Final Marine Area Pre-Remedial Design Investigation Work Plan

Weyerhaeuser Mill A Former
Everett, Washington
Ecology Agreed Order No.DE 8979

for

Washington State Department of Ecology
on Behalf of Port of Everett

September 15, 2025

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Abbreviations and Acronyms

1D	one-dimensional
2D	two-dimensional
Agreed Order	Agreed Order No. DE 8979
bgs	below ground surface
bml	below mudline
CAP	Cleanup Action Plan
CDF	confined disposal facility
cm	centimeters
COC	contaminants of concern
CPT	cone penetration test
CU	consolidated undrained
CY	cubic yard
CyDSS	cyclic direct simple shear test
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
ENR	enhanced natural recovery
EPA	United States Environmental Protection Agency
ft/sec	feet per second
HASP	Health and Safety Plan
HSA	hollow-stem auger
IDP	Inadvertent Discovery Plan
LEAF	Leaching Environmental Assessment Framework
MAM	microtremor array method
MASW	multi-channel analysis of surface waves
MBE	multibeam echosounder
MET	Modified Elutriate Test
MLLW	mean lower low water
MNR	monitored natural recovery
MTCA	Model Toxics Control Act
Port	Port of Everett
PRDI	Pre-Remedial Design Investigation

QAPP	Quality Assurance Project Plan
RCW	Revised Code of Washington
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
Site	Weyerhaeuser Mill A Former Site
SMA	Sediment Management Area
SMS	Sediment Management Plan
SPT	standard penetration test
SWAC	surface-area weighted average concentration
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
Vs	shear wave velocity
WAC	Washington Administrative Code
Weyerhaeuser	Weyerhaeuser Company

1.0 Introduction

This Pre-Remedial Design Investigation (PRDI) Work Plan describes the field and laboratory activities that will be completed to collect supplemental data for the engineering analysis and design of the Washington State Department of Ecology's (Ecology) selected cleanup action for the Marine Area of the Weyerhaeuser Mill A Former Site (Site) located in Everett, Washington (Figure 1). The cleanup action is described in the Marine Area Cleanup Action Plan (CAP; Ecology 2024). The PRDI, remedial design and permitting for the Marine Area cleanup action are being completed under Agreed Order No. DE 8979 (Agreed Order; Ecology 2012) and its amendments pursuant to requirements of the Washington State Model Toxics Control Act (MTCA), Chapter 70A.305 of the Revised Code of Washington (RCW), Chapter 173-340 of the Washington State Administrative Code (WAC) and the Sediment Management Standards (SMS), Chapter 173-204 WAC).

1.1 GENERAL SITE DESCRIPTION

The Site is comprised of two sub-areas: the Marine Area and the Upland Area as shown in Figure 2. The boundary between the Marine and the Upland Areas is the ordinary high-water elevation along the shoreline. The Marine Area is defined in the CAP by the extent of identified contamination and is comprised of land owned by the Port of Everett (Port) and Washington State-owned aquatic lands and is generally situated between Port Gardner Bay and the East Waterway. The Port manages the area situated between the Port's property line and the outer-harbor line under its 2002 Port Management Agreement (No. 20-080027) with the Washington State Department of Natural Resources (DNR; Figure 2).

1.1.1 Site History

Historical industrial activities at the Site have included pulp manufacturing, saw milling, ship building, shingle milling, log storage and log handling since the early 1900s. From 1926 through 1980, the Weyerhaeuser Company (Weyerhaeuser) operated lumber and pulp mills at the Site. Lumber milling continued until around 1933 at which time Weyerhaeuser closed and dismantled the lumber mill and began construction of an unbleached sulfite pulp mill known as Mill A. Construction of Mill A was completed in 1936 and in the early 1940s bleaching facilities were added to the Mill A operations. Figure 3 shows Mill A facilities in 1947 relative to the Marine and Upland Areas of the Site. The Weyerhaeuser Mill A operations ceased in 1980, and the facilities were subsequently demolished. The Port purchased the property in 1983. In 1987, the Port developed the property for use as a log sorting yard for receipt, storage and export of whole logs. Log handling operations by the Port's tenants continued at the property until the mid-2000s. From the mid-2000s to the present, the Site has been used by the Port for break bulk, container cargo storage and other shipping operations. The current layout of the Site is shown in Figure 4.

1.1.2 Local Geology and Hydrogeology

Based on a review of historical development of the Site and information gathered during the Agreed Order Remedial Investigation (Agreed Order RI) and previous environmental studies, the stratigraphy of sediment in the Marine Area consists of recently deposited sediments overlying native sediments of grey silt with varying sand content. The native sediments represent alluvial sediment from the Snohomish Basin deposited prior to industrial development of the Everett waterfront. The recently deposited sediments include loose or soft unconsolidated sands and silts as well as varying amounts of wood debris (i.e., sawdust, wood chips, bark, and twigs, etc.) up to 100 percent. Wood debris in the Marine Area varies

in thickness ranging from approximately 5 to 20 feet with the thickest occurrence in the nearshore area between the South and Pacific Terminal Wharfs.

The stratigraphy of the adjacent Upland Area generally consists of fill material overlying native sediments. The specific sources of the fill material in the South Terminal area are generally unknown but likely include debris and wood from historical mill operations, dredged sediment (South Terminal Wharf and northeast of the South Terminal Wharf) and imported material. Sources of fill at the Pacific Terminal include dredged material placed into a Nearshore Confined Disposal (NCD) Facility constructed within the former Mill A log pond (current location of Pacific Terminal) and imported material. The fill material in the Upland Area is separated from the Marine Area by a bulkhead, containment berms, and/or shoreline armoring.

Groundwater levels in the Upland Area range from approximately 7 to 10 feet below ground surface (bgs). In general, the presence of bulkheads limits the flow of groundwater and tidal influence. Where the bulkhead is absent, groundwater discharges to the adjacent surface water in Port Gardiner Bay and is tidally influenced.

1.2 ECOLOGY-SELECTED CLEANUP ACTION SUMMARY

For the purposes of evaluating remedial alternatives, the Marine Area was divided into seven sediment management areas (SMAs) identified as SMA-1 through SMA-7 as shown in Figure 5. The factors used to delineate the Marine Area SMAs, and their descriptions are summarized in the CAP. Details of the Ecology-selected cleanup action for the Marine Area of the Site are described in detail in the CAP and generally includes the following activities:

- Site preparation.
- Demolition of structures necessary to construct the Containment/Confined Disposal Facility (CDF) Structure.
- Installation of the South Terminal toe wall within SMA-6.
- Installation of the Containment/CDF wall encompassing SMA-5.
- Dredging of contaminated material from SMA-1d, SMA-2 (2a and 2b), SMA-3 (3a through 3c) and SMA-6.
- Containment and disposal of contaminated material in the Containment/CDF Structure (SMA-5).
- Upland transport and disposal of contaminated dredged materials that are more than the Containment/CDF structure capacity.
- Installation of dynamic sand cap within SMA-1d.
- Implementation of enhanced natural recovery (ENR) for SMA-1 (1b and 1c) and SMA-7.
- Implementation of monitored natural recovery (MNR) for SMA-1a.
- Construction of offsite habitat mitigation.
- Implementation of institutional controls.

The anticipated scope of the PRDI was originally presented in Section 8.5.2 of the CAP. As noted above, the PRDI will be completed to collect supplemental data for the engineering analysis and design of the Ecology-selected cleanup action for the Site.

1.3 PRE-REMEDIAL DESIGN INVESTIGATION OVERVIEW

PRDI activities will refine the delineation of the extent of contamination, boundaries of the SMAs and provide data for the engineering design and implementation of the Ecology-selected cleanup action for the Marine Area of the Site. This PRDI Work Plan identifies various surveys and the proposed location and depth of samples as well as the analyses/studies that will be completed on the samples. The anticipated scope of the PRDI was originally presented in Section 8.5.2 of the CAP (see references below to the four scope item bullets in Section 8.5.2 of the CAP.

The PRDI includes the following activities:

- Complete a high-resolution bathymetric survey of the Marine Area and the Eelgrass Mitigation Site. The bathymetry will serve as a basis for design drawings and quantity calculations and to provide data for the evaluation of natural recovery.
- Complete a diver survey beneath the South Terminal and Pacific Terminal Wharfs to evaluate sediment thickness above riprap and to evaluate the upper limit of sediment overlying the slope armor.
- Complete a subsurface structure survey to identify the extent of remnants of the historical pier structure located northeast of the South Terminal Wharf to better understand the potential for obstructions that would impact construction of the Containment/CDF wall.
- Complete environmental sampling and analysis to further evaluate the sedimentation rates, rate of chemical attenuation and chemical quality of the newly deposited sediment within SMA-1 (1a through 1c) and SMA-7, where natural recovery (MNR or ENR) is proposed to confirm the rate of natural recovery and the degree of clean material augmentation that may be necessary. This scope item was discussed in the CAP - Section 8.5.2, Bullet 2.
- Complete environmental sampling and analysis in SMA-1 (1b through 1d) and SMA-7, where placement of clean imported sand for ENR or dynamic sand capping is proposed to refine the SMA boundaries and estimate the acreage and volume of sand needed for placement. This scope item was discussed in the CAP - Section 8.5.2, Bullet 3.
- Complete environmental sampling and analysis in SMA-3 (3b and 3c) and SMA-6 to further evaluate sediment conditions along South and Pacific Terminal armored slopes. This scope item was discussed in the CAP - Section 8.5.2, Bullet 4.
- Complete environmental sampling and analysis in SMA-2 (2a and 2b), SMA-3 (3a through 3c) and SMA-6, where full removal of contaminated media is proposed to refine both the horizontal and vertical extent of contamination, SMA boundaries, and the volume of contaminated media that will be removed. Sediment chemistry testing will be used to pre-characterize the post-dredge surface sediment conditions in SMA-2, SMA-3 (3a through 3c) and SMA-6, where full removal of contaminated media is proposed so that field verification sampling of the dredged areas will not be necessary during construction. Additionally, geotechnical and environmental sampling and analysis will also be completed on materials representative of the dredge prism. The geotechnical analysis will be completed to better understand the dewatering, settlement and consolidation properties for placement

inside of the CDF after dredging, while the environmental analysis will be completed to estimate leachate quality of the dredged material following placement in the Containment/CDF. This scope item was discussed in the CAP - Section 8.5.2, Bullet 4.

- Complete geotechnical sampling and analysis and a geophysical survey in the vicinity of and along the alignment of the South Terminal toe wall and the Containment/CDF wall to further understand geotechnical properties of in-situ sediment, which will be required for design of these walls and ground improvement activities. This scope item was discussed in the CAP - Section 8.5.2, Bullet 1.
- Complete geotechnical sampling and analysis at the proposed Eelgrass Mitigation Site to evaluate the geotechnical properties of in-situ sediment for settlement, bearing failure, and slope stability under dredged materials to be placed on top of the existing sediment.

Activities that will be completed as part of the Marine Area PRDI are described below in Sections 2 through 4. Table 1 presents a summary of the proposed environmental and geotechnical investigation activities, and the associated objectives with each type of investigation. The proposed survey and sampling locations are shown in Figures 6 through 11.

Detailed descriptions of the field and laboratory testing procedures supporting the various PRDI activities are presented in the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) provided in Appendix A. The Health and Safety Plan (HASP) is provided in Appendix B. The Inadvertent Discovery Plan (IDP) is provided in Appendix C.

2.0 Bathymetric Survey, Diver and Subsurface Profile Surveys

2.1 BATHYMETRIC SURVEY

A bathymetric survey will be completed as part of the PRDI to provide updated elevation data throughout the Marine Area and the mitigation area. The bathymetric survey will be completed using a multibeam echosounder (MBE) deployed from a vessel and will provide survey coverage for the areas accessible by the vessel. The MBE will be supplemented where necessary with a single-beam echosounder and a Terrestrial Laser Scanner. The bathymetric survey will generally extend marginally beyond the limits of the Marine Area and the Eelgrass Mitigation Site, to the extent practicable, to ensure complete coverage of the cleanup and mitigation areas. Approximate coverage of the Marine Area bathymetric survey is shown in Figure 6. The Eelgrass Mitigation Site is generally shown in Figure 1. The bathymetric survey methodology is described further in the SAP/QAPP (Appendix A, Section 2.1.1).

The bathymetric survey will be completed to:

- Establish the pre-construction conditions for design and volumetric calculations; and
- Provide comparative data for the evaluation of natural recovery.

The PRDI bathymetric survey for the Marine Area will be compared to the 2017 bathymetric survey to determine changes in bottom elevations over time and establish the pre-construction condition for design. The PRDI bathymetric data will be supplemented by other surveys completed by the Port in the Marine Area as applicable. The survey comparison for the Marine Area will be used to evaluate the sedimentation rate in SMA-1 (1a through 1c) where natural recovery (MNR and ENR) is proposed. A bathymetric survey that

included the Eelgrass Mitigation Site was completed in 2024 for the purposes of identifying candidate sites. The PRDI bathymetric survey of the Eelgrass Mitigation Site will be higher resolution than the 2024 general survey and will collect higher resolution than the 2024 general survey and will collect an increased survey line density to support the design. The PRDI bathymetric survey for the Marine Area and mitigation area surveys will be used to establish the pre-construction condition for design. The bathymetric surveys will be referenced to Mean Lower Low Water (MLLW) and will be completed by a professional surveyor licensed in the State of Washington in accordance with the United States Army Corps of Engineers (USACE) Engineering and Design Hydrographic Surveying Engineer Manual (EM 1110-2-1003).

2.2 DIVER PROBING

The thickness of sediment located on top of the slope armoring at the South Terminal Wharf (within and adjacent to SMA-6) and the Pacific Terminal Wharf (adjacent to SMA-3 [3a and 3b]) is currently not fully delineated. To determine the thickness of sediment on top of armoring in these areas (and facilitate the environmental characterization sampling discussed in Section 3.1), a diver survey will be completed in the three areas shown in Figure 6. Diving activities will be coordinated with the Port of Everett and Naval Station Everett as necessary to ensure continuity with ongoing operations. The divers will measure the sediment thickness using a push probe inserted to detect the underlying slope armoring. The diver probing methodology is described further in the SAP/QAPP (Appendix A, Section 2.1.2).

The extent and thickness of sediment on top of the slope armoring at the two wharfs will be used to support design of the full removal cleanup action at SMA-6 and SMA-3 (3a and 3b).

2.3 SUBSURFACE STRUCTURE SURVEY

The extent of remnants of the historical pier structure located northeast of the South Terminal Wharf (SMA-5) is currently not known. A high-density MBE will be utilized to identify the potential presence of historical piling associated with the historical pier structure or other potential obstructions within SMA-5 that would impact construction of the Containment/CDF wall. The area requiring the subsurface structure survey is shown in Figure 6. The subsurface structure survey methodology is described further in the SAP/QAPP (Appendix A, Section 2.1.3).

The subsurface structure survey results will be used to support the design of and planning for the CDF wall construction.

3.0 Pre-Remedial Design Environmental Investigation

3.1 SURFACE SEDIMENT ENVIRONMENTAL CHARACTERIZATION

Surface sediment samples from locations shown in Figure 7 and summarized in Table 1 will be collected as part of the PRDI to achieve the following objectives:

- Evaluate the concentration of contaminants of concern (COC) in the most recently deposited sediments by collecting surface sediment samples in SMA-1a in the depth interval of 0 to 2 centimeters (cm) below mudline (bml);

- Determine changes in the concentration of COCs over time for the purpose of evaluating natural recovery using several approaches:
  - Comparing the chemical analytical results from the surface sediment samples collected from 0 to 2 cm bml (described above) with results from surface sediment samples collected from 0 to 10 cm bml at the same locations.
  - Comparing chemical analytical results from surface sediment samples collected in SMA-1 (1a through 1c) from 0 to 10 cm bml and SMA-7 from 0 to 40 cm bml with results from sediment samples previously collected at the same locations during the Marine Area Remedial Investigation (RI).
  - Comparing surface-area weighted average concentrations (SWACs) calculated using the Marine Area COC concentrations from surface sediment samples (0 to 10 cm or 0 to 40 cm bml) collected during the PRDI with the SWACs calculated using surface sediment samples collected during the Marine Area RI.
- Refine the horizontal extent of contamination and SMA boundaries by collecting surface sediment samples across SMA-1 (1b through 1d) and SMA-7; and
- Evaluate sediment conditions along the armored slope areas at the South Terminal and the Pacific Terminal Wharfs by collecting diver assisted surface sediment samples at both wharfs.

Surface sediment sample collection and analytical methods are described further in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Sections 2.2.1, 3.2.1 and 3.2.2). Surface sediment samples will be submitted to Ecology-accredited laboratories for chemical analysis of the Marine Area COCs (see Appendix A, Section 3.8.1).

3.1.1 Surface Sampling in SMA-1 (1a through 1d) and SMA-7

Surface sediment samples will be collected in SMA-1 (1a through 1d) and SMA-7 using a grab sampler at depths of 0 to 2 cm bml, 0 to 10 cm bml and 0 to 40 cm bml. The selected cleanup actions in these SMAs include MNR, ENR and dynamic sand caps. The purpose of each sample depth interval and location is described below.

- Surface sediment samples will be collected from 0 to 2 cm bml at six locations (PRDI-1 through PRDI-3, PRDI-7, PRDI-11 and PRDI-20; Figure 7) in SMA-1a to evaluate the sediment quality of the most recent material being deposited within the SMAs subject to natural recovery. The 0 to 2 cm interval is the minimum thickness that can be effectively collected and is representative of three or less years of deposition based on the RI Geochronology Study (GeoEngineers 2017).
- Surface sediment samples will be collected from 0 to 10 cm bml at each of the six locations identified above as well as six additional locations (PRDI-6, PRDI-8, PRDI-10 and PRDI-14 through PRDI-16; Figure 7) in SMA-1 (1b, 1c and 1d) and from 0 to 40 cm bml at one location (PRDI-21; Figure 7) in SMA-7 to evaluate changes in sediment COC concentrations within the compliance interval over time. The 13 proposed surface sediment sample locations are generally co-located with previous RI sampling locations for the purpose of a direct comparison of COC concentrations between the two sampling events. At sample locations PRDI-1 through PRDI-3, PRDI-7, PRDI-11 and PRDI-20 (Figure 7) within SMA-1a, the 0 to 10 cm surface sediment samples will be collected at the same locations as the 0 to 2 cm samples described above. The analytical results from these different depth intervals will be compared to each other as another way to determine if sediment quality in the MNR area is improving over time.

- Surface sediment samples will be collected from 0 to 10 cm bml at eight new locations (PRDI-4, PRDI-5, PRDI-9, PRDI-12, PRDI-13 and PRDI-17 through PRDI-19; Figure 7) in SMA-1 (1b through 1d) and from 0 to 40 cm bml at two new locations (PRDI-72 and PRDI-73) in SMA-7. Surface sediment samples at these ten locations, along with the 12 surface sediment sample locations in SMA-1 (1b through 1d) described above, will be used to refine the horizontal extent of contamination and SMA-1 (1b through 1d) boundaries, and the acreage and volume of sand that will be required for ENR and dynamic sand capping purposes.
- Surface sediment samples will be collected from 0 to 10 cm bml at five new locations (PRDI-67 through PRDI-71) in SMA-1a to increase data density for SWAC calculations.
- Surface sediment samples will target the 0 to 40 cm bml interval at the six surface sediment sample locations in SMA-1d. These six samples will be tested for moisture content to evaluate the settlement of the materials underlying the dynamic sand cap (see Appendix A, Section 3.8.2 for geotechnical moisture content testing).

3.1.2 Surface Sampling in SMA-6 and Adjacent to SMA-3 (3b and 3c)

Surface sediment samples will be collected by divers from 0 to 10 cm at three locations (PRDI-22 through PRDI-24; Figure 7) in SMA-6 and two locations (PRDI-25 and PRDI-26; Figure 7) adjacent to SMA-3 (3b and 3c) to characterize sediment conditions along the armored slopes at the South and Pacific Terminals.

The surface sediment data from this area will be used, along with the diver probing described in Section 2.2, to confirm the boundaries of SMA-6 and SMA-3 (3b and 3c).

3.2 SUBSURFACE SEDIMENT ENVIRONMENTAL CHARACTERIZATION

Subsurface sediment samples will be collected in SMA-2, SMA-3, and SMA-6 as shown in Figure 8 to achieve the following objectives:

- Confirm the elevation of the base of contaminated sediment within the proposed full removal areas to support dredge design, design of the South Terminal toe wall and Containment/CDF structures and refine dredge volume estimates for bidding purposes.
- Characterize the surface to be exposed by the proposed full removal dredging. Post-dredge surface verification sediment sampling requirements will be determined as part of the Engineering Design Report.
- Evaluate leachate quality from the dredged material following placement in the Containment/CDF.

Subsurface sediment sample collection and analytical methods are described further in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Sections 2.2.2 and 3.2.3). Subsurface sediment samples will be submitted to Ecology-accredited laboratories for chemical analysis of the Marine Area COCs (Appendix A, Section 3.8.1).

Additionally, samples of the sediment representative of the proposed dredge prism portion of each core will be collected and submitted for geotechnical laboratory testing as described in Section 4.1.2.

3.2.1 Depth of Contamination Confirmation and Dredged Surface Verification

Subsurface sediment samples will be collected in SMA-2 (2a and 2b), SMA-3 (3a through 3c), and SMA-6 using Vibracore, hollow-stem auger (HSA), or sonic drilling/sampling methods. The depth of sediment contamination was estimated across the Marine Area based on sediment analytical data from the RI. In general, subsurface environmental samples will be collected in 1-foot intervals up to depths of 5 feet below (step-down sample) and above (step-up sample) the currently estimated depth of contamination at locations shown in Figure 8.

The sample interval located immediately below the currently estimated depth of contamination at each location will be initially submitted for chemical analyses to confirm the absence or presence of Marine Area COC exceedances and the other collected samples (step-up and step-down samples) will be archived at the analytical laboratory for potential follow up analysis. If Marine Area COC exceedances are identified in the initial sample that was submitted for chemical analysis, then the next deeper sample interval (step-down sample) will be submitted for chemical analysis to refine the depth of contamination. If Marine Area COC exceedances are not identified in the initial sample interval, then the next overlying sample interval (step-up sample, if available based on relative dredged prism thickness and presence of wood debris less than 15 percent) will be submitted for chemical analysis to refine the depth of contamination. Additional archive sample analysis will be completed based on the results of the step-up or step-down chemical analytical results following the same sequence, using the remaining available sample intervals. Additionally, sediment samples above the estimated depth of contamination at selected locations (see Table 1) will be collected as described in Table 1 to further refine the depth of contamination.

Additionally, sediment samples above the estimated depth of contamination at selected locations (see Table 1) will be collected as described in Table 1 to further refine the depth of contamination.

The initial and archived sample analysis is further described in the SAP/QAPP (Appendix A).

3.2.2 Post-Containment/CDF Placement Dredged Material Leachate Evaluation

Subsurface sediment samples will be composited to form the leachate evaluation sample. For conservatism in the leachate evaluation, a composite test sample will be prepared using subsurface samples collected from locations within the proposed dredge prism that are known to contain the highest levels of contamination, based on the existing RI data (PRDI-33 through PRDI-41, PRDI-45 and PRDI-48). The samples for leachate evaluation will be collected in a separate mobilization after the depth of contamination has been confirmed as described in Section 3.2.1.

The composite sample will be submitted to a testing laboratory for two tests:

- **Modified Elutriate Test** (MET; USACE 2003). Following placement of dredged sediment in the CDF, the sediment will be dewatered in preparation for installation of ground improvements. The purpose of the MET is to evaluate the water quality within the Containment/CDF following placement of the contaminated dredged material. The MET data will support the design of the dewatering decant treatment process for discharge.
- **Leachate Testing using United States Environmental Protection Agency (EPA) Leaching Environmental Assessment Framework (LEAF) Method 1314**. Following placement in the CDF, leachate from the dredged material may occur over time. The purpose of the leachate testing is to evaluate the potential for contaminant release from the dredged material. These data will support the design of the containment system and long-term management approaches.

In addition to samples of the dredged material, marine surface water will be collected and used as the eluent in the MET. Marine surface water will be collected from RI sample location SW01, which is along the SMA-5/SMA-6 boundary and to the proposed CDF. LEAF Method 1314 does not use site-specific water.

4.0 Pre-Remedial Design Geotechnical Investigation

The objective of geotechnical field and laboratory testing program is to characterize the key soil/sediment units (i.e., wood debris fill, beach deposits, glacial drift soils, and sediments to be dredged) in the Marine Area and the Eelgrass Mitigation Site and to develop and refine the geotechnical design parameters for use in the engineering analyses to support the execution of the CAP, including dynamic sand capping, dredging, dredged material management, design of the South Terminal toe wall and the Containment/CDF wall and the design of the material placement at the Eelgrass Mitigation Site.

