Soil Management Plan
Berth 2 Shiploader Replacement and Dumper 2 Replacement Projects

Neptune Bulk Terminals, North Vancouver, BC

Revision No. 0

Prepared for:
Neptune Bulk Terminals (Canada) Ltd.
1001 Low Level Road,
North Vancouver, BC V7L 1A7

Envirochem Project No.: 22026

August 12, 2022

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REVISION INDEX

Revision No.	Date	Description of Change	Initial
A	July 13, 2022	Issued to NBT for Review	PD
B	August 4, 2022	Addressed NBT comments and incorporated edits	AP
0	August 12, 2022	Issued as Revision 0	PD

Note: This document is intended to be a “living document” and subject to change based on changes which may occur for the Berth 2 Shiploader Replacement and Dumper 2 Replacement Projects at Neptune Bulk Terminals.

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ACRONYMS AND DEFINITIONS

Acronym	Definition
B1	Berth 1
B2	Berth 2
B2D2	Berth 2 and Dumper 2
B3	Berth 3
BC	British Columbia
BC ENV	British Columbia Ministry of Environment and Climate Change Strategy
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Plan
CEPA	Canadian Environmental Protection Act
CEQGs	CCME Canadian Environmental Quality Guidelines
CFMP	Chance Find Monitoring Program
CL	Commercial Land Use
CN	Canadian National Railway
CSR	Contaminated Sites Regulation
CWS	Canadian-Wide Standards for Petroleum Hydrocarbons in Soil
D2	Dumper 2
DEE	Director of Engineering and Environment
ECCC	Environment and Climate Change Canada
EM	Environmental Monitor
EMA	Environmental Management Act
EMS	Environmental Management System
ESC	Erosion and Sediment Control
ESMS	Excavated Soil Management Standard
FID	Flame Ionization Detectors
G3	G3 Terminal
Ha	Hectares
HEPH	Heavy Extractable Petroleum Hydrocarbons
HWR	Hazardous Waste Regulation
IL	Industrial Land Use
IL+	Greater Than Industrial Land Use
IL-	Less Than Industrial Land Use
LEPH	Light extractable petroleum hydrocarbons
mbgs	Metres Below Ground Surface
NBT	Neptune Bulk Terminals Ltd.

Acronym	Definition
PAHs	Polycyclic Aromatic Hydrocarbons
PCOCs	Potential Contaminants of Concern
PEL	Probable Effects Level
pH	Potential of Hydrogen
PHC	Petroleum Hydrocarbons
PID	Photoionization Detector
Port Authority	Vancouver Fraser Port Authority
RL	Residential Land Use
SHW	Suspect Hazardous Waste
SMP	Soil Management Plan
SRR	Spill Reporting Regulation
TCLP	Toxicity Characteristic Leaching Procedure
TDG	Transportation of Dangerous Goods Act
TG1	Technical Guidance 1
TWN	Tsleil-Waututh Nation
UCL	Upper Confidence Level
VOC	Volatile Organic Compounds
VPH	Volatile Petroleum Hydrocarbons
WaMP	Water Management Plan

1.0 INTRODUCTION

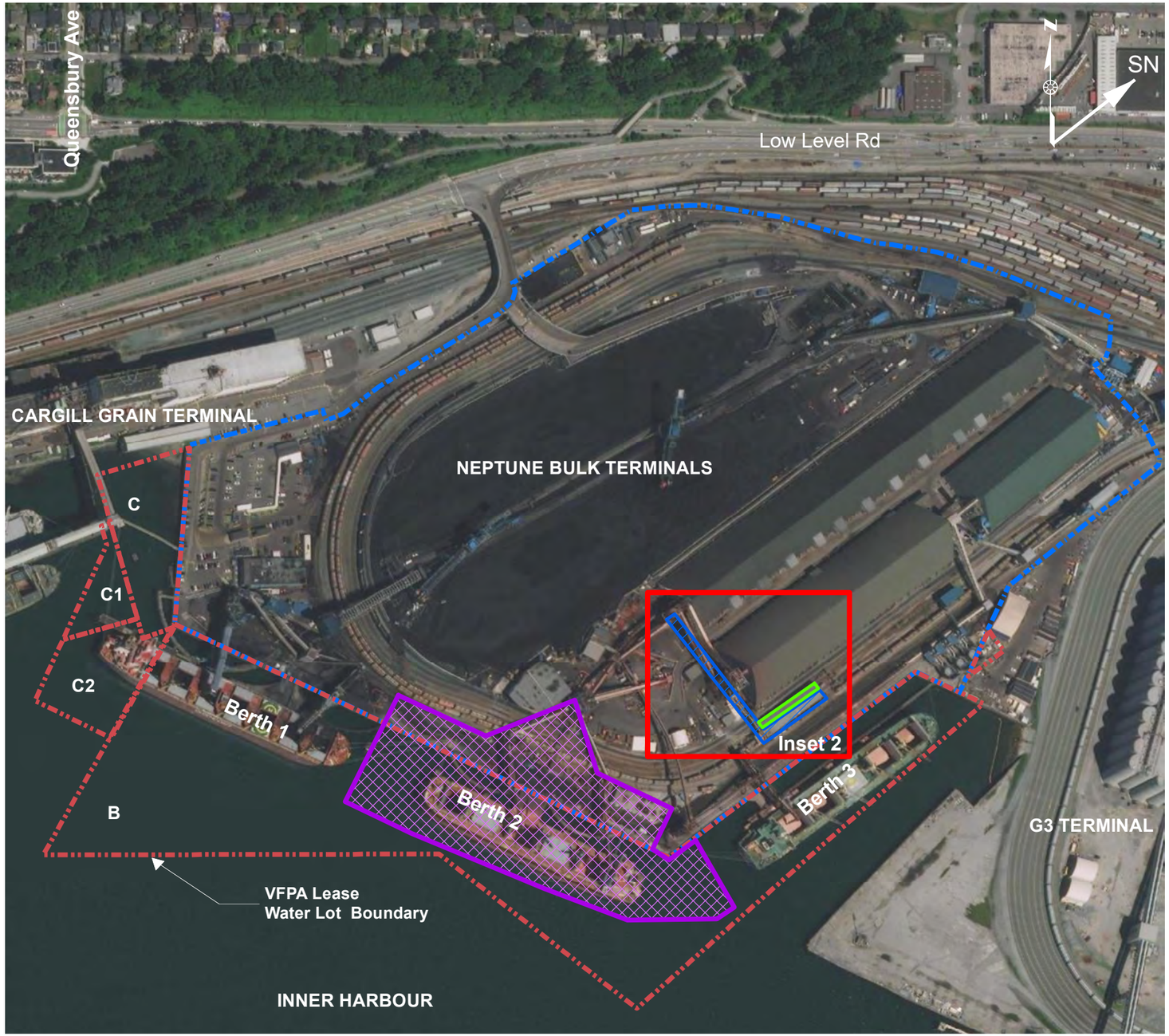
Neptune Bulk Terminals (Canada) Ltd. (NBT) is on the north shore of Vancouver Harbour in Burrard Inlet's Inner Harbour and is approximately 6.0 km southeast from the Lions Gate Bridge and 2.5 km northwest from the Second Narrows Bridge (49° 18.218'N, 123° 2.913'W). NBT located at 1001 Low Level Road, in the City of North Vancouver, British Columbia (BC) is a bulk materials handling venture of Canpotex Ltd. and Teck Resources Ltd. (the Terminal). The Terminal consists of covered and open stockpile storage areas, a rail yard, materials handling areas, and five shiploaders at three berths. The Terminal sits entirely in the Vancouver Fraser Port Authority (Port Authority) jurisdiction and is operated under tenancy by NBT. The Terminal is bounded on the South by the Inner Harbour of Burrard Inlet, and on the North by Low Level Road and commercial land-users, on the West and East by neighbours Cargill Grain Terminal (Cargill) and G3 Terminal (G3). The Terminal location is shown in **Figure 1**.

1.1 SMP Objective

The B2 Shiploader Project (B2 Project) and the D2 Potash Replacement Project (D2 Project), are collectively referred to as the B2D2 Project, and are considered maintenance works to facilitate ongoing operations. A more detailed description of the B2D2 Project is provided in Section 1.3 and Section 3 of the B2D2 Project Construction Environmental Management Plan (CEMP) (NBT, 2022). The Project footprint is considered the maximum extent of the boundaries of the respective Project footprints for B2 and D2. The B2D2 Project footprints are depicted in **Figure 1**.

Envirochem Services Inc. (Envirochem) was retained by Neptune Bulk Terminals (Canada) Ltd. (NBT) to prepare a Soil Management Plan (SMP) as part of the B2D2 Project. Supporting information has been provided by Worley Canada Services Ltd., operating as Advisian, who has completed soil characterization investigations at B2 and D2. The B2D2 Project SMP provides guidance for characterization, handling, storage, reuse, and disposal of soil to be excavated during B2D2 Project, and should be utilized in conjunction with the B2D2 Project CEMP and applicable permits and regulatory approvals.

The B2D2 Project SMP has been developed in accordance with the Port Authority CEMP Guidelines (Port Authority, 2018), and with consideration given to the Tsleil-Waututh Nation (TWN) CEMP Requirements (TWN, 2022) and NBT's Excavated Soil Management Standard (ESMS) contained within the NBT Environmental Management System (EMS) Manual (NBT, 2021).



INSET 1

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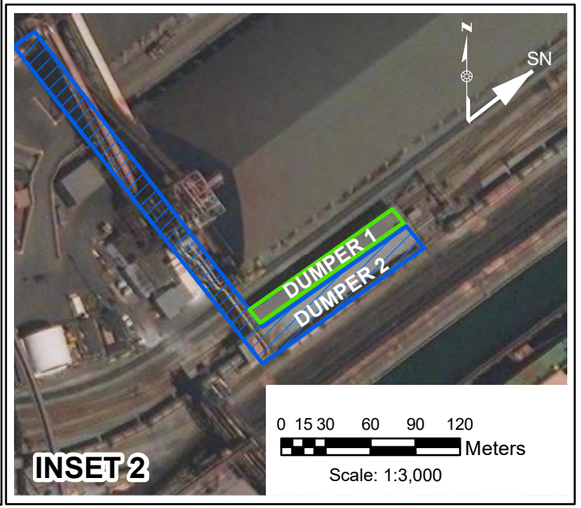
Scale: 1:4,000

0 0.5 1 2 3 4 (km)

Scale: 1:100,000



0 15 30 60 90 120 Meters

Scale: 1:3,000

LEGEND

- Berth 2 Project Footprint
- Dumper 2 Project Footprint
- Dumper 1
- Property Line
- Water Lot Boundary

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NOTE:
- Aerial image is downloaded from Google EarthPro.(2019)
- Original drawing is ANSI full bleed B (11.00 x17.00 Inches) and in color
- N is true north, and SN is site north.

Title: Terminal Location and Project Footprint	Figure No: 1	Rev. No: 00
Client: Neptune Bulk Terminals (Canada) Ltd.	Date: March, 2022	
Project: Berth 2 Shiploader Replacement and Dumper 2 Replacement	Project: 20226	
Site Location: 1001 Low Level Road, North Vancouver, BC	Drawn: HL	Checked: AP

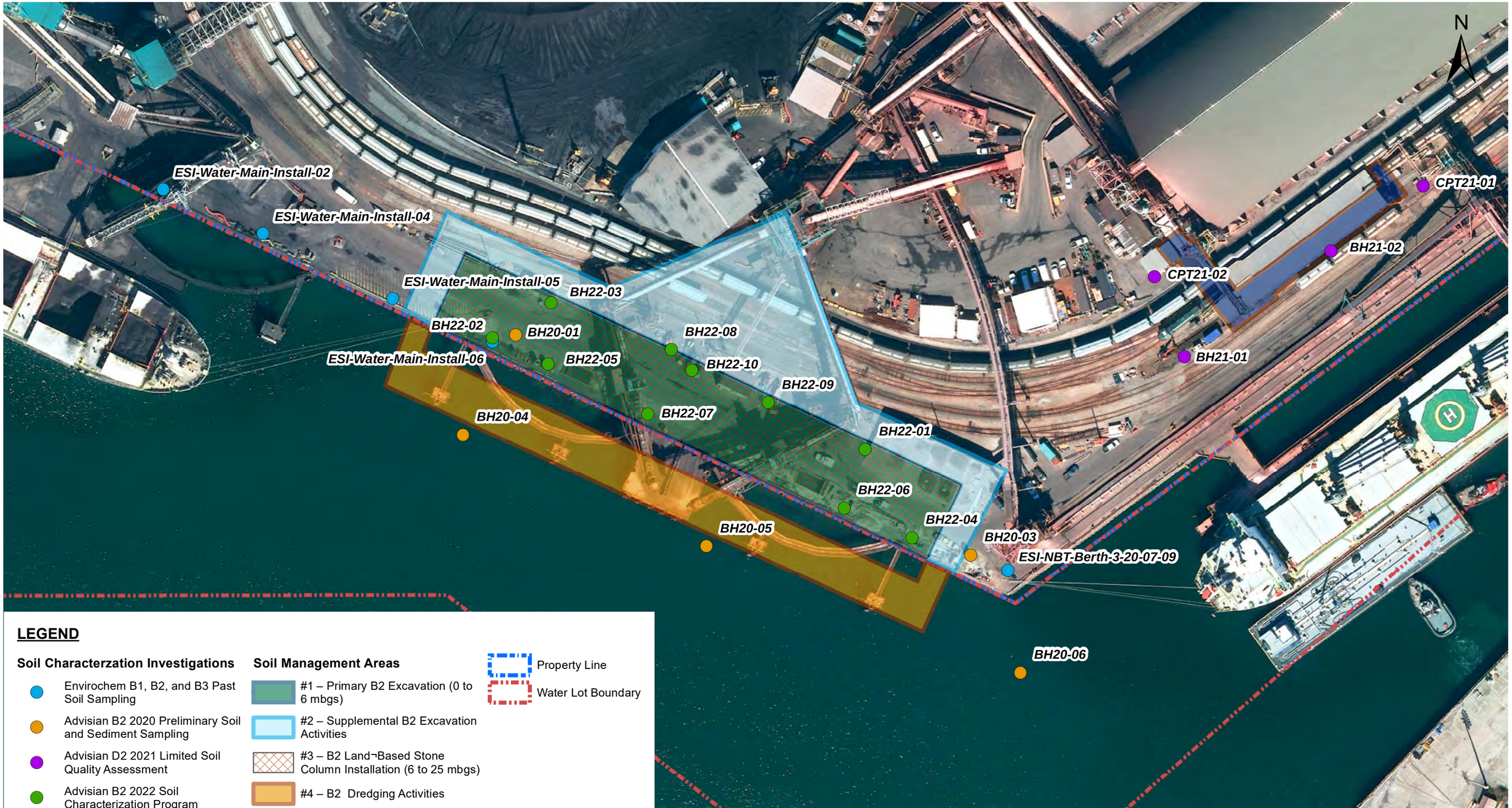
1.2 Soil Management Areas and Excavation Methodologies

Based on the B2D2 Project construction activities, five distinct soil management areas have been identified within the B2D2 Project footprint which are summarized in **Table 1** and presented on **Figure 2**.

Table 1: B2D2 Project Soil Management Areas

Soil Management Area	Description and Expected Soil Volume	Applicable Design Drawings
#1 – Primary B2 Excavation	This large excavation at B2 involves the removal of approximately 30,000 m^3 of soil (the excavation is approximately 185 m long, 27 m wide, and 6 m deep) to expose existing anchor rods for demolition, allow installation of new anchor rods for the combi-wall, and facilitate stone-column installation. This soil management area was the focus of the Advisian B2 2022 Soil Characterization Program (see Section 3.3.3).	**Appendix A:** Drawing No. 317071-00041-02-MA-DGA-1504 and Drawing No. 317071-00041-02-MA-DGA-1508
#2 – Supplemental B2 Excavation Activities	An estimated 198 m^2 of building footprints will require excavation at B2 outside of the primary excavation. These supplemental excavations are anticipated to be relatively shallow and should result in less than 1,000 m^3 of soil.	**Appendix A:** Drawing No. 02-EN-DGA-6002
#3 – B2 Land-Based Stone Column Installation	Land-based stone column installation at B2 will displace approximately 13,500 m^3 of soil (670 stone columns installed over an area of 4,672 m^2; each column has a 1 m diameter and will be installed to a depth of approximately 25 meters below ground surface (mbgs)).	**Appendix A:** Drawing No. 02-EN-DGA-6002 and Drawing No. 317071-00041-02-MA-DGA-1508
#4 – B2 Dredging Activities	Dredging of sediment may be required to stabilize the existing B2 slope for scour protection placement. There are no plans for reuse or disposal at sea – sediment will be characterized and disposed at an approved facility. The anticipated extent of dredging is up to 1 m over an area of 3,632 m^2 for a total volume of less than 4,000 m^3 of sediment.	**Appendix A:** Drawing No. 02-EN-DGA-6001
#5 – D2 Excavation Activities	Targeted excavation activities are required to support D2 demolition including removal of soil over the conveyor tunnel and from between the sheetpiles and dumper walls. An estimated 2,650 m^3 of material is required to be excavated, up to a maximum excavation depth of approximately 12 mbgs. There is no intention to reuse any of the D2 soil, and hence it will only be considered for disposal purposes.	**Appendix B:** Drawing No. 317086-36588-00-GE-DGA-8000 through Drawing No. 317086-36588-00-GE-DGA-8004

Land-based excavation activities will be completed with equipment such as excavators and/or cranes with a clamshell bucket. Stone column installation will be completed with a vibro-replacement 'bottom feed' technique wherein a feeder probe will be inserted with air and water injection until target depth reached. Gravel will then be backfilled from bottom upwards. Dredging will be conducted with a crane mounted on a barge using a clamshell bucket. Various trucks (e.g., dump trucks, tandem trucks, truck-and-pups, etc.) will be used to haul soil and/or sediment.



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NOTE:
- Aerial image is downloaded from Google EarthPro.(2019)
- Original drawing is ANSI full bleed B (11.00 x17.00 Inches) and in color

Scale:

0 10 20 40 60 80 M

Scale: 1:1,250

Title: Soil Management Areas and Soil Investigation Locations	Figure No: 2	Rev. No: 00
Client: Neptune Bulk Terminals (Canada) Ltd.	Date: August 2022	
Project: Berth 2 Shiploader Replacement and Dumper 2 Replacement	Project: 22026	
Site Location: 1001 Low Level Road, North Vancouver, BC	Drawn: HL	Checked: AP

Fig2- B2D2 Project Soil Management Areas & Soil Investigation Locations-22026

1.3 Terminal Setting and Soil Characterization History

The Terminal is located on the industrialized waterfront of the north shore of Burrard Inlet's Inner Harbour. The Terminal, developed in 1970 sits on a shoreline that has experienced industrial activity for the past century. A large portion of the Terminal has been developed on reclaimed land extending seaward (south) into Burrard Inlet from the historical shoreline. The historical shoreline runs parallel to the Canadian National Railway (CN) rail line at the North end of the Terminal. The land portion of the Terminal is relatively flat, largely paved with product storage and rail areas, or areas covered with sand, ballast and/or gravel.

