
To: Catherine Ponsford, Project Manager
Canadian Environmental Assessment Agency
File: 123220020

From: Mike Lambert, Head, Environmental and Regulatory Affairs
Pacific NorthWest LNG
Date: November 10, 2015

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

This technical memo responds to the request for outstanding information received from the Canadian Environmental Assessment Agency (CEA Agency) on June 2, 2015. This response consists of a description of the PNW LNG proposed approach to disposing of dredge material on Lelu Island, associated effects and mitigations.

QUESTION 3: EFFECTS OF DREDGED MATERIAL DISPOSAL

Issue and Information Requested: The proponent did an assessment of the effects of sediment disposal at Brown Passage assuming that material could be permitted for disposal at sea. The proponent did not assess the effects of disposing of sediment on land should disposal at sea not prove feasible. The IRs asked that:

"all potential management options(s) for the dredged material (including alternative disposal at sea locations and proposals for beneficial use) will need to be finalized as part of the EA review in order that the site-specific effects related to these options can be adequately assessed." (August 14, 2014 technical table, Marine Resources #11, Annex 1).

Information provided: The proponent described in Appendix G.5 that:

"Dredging of a marine terminal berth area will no longer be required for project construction, resulting in a substantial decrease in the amount of dredged sediment to be disposed. Although dredging of the materials offloading facility (MOF) will still be required, advancements in engineering design have resulted in a refined estimate of less than 200,000 m³ of sediment to be dredged (in comparison to the 615,000 m³ originally cited in the EIS). As a result, alternatives to the previously-used ocean disposal site at Brown Passage are no longer under consideration. A permit will be sought under the *Canadian Environmental Protection Act* for all dredged sediment from the MOF to be disposed of at Brown Passage."

We understand that, as a result of your discussions with Environment Canada in relation to a permit for Disposal at Sea, that PNW intends to dispose of some dredged material on land. Currently effects to valued components as a result of disposal of sediment on land have not been assessed.

Remaining information: The Agency requires information on the proponent's plans regarding disposal of dredged material on land and associated effects. Additionally, the Agency requires information on measures to mitigate any environmental effects.

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

RESPONSE TO QUESTION 3: DISPOSAL OF MARINE SEDIMENT ON LELU ISLAND

Approach to Disposal on Lelu Island

Construction of the MOF will require dredging of up to 200,000 m³ of sediment from an embayment on the north side of Lelu Island to allow for safe berthing and navigation of vessels visiting the MOF. The surficial 1 m of this material contains levels of dioxins and furans above the Environment Canada screening criteria for disposal at sea at a not non-dispersive site and therefore this material will be disposed of on Lelu Island.

This surficial layer of sediment is estimated to be approximately 8,000 m³. This volume has been revised based on a cross-sectional analysis of the sediment layer and underlying bedrock at the dredge site (Figure 1 and Figure 2). A previous estimate¹ of 40,000 m³ was based on an assumed 1 m sediment depth over 40,000 m² of the total 54,000 m² dredge area. Improved mapping of the sediment layer, the underlying bedrock, and exposed bedrock in the dredge area have allowed for a more accurate calculation of the volume of surface sediment to be disposed on Lelu Island.

