fyke nets (two), tide levels (could only be set at low tides; <1m chart datum), and time (inclusion of Fyke nets as a sample technique was not part of the original study design and are time consuming to setup, retrieve and process). Each monthly survey targeted two Fyke net sets but actual effort ranged from no sets to four sets. Fyke net sets were added to the nighttime program to increase sampling effort using this method (Figure 3).

Method

Fyke nets consisted of a cylindrical (cone-shaped) net bag mounted on a series of rings (0.60 m diameter by 3.8 m long) with wings that act as a funnel to direct moving fish into the net. At the front, leaders (14.6 m long) guide the fish towards the square opening of the net bag (0.76 m high by 0.86 wide). A second central leader (7.3 m) also directs fish into the net.

Fyke nets were deployed during low tide when Flora Bank was exposed. Nets were placed perpendicular to the bank in tidal channels, areas of dense eelgrass, and/or sites identified by field biologists as having a high potential for fish catches (based on experience and knowledge of the area). Deployed nets were fixed to the ground using small mud anchors and allowed to fish over a single tidal cycle, typically a 6 to 10-hour period. To ensure nets did not dewater, during the daytime surveys the nets were retrieved at a mid to high level tide from an 18 foot aluminum skiff.

During the nighttime surveys, field crews set up the Fyke nets during low tide in daylight (usually at the end of the night shift near dawn). The nets were fit with plywood doors that cover the entire opening of the Fyke net so that they do not fish until the doors are removed. A line and float were attached to each door allowing the crew to remove the doors the following day during high tide from the vessel. The nets were left to fish passively until collection at low tide.

Fish captured were identified, measured (fork/total length in mm), enumerated and assessed visually for injuries and abnormalities. In an effort to minimize fish handling and stress, only the first 10 chosen individuals of each species caught in each net were measured.

3.4 CRAB AND PRAWN TRAPPING

Purpose

Crab and prawn traps were deployed to assess and characterize the abundance and distribution of crabs (e.g., Dungeness crab) and prawns within the study area.

Sample Design

Crab trap surveys were completed monthly during the daytime within Porpoise Channel and the areas surrounding Flora Bank. Use of crab traps directly on Flora Bank was not possible as the area is intertidal and would result in crab traps dewatering during low-tide conditions, which is outside the permissions of the Program's Scientific Licence issued by Fisheries and Oceans (DFO). A total of 24 crab sample sites were distributed within the available study area. Twenty crab traps were distributed at the beginning/end points of established hydroacoustics transects and at bisecting points with other transects (Figure 2). Four crab traps were established within Porpoise Channel outside of the traffic route (Figure 2).

Prawn surveys were tested in February 2015 at 11 sample sites. The test program was initiated to determine the feasibility and value of adding prawn surveys to the overall study design. Prawn trapping efforts were limited by the number of prawn traps available (n=5) and were deployed at randomly selected crab sample sites stratified by depth. Three additional sample site locations were incorporated to the test program (Figure 2) in March 2015 to increase sample effort within the study area. Within 3 sample events (February, March and April) a total of 3 out

of 25 prawn traps were lost due to high currents. In May 2015, prawn trapping was removed from the Program due to difficult sampling conditions within the study area (traps being lost), and the lack of meaningful data (limited deep water sites typically used by prawns in the study area).

Methods

At each crab sample site, commercial grade traps (0.91 m bottom ring, 0.86 m top ring, 2 x 105 mm escape hatches, 25 mm weight bar, wrapped in standard mesh [0.05 m diamond weave]) were deployed in accordance with DFO's *Manual for Dungeness Crab Surveys in British Columbia* (DFO 2011). Traps were baited with herring and soaked for 18 to 24 hours before being retrieved. At each sample site, information recorded included date and time in/out, water depth, and UTM coordinates. Temperature was collected with the CTD at each site.

At each prawn sample site, commercial grade prawn traps (71 cm diameter, 7.6 cm stainless steel ring opening, web of 38 mm mesh) were deployed. Traps were baited with commercial dried pellets and soaked for 18 to 24 hours before being retrieved. At each sample site, information recorded included date and time in/out, water depth, and UTM coordinates.

All crabs and prawns captured were identified to the lowest taxonomic level possible (ideally to species), sexed (crabs only), measured (carapace width), weighed, and examined for injuries (e.g., missing/regenerated limbs). Crabs were also assessed for reproductive status (i.e., berried or not) and moult stage (i.e., hard- or soft-shelled). All crabs and prawns were live released at the point of capture.

3.5 WATER PROPERTIES

Purpose

Water properties have a strong influence on the distribution and production of aquatic taxa (Falkowski et al 1998). With an understanding of the key habitat requirement of individual species, and by understanding how key water properties (e.g., temperature, salinity chlorphyll *a*, turbidity and dissolved oxygen), vary in space and time, we can get an idea of the extent of suitable physical, chemical and biological habitat. Also, by understanding the potential habitat changes that might result from project activities or changing climatic conditions, we can increase our understanding of the potential effects on species of interest.

Sample Design

Marine water property data were collected at 17 (daytime) and 19 (nighttime) designated locations during each monthly survey (Figure 2 and Figure 3). CTD sample sites were distributed along established hydroacoustic and trawl transects, with one additional site placed within Porpoise Channel outside of the traffic route. These locations were selected in relation to the fish

(along the transect line) and crab and zooplankton (day and night, respectively) sampling sites in order to compare data taken from the same location.

Methods

Water property data were initially (December 2014, January and February 2015) collected using an XR RBR 620 Conductivity-Temperature-Depth (CTD); however, due to availability of the instrument a combination of an ALEC CLW Infinity and RbR Concentro unit was used in March 2015 through May 2015. Water quality parameters collected with the instruments include:

- Turbidity (FTU)
- Temperature (ºC)
- Conductivity (mS/cm)
- Depth (m)
- Dissolved oxygen (DO) concentration (mL/L)
- Chlorophyll *a* concentration (µg/L)

At each survey site, the CTD instrument package was lowered to the seabed and retrieved at a rate of 1 m/s using a rope and winch.

Measurements of Secchi depth, an indicator of water clarity, were also recorded during the monthly daytime surveys.

3.6 ZOOPLANKTON SAMPLING

Purpose

Zooplankton are the primary conduit from the primary producers to higher trophic level taxa such as fishes (Pomeroy 1974; Sheldon et al. 1977; Pauly and Christensen 1995). The patterns of distribution, abundance and species composition of the zooplankton has an influence on growth and distribution of the taxa that prey on them. Thus by understanding the zooplankton community we can gain insight into the potential suitability of habitat for the taxa that prey on them, such as juvenile salmonids. The purpose of the zooplankton work described here is to examine the abundance and species composition of the zooplankton across the study area such that a more complete understanding of habitat suitability and potential habitat use can be gained.

Sample Design

Zooplankton were sampled at 19 pre-defined stations (the same as the nighttime CTD sites) placed to encompass the entire study area (Figure 3). Zooplankton and CTD sampling were made at the same location in order to have concurrent data and avoid interpolating between

stations (McCarter and Hay 2003). Zooplankton tows were conducted only during the nighttime surveys to coincide with stomach sampling for smolts.

Methods

Zooplankton were sampled using a ring net (diameter = 0.5 m, mesh = 333 microns; as per guidelines in Hyatt 1984). Nineteen vertical tows were completed per survey (one tow per station) at the same locations as the CTD sample sites. At fixed stations ranging in water depth from 2.5 to 60 m, the net was lowered to the seafloor and then returned vertically to the surface at approximately 1 m/s. A flow meter was attached to the net to allow calculation of the volume of water filtered. Zooplankton samples were preserved in 10% formalin saturated with borax and submitted to Biologica Environmental Services Ltd. for identification and enumeration.

3.7 SALMON SMOLT STOMACH CONTENT SAMPLING

Purpose

Salmon smolts were collected to analyze stomach contents to determine spatially and temporally explicit diet composition. In combination with the zooplankton data described above, this will provide some insight into prey selectivity and possibly habitat suitability.

Sample Design

To adequately characterize salmon smolt diet, a target of 1250 stomachs (250 for each of the five species) was set. To maximize the number of smolts caught, and therefore the number of full stomachs in the sample, and provide some comparability between areas, whole fish were retained for analysis during nighttime trawls (when smolts are active and predominantly feeding on vertically migrating zooplankton; Burril et al. 2009, Chapman et al. 2012).

Methods

Salmon smolts caught during nighttime trawls between May 12 – 30, 2015 were euthanized using clove oil and flash frozen using dry ice. Whole fish were submitted to Biologica Environmental Services Ltd. for identification (to Order for Crustacea and insects, chironomidae to Family, and all others to Phylum/Class) and enumeration of stomach contents.

3.8 QUALITY CONTROL/QUALITY ASSURANCE

Measures to collect high quality data during the marine fish surveys include:

1. Routine Equipment Inspection and Calibration

- All beach seines, trawl nets, and Fyke nets were inspected for tears and rips prior to deployment. If tears or rips that could affect fish capture results were identified, the net was mended by field crews (minor repairs, e.g., small holes) and/or professionally repaired (large rips or tears requiring stitching) as required.
- Hydroacoustics data analysis utilized the salinity and temperature conditions within the study area and time of each survey. In addition, a calibrated check was conducted with a tungsten-carbide sphere at the commencement of each survey so that any calibration offsets could be incorporated in the post collection processing of the data.
- Sensors for the water properties work were rented from ASL Environmental Sciences. These are calibrated by ASL on a routine basis.
- All crab traps and lines were inspected for obstructions (e.g., faulty doors) prior to deployment.

2. Field Data Checks

- Quality control checks were conducted on the data during the field program.
- Data was reviewed and approved by a second biologist, confirming accuracy and completeness.
- Data forms were photographed for inventory purposes and to prevent data loss.
- Photographs were downloaded from cameras, sorted, and labelled at the end of each day.
- Data files were uploaded for storage, analysis, or sharing using a secure Stantec server.

3. Data Analysis

- Initial analyses included plotting data and generating summary statistics to identify possible outliers and questionable values (e.g., values that differ from comparable data by one or more orders of magnitude could have resulted from a data entry error). Uncertain values were then cross checked with field notes to determine if correctly entered from field notes to MS Excel.

4. Report Preparation and Review

- All Stantec prepared documentation were subject to a rigorous quality control review process that includes a Quality (Technical) Review and Independent Review by appropriate technical employees to confirm that study design and data interpretation were correct and defensible.

4.0 INTERIM RESULTS

4.1 ALL METHODS AND GEAR TYPES

Six daytime and four nighttime surveys have been conducted to date (Table 3). These surveys have completed 108 beach seines, 57 zooplankton tows, 76 hydroacoustic and trawl surveys (31 day and 45 night), and 15 Fyke net sampling (9 daytime and 6 nighttime) (Table 3).

To date and across all gear types, a total of 38 species (32 fish species, 6 crustaceans) have been identified within the study area (see Table 4 for a complete list). Some captures were not identified to the species level and are not included in this tally.

Table 3 presents the level of effort expended to date (December 2014 to May 2015).

Table 3 Fish and Fish Habitat Sample Effort (December 2014 – May 2015)

Survey Number	Survey Date	Beach Seine Sets	Hydroacoustic and Trawls (Day)	Fyke Net (Day)	Hydroacoustic and Trawls (Night)	Fyke Net (Night)	Zooplankton
F1	December 15 – 20, 2014	9	0	-	-	-	-
F2	January 26 – February 1, 2015	18	6	-	-	-	-
F3	February 18 – 23, 2015	22	6	-	-	-	-
F4	March 19 – 25, 2015	22	5	4	-	-	-
F5	April 23 – 27, 2015	15	5	2	-	-	-
S1	April 30 – May 4, 2015	-	-	-	13	1	0
S2	May 12 – 17, 2015	-	-	-	11	2	19
F6	May 19 – 24, 2015	22	9	3	-	-	-
S3	May 25 – 30, 2015	-	-	-	21	3	19
Total		**108**	**31**	**9**	**45**	**6**	**57**

Note:

F Fish and Fish Habitat Survey (daytime)

S Targeted Smolt Survey (nighttime)

Table 4 Species Caught All Gear Types (December 2014 to May 2015)

Species		Method							
		Beach Seine (12m x 1.5m)	Beach Seine (22m x 3m)	Crab Trap	Prawn Trap	Daytime Trawl	Nighttime Trawl	Daytime Fyke Net	Nighttime Fyke
Fish									
Big Skate	*Raja binoculata*	X							
Buffalo Sculpin	*Enophrys bison*								X
Cabezon	*Scorpaenicthys marmoratus*			X					
Chinook Salmon	*Oncorhynchus tshawytscha*	X	X				X		
Chum Salmon	*O. keta*	X	X				X		
Coho Salmon	*O. kisutch*						X		
Crescent Gunnel	*Pholis laeta*	X	X					X	
Dolly Varden	*Salvelinus malma*	X	X						
English/Lemon Sole	*Parophrys vetelus*	X	X					X	
Giant Wrymouth	*Delolepis gigantea*			X					
Pacific Herring	*Clupea pallasi*	X	X			X	X	X	
Pacific Lamprey	*Lampetra tridentatus*	X	X						
Pacific Sandfish	*Trichodon trichodon*	X				X	X	X	
Pacific Snake Prickleback	*Lumpenus sagitta*	X	X				X		
Pacific Staghorn Sculpin	*Leptocottus armatus*	X	X		X		X	X	X
Pacific Tomcod	*Microgadus proximus*	X	X		X				
Pink Salmon	*O. gorbuscha*	X							
Pipefish	*Syngnathus griseolineatus*	X	X						
Red Irish Lord	*Hemilepidotus hemilepidoyus*			X					
Rock Greenling	*Hexagrommos lagocephalus*	X	X					X	

Species		Method							
		Beach Seine (12m x 1.5m)	**Beach Seine (22m x 3m)**	**Crab Trap**	**Prawn Trap**	**Daytime Trawl**	**Nighttime Trawl**	**Daytime Fyke Net**	**Nighttime Fyke**
Sand Sole	*Psettichthys melanostictus*	X	X			X		X	
Sandlance	*Ammodytes hexapterus*	X	X						
Shiner Perch	*Cymatogaster aggregata*	X	X		X		X	X	X
Sockeye Salmon	*O. nerka*	X	X			X	X		
Spotted Snailfish	*Liparis callyodon*							X	
Starry Flounder	*Platichthys stellatus*	X	X	X		X	X	X	
Surf Smelt	*Hypomesus pretiosus*	X	X			X	X		X
Three-spine Stickleback	*Gasterosteus aculeatus*	X							
Tubesnout	*Aulorhynchus flavidus*	X	X					X	
Walleye pollock	*Theragra chalcogramma*						X		
Whitespotted Greenling	*Hexagrammos stelleri*								X
Yellowtail Flounder	*Pleuronectes ferruginea*			X					
Flatfish (sp.)		X	X				X	X	X
Gunnel (sp.)							X		
Lamprey (sp.)							X		
Lumpsucker (sp.)							X		
Prickleback (sp.)		X							
Sculpin (sp.)		X	X		X		X	X	
Sole (sp.)							X		
Unidentified Larval Fish						X	X		

Species		Method							
		Beach Seine (12m x 1.5m)	**Beach Seine (22m x 3m)**	**Crab Trap**	**Prawn Trap**	**Daytime Trawl**	**Nighttime Trawl**	**Daytime Fyke Net**	**Nighttime Fyke Net**
Crustaceans									
Coonstripe Prawn	*Pandalus hysinotus*	X		X	X				
Dungeness Crab	*Metacarcinus magister*				X			X	X
Humpback Shrimp	*Pandalus hysinotus*				X				
Pacific Spot Prawn	*Pandalus platyceros*				X				
Sidestripe Shrimp	*Pandalopsis dispar*			X	X				
Tanner Crab	*Chionecetes bairdi*								
Crab (sp.)							X		
Crangon (sp.)		X	X	X			X		X
Decorator Crab (sp.)		X			X			X	
Hermit Crab (sp)		X							
Shrimp (spp.)							X		
Echinoderms									
Starfish		X							
Total		**31**	**22**	**8**	**10**	**7**	**22**	**15**	**8**

4.2 BEACH SEINE CATCH

Between December 16, 2014 and May 23, 2015, Stantec completed 108 beach seine sets (14 with the 22 m x 3 m net; 94 with the 12 x 1.5 m net). Number of sets per month ranged from 9 (December) to 22 (February, March and May) (Table 3).

Total catch in beach seines to date was 14,377 individuals among 26 fish and 5 invertebrate taxa (Table 5).

Table 5 Beach Seine Summary by Month, Species, and Gear Type

Month	Species	Gear Type/Number Caught		
		22 m x 3 m	12 m x 1.5 m[a]	Total Caught
December	Chum Salmon	0	1	1
	Flatfish sp.	8	1	9
	Pacific Herring	0	31	31
	Pacific Snake Prickleback	0	1	1
	Pink Salmon	0	2	2
	Sandlance	9	57	66
	Sculpin sp.	1	2	3
	Shiner Perch	0	2	2
	Staghorn Sculpin	36	18	54
	Tubesnout	196	95	291
	Cragnon sp.	87	46	133
December Total		**337**	**256**	**593**
January	Crescent Gunnel	0	1	1
	Flatfish sp.	18	26	44
	Pacific Herring	0	485	485
	Pacific Snake Prickleback	0	1	1
	Pacific Staghorn Sculpin	4	78	82
	Pink Salmon	0	7	7
	Pipefish	0	4	4
	Sculpin sp.	0	14	14
	Shiner Perch	0	1	1
	Starry Flounder	2	4	6

Month	Species	Gear Type/Number Caught		
		22 m x 3 m	12 m x 1.5 m[a]	Total Caught
January (cont'd)	Surf Smelt	106	898	1,004
	Tubesnout	0	225	225
	Cragnon sp.	61	14	75
January Total		**191**	**1,758**	**1,949**
February	Chum Salmon	-	4	4
	Coonstripe Prawn	-	2	2
	Crescent Gunnel	-	2	2
	Flatfish sp.	-	97	97
	Pacific Herring	-	549	549
	Pacific Sandfish	-	1	1
	Pacific Staghorn Sculpin	-	6	6
	Pink Salmon	-	6	6
	Sculpin sp.	-	27	27
	Shiner Perch	-	45	45
	Starry Flounder	-	14	14
	Surf Smelt	-	1,119	1,119
	Tubesnout	-	284	284
	Cragnon sp.	-	212	212
	Starfish	-	1	1
	Hermit Crab	-	1	1
	Decorator Crab	-	2	2
February Total			**2,372**	**2,372**
March	Big Skate	-	1	1
	Chum Salmon	-	7	7
	Crescent Gunnel	-	3	3
	Flatfish sp.	-	215	215
	English Sole	-	1	1
	Pacific Herring	-	22	22
	Pacific Sandfish	-	1	1
	Pacific Staghorn Sculpin	-	25	25
	Pink Salmon	-	31	31
	Pipefish	-	1	1
	Sculpin sp.	-	50	50

Month	Species	Gear Type/Number Caught		
		22 m x 3 m	12 m x 1.5 m[a]	Total Caught
March (cont'd)	Starry Flounder	-	46	46
	Surf Perch	-	117	117
	Surf Smelt	-	1,711	1,711
	Tubesnout	-	83	83
	Cragnon sp.	-	15	15
March Total			**2,329**	**2,329**
April	Chum Salmon	-	159	159
	Crescent Gunnel	-	12	12
	English Sole	-	9	9
	Flatfish sp.	-	20	20
	Pacific Herring	-	7	7
	Pacific Sand Sole	-	27	27
	Pacific Staghorn Sculpin	-	13	13
	Pink Salmon	-	570	570
	Rock Greenling	-	2	2
	Sculpin sp.	-	109	109
	Shiner Perch	-	171	171
	Starry Flounder	-	17	17
	Surf Smelt	-	1,805	1,805
	Three-spine Stickleback	-	1	1
April Total			**2,922**	**2,922**
May	Big Skate	0	4	4
	Chinook Salmon	1	0	1
	Chum Salmon	3	43	46
	Crescent Gunnel	59	38	97
	Dolly Varden	3	4	7
	English Sole	49	116	165
	Flatfish sp.	1	78	79
	Pacific Herring	16	5	21
	Pacific Lamprey	1	0	1
	Pacific Sand Sole	144	71	215
	Pacific Snake Prickleback	180	387	567
	Pacific Staghorn Sculpin	122	187	309

Month	Species	Gear Type/Number Caught		
		22 m x 3 m	12 m x 1.5 m[a]	Total Caught
May (cont'd)	Pacific Tomcod	3	2	5
	Pink Salmon	0	2	2
	Pipefish	4	3	7
	Rock Greenling	4	0	4
	Sculpin sp.	43	109	152
	Shiner Perch	821	119	940
	Sockeye Salmon	2	19	21
	Starry Flounder	169	118	287
	Surf Smelt	150	1,131	1,281
	Tubesnout	1	0	1
May Total		**1,776**	**2,436**	**4,212**
Overall Total		**2,304**	**12,073**	**14,377**

Note:

[a] 4 mm stretch

"-" gear type not used

4.3 DAYTIME HYDROACOUSTIC AND TRAWL SURVEYS

Thirty-one paired hydroacoustic trawls were conducted between January and May; no trawls were conducted in December. A total of six species of fish, represented by 303 individuals (Table 6), were captured.

Table 6 Daytime Trawl Catch by Gear Type

Month (# trawls)	Species	Number Caught			
		1 m x 1 m[a]	2 m x 2 m[a]	5 x 4.6 x 18 (w x d x l)	Total
January (6)	Unidentified larval fish	2	-	-	**2**
February (6)	Unidentified larval fish	-	2	-	**2**
March (5)	Surf Smelt	-	4	-	**4**
April (5)	Pacific Herring	-	0	1	**1**
May (9)	Pacific Herring	-	2	160	**162**
	Sockeye Salmon	-	2	26	**28**
	Surf Smelt	-	4	81	**85**
	Unidentified larval fish	-	2	2	**4**
	Pacific Sandfish	-	1	8	**9**
	Sand Sole	-	1	0	**1**
	Starry Flounder	-	0	5	**5**
TOTAL		**2**	**18**	**283**	**303**

Note:

[a] Tucker Trawl

"-" gear type not used

4.4 DAYTIME FYKE NET

Fyke nets were deployed nine times (nine sets) during the day, at different locations (Figure 2). Four of these were sampled March 19 – 25, two during April 23 – 27, and three between May 19 – 24 (Table 3). Total effort was 87.6 net-hours, during which 605 individuals of 20 taxa were captured (Table 7).

Table 7 Daytime Fyke Net Summary by Month and Species

Month (number of sets)	Species	Total
March (4)	Dungeness Crab	1
	Decorator Crab	1
	Flatfish sp.	3
	Pacific Sandfish	1
	Pacific Staghorn Sculpin	1
	Spotted Snailfish	1
	Tubesnout	24
March Total		**30 fish; 2 crab**
April (2)	Crescent Gunnel	1
	Dungeness Crab	8
	English Sole	1
	Pacific Staghorn Sculpin	1
	Rock Greenling	1
	Shiner Perch	3
	Tubesnout	1
April Total		**8 fish; 8 crab**
May (3)	Dungeness Crab	17
	English Sole	1
	Flatfish sp,	1
	Pacific Herring	2
	Pacific Sand Sole	4
	Pacific Staghorn Sculpin	27
	Rock Greenling	1
	Sculpin sp.	3
	Shiner Perch	11
	Starry Flounder	2
May Total		**52 fish; 17 crab**
Overall Total		**90 fish; 27 crab**

4.5 NIGHTTIME HYDROACOUSTIC AND TRAWL SURVEYS

Forty five night trawls were completed. These trawls resulted in a total of 605 individuals captured (Table 8).

Table 8 Nighttime Trawl Catch by Gear Type

Survey (# trawls)	Species	Number Caught
April 30 – May 4 (13)	Chinook	1
	Cragnon sp.	188
	Crescent Gunnel	1
	Dungeness Crab	1
	English Sole	1
	Flounder sp.	7
	Isopod sp.	3
	Pacific Herring	4
	Pacific Snake Prickleback	1
	Pink Salmon	8
	Poacher sp.	2
	Sandlance	1
	Snailfish sp.	2
	Starry Flounder	1
	Surf Smelt	57
	Walleye Pollock	1
	Yellowfin Flounder	1
April 30 – May 4 Total	**Total Species 18**	**281**
May 12 – 17 (11)	Chinook Salmon	2
	Chum Salmon	4
	Coho Salmon	1
	Gunnel	1
	Pacific Herring	16
	Pacific Sandfish	7
	Pacific Snake Prickleback	3
	Sculpin sp.	2
	Shrimp sp.	20
	Sole sp.	1

Survey (# trawls)	Species	Number Caught
May 12 – 17 (11) (cont'd)	Sockeye Salmon	2
	Staghorn Sculpin	2
	Starry Flounder	2
	Surf Smelt	47
May 12 – 17 Total	**Total Species 14**	**110**
May 25 – 30 (21)	Chinook Salmon	20
	Chum Salmon	1
	Coho Salmon	2
	Crab sp.	7
	Cragnon sp.	14
	Eel sp.	1
	Flounder sp.	3
	Crab sp. (juvenile)	3
	Lamprey eel	1
	Lump Sucker	1
	Pacific Herring	20
	Pacific Lamprey	1
	Pacific Sandfish	14
	Pacific Snake Prickleback	5
	Sculpin sp.	1
	Shrimp sp.	3
	Sockeye Salmon	17
	Staghorn Sculpin	5
	Starry Flounder	7
	Surf Smelt	88
May 25 – 30 Total	**Total Species 20**	**214**
Total		**605**

Note:

[a] 2 x 2 m Tucker Trawl

4.6 NIGHTTIME FYKE NET

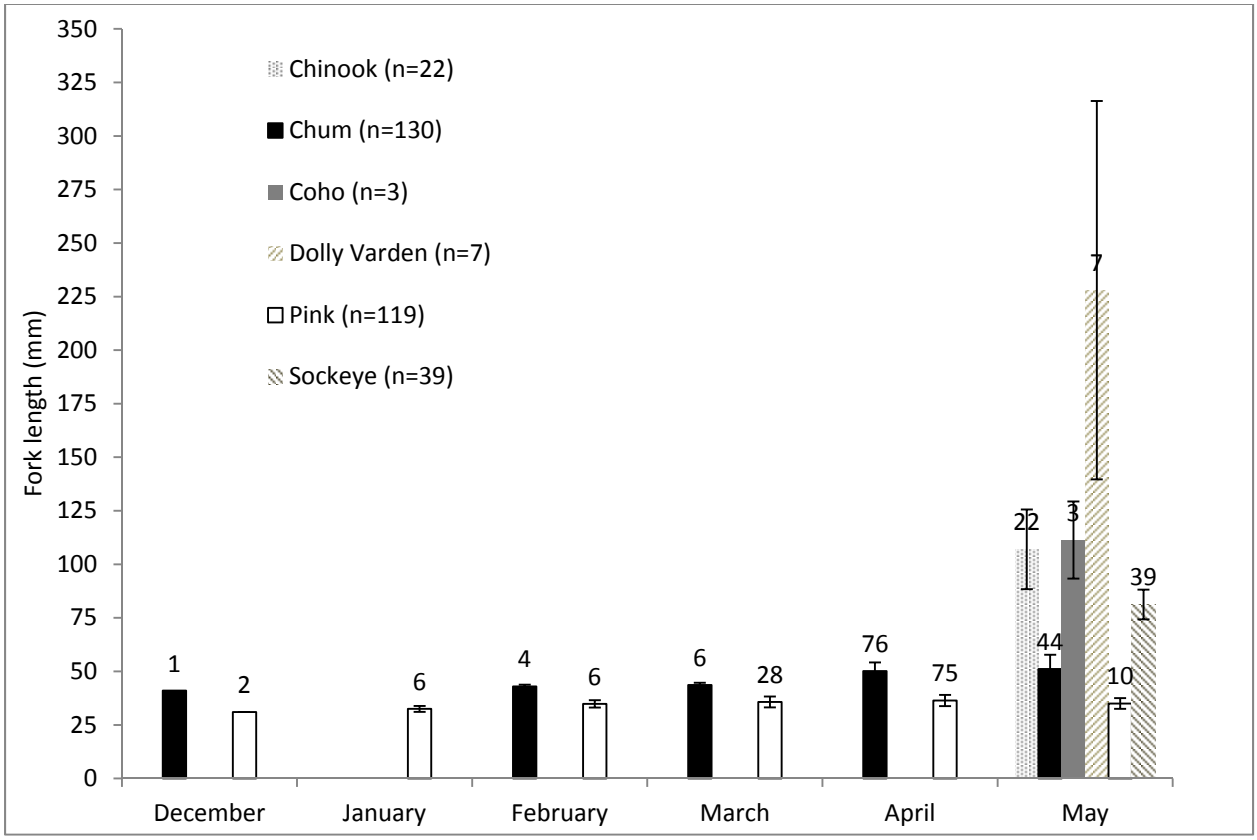
Fyke nets were deployed at five times (five sets) at night, at unique locations. A single station was sampled on each of May 3 and 12 and the three others May 27 – 29 (Table 3). Total soak time during this time was just over 29 hours. These sets of Fyke nets yielded 59 individuals of ten taxa (Table 9). Two of the sets had zero catches.

Table 9 Nighttime Fyke Net Summary by Month and Species

Month (number of sets)	Species	Total
April 30 – May 4 (1)	Buffalo Sculpin	1
	Crescent Gunnel	1
	Dungeness Crab	12
	Pacific Staghorn Sculpin	5
	Shiner Perch	9
	Starry Flounder	1
	White Spotted Greenling	1
April 30 – May 4 Total	**7**	**30**
May 12 – 17 (2)	No catch	0
May 25 – 30 (3)	Cragnon sp.	2
	Dungeness Crab	4
	Flounder sp.	2
	Pacific Staghorn Sculpin	9
	Shiner Perch	5
	Surf Smelt	2
May 25 – 30 Total	**6**	**29**
Overall Total	**7**	**59**

4.7 SMOLT BODY SIZE

Fork length of salmonids caught in beach seines and nighttime trawls are provided in Figure 4. Pink and chum salmon were caught in each month. Chum salmon mean size ranged between 41 and 51 mm and pink salmon from 31.0 to 36.4 mm. Chinook, coho, sockeye salmon, and Dolly Varden were only captured in May.



NOTE: Error bars are SD; Values above columns denote monthly sample size

Figure 4 Mean Fork Length Salmonids Captured December 2014 – May 2015 in Beach Seines (n=273) and Nighttime Trawls (n=47)

4.8 CRAB AND PRAWN TRAPS

Crab traps

Between December 16, 2014 and May 21, 2015, Stantec completed 154 crab trap sets (Table 10), with effort ranging among months from 22 sets (January) to 36 sets (December). Depths sampled ranged from 1.7 to 73 m.