Contaminated soils have been previously encountered at the Terminal. To properly manage historical and present-day soil contamination, an ESMS was prepared by NBT. The ESMS governs sampling, handling, disposal, and delivery of soil/aggregate and is followed for construction and operations projects that involve ground disturbance to manage known and unforeseen areas of contamination. Notwithstanding, the B2D2 Project SMP was developed as a project-specific document which supersedes the ESMS.

As contaminated soils have been previously encountered at the Terminal, past analytical data was examined and several soil characterization investigations were conducted to support the B2D2 Project and development of the B2D2 Project SMP. These investigations are summarized below and discussed in greater detail in **Section 3**. The locations of these soil characterization investigations are shown on **Figure 2**.

- Past soil sampling at Berth 1 (B1), B2, and Berth 3 (B3) conducted by Envirochem. This sampling was undertaken in 2020 and 2021 to support utility replacement projects separate from the B2D2 Project, but overlaps with the B2 Project footprint.
- Berth 2 Shiploader Replacement Sediment and Soil Characterization Report (Advisian, 2021a). This soil and sediment sampling was conducted in 2020 to directly support the B2 Project.
- Potash Dumper No.2 Replacement Limited Soil Quality Assessment (Advisian, 2021b). This soil sampling was conducted in 2021 to directly support the D2 Project.
- Berth No. 2 Soil Investigation Supporting Preliminary Foundation Design for the Berth No. 2 Combi Wall (Advisian, 2022). This soil sampling was conducted in 2022 to directly support the B2 Project.

2.0 REGULATORY FRAMEWORK

2.1 Applicable Standards, Guidelines, Regulations, and Act

The Terminal is located on Federal-leased land that is managed by the Port Authority. The primary element of the federal legislative framework for protecting the environment and human health comes under the *Canadian Environmental Protection Act* (CEPA) enacted in 1999. With respect to the assessment and management of soil quality, the federal government has produced soil quality guidelines under the Canadian Council of Ministers of the Environment (CCME) and the Canada Wide Standards for Petroleum Hydrocarbons in Soil (CWS). These guidelines can often be useful as a screening tool but may have limited application in many cases with respect to the Terminal.

The provincial government is responsible for regulating and cleaning up contaminated lands within their jurisdiction, which, at NBT, generally applies to most soil potentially moving offsite. This is primarily executed through the BC *Environmental Management Act* (EMA) and associated regulations under the BC Ministry of Environment and Climate Change Strategy (BC ENV). Through one of these regulations, the BC Contaminated Sites Regulation (CSR), the provincial government has established various numerical standards to support the evaluation of soil quality within BC, which are based on land-use. These standards are useful for characterizing soil quality for offsite disposal but can also be useful for evaluating soil quality and potential for impacts onsite. The BC Hazardous Waste Regulation (HWR) defines and regulates hazardous waste in BC and is an important component for evaluating soils and materials for offsite disposal. Based on soil quality data to date, hazardous wastes are not expected at the Terminal, but may be generated as part of construction activities (e.g., contaminated soils resulted from spills).

There are various other standards, guidelines, regulations, and acts with implications on soil management such as the *Transportation of Dangerous Goods Act*, *BC Heritage Conservation Act*, and *BC Wildlife Act*, among others. The standards, guidelines, regulations, and acts relevant to the B2D2 Project are summarized in Section 2 of the B2D2 Project CEMP.

2.1.1 Canadian Council of Ministers of the Environment (CCME) and Canada-Wide Standards for Petroleum Hydrocarbons in Soil (CWS)

The CCME, specifically, the CCME Canadian Environmental Quality Guidelines (CEQGs) provides numerical quality guidelines for soil, sediment, and water specific to various land, sediment and water uses. The land use categories outlined in the CCME are Industrial, Commercial, Residential/Parkland, and Agricultural.

For the B2D2 Project, relevant guidelines include:

- Canada-Wide Standards for Petroleum Hydrocarbons in Soil (CWS)
- Canadian Soil Quality Guidelines for the Protection of Environment and Human Health:
  - Commercial (CL) and Industrial (IL)
- Canadian Sediment Quality Guidelines for the Protection of Aquatic Life:

- Interim Sediment Quality Guideline (ISQG), which is based on the Threshold Effects Level (TEL), or the concentration of an analyte below which adverse biological effects are rarely expected (less than 25% of the time); and
- Probable Effects Level (PEL) concentration, which is the level at which adverse biological effects occur more than 50% of the time.

2.1.2 BC Environmental Management Act (EMA)

BC *Environmental Management Act* (EMA) regulates waste discharge, pollution, hazardous waste, contaminated site remediation, and spill reporting requirements. The EMA prohibits the introduction of waste into the environment, except in the accordance with a regulation, permit, or approval code under the act. The associated regulations relevant to the B2D2 Project are as follows:

- Contaminated Sites Regulation (CSR): The BC CSR sets out the requirements for contaminated sites investigation and remediation. This includes site identification, soil relocation, handling, and disposal, investigative and remedial approaches, and determination of appropriate remediation standards.
  - For the B2D2 Project, the following site-specific factors have been considered in the selection of BC CSR Residential Low Density (RL_{LD}), Commercial (CL), and Industrial (IL) Land Use Standards:
    - Human health protection - Intake of contaminated soil;
    - Human health protection - Groundwater used for drinking water;
    - Environmental protection - Toxicity to soil invertebrates and plants; and
    - Environmental protection - Groundwater flow to surface water used by marine aquatic life.
- Spill Reporting Regulations (SRR): Section 91.2 of the EMA identifies the requirements for reporting a spill. There are three components to reporting a spill under SRR: Initial report, update to minister report, and end of spill report.
- Hazardous Waste Regulation (HWR): The BC HWR sets out requirements for hazardous waste storage and disposal. Any person, partnership, or company in BC that produces, stores, treats, recycles or discharges more than a prescribed quantity of hazardous waste must register with the ministry and get a Provincial Identification Number. The prescribed quantities can be found in Schedule 6 of the BC HWR.

3.0 ANTICIPATED SOIL QUALITY

3.1 Expected Contaminants in Soil at B2 and D2

Given the nature of the onsite industrial activities and proximity to the marine environment, potential contaminants of concern (PCOCs) that may be encountered in soil include:

- Metals
- Sodium and chloride ions (Na & Cl)
- Light extractable petroleum hydrocarbons (LEPH)
- Heavy extractable petroleum hydrocarbons (HEPH)
- Polycyclic aromatic hydrocarbons (PAH)
- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Petroleum Hydrocarbons (PHC)
- Volatile petroleum hydrocarbons (VPH)
- Volatile organic compounds (VOC)

3.2 Summary of Soil Characterization Investigations

To prepare for the management of soils excavated during the B2D2 Project, soil material was characterized at the Terminal through several environmental investigations completed by Advisian and Envirochem (introduced in **Section 1.3**). These reports are not appended to the B2D2 Project SMP but can be provided upon request. A high-level summary of the findings of each of the soil characterization investigations is provided in **Table 2**. Each of these investigations and their relevance to the B2D2 Project SMP are discussed in greater detail in **Section 3.3** (for B2) and **Section 3.4** (for D2). The locations investigated in these soil characterization investigations are presented on **Figure 2**.

Table 2: Summary of Soil Characterization Investigations

Investigation	Location	# of Samples Analyzed	Depths	Analysis Conducted	Soil Investigation Findings*
Envirochem B1, B2, and B3 Past Soil Sampling	B1, B2, B3	5 soil samples	0.5 to 2.0 mbgs	Metals, Na & Cl, LEPH, HEPH, PAH, BTEX, and/or VOC	Chloride, Nickel > BC CSR IL
Advisian B2 2020 Preliminary Soil and Sediment Sampling	B2	4 soil samples 5 sediment samples	Soil: 0 to 1 mbgs Sediment: 0 to 2 mbgs	Metals and PAH	Soil: Metals, PAH < BC CSR IL Sediment: Metals, PAH > CCME ISQGs and PELs
Advisian D2 2021 Limited Soil Quality Assessment	D2	10 soil samples	0 to 6.7 mbgs	Metals, LEPH, HEPH, BTEX, PHC, and/or VPH	Benzene > CSR IL and CCME IL Toluene, Ethylbenzene > CCME IL Nickel > CSR IL and CCME IL pH outside CCME IL range
Advisian B2 2022 Soil Characterization Program	B2	88 soil samples	0.60 to 7.95 mbgs	Metals, Na & Cl, LEPH, HEPH, PAH, BTEX, PHC, VPH, and/or VOC	Chloride > BC CSR IL Nickel > CCME IL pH outside CCME IL range

Table Notes:
* See the following sections for a more thorough description of the analytical results

3.3 B2 Soil Characterization Investigations

3.3.1 Envirochem B1, B2, and B3 Past Soil Sampling

During 2020 and 2021, Envirochem collected 5 soil samples at B1, B2, and B3 to support utility installation projects separate from the B2D2 Project. Sample locations are shown in blue on **Figure 2**. One sample (ESI-Water-Main-Install-06) was collected from within the B2 Project footprint.

Samples ranged in depth from 0.5 mbgs to 2 mbgs, and were analyzed for metals, sodium and chloride ions, LEPH, HEPH, PAH, BTEX, and/or VOC. All concentrations were less than BC CSR IL and RL_{LD} standards, with the exception of chloride in sample ESI-Water-Main-Install-05 exceeding RL_{LD} standards, and chloride and nickel in Sample ESI-NBT-Berth-3-20-07-09 exceeding BC CSR IL standards. It is noted that the applied standards were used to support disposal characterization and may not be suitable for assessing the material for reuse (i.e., the applied standards may potentially be too conservative as site-specific factors were not evaluated for their applicability).

Overall, parameters from the sample collected within the B2 Project footprint were less than BC CSR IL standards. However, the results of the other samples suggest that chloride and nickel are potential PCOCs which may be encountered at or near the B2 Project.

3.3.2 Advisian B2 2020 Preliminary Soil and Sediment Sampling

Advisian completed a soil and sediment sampling program at B2 from November 13 to 19, 2020 (Advisian, 2021a). A total of 5 locations (2 terrestrial and 3 marine) were sampled as shown in orange on **Figure 2**.

Soil

A total of 4 soil samples were collected from the terrestrial sample locations (i.e., BH20-01 and BH20-03) at depths ranging from 0 mbgs to 1 mbgs. Samples were analyzed for metals and PAH. All metal and PAH concentrations were less than the applied BC CSR IL standards.

Despite the absence of contamination, these results are insufficient to characterize the soil to be excavated from the B2 Project footprint for the purpose of offsite disposal and/or potential onsite reuse (i.e., the samples are not representative of soil up to a depth of 6 mbgs and a large portion of the proposed excavation area remains uncharacterized). Accordingly, a more thorough B2 soil characterization program was conducted in June 2022 to supplement these findings (see **Section 3.3.3**).

Sediment

A total of 5 sediment samples were collected from the marine sample locations (i.e., BH20-04, BH20-05, and BH20-06) at depths ranging from 0 mbgs to 2 mbgs. Samples were analyzed for metals and PAH. Select metals (arsenic, cadmium, copper, and zinc) and PAH (2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo[a]anthracene, Benzo[a]pyrene, Chrysene, Dibenzo[a,h]anthracene, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, and Pyrene) concentrations were greater than the applied CCME Marine ISQGs and PELs.

Based on these sediment quality results, NBT has confirmed that sediment will be treated as contaminated and disposed at an appropriate offsite disposal facility. There are no plans for reuse of sediment at the Terminal or for disposal-at-sea of excess sediment generated during dredging (i.e., from soil management area #4) or from marine stone column installation. However, based on the sample locations in **Figure 2**, the sediment samples were not collected from within the proposed dredge area, and hence an insufficient amount of data is currently available to adequately characterize the B2 sediment from soil management area #4 for offsite disposal.

3.3.3 Advisian B2 2022 Soil Characterization Program

Between April 29 to May 4, 2022, Advisian advanced ten boreholes (BH22-01 through BH22-10; locations shown in green on **Figure 2**) within the limits of the proposed primary B2 excavation (i.e., soil management area #1) via a combination of hydrovac and sonic drilling to a maximum depth of 8.0 mbgs. The soil stratigraphy was generally described as a surface layer of asphalt overlaying a gravel and/or gravelly sand layer above a sand layer. The upper gravel and/or gravelly sand layer (henceforth referred to as the "upper soil layer") was present below the asphalt to a depth of 0.3 mbgs to 2.0 mbgs (varies by borehole). The sand layer was present below this depth to the termination depth of each borehole (termination depth ranging from 5.9 mbgs to 8.0 mbgs) (henceforth referred to as the "lower soil layer").

As part of the soil characterization program, a total of 88 soil samples (including 7 duplicates) were collected and analyzed for PCOCs including metals, sodium and chloride ions, LEPH, HEPH, PAH, BTEX, PHC, VPH, and/or VOC. Samples were compared against the following regulatory standards/guidelines:

- BC CSR CL and IL Standards with the following pathway and receptor specific matrix standards:
  - Human health protection - Intake of contaminated soil;
  - Human health protection - Groundwater used for drinking water;
  - Environmental protection - Toxicity to soil invertebrates and plants; and
  - Environmental protection - Groundwater flow to surface water used by marine aquatic life.
- CCME IL guidelines

All sample concentrations were less than the applied standards/guidelines with the exception of the following:

- Chloride exceeded the BC CSR CL and IL standards for groundwater used for drinking water (100 mg/kg) in 80 of the 88 analyzed samples;
- pH was greater than the CCME IL guideline range (6.0 to 8.0) in 81 of the 88 analyzed samples; and
- Nickel exceeded the CCME IL soil quality guideline (89 mg/kg) in 2 of the 88 analyzed samples.

To evaluate the suitability of the material for potential reuse, the nickel and chloride concentrations were statistically evaluated for the bulk soil volume for each of the two distinct soil layers encountered (e.g., the upper soil layer and the lower soil layer). The statistical software ProUCL was utilized to calculate the 95th

upper confidence level (UCL) for chloride and nickel in each of these layers[1]. The results of this analysis are summarized in **Table 3** and **Table 4**, with additional information including input data, histograms, and ProUCL output files provided in **Appendix C**. The 95th UCL for pH was not calculated, as pH is a logarithmic (e.g., non-linear) parameter. Furthermore, pH is not inferred to represent a concern for assessing the suitability of the material for reuse or disposal.

Table 3: Statistical Analysis for Chloride at B2 (mg/kg)

Soil Layer	# of Samples	Minimum	Average	95th UCL	Maximum	Most Stringent Standard/Guideline
Upper	8	147	626	929	1480	100[a]
Lower	73	62	350.6	393	1370	

Table Notes:
a – BC CSR CL and IL Standard for groundwater used for drinking water

Table 4: Statistical Analysis for Nickel at D2 (mg/kg)

Soil Layer	# of Samples	Minimum	Average	95th UCL	Maximum	Most Stringent Standard/Guidelines
Upper	8	5.48	13.9	28.2	42.7	70[a] or 89[b]
Lower	73	4.31	12.8	23.9	122	

Table Notes:
a – BC CSR CL and IL Standard (when pH < 7.5) for groundwater used for drinking water and groundwater flow to surface water used by marine aquatic life
b – CCME IL Guideline (i.e., the next most stringent standard/guideline when pH > 7.5)

Chloride Discussion:

The 95th UCL for chloride in both the upper soil layer (929 mg/kg) and the lower soil layer (393 mg/kg) is greater than the BC CSR CL and IL standard for groundwater used for drinking water (100 mg/kg). This is anticipated to be a reflection of the soil being sourced from dredged material. However, Protocol 21 for Contaminated Sites – Water Use Determination (BC ENV, 2017) provides guidance as to the applicability of current and future drinking water use at a site.

According to Protocol 21, current drinking water use applies where the groundwater or surface water at or near a site is currently used for drinking water. Nearby drinking water wells or surface water intakes are defined as those located within a radial distance of 500 metres from the property boundary. If the groundwater flow direction has been reliably determined using approved methods, nearby current uses may be limited to include drinking water wells or surface water intakes located 100 metres upgradient and 500 metres cross-gradient and downgradient of the property boundary.

A review of the BC Groundwater Wells Search Tool (BC Government, 2022) identified the following:

- The nearest groundwater well that may be used for water supply (Well Tag Number 105722; private domestic water use) is located approximately 300 m to the northeast of the Terminal. It is possible that this well is no longer used for water supply, as the property is currently occupied by the MEC

[1]Where duplicate pairs existed, they were treated as a single sample for the purpose of this statistical analysis. The highest concentration for chloride and nickel from the original and duplicate sample was selected for use in the statistical analysis.

North Vancouver outdoor sports store and is unlikely to source domestic water from a groundwater well. This well is located upgradient of the inferred groundwater flow direction at B2 (i.e., towards Burrard Inlet).

- There is also a groundwater well (Well Tag Number 71236; unknown water use) located at the very northeast portion of the Terminal. The well record indicates that the well was completed in June 1967, and hence is unlikely to still be active due to age.

Therefore, there do not appear to be any drinking water wells within 100 meters upgradient of the Terminal property boundary. Hence, current drinking water use likely does not apply.

According to Protocol 21, future drinking water use applies to all drinking water aquifers below a site whether or not current drinking water use applies. However, there are various exemptions. Specific to B2, saturated geological units are considered to have unsuitable water quality for domestic water supply (and hence future drinking water use does not apply) if the geologic unit is located within and below filled former marine and estuarine foreshore. As the B2 Project footprint is located on reclaimed land extending south into Burrard Inlet from the historical shoreline (i.e., located on marine fill), future drinking water use would likely not apply.

Excluding the BC CSR CL and IL standards for groundwater used for drinking water (100 mg/kg) as a screening criterion, then the next most stringent BC CSR CL and IL standard for chloride is groundwater flow to surface water used by aquatic life (600 mg/kg). However, this standard is to protect freshwater aquatic life, and hence doesn't apply to the B2 marine environment. Therefore, the next most stringent BC CSR CL and IL standard for chloride is toxicity to soil invertebrates and plants (2,500 mg/kg).

The 95th UCL for chloride in both the upper soil layer (929 mg/kg) and the lower soil layer (393 mg/kg) is less than the BC CSR CL and IL standard for toxicity to soil invertebrates and plants (2,500 mg/kg).

Nickel Discussion:

The 95th UCL of nickel in both the upper soil layer (28.2 mg/kg) and the lower soil layer (23.9 mg/kg) is less than the most stringent CSR standard and CCME guideline applied (70 mg/kg [pH dependent] or 89 mg/kg, respectively).

Suitability of the B2 Excavation Material for Onsite Reuse:

Based on these results, the soil material from the primary B2 excavation footprint to a depth of approximately 6 mbgs (i.e., soil management area #1) would be characterized as less than BC CSR IL standards (IL-) and, therefore, suitable for reuse onsite. Other areas of B2 (soil management area #2 and #3) remain insufficiently characterized for potential reuse due to an absence of data in these excavation footprints/depths.