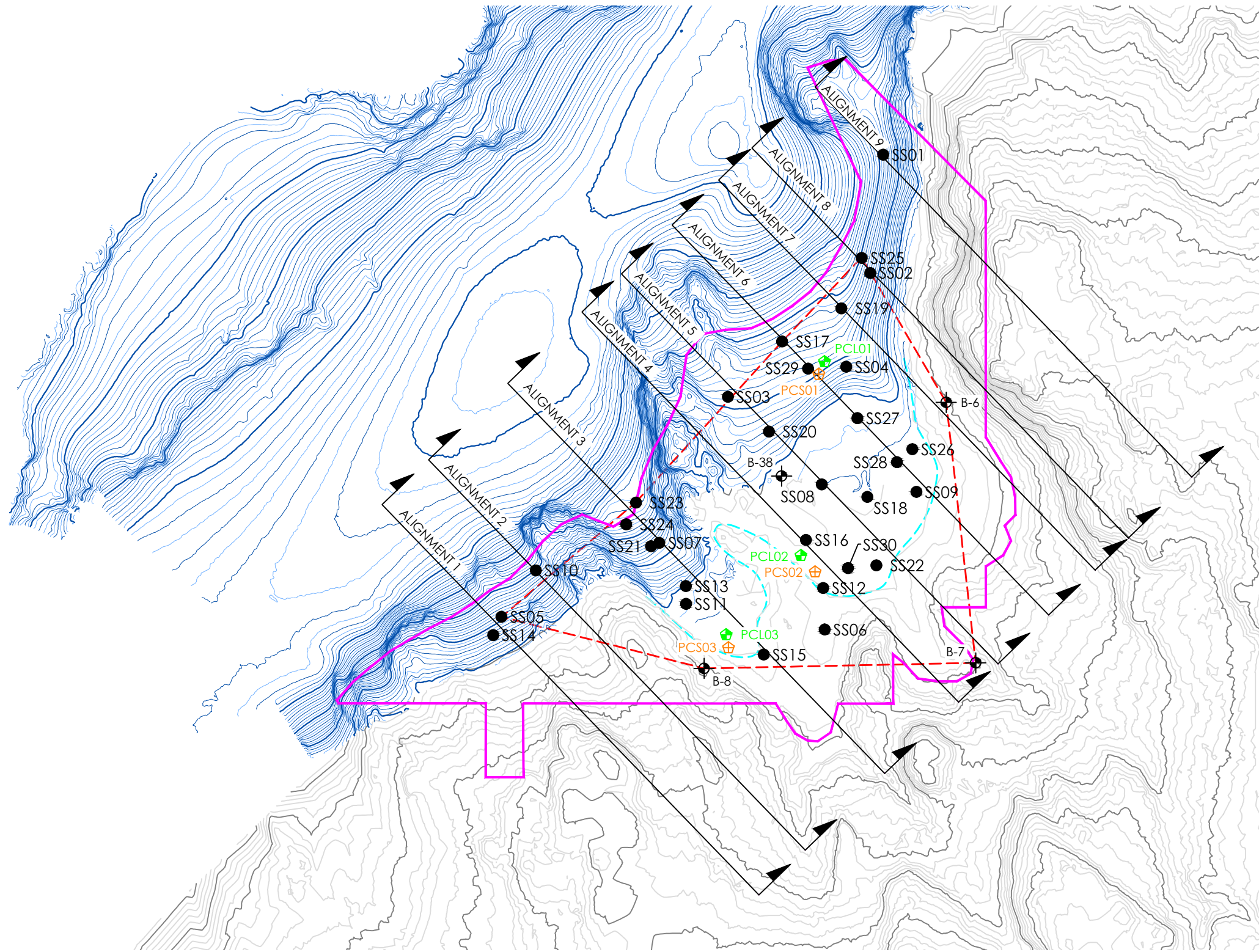
Lelu Island falls within the administrative boundaries of the Prince Rupert Port Authority (PRPA), who have requested a comprehensive sediment disposal plan prior to approving the activity². The sediment disposal plan will include the following elements, the details of which are summarized here based on current engineering design:

- a. Proposed location
- b. Environmental quality of sediment
- c. Design detail for the disposal cell
- d. Environmental management plan for the disposal activity
- e. Environmental monitoring plan for the disposal site








Sediment will be dredged using either a backhoe dredger (BHD) or a clamshell dredger (CLD), and subsequently transported to the Lelu Island disposal area by dump truck. Each truck would carry 5 to 20 tons of dredged material. Dredged sediment will be disposed of in an area within the LNG facility fence line that is currently designated for peat storage (Figure 3).

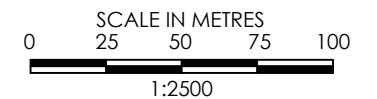
¹ PNW LNG 2015. *Pacific Northwest LNG Dredging and Ocean Disposal Summary*. Prepared for the Canadian Environmental Assessment Agency and Environment Canada. March 27, 2015.

² Letter via e-mail October 28, 2014 from Lorne Keller, Prince Rupert Port Authority, to Gerry Fraser, Pacific NorthWest LNG Re: On-land sediment disposal for projects within the administrative boundaries of the Prince Rupert Port Authority.