4.1 MARINE AREA GEOTECHNICAL INVESTIGATION

The key geotechnical engineering considerations for the cleanup actions in the Marine Area include:

- The liquefiable soils/sediments at the Site and the corresponding seismic induced ground deformations and slope stability that tend to impose large lateral spreading loads to the above structural elements and have significant impacts on the design of the above structural elements;
- The settlement of the contaminated dredged material to be placed behind the containment/CDF wall;
- The stability of the proposed dredged slopes; and
- The settlement of the materials underlying the dynamic sand cap.

Existing geotechnical data obtained from previous investigations will be used as applicable.

4.1.1 Marine Area Geotechnical Data Collection

The PRDI geotechnical field explorations for the Marine Area include a geophysical survey, geotechnical borings with standard penetration tests (SPTs), and cone penetration tests (CPTs).

4.1.1.1 GEOPHYSICAL SURVEY

A geophysical survey will be completed at the Site to primarily capture the site-specific shear wave velocity (Vs) for use in geotechnical engineering analyses. Additionally, the geophysical survey will help characterize the subsurface conditions and estimate the depth of the competent layer across the Site.

A geophysical survey is a non-intrusive subsurface test. The proposed geophysical survey is expected to be conducted on land at the Site. The proposed geophysical survey will include:

- A two-dimensional (2D) multi-channel analysis of surface waves (MASW) to develop a 2D Vs profile along Transect A-A' at the Site shown in Figure 9 to capture the site-specific Vs at relatively shallower depths (e.g., up to approximately 50 to 100 feet bgs).
- A one-dimensional (1D) local microtremor array method (MAM) along two perpendicular arrays B-B' and C-C' shown in Figure 9 to capture the site-specific Vs down to approximately 400 feet bgs.

- If the Vs measured through the local MAM is lower than the typical Vs value for engineering bedrock/firm ground (i.e., 2,500 feet per second [ft/sec]), a 1D regional MAM will be completed along the L-shaped array D-D' that covers a larger area as shown in Figure 9 to capture the site-specific Vs at greater depths to the engineering bedrock/firm ground.

The site-specific Vs data collected through the geophysical survey will be primarily used in site-specific seismic hazard analyses to assess ground shaking intensities, liquefaction potential of the Site soils and the associated seismic-induced ground deformations and slope stability under design earthquake events. The results will influence the design of potential ground improvements and structural elements of the containment/CDF wall and the South Terminal toe wall.

Details on the geophysical testing equipment and procedures are further described in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Section 3.3.1).

4.1.1.2 GEOTECHNICAL STANDARD PENETRATION TEST BORINGS

The geotechnical borings with SPTs will be completed using a truck- or track-mounted drill rig that is capable of mud rotary, HSA or sonic drilling methods to collect material strength data and soil/sediment samples for use in geotechnical laboratory testing to evaluate engineering properties. Mud rotary is the preferred method for acquiring geotechnical data; however, alternative methods may be used if wood debris or other subsurface obstructions prevent advancement of the borings. For the over-water drilling, the drill rig will be mounted on a floating barge that is sufficiently large to provide stable support and work areas for the drilling operations.

The nine proposed geotechnical boring locations (PRDI-33, PRDI-35 and PRDI-54 through PRDI-60) are shown in Figure 10. Six borings (PRDI-33, PRDI-35 and PRDI-54 through PRDI-57) are over-water with target depths of approximately 110 to 120 feet bml or to practical refusal and the remaining three borings (PRDI-58 through PRDI-60) are on-land with target depths of approximately 110 to 120 feet bgs or to practical refusal.

Either undisturbed or disturbed soil/sediment samples will be collected from the geotechnical borings with SPTs depending on the materials encountered in the field. Undisturbed samples will be collected using Shelby Tube/Piston samplers. Disturbed samples will be collected using split-spoon samplers. The geotechnical samples will be collected at 5-foot intervals. If the materials collected from the split-spoon sampler are visually classified as sensitive materials (i.e., wood debris as is anticipated to be encountered in the Marine Area), a Piston sampler will be used to collect undisturbed samples from immediately below the split-spoon sampling depth. If sample recovery is poor using the split-spoon sampler, a modified California sampler with a larger diameter barrel will be used to collect the sample immediately below the split-spoon sampling depth to improve recovery. If the materials collected from the split-spoon sampler are visually classified as cohesive soils, a Shelby Tube sampler will be used to obtain undisturbed samples from immediately below the split-spoon sampling depth. The number of blows (also known as N-value) will be recorded when the split-spoon sampler or modified California sampler is used.

The geotechnical samples collected from these borings will be used for geotechnical laboratory testing (detailed in Section 4.1.2 and in Appendix A, Section 3.8.2) to determine geotechnical engineering properties (e.g., geotechnical index parameters, compressibility, shear strength and dynamic properties).

Along with the number of blows collected through the geotechnical borings that provides a measure of soil penetration resistance, the above engineering properties will be used in geotechnical engineering analyses to evaluate the liquefaction potential of the site soil/sediment and the associated seismic induced ground deformations and slope stability. The results of the geotechnical testing and evaluation will influence the design of potential ground improvements within the Containment/CDF structure, the lateral earth pressures on the structural elements of the containment/CDF wall and the South Terminal toe wall, and the stability of the proposed dredged slopes.

Details on the equipment and SPT boring sampling equipment procedures are further described in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Section 3.3.2).

4.1.1.3 GEOTECHNICAL CONE PENETRATION TESTING

CPT is an in-situ testing method used to determine the geotechnical properties of soil/sediment. The CPT method provides continuous and real-time data on soil behavior and stratigraphy. The CPTs will be completed at four locations (PRDI-61 through PRDI-64; Figure 10). Three CPTs (PRDI-61 through PRDI-63) are located offshore with target depths of approximately 100 feet bml or to practical refusal. The other CPT (PRDI-64) is in the Upland Area with a target depth of approximately 100 feet bgs or to practical refusal.

Shear wave velocity testing will be conducted in conjunction with the CPT to collect Vs data at PRDI-62 and PRDI-64, where PRDI-64 is located adjacent to the geophysical survey 2D MASW array (Transect A-A') so that the measured Vs can be cross-checked.

Piezocone penetrometers with fully compensated independent load cells for both the tip and sleeve, equal end area friction sleeves, and a net end area ratio consistent with the current industry standard will be used. These piezocone features are critical to obtain accurate sleeve friction data within fluid mud under water (Boggess and Robertson 2010).

The key parameters that can be estimated based on the data collected through the CPTs include soil classification, stratigraphic details, site-specific Vs data, and shear strength. As continuous measurements, these key parameters derived from the CPTs can supplement the information from the geotechnical borings and will be used in the geotechnical engineering analyses as described in Section 4.1.1.2.

Details on the CPT equipment and procedures are further described in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Section 3.3.3).

4.1.2 Marine Area Geotechnical Laboratory Testing

Geotechnical laboratory testing will be completed on representative soil samples collected as part of the geotechnical investigation.

4.1.2.1 IN-PLACE SUBSURFACE SOIL/SEDIMENT

Samples of subsurface soils and sediment that will remain in place as part of the cleanup action will be tested to characterize material types (i.e., Unified Soil Classification System [USCS] classification) and evaluate their geotechnical engineering properties (e.g., moisture content, density, percent fines, grain size distribution, plasticity, permeability, compressibility, shear strength and dynamic properties) for use in the engineering analyses and design.

The proposed geotechnical laboratory testing will include geotechnical index tests, permeability tests, 1D consolidation tests, triaxial tests and cyclic direct simple shear tests (CyDSS), as appropriate.

Details regarding these tests are described in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Section 3.8.2.1).

4.1.2.2 SEDIMENTS TO BE DREDGED AND PLACED IN THE CDF OR DISPOSED IN A LANDFILL

Samples of sediment to be dredged as part of the cleanup action will be tested to characterize the sediments and evaluate:

- The physical properties (e.g., moisture content, bulk density, material pH, grain size distribution and plasticity if applicable) of the sediments to be dredged,
- The settling rate (without adding flocculant), permeability, compressibility, shear strength and dynamic properties of the sediments to be dredged and placed in the CDF,
- The free-draining capacity of the sediments to be dredged and disposed in a landfill, and
- The weight (tons) to volume (cubic yards [CY]) conversion for the sediments to be dredged and disposed in a landfill.

The proposed geotechnical laboratory testing will include geotechnical index tests, column settling tests, consolidated undrained (CU) triaxial tests, permeability tests, 1D consolidation tests, CyDSS, gravity drain tests and 5-gallon bucket tests, as appropriate.

Details regarding these tests are described in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Section 3.8.2.2).

4.2 EELGRASS MITIGATION SITE GEOTECHNICAL INVESTIGATION

The planned mitigation action at the Eelgrass Mitigation Site (as shown in Figure 11) includes the placement of fill (cleaned dredged material) to achieve depths suitable for eelgrass growth adjacent to an existing eelgrass bed. The key geotechnical issue at the Eelgrass Mitigation Site includes the potential settlement and slope stability after the placement of fill.

4.2.1 Eelgrass Mitigation Site Geotechnical Data Collection

Geotechnical field explorations will be completed at the Eelgrass Mitigation Site. The two proposed locations consist of completing over-water geotechnical borings with SPTs (PRDI-65 and PRDI-66). The geotechnical borings will be completed using a truck- or track-mounted drill rig that is capable of mud rotary, HSA or sonic drilling methods to collect sediment strength data and samples for use in geotechnical laboratory testing to evaluate engineering properties. For this over-water drilling, the drill rig will be mounted on a floating barge that is sufficiently large to provide stable support and work areas for the drilling operations. The proposed boring locations are presented in Figure 11. The total drilling footage will be approximately 50 feet bml, or to practical refusal.

Either undisturbed or disturbed soil/sediment samples will be collected from the geotechnical borings with SPTs depending on the materials encountered in the field. Undisturbed samples collection will use Shelby Tube/Piston samplers. Disturbed samples collection will use split-spoon samplers. The geotechnical

samples will be collected at 5-foot intervals. If the materials collected from the split-spoon sampler are visually classified as sensitive materials (i.e., wood debris), a Piston sampler will be used to obtain undisturbed samples from immediately below the split-spoon sampling depth. If sample recovery is poor using the split-spoon sampler, a modified California sampler with a larger diameter barrel will be used to collect the sample immediately below the split-spoon sampling depth to improve recovery. If the materials collected from the split-spoon sampler are visually classified as cohesive soils, a Shelby Tube sampler will be used to obtain undisturbed samples from immediately below the split-spoon sampling depth. The number of blows (also known as N-value) will be recorded when split-spoon sampler or modified California sampler is used.

The geotechnical samples collected at the Eelgrass Mitigation Site will be tested to determine geotechnical engineering properties (e.g., geotechnical index parameters, compressibility and shear strength). Along with the number of blows collected through the geotechnical borings that provides a measure of soil penetration resistance, the above engineering properties will be used in geotechnical engineering analyses to evaluate the potential settlement and slope stability after the placement of fill.

Details regarding the equipment and procedure are further described in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Section 3.3.2).

4.2.2 Eelgrass Mitigation Site Geotechnical Laboratory Testing

Geotechnical laboratory testing will be completed on representative sediment samples collected from the proposed Eelgrass Mitigation Site. The samples will be tested to characterize material types (i.e., USCS classification) and evaluate their geotechnical engineering properties (e.g., moisture content, density, percent fines, grain size distribution, plasticity, permeability, compressibility and shear strength) for use in the engineering analyses and design.

The proposed geotechnical laboratory testing will include geotechnical index tests, permeability tests, 1D consolidation tests and triaxial tests, as appropriate. Details regarding these tests are described in the SAP/QAPP, included as Appendix A of this PRDI Work Plan (Appendix A, Section 3.8.2.1).

The material information for the clean dredged material that will be placed over the existing sediment at the Eelgrass Mitigation Site will be provided by the USACE or other project proponents. If this information is not available, then additional samples of the Snohomish River dredged material will need to be collected to characterize the sediment geotechnical properties under a separate Work Plan addendum.

5.0 Health and Safety Plan

Site cleanup-related activities need to be completed in accordance with the requirements of the Washington Industrial Safety and Health Act (RCW 49.17) and the federal Occupational Safety and Health Act (29 CFR 1910, 1926). These applicable regulations include requirements that workers are to be protected from exposure to contaminants. A HASP for project personnel implementing the field work is provided in Appendix B.

6.0 Procedures for the Inadvertent Discovery of Cultural Resources

The IDP for the PRDI is presented in Appendix C and outlines procedures to be completed in the event of the discovery of archaeological materials or human remains, in accordance with applicable state and federal laws. The IDP will be reviewed by the field team prior to beginning fieldwork and kept at the project site during the PRDI to reference in the event of a discovery.

7.0 Reporting

Following completion of environmental and geotechnical investigation activities described in this PRDI Work Plan, a PRDI Data Report will be prepared as required by the Agreed Order. The PRDI Data Report will present the results of the environmental and geotechnical investigation activities and testing results. Evaluation of the PRDI data will be completed as part of the Agreed Order-required Engineering Design Report that will be prepared following approval of the PRDI Data Report.

The environmental laboratory data obtained as part of the PRDI will be reported via electronic media using the tabular outputting capabilities of standard software formats and uploaded to Ecology's Electronic Information Management (EIM) system.

8.0 Schedule

A specific field sampling schedule will be developed following Ecology approval of the Final PRDI Project Plans and receipt of sampling permits. According to the Agreed Order, the PRDI field sampling must begin "within 90 days from the start of the first permit restricted in-water work window following finalization of the PRDI Work Plan." Ecology will be notified at the time unanticipated conditions or changed circumstances are discovered that might result in a schedule delay. Any requests for a schedule extension will be undertaken through the process described in the Agreed Order.

Estimated durations for the PRDI work scope elements are included in the table below. The estimated duration for implementation of the PRDI Work Plan accounts for unknowns identified during the PRDI and is dependent on contractor availability.

PRDI SCHEDULE

WORK SCOPE	ESTIMATED DURATION
Begin implementation of the PRDI Work Plan[1]	Within 90 days from the start of the first permit restricted in-water work window following Ecology's approval of the Final PRDI Work Plan.
Prepare Draft PRDI Data Report	90 days following availability of validated investigation data.
Prepare Final PRDI Data Report	30 days following receipt of Ecology's final comments on the Draft PRDI Data Report.

Note:

[1]Multiple in-water work windows may be required to complete the PRDI depending on the approved scope of study and start date.

9.0 Limitations

This PRDI Work Plan has been prepared for the exclusive use of Port of Everett and their authorized agents for the Weyerhaeuser Mill A Former Site. No other party may rely on the product of our services unless we agree in advance and in writing to such reliance.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

10.0 References

Boggess, R. and Robertson, P.K., 2010. CPT for soft sediments and deepwater investigations. In 2nd International Symposium on Core Penetration Testing, Huntington Beach, CA, USA, May 2010.

Ecology, 2012. "Agreed Order for Remedial Investigation/Feasibility Study and Draft Cleanup Action Plan – Weyerhaeuser Mill A Former Site, No. DE 8979," In the Matter of Remedial Action by: Port of Everett, Weyerhaeuser, and Washington State Department of Natural Resources. Filed August 9, 2012, amended September 30, 2024.

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USACE, 2003. "Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual." USACE Engineer Research and Development Center. ERDC/EL TR-03-1. January 2003.

Tables

TABLE 1. PRE-REMEDIAL DESIGN INVESTIGATION SAMPLE DESCRIPTIONS AND OBJECTIVES

SAMPLE AREA	SAMPLE TYPE	LOCATION NAMES	NUMBER OF LOCATIONS	SAMPLE METHODOLOGY	ANALYSES	OBJECTIVES AND RATIONALE
Proposed Bathymetric Survey, Diver Probing and Subsurface Structure Survey – Figure 6						
Marine Area including SMA-1 through 7	Bathymetric Survey	Marine Area including SMA-1 through 7	n/a	Multibeam	Survey	Perform bathymetric survey of the Marine Area. Compare surveys (new and past surveys) to identify areas of erosion and accretion and calculate sedimentation rates within natural recovery areas (SMA-1 [1a through 1c] and 7). New survey data will also be used to develop cleanup action design and calculate dredge volume for bidding purposes in SMAs-1d, 2a, 2b, 3a, 3b, 3c, 5 and 6.
Mitigation Area		Eelgrass Mitigation Site	n/a	Multibeam		Perform bathymetric survey of the mitigation area. A new survey will be utilized to establish the pre-construction conditions for design.
Pacific and South Terminal	Diver Probing	SMA-3b, SMA-3c and SMA-6	n/a	Hand Probe	Diver survey utilizing probe rod across regular transect intervals	Diver survey to evaluate sediment thickness above riprap (South and Pacific Terminal Wharfs) and to evaluate the upper limit of sediment overlying the slope armor.
SMA-5	Subsurface Structure Survey	SMA-5	1	Multibeam	High-Density Multibeam	Identify possible buried piling associated with the former pier structure.
Proposed Surface Sediment Sampling Locations – Figure 7						
SMA-1, SMA-6, SMA-3, and SMA-7	Surface sediment sample from 0 to 2 cm bml	PRDI-1 through PRDI-3, PRDI-7, PRDI-11, and PRDI-20	6	Power Grab	Chemical Analysis[1]	Re-occupy previous surface sediment locations to determine the chemical quality of the most recent sediments being deposited within the natural recovery areas.
	Surface sediment sample from 0 to 10 cm bml	PRDI-1 through PRDI-3, PRDI-6 through PRDI-8, PRDI-10, PRDI-11, PRDI-14 through PRDI-16,PRDI-20 and PRDI67 through 71	14	Power Grab		Re-occupy previous surface sediment locations to evaluate changes in contaminant concentrations over time within the compliance interval of the natural recovery areas or collect surface sediment from new locations to increase data density for Surface Weighted Average Concentration (SWAC) calculations.
	Surface sediment sample from 0 to 40 cm bml	PRDI-21, PRDI-72 and PRDI-73	3	Power Grab		Re-occupy previous surface sediment location and collect surface sediment from new locations to evaluate changes in contaminant concentrations over time within the compliance interval of the natural recovery areas and refine the horizontal extent of contamination and the SMA boundary.
	Surface sediment sample from 0 to 10 cm bml	PRDI-4, PRDI-5, PRDI-9, PRDI-12 through PRDI-15, and PRDI-17 through PRDI-19	11	Power Grab		Collect surface sediment (0-10 cm) from new locations within the ENR and dynamic sand cap areas to refine the contamination extent, SMA boundaries, and estimate the acreage and volume of sand needed for placement.

SAMPLE AREA	SAMPLE TYPE	LOCATION NAMES	NUMBER OF LOCATIONS	SAMPLE METHODOLOGY	ANALYSES	OBJECTIVES AND RATIONALE
SMA-1, SMA-6, SMA-3, and SMA-7	Surface sediment sample from 0 to 40 cm bml	PRDI-8, PRDI-10, PRDI-12, PRDI-17 through PRDI-19	6	Power Grab	Evaluate geotechnical properties (moisture content)	Re-occupy previous surface sediment sample location and new sample location for testing of near surface sediment to evaluate the potential for settlement of the in-place sediments following placement of the dynamic sand cap.
	Surface sediment sample from 0 to 10 cm bml	PRDI-22 through PRDI-26	5	Diver Deployed Surface Grab	Chemical Analysis[1]	Collect surface sediment from new locations to refine the delineation of sediment quality conditions along South and Pacific Terminal armored slopes.
Proposed Subsurface Sediment Sampling Locations – Figure 8						
SMA-2, SMA-3, and SMA-6	Subsurface sediment samples (New sample location)	PRDI-27 through PRDI-56, PRDI-74 and PRDI-75	32	Vibracore (preferred)[2], Hollow-Stem Auger or Sonic	Chemical Analysis[1] Evaluate dredged material physical characteristics for CDF and landfill disposal	Confirm the elevation of the base of contaminated sediment within the proposed full removal areas to support dredge design, design of the South Terminal toe wall and Containment/Confined Disposal Facility (CDF) structures and to refine dredge volume estimates for bidding purposes including: ■ Characterize the surface to be exposed by the proposed full removal dredging so that field verification sampling of the dredged areas may not be necessary during construction. ■ Estimate leachate quality of the dredged material following placement in the Containment/CDF. ■ Determine the physical properties (e.g., moisture content, bulk density, material pH, grain size distribution, and plasticity if applicable) of the sediments to be dredged. ■ Determine the settling rate, permeability, compressibility, shear strength, and dynamic properties of the sediments to be dredged. ■ Determine the free-draining capacity of the sediments to be dredged. ■ Measure the density of the sediments to be dredged for use in converting volume to weight.
Proposed Geophysical Survey – Figure 9						
Upland Area	Geophysical Survey	Transects A-A', B-B', C-C', and D-D'	4	2D Multichannel Analysis of Surface Waved [MASW] or Microtremor Array Measurement [MAM]) and Regional MAM	Shear wave velocity profile along established transects	Capture the site-specific shear wave velocity (Vs) for use in geotechnical engineering analyses.

SAMPLE AREA	SAMPLE TYPE	LOCATION NAMES	NUMBER OF LOCATIONS	SAMPLE METHODOLOGY	ANALYSES	OBJECTIVES AND RATIONALE
Proposed Geotechnical Investigation Subsurface Sampling Locations – Figure 10						
SMA-5 and SMA-6	Subsurface sediment samples	PRDI-61 through PRDI-63	3	Cone Penetration Test	Evaluate geotechnical properties	Additional investigation on marine sediment and upland soil from new sample locations to refine/update material (soil and sediment) properties for use in the geotechnical analysis, and to support toe wall and CDF design, including: ■ Obtain blow count measurements and material classification. ■ Seismic hazard analysis. ■ Evaluation of global slope stability and lateral ground deformations (under both temporary and permanent conditions) along the Containment/CDF and the South Terminal toe wall. ■ Slope stability evaluation for the dredged cut slope near the southern end of the South Terminal toe wall. ■ Ground improvement design (behind the CDF wall). ■ Earth pressure development on the CDF and toe walls. ■ Field testing includes blow count measurements and material classification. ■ Tip resistance, side friction, water pressure, shear wave velocity, dissipation test through performing cone penetration tests ■ Geotechnical index testing. ■ Engineering properties as appropriate (e.g., plasticity for fine-grained soils, consolidation properties for compressible soils, i.e., clay soils).
	Subsurface sediment samples	PRDI-33, PRDI-35, PRDI-54 through PRDI-57	6	Mud-Rotary (preferred)[3], Sonic, or Hollow-Stem Auger		
Upland Area	Subsurface sediment samples	PRDI-64	1	Cone Penetration Test		
	Subsurface sediment samples	PRDI-58 through PRDI-60	3	Mud-Rotary (preferred)[3], Sonic, or Hollow-Stem Auger		
Proposed Sediment Investigation to Support the Design of Filling at the Mitigation Site – Figure 11						
Habitat Mitigation Site	Subsurface sediment samples	PRDI-65 and PRDI-66	2	Mud-Rotary (preferred)[3], Sonic, or Hollow-Stem Auger	Evaluate geotechnical properties	Collect subsurface sediment from new locations to evaluate potential settlement, bearing failure, and slope stability for in place sediments within the CDF.
	Dredged Material - Snohomish River	n/a[4]	n/a[4]	n/a[4]	n/a[4]	

Notes:

[1] Chemical analysis will include the Marine Area contaminants of concern (COCs).

[2] Vibracore is the preferred method for acquiring environmental data; however, alternative methods may be used if needed due to sample depth requirements

[3] Mud-rotary is the preferred method for acquiring geotechnical data; however, alternative methods may be used if wood debris or other subsurface obstructions prevent advancement of the borings.

[4] Assumes that material information about the sediments (materials to be dredged) provided by others.