Classification of the B2 Excavation Material for Offsite Disposal:

Soil disposal facilities often do not consider site-specific pathways when characterizing material (i.e., most stringent site-specific factor/standard is applied). Hence, the material from soil management area #1 would likely be characterized as greater than BC CSR IL standards (IL+) for disposal purposes. Other areas of B2 (soil management area #2 and #3) remain insufficiently characterized for disposal purposes due to an absence of data in these excavation footprints/depths.

3.4 D2 Soil Characterization Investigations

3.4.1 Advisian D2 2021 Limited Soil Quality Assessment

Advisian completed a limited soil quality assessment in the vicinity of the D2 Project footprint from July 5 to 10, 2021 (Advisian, 2021b). Four boreholes were advanced as shown in purple on **Figure 2**.

A total of 28 soil samples were collected, of which 10 soil samples (including 1 duplicate) at depths ranging from 0 mbgs to 6.7 mbgs were submitted for analysis of PCOCs including metals, LEPH, HEPH, PAH, BTEX, PHC, and/or VPH. Concentrations were less than the applied screening criteria (BC CSR CL and IL standards, CCME IL guidelines, and CWS guidelines), with the following exceptions:

- BH21-01 SA2 (0.8 to 1.5 mbgs):
  - Benzene greater than CSR CL and IL standards and CCME IL guidelines.
  - Toluene and ethylbenzene greater than CCME IL guidelines.
  - Nickel greater than CSR CL and IL standards and CCME IL guidelines.
- BH21-01 SA4 (2.3 to 3.0 mbgs):
  - Benzene, toluene, and ethylbenzene greater than CCME IL guidelines.
  - pH outside the CCME IL guideline range.
  - Nickel greater than CSR CL and IL standards and CCME IL guidelines.
- BH21-01 SA7 (4.6 to 5.4 mbgs), BH21-02 SA1 (0.0 to 0.8 mbgs), and CPT21-02 SA1 (0.0 to 0.8 mbgs)
  - pH outside the CCME guideline range.
  - Nickel greater than CSR CL and IL standards and CCME IL guidelines.
- BH21-02 SA5 (3.6 to 3.8 mbgs), BH21-02 SA9 (6.5 to 6.7 mbgs), and CPT21-01 SA1 (1.2 to 1.8 mbgs)
  - pH outside the CCME guideline range.

These results provide insight into potential soil contamination that could be encountered during construction activities at D2. However, as the excavation activities for D2 are relatively localized to the dumper and conveyor structures and at depths of up to 12 mbgs, the collected soil samples may not be representative of the soil which will be excavated (i.e., the collected samples do not represent soil over the conveyor tunnel, and only BH21-02 represents soil near the dumper walls).

Classification of the D2 Excavation Material for Offsite Disposal:

Although it is understood that the D2 soil is only being considered for disposal purposes (i.e., no plans for material reuse), an insufficient amount of data is currently available to adequately characterize the soil from the D2 excavation activities (i.e., soil management area #5). Further characterization should be conducted of the material that is excavated and stockpiled during construction.

4.0 SOIL MANAGEMENT PLAN

This section provides recommendations for implementation during excavation activities and the overall management of excavated soil materials for the B2D2 Project. The details in the following sections should be utilized in conjunction with the B2D2 Project CEMP and applicable permits and regulatory approvals to successfully carry out B2D2 Project activities.

4.1 General Soil Management Procedures

Based on the soil quality results described in **Section 3**, a general soil management procedure has been recommended for each of the five soil management areas. These procedures are presented in **Table 5**. A flowchart has also been created for easy communication of soil management procedures to the contractor, and is presented in **Figure 3**.

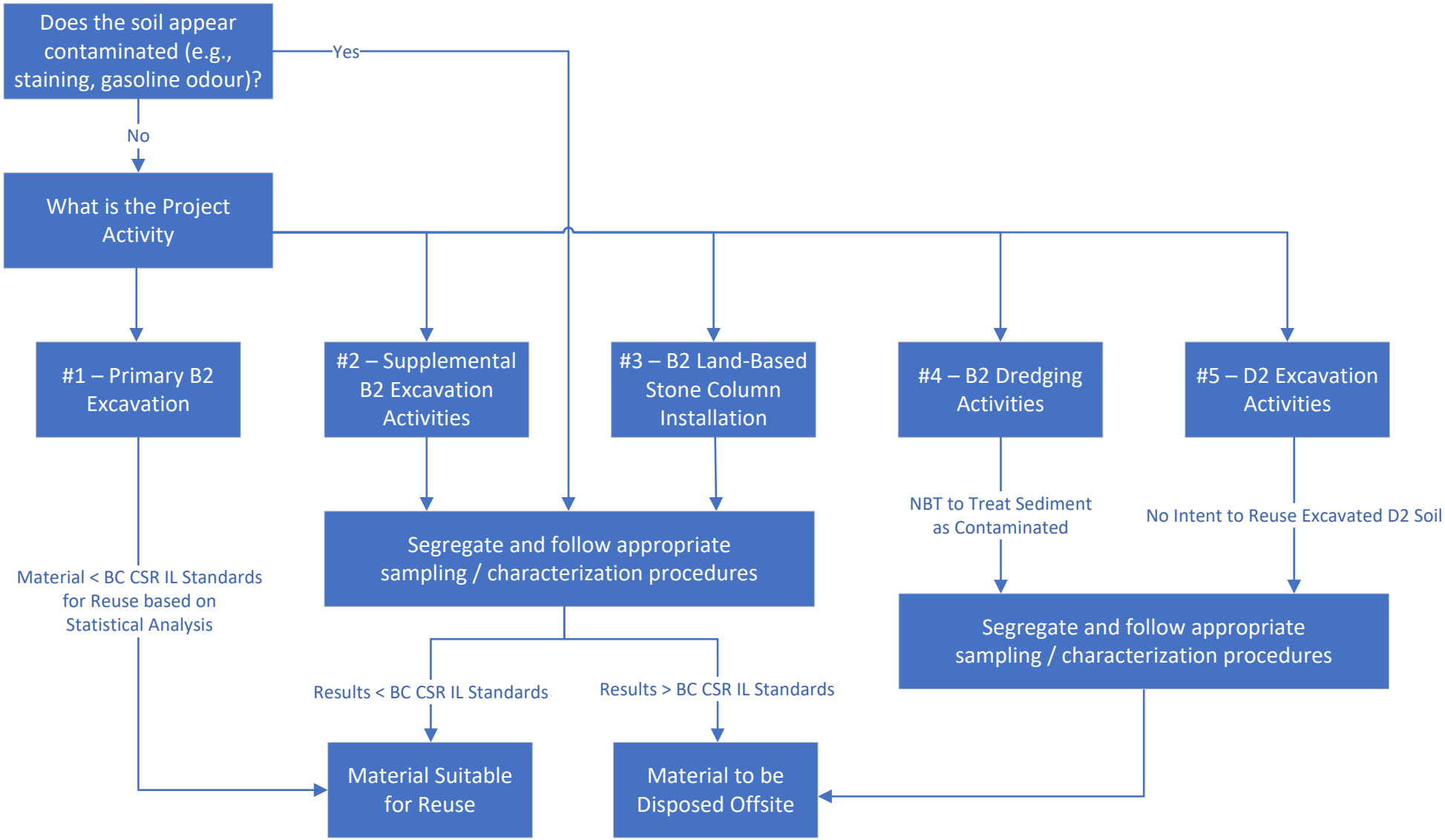
Table 5: B2D2 Project Soil Management Procedures

Soil Management Area	Volume and Depth	Characterization	General Soil Management Procedures
#1 – Primary B2 Excavation	30,000 m^3, from 0 to 6 mbgs	IL- for reuse *	Suitable for onsite reuse
#2 – Supplemental B2 Excavation Activities	< 1,000 m^3, shallow	Not Characterized	Segregate and follow appropriate sampling / characterization procedures to evaluate material suitability for reuse or classification for offsite disposal purposes.
#3 – B2 Land-Based Stone Column Installation	13,500 m^3, from 6 to 25 mbgs	Not Characterized	
#4 – B2 Dredging Activities**	<4,000 m^3, up to 1 mbgs	Not Characterized	Segregate and follow appropriate sampling / characterization procedures for classification for offsite disposal purposes.**
#5 – D2 Excavation Activities	2,650 m^3, from 0 to 12 mbgs	Not Characterized	

Table Notes:
* As noted in Section 3.3.3, if excess soil from soil management area #1 requires offsite disposal it would likely be characterized as IL+ for disposal purposes.
** If dredging is required, management measures for any contaminated material generated during dredging activities will be addressed in the B2D2 Project CEMP.

Detailed information regarding onsite soil reuse, offsite soil relocation, and offsite soil disposal are provided in **Sections 4.2, 4.3, and 4.4** respectively. All excavated soil is to be managed and stored in accordance with the procedures outlined in **Section 4.5**. Where suspect soil is encountered, it is to be managed in accordance with **Section 4.6**. Soil sampling requirements are outlined in **Section 4.7**. Additional soil management measures include archaeology considerations (**Section 4.8**), vegetation and wildlife management considerations (**Section 4.9**) and monitoring requirements (**Section 4.10**).

Figure 3 - B2D2 Project Soil Management Flowchart



The management procedures identified in **Table 5 and Figure 3** are in general conformance with NBT's ESMS, namely:

- For excavated soil permanently relocated onsite (e.g., the IL- material from soil management area #1 being reused as backfill), the proposed excavation location, quantity, management plan, and notification to the Port Authority have all been addressed by NBT.
- For previously uncharacterized soil to be excavated and permanently relocated offsite, the material should be sampled for PCOCs and characterized before leaving the Terminal (see **Section 4.7**). Soil management records are required (see **Section 5**). Soil exceeding BC CSR IL standards must be disposed at a permitted waste management facility (see **Section 4.4**).

4.2 Soil for Onsite Reuse

Excavated industrial grade soil (IL-) may be stored at the Terminal for potential onsite reuse (e.g., as backfill). Of the five soil management areas that have been identified for the B2D2 Project, only soil from soil management area #1 (i.e., the primary B2 excavation, to a depth of 6 mbgs) has been adequately characterized as IL-.

Alternatively, industrial grade soil (IL-) can also be transported offsite to an industrial site for reuse in accordance with applicable regulations for soil relocation (see **Section 4.3**) or transported offsite to an appropriate waste management facility (see **Section 4.4**). This may be required when material is IL- but there is no suitable option for reuse (e.g., due to a greater volume of soil having been excavated than is required for backfill).

This option for soil reuse relates strictly to the chemical properties of these materials and does not consider the engineering properties of the materials (i.e., suitability as backfill material from a stability and bearing perspective). A qualified geotechnical/structural engineer should review the material properties prior to any intended reuse.

4.3 Soil for Offsite Reuse

Industrial grade soils (IL-) that are deemed unsuitable for use as backfill/reuse onsite (e.g., due to geotechnical unsuitability or excess volumes) may be transported offsite for reuse. These soils should only be relocated to other industrial sites under a provincial Soil Relocation Agreement as per the BC CSR. The proposed excavation location, quantity, management plan of stockpile and notification letter/email for the Port Authority must be submitted to NBT's Director of Engineering and Environment (DEE) for approval in advance. Classification/sampling and soil management records are required, including a notification letter/email sent to the Port Authority in advance.

4.4 Soil for Offsite Disposal

If the excavated soil is characterized with concentrations exceeding BC CSR IL standards (IL+), the soil must be disposed of at a permitted waste facility. The proposed excavation location, quantity, management plan of stockpile and notification letter/email for the Port Authority must be submitted to NBT's DEE for approval in advance. Classification/sampling and soil management records are required, including a notification letter/email sent to the Port Authority in advance.

Soil characterized as hazardous under the BC HWR must be disposed in accordance with the BC *EMA* and the BC *HWR* at a permitted waste management facility. Suspect hazardous wastes will be removed and transported directly to a permitted waste management facility or temporarily staged in the designated hazardous waste staging area only (e.g., sealed bin located onsite). If soil is found to be hazardous contractors should notify NBT and have valid personnel with TDG certification to manifest the hazardous soil for disposal. Copies of the manifest should be forward the DEE and BC ENV. It should be noted that hazardous soil must be transported only by personnel with the appropriate hazardous waste transport license issued by the BC ENV.

4.4.1 Waste Approval for Offsite Disposal

No soil removed from the Terminal may be disposed offsite or reused at any location other than a facility and/or offsite location permitted to accept the specific soil material. It is the responsibility of the contractor to ensure that any potentially impacted soils excavated are appropriately managed, and that the hauler and the destination site or facility (if landfilling is to be completed) is aware of the source and nature of the materials and has indicated that the material is acceptable for disposal at the desired facility. The material for disposal should be transported by appropriately licensed transporters to the designated, permitted facilities.

Under no circumstances will material be transported offsite by the contractor until the Environmental Monitor (EM) has identified/manifested where the soil material can be transported.

4.4.2 Disposal Facilities

Disposal facilities for the B2D2 Project will be selected prior to the commencement of the B2D2 Project. Acceptable material types are based on site-specific permits, operating certificates, and approvals and management plans issued under the BC *EMA*. Approval must be issued by the permitted receiving site prior to arranging offsite disposal. In general, disposal facilities will evaluate chemical analytical results of the soil materials to be disposed, and issue a manifest document associated to the soil materials upon approval.

It is recommended that several facilities be selected ahead of the commencement of the B2D2 Project so that backup options are available in case a facility runs out of capacity to receive soil part way through the B2D2 Project.

4.4.3 Material Transportation

The contractor must ensure that the methods used to transport any materials offsite meet the requirements and intent of the federal and provincial requirements for TDG, if applicable. The contractor should also apply methods comparable to federal TDG requirements, if applicable, for transport of materials around the Terminal for the safety of workers and the public. Examples of requirements include manifests, load covering, analytical testing, notification, and training.

During all transportation of contaminated soil, covers or liners shall be used to prevent dust emissions. These temporary covers on trucks or other hailing equipment should be installed with care to minimize possibilities for the waste to encounter high winds during transport. In addition, if wet materials are to be

transported offsite, appropriate transportation equipment should be used to prevent leakage and material from tracking out (e.g., lining the truck beds with poly sheeting).

Trucking routes at the Terminal will be determined between the contractor and NBT prior to the start of construction and can be amended to the B2D2 Project SMP at that time. However, it is anticipated that trucking will follow the routes outlined in the D2 Construction Plan (Drawing No. 317086-36588-00-CI-DLP-1003) included in **Appendix B**.

4.5 Soil Storage Considerations

4.5.1 Stockpile Management

Stockpile Locations

Prior to the start of construction, designated stockpile area(s) will be proposed by the contractor and must be reviewed and approved by the EM and NBT. Stockpile areas should be situated such that, where feasible, excavated soil should be stockpiled at least 30 m away from sensitive receptors (e.g., stormwater catch-basins and water bodies). Stockpile areas within 30 m may require more stringent erosion and sediment controls. For interim soil storage (e.g., intraday, or overnight, during dry weather conditions), excavated soil may be placed in an onsite containment cell located in close proximity to the excavation location. Any changes to stockpile areas during construction must also be reviewed and approved by the EM and NBT.

Containment Cell Design and Drainage

Designated stockpile areas should consist of containment cells (unless otherwise approved by the EM and NBT). The perimeter of the containment cell is to be defined with concrete lock blocks – as designed and specified by the contractor. The base of the cell should be lined with appropriate liners to prevent infiltration of runoff from the stockpiled material to enter the soil and groundwater. The base layer will be slightly sloped to prevent runoff from pooling and runoff must be contained within the containment cell area or directed to a collection point for the B2D2 Project water treatment system(s) via sloped impermeable surface or dedicated underground piping. The cell should be designed to contain drained excavated material from the B2D2 Project activities. Additional details regarding water management will be provided in the B2D2 Project Water Management Plan (WaMP) (Envirochem, In Development).

The length of time stockpile areas are present for should be constrained to the excavation and backfill activities. Once all excavation activities and material reuse/disposal activities are completed, the stockpile area should be decommissioned. Concrete lock blocks can be reused, and liners should be appropriately disposed of. The surrounding area should be cleaned (e.g., with brooms or a street sweeper as necessary) to remove any loose soil or debris and mitigate potential erosion and sediment control concerns.

Soil Segregation

Soil materials should be clearly segregated based on designated soil quality classifications. Soil materials of different designated soil quality classifications must be kept separate from other stored excavated materials and may not be mixed. This is in general conformance with the NBT ESMS, to ensure the material does not become contaminated, or further contaminated, due to contact with other materials onsite.

In addition, saturated soil should not be comingled with dry soil, even when they are of the same soil quality classification. Saturated soils often result in a higher disposal cost. Mixing saturated soil and dry soil may result in the entire volume being treated as saturated and disposed of at the higher disposal cost, and should hence be avoided.

Accidental Stockpile Contamination

In the event of a stockpile being suspected to contain contamination with PCOCs in addition to previously tested parameters (e.g., such as the result of an environmental spill in the stockpile), soil samples should be collected, and the stockpile characterized as outlined in S**ection 4.7**.

4.5.2 Erosion and Sediment Control

To minimize erosion and runoff from exposed soils during construction, the following erosion and sediment control (ESC) measures should be implemented as applicable:

- The contractor should routinely monitor stockpiles and areas onsite with high potential for erosion.
- Erosion and sediment control devices (such as, but not limited to, silt fencing, straw, mulch, gravel for check dams, etc.) will be available for use onsite. The contractor should implement these devices as necessary based on their monitoring of stockpiles.
- The contractor should inspect ESC installations, at minimum on a weekly basis, to ensure that installations are in good condition and working as intended. Mitigation measures and management practices should be adaptive to ensure effectiveness.
- Stockpiled soil should be covered as needed (e.g., with vinyl or polyethylene tarps) to prevent mobilization of fine solids.
- ESC measures should remain in place until the work areas are stabilized and there is no longer a risk of soil erosion, sedimentation, or sediment run-off.

4.6 Management of Suspect Material

During ground disturbance activities, if unanticipated material types/sources are encountered, including, but not limited to, soil staining, ambient odours, or sheen on surface water, the EM should be contacted, and this plan may require modification which may include further soil characterization and confirmatory sampling around the affected area to determine appropriate soil management options.

In the event of a contaminant discovery or release at the Terminal during construction, the assessment approach will vary depending on the appearance of the impacted material and the area affected. The EM should be consulted immediately on the appropriate approach in the event of a contaminant discovery or release. Analytical parameters and sampling methodologies may change depending on the area of the potential contaminant discovery, observations made, and size of the affected area or excavation.

4.7 Soil Sampling

Situations which will require soil sampling to be conducted include:

- Excavating known areas of uncharacterized soil (e.g., soil management area #2 through #5).