Table 10 Crab and Prawn Sample Effort (December 2014 to May 2015)

Survey Dates	Crab Trap		Prawn Traps	
	Traps Set	Total Hours	Traps Set	Hours
December 15 – 20, 2014	36[1]	760.8	0	0
January 26 – February 1, 2015	22	495	0	0
February 18 – 23, 2015	24	524	11	247
March 19 – 25, 2015	24	541.2	9	158.8
April 23 – 27, 2015	24	465.6	5	60.9
May 19 – 24, 2015	24	545.6	0	0
TOTAL	**154**	**3,332.2**	**25**	**466.7**

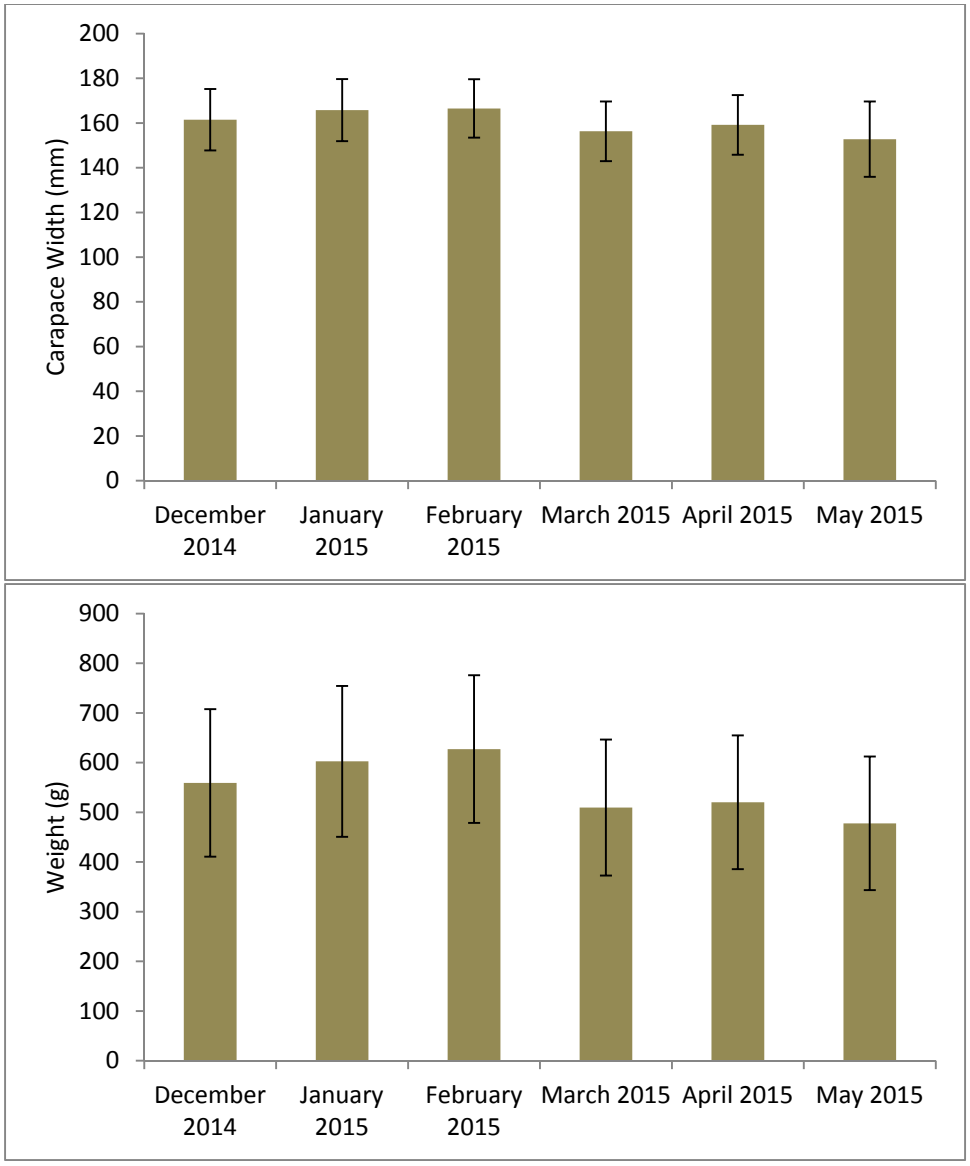
[1] Additional crab traps were deployed within Porpoise Channel to collect Dungeness samples in support of the Human and Ecological Health program.

A total of 1,070 Dungeness crab were captured during the six sampling events between December 2014 and May 2015 (Table 11). Mean monthly crab carapace width and weight are shown in Figure 5.

Table 11 Crabs Caught by Month, Depth Class and Sex

Month (Traps)	Depth (m)	Species	Number Caught	Males	Females
December (36)	0 – 10	Dungeness Crab	104	88	16
		Decorator spp.	0	0	0
	11 – 30	Dungeness Crab	64	62	2
		Decorator spp.	2	ND	ND
	> 31	Dungeness Crab	26	26	0
		Decorator spp.	0	0	0
December Total		**Dungeness Crab**	**194**	**176**	**18**
		Decorator spp.	**2**	**ND**	**ND**
January (24)	0 – 10	Dungeness Crab	118	115	3
		Tanner Crab	1	ND	ND
	11 – 30	Dungeness Crab	49	48	1
		Tanner Crab	0	0	0
	> 31	Dungeness Crab	9	9	0
		Tanner Crab	0	0	0
January Total		**Dungeness Crab**	**176**	**172**	**4**
		Tanner Crab	**1**	**0**	**1**
February (24)	0 – 10	Dungeness Crab	88	86	2
	11 – 30		58	55	3
	> 31		54	51	3
February Total		**Dungeness Crab**	**200**	**192**	**8**
March (24)	0 – 10	Dungeness Crab	52	50	2
	11 – 30		56	37	19
	> 31		37	34	3
March Total		**Dungeness Crab**	**145**	**121**	**24**
April (24)	0 – 10	Dungeness Crab	92	77	15
	11 – 30		45	34	11
	> 31		27	14	13
April Total		**Dungeness Crab**	**164**	**125**	**39**
May (24)	0 – 10	Dungeness Crab	84	55	29
	11 – 30		58	39	19
	> 31		49	28	21
May Total		**Dungeness Crab**	**191**	**122**	**69**

Note: ND Not Determined



NOTE: Error bars are SD

Figure 5 Mean Carapace Width (upper panel) and Weight (lower panel) of Dungeness Crab Captured by Crab Trap during Monthly Sampling

Prawn Trap

Prawn traps were set on February 21 (11 stations), March 21 – 22 (9 stations), and April 24 – 25 (5 stations) (Figure 2). Total effort was 466.7 trap hours. Depths sampled ranged from 6.0 to 72.3 m.

This sampling resulted in 13 individuals in four different prawn species (Table 12).

Table 12 Prawns Caught Per Trap

Month (Sets)	Depth (m)	Species	Number Caught
February (11)	0 – 10	Humpback Shrimp	0
	11 – 30		2
	> 31		4
February Total		**Humpback Shrimp**	**6**
March (9)	0 – 10	Humpback Shrimp	0
	11 – 30		0
	> 31		3
March Total		**Humpback Shrimp**	**3**
April (5[a])	0 – 10	Sidestripe Shrimp	0
		Pacific Spot Prawn	0
		Coonstripe Shrimp	0
	11 – 30	Sidestripe Shrimp	0
		Pacific Spot Prawn	0
		Coonstripe Shrimp	1
	> 31	Sidestripe Shrimp	2
		Pacific Spot Prawn	1
		Coonstripe Shrimp	0
April Total		**All Species**	**4**

Note:

[a] One trap was not recovered; data summarized from 4 sets

4.9 WATER PROPERTIES

The turbidity, temperature, salinity, DO, and chlorophyll a data are shown in Figure A- 1 through Figure A- 39. Data is organized by month and transect, with each figure displaying results for measured water quality parameters (including chlorophyll *a* concentration, water temperature, turbidity, salinity, and dissolved oxygen concentration) with depth for the transect of interest in a given month. In December 2014, only four transects were surveyed (Figure A- 1 through Figure A- 4). Five transects were surveyed in all subsequent months (January 2015 – Figure A- 5 through Figure A- 9; February 2015 – Figure A- 10 through Figure A- 14; March 2015 – Figure A- 15 through Figure A- 19; April 2015 – Figure A- 20 through Figure A- 24; May 2015 – Figure A- 25 through Figure A- 29). During the nighttime targeted smolt survey, 10 transects were completed in May (Figure A- 30 through Figure A- 39).

Measurements of Secchi depth, an indicator of water clarity, were recorded during the December 2014, January 2015, and February 2015 daytime surveys (Table 13).

Table 13 Water Clarity Data (Secchi Depth)

Site ID	Secchi Depth (m)											
	2014		2015									
	December		January		February		March		April		May	
	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)
CTD1	-	5	68	3.5	72.6	3.5	-	-	70	4.1	-	-
CTD2	-	5	10	3.5	11.0	5.0	-	-	9.5	4.1	-	-
CTD3	-	4	3.2	2.5	6.3	4.2	-	-	5.7	4.1	-	-
CTD4	-	5	23	3	26.0	4.0	-	-	9.8	3	-	-
CTD5	-	6	29	3.5	35.5	5.2	-	-	32.2	4	-	-
CTD6	-	8	8	2.5	11.7	4.0	-	-	11.1	3.6	-	-
CTD7	-	5	14.2	2.7	17.3	4.1	-	-	16.8	2.9	-	-
CTD8	-	5	2.8	2.5	6.4	5.0	-	-	5.6	2.3	-	-
CTD9	-	5	9.5	3.2	12.4	3.1[a]	-	-	7.1	3	-	-
CTD10	-	3	2	2	5.7	3.5	-	-	4.7	2.6	-	-
CTD11	-	4.5	19.1	2.5	19.8	3.0	-	-	24.6	2.9	-	-
CTD12	-	-	1	1	4.5	4.4	-	-	4	3.4	-	-
CTD13	-	-	1	1	4.5	4.4	-	-	3.9	3.1	-	-
CTD14	-	-	2	1.9	5.3	5.0	-	-	4.6	3.2	-	-

	Secchi Depth (m)											
	2014		2015									
	December		January		February		March		April		May	
Site ID	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)	Max Depth (m)	Secchi Depth (m)
CTD15	-	-	26	2.5	29.2	3.0	-	-	28.7	3.2	-	-
CTD16	-	-	27	3	30.9	3.0	-	-	31.3	3.3	-	-
CTD17	-	-	34	3	36.0	4.5	-	-	34.8	3	-	-

Notes:

[a] CTD site moved ~50 m south to avoid rock.

4.10 STOMACH CONTENTS

To date 59 individual salmonids (23 Chinook, 19 sockeye, 6 chum, 8 pink, and 3 coho) have been caught during nighttime surveys (Table 14). The DFO sample permit was pending during the first survey (April 30 – May 4, 2015), so no fish were retained.

Table 14 Salmonids Caught and Retained for Stomach Content Analysis during Nighttime Trawls

Survey Number	Survey Date	Chinook Salmon	Sockeye Salmon	Chum Salmon	Pink Salmon	Coho Salmon
S1[a]	April 30 – May 4, 2015	1	0	1	8	0
S2	May 12 – 17, 2015	2	2	4	0	1
S3	May 25 – 30, 2015	20	17	1	0	2
Total Retained for Analysis		**22**	**19**	**5**	**0**	**3**

Note:

[a] Fish from the first survey were not retained because the sample permit was still pending.

5.0 SUMMARY

This report provides interim results of fish and water property sampling over the first six months (December 2014 and May 2015) of a twelve month program. Fish sampling methods have included beach seines (108 sets), Fyke nets (15 sets), crab traps (154 sets), prawn traps (25 sets), zooplankton (57 tows) and hydroacoustic and trawl surveys (73 trawls). Fish collections included capture of more than 12,000 individuals in a minimum of 38 taxa. A further nine surveys are planned between June and November, 2015, with a comprehensive analysis of the collected data to be completed upon termination of the field program.

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July 9, 2015

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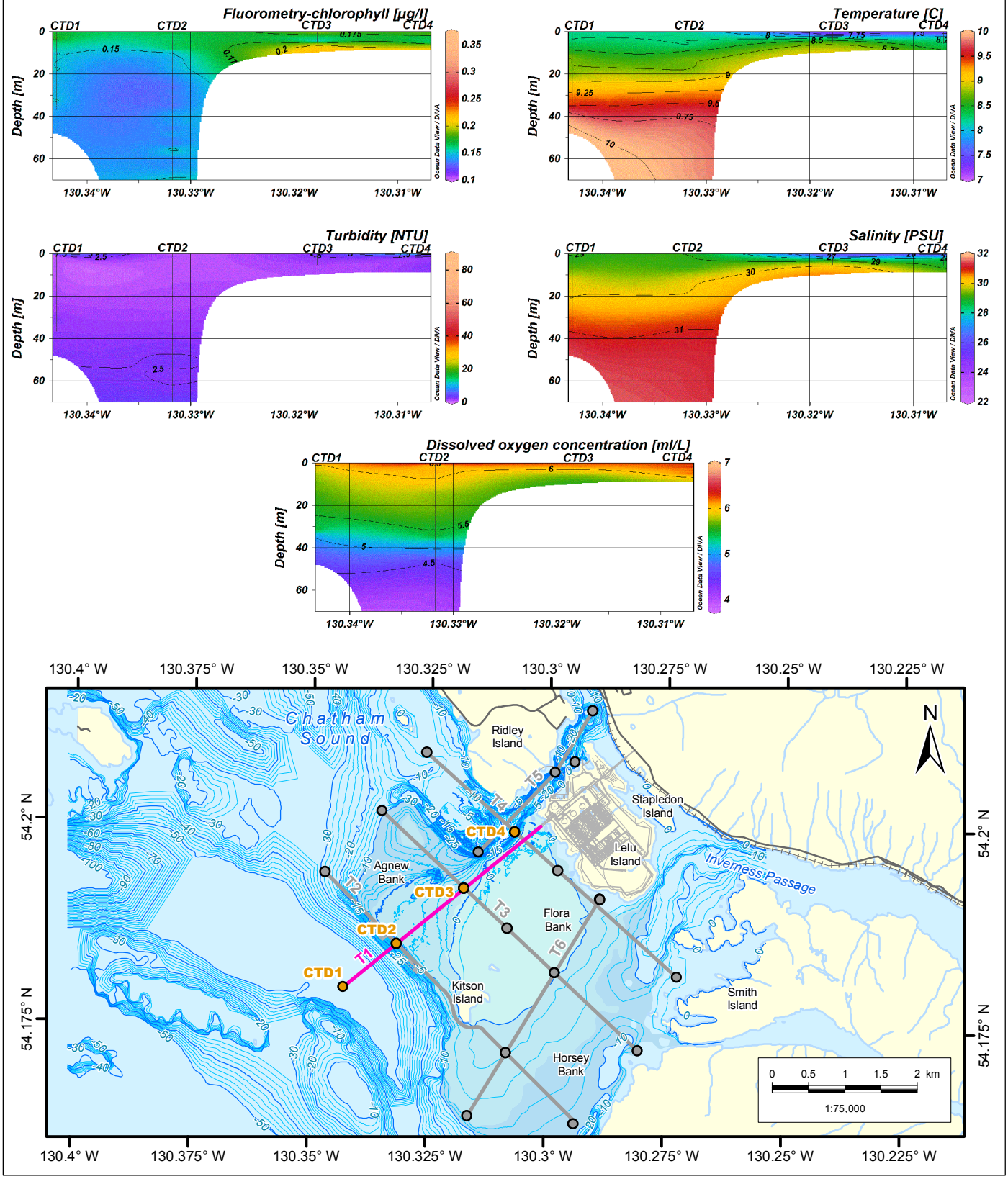
APPENDIX A
FIGURES

Appendix A WATER PROPERTIES FIGURES



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Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (December 2014)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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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PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

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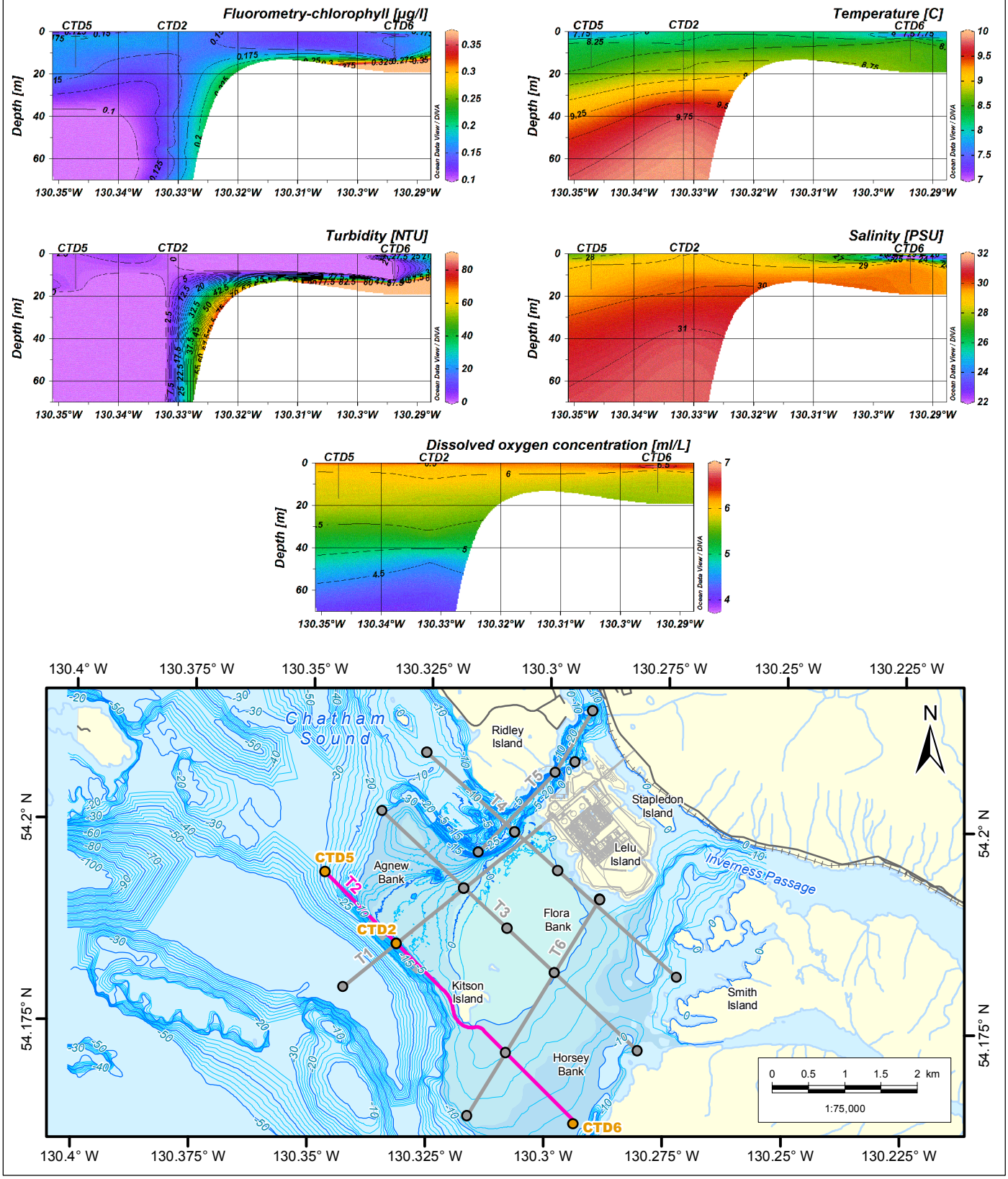

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Other Transect
Project Component

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Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (December 2014)

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

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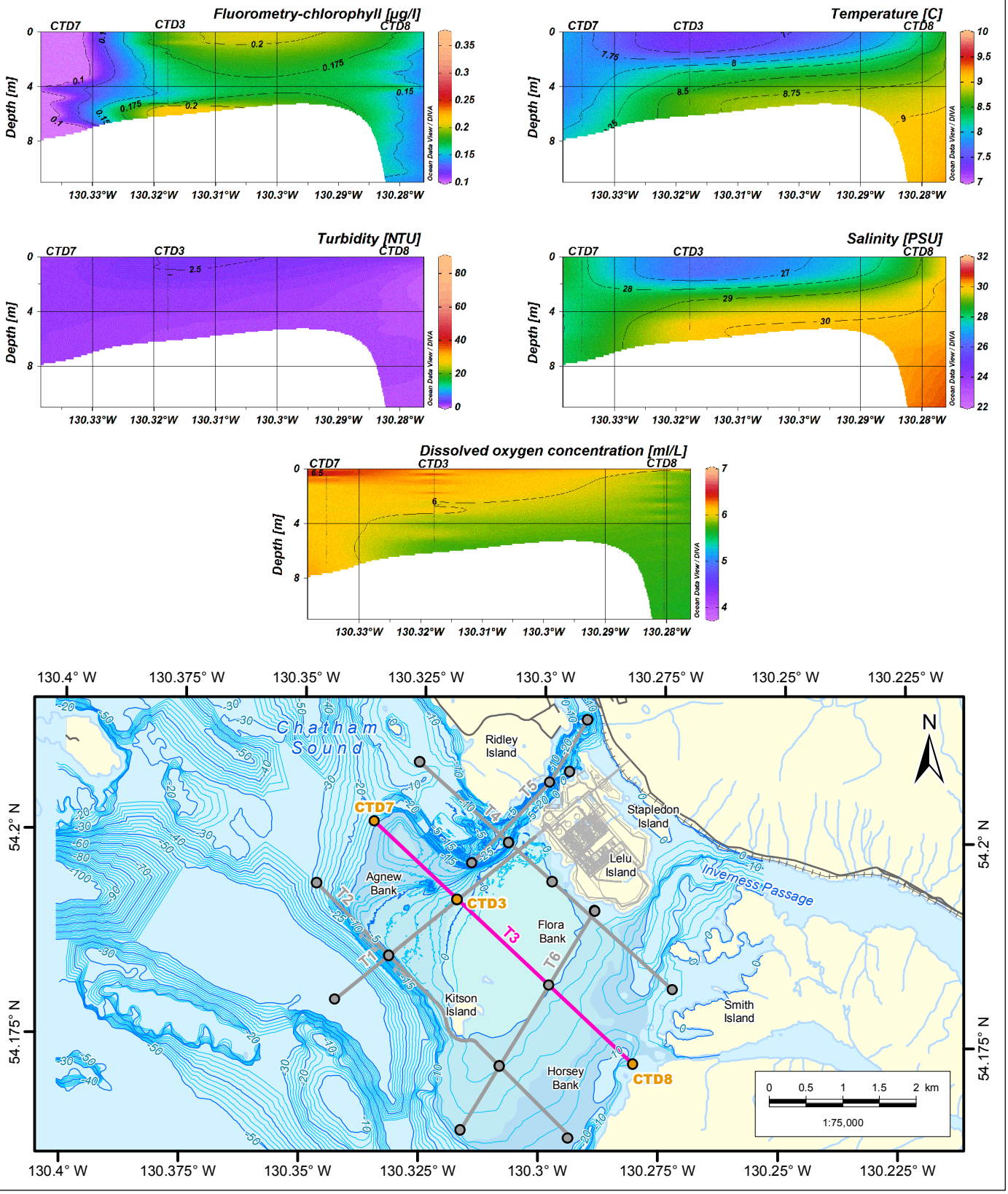

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Other Transect
Project Component

Bathymetry (m)
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Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (December 2014)

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

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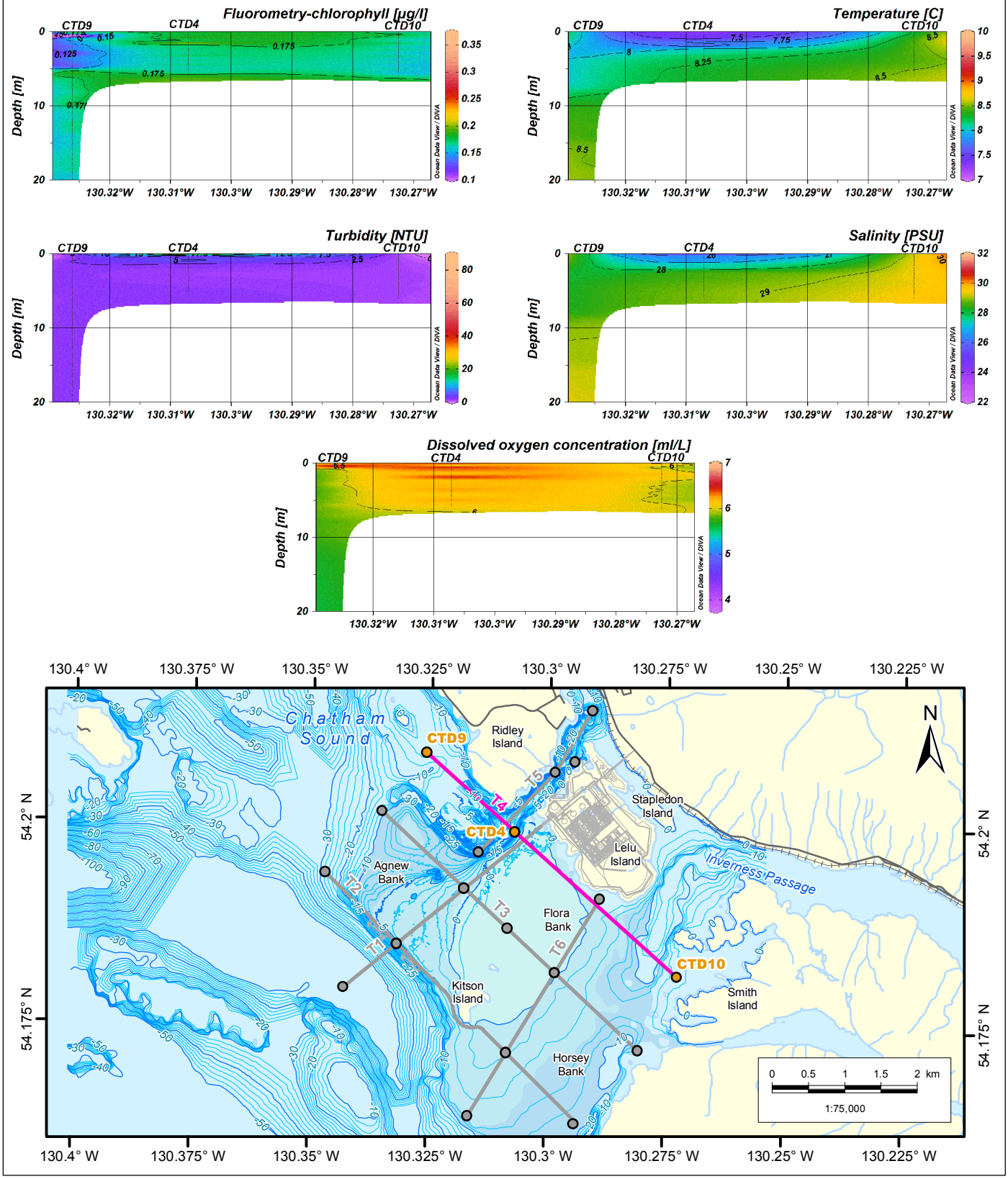

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Project Component

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Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (December 2014)

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

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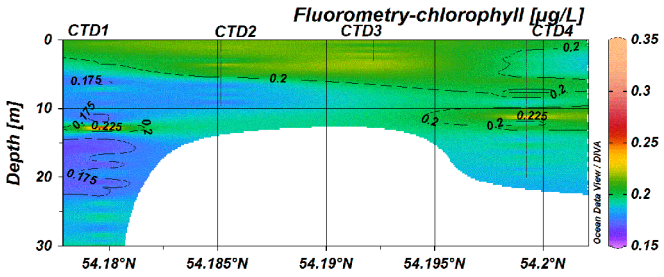

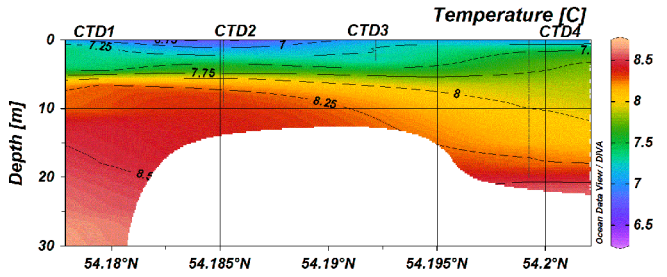

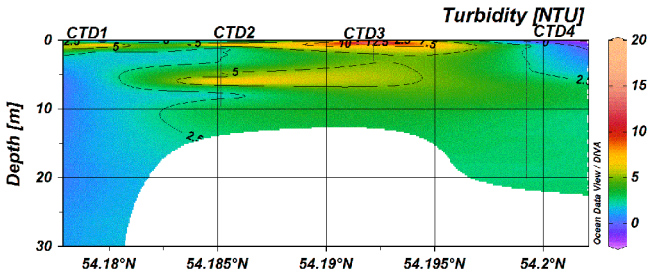

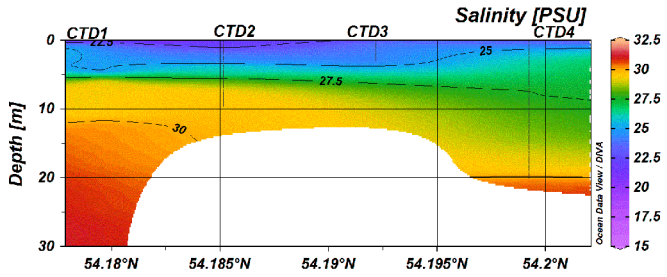

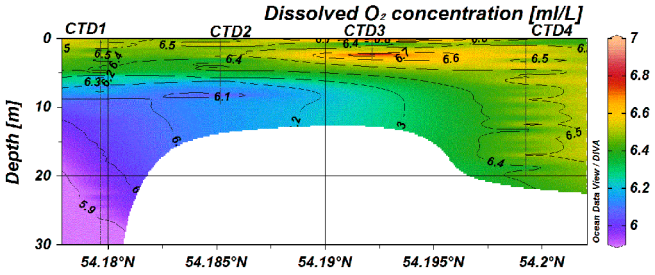

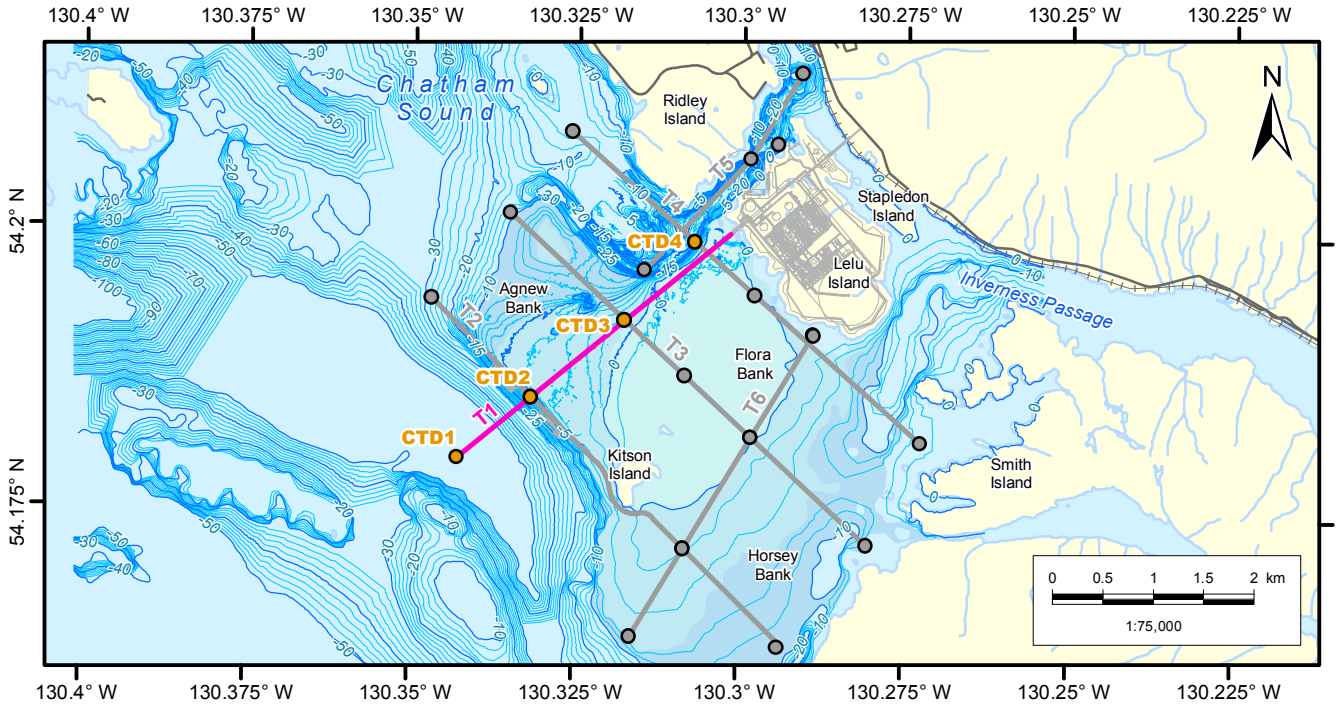

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Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (January 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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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DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