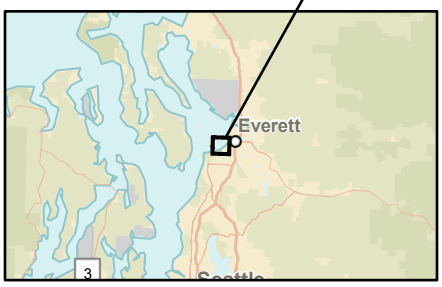
bml = below mud line

CDF = Confined Disposal Facility

cm = centimeters

SMA = Sediment Management Area

Figures



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Vicinity Map

Weyerhaeuser Mill A Former Site
Everett, Washington

GeoEngineers

Figure 1

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 10N

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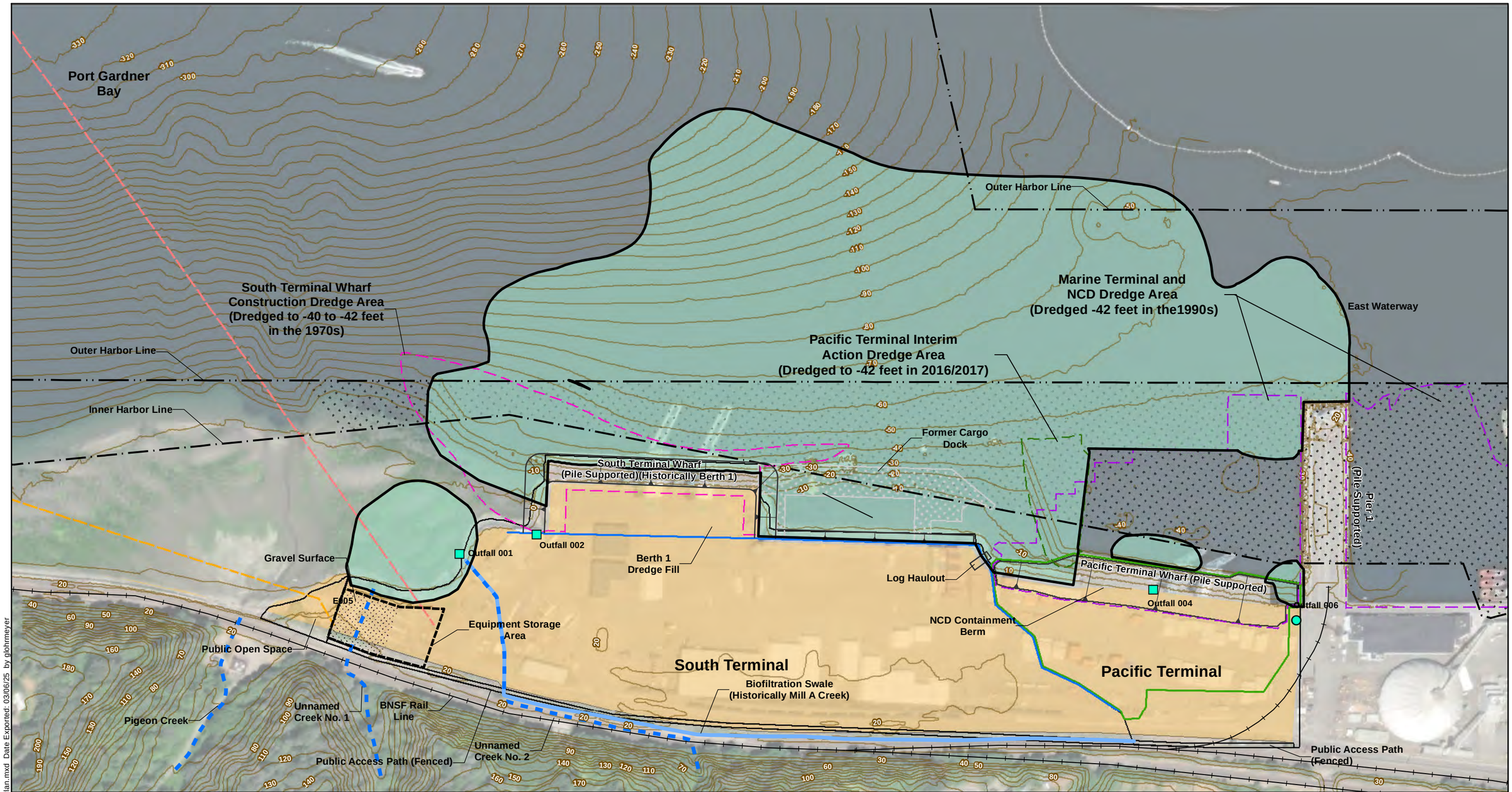

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Source(s):
- Base aerial from ESRI, 2022

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

Legend

- *Construction Berm*
- *Historical Piling Area*
- *Nearshore Confined Disposal (NCD) Facility (Former Log Pond)*
- *Sediment Management Area Boundary*
- *Approximate Marine Area*
- *Approximate Upland Area*
- *Area Managed By the Port of Everett Under PMA No. 20-08-0027 With the DNR*

PMA Port Management Agreement DNR Department of Natural Resources

- *Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (approximate)*
- *Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (approximate)*
- *Bulkhead*
- *Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])*
- *Current CSO*
- *Current Stormwater Outfall*

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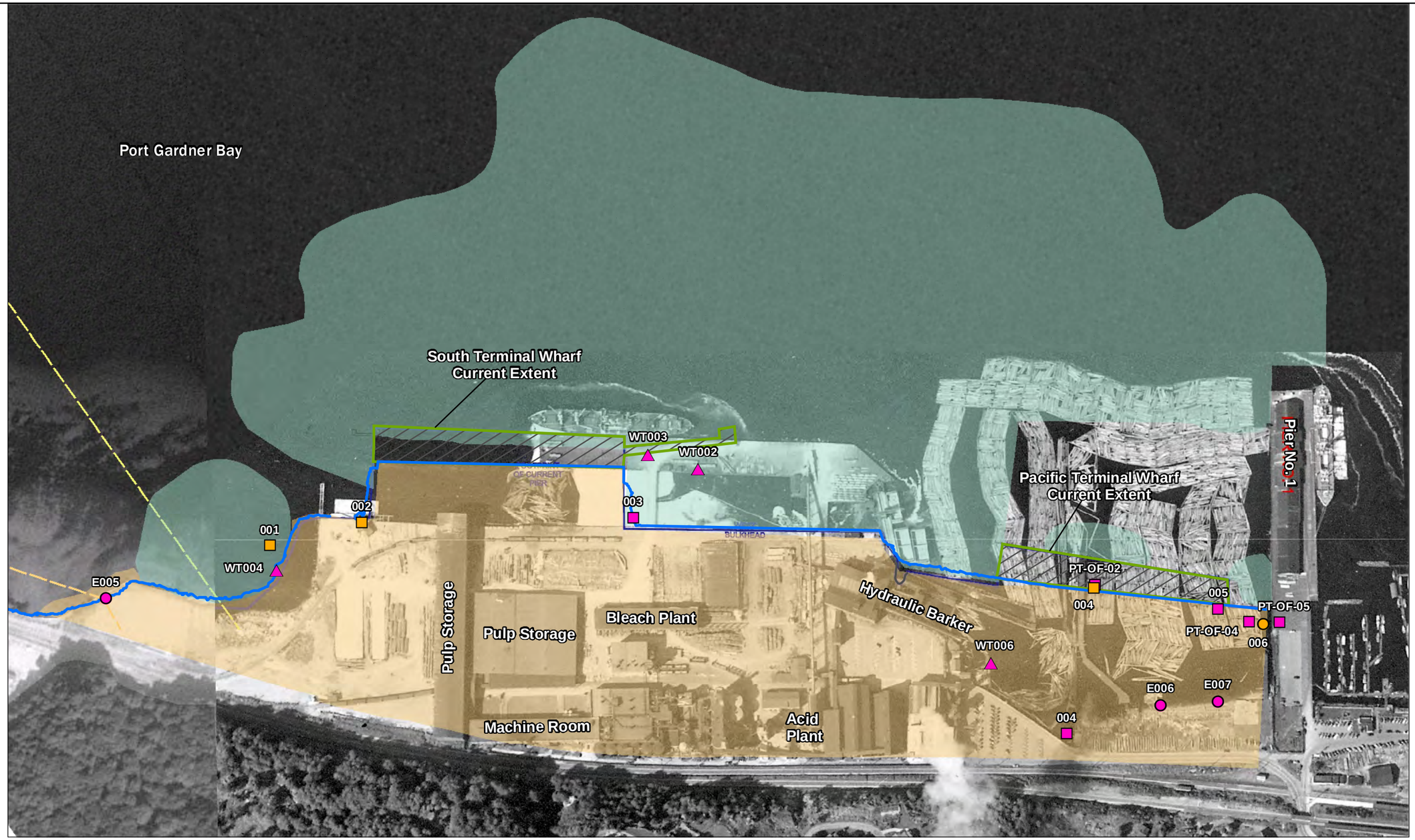
Site Plan

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 2



Source(s):
- Base aerial and Approximate Shoreline from Geomatrix 2007. Data Report. Former Mill A MTCA Support Sample Collection. EVerett, Washington. November 2007.
- Southwest side aerial from Google Earth, 1990

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Current Shoreline
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001
- Approximate Extent of Weyerhauser Mill A Former Site Marine Area Contamination. Based on Marine Area Cleanup Action Plan (CAP) dated November 2024
- Approximate Upland Area
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

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Site Information on 1947 Aerial Photograph

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 3

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Source(s):
- Aerial photo from Port of Everett, 2009.

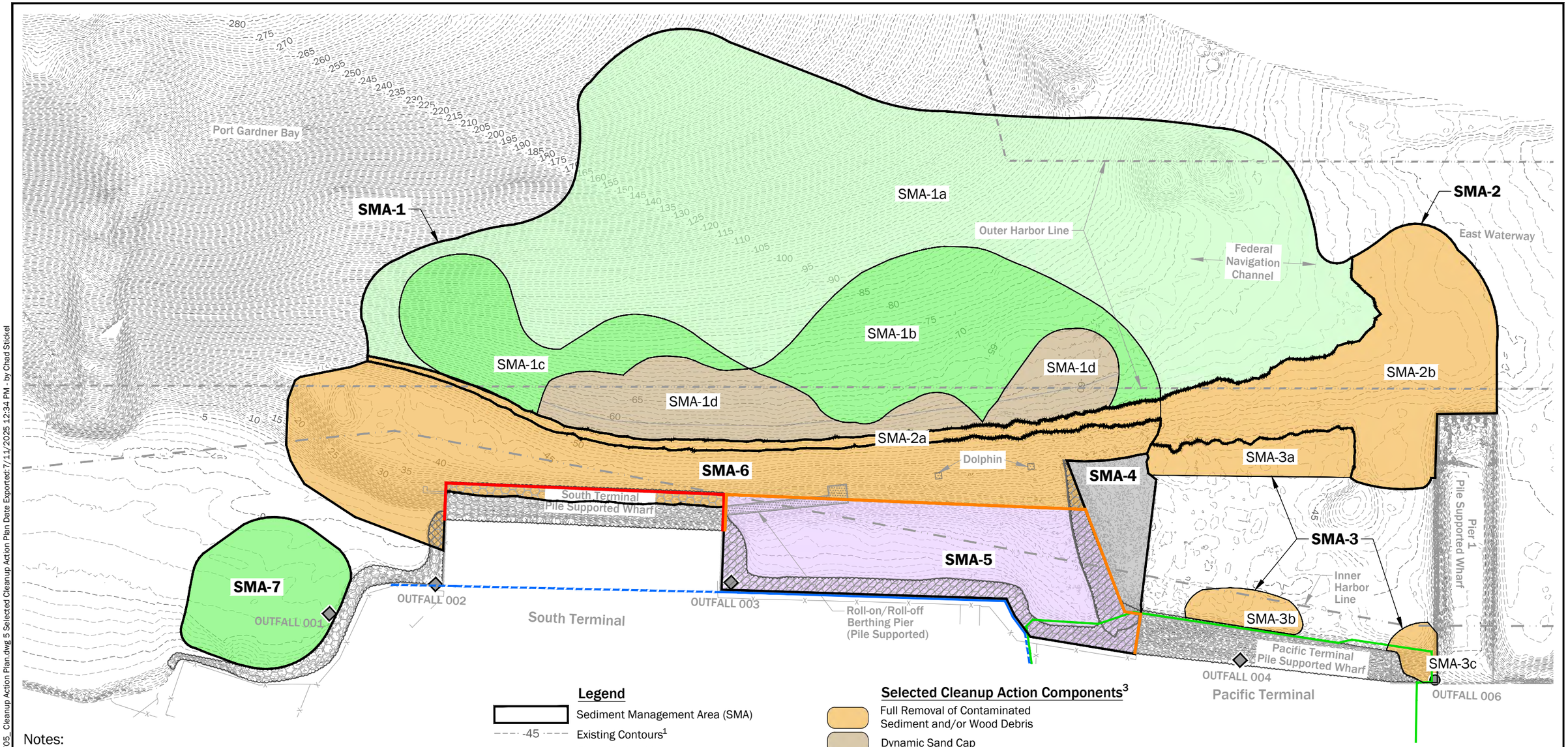
Overview

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 4

Path: P:\0\0676020\GIS\MXD\0676020 06_F04_Overview.mxd Map Revised: 06 March 2025 glohmeyer



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall

Selected Cleanup Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Dynamic Sand Cap
- Enhanced Natural Recovery (ENR)
- Monitored Natural Recovery (MNR) Temp
- Containment/Confined Disposal Facility (CDF)
- Remove Existing Pile-Supported Roll-on/Roll-off Berthing Pier and Dolphins
- Remove Existing Armor
- Remove and Replace Existing Armor
- No Action
- New South Terminal Wharf Toe Wall
- New Containment/Confined Disposal Facility (CDF) Wall

250 0 250
Feet

N W E S

Ecology Selected Cleanup Action Plan

Weyerhaeuser Mill A Former
Everett, Washington

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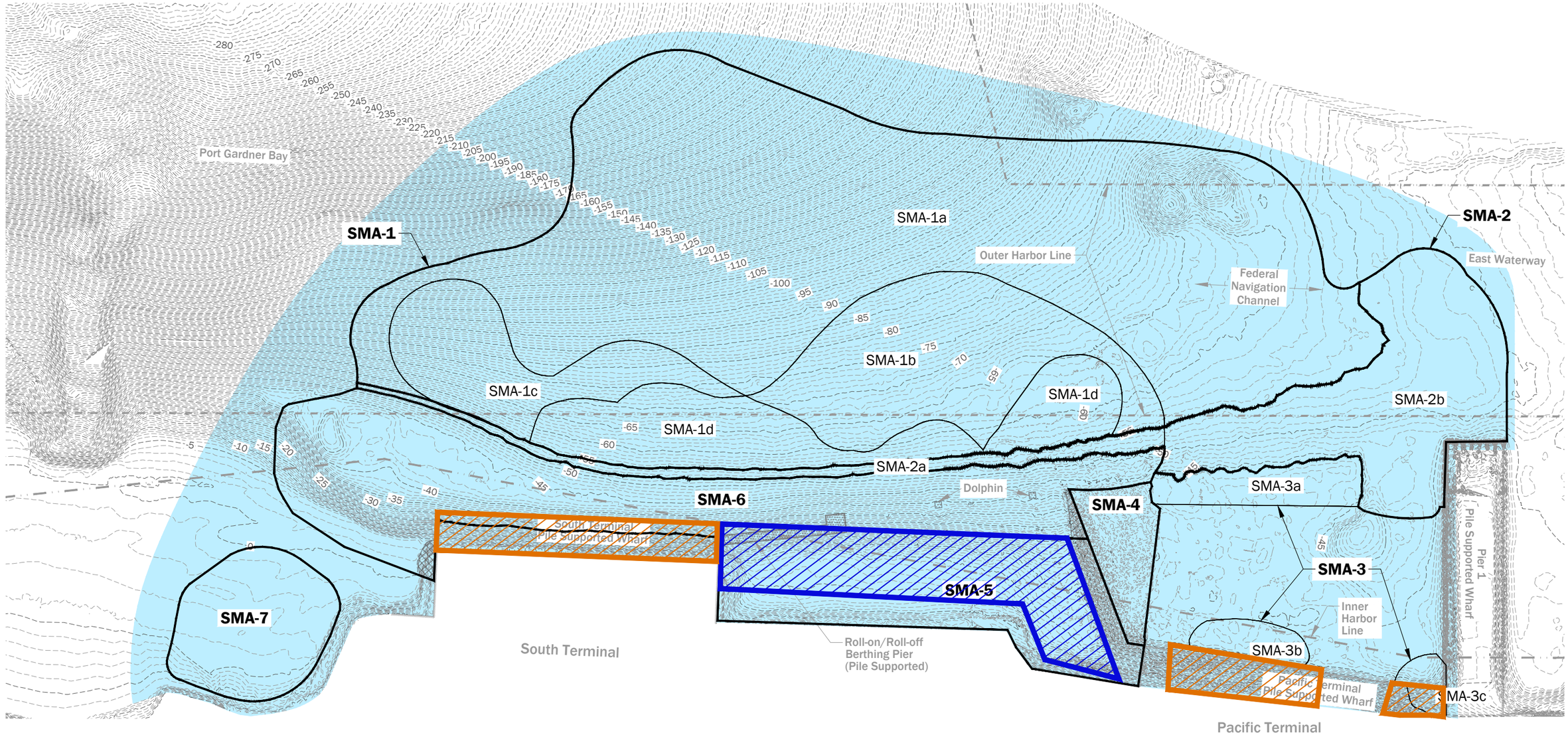
Figure 5

Notes:

1. Bathymetric Contours are based on merged survey data provided by Tetra Tech on 12/12/2017. Three surveys were merged by Tetra Tech - 1) Tetra Tech survey dated February 2017 presenting bathymetry of the marine areas adjacent to the South Terminal, 2) Tetra Tech survey dated December 2015 presenting bathymetry of areas underneath the Pacific/South Terminal Wharfs, and 3) Pacific Geomatic Services, Inc. survey dated October 2014 presenting the bathymetry of the rest of the marine areas of the site except for Pacific Terminal Interim Action Dredge Area. The bathymetry for the Pacific Terminal Interim Action Dredge Area is based on Tetra Tech survey dated February 2017 and was merged by GeoEngineers.
2. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Cleanup Action Plan.
3. The locations of all features shown are approximate.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: See Notes 1 and 2.

Horizontal Datum: North American Datum (NAD) 1983/1991, WA State Plane, N Zone, US Foot
Vertical Datum: Mean Lower Low Water (MLLW)
Vertical Datum Conversion (based on NOAA's Publication Sheet (944-7659), dated 09/29/1988):
MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW



Notes:

1. Bathymetric Contours are based on merged survey data provided by Tetra Tech on 12/12/2017. Three surveys were merged by Tetra Tech - 1) Tetra Tech survey dated February 2017 presenting bathymetry of the marine areas adjacent to the South Terminal, 2) Tetra Tech survey dated December 2015 presenting bathymetry of areas underneath the Pacific/South Terminal Wharfs, and 3) Pacific Geomatic Services, Inc. survey dated October 2014 presenting the bathymetry of the rest of the marine areas of the site except for Pacific Terminal Interim Action Dredge Area. The bathymetry for the Pacific Terminal Interim Action Dredge Area is based on Tetra Tech survey dated February 2017 and was merged by GeoEngineers.
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MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Bathymetric Survey Area - Establish Pre-Construction Conditions for Design and Volumetric Calculations
- Subsurface Profiling Area - Identify Possible Buried Piling Associated with the Former Pier Structure
- Diver Survey Area - Evaluate Sediment Thickness on Top of Slope Armoring

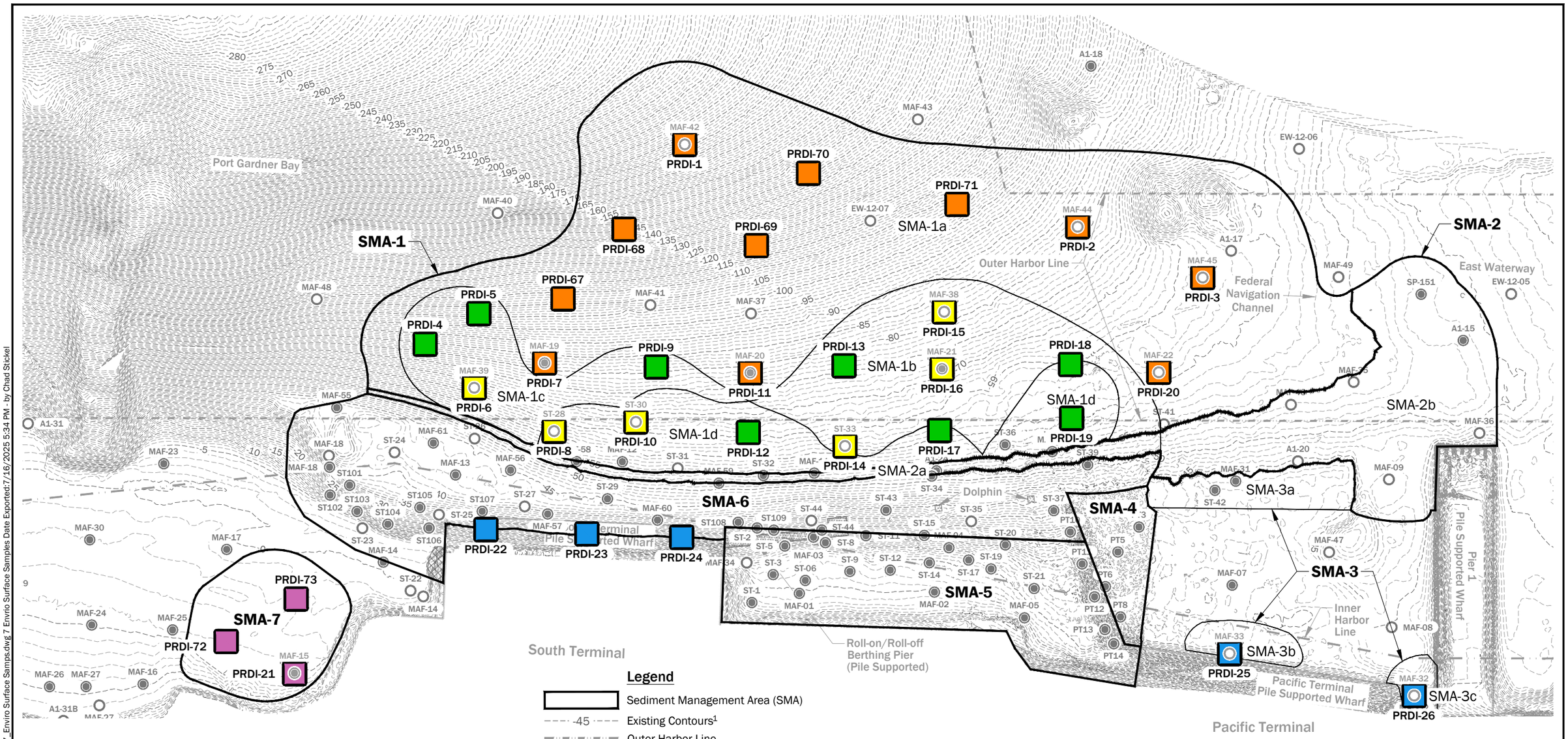
250 0 250
Feet

Marine Area Surveys

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 6



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Previous Sediment Surface Sample
- Previous Sediment Core Sample

Proposed Surface Sediment Sampling Locations

- Re-Occupy Previous Surface Sediment Location to Evaluate Changes in Contaminant Concentrations Over Time (0 to 10 cm) and to Refine the Horizontal Extent of Contamination and SMA boundary
- Re-Occupy Previous Surface Sediment Location or New Location to Evaluate Changes in Contaminant Concentrations Over Time (0 to 10 cm) and New Sediment Quality (0 to 2 cm) and to Refine the Horizontal Extent of Contamination and SMA boundary
- Re-Occupy Previous Surface Sediment Location or New Location to Evaluate Changes in Contaminant Concentrations Over Time (0 to 40 cm) and to Refine the Horizontal Extent of Contamination and SMA boundary
- Collect Surface Sediment (0 to 10 cm) from New Location to Refine the Horizontal Extent of Contamination and SMA Boundary
- Collect Diver Assisted Surface Sediment (0 to 10 cm) from New Location to Evaluate Sediment Conditions Along the South Terminal and Pacific Terminal Armored Slopes

Notes:

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MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