    - As these are known areas of uncharacterized soil, the contractor and EM should plan for how and when to characterize these soils. Material will not be able to leave the Terminal until sampling has been completed and disposal approval obtained.
- Excavating soil that has not yet been characterized due to changes in construction activities.
- If visual observations by the contractor or EM identify obvious variations from the anticipated previously characterized material.
- If soil receiving facilities require additional information or if they raise any concerns about the quality of soil they are receiving and wish to see confirmatory (e.g., QA/QC) sampling conducted.

Soil sampling may be conducted by the contractor, the EM, NBT, or others as NBT deems appropriate. Regardless, an appropriate plan must be prepared and submitted to NBT prior to commencing any sampling (see **Section 4.7.2**).

4.7.1 Field Screening Methodology

During excavation where suspected areas of contamination is encountered, field observations and measurements can be used as a screening tool to guide sample testing. Instruments such as photoionization detectors (PID) or flame ionization detectors (FID) can be used to screen samples for indications of petroleum hydrocarbons and VOC. Visual and olfactory observations can further determine the extent of contamination, which includes odor, surficial staining and/or discoloration, and hydrocarbon sheen on surface water.

If potential contamination is indicated during excavation activities from visual and olfactory observations, or instruments, the EM should be consulted. At the discretion of the EM, soil sampling may be conducted to characterize the soil material.

4.7.2 Soil Sampling

The specific number and methodology of sample collection may vary depending on the excavation activity and anticipated volume of soil. For each unique volume of soil, a sampling plan should be provided to NBT for review and approval and may also be shared with the Port Authority.

In general, soil sampling should be conducted in conformance with the BC Field Sampling Manual Part D – Solids (BC Government, 2020). The BC ENV Technical Guidance 1 document for Site Characterization and Confirmation Testing (BC ENV, 2009) can also be referenced for best practice with respect to developing a sampling plan. For example, when sampling a stockpile of suspect industrial quality material (IL-), it is recommended to collect 1 sample for every 50 m^2 of material, up to a maximum stockpile size of 250 m^3.

In general, soil samples should be collected for the following PCOCs:

- Metals
- Sodium and chloride ions
- Light extractable petroleum hydrocarbons (LEPH)
- Heavy extractable petroleum hydrocarbons (HEPH)

- Polycyclic aromatic hydrocarbons (PAH)
- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Petroleum Hydrocarbons (PHC)
- Volatile petroleum hydrocarbons (VPH)
- Volatile organic compounds (VOC)

The samples should then be tested for suspected PCOCs at an approved laboratory and evaluated for suitability for reuse and/or disposal by comparison to BC CSR IL standards (and other screening criteria as applicable).

4.8 Archaeology Considerations

Subsurface activities such as excavation and dredging have the potential to encounter archeological materials.

A Technical Archaeological Review for the B2D2 Project (EcoLogic, 2022a) identified that the proposed construction activities will be occurring in an area of low archaeological potential. It is unlikely that archaeological materials will be present in the B2D2 Project footprint. It is also considered unlikely that the proposed construction activities will encounter or impact any archaeological materials should they be present. Due to the nature of archaeological materials, however, these possibilities cannot be entirely ruled out. As such, it is recommended that all subsurface works associated with the proposed development proceed under a Chance Find Management Plan (CFMP) (EcoLogic, 2022b).

Additional archaeology details and mitigation measures are provided in Section 1.4.1.2, Section 5, and Section 6.6.12 of the B2D2 Project CEMP.

4.9 Vegetation and Wildlife Management Considerations

Vegetation and wildlife features are sparse within the Terminal and are not anticipated to be encountered during the B2D2 Project excavation activities. Hence, no specific vegetation and wildlife monitoring measures related to excavation activities are identified in the B2D2 Project SMP at this time.

General vegetation and wildlife effects are discussed in Section 4.6 of the B2D2 Project CEMP, while vegetation and wildlife management mitigation measures are addressed in Section 6.4.6 of the B2D2 Project CEMP.

4.10 Monitoring Measures

The EM shall:

- Verify that all subsurface works are proceeding under the CFMP.
- Conduct supplemental soil testing/characterization where necessary.
- Inspect and verify that soil storage and stockpile procedures are in accordance with the B2D2 Project SMP and B2D2 Project CEMP.

- Inspect and verify that saturated soils are being properly managed, that runoff is being managed in accordance with the Water Management Plan, and that trucks hauling saturated soils are appropriately lined.
- Document and appropriately manifest (or assign a delegate to document and manifest) material loads including identifying the soil source, suitability for disposal, and tracking the number of loads and properly manifesting each load leaving the Terminal.
- Address any vegetation and wildlife management concerns specific to excavation activities that arise throughout the B2D2 Project.

5.0 DATA MANAGEMENT PLAN

5.1 Tracking and Record Keeping

Records of the transport and disposal of soils must be maintained. These will include:

- Daily logs for any soil disposed by the B2D2 Project (maintained by either the EM or a designate) detailing the number of trucks that left the Terminal, the material source location and classification, the manifested disposal facility, truck information (license plate, driver, etc.), and departure time of each load;
- Manifests for transportation;
- Weigh scale tickets at the destination facility; and
- Associated permitting with the landfill.

The EM will be required to maintain close communication with the contractor and disposal facility to confirm that appropriate documentation has been completed and provided prior to any movement of material.

A record of soil transported to offsite permitted receiving facilities should be provided monthly by the receiving facilities. These records, including summaries of quantities and material types, transportation details, and weights for each load transported offsite, will be used to cross reference against records and applicable material movement documentation consolidated by the EM.

5.2 Reporting

As outlined in the B2D2 Project CEMP, the EM will prepare both (i) summary construction reports consisting of details for each visit conducted by the EM, and (ii) weekly monitoring reports summarizing the information presented in summary construction reports. Both reports should include information related to any soil sampling conducted, analytical results received, and documented offsite material movement (e.g., loads of contaminated soil that were manifested).

Furthermore, a monthly summary of soil movement will be generated by the EM. The summary will include copies of the manifests for each load of soil material sent to the receiving sites, copies of weigh scale tickets from the receiving sites, and transport vehicle details. This information will also be uploaded to NBT's soil tracking system in Envolv and completed in accordance with NBT's ESMS.

5.3 Information Sharing with Interested Indigenous Groups

NBT will provide relevant B2D2 Project information to interested indigenous groups on a timely basis. Any soil analytical results of suspect material will be provided upon request. Interested indigenous groups will be notified in the event of confirmed hazardous waste onsite.

6.0 CORRECTIVE ACTION PLAN

6.1 Adaptive Management

At a minimum, the B2D2 Project SMP will be reviewed annually by the contractor, EM, and NBT. It should also be reviewed when a change in B2D2 Project activities may require modifications to the B2D2 Project SMP (e.g., if new excavation activities are proposed).

Any soil management deficiencies noted during the B2D2 Project, or characterization of new soil material may also prompt a review and/or modification to the SMP.

6.2 Action Triggers

For the purpose of the B2D2 Project SMP, an action trigger is defined as an action which could potentially contravene a relevant act, regulation, permit requirement, or put the environment at harm. There are various scenarios that may be considered an action trigger, such as:

- The B2D2 Project encounters hazardous waste during excavation,
- The B2D2 Project encounters archeology artifacts during excavation, or
- The B2D2 Project encounters a species at risk or migratory bird during excavation activities.

If the contractor or EM identify a potential action trigger, work should immediately halt and NBT should be notified. Work should not resume until approval is provided by NBT.

6.3 Emergency Response

Emergency response measures are outline in Section 6.5.1 of the B2D2 Project CEMP. The contractor will be responsible for preparing a Contractor Spill Prevention and Emergency Response Plan (CSERP) which will identify their plans for responding to emergencies and accidental spills (e.g., spill response materials and spill kit contents required during construction activities, the response procedures in the event of emergencies, and notification/communication commitments).

Examples of potential emergencies that may arise during soil management activities which should be included in the CSERP include:

- Environmental spills,
- Fueling incidents, and
- Traffic related (e.g., trucking) incidents.

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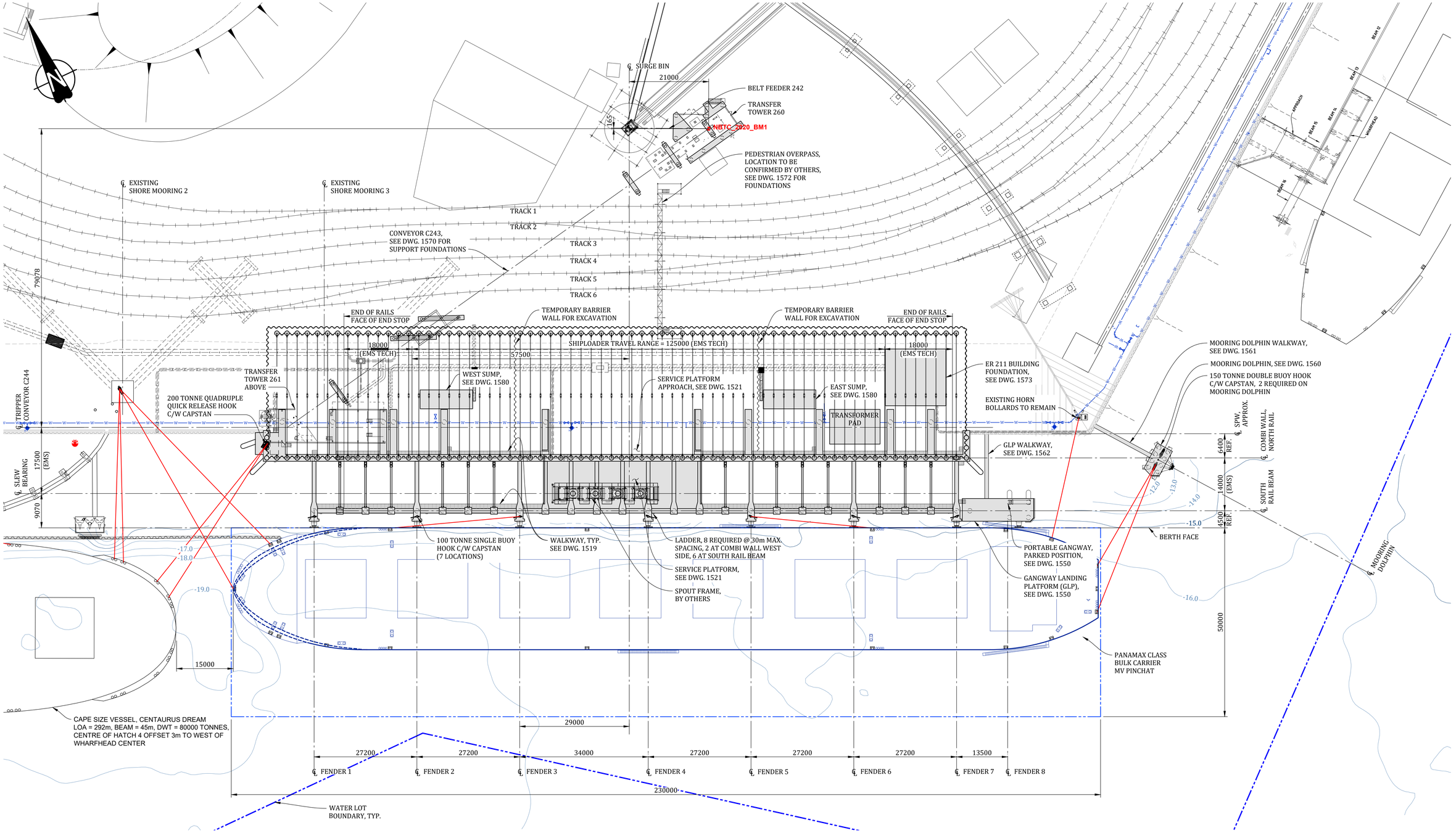
Transportation of Dangerous Goods Act [Provincial]. Chapter 458 [RSBC 1996]. Current to June 2022. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96458_01.

Transportation of Dangerous Goods Regulations [Federal]. SOR/2001-286. Enabling Act: Transportation of Dangerous Goods Act [Federal], 1992. Last amended Jun 23, 2021. Available at: https://laws-lois.justice.gc.ca/PDF/SOR-2001-286.pdf.

Transportation of Dangerous Goods Regulations [Provincial]. B.C. Reg. 203/85. Enabling Act: BC Transport of Dangerous Goods Act [Provincial]. Last amended by B.C. Reg. 231/2002. Current to July 2022. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/203_85/.

TWN (Tsleil-Waututh Nation), 2022. Construction Environmental Management Plan Requirements. January 2022.

APPENDIX A
RELEVANT B2 DESIGN DRAWINGS



LEGEND:

NEW STRUCTURE

m 0 5 10 15 20 25 m

1:500

NOTES:

1. FOR DESIGN CRITERIA AND GENERAL NOTES, SEE DWG. 317071-00041-02-MA-DGA-1501.

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Apr. 08/22 3:02pm

		PROJECT / W.O.:	B2 MARINE WORKS						ENGINEERING SEAL:
		SYSTEM:	POTASH						
		ASSET:	251						
DRAWING NO.	DRAWING DESCRIPTION / TITLE	DISCIPLINE:	STRUCTURAL	A	2022-04-08	ISSUED FOR CLIENT REVIEW	AAL	AMT	
REFERENCE DRAWINGS / DESIGN STANDARDS				REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED	VENDOR P2P:
				ISSUES / REVISIONS					

VENDOR: Advisian Worley Group 317071-00041

OEM:

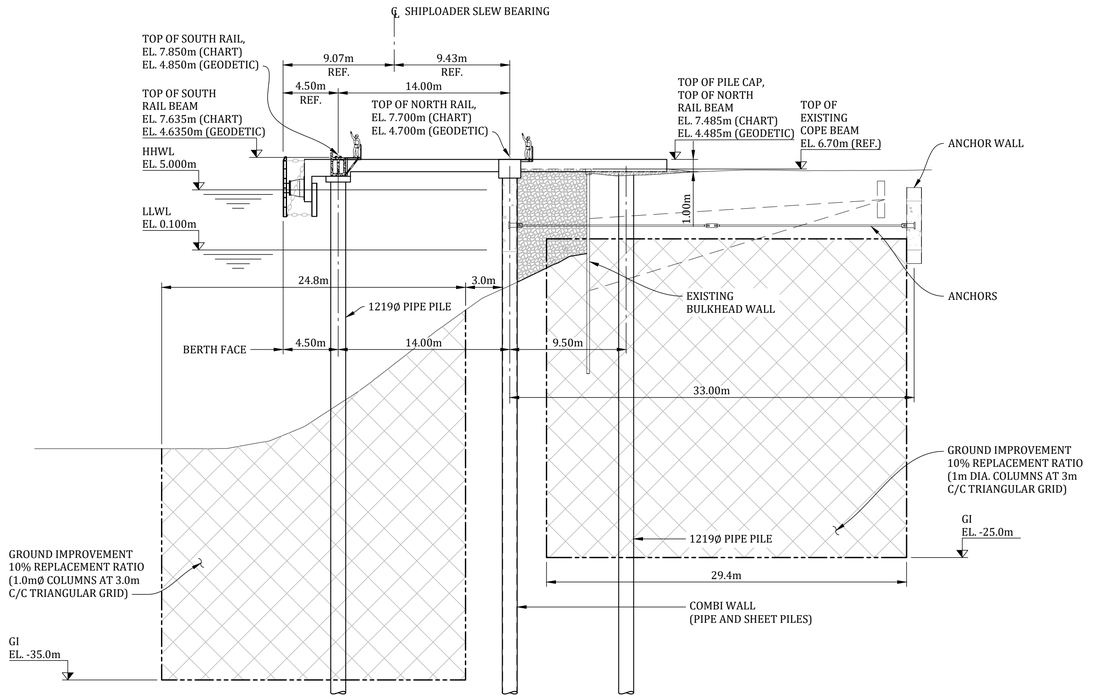
ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

TITLE:
BERTH 2 SHIPLOADER PROJECT
MARINE STRUCTURES
GENERAL ARRANGEMENT

SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317071-00041-02-MA-DGA-1504	A

U:\YVR\317071\00041_NEP_B2SHIPLFDN\11_DRAWINGS\15_LAND_E\02_MARINE\317071-00041-02-MA-DGA-1504.DWG DATE: 2022-04-08



SECTION A
1:250
1507

m 0 5 10 15 m

1:250

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Apr. 08/22 2:27pm

NOTES:

1. ELEVATIONS ARE IN METRES AND ARE IN TIDE AND CHART DATUM, UNLESS NOTED OTHERWISE.

		PROJECT / W.O.:	B2 MARINE WORKS					
		SYSTEM:	POTASH					
		ASSET:	251					
DRAWING NO.	DRAWING DESCRIPTION / TITLE	DISCIPLINE:	STRUCTURAL	REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
REFERENCE DRAWINGS / DESIGN STANDARDS				ISSUES / REVISIONS				
				A	2022-04-08	ISSUED FOR CLIENT REVIEW	AAL	AMT

ENGINEERING SEAL:

VENDOR P2P:

VENDOR: Advisian (Worley Group) 317071-00041
"This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

OEM:

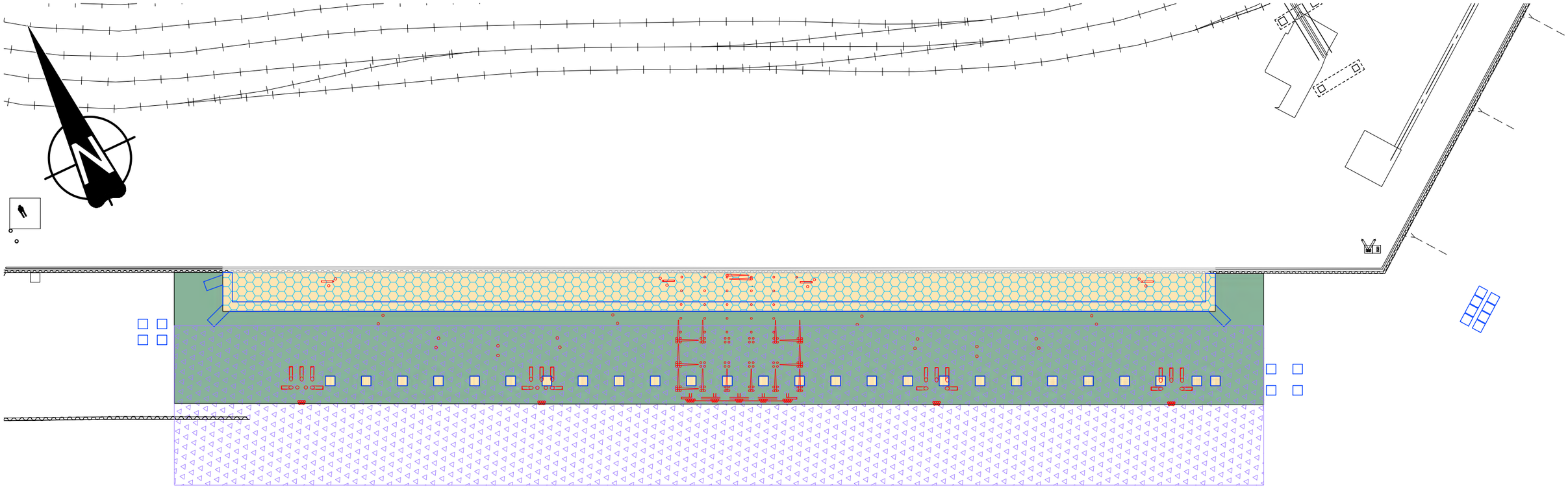
ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