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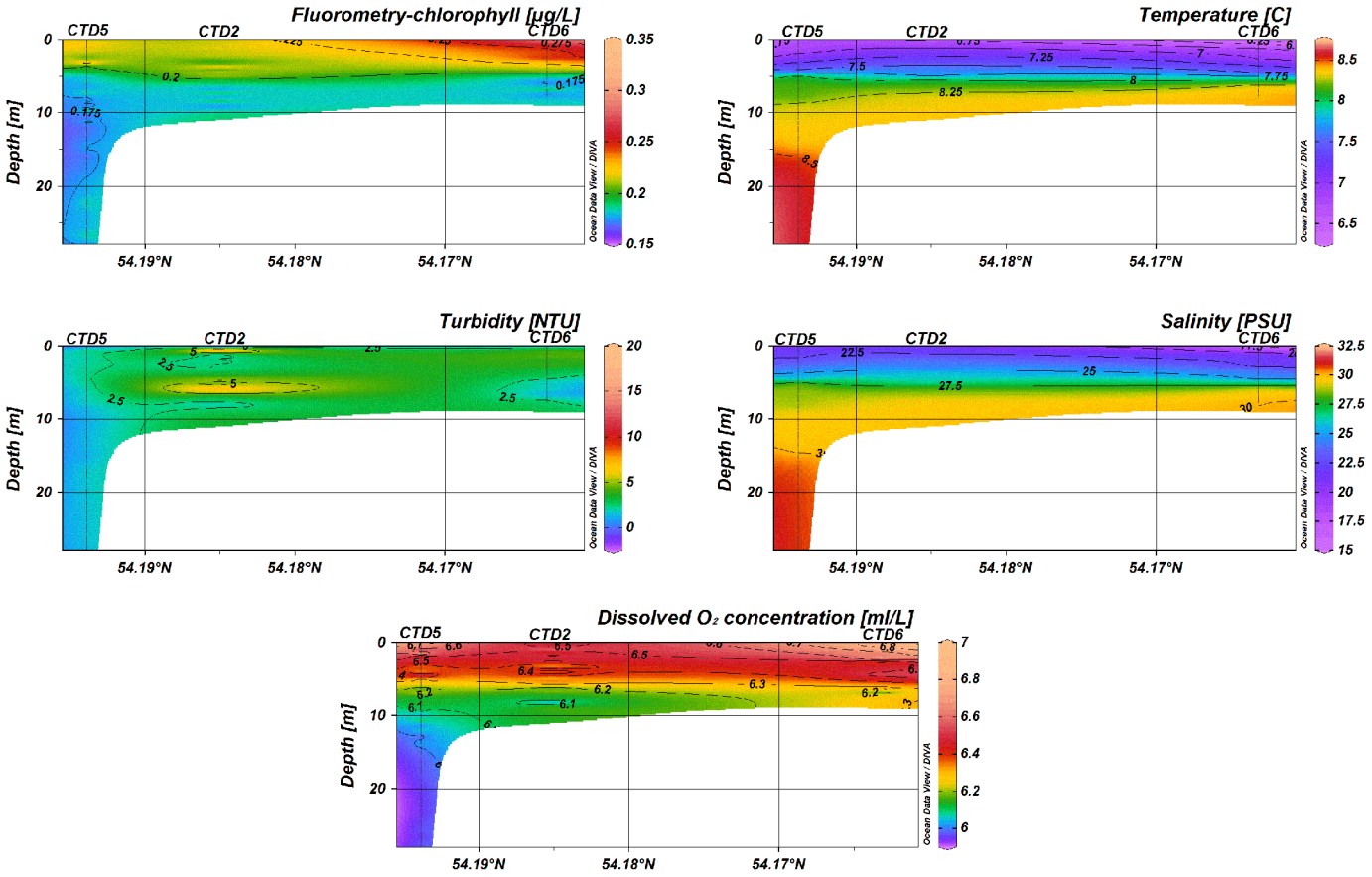

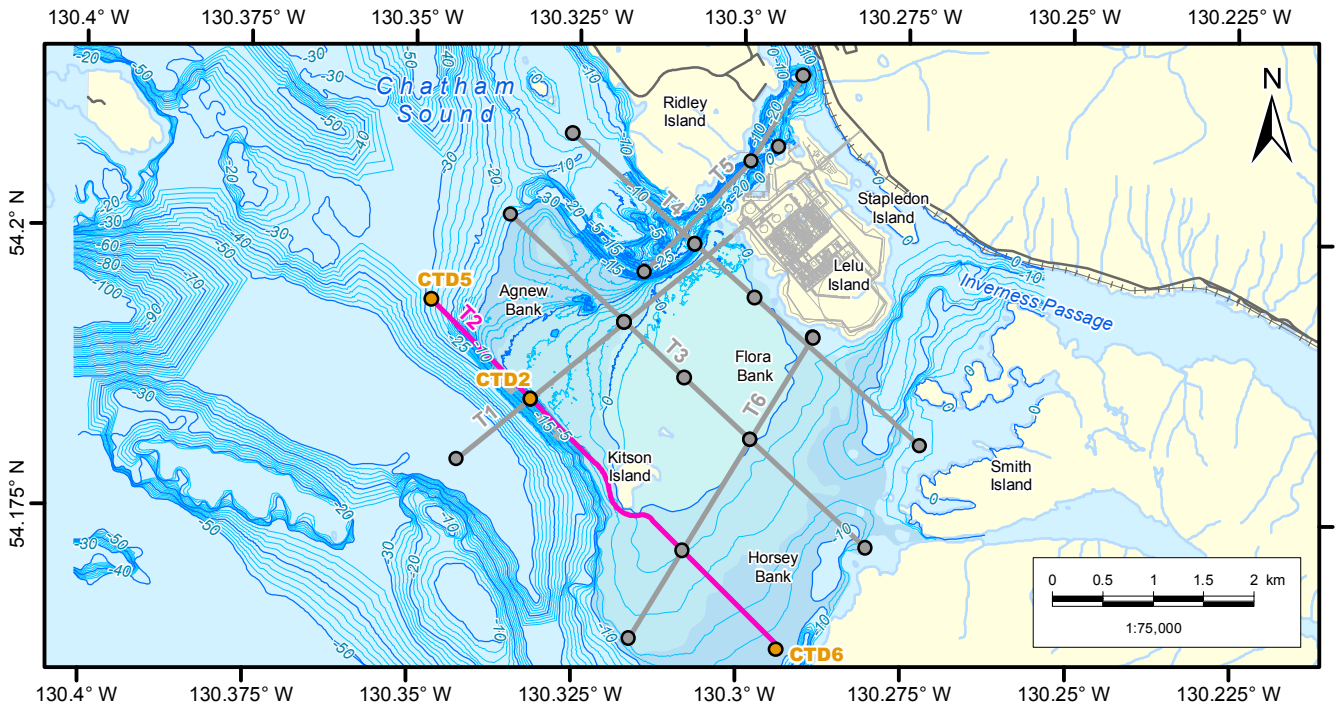

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Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (January 2015)

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

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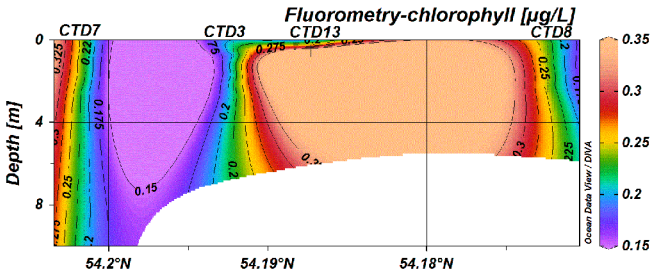
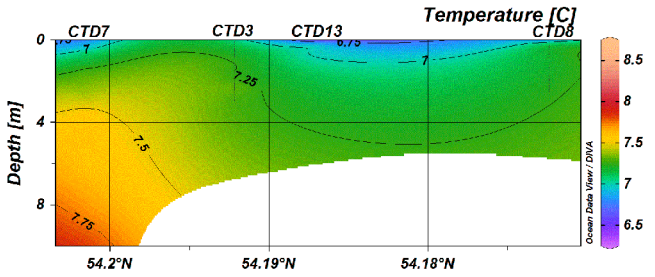
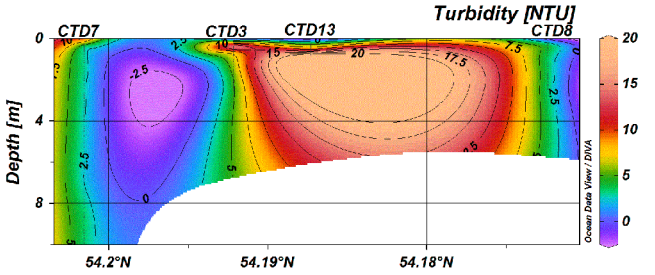
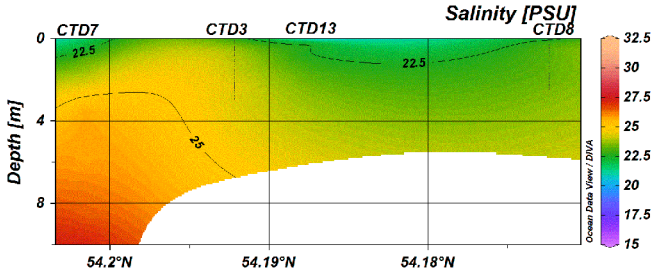
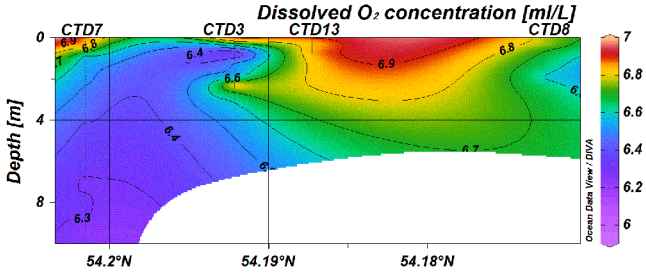
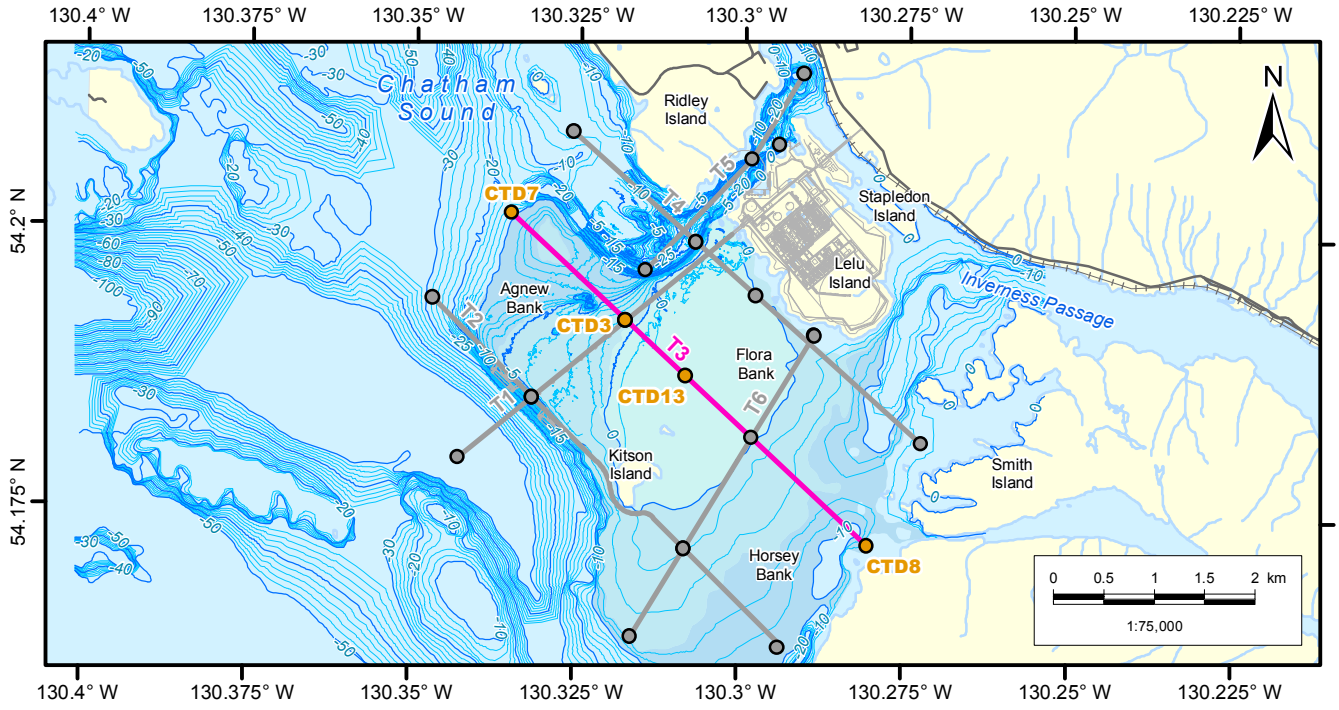












Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (January 2015)

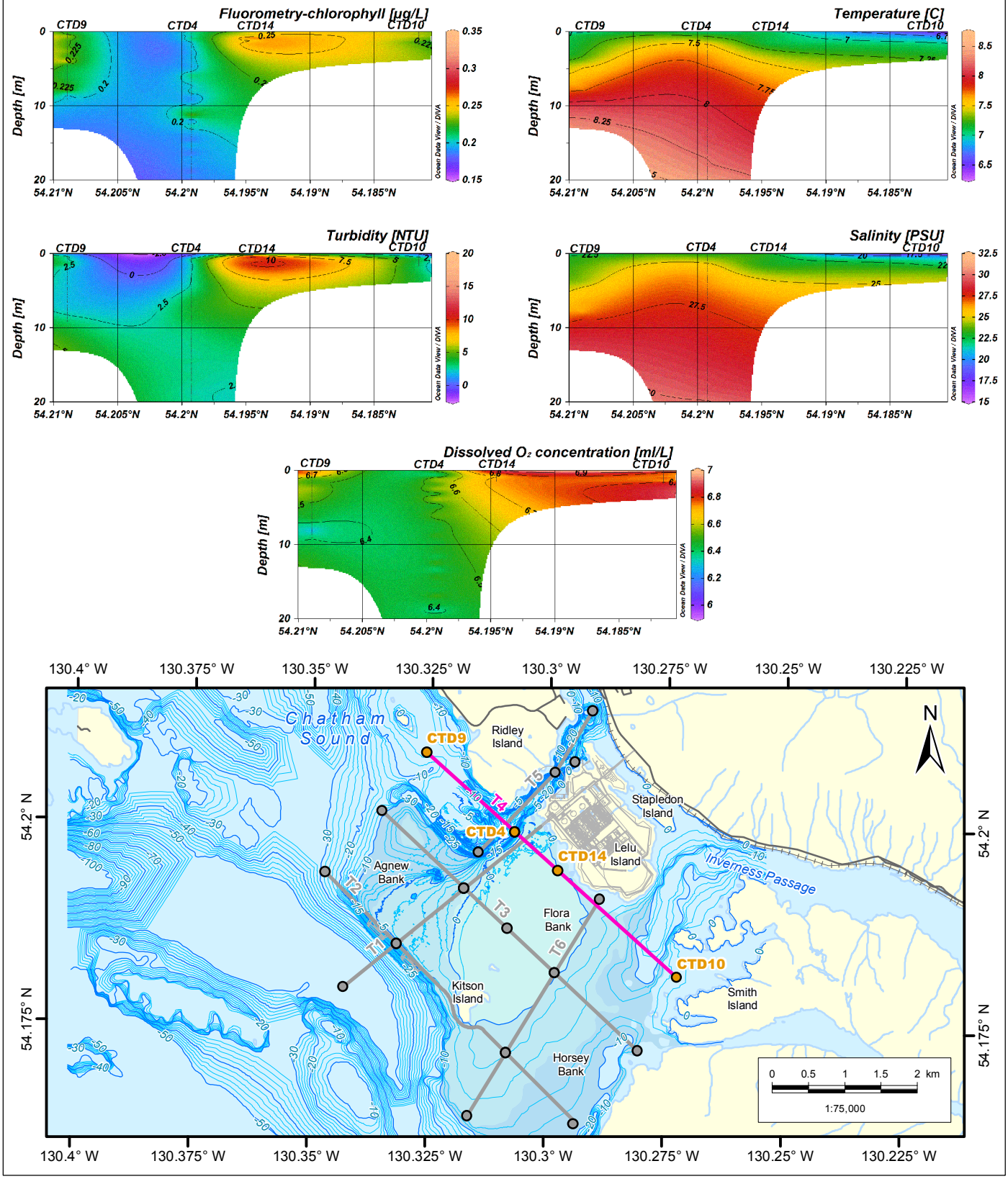
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A7**

7/3/2015 - 2:38:50 PM \\cd1186-f04\workgroup\actwe\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (January 2015)

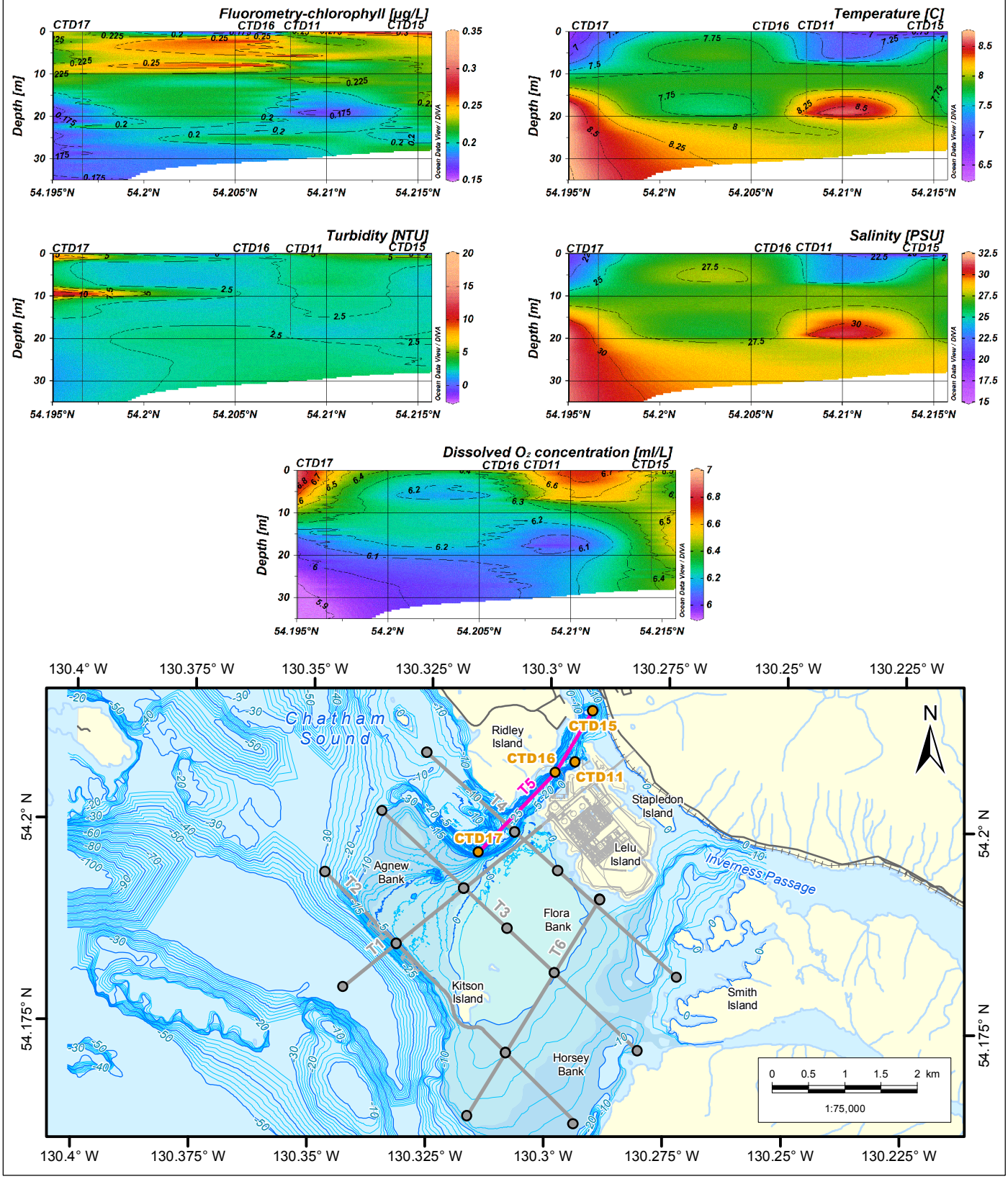
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A8**

7/3/2015 - 2:38:53 PM \\cd1186-f04\workgroup\acad\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 5 (January 2015)

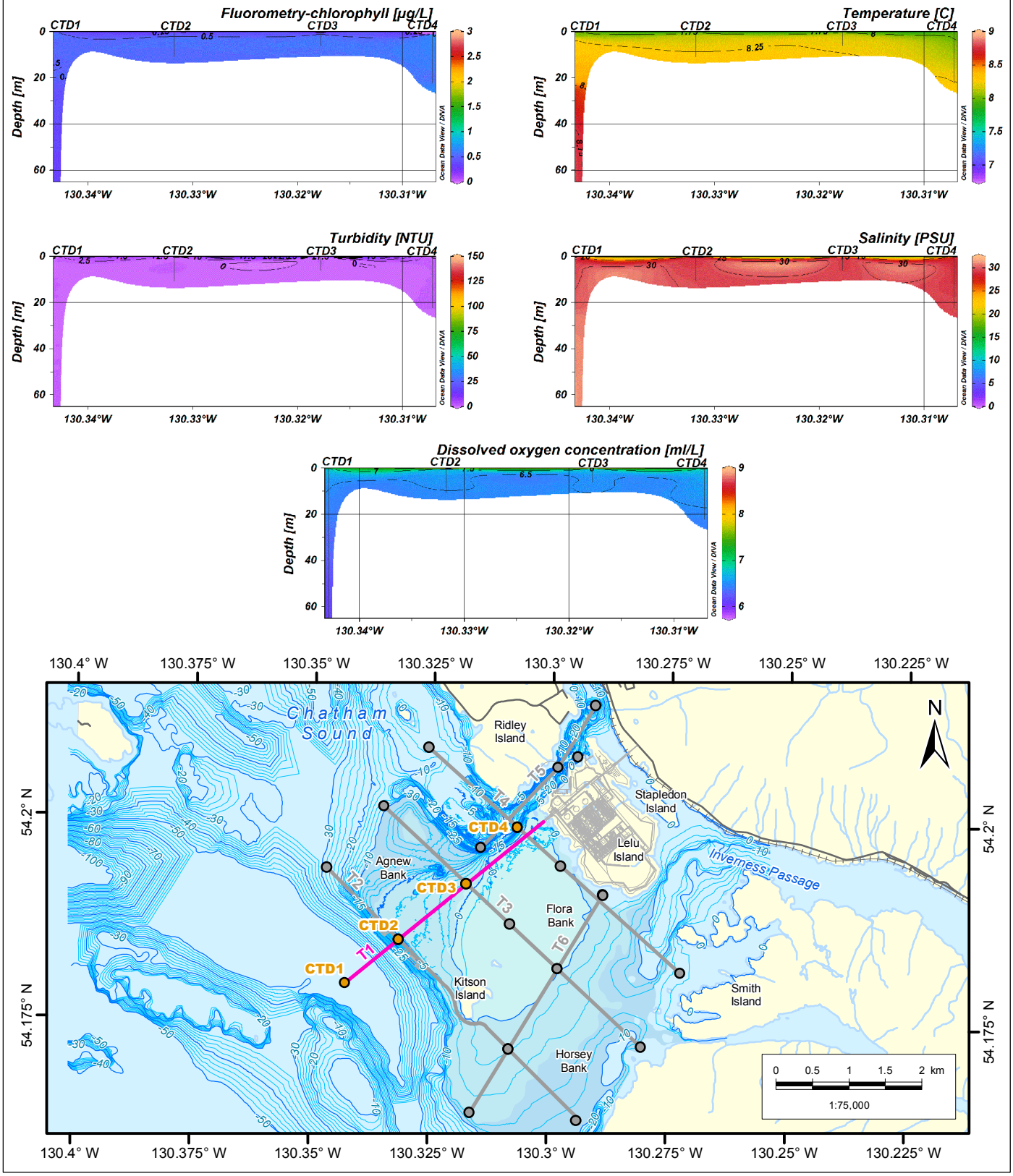
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A9**

7/3/2015 - 2:38:57 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (February 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

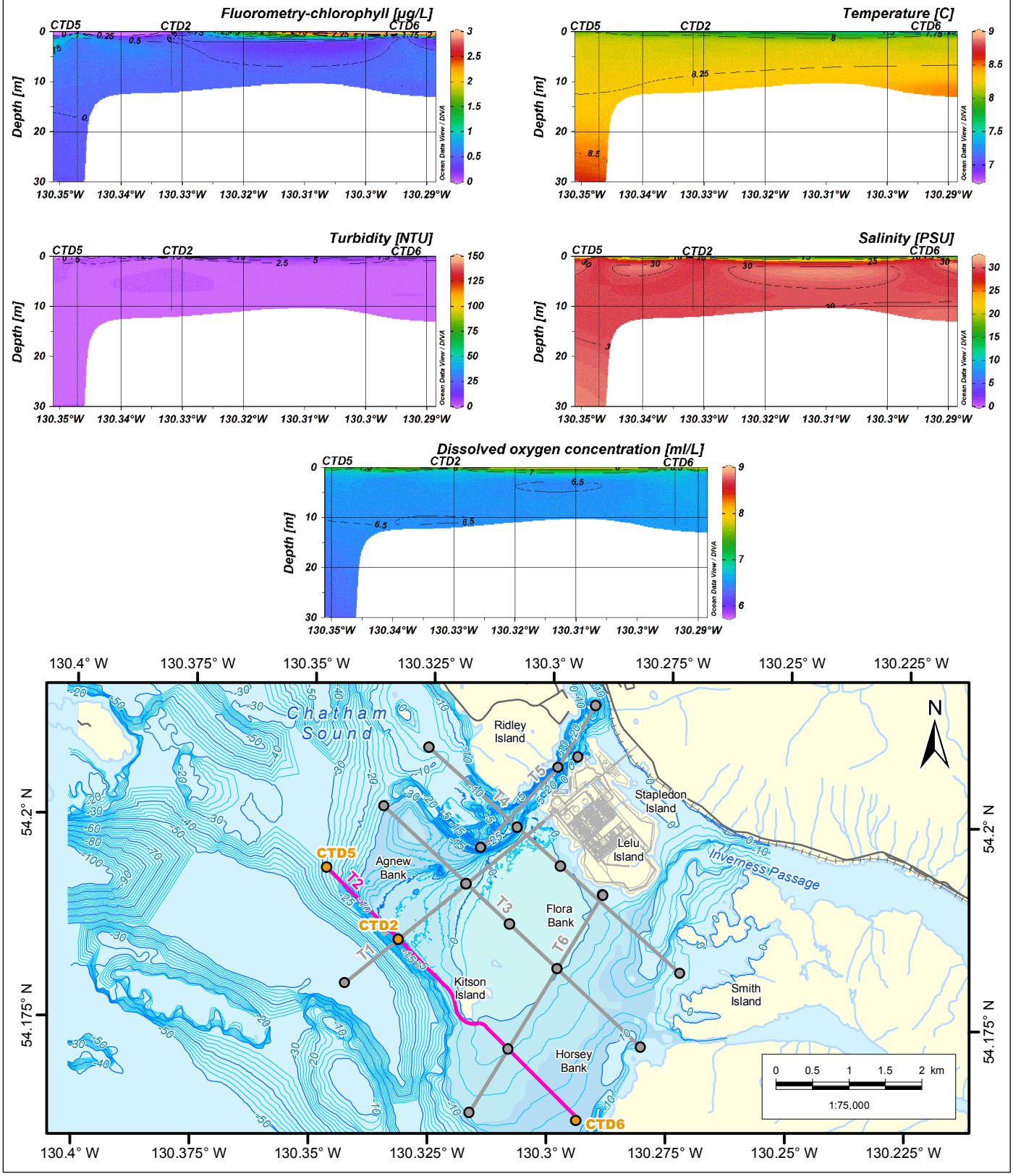
DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A10**

7/3/2015 - 2:40:23 PM \\cd1186-f04\workgroup\actve\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (February 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A11**