LEGEND

-  MOF DREDGE BOUNDARY
-  EXTENTS OF BEDROCK DATA INFERRED ON SEDIMENT SAMPLING AND FUGRO BOREHOLES
-  UPPER INTERTIDAL
-  SEDIMENT SAMPLE
-  BOREHOLE BY FUGRO
- SEDIMENT SAMPLE TESTED FOR DIOXINS/FURANS**
-  LARGE INTERVAL (0.5 m) CORE SAMPLE
-  SMALL INTERVAL (0.2 m)



Project Information
 Project No.: 12320020
 Scale: 1:2500
 Date: 2015-MAR-15
 Drawn by: G. HUYNH
 Checked by: B. BYRD

Client/Project
 PACIFIC NORTHWEST LNG

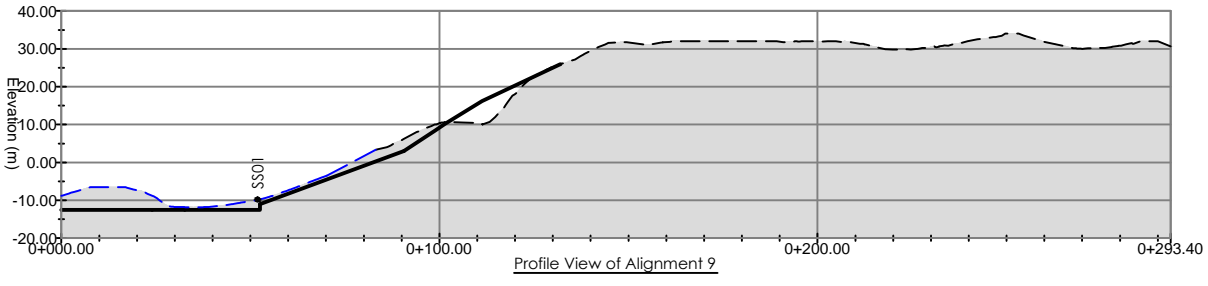
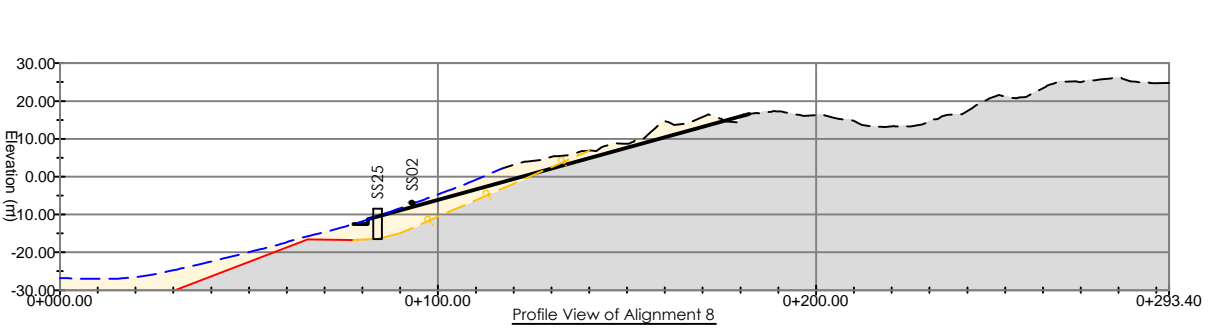
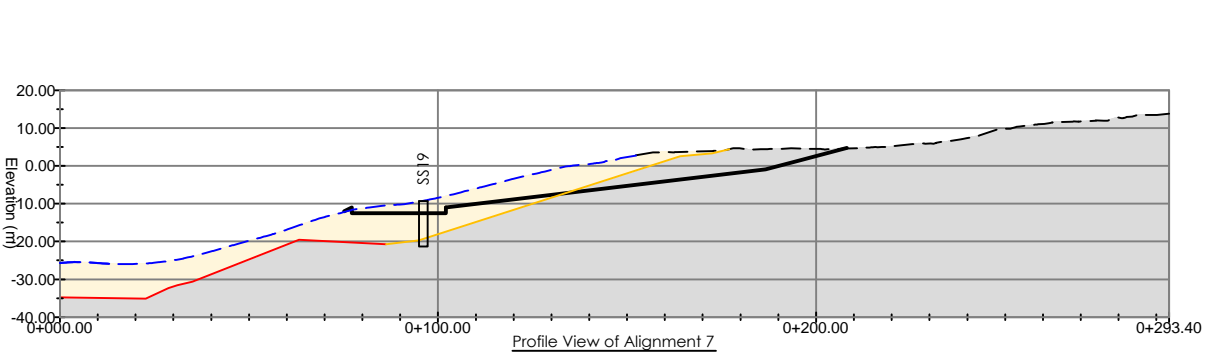
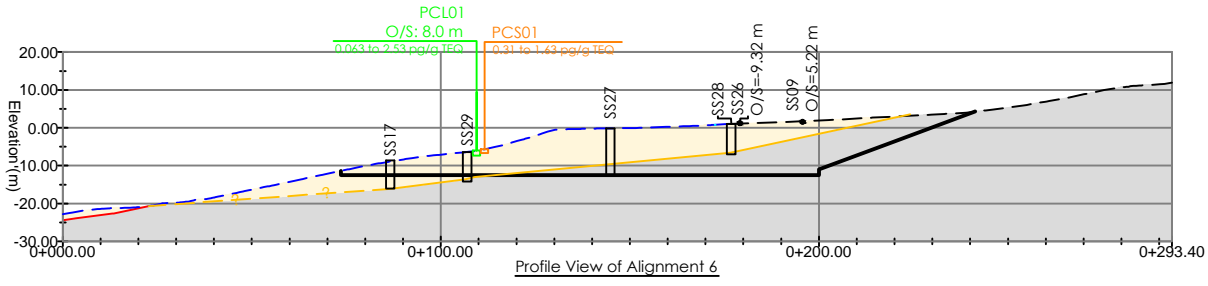