TITLE:
BERTH 2 SHIPLOADER PROJECT
MARINE STRUCTURES
GROUND IMPROVEMENT - SECTION

SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317071-00041-02-MA-DGA-1508	A

U:\YVR\317071\00041_NEP_B2SHIPLFDN\11_DRAWINGS\15_I_AND_E\02_MARINE\317071-00041-02-MA-DGA-1508.DWG DATE: 2022-04-08



PLAN
1:750

m 0 10 20 30 40 m

1:750

LEGEND:

- SCOUR PROTECTION REMOVAL (1440m^2)
- TEMPORARY SCOUR PROTECTION REMOVAL AND DREDGING AREA (3632m^2)
- STONE COLUMN CONSTRUCTION (GI) AREA (6070m^2)
- INFILL AREA (1355m^2)
- PILES TO BE INSTALLED
- PILES TO BE REMOVED

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Apr. 21/22 12:10pm

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
A	2022-04-21	ISSUED FOR PERMITTING	AAL	AMT

ISSUES / REVISIONS

DRAWING NO. | DRAWING DESCRIPTION / TITLE

REFERENCE DRAWINGS / DESIGN STANDARDS

PROJECT / W.O.:
SYSTEM:
ASSET:
DISCIPLINE:

ENGINEERING SEAL:

VENDOR: Advisian, Worley Group — 317071-00041
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OEM:

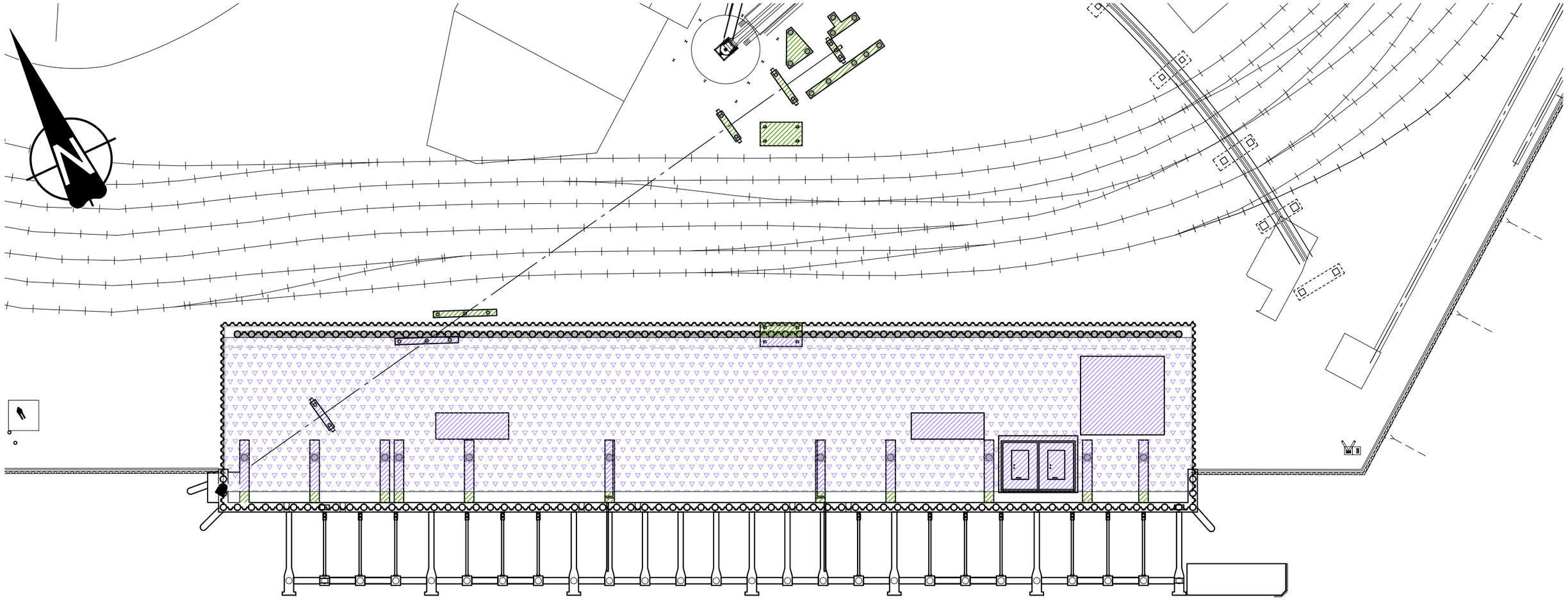
ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

TITLE:
SEABED FOOTPRINT MODIFICATIONS
DEMOLITION AND CONSTRUCTION WORKS
PLAN

SCALE:	SHEET	OF	DRAWING NO.	REV:
N.T.S.	1	1	02-EN-DGA-6001	A

U:\VVR\317071\00041_NEP_B2SHIPLFDN\11_DRAWINGS\14_ENV_PLANNING\307071-00041-02-EN-DGA-6001.DWG DATE: 2022-02-10



PLAN
1:750

m 0 10 20 30 40 m

1:750

LEGEND:

- FOUNDATION FOOTPRINT OUTSIDE OF STONE COLUMN CONSTRUCTION ZONE (198m²)
- FOUNDATION FOOTPRINT WITHIN STONE COLUMN CONSTRUCTION ZONE(1092m²)
- STONE COLUMN CONSTRUCTION (GI) (4672m²)
- PILES TO BE INSTALLED

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Apr. 21/22 12:08pm

DRAWING NO.	DRAWING DESCRIPTION / TITLE	PROJECT / W.O.:	REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
REFERENCE DRAWINGS / DESIGN STANDARDS		SYSTEM:	A	2022-04-21	ISSUED FOR PERMITTING	AAL	AMT
		ASSET:	ISSUES / REVISIONS				
		DISCIPLINE:					

ENGINEERING SEAL:

VENDOR: Advisian Worley Group
317071-00041
"This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

OEM:

ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

TITLE:
FOOTPRINT MODIFICATIONS
DEMOLITION AND CONSTRUCTION WORKS
PLAN

SCALE:	SHEET	OF	DRAWING NO.	REV:
N.T.S.	1	1	02-EN-DGA-6002	A

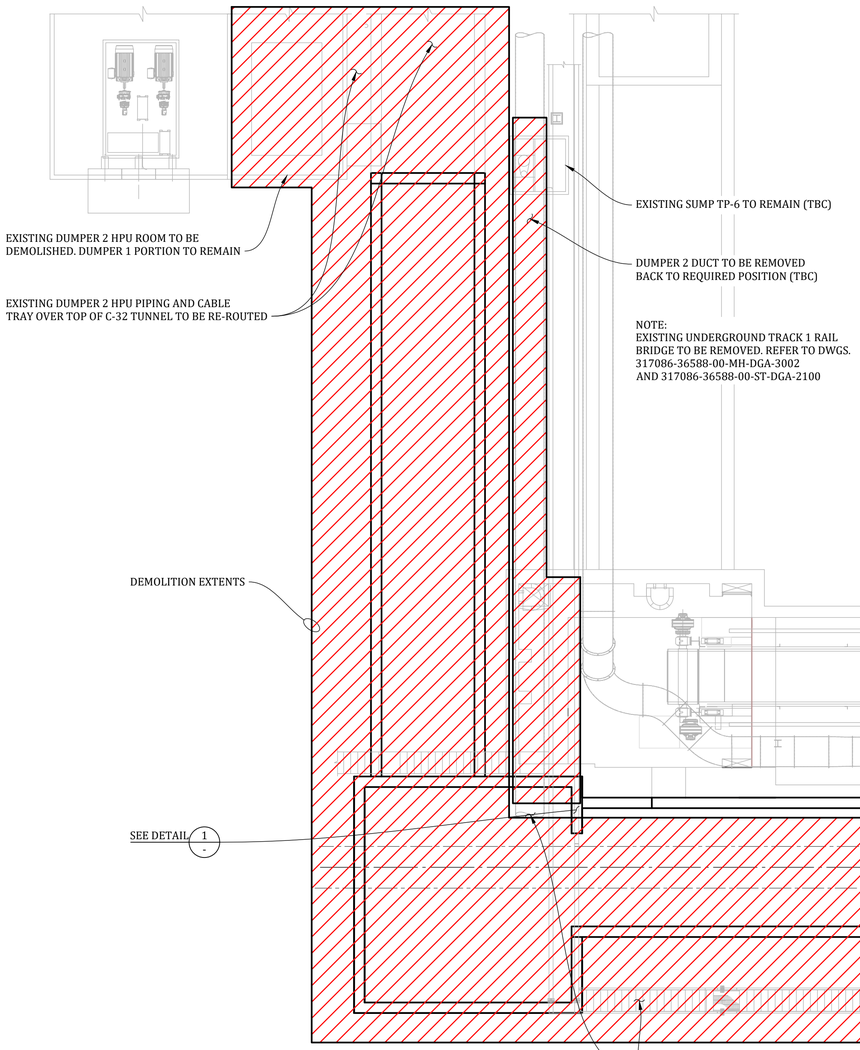
I:\VVR\317071\00041-NEP-R2SHIPLFDN\11_DRAWINGS\14_ENV_PLANNING\307071-00041-02-EN-DGA-6002.DWG DATE: 2022-02-10

APPENDIX B
RELEVANT D2 DESIGN DRAWINGS

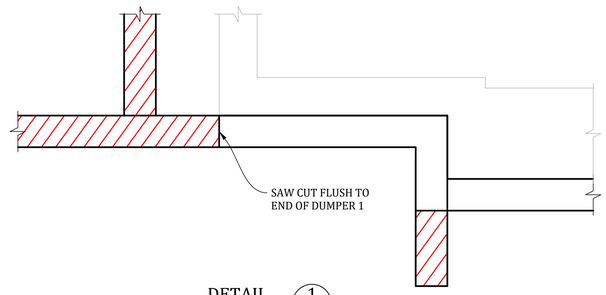
PROJECT NORTH

TRUE NORTH

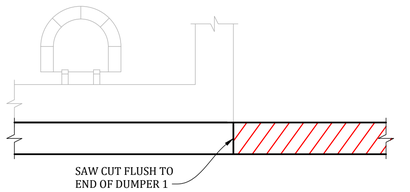
FOR CONTINUATION, SEE DWG.
317086-36588-00-GE-DGA-8005



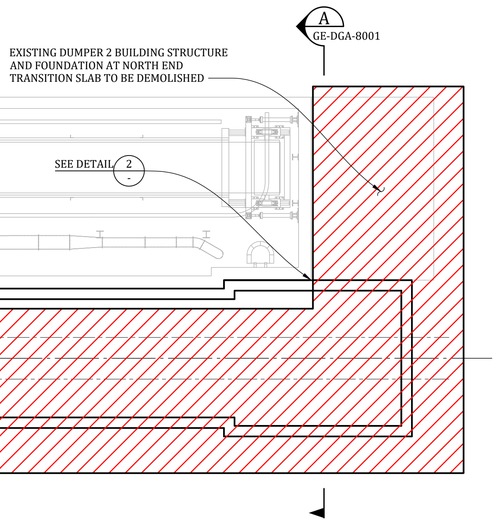
PLAN - EXTENTS OF DEMOLITION
1:150



DETAIL 1
1:50



DETAIL 2
1:50



PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: May. 31/22 4:26pm

LEGEND:

AREA TO BE DEMOLISHED

NOTES:

1. REFER TO SCOPE OF WORK DOCUMENT No. 317086-36588-00-GE-SOW-0001 FOR DUMPER 2 DEMOLITION PLAN.

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
B	2022-05-31	CLIENT REVIEW - 60% SUBMISSION	KDP	PLN
A	2022-03-31	CLIENT REVIEW - 30% SUBMISSION	CH	PLN

ISSUES / REVISIONS

DRAWING NO. | DRAWING DESCRIPTION / TITLE

REFERENCE DRAWINGS / DESIGN STANDARDS

PROJECT / W.O.:
SYSTEM: POTASH
ASSET: 623
DISCIPLINE: GENERAL

ENGINEERING SEAL:

VENDOR P2P:

SUB VENDOR: SECURE ENERGY

VENDOR: Advisian Worley Group 317071-xxxxx

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OEM:

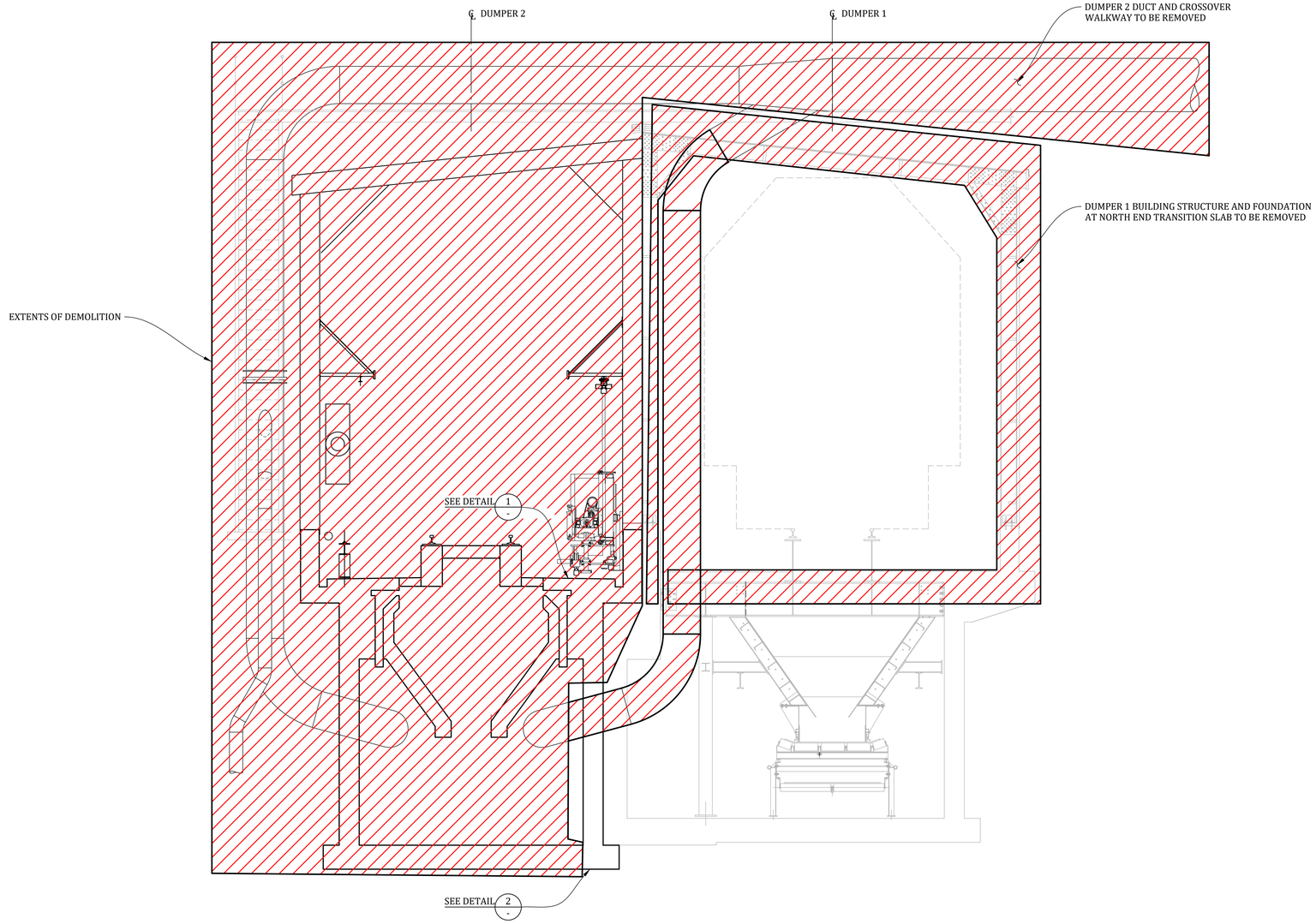
ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

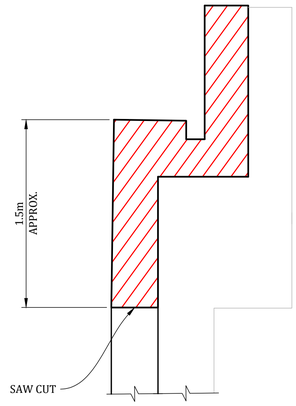
TITLE:
POTASH DUMPER No. 2 REPLACEMENT
GENERAL - DUMPER 2
DEMOLITION - SHEET 1

SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317086-36588-00-GE-DGA-8000	B

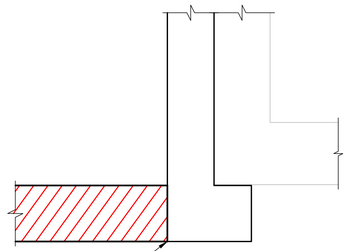
U:\YVR\317086\36588_NBTC_D2REPLACE\11_DRAWINGS\15_I_AND_E\05_DEMOLITION\317086-36588-00-GE-DGA-8000_8001_8002_8003_8004.DWG DATE: 2022-05-31



SECTION A EXTENTS OF DEMOLITION
1:50 GE-DGA-8000



DETAIL 1
1:25



DETAIL 2
1:25

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: May. 31/22 6:02pm

LEGEND:

AREA TO BE DEMOLISHED

NOTES:

1. REFER TO SCOPE OF WORK DOCUMENT No. 317086-36588-00-GE-SOW-0001 FOR DUMPER 2 DEMOLITION PLAN.

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
B	2022-05-31	CLIENT REVIEW - 60% SUBMISSION	KDP	PLN
A	2022-03-31	CLIENT REVIEW - 30% SUBMISSION	CH	PLN

ISSUES / REVISIONS

DRAWING NO. | DRAWING DESCRIPTION / TITLE

REFERENCE DRAWINGS / DESIGN STANDARDS

PROJECT / W.O.:
SYSTEM: POTASH
ASSET: 623
DISCIPLINE: GENERAL

ENGINEERING SEAL:

VENDOR P2P:

SUB VENDOR: SECURE ENERGY

VENDOR: Advisian Worley Group 317071-xxxxx
"This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

OEM:

ISSUED AS RECORD COPY? (YES/NO) NO

TITLE:
POTASH DUMPER No. 2 REPLACEMENT
GENERAL - DUMPER 2
DEMOLITION - SHEET 2

SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317086-36588-00-GE-DGA-8001	B