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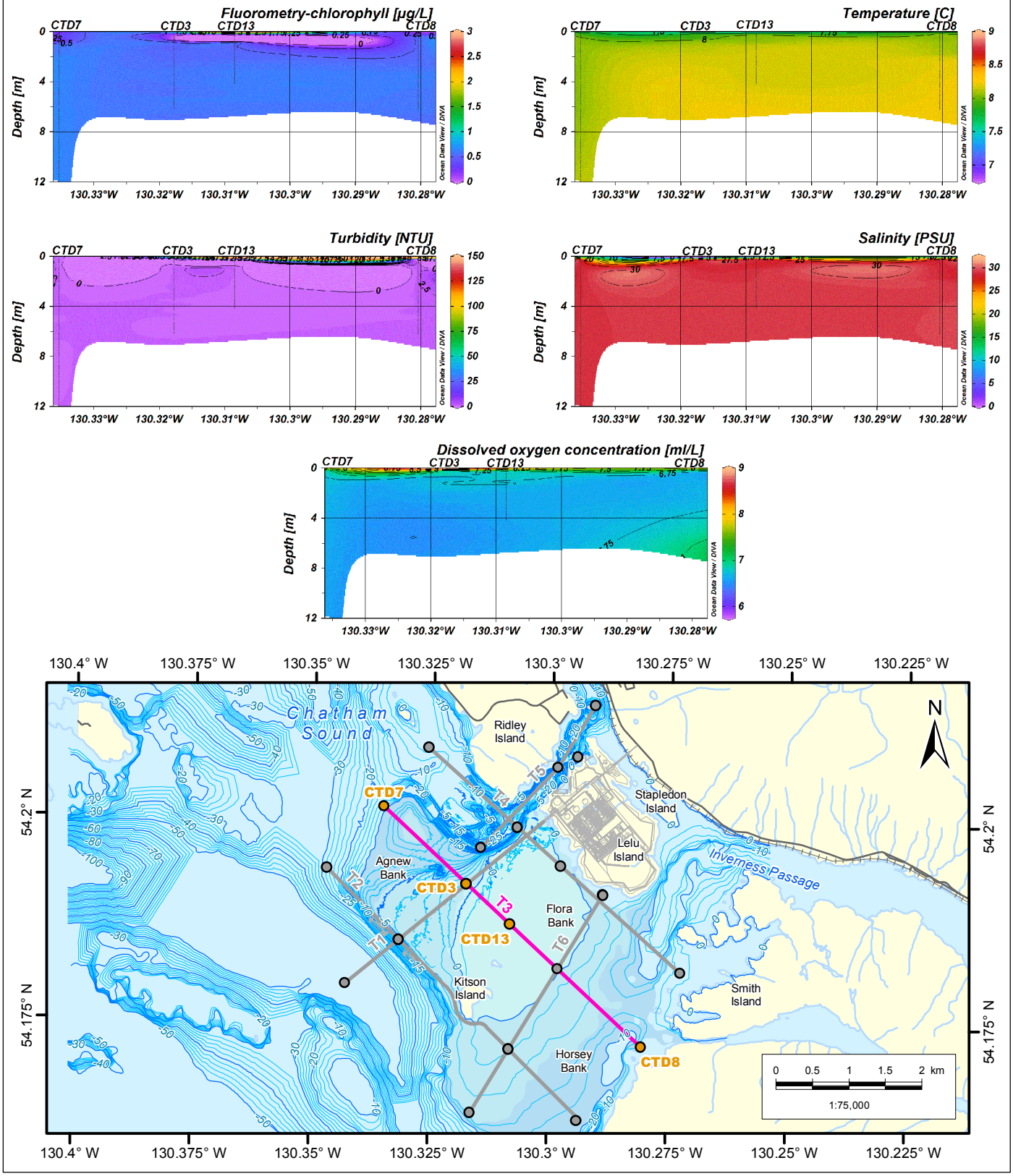


Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (February 2015)

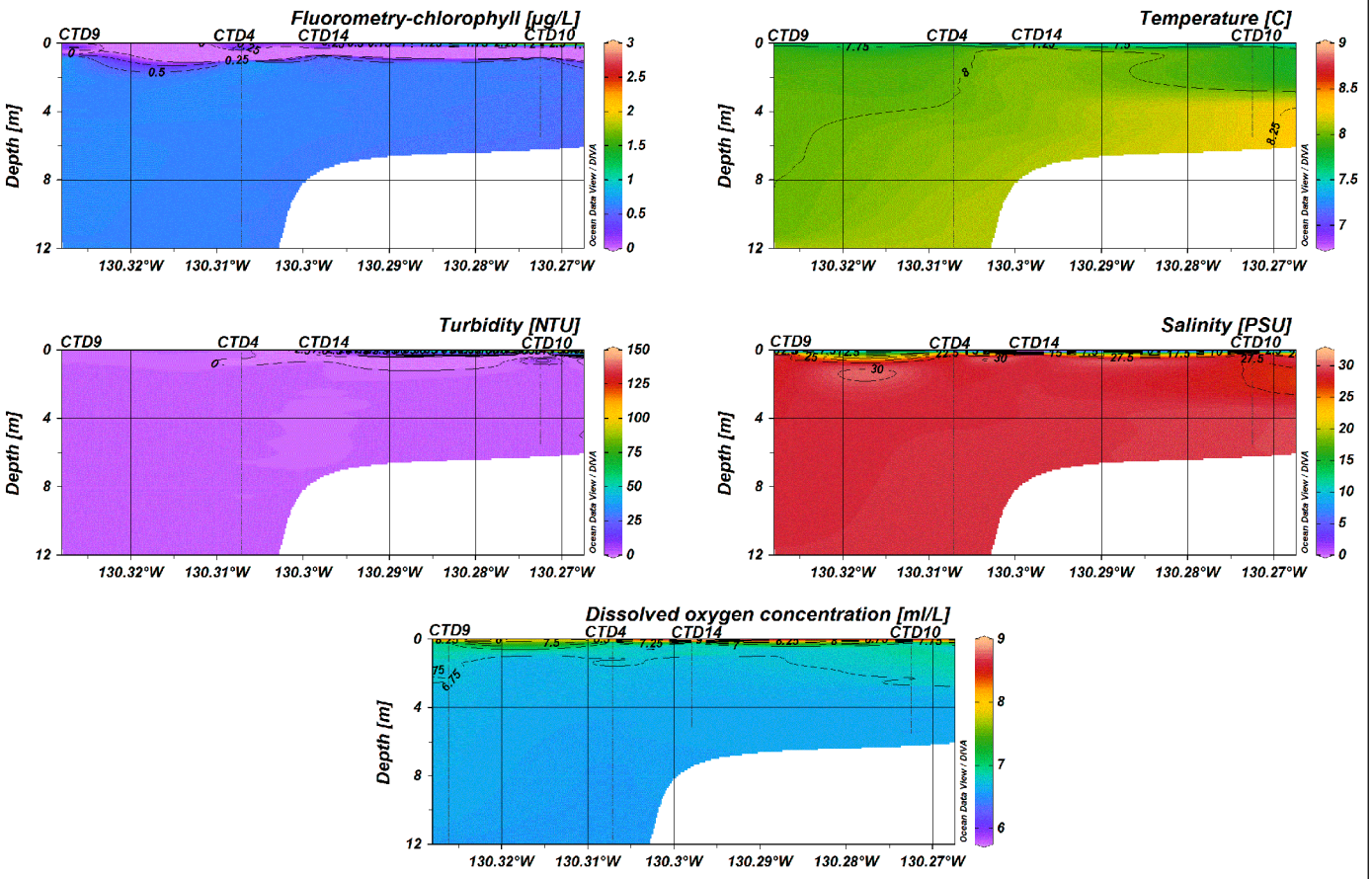
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

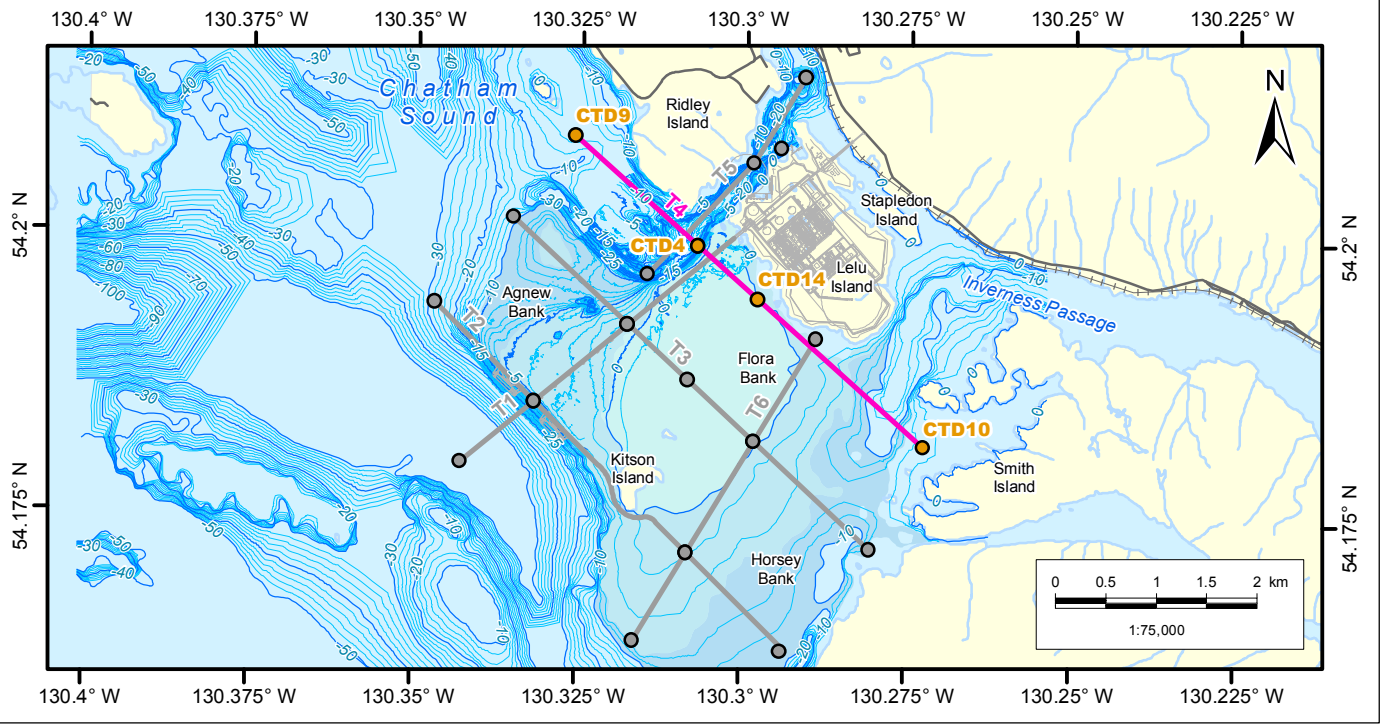
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A12**

7/3/2015 - 2:40:30 PM \\cd1186-f04\workgroup\actw\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (February 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

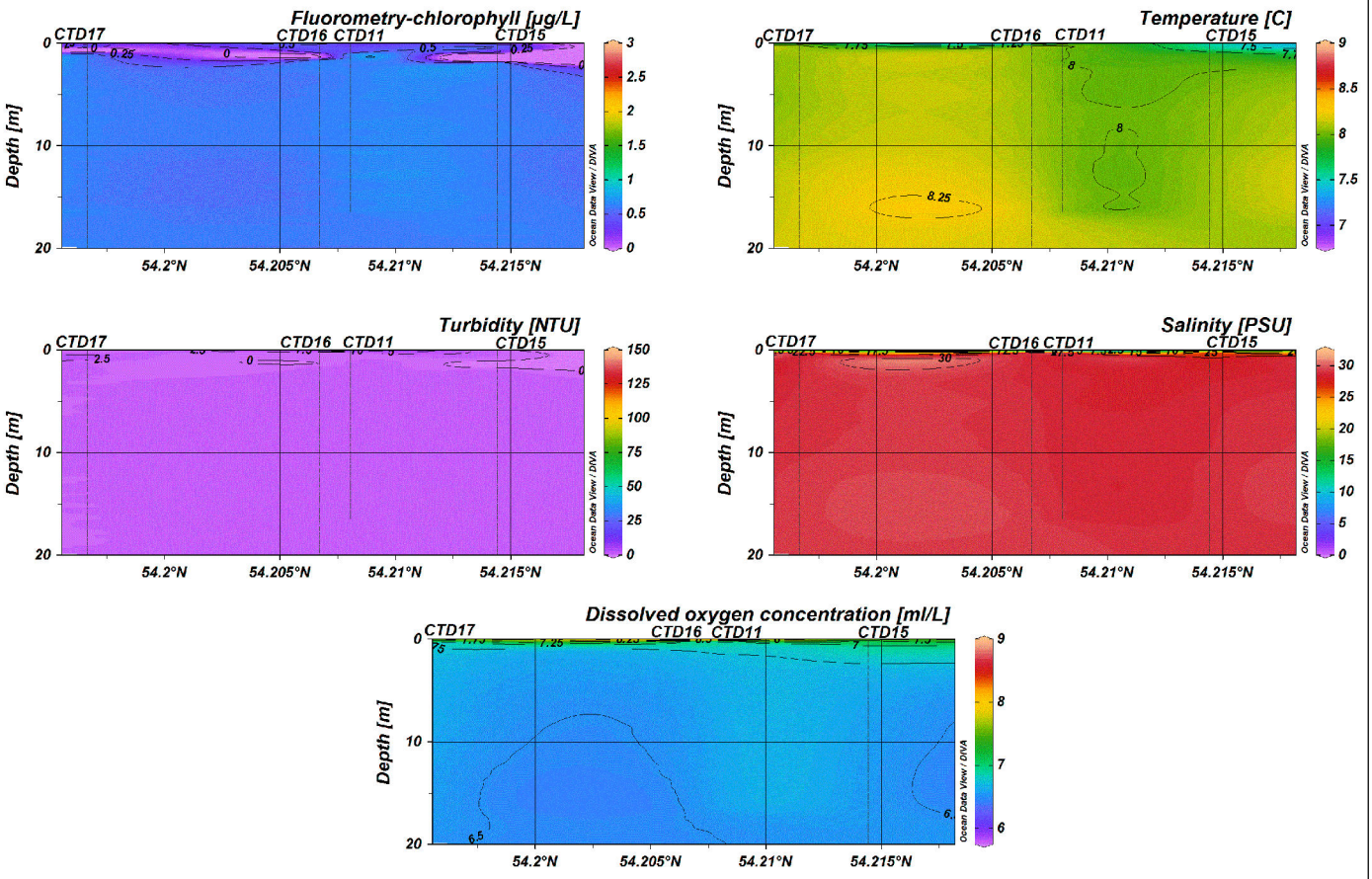
DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

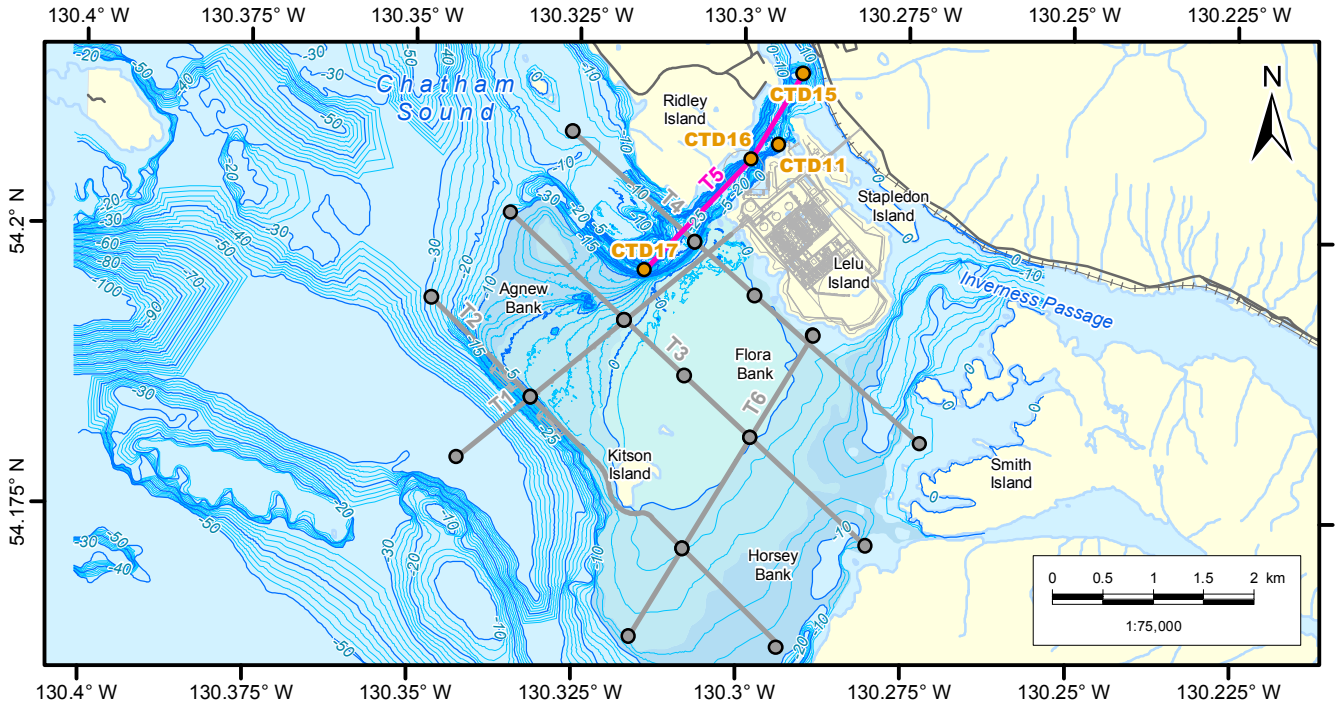
PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A13**

7/3/2015 - 2:40:34 PM \\cd1186-f04\workgroup\actw\e1231 10537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 5 (February 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A14**

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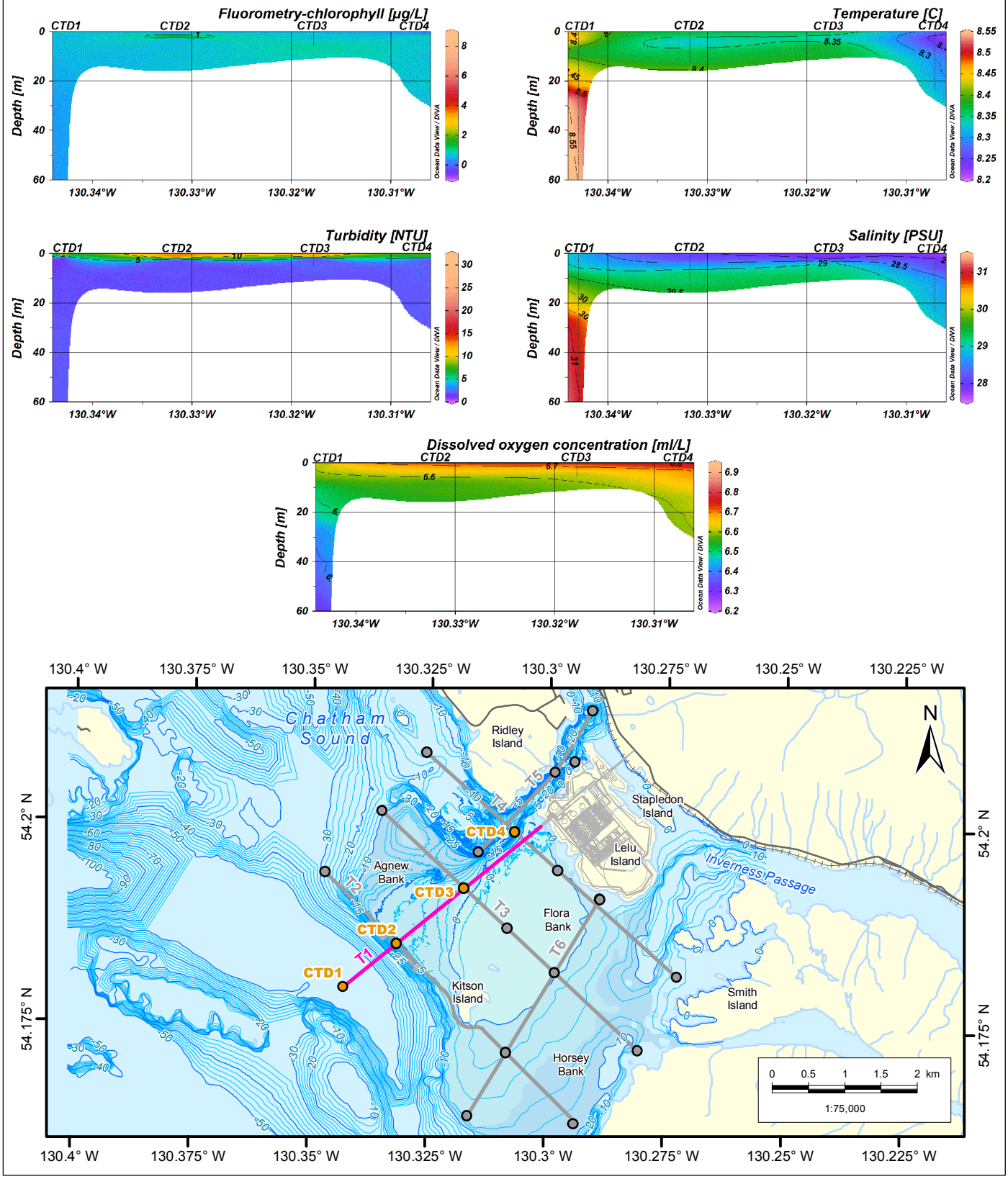

Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (March 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A15**

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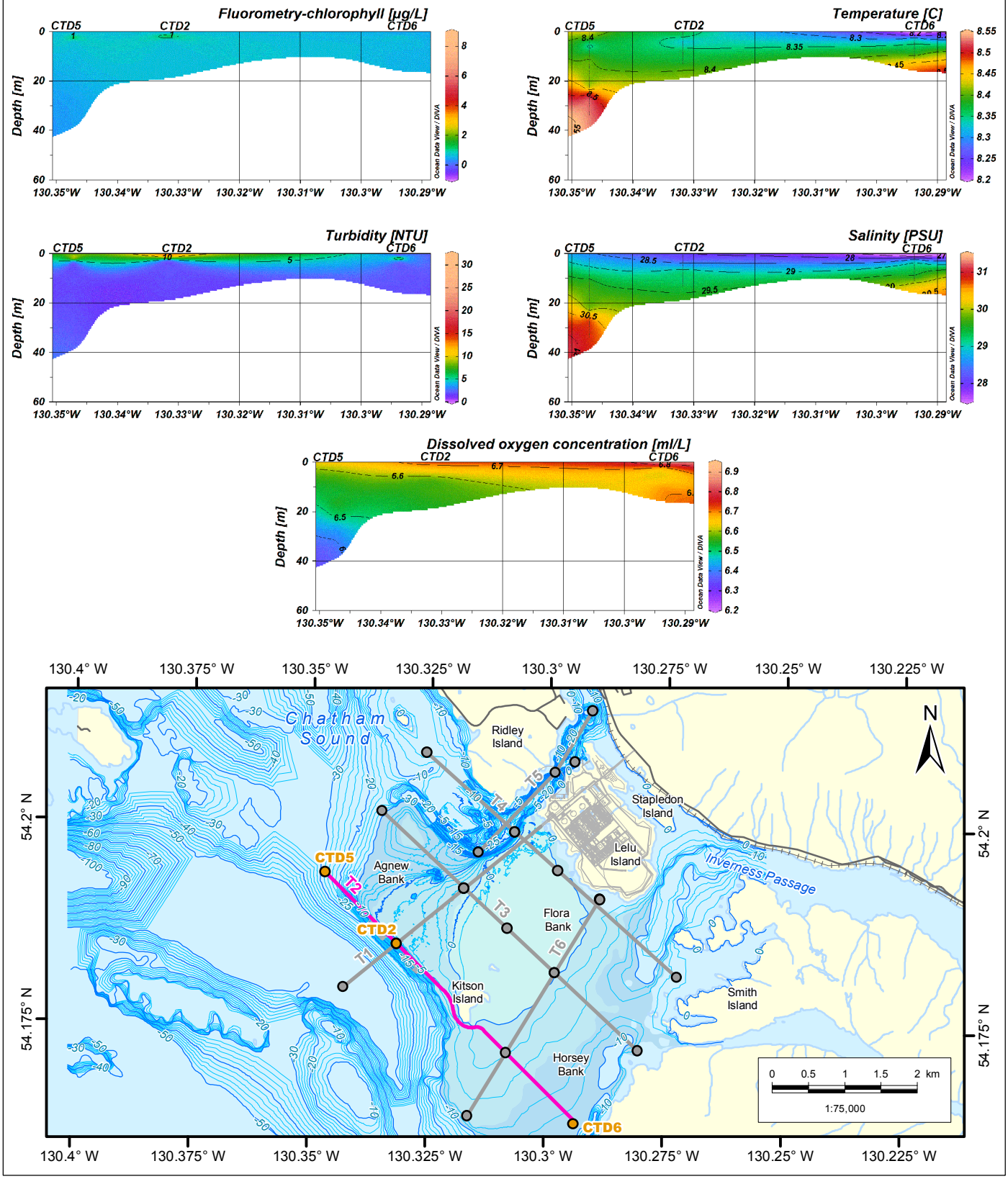

Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (March 2015)

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

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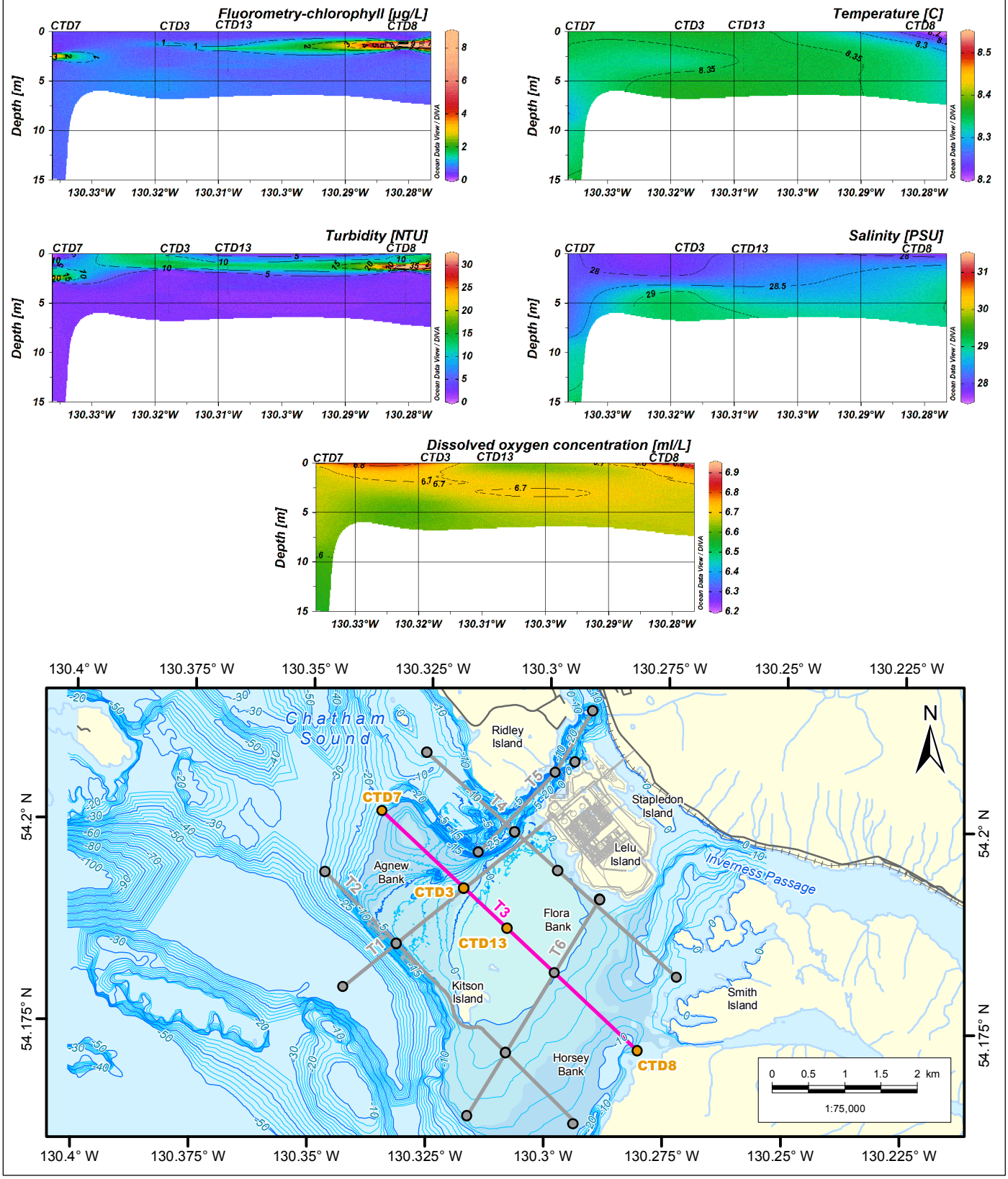
DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A16**

7/3/2015 - 2:41:48 PM \\cd1186-f04\workgroup\acad\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (March 2015)

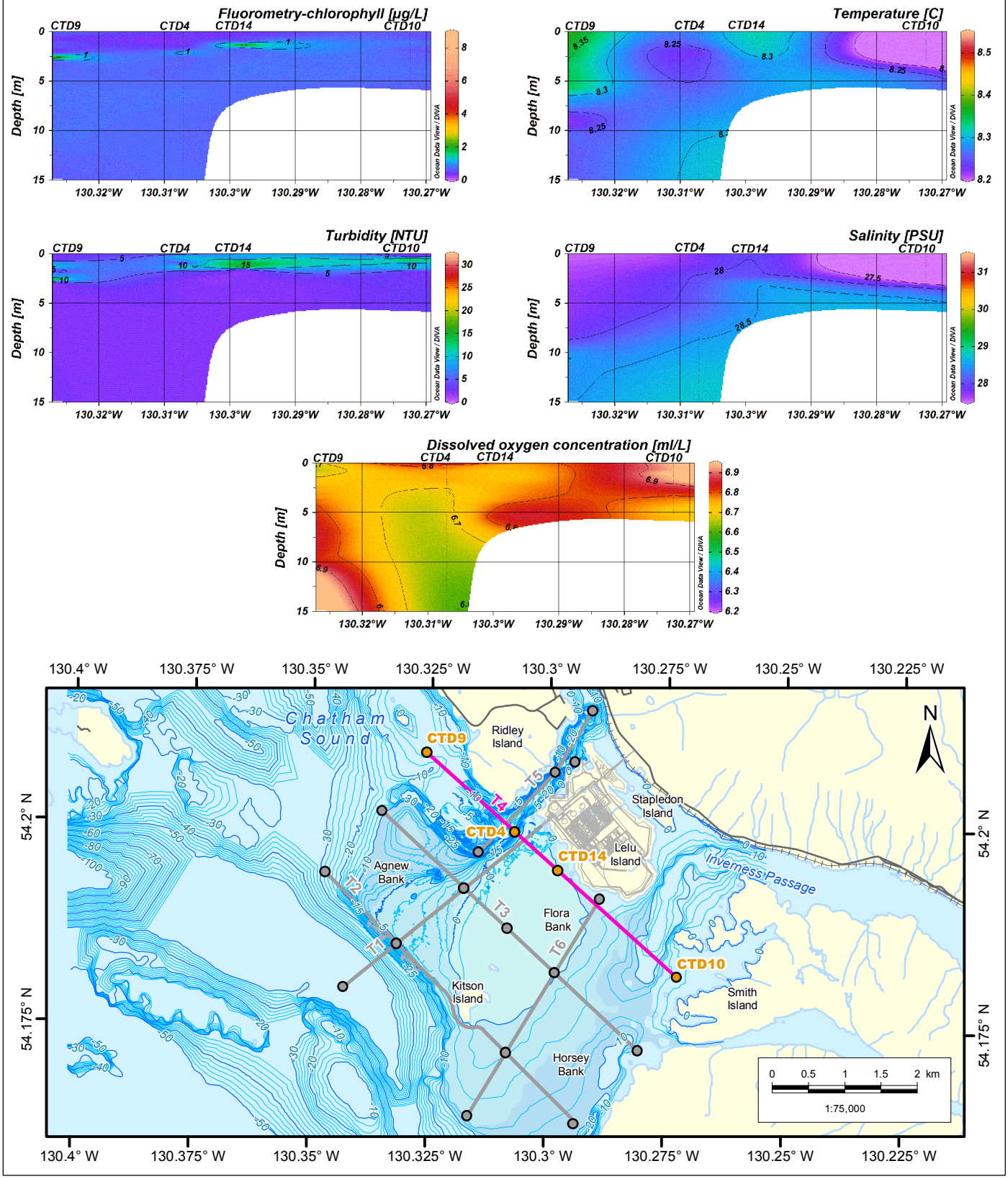
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A17**