250 0 250
Feet

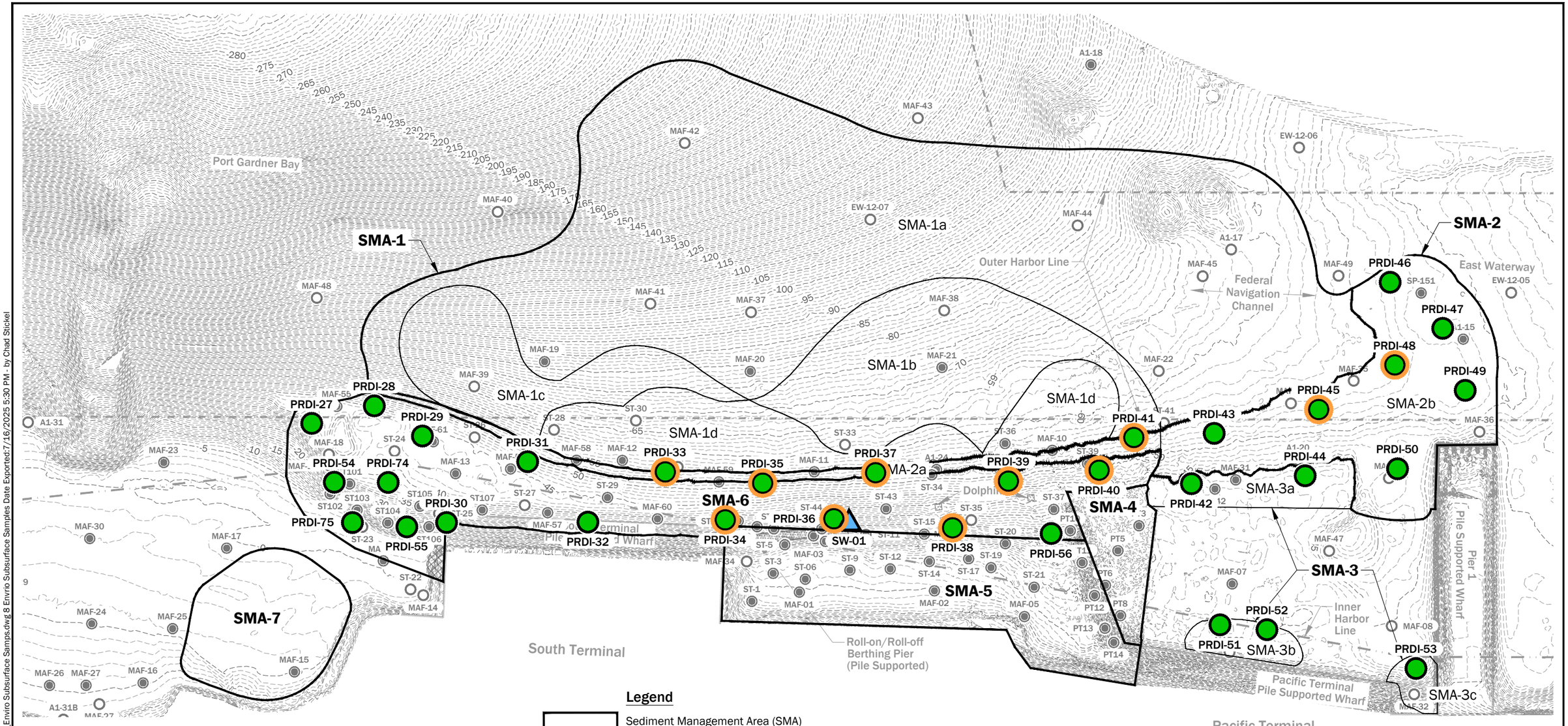
Environmental Investigation
Surface Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 7

P:\0\0676020\CAD\07\task 3000 [prdi work plan]\0676020007_F07_Enviro Surface Samps.dwg 7 Enviro Surface Samples Date Exported:7/16/2025 5:34 PM - by Chad Stickel



Notes:

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NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Previous Sediment Surface Sample
- Previous Sediment Core Sample

Proposed Subsurface Sediment and Surface Water Sampling Locations

- Sediment core (Vibracore, Sonic, or Hollow Stem Auger) will be completed to confirm the estimated base elevation of contamination and provide data for dredge depth verification. Additionally, from select core locations dredged material composite samples will be collected to evaluate material characterization for dredge dewatering and placement in the Confined Disposal Facility (CDF).
- Sediment core location for leachate testing composite sample
- Surface water will be collected and used as eluent in elutriate and leachate tests

250 0 250
Feet

Environmental Investigation Subsurface and Surface Water Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

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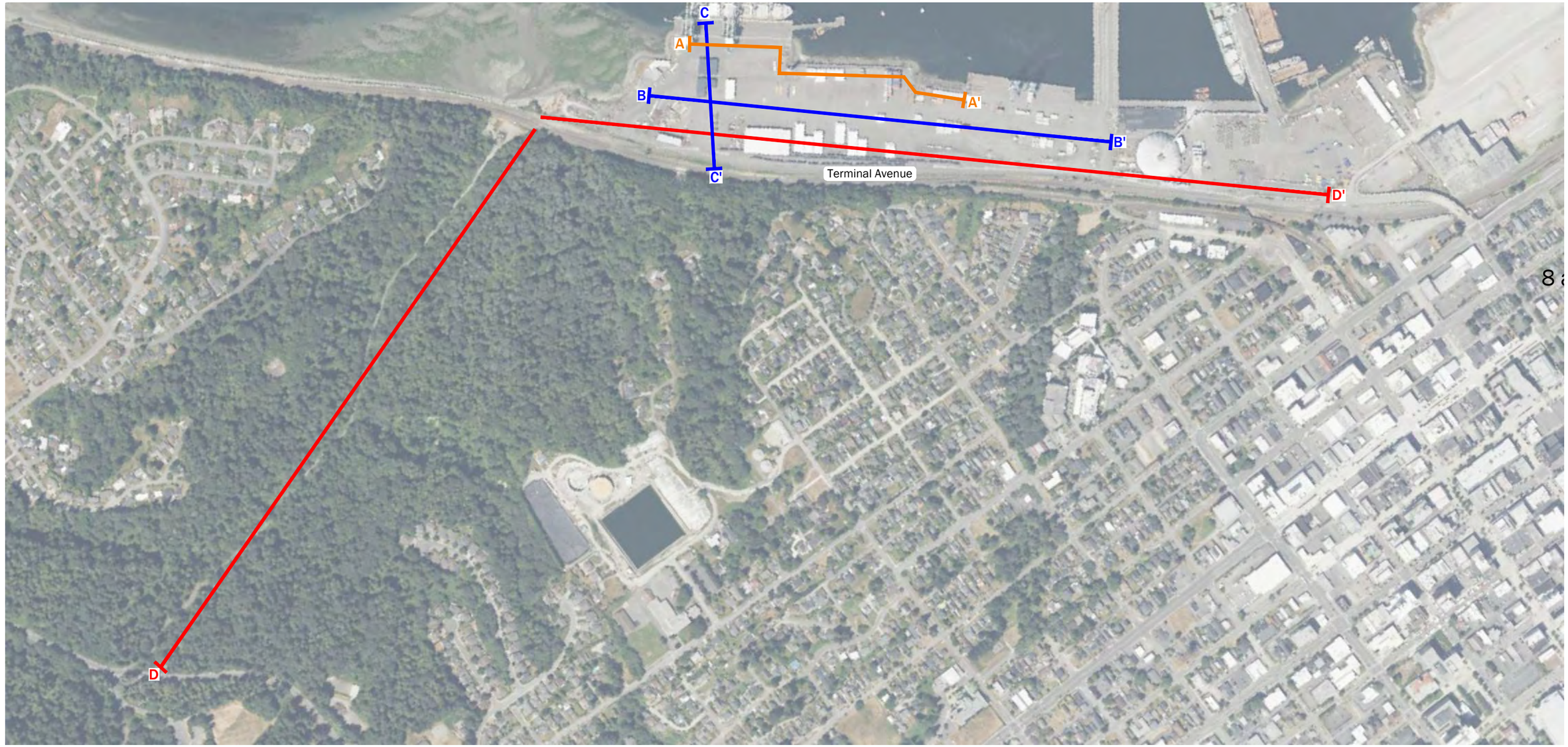
Figure 8

P:\0\0676020\CAD\07\Task 3000 [PRD Work Plan]\067602007_F08_Enviro Subsurface Samps.dwg 8 Enviro Subsurface Samples Date Exported:7/16/2025 5:30 PM- by Chad Stickel



Legend

Proposed Geophysical Survey Transects:

A — A' Multi-Channel Analysis of Surface Waves (MASW)

B — B' Local Microtremor Array Method (MAM)

D — D' Regional Microtremor Array Method (MAM)

250 0 250
Feet

N W E S

Geophysical Survey Transects

Weyerhaeuser Mill A Former
Everett, Washington

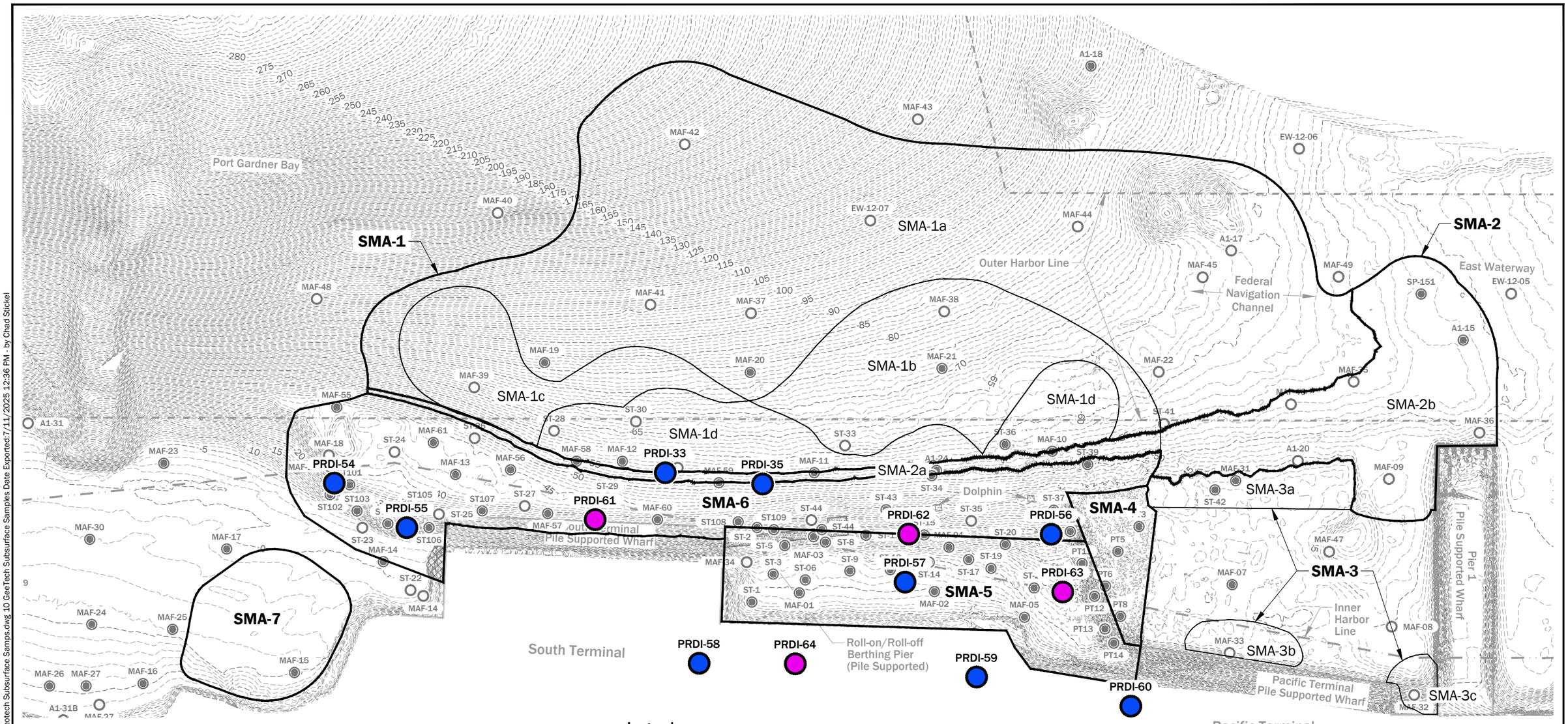
GeoEngineers | **Figure 9**

Notes:

1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Microsoft Bing, 2024

p:\0\0676020\CAD\07\task 3000 [prdi work plan]\0676020007_F09_Geophysics Survey.dwg 9 Geophysical Survey Date Exported:7/11/2025 12:36 PM - by Chad Stickel



Notes:

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MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Previous Sediment Surface Sample
- Previous Sediment Core Sample

Proposed Subsurface Sediment Sampling Locations

- Standard Penetration Test (Mud Rotary, Sonic or Hollow Stem Auger Drilling Methods) will be Completed to Evaluate Geotechnical Properties
- Cone Penetration Test will be Completed to Evaluate Geotechnical Properties

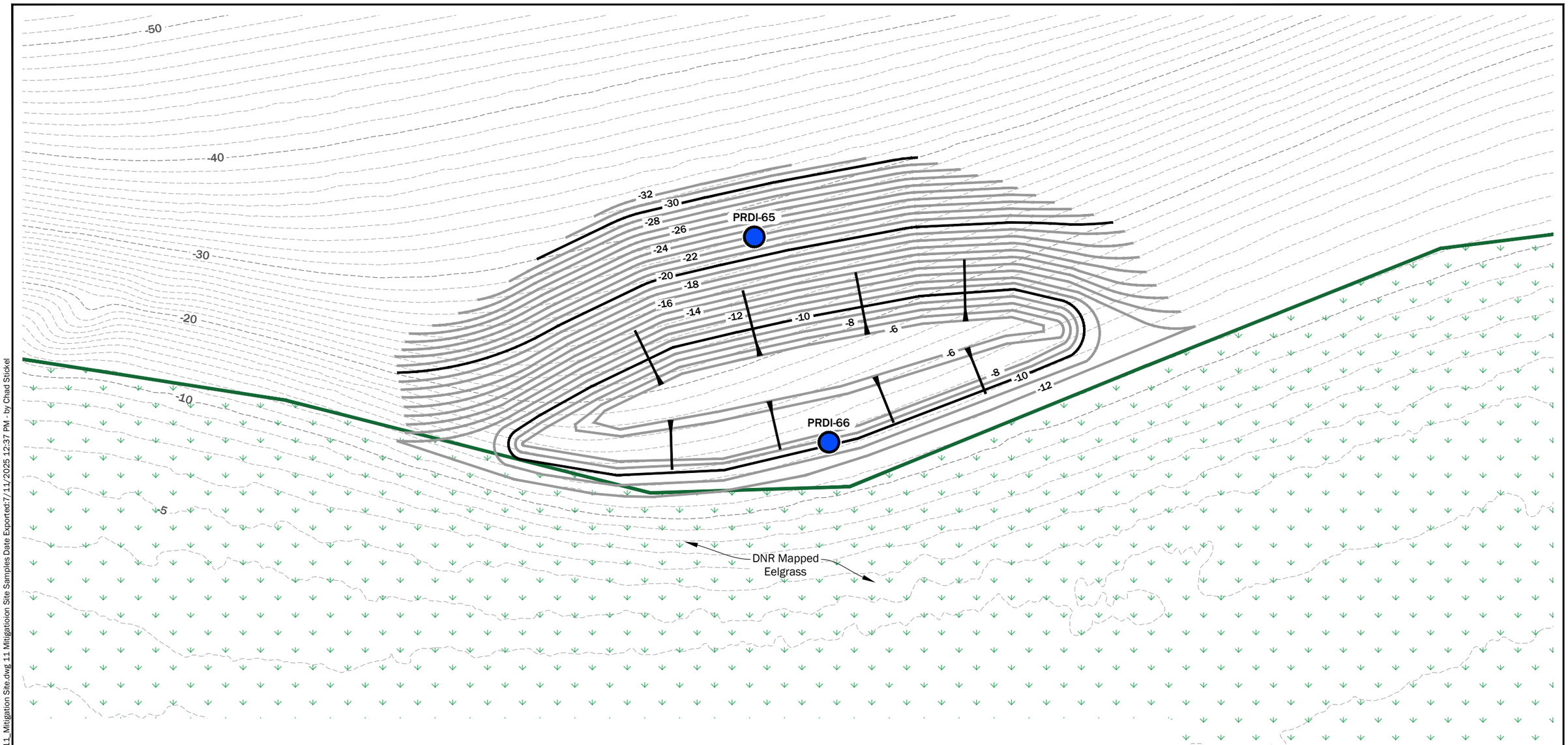
250 0 250
Feet

GeoTechnical Investigation
Subsurface Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers | Figure 10

p:\0_0676020\CAD\07\task 3000 [prdi work plan]\0676020007_F10_Geotech Subsurface Samps.dwg 10 GeoTech Subsurface Samples Date Exported:7/11/2025 12:36 PM - by Chad Stickel



Legend

-20 Proposed Finish Grade Major Contours

-18 Proposed Finish Grade Minor Contours

-45 Existing Contours

DNR Mapped Eelgrass

Proposed Subsurface Sediment Sampling Locations

(Location of the Eelgrass Mitigation Site is shown on Figure 1)

Standard Penetration Test (Mud Rotary, Sonic or Hollow Stem Auger Drilling Methods) will be Completed to Evaluate Geotechnical Properties

100 0 100
Feet

W N S E

Notes:

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Data Sources:

- Bathymetric Survey by Tetra Tech, dated February 2024
- Proposed Layout by Grette, dated 12/13/2024

Horizontal Datum: North American Datum (NAD) 1983/2011, WA State Plane, N Zone, US Foot
Vertical Datum: Mean Lower Low Water (MLLW)
Vertical Datum Conversion (based on NOAA's Publication Sheet (944-7659), dated 09/29/1988):
MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

GeoTechnical Investigation Subsurface Sampling Locations - Eelgrass Mitigation Site

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Figure 11

p:\0\0676020\CAD\07\task 3000 [prdi work plan]\067602007_F11_Mitigation Site.dwg 11 Mitigatioion Site Samples Date Exported:7/11/2025 12:37 PM - by Chad Stickel

Appendices

Appendix A

Sampling and Analysis Plan/ Quality Assurance Project Plan

Final Marine Area Pre-Remedial Design Investigation Sampling and Analysis Plan/Quality Assurance Project Plan

Weyerhaeuser Mill A Former
Everett, Washington
Ecology Agreed Order No. DE 8979

for

Washington State Department of Ecology
on Behalf of Port of Everett

September 15, 2025

2101 4th Avenue, Suite 950
Seattle, Washington 98121
206.728.2674

GeoEngineers

Marine Area Pre-Remedial Design Investigation
Sampling and Analysis Plan/Quality Assurance Project Plan

Weyerhaeuser Mill A Former
Everett, Washington
Agreed Order No. DE 8979

File No. 0676-020-07
September 15, 2025

Prepared for:

Washington State Department of Ecology
PO Box 47600
Olympia, Washington 98504-7600

Attention: Ryan Hardwick

On Behalf of

Port of Everett
P.O. Box 583
Everett, Washington 98206

Prepared by:
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Luke Thies – Weyerhaeuser
Lynn Grochala – Floyd|Snider

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Table of Contents

List of Tables

List of Figures

Abbreviations and Acronyms

1D	one-dimensional
2D	two-dimensional
ALS	ALS Environmental
ARI	Analytical Resources, LLC
ASTM	American Society for Testing and Materials
bgs	below ground surface
bml	below mudline
CAP	Cleanup Action Plan
CDF	confined disposal facility
cm	centimeter
COC	contaminants of concern
cPAH	carcinogenic PAH
CPT	cone penetration test
CY	cubic yard
CyDSS	cyclic direct simple shear test
DD	decimal degrees
DGPS	differential global positioning system
DM	degrees-minutes
DMS	degrees-minutes-seconds
DOT	Department of Transportation
DQO	data quality objective
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
EPA	United States Environmental Protection Agency
fps	foot per second
GNSS	global navigation satellite system
GPS	global positioning system
HASP	Health and Safety Plan
HPAH	high molecular weight polycyclic aromatic hydrocarbon
HSA	hollow-stem auger
IDW	investigation-derived waste
IDP	Inadvertent Discovery Plan
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LPAH	low molecular weight polycyclic aromatic hydrocarbon
MAM	microtremor array method
MASW	multi-channel analysis of surface waves
MBE	multibeam echosounder
MDL	method detection limit

Mill A	Weyerhaeuser Mill A
MLLW	mean lower low water
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
NAD83	North American Datum of 1983
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness and comparability
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PQL	practical quantitation limit
PRDI	Pre-Remedial Design Investigation
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
RSD	percent standard deviation
RTK	real-time kinematic
SAP	Sampling and Analysis Plan
SBE	single-beam echosounder
SCUM	Sediment Cleanup Users' Manual
Site	Weyerhaeuser Mill A Former Site
SMA	Sediment Management Area
SMS	Sediment Management Plan
SOP	standard operating procedure
SPT	standard penetration test
SVOC	semi-volatile organic compound
TEF	toxicity equivalency factor
TEQ	toxicity equivalence
TRL	target reporting limit
TLS	terrestrial laser scanner
TOC	total organic carbon
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
Vs	shear wave velocity
WAC	Washington Administrative Code
WSRN	Washington State Real-time Network

1.0 Introduction

This document describes the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) for Marine Area Pre-Remedial Design Investigation (PRDI) activities at the former Weyerhaeuser Mill A (Mill A) Site (Site) located in Everett, Washington (Figure 1). This SAP/QAPP serves as the guide for the standard operating procedures that will be utilized for the field investigation that will be completed during the PRDI. The investigation activities described in this SAP/QAPP are being conducted to satisfy the requirements of Agreed Order No. DE 8979 (Agreed Order; Ecology 2012) and its amendments issued by the Washington State Department of Ecology (Ecology). The Agreed Order requires collection of data needed for use in the engineering analysis and design of the planned cleanup action for the Marine Area of the Site.

The SAP portions of this document have been prepared following Ecology's Sediment Sampling and Analysis Plan Appendix (Ecology 2008). The quality assurance/quality control (QA/QC) portions of this document were prepared following the United States Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA 2001), Guidance for Quality Assurance Project Plans (EPA 2002) and Ecology's Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2016). This SAP/QAPP has also been prepared in general accordance with the requirements of the Agreed Order, Model Toxics Control Act (MTCA) Cleanup Regulations (Chapter 173-340 of the Washington Administrative Code [WAC]) and Sediment Management Standards (SMS; Chapter 173-204 WAC).

2.0 Pre-Remedial Design Investigation Study Design

For the purposes of development and evaluation of remedial alternatives, the Marine Area was divided into seven Sediment Management Areas (SMAs) identified as SMA-1 through SMA-7 in the Marine Area Remedial Investigation/Feasibility Study (RI/FS; GeoEngineers 2024). The factors used to delineate the Marine Area SMAs, and their descriptions are summarized in the Marine Area Cleanup Action Plan (CAP; Ecology 2024). As described in the CAP, PRDI activities are being completed to refine the delineation of the extent of contamination, boundaries of the SMAs and provide data for the engineering design and implementation of the selected cleanup action. The SMAs and components of the Ecology-selected cleanup action for the Marine Area are shown in Figure 2.

An overview of the study design for sediment sampling is provided in the sections below. The subsequent sections provide descriptions of the field equipment and procedures that will be used to obtain the identified data. The sampling and analysis objectives and how the data will be utilized for future engineering analysis design work are presented in the PRDI Work Plan. Ecology will be notified if significant changes to the approaches and equipment proposed in this Work Plan are needed to complete the work.

2.1 PRE-REMEDIAL DESIGN INVESTIGATION SURVEYS

2.1.1 Bathymetric Survey

To establish pre-construction conditions for design and volumetric calculations and to provide comparative data for the evaluation of natural recovery, a bathymetric survey of the Marine Area and the Eelgrass

Mitigation Site will be completed. Approximate coverage of the Marine Area bathymetric survey is shown in Figure 3. The Eelgrass Mitigation Site is generally shown in Figure 1.

The bathymetric survey will utilize a multibeam echosounder (MBE). The MBE will be supplemented where necessary with a single-beam echosounder (SBE) and a Terrestrial Laser Scanner (TLS) with real-time kinematic (RTK) positioning derived from satellite-based positioning systems (global navigation satellite systems [GNSS]).

An R2Sonic 2026 MBE is proposed to obtain the best deep-water resolution in the deeper portions of the survey area and to obtain the highest resolution in the shallow water for piling detection. After collecting the MBE data, standard bathymetric processing will be accomplished on the wide-area survey data to create an up-to-date bathymetric surface.

The bathymetric surveys will be referenced to North American Datum 1983 (horizontal datum) and Mean Lower Low Water (MLLW) (vertical datum) and will be completed by a professional surveyor licensed in the State of Washington in accordance with the United States Army Corps of Engineers (USACE) Engineering and Design Hydrographic Surveying Engineer Manual (EM 1110-2-1003).

Additional details on the approach and equipment used to complete the bathymetric survey will be determined by the contacted surveyor to meet the overall objectives of the PRDI.

2.1.2 Diver Probing

The thickness of sediment located on top of the slope armoring at the South Terminal Wharf (within and adjacent to SMA-6) and the Pacific Terminal Wharf (adjacent to SMA-3 [3a and 3b]) is currently not fully delineated. To determine the thickness of sediment on top of armoring in these areas (and facilitate the environmental characterization sampling discussed in Section 2.2), a diver survey will be completed in the three areas shown in Figure 3. Diving activities will be coordinated with the Port of Everett and Naval Station Everett as necessary to ensure continuity with ongoing operations. In general, the sediment thickness will be measured along transects spaced approximately 40 feet apart in SMA-6 and the areas adjacent to SMA-3 (3b and 3c). Each transect will start at the approximate pier face and extend landward until the sediment is no longer present on the armoring, or the bulkhead is reached. Along each transect, the divers will measure the sediment thickness using a push probe inserted to detect the underlying slope armoring at approximately three-to-five-foot intervals. Each transect will be referenced relative to the existing pile supported pier structures for mapping purposes.