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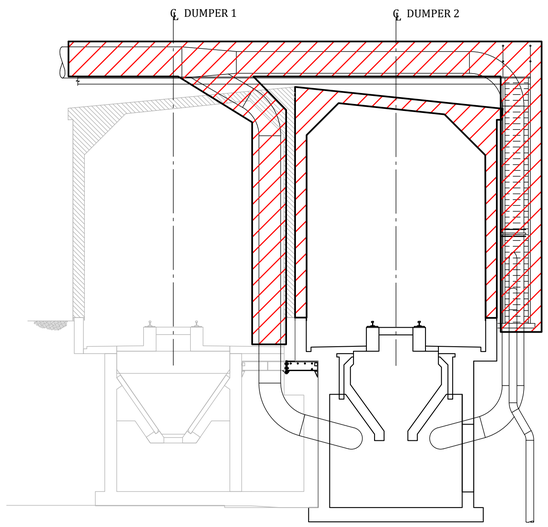
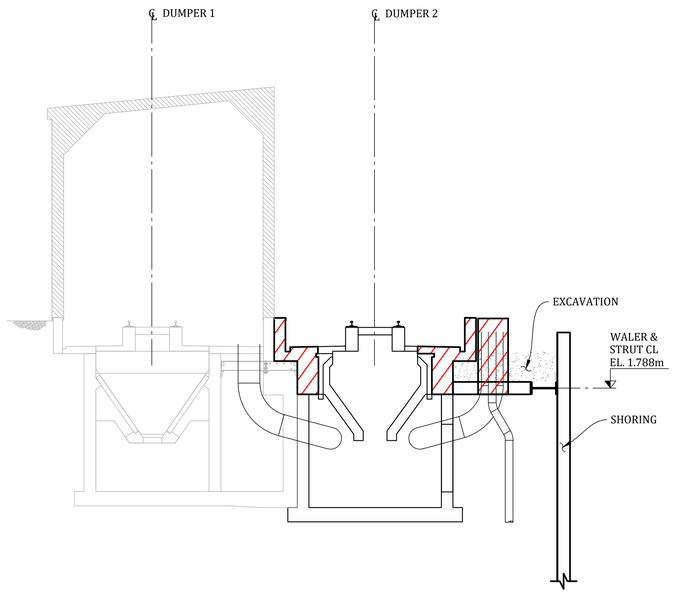
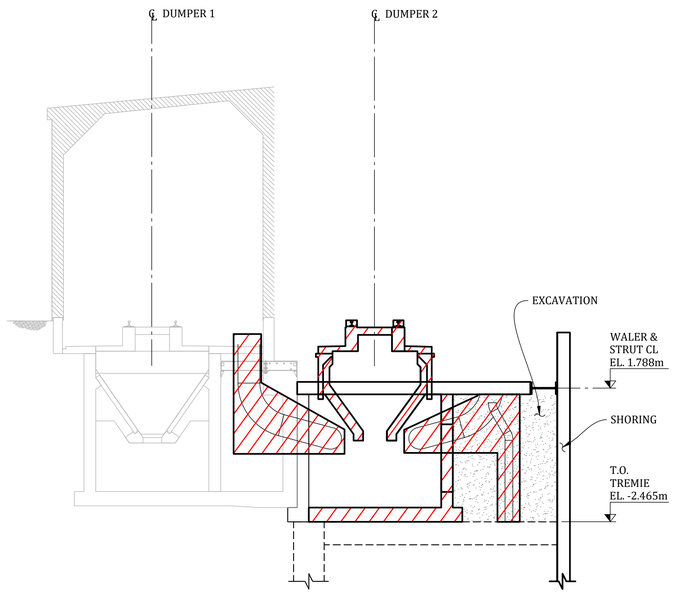


DEMOLITION - STAGE 1
1:100



DEMOLITION - STAGE 2A
1:100

NOTE:
PARTIAL DEMOLITION TO
ACCOMMODATE STRUTS AND WALERS



DEMOLITION - STAGE 2B
1:100

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: May. 31/22 5:52pm

LEGEND:

AREA TO BE DEMOLISHED

NOTES:

1. REFER TO SCOPE OF WORK DOCUMENT No. 317086-36588-00-GE-SOW-0001 FOR DUMPER 2 DEMOLITION PLAN.

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
B	2022-05-31	CLIENT REVIEW - 60% SUBMISSION	KDP	PLN
A	2022-03-31	CLIENT REVIEW - 30% SUBMISSION	CH	PLN

ISSUES / REVISIONS

DRAWING NO. | DRAWING DESCRIPTION / TITLE

REFERENCE DRAWINGS / DESIGN STANDARDS

PROJECT / W.O.:
SYSTEM: POTASH
ASSET: 623
DISCIPLINE: GENERAL

ENGINEERING SEAL:

VENDOR P2P:

SUB VENDOR: SECURE ENERGY

VENDOR: Advisian, Worley Group
317071-xxxxx

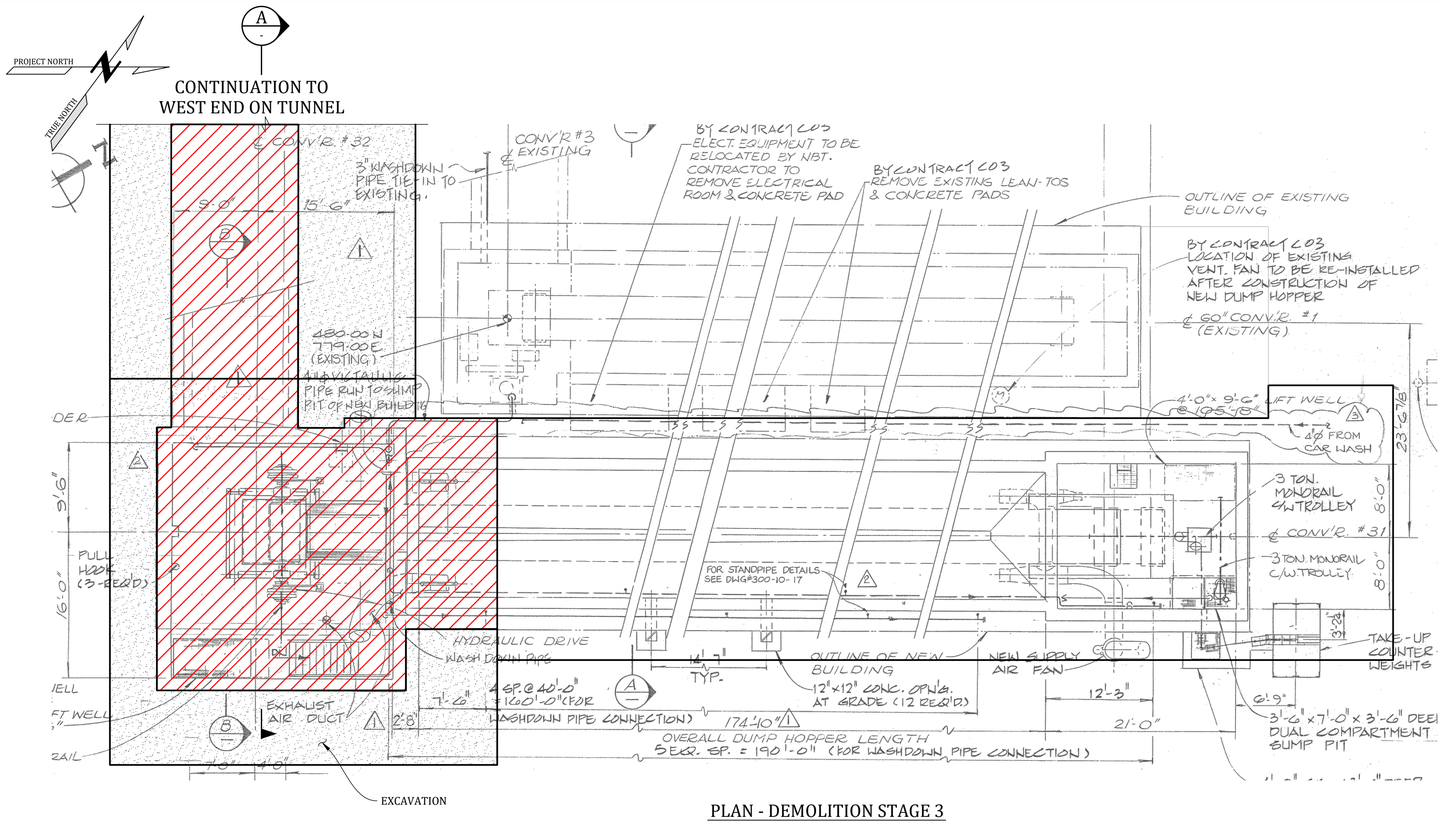
OEM:

ISSUED AS RECORD COPY? (YES/NO) NO

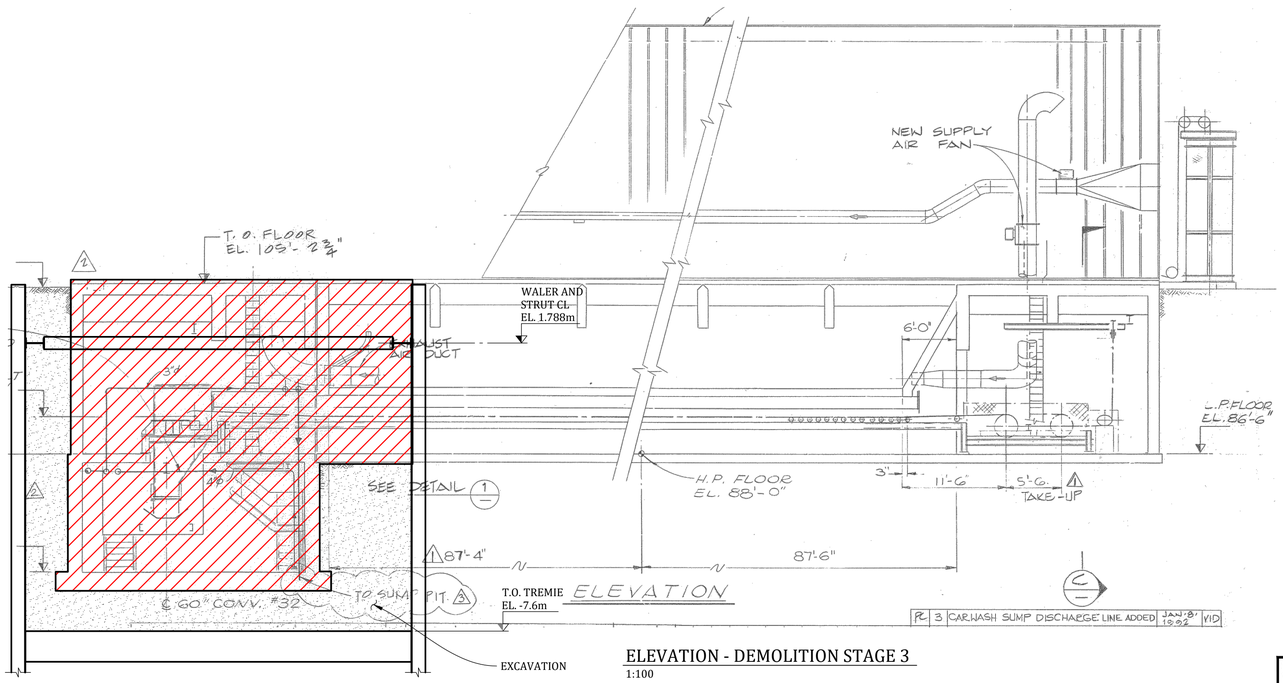
Neptune TERMINALS

TITLE:
POTASH DUMPER No. 2 REPLACEMENT
GENERAL - DUMPER 2
DEMOLITION - SHEET 3

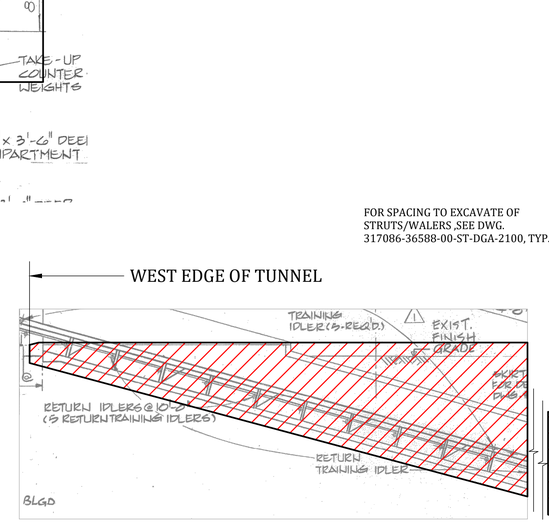
SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317086-36588-00-GE-DGA-8002	B

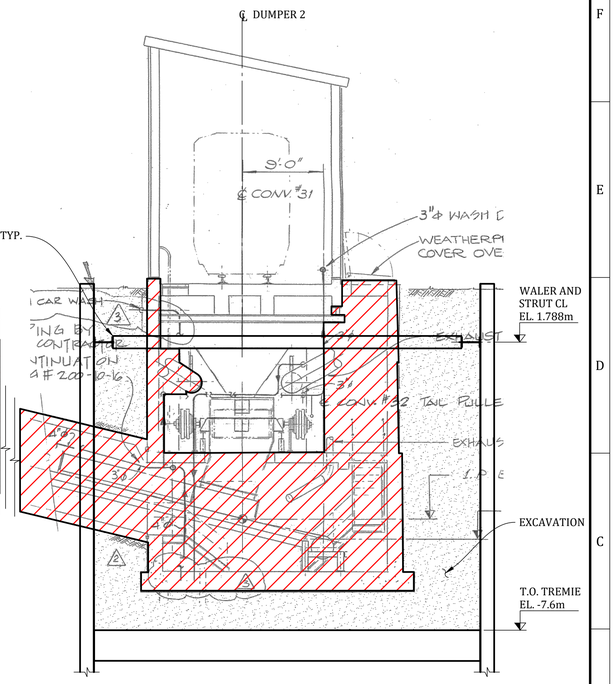


PLAN - DEMOLITION STAGE 3
1:100



ELEVATION - DEMOLITION STAGE 3
1:100





SECTION A
1:100

LEGEND:

AREA TO BE DEMOLISHED

NOTES:

1. REFER TO SCOPE OF WORK DOCUMENT No. 317086-36588-00-GE-SOW-0001 FOR DUMPER 2 DEMOLITION PLAN.

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: May. 28/22 4:50pm

SUB VENDOR: SECURE ENERGY

VENDOR: Advisian Worley Group 317071-xxxxx
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OEM:

ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
B	2022-05-31	CLIENT REVIEW - 60% SUBMISSION	KDP	PLN
A	2022-03-31	CLIENT REVIEW - 30% SUBMISSION	CH	PLN

ISSUES / REVISIONS

ENGINEERING SEAL:

VENDOR P2P:

PROJECT / W.O.:
SYSTEM: POTASH
ASSET: 623
DISCIPLINE: GENERAL

DRAWING NO. | DRAWING DESCRIPTION / TITLE

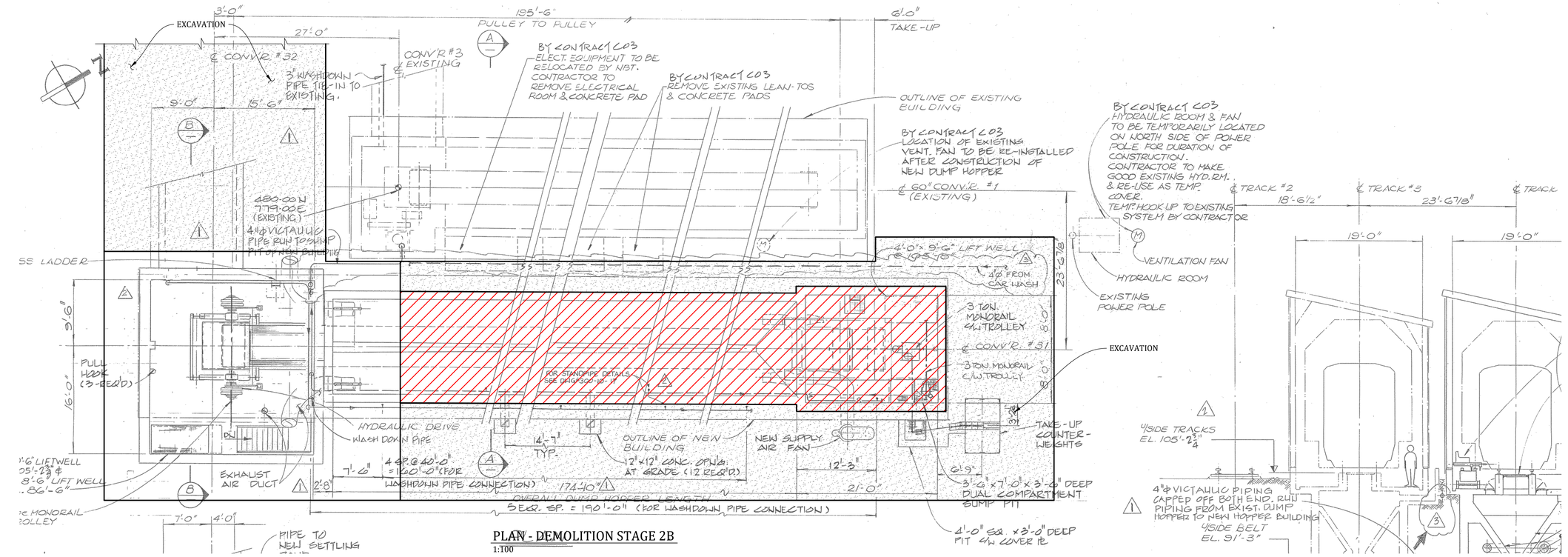
REFERENCE DRAWINGS / DESIGN STANDARDS

TITLE:
POTASH DUMPER No. 2 REPLACEMENT
GENERAL - DUMPER 2
DEMOLITION - SHEET 4

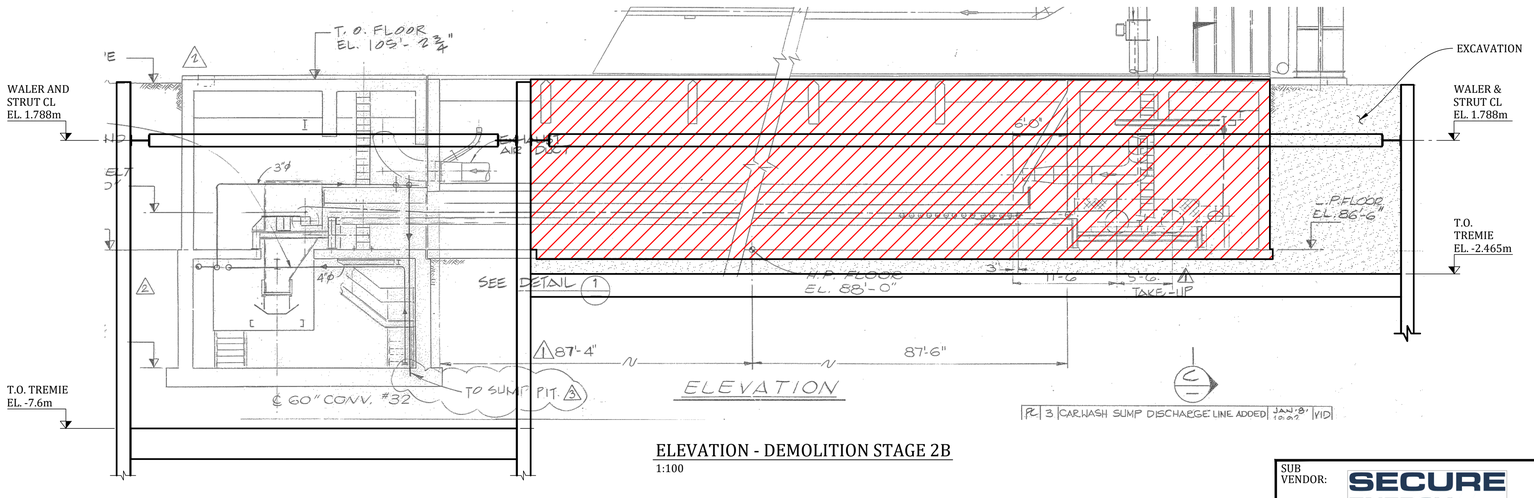
SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317086-36588-00-GE-DGA-8003	B