7/3/2015 - 2:41:51 PM \\cd1186-f04\workgroup\acad\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (March 2015)

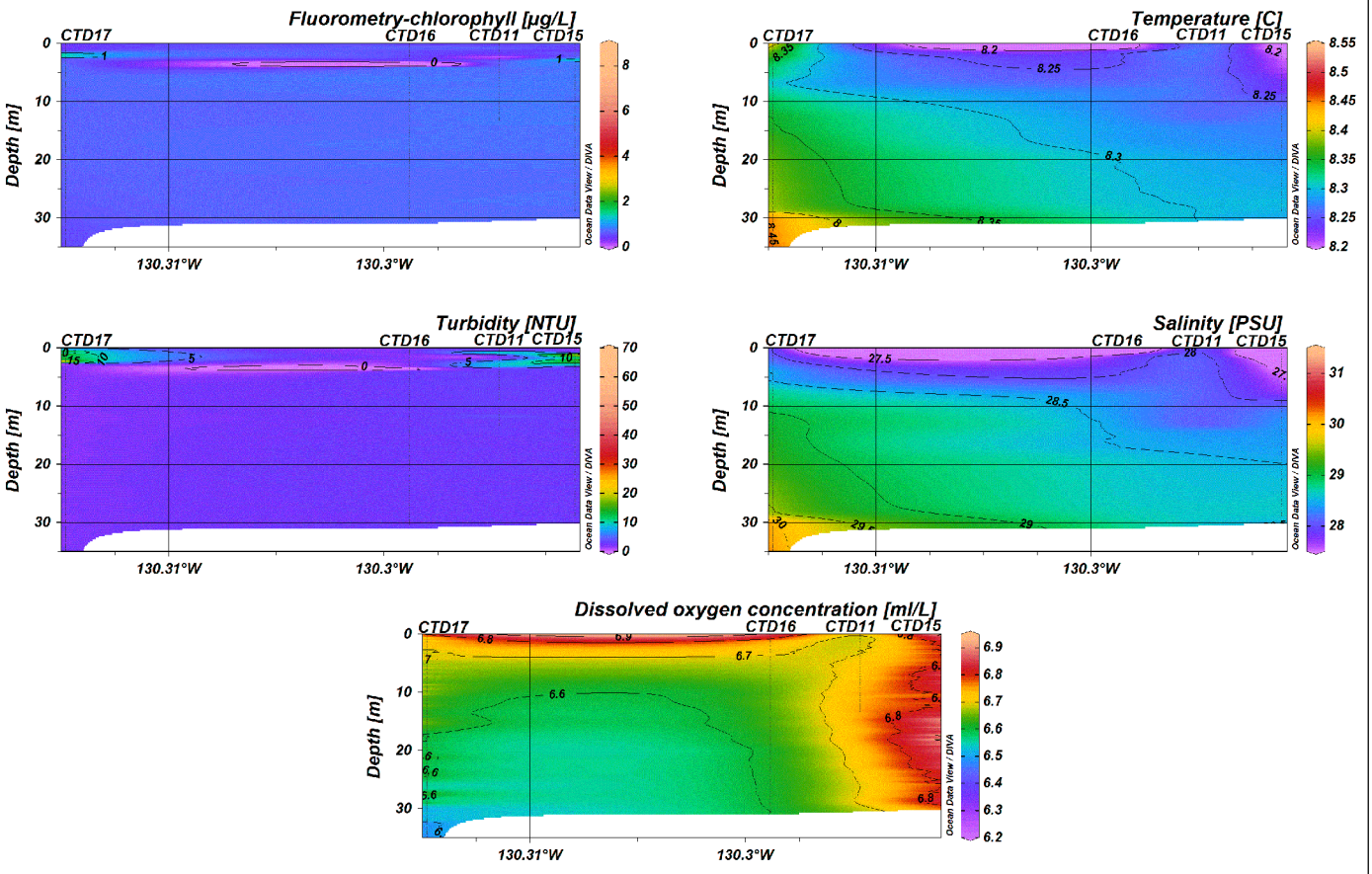
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

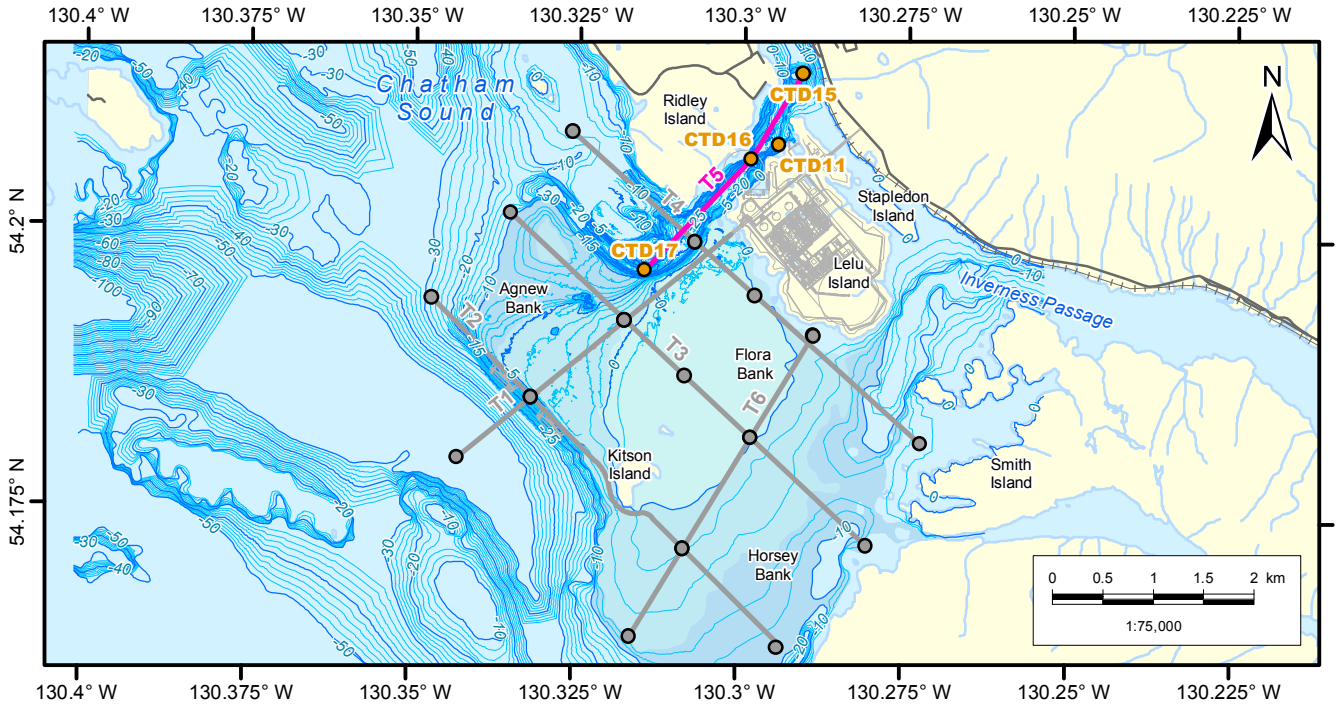
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A18**

7/3/2015 - 2:41:55 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 5 (March 2015)

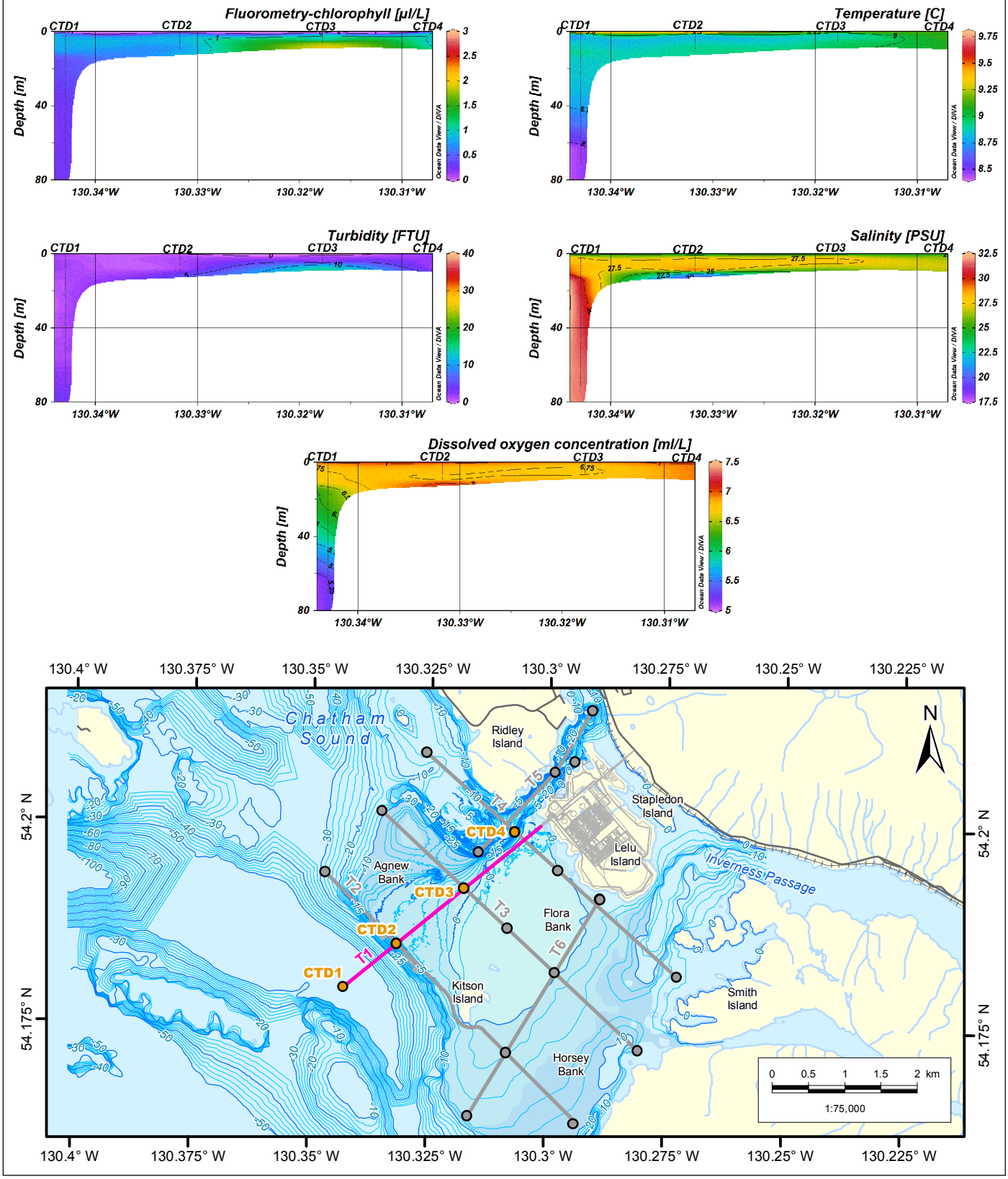
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A19**

7/3/2015 - 2:41:59 PM \\cd1186-f04\workgroup\acad\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (April 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A20**

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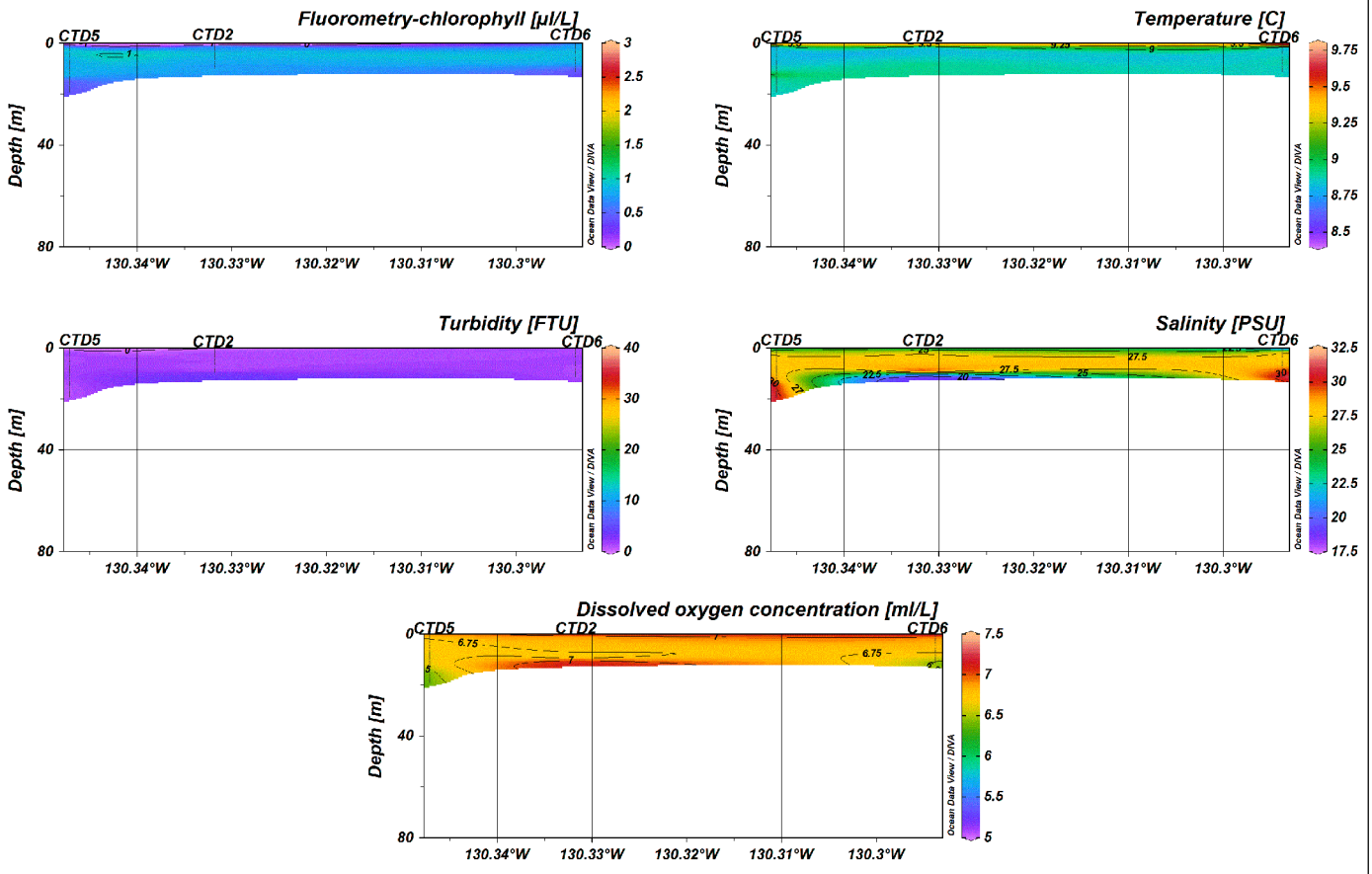
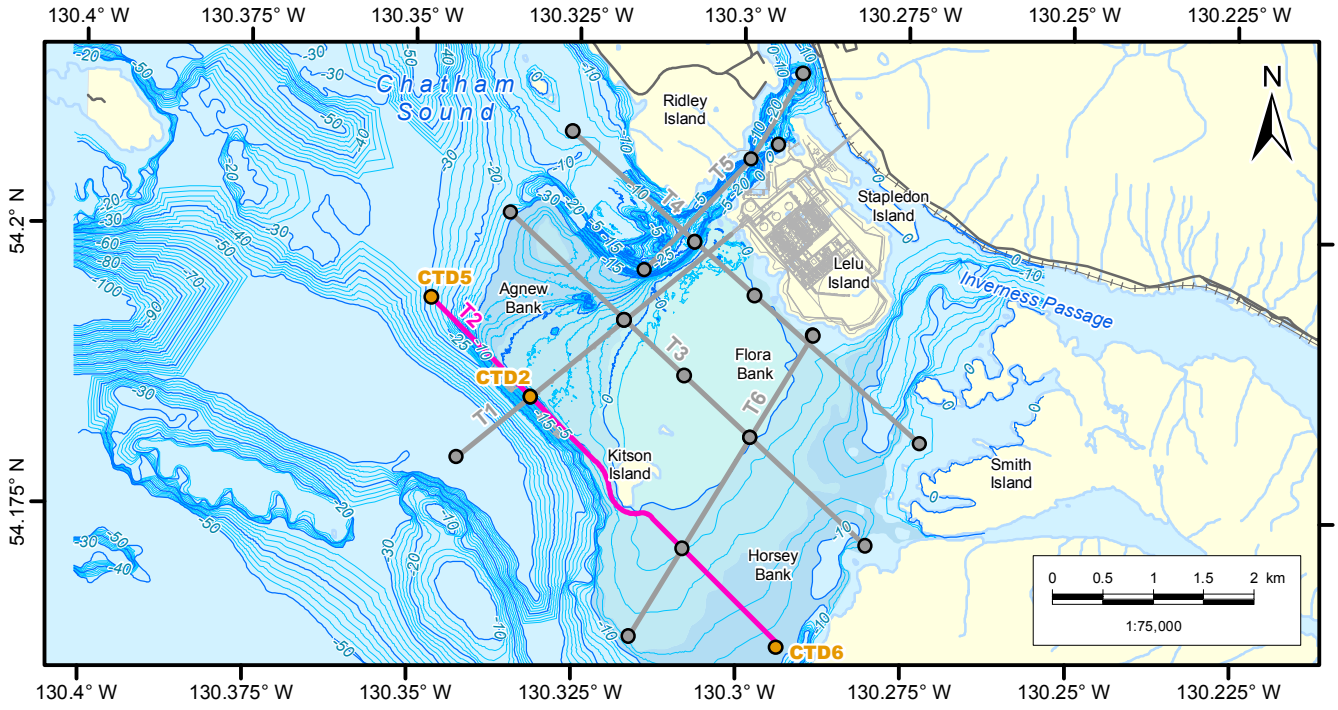




Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (April 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

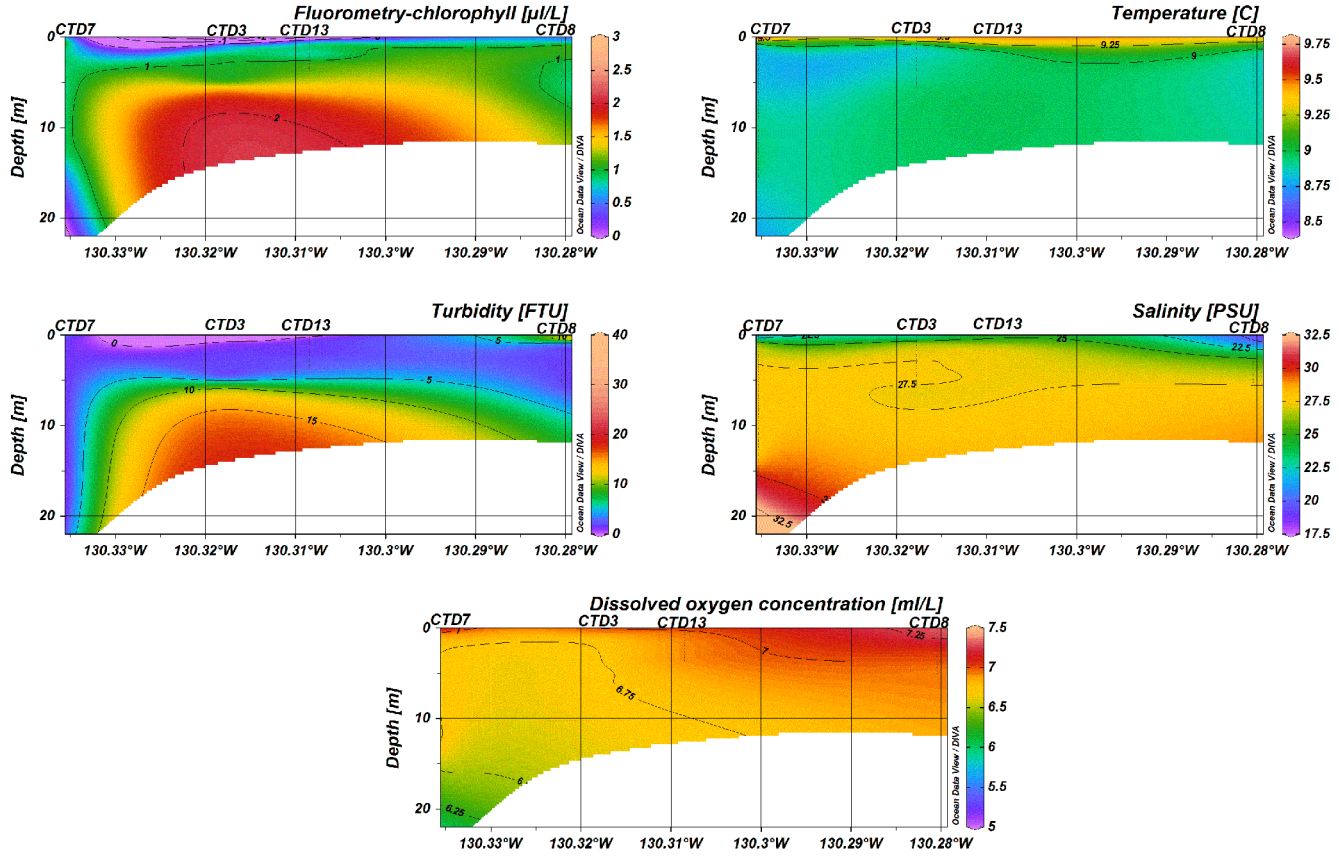
DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

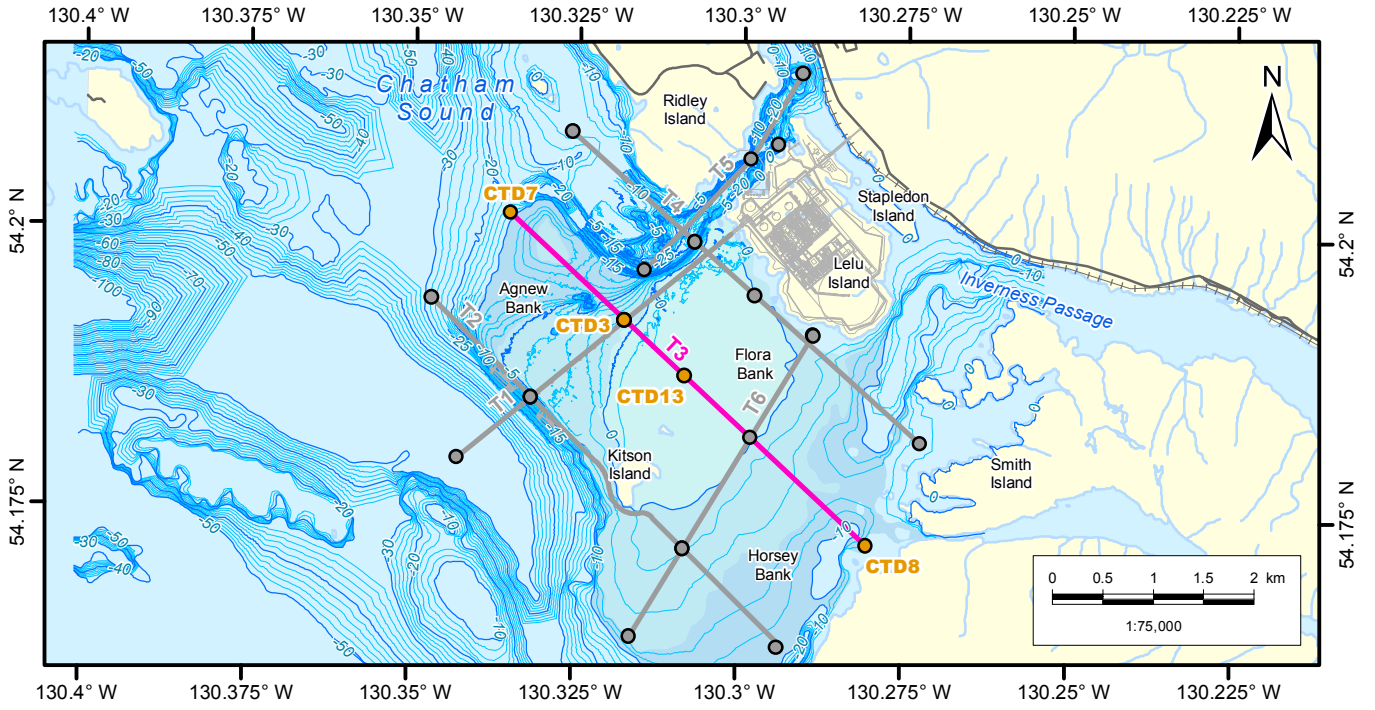
PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A21**

7/3/2015 - 2:43:21 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (April 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A22**

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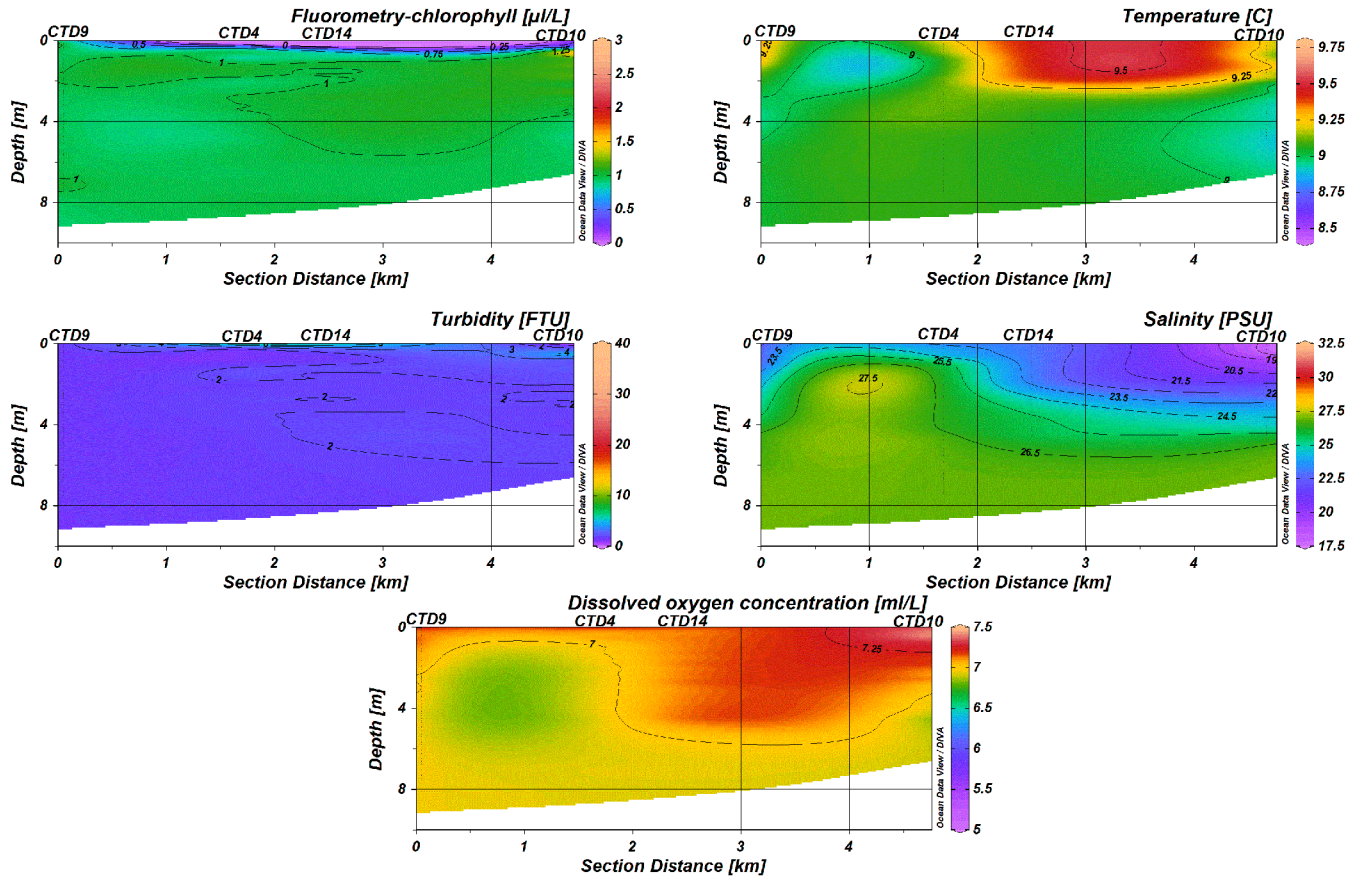

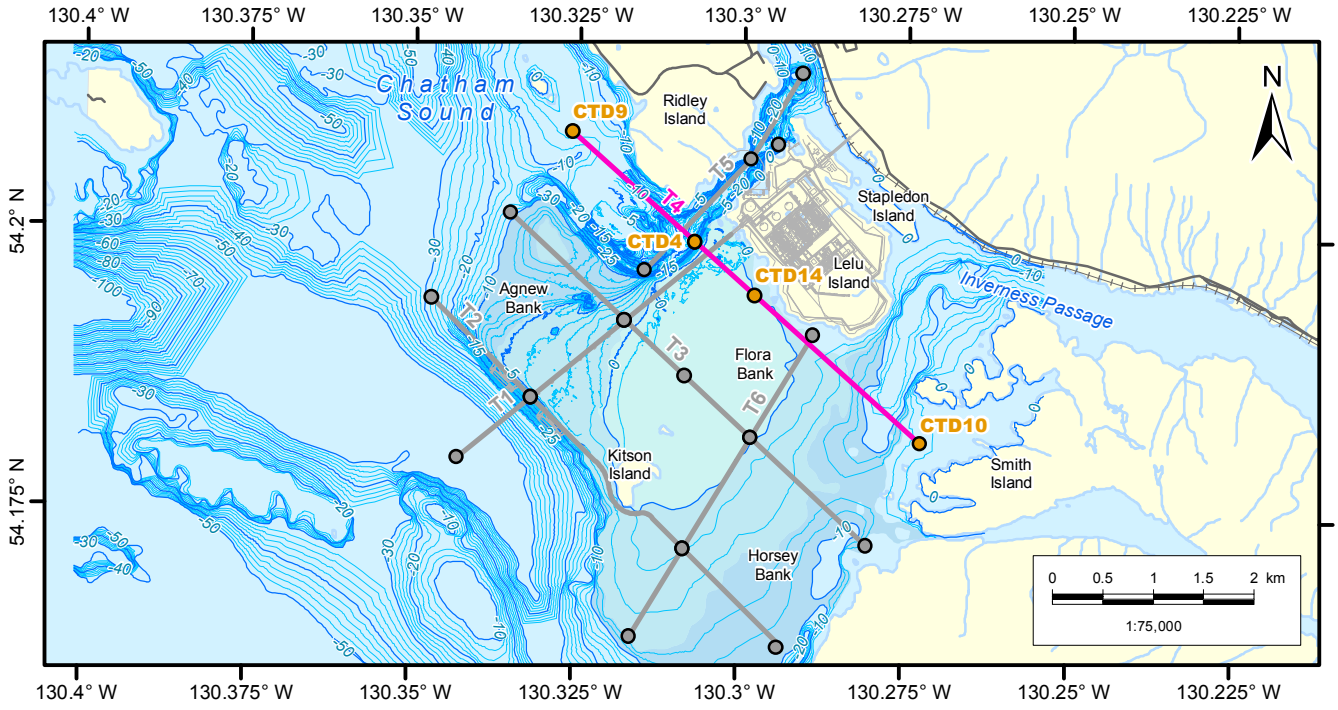

Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (April 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A23**