Field procedures for completion of the diver survey to evaluate sediment thickness along the South Terminal and Pacific Terminal Wharfs are further discussed in Section 3.2.2.

2.1.3 Subsurface Structure Survey

The extent of remnants of the historical pier structure located northeast of the South Terminal Wharf (SMA-5) is currently not known. A high-density MBE will be utilized to identify the potential presence of historical piling associated with the historical pier structure or other potential obstructions within SMA-5 that would impact construction of the Containment/Confined Disposal Facility (CDF) wall. The area requiring the subsurface profiling is shown in Figure 3.

Historic pilings are often cut off or broken above the mudline and are identifiable in high-resolution, high-density MBE data, as are broken pilings and debris lying on or slightly beneath the sediment surface. For identification of pilings and debris, a separate data processing approach will be taken with the full-density MBE data. After removal of noise the full density point cloud will be analyzed for anomalies that are not the sediment surface. These points clusters of items will be extracted separately and mapped as polygon boundaries of objects. The debris polygon can then be overlaid on historic photos and or drawings depicting where the piers and pilings were in the past. This approach should yield a map of where pilings and other obstructions are identified and locations where, based on historic comparison, pilings should be expected. These results will be useful in defining the design of and planning for the CDF wall construction.

Additional details on the approach and equipment used to complete the subsurface structure survey will be determined by the contracted surveyor to meet the overall objectives of the PRDI.

2.2 PRE-REMEDIAL DESIGN ENVIRONMENTAL INVESTIGATION

2.2.1 Surface Sediment Environmental Characterization

Surface sediment samples will be collected from 28 locations (PRDI-1 through PRDI-21 and PRDI-68 through PRDI73) using grab sampler (Power Grab or similar) deployed from a research vessel positioned within SMA-1 and SMA-7 and from five locations on the armored slopes adjacent to SMA-3 (3b and 3c) and SMA-6 using diver-assisted sampling methods (Figure 4).

The surface sediment sampling objectives are to:

- Evaluate the concentration of COCs in the most recently deposited sediments;
- Determine changes in chemical concentrations over time;
- Refine the SMA boundaries: and
- Evaluate sediment quality conditions along the South Terminal and the Pacific Terminal armored slopes.

The surface sediment samples will be collected from 0 to 2 centimeters (cm) below mudline (bml) to evaluate recent sediment quality for natural recovery and from the 0 to 10 cm bml or 0 to 40 cm bml compliance depth depending on location, to evaluate sediment quality within the compliance depth interval. Surface sediment samples will also be collected at the six locations in SMA-1d from 0 to 40 cm bml to measure moisture content below the dynamic sand cap.

Surface sample collection intervals and laboratory analysis are summarized in Table 1. The proposed locations of surface sediment samples shown are in Figure 4 and may be adjusted in coordination with Ecology during investigation activities based on field observation and actual conditions encountered.

Surface sediment samples (0 to 2 cm and 0 to 10 cm) collected as part of the PRDI will be analyzed for contaminants of concern (COCs) identified in the Marine Area CAP (see Section 3.8.1 and Table 1). Surface sediment samples (0 to 40 cm) from SMA-1d will also be tested for moisture content (see Section 3.8.2 and Table 1). Environmental laboratory testing is discussed in Section 3.8.1. Field procedures for completion of the surface sediment characterization are further discussed in Section 3.2.1 and 3.2.2.

2.2.2 Subsurface Sediment Environmental Characterization

Subsurface sediment samples will be collected at 33 locations (PRDI-26 through PRDI-56, PRDI 74 and PRDI-75) using a vibracore deployed from a research vessel or barge based vibracore, sonic or hollow-stem auger (HSA) drilling methods positioned in SMA-2, SMA-3 and SMA-6 (Figure 5). Vibracore is the preferred method for acquiring environmental data; however, alternative methods may be used if needed due to sample depth requirements. The subsurface sediment sampling objectives are to:

- Confirm the elevation of the base of contaminated sediment within the proposed full removal areas to support dredge design, design of the South Terminal toe wall and Containment/CDF structures and refine dredge volume estimates for bidding.
- Characterize the surface to be exposed by the proposed full removal dredging. Post-dredge surface verification sediment sampling requirements will be determined as part of the Engineering Design Report.
- Estimate leachate quality of the dredged material following placement in the Containment/CDF.
- Evaluate the geotechnical engineering properties of composite samples of the material that will be placed inside containment/CDF wall and for the design of stable dredged slopes and structures (further discussed in Sections 2.3.2 and 3.8.2.2).

The subsurface sediment samples will be collected at 1-foot intervals to a maximum depth of approximately 20 feet bml to evaluate sediment quality (anticipated sample intervals are included in Table 1). The target depth subsurface sediment cores will be at least three feet below the base of the proposed dredge prism or refusal, if the full target penetration depth objective is not met. Target sediment core depths, subsurface sample collection intervals and laboratory analysis are summarized in Table 1. The proposed locations of subsurface sediment samples are shown in Figure 5 and may be adjusted in coordination with Ecology during investigation activities based on field observation and actual conditions encountered.

Subsurface sediment samples collected as part of the PRDI below the base of the anticipated dredge depth will be initially analyzed for COCs identified in the Marine Area CAP (see Section 3.8.1 and Table 1). Archive samples (step-up and step-down samples) collected as indicated in Table 1 will be analyzed as follows:

- If the sample at anticipated dredged depth meets the cleanup standard, then analyze the overlying archived step-up sample.
  - If the archived step-up sample meets the cleanup standard, analyze the next sequential step-up sample.
  - If the archived step-up sample fails the cleanup standard, then no further analysis.
- If the sample at anticipated dredge depth fails the cleanup standard, then analyze the underlying archived step-down sample.
  - If the archived step-down sample fails the cleanup standard, analyze the next sequential step-down sample.
  - If the archived step-down sample meets the cleanup standard, then no further analysis.

Environmental laboratory testing is further discussed in Section 3.8.1. Based on the results of the environmental analysis, split archived sample intervals corresponding to environmental sample intervals failing to meet the cleanup standard will be composited for geotechnical analysis (see Section 2.8.2.2).

Subsurface sediment collected within the proposed dredge prism will also be evaluated using the elutriate and leachate tests discussed in Section 3.2.2 of the PRDI Work Plan.

Subsurface sediment sample collection for the elutriate and leachate testing will be completed as a separate mobilization and following review of the environmental analytical results so that sample intervals corresponding to environmental sample intervals failing to meet the cleanup standard are collected for analysis to best represent the full depth of material that will be dredged and placed in the CDF.

Field procedures for completion of the surface sediment characterization are further discussed in Section 3.2.3.

2.2.3 Surface Water Environmental Characterization

Surface water will be collected at RI sample location SW01 using a peristaltic or submersible pump. Surface water samples collected as part of the PRDI will be analyzed for the sediment COCs identified in the Marine Area CAP (see Section 3.8.1 and Table 1) for interpretation of the elutriate test results. Environmental laboratory testing is further discussed in Section 3.8.1.2. Field procedures for completion of the surface water characterization are further discussed in Section 3.2.4.

2.3 PRE-REMEDIAL DESIGN GEOTECHNICAL INVESTIGATION

2.3.1 Geophysical Survey

A geophysical survey will be completed in the Upland Area of the Site as a non-intrusive test to capture the site-specific shear wave velocity (Vs) for use in the geotechnical engineering analyses (e.g., site-specific seismic hazard analyses). Additionally, the geophysical survey data will help with characterization of subsurface conditions and estimate the depth of the competent layer across the Site. The proposed geophysical survey will include:

- A two-dimensional (2D) multi-channel analysis of surface waves (MASW) to develop a 2D Vs profile along Transect A-A' at the Site shown in Figure 6 to capture the site-specific Vs at relatively shallower depths (e.g., up to approximately 50 to 100 feet below ground surface [bgs]).
- A one-dimensional (1D) local microtremor array method (MAM) along two perpendicular arrays, B-B' and C-C' shown in Figure 6 to capture the site-specific Vs down to approximately 400 feet bgs.
- If the Vs measured through the local MAM is lower than the typical Vs value for engineering bedrock/firm ground (i.e., 2,500 feet per second [ft/sec]), a 1D regional MAM will be completed along the L-shaped array D-D' that covers a larger area as shown in Figure 6 to capture the site-specific Vs at greater depths to the engineering bedrock/firm ground.

Field procedures for completion of the geophysical survey are further discussed in Section 3.3.1.

2.3.2 Marine Area Geotechnical Characterization

The PRDI geotechnical investigation includes samples collected from both the geotechnical and environmental field explorations and geotechnical laboratory testing with the primary objectives to:

- Characterize the key soil/sediment units (i.e., wood debris fill, beach deposits, glacial drift soils and the sediments to be dredged) and

- Develop and refine the geotechnical design parameters for use in the engineering analyses to support the execution of planned cleanup actions, including dredging, dredged material management and design of the containment/CDF wall and the South Terminal toe wall and design of filling at the Eelgrass Mitigation Site.

Geotechnical field explorations completed as part of this PRDI will include geotechnical borings with standard penetration tests (SPTs) and cone penetration tests (CPTs) and are further discussed below. Field procedures for completion of the subsurface geotechnical characterization of the Site are further discussed in Sections 3.3.2 and 3.3.3.

2.3.2.1 STANDARD PENETRATION TESTS

SPTs will be completed using mud rotary, HSA or sonic drilling methods to collect material strength data and soil/sediment samples for use in geotechnical laboratory testing to evaluate engineering properties (as described in Section 3.8.2). The drilling approach will be refined with the contract driller to ensure that samples can be collected in Site conditions. Mud rotary is the preferred method for acquiring geotechnical data; however, alternative methods may be used if wood debris or other subsurface obstructions prevent advancement of the borings.

Geotechnical borings with SPTs will be completed at eleven locations including:

- Nine geotechnical borings at the Mill-A Site (see Figure 7). Six borings (PRDI-33, PRDI-35 and PRDI-54 through PRDI-57) are located offshore with target depths of approximately 110 to 120 feet bml or practical refusal. The other three borings (PRDI-58 through PRDI-60) are located on-land with target depths of approximately 110 to 120 feet bgs or practical refusal.
- Two offshore geotechnical borings (PRDI-65 and PRDI-66) at the Eelgrass Mitigation Site with target depth of approximately 25 feet bml or practical refusal (see Figure 8).

The approximate locations of geotechnical explorations shown are in Figures 7 and 8 and may be adjusted during investigation activities based on field observation and actual conditions encountered. This will be coordinated and approved by Ecology prior to changing the locations.

2.3.2.2 CONE PENETRATION TESTS

The CPT is an in-situ testing method used to determine the geotechnical properties of soil/sediment. The test provides continuous and real-time data on soil behavior and stratigraphy.

The CPTs will be completed at four locations (PRDI-61 through PRDI-64, as shown in Figure 7). Three CPTs (PRDI-61 through PRDI-63) are located offshore with target depths of approximately 100 feet bml or to practical refusal. The other CPT (PRDI-64) is in the Upland Area with a target depth of approximately 100 feet bgs surface or to practical refusal. Shear wave velocity testing will be conducted in conjunction with the CPT to collect Vs data at PRDI-62 and PRDI-64, where PRDI-64 is located adjacent to the geophysical survey 2D MASW array (Transect A-A') so that the measured Vs can be cross-checked.

The proposed locations of geotechnical explorations shown in Figure 7 and may be adjusted in coordination with Ecology during investigation activities based on field observation and actual conditions encountered.

3.0 Field Investigation and Procedures

3.1 EXPLORATION AND SAMPLE NOMENCLATURE

Discrete samples collected from the surface and subsurface will be assigned unique sample identifiers consisting of the sample location number, sample type and depth interval in feet or cm bml. The sample type will be one of the following:

- **S** – For surface sediment samples collected using a power grab or diver-assisted sampler from 0 to 2 cm bml, 0 to 10 cm bml or 0 to 40 cm bml.
- **C** – For sediment core samples collected using vibracore, mud rotary, sonic or HSA methods.
- **B** – For soil boring samples collected using mud rotary, sonic or HSA methods.

For example, a surface sediment sample from PRDI-1 from 0 to 10 cm bml would be identified as PRDI-1-S_0-10. A sediment sample collected from PRDI-28 from 10 to 11 ft bml would be identified as PRDI-28-C_10-11.

There are five sediment locations where environmental and geotechnical explorations will be co-located, including PRDI-33, PRDI-35, PRDI-54, PRDI-55 and PRDI-56. At these locations, separate drilling methods will be utilized to ensure that both the environmental and geotechnical data needs are met for the PRDI. Separate field logs will be maintained for environmental and geotechnical purposes. Co-located boring IDs will be denoted as “E” or “G” to distinguish between environmental and geotechnical sample types. For example, an environmental sediment sample collected from PRDI-33 from 10 to 11 ft bml would be identified as PRDI-33-C_10-11_E.

The surface water sample from location SW01 will be assigned a unique sample identifier consisting of the sample location number and sample date (day, month, year). For example, a surface water sample collected from SW01 on May 7, 2025, would be identified as SW01_070525.

3.2 ENVIRONMENTAL SAMPLE COLLECTION METHODS

3.2.1 Surface Sediment Sample Collection and Processing

Surface sediment samples are anticipated to be collected using a grab sampler (Power Grab or similar) deployed from a research vessel designed for such purposes. If the vessel cannot reach a sample location due to shallow water, the sample may be collected from shore at low tide. Sampling equipment will be decontaminated and inspected before use (Section 3.5). Surface sediment sampling activities will be observed by a GeoEngineers field representative who will maintain field records of the number of sampling attempts at each location, verification of the acceptance criteria, descriptions of the materials encountered, and samples collected for laboratory analysis.

The procedures for collecting surface sediment samples are as follows:

1. Maneuver the sampling vessel to the proposed sampling location, steady the vessel and verify location control using a GPS (see Section 3.6).
2. Record the location of the sample.

3. Prepare the sampler for deployment.
4. Deploy the sampler through the water column to the mudline at approximately 1-foot per second (fps). Verify that the cable attached to the sampler is plumb (i.e., vertical).
5. Record the sampling time and the depth to mudline below the water surface using the lead-line or depth sounder, adjusted for tide height.
6. Close the sampler jaws and raise the sampler to the vessel at approximately 1 fps.
7. Place the sampler on the work surface of the vessel. Avoid jostling the sampler and disturbing the sample.
8. Examine the sample for the following sediment acceptance criteria:
    a. The sampler jaw is closed.
    b. The sampler is not overfilled so that the sediment surface is pressing against the top of the sampler.
    c. Minimal leakage has occurred, as evidenced by overlying water on the sediment surface.
    d. Minimal sample disturbance has occurred, as evidenced by limited turbidity in the water overlying the sample.
    e. A penetration of greater than 2 cm, 10 cm or 40 cm has been achieved (sample depths vary by location). Greater than 2 cm, 10 cm or 40 cm shall be the target penetration depths to sample sediment that has not contacted side or bottom of the sampler.
    f. If any of the sediment acceptance criteria are not achieved, the sample will be rejected and the location resampled. Successive deployments should be within an approximate 10-foot radius of the initial deployment location. If the proposed sampling location cannot be achieved after three deployments, the Project Manager shall be notified, and Ecology will be contacted prior to additional sampling to provide the required review and approval of an appropriate alternative location.
9. Siphon off the water overlying the surface of the sediment while taking care not to disturb the surface of the sediment.
10. Visually classify sediment in accordance with American Society for Testing and Materials (ASTM) International (ASTM) D 2488 methods and the Unified Soil Classification System (USCS) (ASTM D 2487) and record on the field form. In addition to the visual classification, sediment samples will be observed and tested in the field (see Section 3.4). Qualitative descriptive parameters including biota, debris and presence of staining will also be recorded.
11. The visual absence or presence of wood debris in the surface sediment sample will be recorded on the field form. If wood debris is present, the type or types of wood debris (i.e. saw dust, bark, chips, chunks, twigs, fibers, etc.), the estimated quantity (i.e., observed percent by volume) of each type of wood debris and the depth interval where the wood is observed will be recorded on the field form. Fine sawdust generated by sawmills may be indistinguishable from other sediments, so care will be taken to attempt to identify finer fractions of wood debris in samples.

12. Photograph the sediment sample. Include in the camera's field of view, a tape measure and a sheet of paper or whiteboard with the sample name written in large print. Care will be used so that the sediment does not contact the paper/whiteboard or with hands contaminated with whiteboard ink.
13. To avoid cross-contamination, a clean hands/dirty hands approach to use of whiteboard pens and erasers and lab pens will be utilized during all sample collection activities where subsequent chemical analyses will be carried out on the samples collected. Gloves that have been in contact with lab pens and whiteboard pens will not be used for sample handling.
14. Collect the upper 2 cm, 10 cm or 40 cm of sediment (depending on location) from the sampler using a decontaminated stainless-steel spoon. Care will be taken to ensure that sediment that has been in contact with the sides of the sampler is not collected.
15. Place the sediment into a decontaminated stainless-steel mixing bowl. Cover the mixing bowl with a new sheet of aluminum foil and dispose of the foil after use. If sufficient sample volume was not collected, repeat the sampling process until sufficient volume is achieved. Successive deployments should be within an approximate 10-foot radius of the initial deployment. If multiple deployments are needed, note the number of deployments needed and why multiple deployments are needed to obtain one sample.
16. Homogenize the sediment (from one deployment if adequate sediment volume was achieved, or from multiple deployments if multiple deployments were required) in the stainless-steel mixing bowl using the stainless-steel spoon until the sediment appears generally uniform in color and texture.
17. Distribute the sample material to designated sample containers and ensure that the samples are properly labeled and tightly closed.
18. Clean the exterior of the sample containers and store them in a cooler with ice.
19. Decontaminate all equipment as described in Section 3.5.
20. Double check that field collection forms are completely filled out (see Section 5.3.1 for field observation documentation requirements).

Extra and discarded sediment from surface sediment processing will be collected in a drum and transferred to an appropriate waste handling facility. Collected sediment will not be disposed of at or returned to the Site (see Section 3.7).

3.2.2 Diver-Assisted Sediment Probing and Surface Sediment Sample Collection and Processing

Sediment is present on top of armoring at the South Terminal Wharf and the Pacific Terminal Wharfs. Divers will be used to evaluate the thickness of this sediment and to collect surface sediment samples. Surface sediment samples are anticipated to be collected by a diver using a sediment core sampler, such as cylindrical tube. All equipment will be decontaminated and inspected before sampling. The diver survey and diver assisted sampling activities will be observed by a GeoEngineers field representative. The GeoEngineers field representative will maintain field records of the number of sampling attempts, verification of the acceptance criteria, descriptions of the materials encountered and samples collected for laboratory analysis.

The procedures for evaluating sediment thickness are as follows:

1. Dive to the area where sediment thickness will be measured.
2. Lay out a line starting at the top of the transect, at the sediment/armor interface and extending to the pier face.
3. Starting at the top or bottom of the transect, insert a metal rod into the sediment until the rod is fully inserted or meets refusal.
4. Mark the location on the mudline on the rod and measure the length of the rod that was inserted into the sediment.
5. Record the measurement location and sediment thickness.
6. Move approximately three to five feet along the transect to the next measurement location.
7. Repeat Steps 2 through 6 until the transect is completed.
8. Move approximately 40 feet to the next transect and repeat Steps 2 through 7 until the zone is completed.
9. Move to the next survey area and repeat Steps 2 through 8.

The procedures for collecting surface sediment samples are as follows:

1. Dive to the proposed sampling location (see Section 3.6).
2. Record the location of the sample.
3. Position the sediment core sampler perpendicular to the sediment surface.
4. Press or twist the sampler into the sediment to a minimum depth of 20 cm bml.
5. While the sampler is in place, cap the bottom of the sampler.
6. Extract the sampler and return the sampler to the vessel.
7. Examine the sampler to make sure at least 10 cm of sediment has been collected.
8. Remove sediment representative of the upper 10 cm of material into a decontaminated stainless-steel mixing bowl. Cover the container with a new sheet of aluminum foil and dispose of the foil after use. If sufficient sample volume was not collected, multiple samplers may be used or the sampling process repeated until sufficient volume is achieved. Successive deployments should be within an approximate 10-foot radius of the initial deployment.
9. Visually classify sediment in accordance with ASTM D 2488 methods and the USCS (ASTM D 2487) and record on the field form. In addition to the visual classification, sediment samples shall be observed and tested in the field (see Section 3.4). Qualitative descriptive parameters including biota, debris and presence of staining shall also be recorded.
10. The visual absence or presence of wood debris in the surface sediment sample will also be recorded on the field form. If wood debris is present, the type or types of wood debris (i.e., saw dust, bark, chips, chunks, twigs, fibers, etc.), the estimated quantity (i.e., observed percent by volume) of each type of wood debris and the depth interval where the wood is observed will be recorded on the field form. Fine sawdust generated by sawmills may be indistinguishable from other sediments, so care will be taken to attempt to identify finer fractions of wood debris in samples.

11. Photograph the sediment sample. Include in the camera's field of view, a tape measure and a sheet of paper or whiteboard with the sample name written in large print; use care not to touch the sediment with the paper/whiteboard or with hands contaminated with whiteboard ink.
12. To avoid cross-contamination, a clean hands/dirty hands approach to use of whiteboard pens and erasers and lab pens will be utilized during all sample collection activities where subsequent chemical analyses will be carried out on the samples collected. Gloves that have been in contact with lab pens and whiteboard pens will not be used for sample handling.
13. Homogenize the sediment (from one deployment if adequate sediment volume was achieved, or from multiple deployments if multiple deployments were required) in the stainless-steel mixing bowl using the stainless-steel spoon until the sediment appears generally uniform in color and texture.
14. Distribute the sample to designated sample containers and ensure that the samples are properly labeled and tightly closed.
15. Clean the exterior of the sample containers and store them in a cooler with ice.
16. Decontaminate all equipment as described in Section 3.5.
17. Double check that field collection forms are completely filled out (see Section 5.3.1 for field observation documentation requirements).

Extra and discarded sediment from surface sediment processing will be collected in a drum and transferred to an appropriate waste handling facility. Collected sediment will not be disposed of at or returned to the Site (see Section 3.7).

3.2.3 Subsurface Sediment Sample Collection and Processing

Subsurface sediment samples will be collected using vibracore, HSA or sonic drilling methods. The sediment cores will be collected from a vessel designed for such purposes. Vibracore and sonic coring will utilize a 3- to 4-inch-diameter core barrel containing dedicated (disposable) clear CAB (butryn) liners to collect continuous samples. HSA coring will utilize a decontaminated stainless steel 2.5-inch-diameter split-barrel sampler or equivalent to collect continuous samples. Vibracore is the preferred method for acquiring environmental data; however, alternative methods may be used if needed due to sample depth requirements. The sediment core collection methodology may be adjusted based on location, thickness of the dredge prism and the anticipated sediment substrate to be sampled (i.e., silt and sand, wood debris, etc.). Subsurface sediment sampling activities will be observed by a GeoEngineers field representative who will maintain field records of the number of sampling attempts, verification of the acceptance criteria, descriptions of the materials encountered, and samples collected for laboratory analysis.

The procedures for collecting subsurface sediment samples are as follows:

1. Maneuver the sampling vessel to the proposed sampling location, steady the vessel and verify location control using the GPS (see Section 3.6).
2. Record the location of the sample.
3. Record the sampling time and depth to mudline below the water surface using the lead-line or depth sounder, adjusted for tide height.

4. For vibracore and sonic drilling methods, proceed to **Step 5**. For HSA drilling methods, proceed to **Step 8**.

VIBRACORE AND SONIC ONLY STEPS

5. Advance the core barrel into the sediment surface to collect a continuous core to the specified target depth (see Table 1) or until refusal.
6. For each sample core, record the penetration depth on the field form.
7. Extract the core barrel, cap the ends of the liner and examine the core relative to the following acceptance criteria:
    a. Overlying water is present, and the surface is intact.
    b. Calculated linear compaction is not greater than 25 percent as determined by the ratio of the drive to recovery lengths.
    c. The core tube appears intact without obstructions or blockage.
    d. If any of the sediment acceptance criteria are not achieved, the sample will be rejected and the location resampled. Successive deployments should be within an approximate 10-foot radius of the initial deployment location. If the proposed sampling location cannot be achieved after three deployments, the Project Manager shall be notified, and Ecology will be contacted prior to additional sampling to provide the required review and approval of an appropriate alternative location.
    e. If the core meets the acceptance criteria, then proceed with core processing (**Step 12**). Sediment cores that are not immediately processed onboard the vessel following collection will be sealed, labeled and stored upright for transport to an upland core processing facility. All sediment cores collected will be processed on the same day of collection to the extent practicable. If sediment cores are not processed within the same day of collection, the cores will be placed in a container with ice or refrigerated space.