U:\YVR\317086\36588_NBTC_D2REPLACE\11_DRAWINGS\15_I_AND_E\05_DEMOLITION\317086-36588-00-GE-DGA-8000_8001_8002_8003_8004.DWG DATE: 2022-05-28

FOR CONTINUATION, SEE DWG.
317086-36588-00-GE-DGA-8005



PLAN - DEMOLITION STAGE 2B
1:100



ELEVATION - DEMOLITION STAGE 2B
1:100

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: May. 28/22 4:31pm

LEGEND:

AREA TO BE DEMOLISHED

NOTES:

1. REFER TO SCOPE OF WORK DOCUMENT No. 317086-36588-00-GE-SOW-0001 FOR DUMPER 2 DEMOLITION PLAN.

SUB VENDOR: SECURE ENERGY

VENDOR: Advisian Worley Group 317071-xxxxx
"This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

OEM:

ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
B	2022-05-31	CLIENT REVIEW - 60% SUBMISSION	KDP	PLN
A	2022-03-31	CLIENT REVIEW - 30% SUBMISSION	CH	PLN

ISSUES / REVISIONS

ENGINEERING SEAL:

VENDOR P2P:

DRAWING NO.	DRAWING DESCRIPTION / TITLE
REFERENCE DRAWINGS / DESIGN STANDARDS	

PROJECT / W.O.:
SYSTEM: POTASH
ASSET: 623
DISCIPLINE: GENERAL

TITLE:
POTASH DUMPER No. 2 REPLACEMENT
GENERAL - DUMPER 2
DEMOLITION - SHEET 5

SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317086-36588-00-GE-DGA-8004	B

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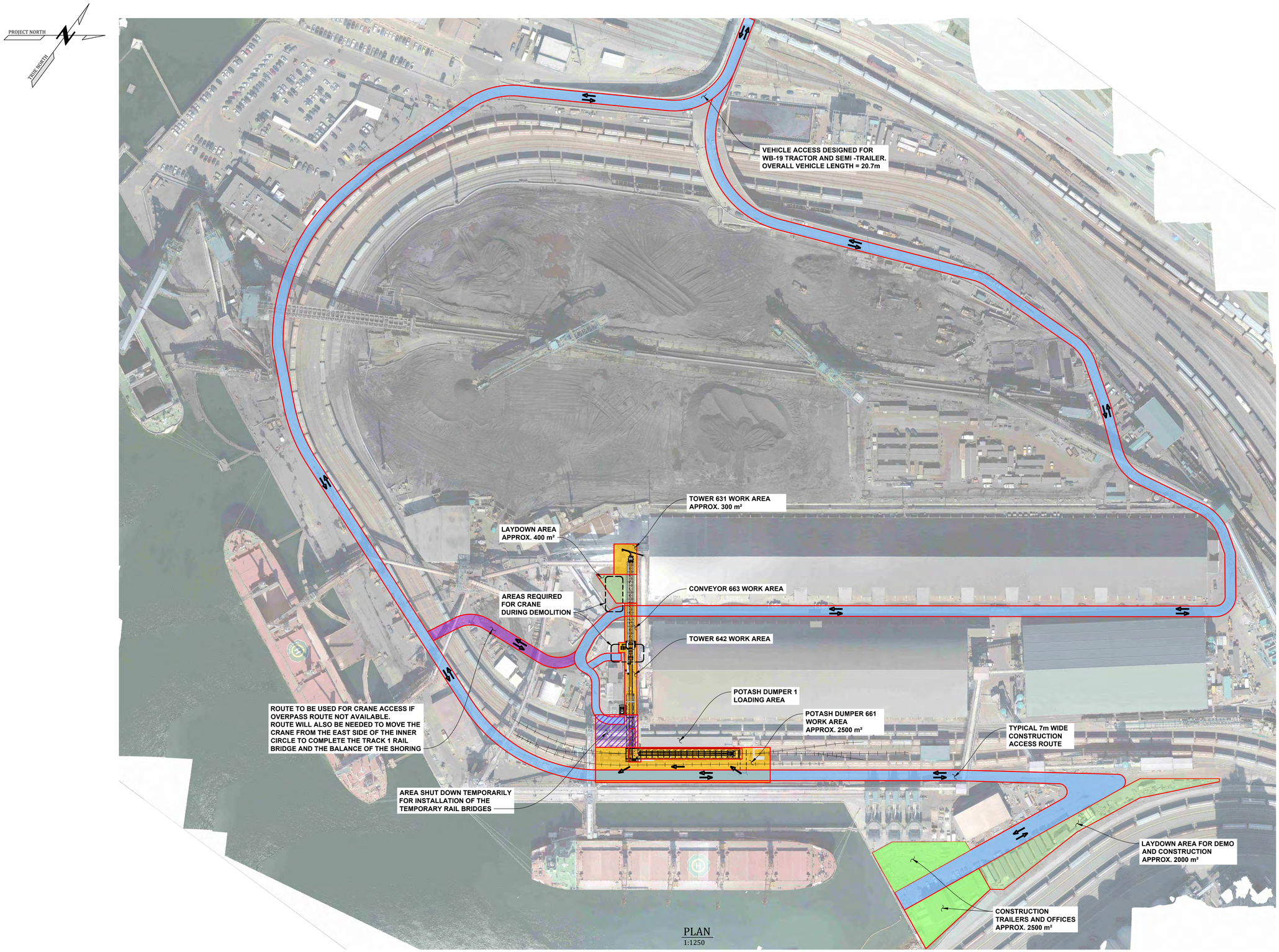

PLAN
1:1250

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: May. 28/22 10:30am

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1:1250

DRAWING NO.	DRAWING DESCRIPTION / TITLE						
REFERENCE DRAWINGS / DESIGN STANDARDS							

PROJECT / W.O.:
SYSTEM: POTASH
ASSET: 661/662/663
DISCIPLINE: CIVIL

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
C	2022-05-31	CLIENT REVIEW - 60% SUBMISSION	KDP	PLN
B	2022-04-26	RE-ISSUED CLIENT REVIEW	KDP	PLN
A	2022-03-31	CLIENT REVIEW - 30% SUBMISSION	KDP	PLN

ISSUES / REVISIONS

ENGINEERING SEAL:

VENDOR: Advisian Worley Group 317086-36588
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OEM:

VENDOR P2P:

ISSUED AS RECORD COPY? (YES/NO) NO

Neptune TERMINALS

TITLE:
POTASH DUMPER No 2 REPLACEMENT
CIVIL - DUMPER 661/CONVEYOR 662.CONVEYOR 663 - REVISED SITE CONSTRUCTION PLAN

SCALE:	SHEET	OF	DRAWING NO.	REV:
SHOWN	1	1	317086-36588-00-CI-DLP-1003	C

U:\YVR\317086\36588_NBTC_D2REPLACE\11_DRAWINGS\01_CIVIL\317086-36588-00-CI-DLP-1003.DWG DATE: 2022-05-28

APPENDIX C

B2 SOIL STATISTICAL ANALYSIS FOR CHLORIDE AND NICKEL

Table C1: B2 Upper Soil Layer - Soil Data

Sample ID	Sample Depth (m)	Chloride (mg/kg)	Nickel (mg/kg)
BH22-01 SA1	0.70-0.80	398	8.79
BH22-01 SA2	1.50-1.60	494	5.48
BH22-02 SA1	0.70-0.80	165	6.82
BH22-02 SA2	1.55-1.65	147	6.02
BH22-04 SA1	0.75-0.85	1480	15.3
BH22-04 SA2	1.50-1.60	946	8.76
BH22-06 SA1	0.70-0.80	891	17.1
BH22-07 SA1	0.70-0.80	487	42.7

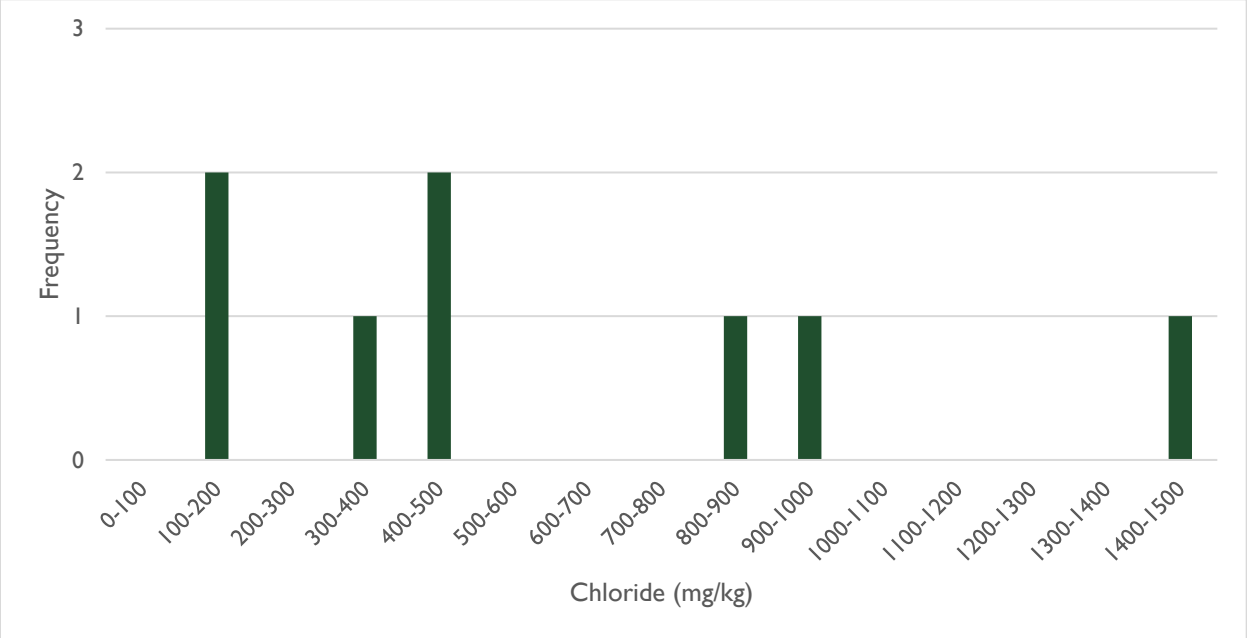

Figure C1: B2 Distribution of Chloride Concentrations in the Upper Soil Layer

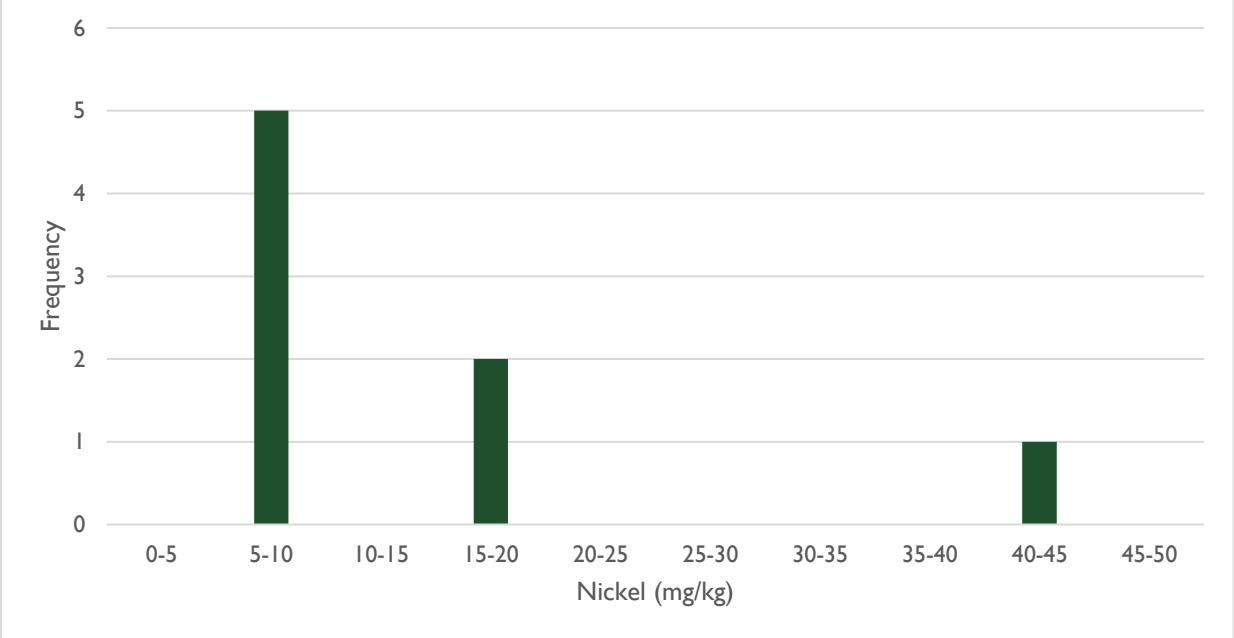

Figure C2: B2 Distribution of Nickel Concentrations in the Upper Soil Layer

SEE NEXT 4 PAGES FOR THE B2 UPPER SOIL LAYER PROUCL 95UCL OUTPUT TABLES

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.12022-08-02 10:10:31 AM
From File	Upper Soil Layer - Soil Data.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloride (mg/kg)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	147	Mean	626
Maximum	1480	Median	490.5
SD	452.4	Std. Error of Mean	159.9
Coefficient of Variation	0.723	Skewness	0.925

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	929	95% Adjusted-CLT UCL (Chen-1995)	945
		95% Modified-t UCL (Johnson-1978)	937.7

Gamma GOF Test

A-D Test Statistic	0.273	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.059	k star (bias corrected MLE)	1.37
Theta hat (MLE)	304.1	Theta star (bias corrected MLE)	456.9
nu hat (MLE)	32.94	nu star (bias corrected)	21.92
MLE Mean (bias corrected)	626	MLE Sd (bias corrected)	534.8
		Approximate Chi Square Value (0.05)	12.28
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	10.5

53	**Assuming Gamma Distribution**											
54	95% Approximate Gamma UCL (use when n>=50))				1118		95% Adjusted Gamma UCL (use when n<50)				1307	
55												
56	**Lognormal GOF Test**											
57	Shapiro Wilk Test Statistic				0.933		**Shapiro Wilk Lognormal GOF Test**					
58	5% Shapiro Wilk Critical Value				0.818		Data appear Lognormal at 5% Significance Level					
59	Lilliefors Test Statistic				0.158		**Lilliefors Lognormal GOF Test**					
60	5% Lilliefors Critical Value				0.283		Data appear Lognormal at 5% Significance Level					
61	**Data appear Lognormal at 5% Significance Level**											
62												
63	**Lognormal Statistics**											
64	Minimum of Logged Data				4.99		Mean of logged Data				6.177	
65	Maximum of Logged Data				7.3		SD of logged Data				0.818	
66												
67	**Assuming Lognormal Distribution**											
68	95% H-UCL				1699		90% Chebyshev (MVUE) UCL				1206	
69	95% Chebyshev (MVUE) UCL				1462		97.5% Chebyshev (MVUE) UCL				1818	
70	99% Chebyshev (MVUE) UCL				2517							
71												
72	**Nonparametric Distribution Free UCL Statistics**											
73	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
74												
75	**Nonparametric Distribution Free UCLs**											
76	95% CLT UCL				889.1		95% Jackknife UCL				929	
77	95% Standard Bootstrap UCL				872		95% Bootstrap-t UCL				1035	
78	95% Hall's Bootstrap UCL				977.4		95% Percentile Bootstrap UCL				879.1	
79	95% BCA Bootstrap UCL				906.5							
80	90% Chebyshev(Mean, Sd) UCL				1106		95% Chebyshev(Mean, Sd) UCL				1323	
81	97.5% Chebyshev(Mean, Sd) UCL				1625		99% Chebyshev(Mean, Sd) UCL				2217	
82												
83	**Suggested UCL to Use**											
84	95% Student's-t UCL				929							
85												
86	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
87	Recommendations are based upon data size, data distribution, and skewness.											
88	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
89	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
90												
91												
92	**Nickel (mg/kg)**											
93												
94	**General Statistics**											
95	Total Number of Observations				8		Number of Distinct Observations				8	
96							Number of Missing Observations				0	
97	Minimum				5.48		Mean				13.87	
98	Maximum				42.7		Median				8.775	
99	SD				12.41		Std. Error of Mean				4.386	
100	Coefficient of Variation				0.894		Skewness				2.225	
101												
102	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											
103	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
104	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											

105	**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**											
106												
107	**Normal GOF Test**											
108					Shapiro Wilk Test Statistic	0.703	**Shapiro Wilk GOF Test**					
109					5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level					
110					Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**					
111					5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level					
112	**Data Not Normal at 5% Significance Level**											
113												
114	**Assuming Normal Distribution**											
115				**95% Normal UCL**				**95% UCLs (Adjusted for Skewness)**				
116					95% Student's-t UCL	22.18			95% Adjusted-CLT UCL (Chen-1995)	24.77		
117									95% Modified-t UCL (Johnson-1978)	22.76		
118												
119	**Gamma GOF Test**											
120					A-D Test Statistic	0.625	**Anderson-Darling Gamma GOF Test**					
121					5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level					
122					K-S Test Statistic	0.278	**Kolmogorov-Smirnov Gamma GOF Test**					
123					5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level					
124	**Detected data appear Gamma Distributed at 5% Significance Level**											
125												
126	**Gamma Statistics**											
127					k hat (MLE)	2.196			k star (bias corrected MLE)	1.456		
128					Theta hat (MLE)	6.318			Theta star (bias corrected MLE)	9.53		
129					nu hat (MLE)	35.13			nu star (bias corrected)	23.29		
130					MLE Mean (bias corrected)	13.87			MLE Sd (bias corrected)	11.5		
131									Approximate Chi Square Value (0.05)	13.31		
132					Adjusted Level of Significance	0.0195			Adjusted Chi Square Value	11.45		
133												
134	**Assuming Gamma Distribution**											
135					95% Approximate Gamma UCL (use when n>=50)	24.27			95% Adjusted Gamma UCL (use when n<50)	28.22		
136												
137	**Lognormal GOF Test**											
138					Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk Lognormal GOF Test**					
139					5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level					
140					Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**					
141					5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level					
142	**Data appear Lognormal at 5% Significance Level**											
143												
144	**Lognormal Statistics**											
145					Minimum of Logged Data	1.701			Mean of logged Data	2.385		
146					Maximum of Logged Data	3.754			SD of logged Data	0.689		
147												
148	**Assuming Lognormal Distribution**											
149					95% H-UCL	27.89			90% Chebyshev (MVUE) UCL	23.18		
150					95% Chebyshev (MVUE) UCL	27.65			97.5% Chebyshev (MVUE) UCL	33.86		
151					99% Chebyshev (MVUE) UCL	46.06						
152												
153	**Nonparametric Distribution Free UCL Statistics**											
154	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
155												
156	**Nonparametric Distribution Free UCLs**											