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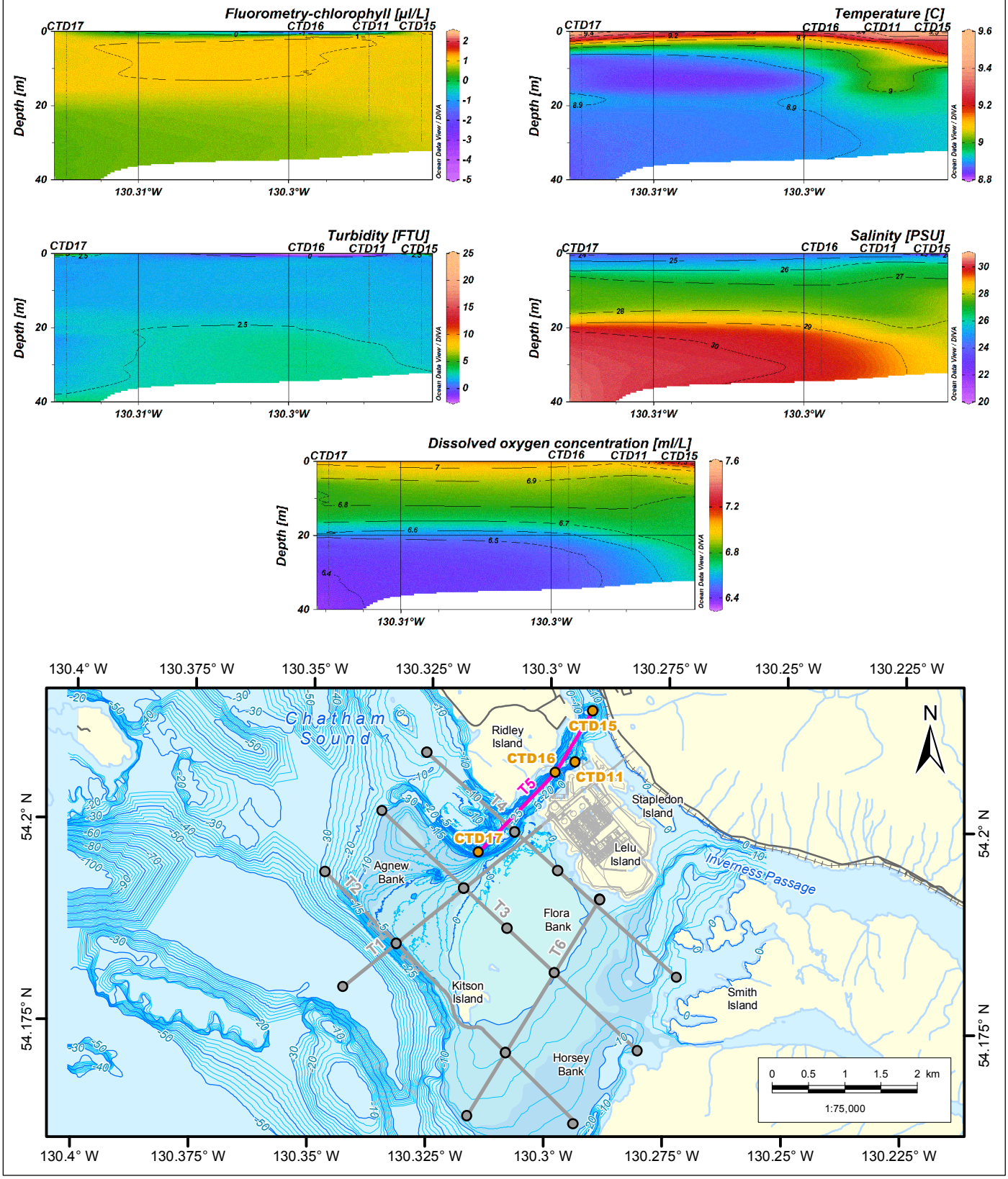


Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 5 (April 2015)

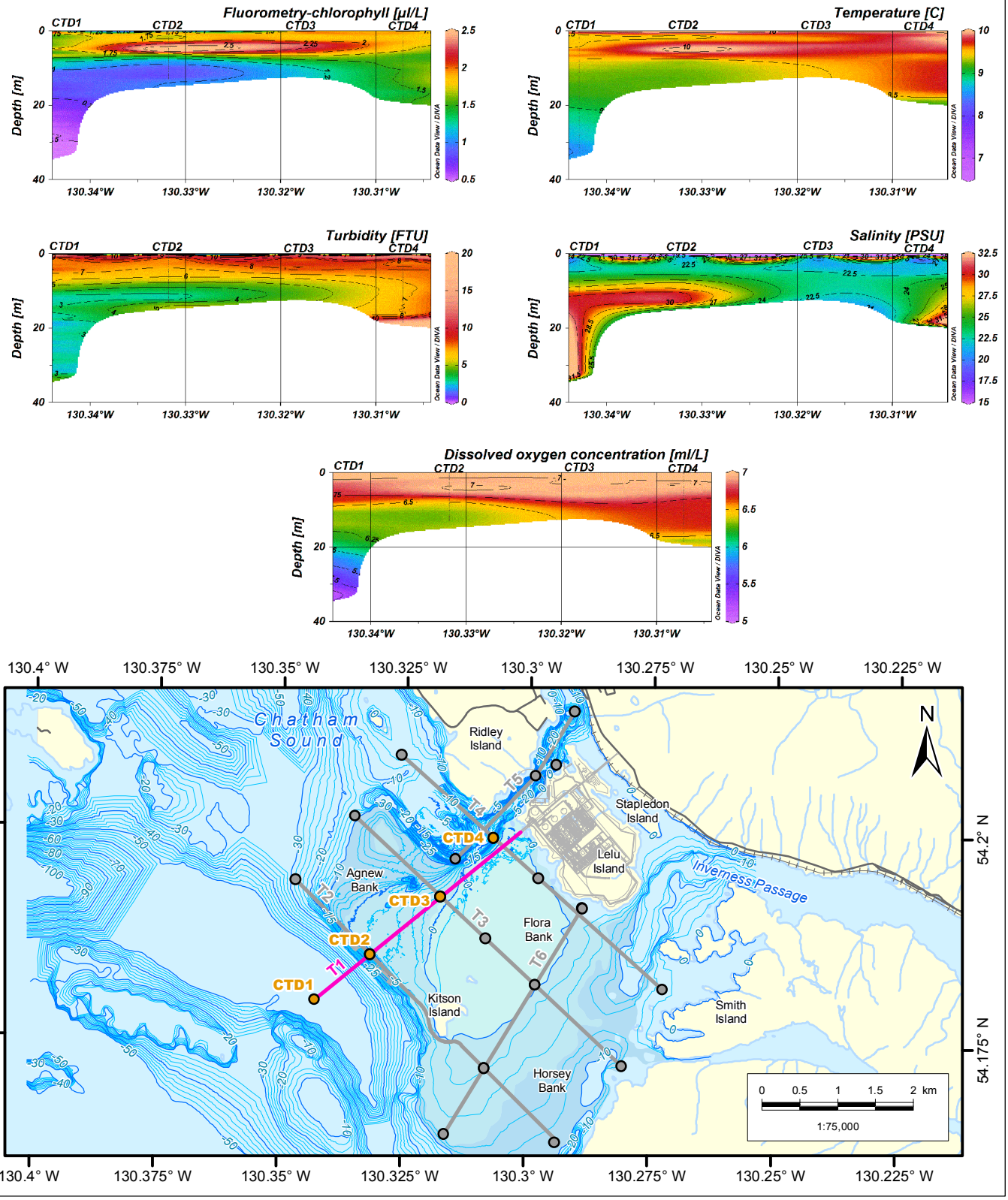
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A24**

7/3/2015 - 2:43:32 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (May 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

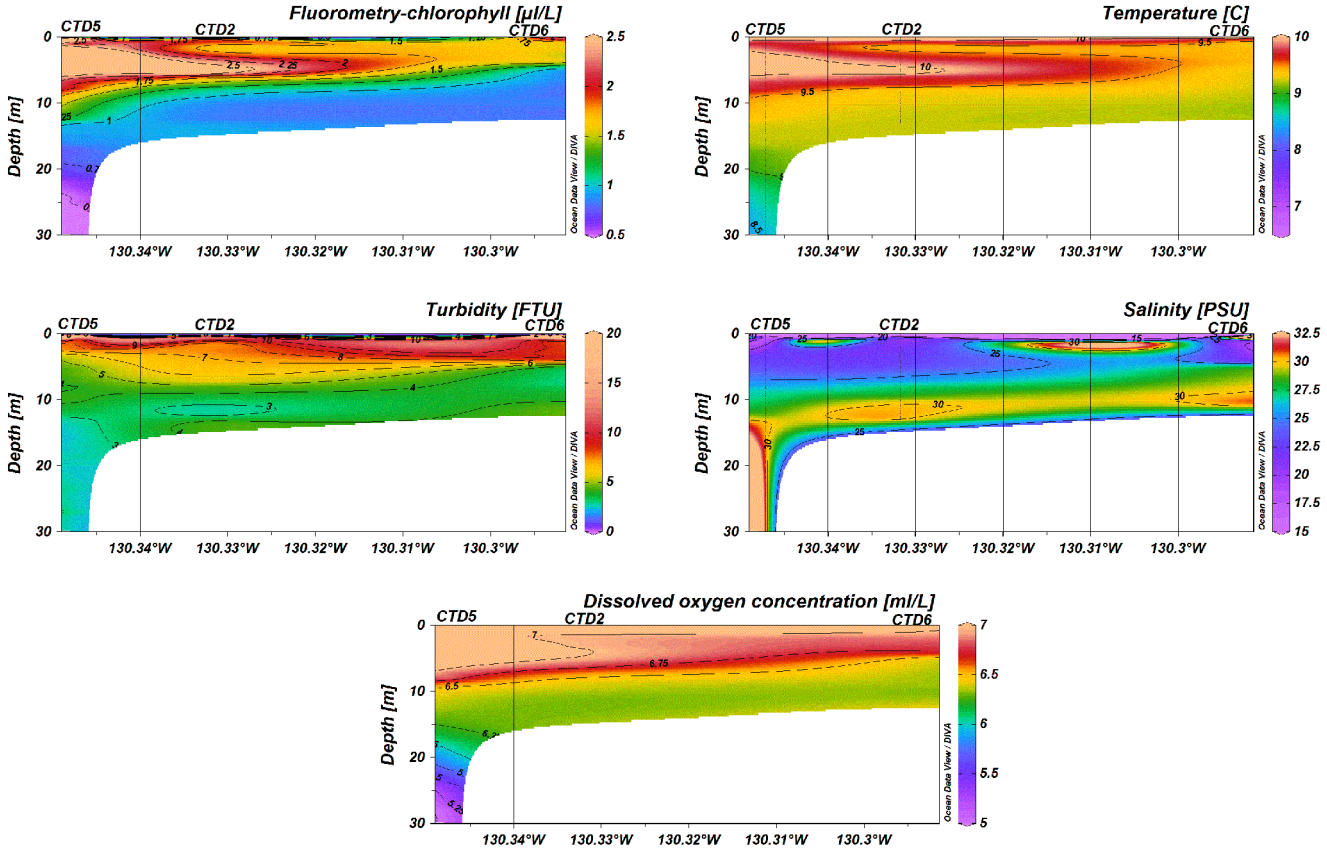
DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

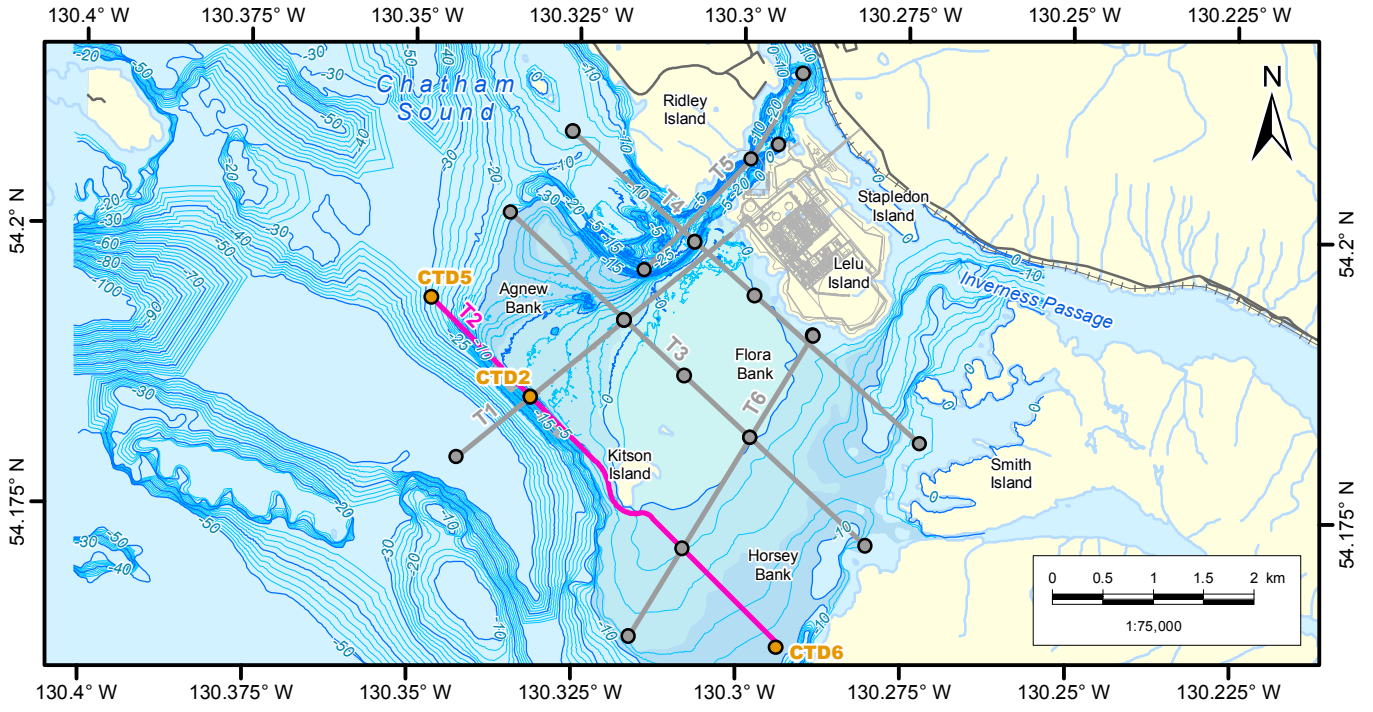
PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A25**

7/3/2015 - 2:45:33 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (May 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

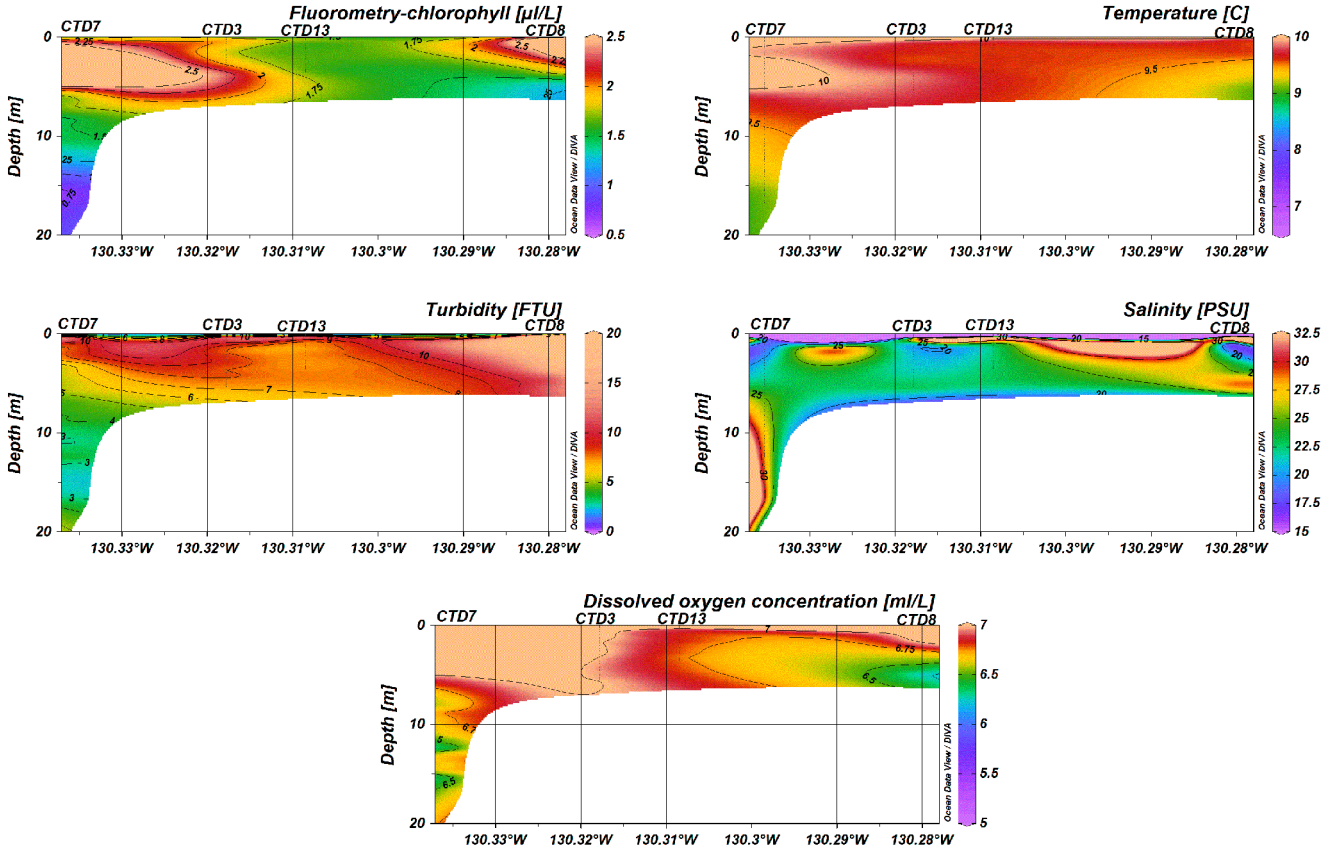
DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

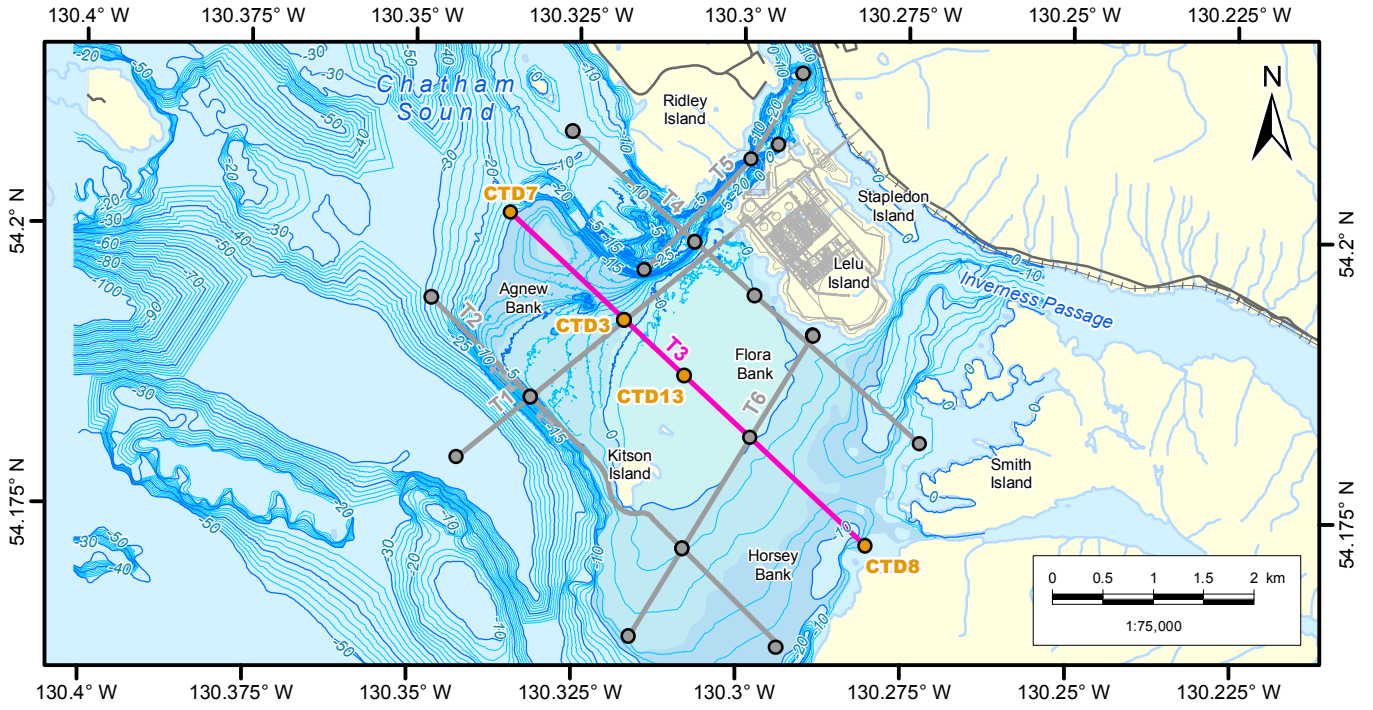
PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A26**

7/3/2015 - 2:45:37 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (May 2015)

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

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DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A27**

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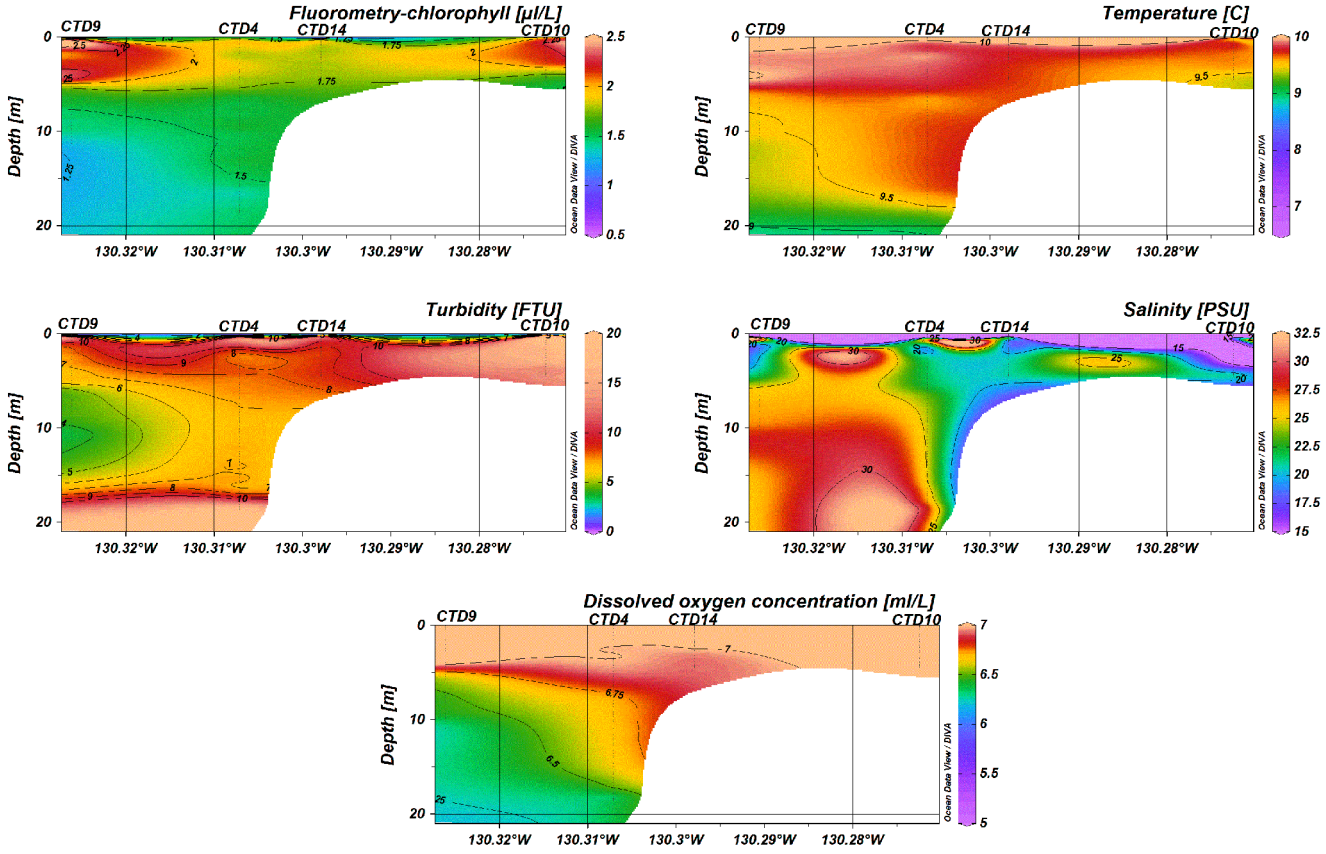
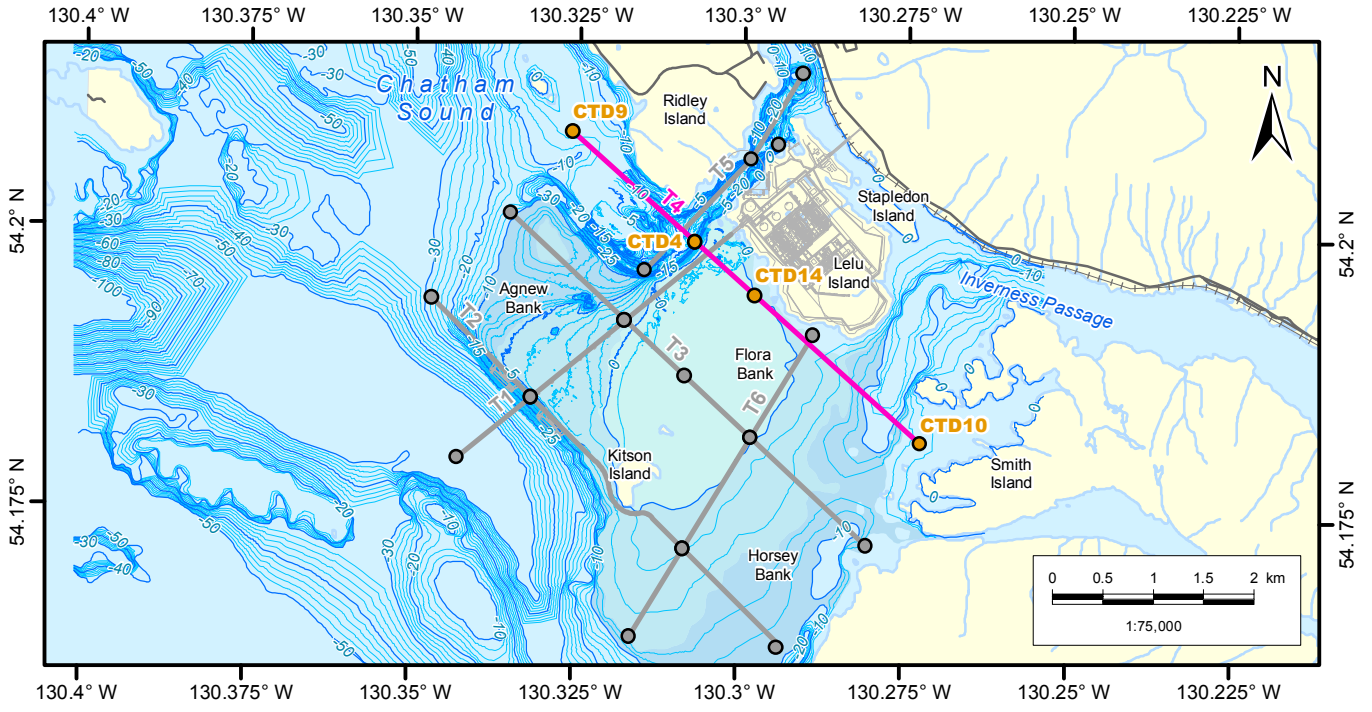




Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (May 2015)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

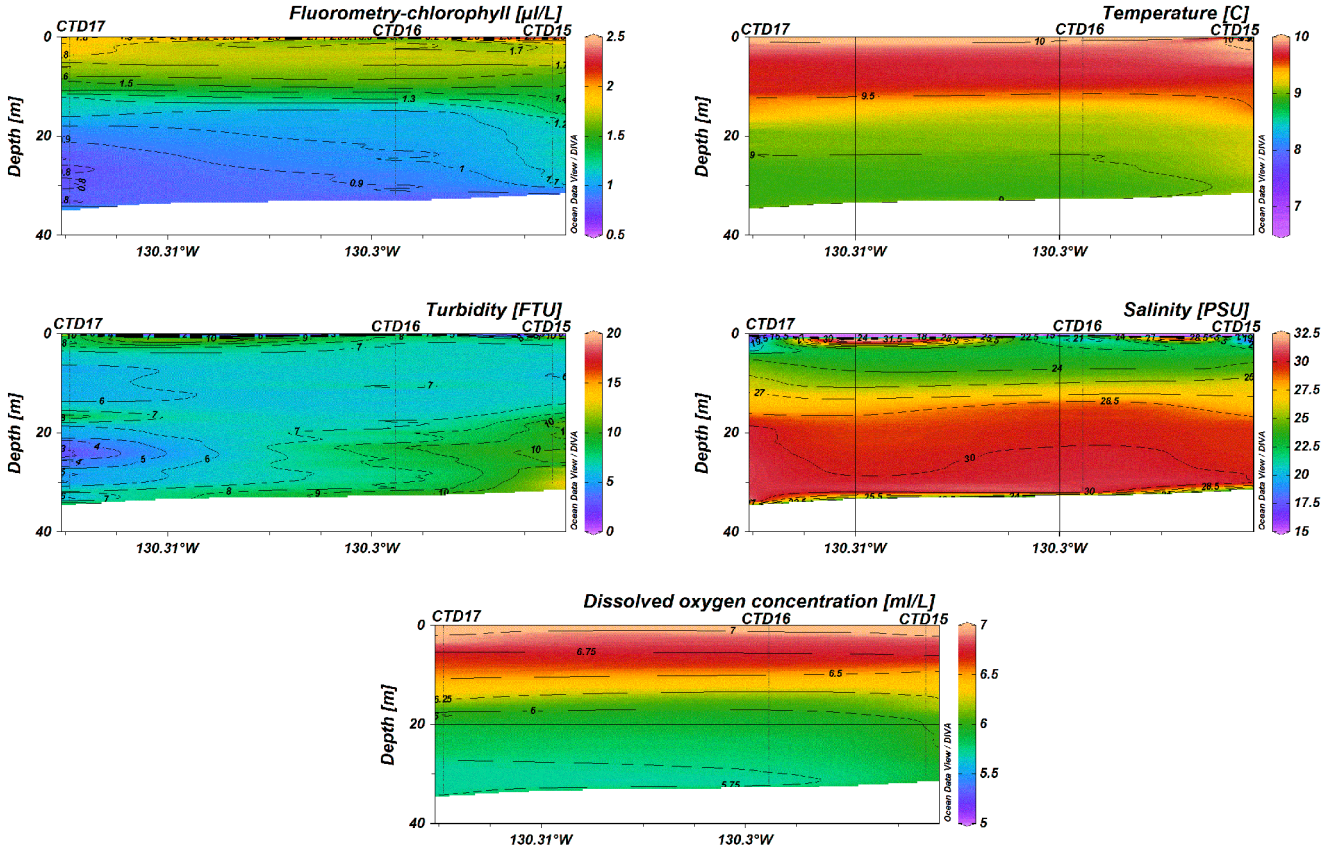
DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