HSA ONLY STEPS

8. Attach the split-barrel sampler to the end drill rod and lower to the bottom base of the borehole.
9. Drive the sampler at three 6-inch increments (18 inches total) using a 140- or 300-pound hammer with a free-falling height of 30 inches onto a collar on the drill rod.
10. Record the number of hammer strikes or blows required to advance each 6-inch increment. If 6 inches of drive length is not achieved following a maximum of 50 blows, the sampler has met refusal.
11. Remove the sampler from the borehole, detach from the drill rod and unscrew the drive shoe and sampler head. Carefully open the split-barrel halves to observe the sample, measure the recovered length of the sample on the field form and proceed to **Step 13**. If sufficient material for laboratory analysis is not retained to characterize the proposed base of the dredge prism, the location will be resampled. Successive deployments should be within an approximate 10-foot radius of the initial deployment location. If the proposed sampling location cannot be achieved after three deployments, the Project Manager will be notified, and Ecology will be contacted prior to additional sampling to provide the required review and approval of an appropriate alternative location.

VIBRACORE, SONIC, AND HSA STEPS

12. Open the core with a decontaminated device.

13. Visually classify sediment in accordance with ASTM D 2488 methods and the USCS (ASTM D 2487) and record on the field form. In addition to the visual classification, sediment samples shall be observed and tested (see Section 3.4). Qualitative descriptive parameters including biota, debris and presence of product/staining shall also be recorded.

14. The visual absence or presence of wood debris in the sediment core will also be recorded on the field form. If wood debris is present, the type or types of wood debris (i.e., saw dust, bark, chips, chunks, twigs, fibers, etc.), the estimated quantity (i.e., observed percent by volume) of each type of wood debris and the depth interval where the wood is observed will be recorded on the field form and a photograph obtained representing and supporting the quantity estimated. Fine sawdust generated by sawmills may be indistinguishable from other sediments, so care will be taken to attempt to identify finer fractions of wood debris in samples.

15. Photograph the sample. Include in the camera's field of view, a tape measure and a sheet of paper or whiteboard with the sample name written in large black print; use care not to touch the sediment with the paper/whiteboard or with gloved hands in contact with whiteboards, pens or with whiteboard ink. It is likely several photos will be necessary to record the entire length of the core sample. Include the depth interval on the paper/whiteboard.

16. To avoid cross-contamination, a clean hands/dirty hands approach to use of whiteboard pens and erasers and lab pens will be utilized during all sample collection activities where subsequent chemical analyses will be carried out on the samples collected. Gloves that have been in contact with lab pens and whiteboard pens will not be used for sample handling.

17. Section the recovered sample intervals identified in Table 1. Collect sediment from each sectioned interval using a decontaminated stainless-steel spoon. Do not collect sediment that has been in contact with the sides of the core liner or sample barrel, or the core-opening device. Place the sectioned sediment interval into a decontaminated stainless-steel mixing bowl. Cover the container with a new sheet of aluminum foil and dispose of the foil after use.

18. Homogenize the sectioned sediment sample (from one deployment if adequate sediment volume was achieved, or from multiple deployments if multiple deployments were required) in the stainless-steel bowl using the stainless-steel spoon until the sediment appears generally uniform in color and texture.

    a. For sediment samples collected within the dredge prism, place the sediment in sealed containers for compositing. Two types of composite samples will be collected as follows:

        i. **Elutriate and Leachate Tests**: A composite test sample will be prepared using subsurface samples within the proposed dredge prism collected from locations that are known to contain the highest levels of contamination, based on the existing RI data (PRDI-33 through PRDI-41, PRDI-45 and PRDI-48). See Section 3.8.1.1 for laboratory testing details.

        ii. **Geotechnical Tests**: Sediment from within the proposed dredge prism will be composited based on material type and location. Compositing will be completed after each of the sediment borings have been collected and evaluated. The composites will be generated to evaluate the physical properties of the sediment for placement behind the containment/CDF wall or for upland disposal (see Section 3.8.2.2 for laboratory testing details).

b. For sediment samples collected beneath the dredge prism, distribute the sample to appropriate sample containers and ensure that the samples are properly labeled and tightly closed.

19. Clean the exterior of the sample containers and immediately store them in a cooler with ice.
20. Decontaminate all equipment as described in Section 3.5.
21. Double check that field collection forms are completely filled out (see Section 5.3.1 for field observation documentation requirements).

Extra and discarded sediment from subsurface sediment processing will be collected in a drum and transferred to an appropriate waste handling facility. Collected sediment will not be disposed of at or returned to the Site (see Section 3.7).

3.2.4 Surface Water Sample Collection

Surface water sampling will be completed on a flood tide with tidal stage of at least mean high water to the extent practicable.

The procedures for collecting surface water samples are as follows:

1. Record the location, time and tidal stage of the surface water sampling location.
2. Lower a weighted rope with attached disposable polyethylene tubing from the South Terminal dolphin pier at SW01 a minimum of three feet below the surface of the water.
3. Collect surface water using low-flow sampling techniques (EPA 2010) using a peristaltic or submersible pump with flow controller at a rate not exceeding 500 milliliters (mL) per minute.
4. Record water quality parameters (electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, oxidation-reduction potential and temperature) using a water quality meter (YSI-Pro or similar) with a flow-through cell.
5. Record turbidity use a Hach turbidimeter (or similar).
6. Disconnect the tubing from the flow through cell to collect the surface water sample.
7. Place the surface water sample in laboratory-supplied containers.
8. Clean the exterior of the sample containers and place in a cooler with ice immediately after sample collection.
9. Document the field measurements on the field log.
10. Decontaminate all equipment as described in Section 3.5.
11. Double check that field collection forms are filled out (see Section 5.3.1 for field observation documentation requirements).

3.3 GEOTECHNICAL FIELD EXPLORATIONS

3.3.1 Geophysical Survey

The geophysical survey to be conducted at the Site will include a 2D MASW and a 1D local and/or regional MAM. The geophysical survey will be completed by a qualified geophysicist subcontractor. GeoEngineers will be onsite to observe the geophysical survey data collection.

3.3.1.1 TWO-DIMENSIONAL MULTI-CHANNEL ANALYSIS OF SURFACE WAVES

The MASW method is an active survey where seismic waves are generated and recorded by a geophone array. Typically, a MASW deployment contains a linear array of at least 24 geophones spaced 5 to 10 feet apart and connected to a seismograph. Common sources of seismic waves for shallow investigations are various sized hammers and accelerated weight drops from vehicle-mounted devices. Data is collected by generating a seismic wave (shot) at a known location along the array and recording the response of each geophone as the seismic waves arrive with the seismograph. A dispersion curve is generated from the data and then inverted to create a 1D profile of the subsurface located at the center of the array. When multiple shots are made at set intervals along the seismic array, the subsequent 1D profiles can be interpolated to create a 2D profile along the length of the array.

3.3.1.2 ONE-DIMENSIONAL LOCAL/REGIONAL MICROTREMOR ARRAY METHOD

The MAM method is a passive survey, where the ambient vibrations of the surroundings are utilized rather than generating a seismic wave. These passive sources can come from all directions and can include traffic, ocean waves, industrial noise and construction. MAM arrays generally have a greater degree of flexibility with their design and in addition to linear arrays, can be deployed in 3D arrays such as circular, triangular, “T” shape and “L” shape arrays. Wireless sensors are proposed to be used for this site. The wireless sensors enable passive arrays to be deployed to sizes much larger than wired arrays. Wireless MAM arrays can span several hundred, or even several thousand feet; enabling much deeper investigations into the subsurface.

3.3.2 Standard Penetration Test

SPTs will be completed using a truck- or track-mounted drill rig that is capable of mud rotary, HSA or sonic drilling methods. For over-water drilling, the drill rig will be mounted on a barge that is sufficiently large to provide sufficiently stable support for the drilling operations and has a moon pool through which the drill can be deployed.

The SPTs will be completed in accordance with the ASTM D1586-11. In SPTs, typically a 2-inch outside-diameter, 1.375-inch inner-diameter, split-spoon sampler is driven with a 140-pound hammer, falling freely from a height of 30 inches. The number of blows required to achieve each of three 6-inch increments of sampler penetration will be recorded. When penetration resistance exceeds 50 blows for 6 inches or less of penetration, the test will be terminated, and the number of blows and the penetration length will be recorded on the field log. The recovered sample from the SPT test will be collected, logged, labeled, described and placed in plastic bags to minimize moisture loss for transport to a geotechnical laboratory.

The number of blows required for the last 12 inches of penetration is termed the penetration resistance. In SPTs, this number is called the Standard Penetration Resistance or N-value. The SPT N-value is a useful parameter for determining the relative density or consistency of soil. However, it should also be noted that the presence of gravel or cobbles larger than the sampler may affect measured penetration resistances

and result in artificially high values. The energy transferred to the drill rods and sampler during the penetration test can vary depending on the hammer type and the drill rig configuration.

The drilling contractor will provide calibration data for their auto hammers. Hammer efficiencies will be presented on the boring logs.

Either undisturbed or disturbed soil/sediment samples will be collected from the geotechnical borings with SPTs depending on the materials encountered in the field. Undisturbed samples will be collected using Shelby Tube/Piston samplers. Disturbed samples will be collected using split-spoon samplers. The geotechnical samples will be collected at 5-foot intervals. If the materials collected from the split-spoon sampler are visually classified as sensitive materials (i.e., wood debris as is anticipated to be encountered in the Marine Area), a Piston sampler will be used to collect undisturbed samples from immediately below the split-spoon sampling depth. If sample recovery is poor using the split-spoon sampler, a modified California sampler with a larger diameter barrel will be used to collect the sample immediately below the split-spoon sampling depth to improve recovery. If the materials collected from the split-spoon sampler are visually classified as cohesive soils, a Shelby Tube sampler will be used to obtain undisturbed samples from immediately below the split-spoon sampling depth.

Borings will be continuously observed by a field representative, who will examine and classify the soil/sediment encountered, obtain representative samples, observe water conditions and prepare a detailed log of each boring. Sample material will be visually classified in accordance with ASTM D2488 method and the USCS per ASTM D2487 and recorded on a field log and the material will be photographed. The field classifications will be further evaluated in the laboratory. Observations of surface and/or groundwater conditions will be made during drilling and noted on the boring logs.

The general procedure for completing overwater geotechnical borings with SPTs includes the following steps:

- Maneuver the barge to the proposed boring location, steady the barge and verify location control using a GPS (see Section 3.6).
- Record the boring location.
- Measure and record the mudline elevation, time, surface water elevation and confirm location.
- Drill through sediments using an appropriate drilling method (e.g., mud rotary, HSA or sonic drilling) and advance the borehole to the required depth for sampling. If using mud rotary drilling, advance a minimum of 10 feet of 6.5-inch SWT conductor casing (or more depending on lithology) into mudline to contain and circulate drill mud.
- Insert the split-spoon sampler into the borehole, drive the sampler using a hammer and record the number of blows required for 6-inch increments.
- Retrieve the split-spoon sampler containing samples and store samples in containers.
- Use Shelby Tube sampler/Piston sampler/modified California sampler to collect samples immediately below the split-spoon sampling depth, where necessary.
- Advance the borehole to the next interval and repeat the process at specified intervals.

- Upon completion, remove drill rods from the borehole.
- Decontaminate equipment (see Section 3.5) and reposition the barge to the next target location.

The general procedure for completing on-land geotechnical borings with SPTs includes the following steps:

- Mobilize and position the drill rig at the proposed boring location.
- Level and stabilize the drill rig for safe operation.
- Drill through surface materials using an appropriate drilling method (e.g., mud rotary or HSA) and advance the borehole to the required depth for sampling.
- Insert the split-spoon sampler into the borehole, drive the sampler using a hammer and record the number of blows required for 6-inch increments.
- Retrieve the split-spoon sampler containing samples and store samples in containers.
- Use Shelby Tube sampler/Piston sampler/modified California sampler to collect samples immediately below the split-spoon sampling depth, where necessary.
- Advance the borehole to the next interval and repeat the process at specified intervals.
- Upon completion, remove drill rods from the borehole.
- Backfill the borehole and seal it with bentonite.
- Decontaminate equipment (see Section 3.5) and reposition the drill rig to the next target location.

3.3.3 Cone Penetration Tests

3.3.3.1 OVER-WATER CONE PENETRATION TEST EQUIPMENT AND PROCEDURES

The equipment that will be needed for completing the overwater CPTs include:

- Drilling equipment includes a multi-drill rotary track rig, 6-inch conductor casing, modified CPT support casing and other operational support equipment (i.e. tooling, tool handling, pumps, generators, etc.).
- CPTu (CPT with porewater pressure measurement) and seismic CPTu equipment. A CPTu is typically comprised of an electronic piezocone penetrometer and a data acquisition system. The probe has independent load cells for both tip and sleeve. The penetrometers are designed with equal end area friction sleeves and a net end area ratio of 0.8 allowing typical industrial standard. Additionally, the equipment also includes redundant and multiple back-up equipment (e.g., spare CPT probes, etc.), a 20-ton 1-meter stroke integrated ramset for CPTu deployment and an underwater mechanical seismic wave source.
- A 20-ton direct push CPTu ramset that has 20-ton thrust capacity, full 1-meter CPT rod stroke, a secondary hydraulic foot clamp, integrated logic circuit to eliminate accidental rod drops, integrated depth encoder during CPT data collection and slow and rapid feed options.
- A barge that is sufficiently large to provide stable support for the drilling operations and has a moonpool through which the drill can be deployed.

The general over-water CPT procedure includes the following steps:

- Maneuver the barge to the target CPT location, steady the vessel and verify location control using a GPS (see Section 3.6).
- Record the CPT location.
- Record the sampling time and depth to mudline below the water surface using the lead-line or depth sounder, adjusted for tide height.
- Complete soft CPT push from approximately 0 to 10 feet below mudline (optional) and then extract CPT rods.
- Set the 6-inch conductor casing to approximately 10 feet below mudline.
- Hang the CPT support casing inside the 6-inch casing.
- Push the CPT using either drill head or hydraulic ramset.
- Upon completion, remove the CPT rods, support casing and the 6-inch conductor casing.
- Decontaminate equipment (see Section 3.5) and reposition the barge to the next target location.

3.3.3.2 ON-LAND CONE PENETRATION TEST EQUIPMENT AND PROCEDURES

The equipment that will be needed for completing the on-land CPTs includes:

- 30-ton CPT truck rig.
- CPTu and seismic CPTu equipment, including redundant and multiple back-up equipment and a seismic beam for seismic wave source.

The general on-land CPT procedure includes the following steps:

- Position the CPT rig at the target location (see Section 3.6).
- Pre-punch through asphalt, if necessary.
- Push the CPT using the hydraulic ramset.
- Upon completion, remove the CPT rods.
- Abandon the location with bentonite and finish with proper surface material or patch with asphalt when applicable.
- Decontaminate equipment and reposition to the next target location.

3.4 FIELD OBSERVATION AND FIELD TESTING FOR EVIDENCE OF CONTAMINATION

Sediment samples will be observed and tested in the field for evidence of possible contamination. Field results will be recorded on the field forms and the results will be used as evidence of possible contamination. The following screening methods will be used:

- Visual and olfactory observation; and
- Water sheen testing.

Field testing and observation results are site- and location-specific. The results may vary with temperature, moisture content, sediment type and chemical constituent. All field testing and observation results will be documented on the field log and reported.

3.4.1 Visual Observation

The samples will be observed for indicators of recently deposited and native sediment. Specific components of the recently deposited and native sediment include the following:

- **Recently Deposited Sediment** – Comprised of silts, sands and wood debris that have been accumulated on top of the native sediments at the Site since the beginning of the industrial development of the Everett waterfront (i.e., after the late 1800s), including:
  - Wood debris (greater than 15 percent by volume) is located within the nearshore area between the South Terminal Wharf and the interim action on the southwest end of Pacific Terminal and includes varying amounts of sawdust, wood chips, bark, twigs, fibers and dimensional lumber.
  - Mixed sand with silt, variable amounts of shell fragments and visual wood debris greater than 15 percent by volume that have been redeposited as a result of sediment bed disturbances (i.e., wave action, propeller scour, bioturbation, etc.).
  - Unconsolidated sand and silt with visual wood debris less than 15 percent by volume showing evidence of disturbance (i.e., wave action, propeller scour, bioturbation, etc.).
  - Sediment originating from Pigeon Creek is comprised of brown silt and sand and forms an intertidal delta southwest of the Upland Area.
- **Native Sediment** – Comprised of gray, moderately dense, poorly graded sand, silty sand, sandy silt to moderately soft silts and does not contain sawdust or dimensional wood debris. Due to the potential for scour, chemical analysis as proposed by this PRDI Work Plan is necessary to confirm the elevation of the base of contaminated sediment, including materials appearing to be native within the proposed full removal areas to support dredge design.

3.4.2 Water Sheen Testing

This is a qualitative field-testing method that can help identify the presence or absence of petroleum hydrocarbons. A portion of the sediment sample (about a tablespoon) will be placed in a small pan containing distilled water. To enhance visual observations, a small amount of hydrophobic dye such as Sudan IV may be dropped on the water. The water surface will be observed for signs of sheen. The following sheen classifications will be used:

CLASSIFICATION	IDENTIFIER	DESCRIPTION
No Sheen	NS	No visible sheen on the water surface
Slight Sheen	SS	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen	MS	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface
Heavy Sheen	HS	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen

3.5 SAMPLING EQUIPMENT AND DECONTAMINATION PROCEDURES

All reusable sampling equipment that will come in contact with sample material will be thoroughly cleaned prior to use. The sampling equipment will be cleaned according to the following procedures:

- Seawater or distilled water rinse over equipment to dislodge and remove any soil or sediment;
- Washing with a brush and non-phosphate detergent solution (e.g., Liqui-Nox and distilled water);
- Distilled water rinse; and
- Decontaminated equipment not immediately used will be temporarily stored on clean plastic sheeting, wrapped or covered with aluminum foil, and/or stored in a clean, dry place as appropriate.

Disposable nitrile gloves will be used and will be replaced after handling each individual sample to prevent sample cross-contamination.

3.6 LOCATION CONTROL

3.6.1 Upland Area Positioning

Station positions will be determined in latitude and longitude referenced to North American Datum of 1983 (NAD83) using a GPS unit or measured in the field using a known reference point that has been previously surveyed (i.e., monitoring well, building corner, stormwater monument, etc.). The accuracy of measured and recorded horizontal coordinates will be within 2 meters. Latitude and longitude coordinates for each sample location will be recorded to six decimal places for decimal degrees (DD), four decimal places for degrees-minutes (DM) or two decimal places for degrees-minutes-seconds (DMS).

Vertical elevations at each sampling location will be referenced to the local ground surface. The ground surface elevation will be surveyed relative to a permanent benchmark using a laser level which has an accuracy of 0.01 foot.

3.6.2 Marine Area Positioning

The vessel positioning system will be based on either differential global positioning system (DGPS) or real-time kinematic GPS, capable of providing positional accuracies of 2-meter level or better. If equipped on the vessel, the GPS antenna will be located directly above the sampling device for accuracy. If not equipped with an antenna, a handheld GPS will be positioned as close as practicable to the sampling device while maintaining the safety of the personnel operating the device. Sampling positions will be determined in latitude and longitude referenced to NAD83. Latitude and longitude coordinates for each sample location will be recorded to six decimal places for decimal degrees (DD), four decimal places for degrees-minutes (DM) or two decimal places for degrees-minutes-seconds (DMS).

Vertical control will be established using real time kinematic global positioning system (RTK-GPS) instrumentation if equipped onboard the vessel. The RTK-GPS positioning system will employ a ground-based reference station, which will send carrier-phase corrections to an onboard GPS receiver to achieve 0.1-feet accuracy. The RTK-GPS system will be linked to the local Washington State Real-time Network (WSRN), which will use the Puget Sound base station network. The waterline elevations obtained using RTK-GPS will be corrected from the antenna height. The onboard RTK-GPS receiver will be surveyed on the

vessel tower to correct for height to water level. RTK elevations are provided by WSRN corrections. At the beginning of each day a control/reference point onshore will be checked with the RTK to verify corrections by the WSRN base receiver. As a backup, tide boards will be established within the project area and will be referenced to permanent survey control points with known elevation referenced to MLLW.

The mudline elevation at each coring location will be determined from the bathymetric survey discussed in Section 2.1.1. During field work, the mudline elevation will be estimated by subtracting the measured depth of the water column from the real-time tidal elevation approximately 0.1 foot to the extent practical. The depth of the water column at each coring location will be measured by lowering a weighted tape measure from the sampling vessel or depth sounder, adjusted for tide height. Vertical elevations at each sampling location will be determined directly based on core penetration depth compared to the mudline elevation.

3.7 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) will be placed in Department of Transportation (DOT)-approved 55-gallon drums and stored in the Upland Area of the Site in an area designated by the Port. Each waste container will be labeled with "Investigation-Derived Waste – Pending Analysis" and the following information:

- A description of the media (i.e., soil, sediment, decontamination water)
- Origin of the media
- Accumulation start date
- Site identification
- Generator name
- Contact person
- Drum ID number corresponding to the drum inventory form

Once waste characterization has been completed, drums will then be labeled with Hazardous/Dangerous Waste or Non-Hazardous/Non-Dangerous Waste labels, as appropriate and removed from the Site for permitted disposal.

Incidental waste including disposable personal protective equipment (PPE) generated during sampling activities includes items such as gloves, plastic sheeting, sample tubing, paper towels and similar expended and discarded field supplies. These materials are considered *de minimis* and will be disposed of in a local trash receptacle or county disposal facility.

3.8 LABORATORY ANALYSIS

3.8.1 Environmental Laboratory Testing

3.8.1.1 SEDIMENT

Surface sediment samples collected to support the design of the natural recovery and dynamic sand cap remedies and to refine the extent of sediment contamination in material that is located on top of the armoring beneath the South Terminal and the Pacific Terminal Wharfs, and subsurface samples collected to confirm the base of contamination in the full removal areas will be submitted for analysis of the Marine Area sediment COCs (see below). Samples that are not initially selected for analyses from a specific location

will be archived for potential future analysis based on the initial sample results. Sample results will be reported in both dry weight and organic content normalized concentration to facilitate evaluation of the data.

The Marine Area COCs and analytical methods for sediment samples include:

- Total organic carbon (TOC) by SW 9060A.
- SMS Metals including arsenic, cadmium, copper, lead, mercury and zinc using EPA methods 6020B and 7471B.
- Polycyclic aromatic hydrocarbons (PAHs) including 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h.i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene and pyrene using EPA Method 8270E/SIM.
- SMS semivolatile organic compounds (SVOCs) including 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, hexachlorobenzene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, diethyl phthalate, 2,4-dimethylphenol, 2-methylphenol, 4-methyl phenol, phenol, dibenzofuran, hexachlorobutadiene, benzoic acid and benzyl alcohol using EPA Methods 8081B and 8270E/SIM.
- Polychlorinated Biphenyl (PCB) congeners using EPA Method 1668C.
- Dioxins and furans using EPA Method 1613B.

These analytes are identified as COCs for the Marine Area in the final CAP. Sample containers and preservation methods are presented in Table 2. Sediment samples will be submitted to Analytical Resources, LLC (ARL; Tukwila, Washington) and Enthalpy Analytical (El Dorado Hills, California).

3.8.1.2 SURFACE WATER AND ELUTRIATE AND LEACHATE TEST WATER

Surface water samples and elutriate and leachate test water samples will be submitted to ALS Environmental (ALS; Kelso, Washington) and Enthalpy Analytical (El Dorado Hills, California) for analysis of the Marine Area sediment COCs listed above in Section 3.8.1.1, except for TOC).

The analytical methods for surface water and elutriate and leachate test water samples include:

- SMS Metals including arsenic, cadmium, copper, lead, mercury and zinc using EPA methods 200.8 and 1631E.
- PAHs including 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h.i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene and pyrene using EPA Method 8270D/SIM.
- SMS SVOCs including 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, hexachlorobenzene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, diethyl phthalate, 2,4-dimethylphenol, 2-methylphenol, 4-methyl phenol, phenol, dibenzofuran, hexachlorobutadiene, benzoic acid and benzyl alcohol using EPA Method 8270D and 8270D/SIM.
- PCB congeners using EPA Method 1668C.

- Dioxins and furans using EPA Method 1613B.

Sample containers and preservation methods are presented in Table 2.

3.8.2 Geotechnical Laboratory Testing

Geotechnical laboratory testing will be completed on the samples collected from both the Upland Area and Marine Area at the Mill-A site and the Eelgrass Mitigation Site to evaluate their physical and geotechnical properties for design of stable dredged slopes and structures at the Mill-A site and potential settlement and slope stability after fill placement at the Eelgrass Mitigation Site.