	A	B	C	D	E	F	G	H	I	J	K	L
157					95% CLT UCL	21.09				95% Jackknife UCL		22.18
158					95% Standard Bootstrap UCL	20.68				95% Bootstrap-t UCL		36.07
159					95% Hall's Bootstrap UCL	44.88				95% Percentile Bootstrap UCL		21.65
160					95% BCA Bootstrap UCL	25.15						
161					90% Chebyshev(Mean, Sd) UCL	27.03				95% Chebyshev(Mean, Sd) UCL		32.99
162					97.5% Chebyshev(Mean, Sd) UCL	41.26				99% Chebyshev(Mean, Sd) UCL		57.51
163												
164					**Suggested UCL to Use**							
165					95% Adjusted Gamma UCL	28.22						
166												
167	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
168	Recommendations are based upon data size, data distribution, and skewness.											
169	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
170	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
171												

Table C2: B2 Lower Soil Layer - Soil Data

Sample ID	Sample Depth (m)	Chloride (mg/kg)	Nickel (mg/kg)
BH22-01 SA3	2.15-2.25	511	6.99
BH22-01 SA4	2.95-3.05	413	8.11
BH22-01 SA5	4.20-4.30	1370	8.44
BH22-01 SA6	5.25-5.35	541	7.85
BH22-01 SA7	5.80-5.90	529	6.3
BH22-02 SA3	2.40-2.50	206	5.78
BH22-02 SA4	2.90-3.00	148	5.55
BH22-02 SA5	3.60-3.70	181	5.44
BH22-02 SA6	4.20-4.30	162	6.18
BH22-02 SA7 / BH22-DUPA	4.90-5.00	279	7.59
BH22-02 SA8	5.40-5.50	442	7.69
BH22-03 SA1	0.75-0.85	682	49.3
BH22-03 SA2	1.50-1.60	355	18.5
BH22-03 SA3	2.20-2.30	301	8.78
BH22-03 SA4	2.85-2.95	187	5.55
BH22-03 SA5	3.70-3.80	62	5.79
BH22-03 SA6	4.35-4.45	136	4.58
BH22-03 SA7	4.90-5.00	99	10.7
BH22-03 SA8	5.50-5.60	90	7.03
BH22-04 SA3	2.30-2.40	142	6.27
BH22-04 SA4 / BH22-DUPC	3.70-3.80	86	6.33
BH22-04 SA5	4.30-4.40	210	5.87
BH22-04 SA6	5.00-5.10	186	6.19
BH22-04 SA7	5.60-5.70	299	7.37
BH22-05 SA1	0.60-0.70	69	108
BH22-05 SA2 / BH22-DUPB	1.50-1.60	88	64.5
BH22-05 SA3	2.25-2.35	361	31.5
BH22-05 SA4	3.00-3.10	239	10.8
BH22-05 SA5	3.90-4.00	461	25.5
BH22-05 SA6	4.50-4.60	349	13.2
BH22-05 SA7	5.25-5.35	293	5.92
BH22-05 SA8	5.80-5.90	440	5.77
BH22-06 SA2	1.25-1.35	887	5.78
BH22-06 SA3	2.00-2.10	491	4.46
BH22-06 SA4	2.65-2.75	426	5.93
BH22-06 SA5	3.80-3.90	305	5.49

Sample ID	Sample Depth (m)	Chloride (mg/kg)	Nickel (mg/kg)
BH22-06 SA6 / BH22-DUPD	4.50-4.60	288	5.57
BH22-06 SA7	5.25-5.35	362	5.25
BH22-06 SA8	5.95-6.05	500	5.26
BH22-07 SA2	1.50-1.60	301	13.1
BH22-07 SA3	2.10-2.20	407	6.62
BH22-07 SA4	2.80-2.90	314	6.16
BH22-07 SA5	3.80-3.90	229	6.37
BH22-07 SA6	4.50-4.60	215	5.04
BH22-07 SA7	5.25-5.35	237	5.12
BH22-07 SA8	5.80-5.90	344	4.81
BH22-08 SA1	0.70-0.80	450	4.31
BH22-08 SA2	1.40-1.50	910	4.8
BH22-08 SA3	2.25-2.35	603	4.46
BH22-08 SA4	2.90-3.00	412	6.26
BH22-08 SA5	3.70-3.80	225	5.5
BH22-08 SA6	4.50-4.60	243	4.63
BH22-08 SA7 / BH22-DUPE	5.25-5.35	194	4.93
BH22-08 SA8	5.95-6.05	349	5.6
BH22-09 SA1	0.75-0.85	602	122
BH22-09 SA2	1.40-1.50	661	86.9
BH22-09 SA3	2.25-2.35	541	4.79
BH22-09 SA4	2.85-2.95	209	5.39
BH22-09 SA5	3.90-4.00	314	6.19
BH22-09 SA6	4.65-4.75	403	5.45
BH22-09 SA7	5.30-5.40	385	5.05
BH22-09 SA8 / BH22-DUPF	5.95-6.05	418	6.05
BH22-10 SA1	0.60-0.70	347	19.8
BH22-10 SA2	1.30-1.40	264	14.3
BH22-10 SA3 / BH22-DUPG	2.20-2.30	337	6.15
BH22-10 SA4	2.80-2.90	155	5.21
BH22-10 SA5	3.30-3.40	233	6.76
BH22-10 SA6	4.05-4.15	185	4.72
BH22-10 SA7	4.50-4.60	303	4.87
BH22-10 SA8	5.45-5.55	462	4.6
BH22-10 SA9	6.30-6.40	512	5.5
BH22-10 SA10	7.15-7.25	459	5.29
BH22-10 SA11	7.85-7.95	196	5.81

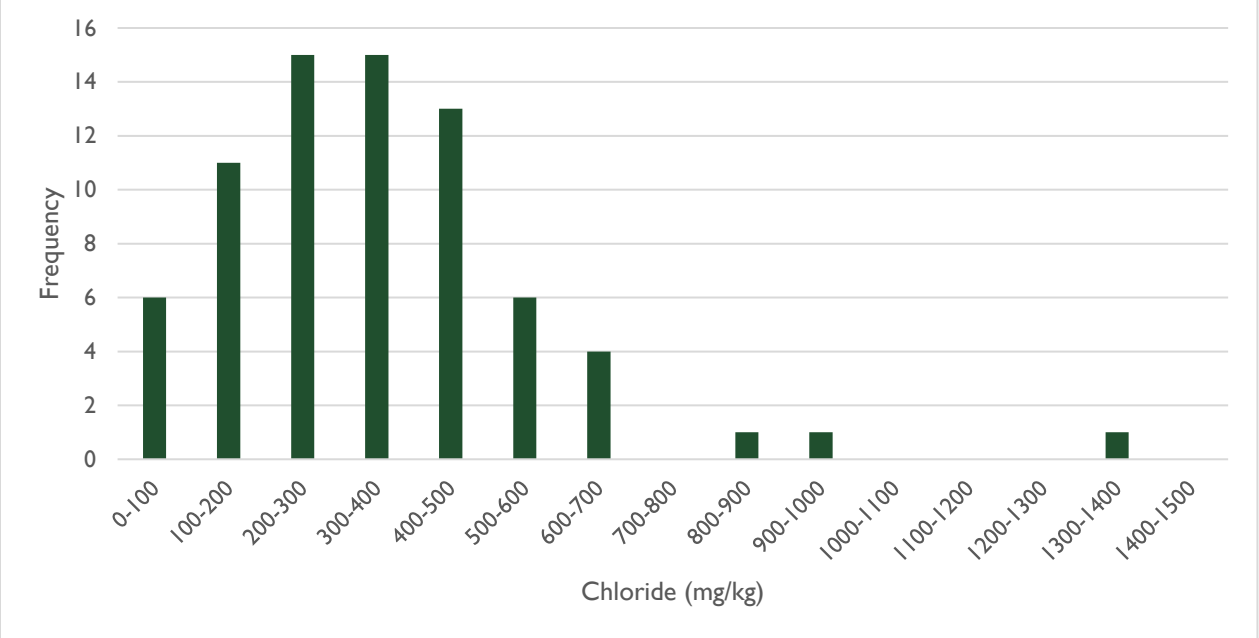

Figure C3: B2 Distribution of Chloride Concentrations in the Lower Soil Layer

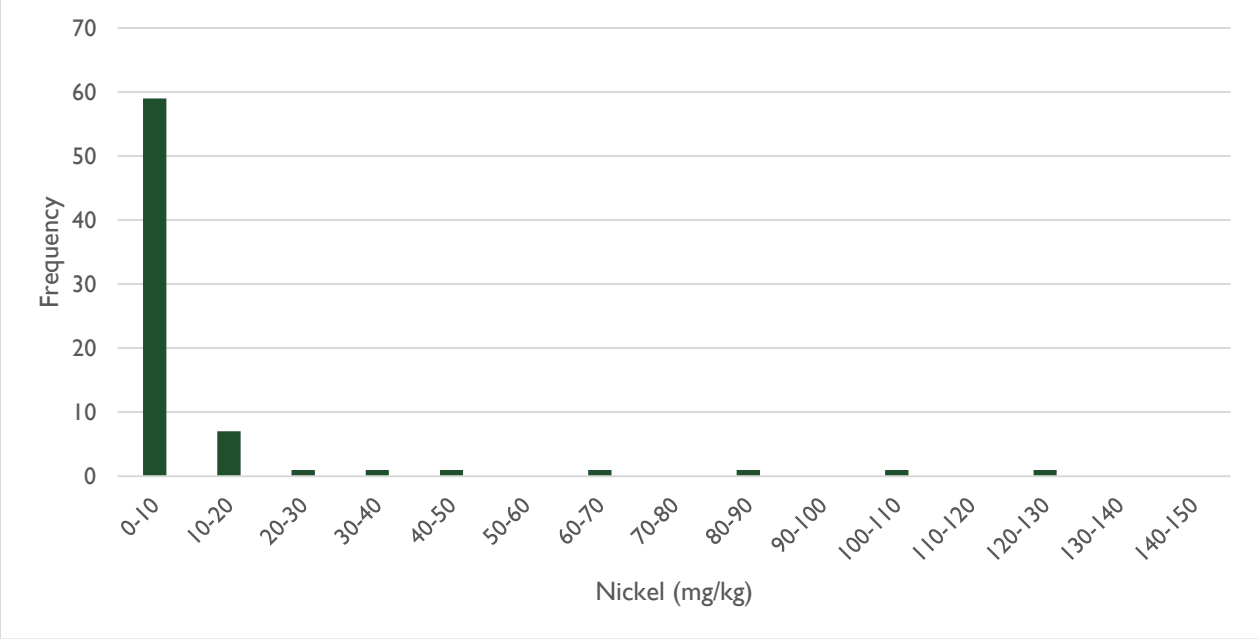

Figure C4: B2 Distribution of Nickel Concentrations in the Lower Soil Layer

SEE NEXT 4 PAGES FOR THE B2 LOWER SOIL LAYER PROUCL 95UCL OUTPUT TABLES

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.12022-08-02 10:09:19 AM
From File	Lower Soil Layer - Soil Data.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloride (mg/kg)

General Statistics

Total Number of Observations	73	Number of Distinct Observations	69
		Number of Missing Observations	0
Minimum	62	Mean	350.6
Maximum	1370	Median	314
SD	212.5	Std. Error of Mean	24.87
Coefficient of Variation	0.606	Skewness	1.969

Normal GOF Test

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	1.2185E-8	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.109	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	392	95% Adjusted-CLT UCL (Chen-1995)	397.6
		95% Modified-t UCL (Johnson-1978)	393

Gamma GOF Test

A-D Test Statistic	0.278	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0599	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.105	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.152	k star (bias corrected MLE)	3.032
Theta hat (MLE)	111.2	Theta star (bias corrected MLE)	115.6
nu hat (MLE)	460.2	nu star (bias corrected)	442.7
MLE Mean (bias corrected)	350.6	MLE Sd (bias corrected)	201.4
		Approximate Chi Square Value (0.05)	394.9
Adjusted Level of Significance	0.0467	Adjusted Chi Square Value	394

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	393	95% Adjusted Gamma UCL (use when n<50)	393.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**

53				5% Shapiro Wilk P Value	0.385	Data appear Lognormal at 5% Significance Level						
54				Lilliefors Test Statistic	0.083	**Lilliefors Lognormal GOF Test**						
55				5% Lilliefors Critical Value	0.104	Data appear Lognormal at 5% Significance Level						
56	**Data appear Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59				Minimum of Logged Data	4.127	Mean of logged Data	5.693					
60				Maximum of Logged Data	7.223	SD of logged Data	0.602					
61												
62	**Assuming Lognormal Distribution**											
63				95% H-UCL	407.4	90% Chebyshev (MVUE) UCL	435.2					
64				95% Chebyshev (MVUE) UCL	471.7	97.5% Chebyshev (MVUE) UCL	522.3					
65				99% Chebyshev (MVUE) UCL	621.9							
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71				95% CLT UCL	391.5	95% Jackknife UCL	392					
72				95% Standard Bootstrap UCL	391.8	95% Bootstrap-t UCL	398.4					
73				95% Hall's Bootstrap UCL	406.6	95% Percentile Bootstrap UCL	392					
74				95% BCA Bootstrap UCL	400.5							
75				90% Chebyshev(Mean, Sd) UCL	425.2	95% Chebyshev(Mean, Sd) UCL	459					
76				97.5% Chebyshev(Mean, Sd) UCL	505.9	99% Chebyshev(Mean, Sd) UCL	598					
77												
78	**Suggested UCL to Use**											
79				95% Approximate Gamma UCL	393							
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	Recommendations are based upon data size, data distribution, and skewness.											
83	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
84	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
85												
86												
87	**Nickel (mg/kg)**											
88												
89	**General Statistics**											
90				Total Number of Observations	73	Number of Distinct Observations	68					
91						Number of Missing Observations	0					
92				Minimum	4.31	Mean	12.79					
93				Maximum	122	Median	5.93					
94				SD	21.73	Std. Error of Mean	2.543					
95				Coefficient of Variation	1.699	Skewness	3.825					
96												
97	**Normal GOF Test**											
98				Shapiro Wilk Test Statistic	0.41	**Shapiro Wilk GOF Test**						
99				5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level						
100				Lilliefors Test Statistic	0.381	**Lilliefors GOF Test**						
101				5% Lilliefors Critical Value	0.104	Data Not Normal at 5% Significance Level						
102	**Data Not Normal at 5% Significance Level**											
103												
104	**Assuming Normal Distribution**											

105	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
106				95% Student's-t UCL		17.03				95% Adjusted-CLT UCL (Chen-1995)		18.19
107										95% Modified-t UCL (Johnson-1978)		17.22
108												
109	**Gamma GOF Test**											
110				A-D Test Statistic		13.03	**Anderson-Darling Gamma GOF Test**					
111				5% A-D Critical Value		0.777	Data Not Gamma Distributed at 5% Significance Level					
112				K-S Test Statistic		0.335	**Kolmogorov-Smirnov Gamma GOF Test**					
113				5% K-S Critical Value		0.107	Data Not Gamma Distributed at 5% Significance Level					
114	**Data Not Gamma Distributed at 5% Significance Level**											
115												
116	**Gamma Statistics**											
117				k hat (MLE)		1.169				k star (bias corrected MLE)		1.13
118				Theta hat (MLE)		10.94				Theta star (bias corrected MLE)		11.32
119				nu hat (MLE)		170.7				nu star (bias corrected)		165
120				MLE Mean (bias corrected)		12.79				MLE Sd (bias corrected)		12.03
121										Approximate Chi Square Value (0.05)		136.3
122				Adjusted Level of Significance		0.0467				Adjusted Chi Square Value		135.8
123												
124	**Assuming Gamma Distribution**											
125				95% Approximate Gamma UCL (use when n>=50))		15.48				95% Adjusted Gamma UCL (use when n<50)		15.54
126												
127	**Lognormal GOF Test**											
128				Shapiro Wilk Test Statistic		0.658	**Shapiro Wilk Lognormal GOF Test**					
129				5% Shapiro Wilk P Value		0	Data Not Lognormal at 5% Significance Level					
130				Lilliefors Test Statistic		0.272	**Lilliefors Lognormal GOF Test**					
131				5% Lilliefors Critical Value		0.104	Data Not Lognormal at 5% Significance Level					
132	**Data Not Lognormal at 5% Significance Level**											
133												
134	**Lognormal Statistics**											
135				Minimum of Logged Data		1.461				Mean of logged Data		2.063
136				Maximum of Logged Data		4.804				SD of logged Data		0.756
137												
138	**Assuming Lognormal Distribution**											
139				95% H-UCL		12.56				90% Chebyshev (MVUE) UCL		13.52
140				95% Chebyshev (MVUE) UCL		14.91				97.5% Chebyshev (MVUE) UCL		16.86
141				99% Chebyshev (MVUE) UCL		20.67						
142												
143	**Nonparametric Distribution Free UCL Statistics**											
144	**Data do not follow a Discernible Distribution (0.05)**											
145												
146	**Nonparametric Distribution Free UCLs**											
147				95% CLT UCL		16.97				95% Jackknife UCL		17.03
148				95% Standard Bootstrap UCL		16.99				95% Bootstrap-t UCL		20
149				95% Hall's Bootstrap UCL		17.57				95% Percentile Bootstrap UCL		17.03
150				95% BCA Bootstrap UCL		18.42						
151				90% Chebyshev(Mean, Sd) UCL		20.42				95% Chebyshev(Mean, Sd) UCL		23.87
152				97.5% Chebyshev(Mean, Sd) UCL		28.67				99% Chebyshev(Mean, Sd) UCL		38.09
153												
154	**Suggested UCL to Use**											
155				95% Chebyshev (Mean, Sd) UCL		23.87						
156												

	A	B	C	D	E	F	G	H	I	J	K	L
157	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
158	Recommendations are based upon data size, data distribution, and skewness.											
159	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
160	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
161												