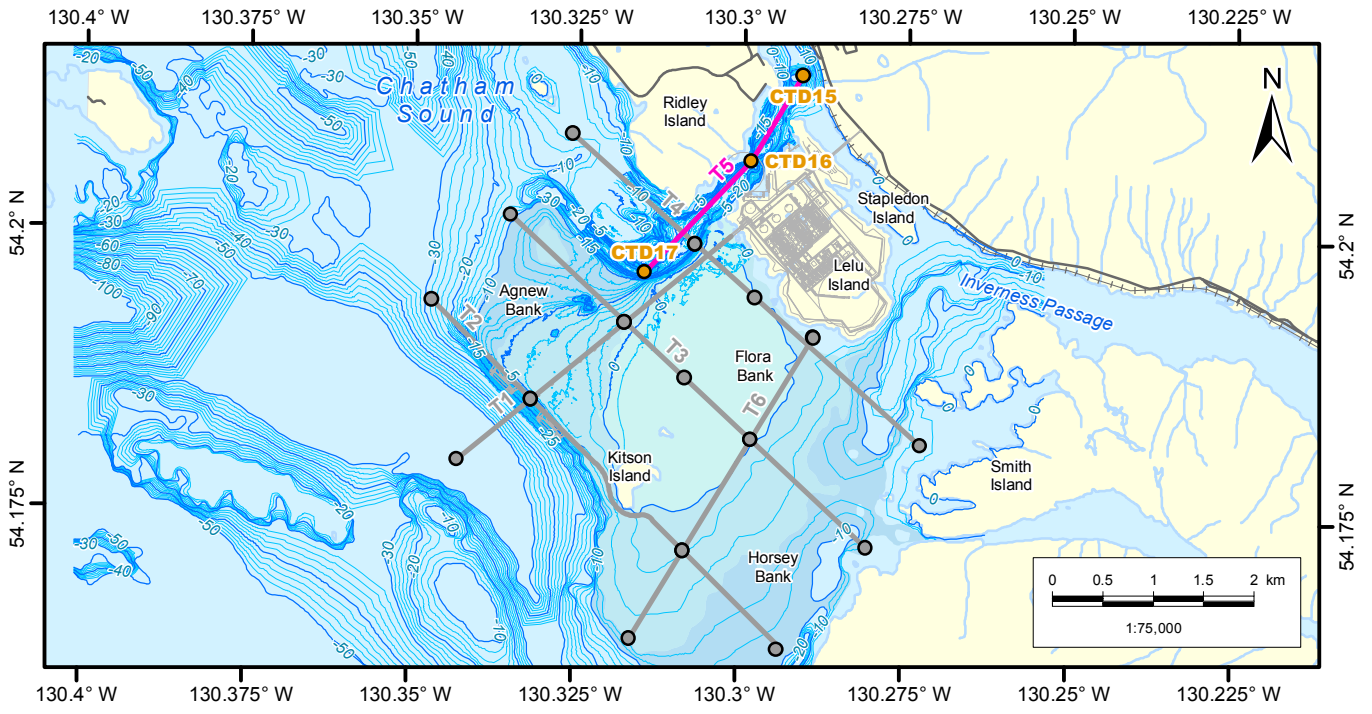
PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A28**

7/3/2015 - 2:45:44 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 5 (May 2015)

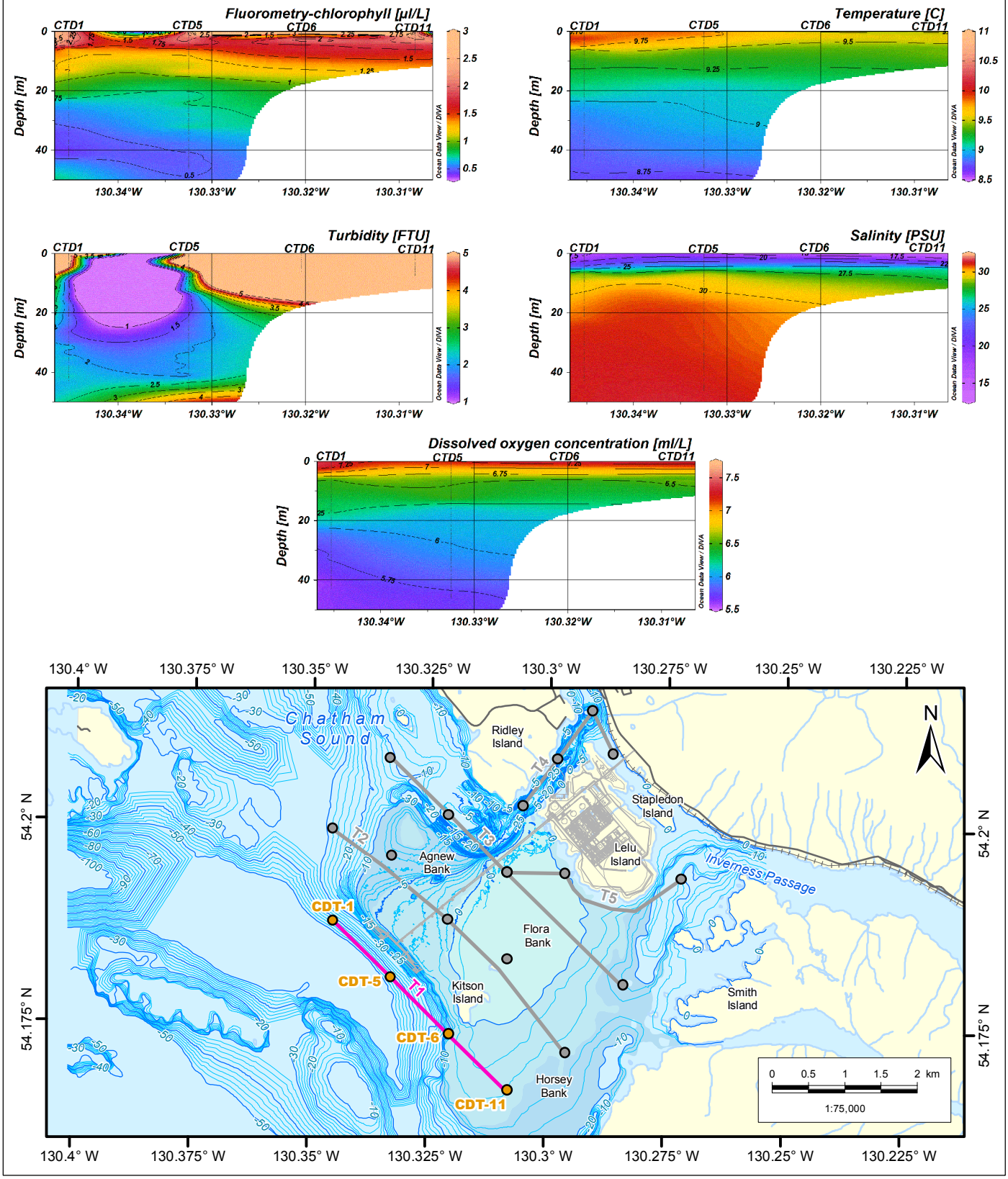
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A29**

7/3/2015 - 2:45:48 PM \\cd1186-f04\workgroup\acad\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (May 12, 2015 - Nighttime)

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

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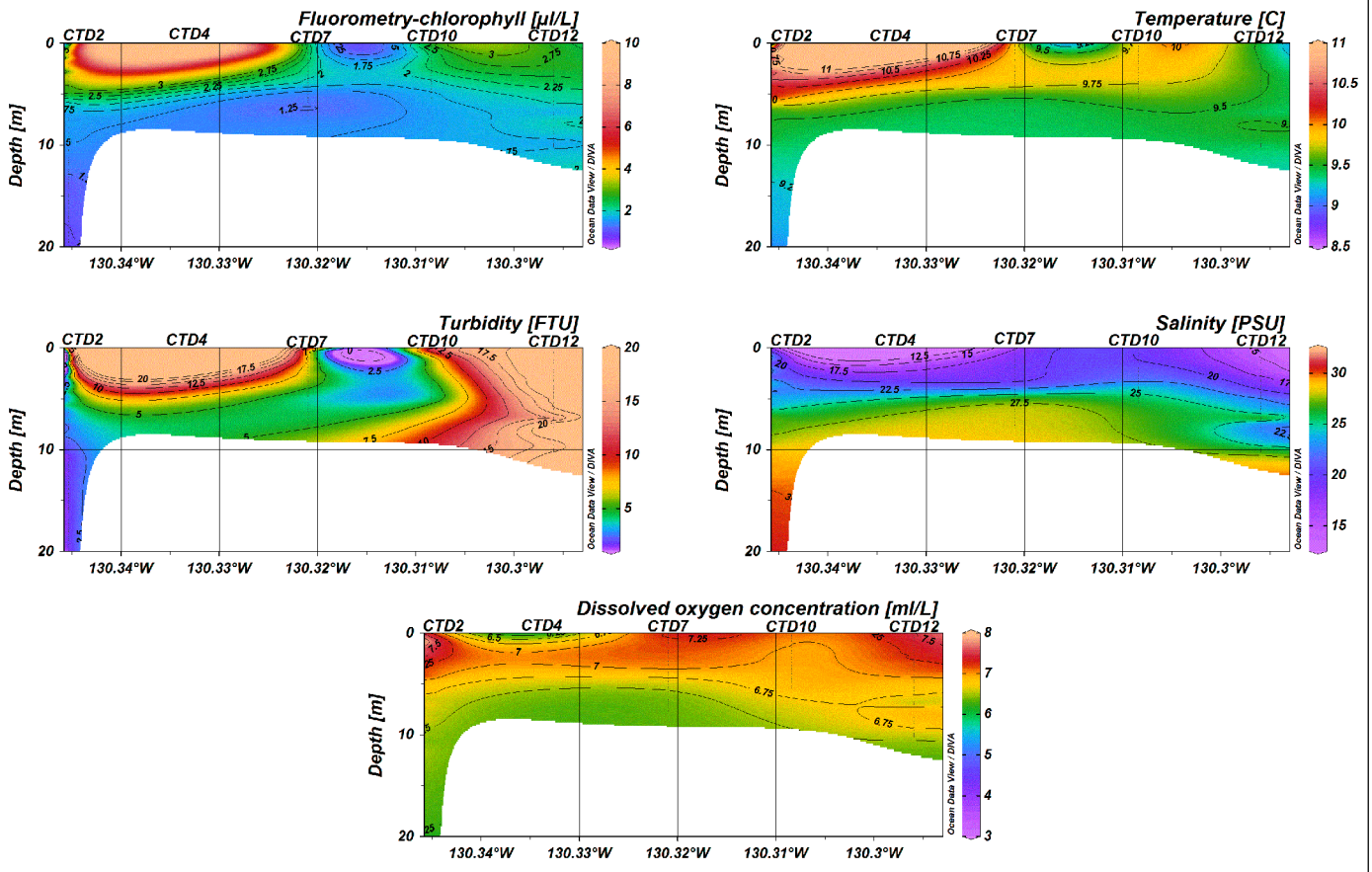
DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

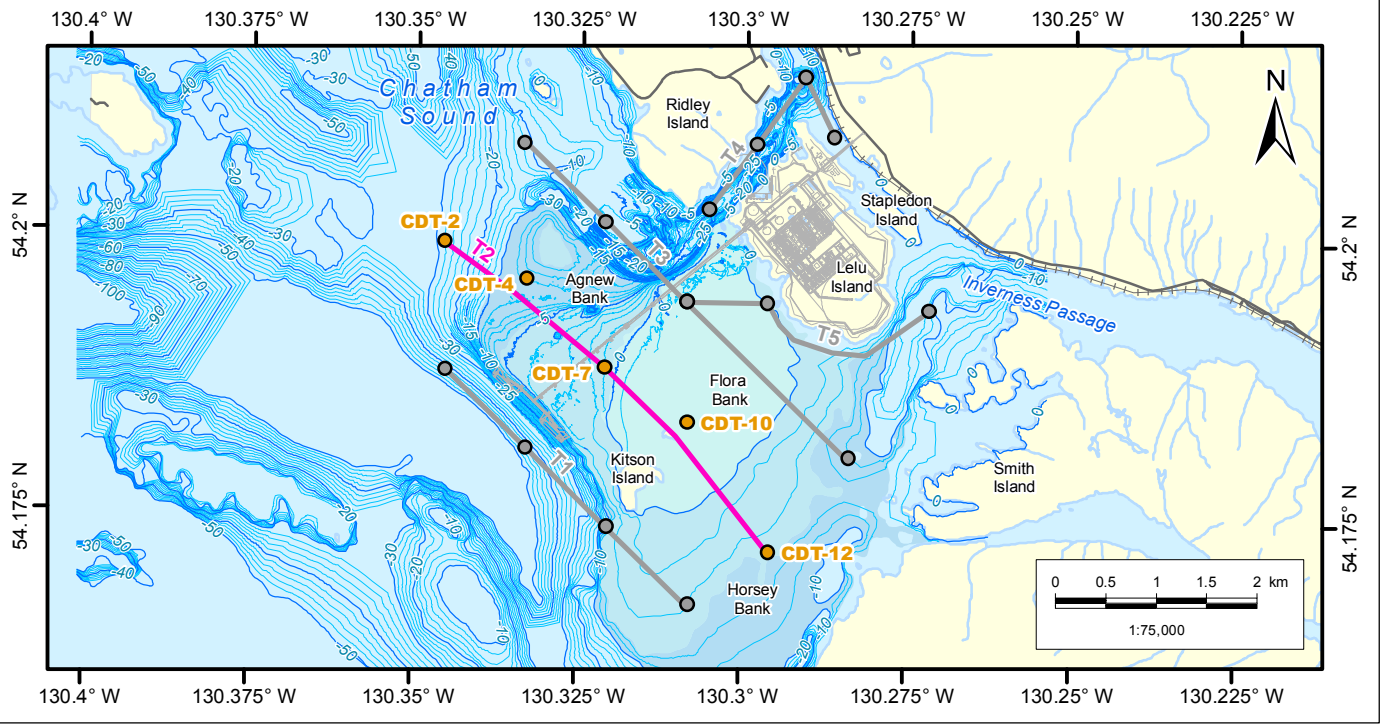
PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A30**

7/3/2015 - 2:50:30 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook_smdl.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (May 12, 2015 - Nighttime)

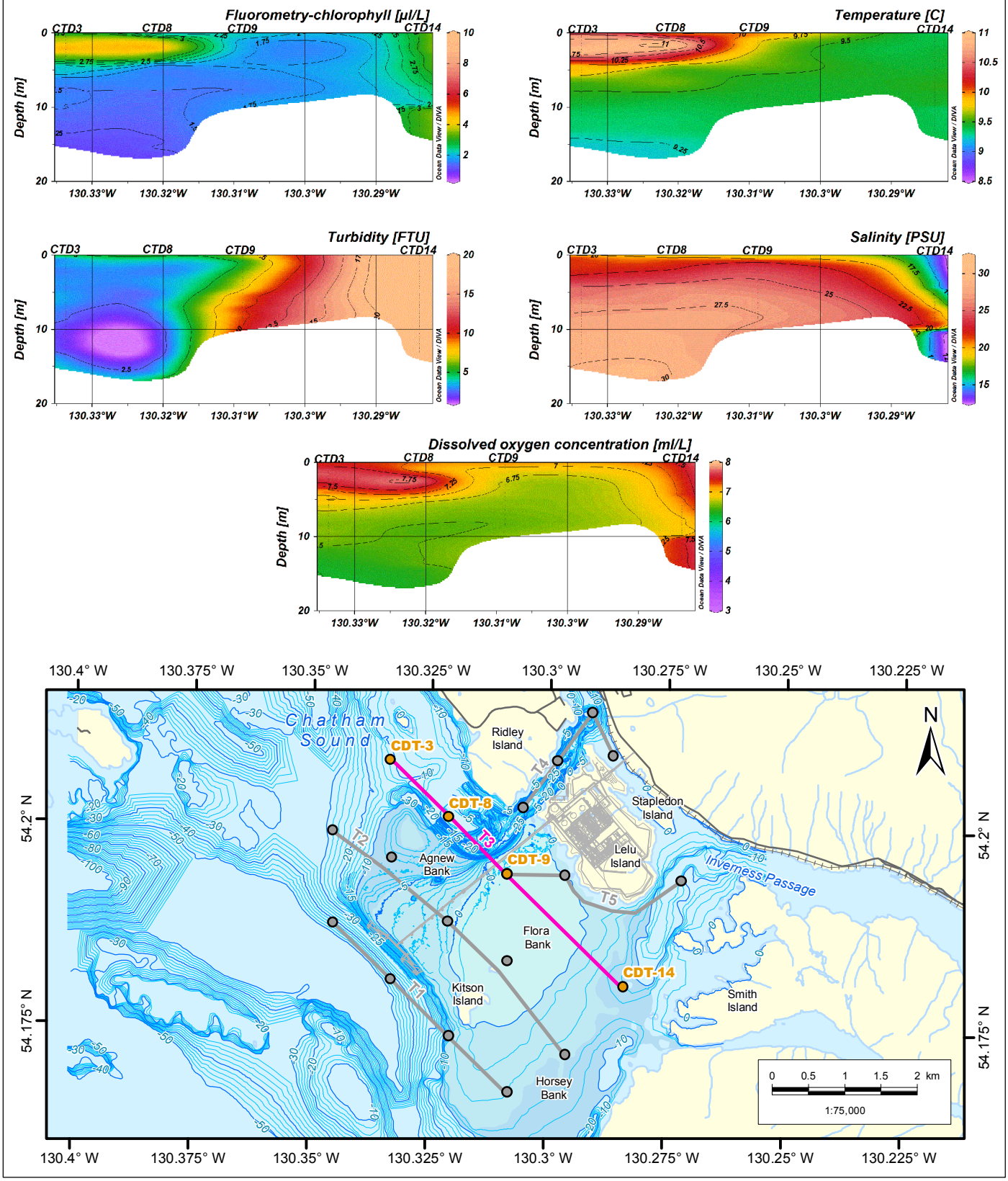
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A31**

7/3/2015 - 2:50:33 PM \\cd1186-f04\workgroup\acad\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook_smdl.mxd



Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (May 12, 2015 - Nighttime)

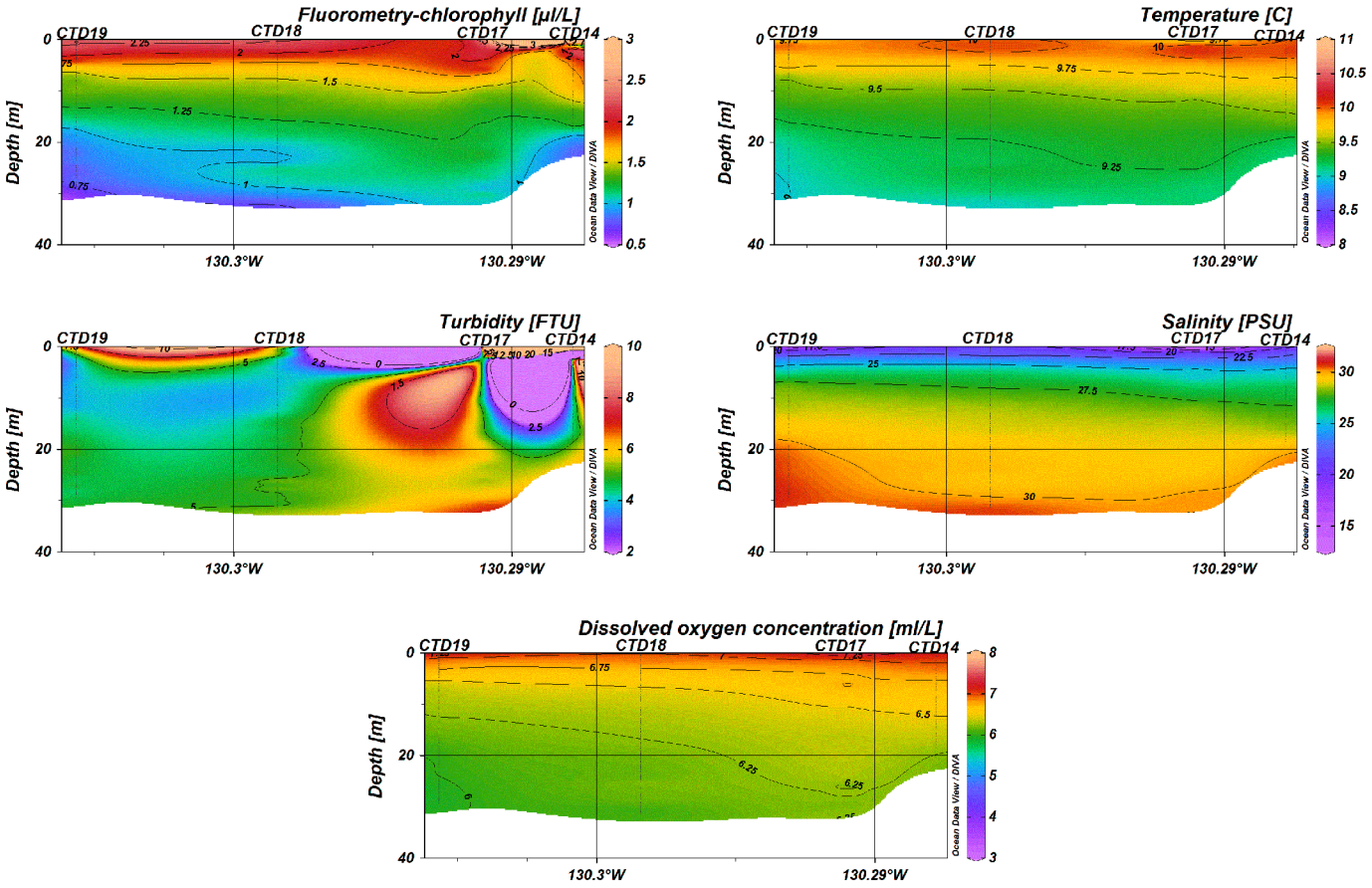
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

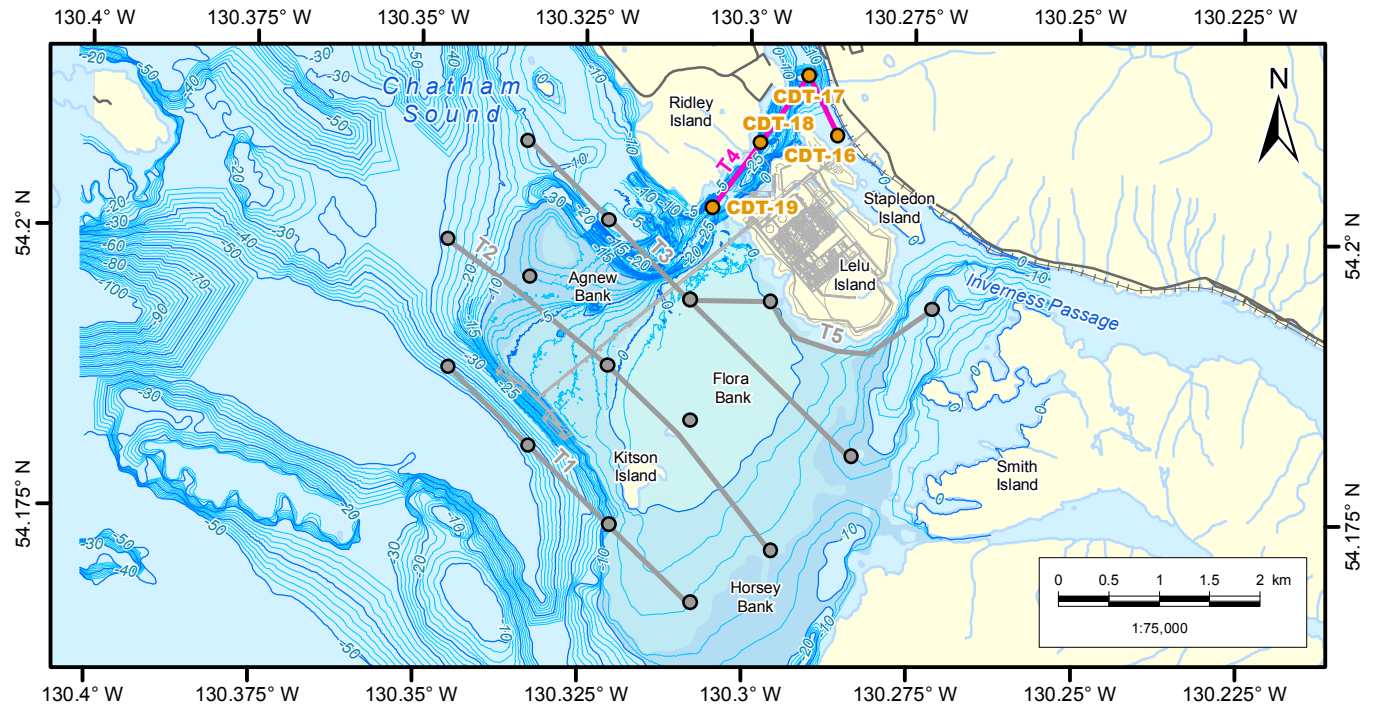
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A32**

7/3/2015 - 2:50:37 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook_smdt.mxd





Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (May 12, 2015 - Nighttime)

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

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DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A33**

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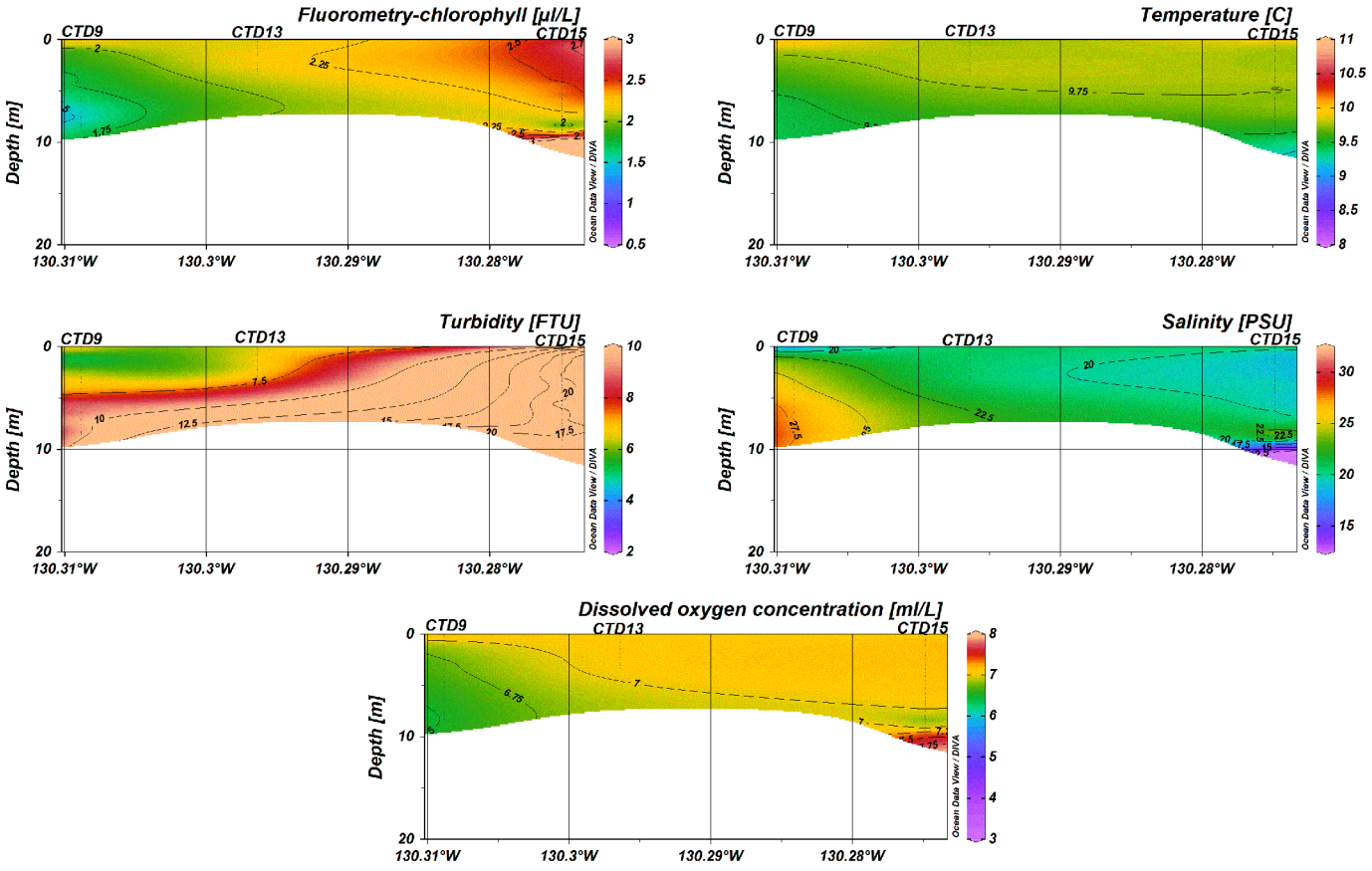