3.8.2.1 IN-PLACE SUBSURFACE SOIL/SEDIMENT

The primary goal of completing laboratory testing on the soil and underlaying sediment samples collected through geotechnical borings (see Section 3.3.2) is to characterize the materials and evaluate their geotechnical properties for design. Testing will include material classification, moisture content, density, percent fines, grain size distribution, plasticity, permeability, compressibility, shear strength and dynamic properties. The following table presents the proposed laboratory testing to be included, as appropriate:

PROPOSED LABORATORY TESTING FOR IN-PLACE SUBSURFACE SOIL/SEDIMENT

TESTING	STANDARD	SOIL/ SEDIMENT TYPES	PURPOSE	PROPOSED NUMBER OF TESTS
Geotechnical Index Tests				
Moisture content	ASTM D2216	All	To assess the physical properties (e.g., moisture content, density, percent fines, grain size distribution and plasticity) of the soils/sediments and to classify the materials.	Up to 6 tests for soils obtained from SMA-1d area and up to 6 tests per boring.
Bulk density	ASTM D7263	All		Up to 4 tests per boring.
Percent fines	ASTM D1140	All		Up to 5 tests per boring.
Grain size distribution	ASTM D6913	All		Up to 4 tests per boring.
Hydrometer	ASTM D422	Fine-grained		Up to 2 tests per boring.
Atterberg limits	ASTM 4318	Fine-grained		Up to 4 tests per boring.
Permeability test	ASTM D2434 and/or D5084	All	To assess the permeability of the soils/sediments, which indicates the rate at which water flows through them, for use in geotechnical analysis (e.g., seismic hazard analysis) and evaluating drainage conditions.	Up to 3 tests per group of borings. Five groups were identified by locations, i.e., group 1 (PRDI-33 and 35), group 2 (PRDI-54 and 55), group 3 (PRDI-56 and 57), group 4 (PRDI-58, 59 and 60), and group 5 (PRDI-65 and 66).

TESTING	STANDARD	SOIL/ SEDIMENT TYPES	PURPOSE	PROPOSED NUMBER OF TESTS
1D consolidation test	ASTM D2435	Compressible and/or wood debris	To assess the compressibility of the soils/sediments for use in estimating the potential settlement under fill/dredged material placement etc.	Up to 2 per each of the two borings (i.e., PRDI-56 and 57).
Triaxial test	ASTM D2850, D4767, D7181, or USACE EM 1110-2-1906	Fine-grained and/or wood debris	To assess the shear strength of the soils/sediments for use in geotechnical analysis and recommendations (e.g., seismic hazard analysis, slope stability evaluation, ground improvement design and lateral earth pressure development).	Up to 3 tests per group of borings. Five groups were identified as above.
Cyclic direct simple shear test (CyDSS)	ASTM D8296	Fine-grained and/or wood debris	To assess the engineering properties of the soils/sediments under cyclic seismic loading for use in geotechnical analysis and recommendations under seismic condition.	Up to 2 sets (each set contains 3 tests) for soils obtained from borings PRDI-56 to 60.

3.8.2.2 SEDIMENTS TO BE DREDGED AND PLACED IN THE CDF OR DISPOSED IN A LANDFILL

The samples from the sediments to be dredged will be collected through environmental (see Section 3.2.3) and geotechnical borings (see Section 3.3.2). The primary goal of completing laboratory testing on these samples is to characterize the sediments and evaluate:

- The physical properties (e.g., moisture content, bulk density, material pH, grain size distribution and plasticity if applicable) of the sediments to be dredged.
- The settling rate (without adding flocculant), permeability, compressibility, shear strength and dynamic properties of the sediments to be dredged and placed in the CDF.
- The free-draining capacity of the sediments to be dredged and placed in CDF or disposed in a landfill.
- The weight (tons) to volume (cubic yards [CY]) conversion for the sediments to be dredged and disposed of in a landfill.

The following table presents the proposed laboratory testing to be included, as appropriate:

PROPOSED LABORATORY TESTING FOR SEDIMENT TO BE DREDGED AND PLACED IN THE CDF OR DISPOSED IN A LANDFILL

TESTING	STANDARD	SEDIMENT TYPES	PURPOSE	PROPOSED NUMBER OF TESTS
Geotechnical index tests, including:				
Moisture content	ASTM D2216	All	To assess the physical properties (e.g., moisture content, bulk	Up to 16 tests.
Bulk density	ASTM D7263	All		Up to 16 tests.

TESTING	STANDARD	SEDIMENT TYPES	PURPOSE	PROPOSED NUMBER OF TESTS
Grain size distribution	ASTM D6913	All	density, grain size distribution, material pH, and plasticity if applicable) of the sediments and to classify the materials.	Up to 16 tests.
Hydrometer	ASTM D422	Fine-grained		Up to 16 tests.
Atterberg limits	ASTM 4318	Fine-grained		Up to 16 tests.
Material pH	EPA Method 9045D	All		Up to 16 tests.
Column settling test	-[1,2]	Blended[3]	To assess the settling rate of the dredged materials to be placed within the CDF wall area, which indicates how quickly the dredged materials can settle under gravity with and without flocculant. The testing results will help develop an appropriate dewatering treatment system, if needed.	Up to 16 tests.
Consolidated undrained triaxial test	ASTM D4767	Blended and remolded[4]	To assess the shear strength of the settled dredged materials to evaluate if the dredged materials have sufficient capacity to support the fill placement and the CDF wall in a temporary condition after the dredged materials placed within the CDF wall area settle. If the strength of the settled dredged materials is not sufficient, further treatability will be needed to improve the strength of the settled dredged material. It will be further used in geotechnical analysis and recommendations (e.g., seismic hazard analysis, slope stability evaluation, ground improvement design, and lateral earth pressure development).	Up to 8 tests.
Permeability test	ASTM D5084	Blended and remolded[4]	To assess the permeability of the settled dredged materials, which indicates the rate at which water flows through them, for use in geotechnical analysis (e.g., seismic hazard analysis) and evaluating drainage conditions after the dredged materials placed within the CDF wall area settle. If further treatability is needed, permeability needs to be re-assessed.	Up to 8 tests.

TESTING	STANDARD	SEDIMENT TYPES	PURPOSE	PROPOSED NUMBER OF TESTS
1D consolidation test	ASTM D2435	Blended and remolded[4]	To assess the compressibility of the settled dredged materials. It will be used to evaluate the potential settlement of the dredged materials under fill placement, etc. after the dredged materials placed within the CDF wall area settle. If further treatability is needed, compressibility needs to be re-assessed.	Up to 8 tests.
CyDSS	ASTM D8296	Blended and remolded[4]	To assess the engineering properties of the settled dredged materials under cyclic seismic loading for use in geotechnical analysis and recommendations under seismic condition after the dredged materials placed within the CDF wall area settle. If further treatability is needed, the dynamic engineering properties need to be re-assessed.	Up to 9 tests.
Gravity drain test	-[1,5]	Blended[3]	To assess the free-draining capacity of the sediments to be dredged and disposed in a landfill.	Up to 6 tests.
Sediment bulk density measurement	-[1,6]	Blended[3]	To assess the weight (tons) to CY conversion for the sediments to be dredged and disposed in a landfill.	Up to 6 tests.

Notes:

[1] No specific ASTM standard applicable to this testing.

[2] The general procedure for the column settling test is to (1) complete geotechnical index testing on the prepared samples, (2) transfer the prepared samples to cylinders; if testing flocculant effects, prepare separate columns with and without flocculant, (3) allow the solids to settle under gravity during test and record the interface level at regular time intervals and note the turbidity changes in the upper portion of the column, and (4) plot settling curve (e.g., interface height versus time) and estimate settling rate.

[3] The samples for the column settling test and the gravity drain test will be prepared by blending the samples collected from different locations to simulate the condition in which sediments will be dredged at different locations and placed within the CDF wall area or disposed in a landfill.

[4] The samples for the 1D consolidation test, CU triaxial test, permeability test, and CyDSS test will be (1) obtained from the settled sediments after the completion of the column settling test, and (2) remolded using the samples obtained from different locations to achieve the density of the settled sediments after the completion of the column settling test.

[5] The general procedure for the gravity drain test is to (1) place the prepared sample in a pan, weigh the sample, and set the plan at an incline, (2) after 8 hours, weight and restack the sample, and repeat it at 24 hours, (3) if free water continues to drain, the process is continued until significant free water is no longer draining from the sample.

[6] The general procedure for the sediment bulk density measurement is to (1) fill a bucket with a specific volume of sediments, and (2) get the weights of the sediments. Multiple measurements will be made to obtain data on the range of material types within the proposed dredge prism.

3.8.2.3 TESTING CONSIDERATIONS

For the subsurface soils and sediments, the permeability test, 1D consolidation test, triaxial tests and CyDSS test should be completed on the relatively undisturbed samples collected using the Shelby Tube or Piston sampler from the geotechnical borings. The 1D consolidation test, triaxial tests and CyDSS test will be completed on the fine-grained samples and/or wood debris samples. However, there is a risk that recovering undisturbed samples may not be practicable, especially in the wood debris areas.

For the subsurface sediments to be dredged, the sediments will be highly disturbed during the construction sequence. Therefore, the permeability test, 1D consolidation test, triaxial tests and CyDSS test will be completed on disturbed and remolded samples. Considering that these samples will be remolded and may contain a mix of variable materials – such as soils, wood debris and/or flocculant, etc., there is a risk that the remolded samples might not be appropriate for the above testing, especially for the triaxial tests and CyDSS test as these tests typically require high quality samples with relatively uniform and consistent material to produce reliable results. The presence of heterogeneous materials could interfere with the integrity of the samples, compromise the accuracy of the testing and potentially lead to invalid or inconclusive results. Sample quality will be evaluated before tests are completed.

4.0 Procedures for the Inadvertent Discovery of Cultural Resources

An Inadvertent Discovery Plan (IDP) is included in Appendix C of the PRDI Work Plan. The IDP outlines procedures to complete in the event of a discovery of archaeological materials or human remains, in accordance with applicable state and federal laws. The IDP will be reviewed by the field team prior to beginning fieldwork and kept at the project site during the PRDI to reference in the event of a discovery.

5.0 Quality Assurance and Quality Control

The following sections present the objectives, procedures, organization and specific QA and QC activities designed to achieve the data quality goals for the PRDI. QA/QC procedures will be implemented so that the precision, accuracy, representativeness, completeness and comparability (PARCC) of the data generated meet the specified data quality objectives and that environmental measurements produce data that are scientifically valid and are of known and acceptable quality to meet the overall project objectives.

5.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

Descriptions of the responsibilities, lines of authority and communication for the key positions providing quality assurance and quality control are discussed in the following sections. The project organization facilitates the efficient production of project work, allows for an independent quality review and permits resolution of any QA issues.

5.1.1 Project Leadership and Management

The Principal/Associate–in-Charge is responsible to the Port for fulfilling contractual and administrative control of the project. The Principal-in-Charge's duties include defining the project approach and tasks, selecting project team members and establishing budgets and schedules.

Robert Trahan (206.239.3253) is the Associate-in Charge.

The Project Manager's duties consist of implementing the project approach and tasks, overseeing project team members during performance of project tasks, adhering to and communicating the status of budgets and schedules to the Principal/Associate-in-Charge, providing technical oversight, coordinating with Ecology for needed review and approval of non-urgent changes to this plan and providing overall production and review of project deliverables.

Niel Morton (206.239.3238) is the Project Manager.

5.1.2 Field Coordinator

The Field Coordinator is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Provides technical direction to the field staff;
- Develops schedules and allocates resources for field tasks;
- Coordinates data collection activities to be consistent with information requirements;
- Supervises the compilation of field data and laboratory analytical results;
- Assures that data are correctly and completely reported;
- Implements and oversees field sampling in accordance with project plans;
- Supervises field personnel;
- Coordinates work with on-site subcontractors;
- Coordinates with the Project Manager and Ecology for review and approval of immediately needed changes to this plan dictated by field conditions;
- Schedules sample shipment with the analytical laboratory;
- Monitors that appropriate sampling, testing and measurement procedures are followed;
- Coordinates the transfer of field data, sample tracking forms and field forms to the Project Manager for data reduction and validation; and
- Participates in QA corrective actions as required.

The Field Coordinator will be confirmed before beginning the field work.

5.1.3 Quality Assurance Leader

The QA Leader is responsible for coordinating QA/QC activities as they relate to the acquisition of field data. Specific responsibilities include the following:

- Serves as the official contact for laboratory data QA concerns;
- Reviews and approves the laboratory QA Plan;
- Responds to laboratory data QA needs, answers laboratory requests for guidance and assistance and resolves issues;
- Monitors laboratory compliance with data quality requirements;

- Ensures that appropriate sampling, testing and analysis procedures are followed and that proper QC checks are implemented;
- Reviews the implementation of the QA/QC procedures and the overall quality of the analytical data generated; and
- Maintains the authority to implement corrective actions as necessary.

The QA leader will be confirmed before beginning the field work.

5.1.4 Laboratory Management

Subcontracted laboratories conducting sample analyses/testing for this project are required to obtain approval from the QA Leader before the initiation of sample analysis/testing to assure that the laboratory QA plan complies with the project QA objectives. The Laboratory's QA Coordinator administers the Laboratory QA Plan and is responsible for QC. Specific responsibilities of this position include:

- Ensure implementation of the QA Plan;
- Serve as the laboratory point of contact;
- Activate corrective action for out-of-control events;
- Issue the final QA/QC report;
- Administer QA sample analysis/testing;
- Comply with the specifications established in the project plans, as related to laboratory services; and
- Participate in QA audits and compliance inspections.

Analytical Resources, LLC (ARL; Tukwila, Washington), ALS Environmental (ALS; Kelso, Washington), and Enthalpy Analytical (El Dorado Hills, California) will provide chemical analytical laboratory services for the project. Sue Dunnihoo (206.695.6207) is ARI's Laboratory's QA Coordinator. Naomi Pederson (360.501.3301) is ALS's Laboratory QA Coordinator. Kathy Zipp (916.673.1520 x 112) is Enthalpy Analytical's Laboratory's QA Coordinator.

5.1.5 Data Validation

EcoChem, Inc. (Seattle, Washington) will serve as the data validation subcontractor and will review and validate the analytical data provided by the analytical laboratories. Christine Ransom will be EcoChem's project lead. Specific data validation responsibilities include:

- Verify electronic data packages deliverables received from the laboratories.
- Complete EPA Stage 2B data validation.
- Add data qualifiers to the data as necessary.
- Prepare data validation reports.

5.1.6 Health and Safety

Health and safety protocols that will be utilized to complete the RI/FS work are documented in a Site-specific Health and Safety Plan (HASP) included in the PRDI Work Plan (Appendix B). The Field Coordinator will be responsible for implementing the HASP during sampling activities. The Project Manager will discuss health and safety issues with the Field Coordinator on a routine basis during the completion of field activities. The Field Coordinator will terminate any work activities that do not comply with the HASP. Companies providing services for this project on a subcontracted basis will be responsible for developing and implementing their own HASP.

5.2 ENVIRONMENTAL DATA QUALITY OBJECTIVES

The quality assurance objective for technical data is to collect environmental monitoring data of known, acceptable and documentable quality. The QA objectives established for the project are:

- Implement the procedures outlined herein for field sampling, sample custody, equipment operation and calibration, laboratory analysis and data reporting that will facilitate consistency and thoroughness of data generated.
- Achieve the acceptable level of confidence and quality required so that data generated are scientifically valid and of known and documented quality. This will be completed by establishing criteria for precision, accuracy, representativeness, completeness and comparability, and by testing data against these criteria.

The sampling design, field procedures, laboratory procedures and QC procedures are set up to provide high-quality data for use in this project. Specific data quality factors that may affect data usability include quantitative factors (bias, detection limits, precision, accuracy, completeness and reporting limits) and qualitative factors such as representativeness and comparability. The laboratory QA/QC requirements for sediment analyses summarized in Tables 3 through 6, will be followed so that data of adequate quality is generated to support the PRDI. The specific data quality objectives (DQOs) associated with these data quality factors are discussed below.

5.2.1 Detection Limits

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Although results reported near the MDL provide insight into Site conditions, quality assurance dictates that analytical methods achieve a consistently reliable level of detection known as the practical quantitation limit (PQL), which is typically demonstrated with the lowest point of a linear calibration. The contract laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

Laboratory MDLs/PQLs are method specific and are considered target reporting limits (TRLs) because several factors may influence final reporting limits (RLs). First, moisture and other physical conditions affect detection limits. Second, analytical procedures may require sample dilutions or other practices to accurately quantify a particular analyte at concentrations above the range of the instrument. The effect is that other analytes could be reported as undetected but at a value higher than a specified TRL. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize Site conditions.

5.2.2 Precision

Precision is the measure of mutual agreement among replicate or duplicate measurements of an analyte from the same sample and applies to field duplicate or split samples, replicate analyses and duplicate spiked environmental samples (matrix spike duplicates). The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as the relative percent difference (RPD) for spike sample comparisons of various matrices and field duplicate comparisons for sediment samples.

This value is calculated by:

$$RPD\,(\%) = \frac{|\,D_1 - D_2\,|}{(\,D_1 + D_2\,)/2}\ X\ 100,$$

Where:

D_1 = Concentration of analyte in sample.

D_2 = Concentration of analyte in duplicate sample.

The RPD will be calculated for samples and compared to the laboratory RPD QC limits. The RPD QC limits are only applicable if the primary and duplicate sample concentrations are greater than five times the PQL. For results less than five times the PQL, the difference between the primary and duplicate samples should be less than two times the PQL for sediment samples.

5.2.3 Accuracy

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported values versus the actual value and is often measured with the addition of a known compound to a sample. The amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

For this project, accuracy will be expressed as the percent recovery of a known surrogate spike, matrix spike or laboratory control sample (blank spike), concentration:

$$Recovery\,(\%) = \frac{Spiked\ Result - Unspiked\ Result}{Known\ Spike\ Concentration}\ X\ 100$$

5.2.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents the actual Site conditions. The determination of the representativeness of the data will be completed by completing the following:

- Comparing actual sampling procedures to those delineated within this SAP/QAPP.
- Comparing analytical results of field duplicates to determine the variations in the analytical results.
- Identifying data to be classified as questionable or qualitative and providing those data to Ecology in the data validation report for review on a case-by-case basis.

All analytical data generated as part of the PRDI will be reported to Ecology. Any data suspected to be "non-representative" will be identified and the reason for suspecting that the data was non-representative will be described to Ecology. Ecology will determine on a case-by-case basis the appropriateness of including those data in subsequent data reduction, validation and reporting activities.

5.2.5 Completeness

Completeness establishes whether a sufficient number of valid measurements were obtained to meet project objectives. The number of samples and results expected establishes the comparative basis for completeness. Completeness goals are 90 percent useable data for samples/analyses planned. The completeness of the data will be reported to Ecology. If the completeness goal is not achieved, Ecology will determine if the data are adequate to meet study objectives.

$$Completeness = \frac{number\ of\ valid\ measurements}{total\ number\ of\ data\ points\ planned} x\ 100$$

5.2.6 Comparability

Comparability expresses the confidence with which one set of data can be compared to another. Although numeric goals do not exist for comparability, a statement on comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy.

5.2.7 Holding Times

Holding times are defined as the time between sample collection and extraction, sample collection and analysis or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. If a sample exceeds a holding time, then the results may be biased. Results for that analysis would be qualified as estimated to indicate that the reported results may be different than actual Site conditions. Holding times are presented in Tables 2 and 3.

5.2.8 Blanks

According to the National Functional Guidelines for Organic Data Review (USEPA 2020b), "The purpose of laboratory (or field) blank analysis is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to any blank associated with

the samples (e.g., method blanks, instrument blanks, trip blanks and equipment blanks)." Method blanks are created during sample preparation and follow samples throughout the analysis process.

Analytical results for blanks will be interpreted in general accordance with EPA's National Functional Guidelines for Inorganic (EPA 2020a), Organic (EPA 2020b), and High Resolution Methods Data Review (EPA 2020C) and professional judgment. Site analytical chemical or constituent sample results associated with analytical detections of a blank sample will be reported separately to Ecology for point-by point review, together with any other data determined to be possibly "non-representative" of Site conditions.

5.3 DOCUMENTATION AND RECORDS

5.3.1 Field Observations

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will maintain daily field logs. The field logs will be prepared on field report forms. Entries in the field logs and associated sample documentation forms will be made in waterproof ink, and corrections will consist of line-out deletions that are initialed and dated. Individual logbooks will become part of the project files at the conclusion of the field work.

At a minimum, the following information will be recorded during the collection of each sample.

- Sample location designation;
- Sample identification number assigned for individual surface or core sections;
- Geographic coordinates of the sampling location using GPS;
- Date and time of sample collection;
- Names of field person(s) collecting and logging in the sample;
- The penetration depth for surface samples and soil and sediment cores and actual length of recovery and calculated percent recovery for each core sample;
- Number of attempts to collect the sample and the number of deployments needed to obtain sufficient sample material (when multiple deployments are needed);
- Observed characteristics of the sample including:
  - Presence or absence of stratification;
  - Texture;
  - Color;
  - Presence of biota or biological structures;
  - Presence of debris including wood; and
  - Field observation and testing results (see Section 3.5).
- Description of wood if visible and identifiable including:
  - Type of wood (i.e., saw dust, bark, chips, chunks, twigs, fibers, etc.); and
  - Depth interval of wood (i.e., surface (0) to 1 foot, 1.5 to 4.25 feet, etc.).

- Visually based volumetric estimate of wood (i.e., 10 percent, 25 percent, 50 percent, etc.) in the sediment and/or in discernible sediment horizons using percentage diagrams available from soil classification charts (Compton 1985);
- Gross characteristics of the vertical profile including:
  - Presence of a redox layer and redox layer thickness, if present; and
  - Changes in material characteristics.
- Photographs of each surface sample and soil and sediment core sufficiently detailed to verify submitted logs;
- Type of sampling equipment used;
- Sample preservation (if used); and
- Weather conditions.

In addition to the sampling information, the following specific information also will be recorded in the field log for each day of sampling.

- Sampling team members;
- Time of arrival/entry on Site and time of Site departure;
- Other personnel present at the Site;
- Summary of pertinent meetings or discussions with regulatory agency or contractor personnel;
- Deviations from SAP/QAPP and/or HASP. Deviations to the SAP/QAPP will be reported to Ecology;
- Changes in field personnel and responsibilities with reasons for the changes;
- Decontamination procedures; and
- Calibration readings for any equipment used.

The handling, use and maintenance of field logs are the Field Coordinator's responsibility.

5.3.2 Physical and Chemical Analytical Laboratory Records

The laboratories will be responsible for internal checks on data reporting and will correct errors identified during the QA review. The laboratory must be accredited by Ecology for the required analytical methods. Close contact will be maintained with the laboratory to resolve any quality control problems in a timely manner. The laboratory will be required to provide the following:

- **Project narrative** – This summary, in the form of a cover letter, will present any problems encountered during any aspect of analysis. The summary will include, but not be limited to, a discussion of QC, sample shipment, sample storage and analytical difficulties. Any problems encountered by the laboratory, and their resolutions, will be documented in the project narrative.
- **Records** – Legible copies of the chain-of-custody forms will be provided as part of the data package. This documentation will include the time of receipt and the condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.

- **Sample results** – The data package will summarize the results for each sample analyzed. The summary will include the following information, as applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample extraction/digestion
  - Date and time of analysis
  - Weight and/or volume used for analysis
  - Final dilution volumes or concentration factor for the sample
  - Total solids in the samples
  - Identification of the instruments used for analysis
  - MDLs and PQLs
  - All data qualifiers and their definitions
- **QA/QC summaries** – These summaries will contain the results of all QA/QC procedures. Each QA/QC sample analysis will be documented with the same information as that required for the sample results (see above). The laboratory will make no recovery or blank corrections. The required summaries are listed below.
  - The calibration data summary will contain the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. The response factor, percent standard deviation (RSD), RPDs and retention time for each analyte will be listed, as appropriate. Results for standards analyzed at the PQL to determine instrument sensitivity will be reported.
  - The internal standard area summary will report the internal standard areas, as appropriate.
  - The method blank analysis summary will report the method blank analysis associated with each sample and the concentrations of all compounds of interest identified in these blanks.
  - The surrogate spike recovery summary will report all surrogate spike recovery data for organic analyses. The names and concentrations of all compounds added, percent recoveries and QC limits will be listed.
  - The matrix spike (MS) recovery summary will report the MS or MS duplicate (MSD) recovery data for analyses, as appropriate. The names and concentrations of all compounds added, percent recoveries and QC limits will be included in the data package. The RPD for all MS/MSD analyses will be reported.
  - The laboratory replicate summary will report the RPD for all of the laboratory replicate analyses. The QC limits for each compound or analyte will be listed.
  - The laboratory control sample (LCS) analysis summary will report the results of the analyses of the LCS. The QC limits for each compound or analyte will be included in the data package.
  - The relative retention time summary will report the relative retention times for the primary and confirmational columns of each analyte detected in the samples, as appropriate.