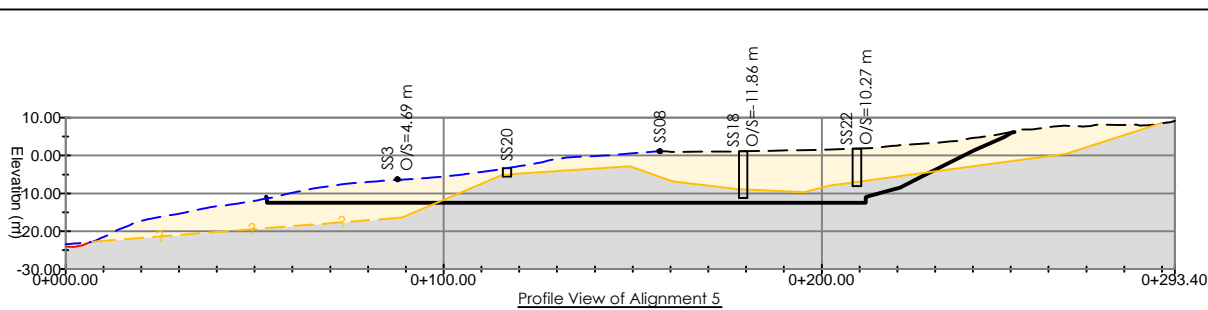
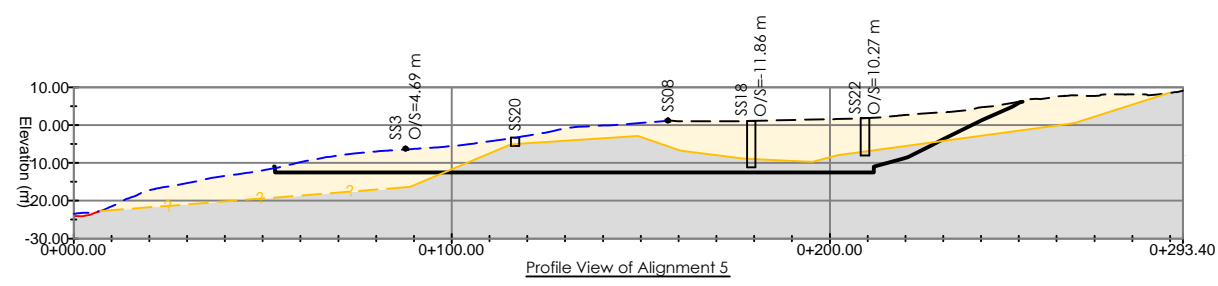
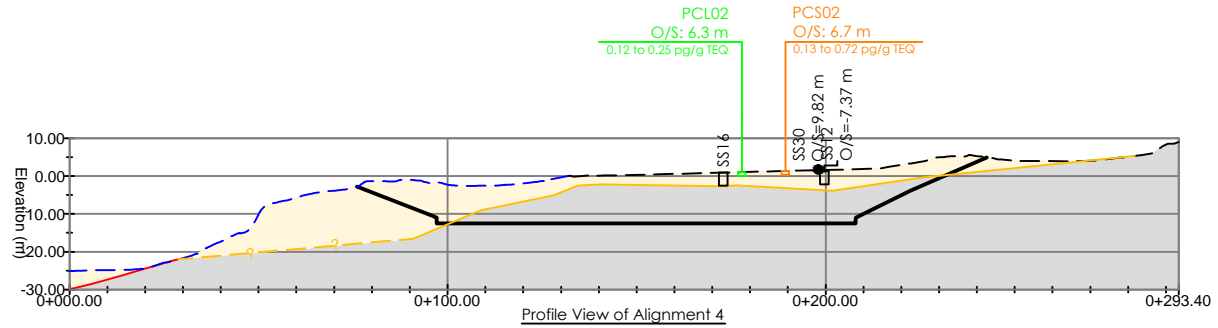
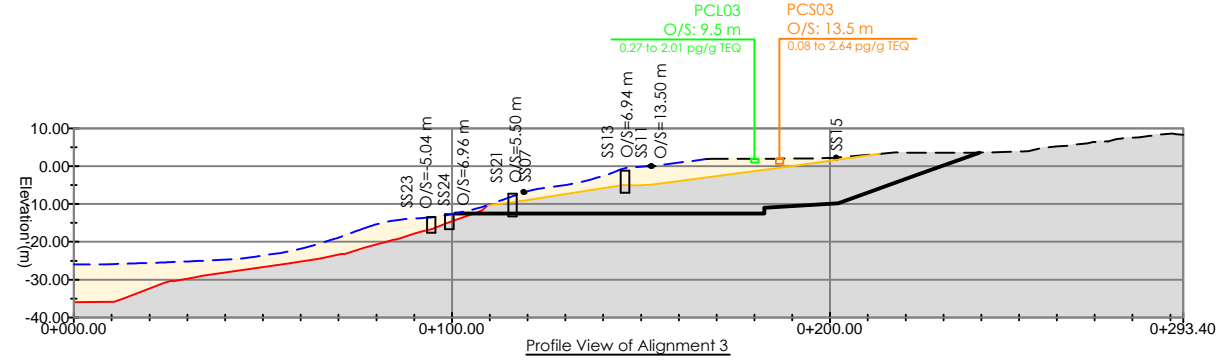
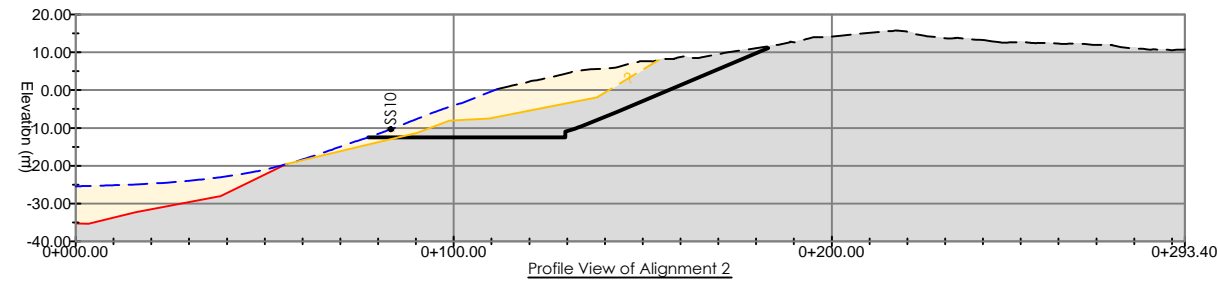
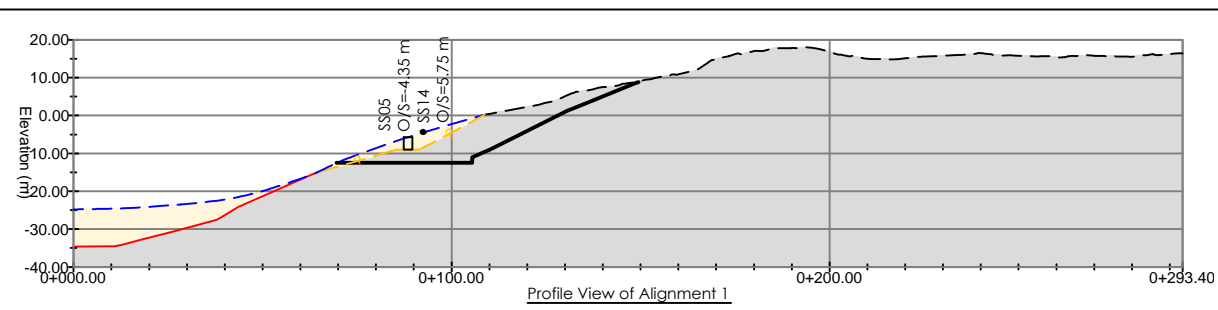
Project Location
 LELU ISLAND, BC