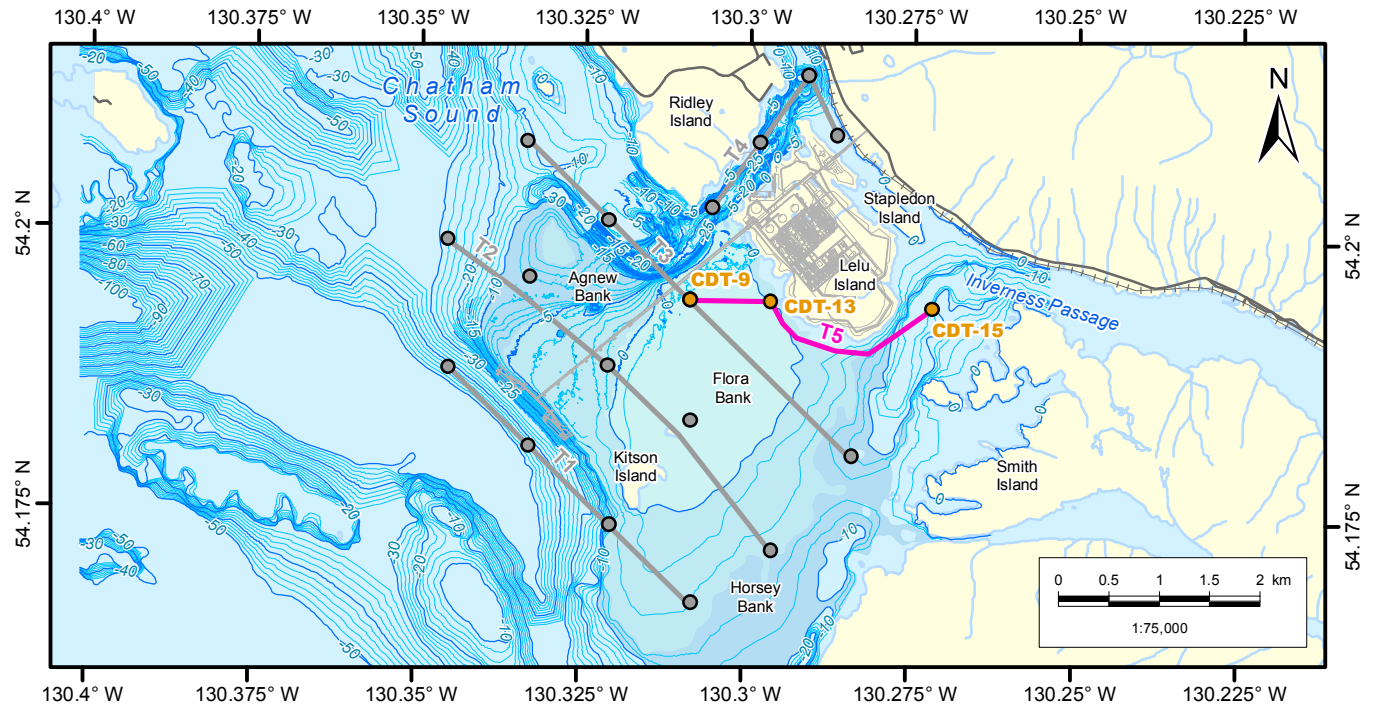

Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 5 (May 12, 2015 - Nighttime)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A34**

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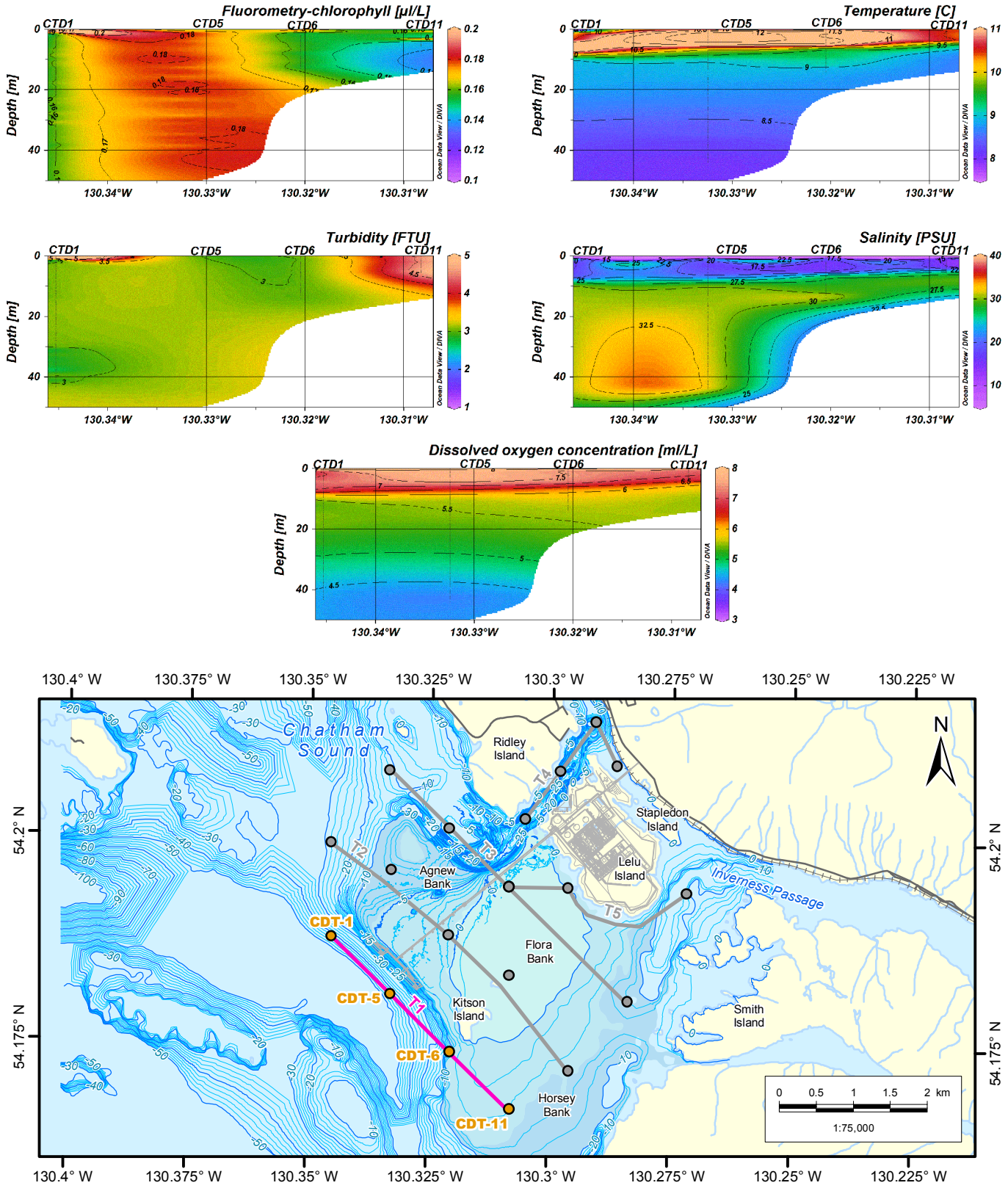


Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 1 (May 25, 2015 - Nighttime)

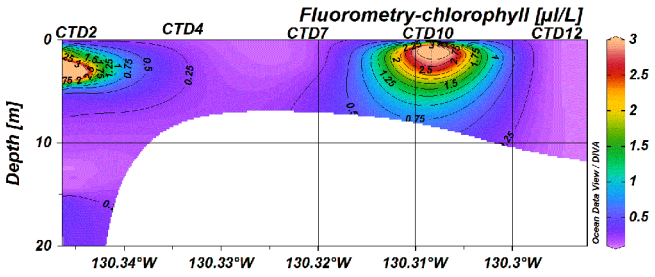
Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

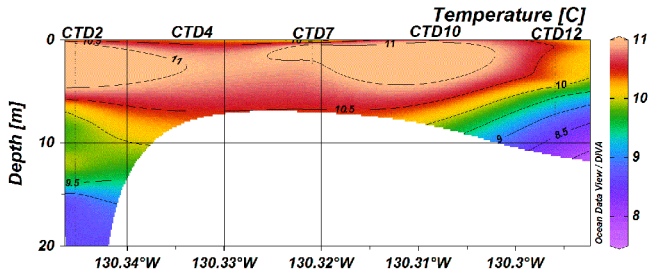
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

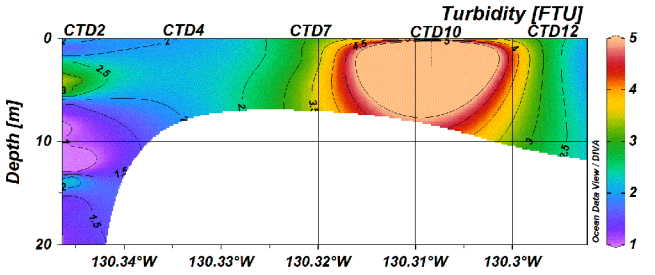
DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

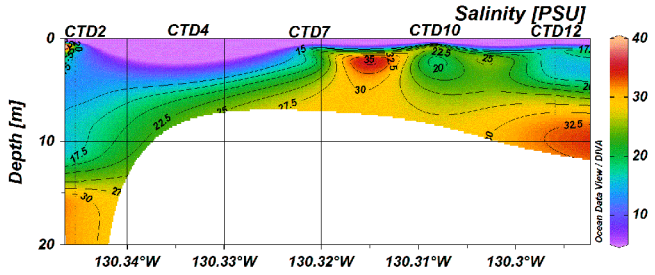
PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A35**

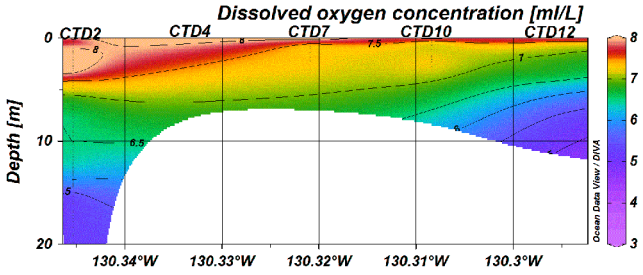
7/3/2015 - 2:51:00 PM \\cd1186-f04\workgroup\acad\e\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook_smdl.mxd

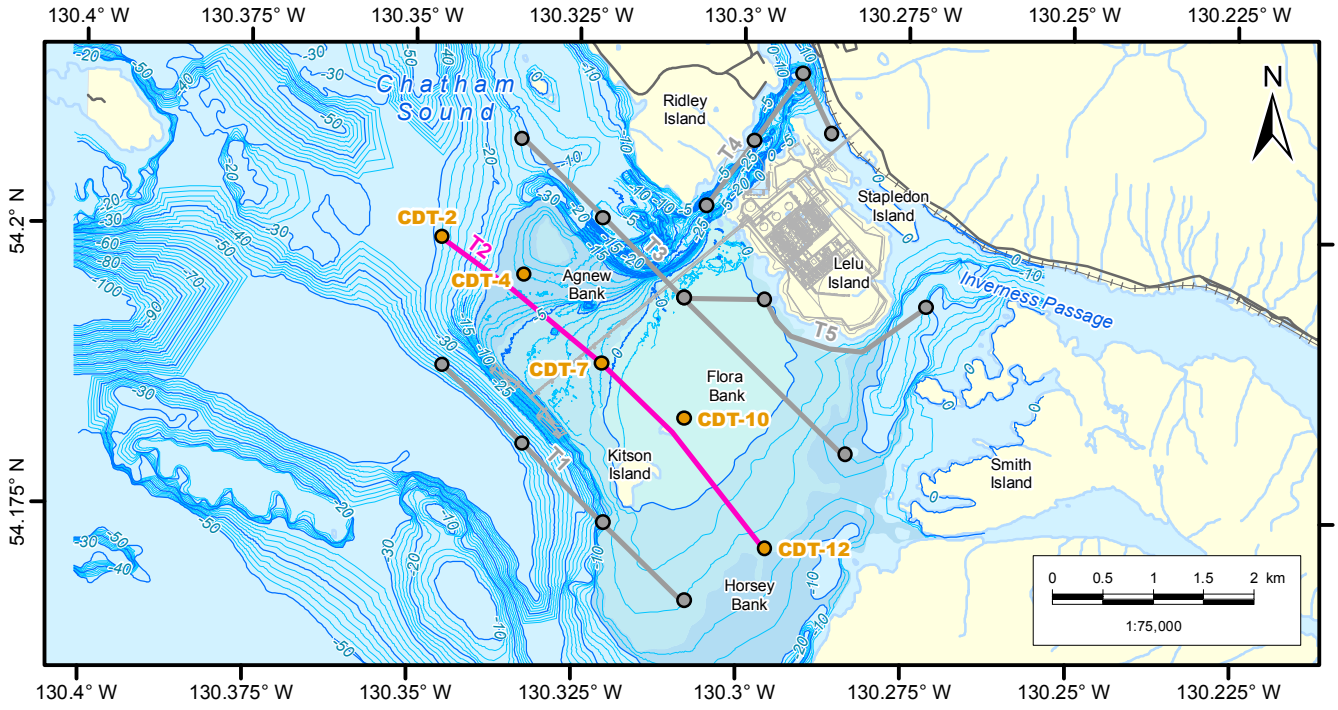












Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 2 (May 25, 2015 - Nighttime)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A36**

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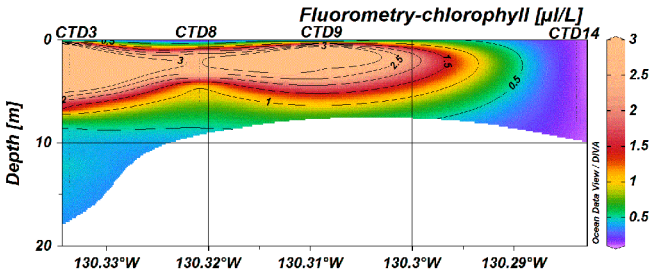

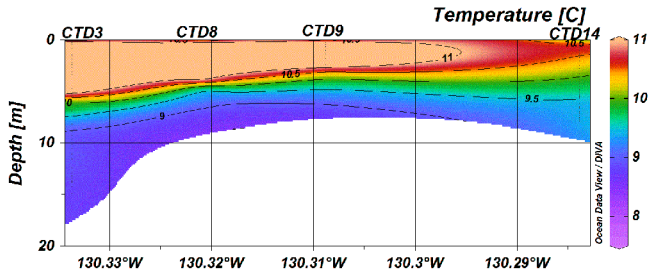

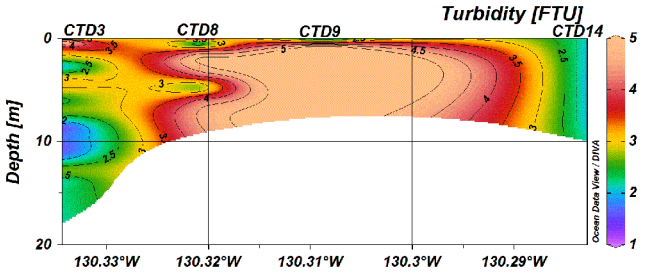

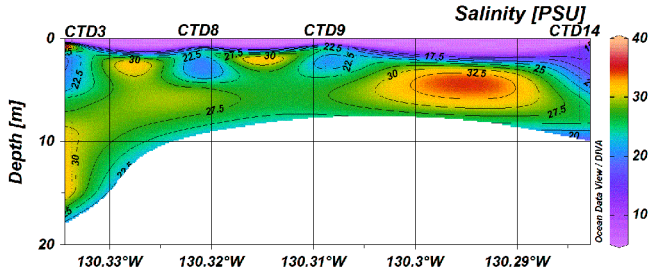

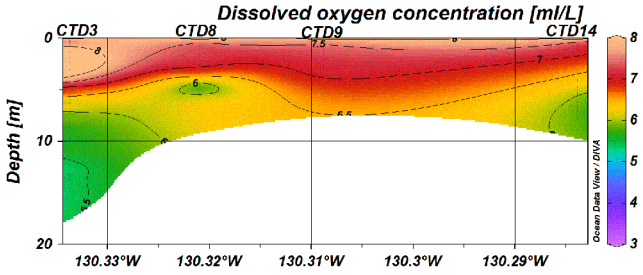

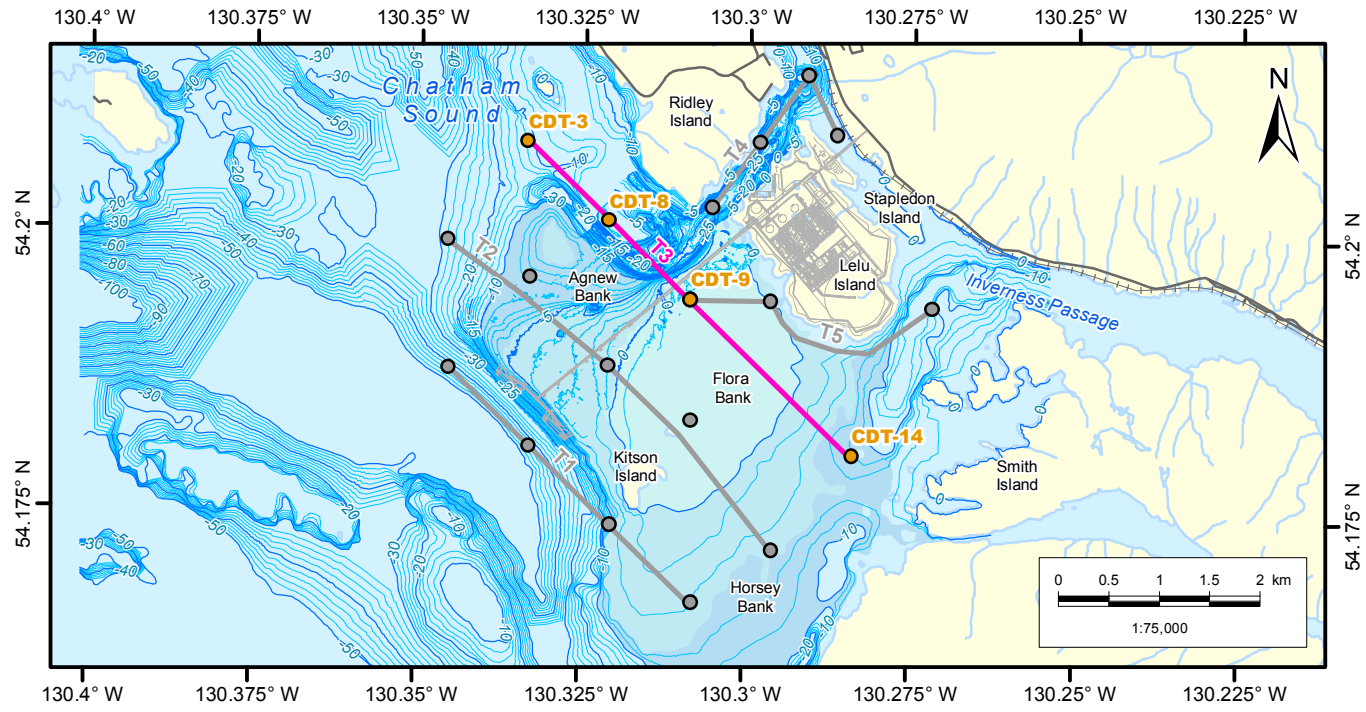

Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 3 (May 25, 2015 - Nighttime)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A37**

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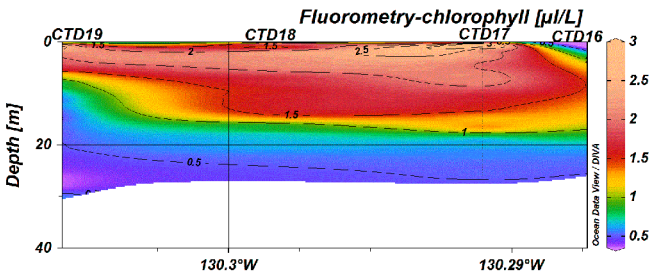

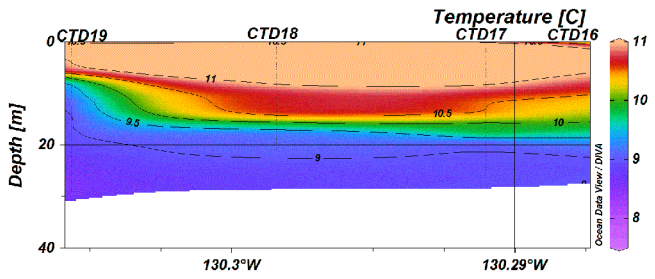

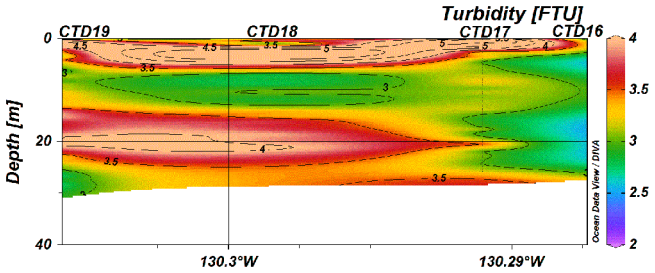

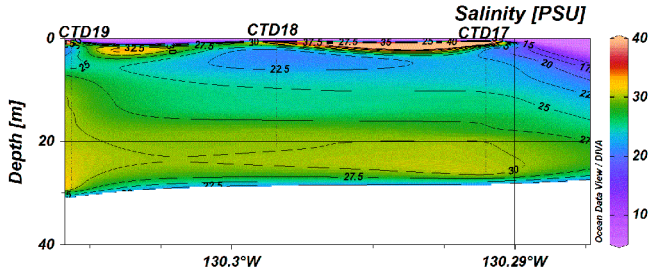

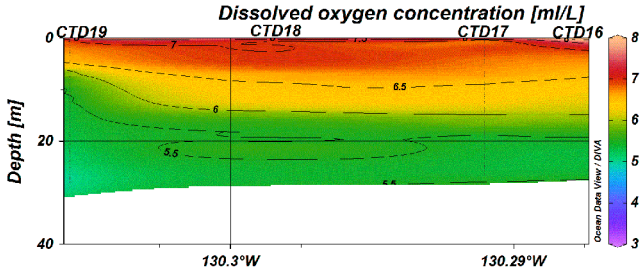

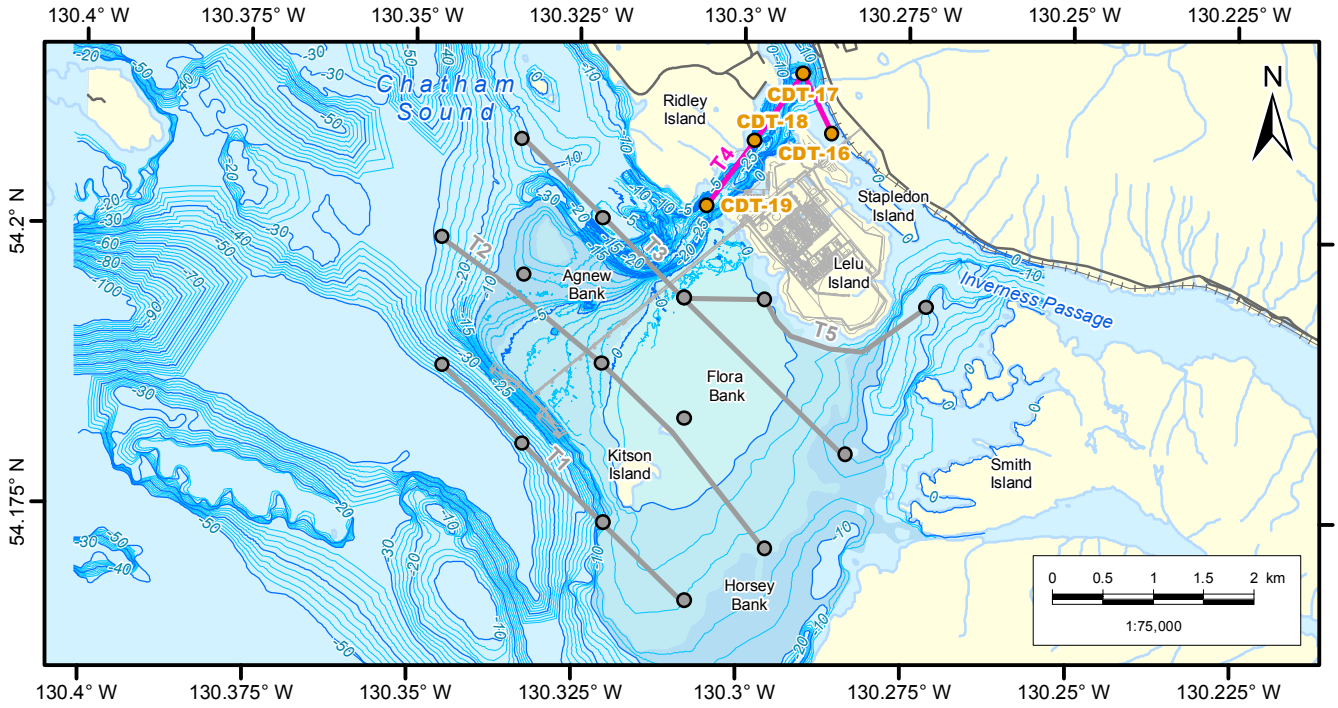

Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 4 (May 25, 2015 - Nighttime)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15	PROJECTION: UTM - ZONE 9
FIGURE ID: 123110537	DATUM: NAD 83
DRAWN BY: A. BOONE	CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **A38**

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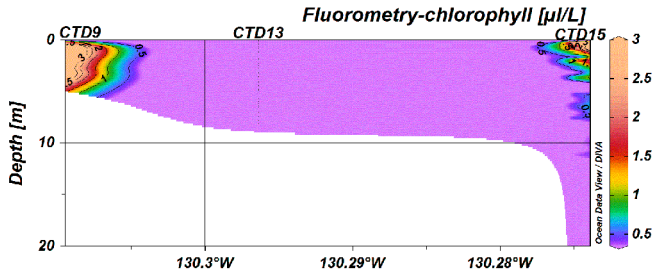

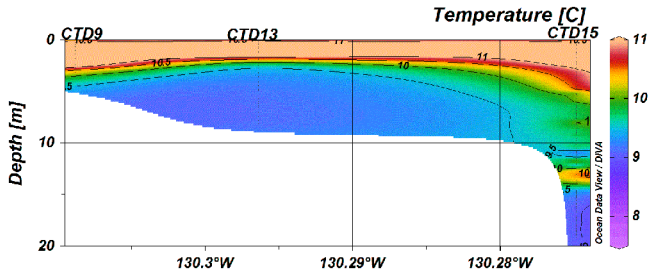

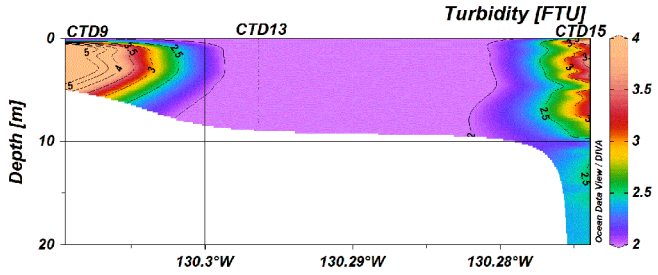

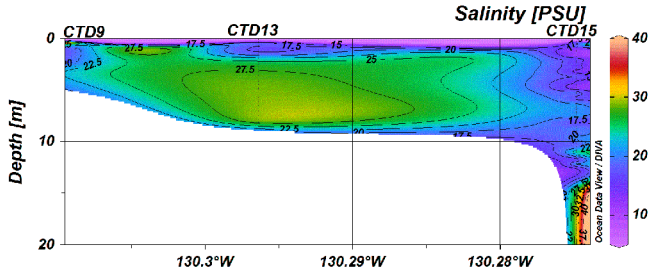

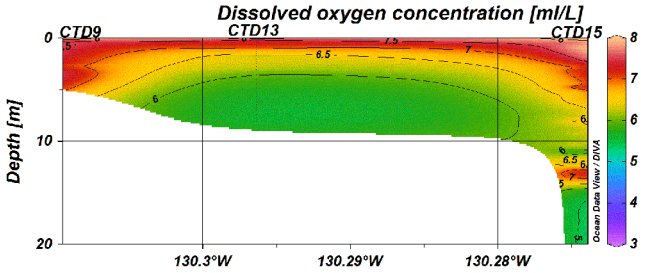

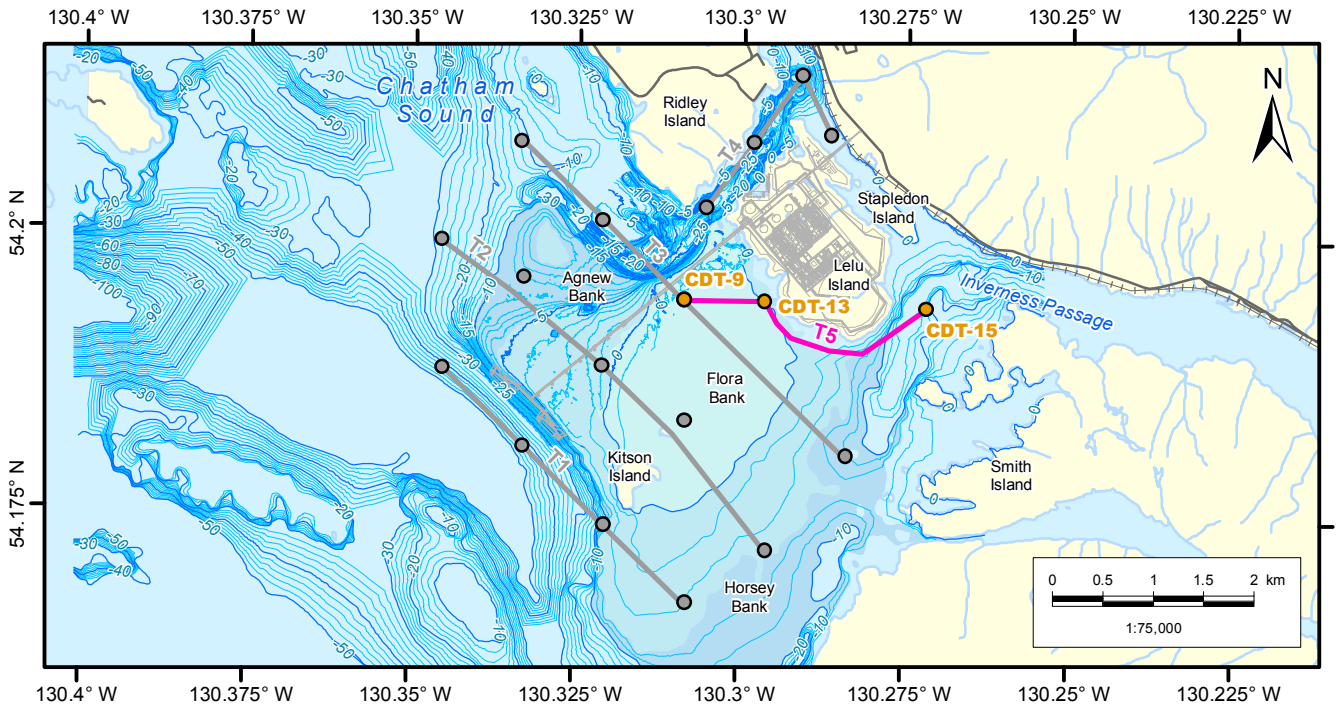

Illustrated Oceanographic Site
Other Oceanographic Site
Illustrated Transect
Other Transect
Project Component

Bathymetry (m)
Major Contour
Minor Contour
Railway
Road
Secondary Road
Watercourse

Waterbody
Flora Bank
0 - 5 m Deep Shoal
5 - 10 m Deep Shoal

Pacific NorthWest LNG

Marine Water Column Profiling: Transect 5 (May 25, 2015 - Nighttime)

Sources: Government of British Columbia; Prince Rupert Port Authority; 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.

DATE: 03-JUL-15
FIGURE ID: 123110537
DRAWN BY: A. BOONE
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: **A39**

7/3/2015 - 2:51:15 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\field_reports\mxds\123110537_pnw_marfish_water_column_profiling_mapbook_smdt.mxd