TITLE
PLAN VIEW OF DREDGE FOOTPRINT FOR MATERIALS OFF-LOADING FACILITY, SHOWING TRANSECTS FOR VERTICAL PROFILES AND SEDIMENT SAMPLING LOCATIONS

Dwg No. **1**

DISCLAIMER: The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any error or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

V:\1231\02\active\1231\0556\GIS\figures\mol_sediment_of_xsects\reduced_dwg\12320020_541_10_06.dwg
2015/08/06 4:23 PM By: Huynh, Gordon



LEGEND

- EXISTING GROUND SURFACE
- - - BATHYMETRY SURFACE
- BEDROCK SURFACE
- BEDROCK SURFACE INFERRED FROM SEDIMENT SAMPLES AND FUGRO BOREHOLES
- MOF DREDGE SURFACE
- █ BEDROCK
- █ SEDIMENT
- SURFACE GRAB SEDIMENT SAMPLE
- SEDIMENT CORE SAMPLE DEPTH
- O/S OFFSET

SCALE IN METRES
0 25 50 75 100
1:2000



Project Information
 Project No.: 12320020
 Scale: 1:2000
 Date: 2015-MAR-15
 Drawn by: G. HUYNH
 Checked by: B. BYRD
 Project Location
 LELU ISLAND, BC

Client/Project
 PACIFIC NORTHWEST LNG
 TITLE
**PROFILE VIEW OF DREDGE FOOTPRINT,
 ALIGNMENTS 1 TO 9, SHOWING LOCATIONS
 AND DEPTHS OF SAMPLING**
 Dwg No.
2

C:\1231\0\active\tb\12311053\6\gis\figures\mol_equipment_of_xsects\reduced_dwg\12320020.dwg
 2015/08/06 4:40 PM By: Huynh, Gordon

DISCLAIMER: The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any error or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

ORIGINAL SHEET - ANSI B

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

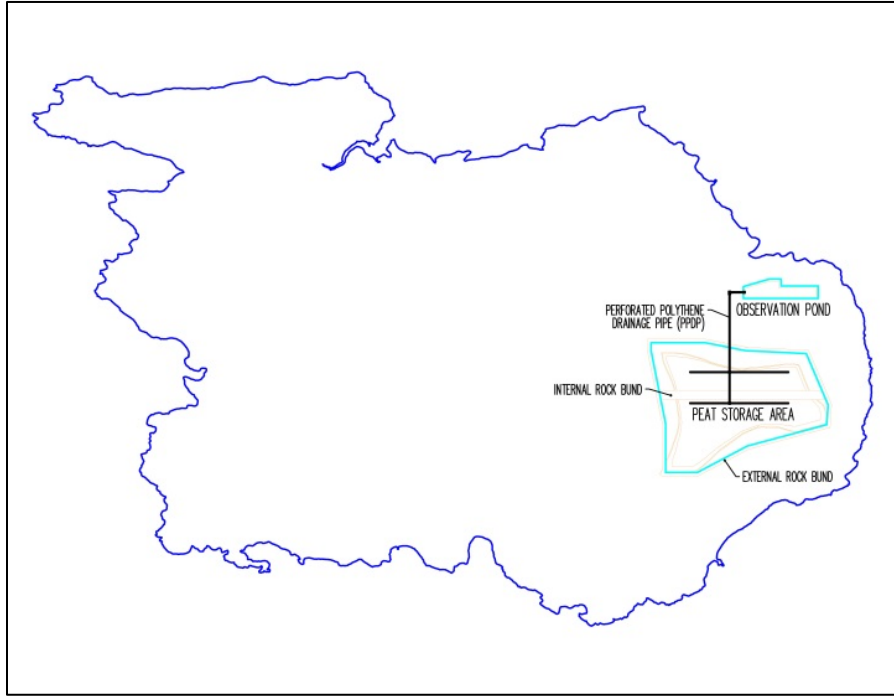


Figure 3 Proposed Location of Storage Area on Lelu Island

This area will be designed to accommodate placement of wet materials including peat and marine sediments. The peat/sediment storage area will be constructed on bedrock, with surrounding and internal bund (retaining) walls. Bund walls will be permeable and will contain solids; water will separate from the peat and sediment and seep into perforated polyethylene drainage pipes. It will then flow through a sediment pond and into an observation basin for monitoring and testing prior to discharge (Figure 4).

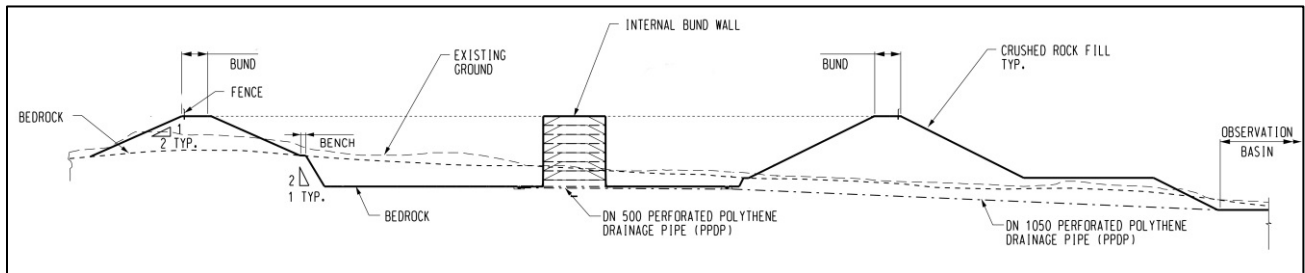


Figure 4 Cross Section of Proposed Storage Area

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

As required by the PRPA, an environmental monitoring plan will be developed and implemented for the disposal site. This will include wildlife and bird deterrence measures, and monitoring of the quality of water discharged from the observation basin. Water will be sampled prior to release to the receiving environment for parameters determined appropriate in consultation with the PRPA, which may include total suspended solids (TSS), salinity, pH, and metals, due to concerns with mobilization of metals from sediment in a potentially acidic peat environment.

It is not anticipated that the residual dioxins and furans in the sediments will affect the quality of water in the sediment pond or observation basin or migrate offsite in the drainage. This conclusion is due to their low water solubility and preferential sorption to soils, sediment and organic matter³. Once adsorbed to the organic carbon in the soil or sediment, persistent and lipophilic compounds such as dioxins and furans remain relatively unchanged in concentration due to their very long half-lives in soil and sediment⁴, as evidenced by their detection in sediments deposited in Porpoise Channel decades ago. As such, they would not be expected to migrate offsite with water-soluble tannins that may be present in the disposal site. The potential for leaching of dioxins and furans in acidic peat environments is considered low. An investigation of the roles of soil composition (e.g., peat vs. clay), organic matter content, dissolved organic carbon, and pH in leaching rates of hydrophobic organic chemicals (e.g., PCBs, dioxins and furans) found that leaching rates vary with the specific compound being investigated.⁵ In soils containing clay and peat, such as would be encountered in the disposal facility, leachability was negatively correlated with peat content (i.e., high peat resulted in low leachability) for the dioxin and furan congeners studied (namely 1,3,6,8-TCDD and 1,3,6,8-TCDF)⁶.

Similarly, it is not anticipated PAHs will affect the quality of the water in the sediment pond or observation basin as they were measured above detection limits (but below Canadian Council of Ministers of the Environment [CCME] probable effects levels) in only 3 of 81 sediment samples collected from the MOF⁷. Water quality monitoring results will be compared to BC water quality guidelines for protection of marine or freshwater aquatic life (as appropriate depending on outfall location) and reported monthly to the PRPA. In the event of guideline exceedances, flow to the outfall line would be shut off to allow treatment of water in the observation basin. No water will be discharged from the site unless it meets all water quality requirements established through PRPA permitting.

Further details of each element of the sediment disposal plan will be refined in the permitting phase, as engineering design progresses.

³ CCME. 2002. Canadian Soil quality guidelines for the protection of environmental and human health: Dioxins and Furans. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg. Available online at: <http://cegg-rcqe.ccme.ca/download/en/275>. Accessed July 22, 2015.

⁴ Fiedler, H. (ed.). 2003. The Handbook of Environmental Chemistry Vol. 3, Part O: Persistent Organic Pollutants. Available online at: <http://www.lu.lv/ecotox/publikacijas/DIOXINS.PDF>. Accessed July 30, 2015.

⁵ Badea, S.-L., Lundstedt, S., Liljelind, P., Tysklind, M.. 2013. The influence of soil composition on the leachability of selected hydrophobic organic compounds (HOCs) from soils using a batch leaching test. *Journal of Hazardous Materials*, 254–255, 26-35.

⁶ Ibid.

⁷ EIS/Application, Appendix L: Technical Data Report – Marine Sediment and Water Quality. February 7, 2014.

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

Effects of Disposing on Lelu Island

The on-land disposal of sediment will occur within the project development area (PDA), which will be cleared and leveled for construction of the facility. This clearing has been previously assessed in the EIS/Application. The spatial extent of clearing and grading for construction will not change as a result of the plan to dispose of the sediments on land. The water quality monitoring program that was planned for dewatering of the peat storage area will be applicable to the blended peat and sediment and has been designed to protect water quality in the adjacent marine environment.

Dioxin and furan concentrations in sediment from the MOF (maximum of 2.64 pg/g TEQ) are well below provincial standards described in the *Contaminated Sites Regulation (CSR)*, including:

- Schedule 7 Column II standards for relocation of soil to non-agricultural land (350 pg/g TEQ)
- Schedule 9 standards for typical (260 pg/g TEQ) and sensitive (130 pg/g) marine and estuarine environments

As a result, the material is chemically suitable for on-land management and deposition of MOF sediments on Lelu Island will not create a future contaminated soils management issue. Further, as the saline leachate (run-off) from the disposal area will be directed back into the marine environment, there is no risk of sodium and chloride toxicity to salt-intolerant plants and soil invertebrates in the forest buffer that will be retained around the perimeter of Lelu Island.

Accordingly, on-land disposal is not predicted to change the characterization of residual or cumulative effects to any biophysical valued component or to the current use of land and resources for traditional purposes by Aboriginal peoples. As a result, there is no change to the significance determinations presented in the EIS/Application and EIS Addendum.

EFFECTS ON OCEAN DISPOSAL AT BROWN PASSAGE

The volume of sediment to be disposed of at the Brown Passage ocean disposal site will be reduced by approximately 8,000 m³ as a result of the surface 1 m of sediment from the MOF dredge pocket being disposed of on land. This is expected to result in a minor decrease in the predicted change in sediment or water quality described in the Environmental Impact Statement (EIS) Addendum. Less sediment will be deposited at the Brown Passage disposal site and therefore the period of reduced water clarity through elevated total suspended solids (TSS) or turbidity will be less. Furthermore, as there are negligible levels of dioxins and furans in the sediment that will be disposed at Brown Passage, the risk of adverse effects on sediment quality, previously characterized as low in the EIS Addendum, will be eliminated.

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

CLOSURE

The disposal of sediment on Lelu Island will not result in any new disturbances or new effects from what has been considered in the EIS/Application and EIS Addendum. The storage area is within the PDA and this area will be cleared and leveled for construction of the facility (with or without the on-land disposal of marine sediments). Effects from the clearing have been assessed in the EIS/Addendum and remain unchanged. A review of the dioxin and furan concentrations in the sediments shows they are below the most conservative standards (sensitive marine environments) set out in the provincial Contaminated Sites Regulation. The PRPA's permitting process will provide oversight for land disposal of sediment and will require discharge water to be managed to applicable provincial water quality guidelines. All water discharge will also comply with other relevant regulations (e.g., the Fisheries Act prohibition against the deposition of deleterious substances). Further, disposal of the sediments on Lelu Island will eliminate the risk of adverse effects related to dioxins and furans at the Brown Passage disposal site.

Based on this analysis, residual and cumulative effects on the biophysical valued components and the current use of land and resources for traditional purposes remain not significant. If you have any questions, please contact Pacific NorthWest LNG.

Sincerely,

<Signature Removed>

Mike Lambert
Head, Environmental and Regulatory Affairs
Pacific NorthWest LNG