EQuIS four-file format electronic data deliverables will be obtained from the laboratory, and data will be submitted into Ecology's Environmental Information Management (EIM) system after data quality assessments are completed.

5.3.2.1 DATA REDUCTION

Data reduction is the process by which original data are converted or reduced to a specified format or unit to facilitate the analysis of the data. For example, a final analytical concentration may need to be calculated from a diluted sample result. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. The laboratory personnel will reduce the analytical data for review by the Quality Assurance Leader and Project Manager.

During chemical analysis, samples are occasionally diluted after the initial analysis if the estimated concentration curve for one or more of the target analytes is above the calibration curve. In these instances, concentrations from the initial analysis will be identified as the "best result" for all target analytes other than the chemical(s) that was originally above the calibration range. The "best result" for this qualified analyte(s) will be taken from the diluted sample.

5.4 SAMPLE HANDLING AND CUSTODY

5.4.1 Sample Containers and Labeling

The Field Coordinator will establish field protocol to manage field sample collection, handling and documentation. Samples will be placed in appropriate laboratory-prepared containers. Sample containers and preservatives are listed in Table 2.

Sample containers will be labeled with the following information at the time of sample collection:

- Project name and number;
- Type of sample preservative used (where applicable);
- Sample name, which will include a reference to date and sampling depth (if applicable); and
- Date and time of collection.

The sample collection activities will be noted on the field forms. The Field Coordinator will monitor consistency between sample containers/labels, field forms and COC forms.

5.4.2 Sample Storage

Samples will be placed in a cooler with ice after they are collected. Samples will be maintained between 2 to 6 degrees Celsius. Holding times (Table 2) will be observed during sample storage.

5.4.3 Sample Shipment

Samples will be transported and delivered to the analytical laboratory in the sample coolers. The samples will either be transported by field personnel, laboratory personnel or by courier service. The Field Coordinator will ensure that the cooler has been properly secured using clear plastic tape and custody seals.

5.4.4 Chain-of-Custody Records

Field personnel are responsible for the security of samples from the time the samples are collected until the samples have been received by the courier service or laboratory personnel. A COC form will be

completed for each group of samples being shipped to the laboratory. Information to be included on the COC form includes:

- Project name and number;
- Sample identification numbers;
- Date and time of sampling;
- Sample matrix, preservative and number of containers for each sample;
- Analyses to be completed;
- Names of sampling personnel;
- Project manager name and contact information including phone number; and
- Shipping information including shipping container number, if applicable.

The original COC form will be signed by a member of the field team. Field personnel will retain copies and place the original and remaining copies in a plastic bag. The plastic bag containing the COC form will be placed in the cooler before sealing the cooler for transport to the laboratory.

5.4.5 Laboratory Custody Procedures

The laboratory will follow their standard operating procedures (SOPs) to document sample handling from time of receipt (sample log-in) to reporting. Documentation will include, at a minimum, the analyst's name or initials, time and date.

5.5 TEST METHODS

The methods of conventional and chemical analysis are identified in Table 2. All methods selected represent standard methods used for the analysis of these analytes. The laboratory project manager will determine the remedy to be used if the project quality control objectives cannot be attained, in consultation with GeoEngineers Quality Assurance Leader. Data obtained outside of project quality control objectives will be reported separately to Ecology for review and approval prior to inclusion.

5.6 QUALITY CONTROL

Tables 3 through 6 summarize the types and frequency of QC samples to be analyzed, including both field QC and laboratory QC samples.

5.6.1 Field Quality Control

Field QC samples serve as a control and check mechanism to monitor the consistency of field sampling methods and the potential influence of off-site factors on project samples. The types of QC samples for the Marine Area PRDI are described below.

5.6.1.1 BLIND FIELD DUPLICATES

Blind field duplicates serve as a measure for precision. Under ideal field conditions, sediment blind field duplicates (sometimes referred to as splits), are created by thoroughly mixing a volume of the sediment, placing aliquots of the mixed sediment in separate containers and identifying one of the aliquots as the

primary sample and the other as the duplicate sample. Field duplicates measure the precision and consistency of laboratory analytical procedures and methods, as well as the consistency of the sampling techniques used by field personnel.

One blind field duplicate will be collected for every 10 sediment samples analyzed. In addition, a minimum of one field duplicate per matrix will be collected for every sampling event if less than 10 samples are collected as part of each sampling event.

5.6.1.2 TEMPERATURE CONTROL

Cooler temperatures will be recorded at the analytical laboratory upon arrival of the coolers. Cooler temperature will be recorded upon cooler receipt using a calibrated infrared thermometer on temperature blanks included in each cooler. Samples received outside of the required temperature range will be reported as possibly non-representative to Ecology for review and approval prior to inclusion of the sample in data analyses.

5.6.2 Analytical Laboratory Quality Control

Laboratory QC procedures will be evaluated through a formal data quality assessment process. The analytical laboratory will follow standard analytical method procedures that include specified QC monitoring requirements. These requirements will vary by method, but generally include:

- Method blanks
- Internal standards
- Instrument calibrations
- Matrix spike/matrix spike duplicates (MS/MSD)
- Laboratory control samples/laboratory control sample duplicates (LCS/LCSD)
- Laboratory replicates or duplicates
- Surrogate/Labeled compounds

5.6.2.1 LABORATORY BLANKS

Laboratory procedures utilize several types of blanks, but the most commonly used blanks for QC monitoring are method blanks. Method blanks are laboratory QC samples that consist of either a soil-like material having undergone a contaminant destruction process, or reagent (contaminant-free) water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. If a substance is detected in a method blank, then one (or more) of the following occurred:

- Sample containers, measurement equipment and/or analytical instruments were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.

It is difficult to determine which of the above scenarios took place if blank contamination occurs. However, it is assumed that the conditions that affected the blanks also likely affected the project samples. If target analytes are detected in method blanks, data validation guidelines assist in determining which substances

in project samples are considered "real," and which ones are attributable to the analytical process. See Tables 4 through 7 for additional details on method blank frequency, control limits, and corrective actions.

5.6.2.2 CALIBRATIONS

Several types of instrument calibrations are used, depending on the analytical method, to assess the linearity of the calibration curve and assure that the sample results reflect accurate and precise measurements. The main calibrations used are initial calibrations, daily calibrations and continuing calibration verification. See Tables 4 through 7 for additional details on calibration frequency, control limits, and corrective actions.

5.6.2.3 MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD)

MS/MSD samples are used to assess influences or interferences caused by the physical or chemical properties of the sample itself. For example, extreme pH can affect the results for semi-volatile organic compounds, or the presence of a particular compound may interfere with accurate quantitation of another analyte. MS/MSD data is reviewed in combination with other QC monitoring data to determine matrix effects. In some cases, matrix effects cannot be determined due to dilution and/or high levels of related substances in the sample. A matrix spike is evaluated by spiking a project sample with a known amount of one or more of the target analytes, ideally at a concentration that is 5 to 10 times higher than the sample result. A percent recovery is then calculated by subtracting the un-spiked sample result from the spiked sample result, dividing by the known concentration of the spike, and multiplying by 100.

A minimum of one (1) laboratory MS/MSD per 20 samples, not including QC samples, or one (1) MS/MSD sample per batch of samples, if fewer than 20 samples are obtained, will be collected for sediment samples. The samples for the MS/MSD analyses should be collected from a sampling location that is believed to have only low-level contamination. A sample from an area of low-level contamination is needed because the objective of MS/MSD analyses is to determine the presence of matrix interferences, which can best be achieved with low levels of contaminants. Additional sample volume will be collected for the MS/MSD analyses as required by the laboratory. See Tables 4 through 7 for additional details on MS/MSD frequency, control limits, and corrective actions.

5.6.2.4 LABORATORY CONTROL SAMPLE/ LABORATORY CONTROL SAMPLE DUPLICATES (LCS/LCSD)

Also known as blank spikes, LCS are similar to MS samples in that a known amount of one or more of the target analytes are spiked into a prepared sample medium, and a percent recovery of the spiked substances is calculated. The primary difference between LCS and MS samples is that the LCS uses a contaminant-free sample medium. For example, reagent water is typically used for LCS water analyses. The purpose of an LCS is to help assess the overall accuracy and precision of the analytical process including sample preparation, instrument performance and analyst performance. See Tables 4 through 7 for additional details on LCS/LCSD frequency, control limits, and corrective actions.

5.6.2.5 LABORATORY REPLICATES/DUPLICATES

Laboratories utilize MS/MSDs, LCS/LCSDs and/or replicates to assess precision. Replicates are a second analysis of a field-collected environmental sample. Replicates are split from the original sample prior to the sample preparation and analysis process. See Tables 4 through 7 for additional details on laboratory replicates/duplicates frequency, control limits, and corrective actions.

5.6.2.6 SURROGATES/LABELED COMPOUNDS

Surrogate spikes are used in the organic analyses to verify proper extraction procedures and the accuracy of the analytical instrument. Surrogates are substances with characteristics like the target analytes. A known concentration of surrogate is added to the project sample and passed through the instrument and the percent recovery is calculated. Each surrogate used has acceptance limits (i.e., an acceptable range) for percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified acceptance limits, a possibility of false positives exists, although non-detect results are considered accurate. See Table 6 for additional details on surrogate spike frequency, control limits, and corrective actions.

5.7 INSTRUMENT TESTING, INSPECTION AND MAINTENANCE

The field coordinator will be responsible for overseeing the testing, inspection and maintenance of all field equipment. The laboratory project manager will be responsible for laboratory equipment testing, inspection and maintenance requirements. The calibration methods used in calibrating the analytical instrumentation are described in the following section.

5.7.1 Field Instrumentation

Field instrument calibration and calibration checks facilitate accurate and reliable field measurements. As noted in Section 3.2.4, a YSI-Pro or similar water quality measuring equipment will be used to collect a surface water sample at location SW01. The water quality measure equipment will be calibrated prior to each day of use. The calibration of field instruments used on the project will be checked and adjusted as necessary in general accordance with the manufacturer's recommendations.

5.7.2 Analytical Laboratory Instrumentation

For chemical analytical testing, calibration procedures will be completed in general accordance with the analytical methods used and the laboratory's SOPs. Calibration documentation will be retained at the laboratory.

All instrument calibrations and their appropriate chemical standards are to comply with the specific methods identified in this SAP and the Laboratory SOPs. Calibration documentation, initial and continuing, will be retained at the Laboratory.

5.8 INSPECTION OF SUPPLIES AND CONSUMABLES

Supplies and consumables for the field sampling effort will be inspected upon delivery and accepted if the condition of the supplies is satisfactory. For example, jars will be inspected to ensure that they are the correct size and quantity and are not damaged in shipment.

5.9 DATA MANAGEMENT

Laboratories will report data in formatted hardcopy and digital formats. Analytical laboratory measurements will be recorded in standard formats that display, at a minimum, the field sample identification, the

laboratory identification, reporting units, data qualifiers, analytical method, analyte tested, analytical result, extraction and analysis dates and quantitation limits.

Each sample delivery group will be accompanied by sample receipt forms and a case narrative identifying data quality issues. Laboratory electronic data deliverable requirements will be established by GeoEngineers, Inc. with the contract laboratory. The laboratory will send final analytical testing results to the Project Manager.

Final validated data will be uploaded to Ecology's EIM system under EIM Study ID AODE8979.

5.10 ASSESSMENT AND RESPONSE ACTIONS

5.10.1 Review of Field Documentation and Laboratory Receipt Information

Documentation of field sampling data will be reviewed periodically for conformance with project QC requirements described in this SAP/QAPP. At a minimum, field documentation will be checked for proper documentation of the following:

- Sample collection information (date, time, location, matrices, etc.);
- Field instruments used and calibration data;
- Sample collection protocol;
- Sample containers, preservation and volume;
- Field QC samples collected at the frequency specified;
- COC protocols; and
- Sample shipment information.

Sample receipt forms provided by the laboratory will be reviewed for QC exceptions. The final laboratory data package will describe (in the case narrative) the effects that any identified QC exceptions have on data quality. The laboratory will review transcribed sample collection and receipt information for correctness prior to delivering the final data package.

5.10.2 Response Actions for Field Sampling

The Field Coordinator, or a designee, will be responsible for correcting equipment malfunctions throughout the field sampling effort and resolving situations in the field that may result in nonconformance or noncompliance with the SAP/QAPP. All corrective measures will be documented in the field logbook.

5.10.3 Corrective Action for Laboratory Analyses

Laboratories are required to comply with their current written standard operating procedures. The laboratory project manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SAP/QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data to the laboratory project manager. A narrative describing the anomaly, the steps taken to identify and correct it and the treatment of the relevant sample batch (i.e., recalculation, reanalysis and re-extraction) will be submitted with the data package.

5.11 DATA REVIEW, VERIFICATION AND VALIDATION

The data validation and usability elements of the SAP/QAPP as detailed below address the QA/QC activities that occur after data collection and/or data generation is complete. Implementation of these elements ensures that the data conforms to the specified criteria and will achieve the project objectives.

The data are not considered final until validated. All data, including laboratory and field QC sample results, will be summarized in a data validation report. The data validation report will focus on data that did not meet the laboratory QA/QC requirements specified in Tables 4 through 7 for conventional and chemical analysis. The data validation reports will be included as an appendix to the final report and will meet Ecology's requirements for data validation reports submitted as part of the PRDI. The data report will also describe any deviations from this SAP/QAPP, and actions taken to address those deviations.

Level III laboratory data packages at a minimum will be obtained for all samples. Level IV data packages will be included for dioxin/furan and/or PCB congener analyses. Data validation will be completed by EcoChem, Inc and will generally conform to an EPA Stage 2B validation; 10 percent of the dioxin/furan and PCB congener data will conform to an EPA Stage 4 validation (EPA 2009). If data quality issues are identified during dioxin/furan and PCB congener validation, a larger portion of the data may be validated at EPA Stage 4, as determined in consultation with Ecology. The data validation will include review of data for the following QC parameters:

- Holding times and sample preservation
- Laboratory method blanks
- MS/MSD analyses
- LCS/LCSD analyses
- Surrogate spikes
- Field duplicates
- Lab duplicates/replicates
- Calibrations (Initial and Continuing)
- Internal Standards
- Instrument Tunes

Other documentation such as chain of custody records, sample receipt forms and case narratives will also be reviewed to evaluate laboratory QA/QC.

In addition to a review of the quality control elements from an EPA Stage 2B review, the following elements are included in an EPA Stage 4 validation:

- Compound identification evaluated from raw data (ion ratios, retention times, review of chromatography).
- Compound quantitation, transcription, and calculation checks performed at a frequency of ~10 percent from raw data.

Laboratory reports will be provided by the laboratory that provide analysis-specific information including final sample analytical results, reportable field and laboratory QA/QC analytical results and PQL and MDL.

The term "practical quantitation limit" means the lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness and comparability during routine laboratory operating conditions, using Ecology approved methods. This term is different from "MDL," which means the minimum concentration of a compound that can be measured and reported with ninety-nine percent (99 percent) confidence that the value is greater than zero. The PQLs provided in Tables 8 and 9 are requirements for all analyses completed for this project. Results will be qualified as "U" if an analyte is undetected at the PQL. Results above PQL will be reported as detected and unqualified.

Data validation qualifiers consistent with qualifiers used in Ecology's EIM system will be used following the reported laboratory results to explain data quality issues affecting the laboratory data to the data user. Several of the more common and/or important qualifiers are explained as follows:

- "U" indicates that a compound was analyzed for but not detected. The associated numerical value is the PQL, as determined by the laboratory which is corrected for dilution and percent moisture.
- "J" indicates that the value was estimated by the validator because of instrument bias reasons.

If any target analytes are found in a laboratory method blank, it will be regarded as possible blank contamination.

5.12 CALCULATED SUMS

Some of the sediment cleanup levels and surface water screening levels (e.g., total low molecular weight PAHs [LPAHs], total high molecular weight PAHs [HPAHs], total benzofluoranthenes, total carcinogenic PAH [cPAH] toxicity equivalence [TEQ], total PCB congeners, total dioxin-like PCB congener TEQ, total dioxin/furan TEQ) are for sums of individual compounds, isomers, or congeners. The approaches for handling non-detects when calculating these sums are described below.

5.12.1 Simple Sums

Simple sums will be calculated using the following approach from Ecology's Sediment Cleanup Users' Manual (SCUM; Ecology 2021):

- Total LPAH represents the sum of the concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene, (WAC 173-204-562(2)(i)). 2-Methylnaphthalene is not included in the sum.
- Total HPAH represents the sum of the concentrations of the following HPAH compounds: benz[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, dibenzo[a,h]anthracene, fluoranthene, indeno[1,2,3-c,d]pyrene, pyrene, and total benzofluoranthenes, (WAC 173-204-562(2)(j).
- Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers of benzofluoranthenes (WAC 173-204-562(2)(k)). Some laboratories report the total benzofluoranthenes concentration rather than concentrations of individual compounds since they may not be able to resolve all three isomers.

When all individual chemicals are undetected, the highest individual reporting limit will be reported as the total and appropriately qualified. If some individual chemicals are detected and some are not, only detected concentrations will be included in the sum.

5.12.2 TEQ Sums

TEQs will be calculated using the simple alternative approach in Ecology's SCUM guidance (Ecology 2021) where one-half the reporting limit will be substituted for analytes/congeners that are not detected. Toxicity equivalency factors (TEFs) for cPAH TEQ calculation will reference Table 6-1 of SCUM. The TEFs that will be used for TEQ calculations for dioxins/furans and dioxin-like PCB congeners are listed in Table 6-2 and Table 6-3 of SCUM, respectively,

In addition, these sums will be bounded by reporting sums using substitution at zero and one. When non-detect results used for a TEQ calculation are greater than 50 percent, the resulting TEQ concentration will be qualified appropriately as an estimate with a "K" qualifier to indicate the variable accuracy of the estimated sum.

5.13 RECONCILIATION WITH USER REQUIREMENTS

A data quality assessment will be conducted by the project Quality Assessment Leader to identify cases where the projects DQOs were not met. The data quality assessment will be included in the project's PRDI Data Report for Ecology review and approval.

6.0 References

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Tables

Table 1

Proposed Sediment Sample Locations, Objectives, and List of Analyses

Weyerhaeuser Mill A Former Site
Everett, Washington

Sample Station Information[1]					Proposed Samples						Laboratory Analyses[3]								Objectives[10]
Sampling Station Identification	Sample Location / Sediment Management Area (SMA)	Sample Coordinates[2]		Mudline/Ground Surface Elevation (ft MLLW)	Sample Identification	Media	Collection Method	Sample Target Depth Interval[4] (Melow Mudline /Ground Surface)			Total Organic Carbon (EPA 9060A)	Metals[5] (EPA 6020B/7471B & 200.8/1631E)	PAHs[6] (EPA 8270E-SIM & EPA 8270D-SIM)	SVOCs[7] (EPA 8270E/EPA 8081B & EPA 8270D)	PCBs Congeners (EPA 1668C)	Dioxins/Furans (EPA 1613B)	Elutriate and Leachate Testing[8]	Geotechnical Analyses[9]	
		Northing	Easting					Top	Bottom	Unit									
Environmental Surface Sediment Investigation (Figure 4)																			
PRDI-1	SMA-1a	359267.1	1297930.2	-183.83	PRDI-1-S_ 0.0 - 2	Sediment	Power Grab	0	2	cm	X	X	X	X	X	X			Re-occupy previous surface sediment location to evaluate changes in contaminant concentrations over time (0 to 10 cm) and new sediment quality (0 to 2 cm).
					PRDI-1-S_ 0.0 - 10		Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-2	SMA-1a	359939.5	1298701.8	-81.45	PRDI-2-S_ 0.0 - 2	Sediment	Power Grab	0	2	cm	X	X	X	X	X	X			
					PRDI-2-S_ 0.0 - 10		Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-3	SMA-1a	360111.0	1298992.9	-63.37	PRDI-3-S_ 0.0 - 2	Sediment	Power Grab	0	2	cm	X	X	X	X	X	X			
					PRDI-3-S_ 0.0 - 10		Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-4	SMA-1c	358432.3	1297948.0	-84.00	PRDI-4-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundaries.
PRDI-5	SMA-1c	358587.3	1297968.0	-101.70	PRDI-5-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-6	SMA-1c	358465.6	1298116.3	-66.48	PRDI-6-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Re-occupy previous surface sediment (0 to 10 cm) location to evaluate changes in contaminant concentrations over time and to refine the horizontal extent of contamination and SMA boundaries.
PRDI-7	SMA-1a	358640.8	1298157.2	-82.92	PRDI-7-S_ 0.0 - 2	Sediment	Power Grab	0	2	cm	X	X	X	X	X	X			Re-occupy previous surface sediment location to evaluate changes in contaminant concentrations over time (0 to 10 cm) and new sediment quality (0 to 2 cm).
					PRDI-7-S_ 0.0 - 10		Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-8	SMA-1d	358546.1	1298276.6	-63.17	PRDI-8-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundaries and evaluate moisture content below the dynamic sand cap.
					PRDI-8-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm								X	
PRDI-9	SMA-1c	358864.9	1298346.0	-81.64	PRDI-9-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundaries.
PRDI-10	SMA-1d	358769.0	1298460.3	-66.90	PRDI-10-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundaries and evaluate moisture content below the dynamic sand cap.
					PRDI-10-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm								X	
PRDI-11	SMA-1a	359053.0	1298497.7	-78.84	PRDI-11-S_ 0.0 - 2	Sediment	Power Grab	0	2	cm	X	X	X	X	X	X			Re-occupy previous surface sediment location to evaluate changes in contaminant concentrations over time (0 to 10 cm) and new sediment quality (0 to 2 cm).
					PRDI-11-S_ 0.0 - 10		Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-12	SMA-1d	358951	1298618.39	-65.97	PRDI-12-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundaries and evaluate moisture content below the dynamic sand cap.
					PRDI-12-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm								X	
PRDI-13	SMA-1b	359246.0	1298629.5	-76.17	PRDI-13-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundaries.
PRDI-14	SMA-1b	359140.4	1298762.0	-63.78	PRDI-14-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Re-occupy previous surface sediment (0 to 10 cm) location to evaluate changes in contaminant concentrations over time and to refine the horizontal extent of contamination and SMA boundaries.
PRDI-15	SMA-1b	359527.2	1298673.5	-82.00	PRDI-15-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-16	SMA-1b	359439.4	1298784.7	-71.11	PRDI-16-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-17	SMA-1d	359340.6	1298905.79	-61.21	PRDI-17-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundaries and evaluate moisture content below the dynamic sand cap.
					PRDI-17-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm								X	
PRDI-18	SMA-1d	359705.6	1298971.79	-64.76	PRDI-18-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
					PRDI-18-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm								X	
PRDI-19	SMA-1d	359626.06	1299082.05	-59.63	PRDI-19-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
					PRDI-19-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm								X	
PRDI-20	SMA-1a	359877.0	1299105.6	-63.00	PRDI-20-S_ 0.0 - 2	Sediment	Power Grab	0	2	cm	X	X	X	X	X	X			Re-occupy previous surface sediment location to evaluate changes in contaminant concentrations over time (0 to 10 cm) and new sediment quality (0 to 2 cm).
					PRDI-20-S_ 0.0 - 10		Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-21	SMA-7	357667.0	1298414.7	7.27	PRDI-21-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm	X	X	X	X	X	X			Re-occupy previous surface sediment (0 to 40 cm) location to evaluate changes in contaminant concentrations over time.
PRDI-22	SMA-6 adjacent	358272.7	1298415.0	-23.93	PRDI-22-S_ 0.0 - 10	Sediment	Diver-Assisted Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location along South and Pacific Terminal to evaluate sediment conditions
PRDI-23	SMA-6 adjacent	358463.6	1298580.5	-21.95	PRDI-23-S_ 0.0 - 10	Sediment	Diver-Assisted Grab	0	10	cm	X	X	X	X	X	X			
PRDI-24	SMA-6 adjacent	358678.2	1298746.4	-24.72	PRDI-24-S_ 0.0 - 10	Sediment	Diver-Assisted Grab	0	10	cm	X	X	X	X	X	X			
PRDI-25	SMA-3b adjacent	359616.9	1299808.3	-40.90	PRDI-25-S_ 0.0 - 10	Sediment	Diver-Assisted Grab	0	10	cm	X	X	X	X	X	X			
PRDI-26	SMA-3c adjacent	359908.8	1300141.2	-34.67	PRDI-26-S_ 0.0 - 10	Sediment	Diver-Assisted Grab	0	10	cm	X	X	X	X	X	X			
PRDI-67	SMA-1a	358780.0	1298066.2	-107.23	PRDI-65-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to increase data density for surface-area weighted average concentration calculations.
PRDI-68	SMA-1a	359009.2	1298018.8	-145.63	PRDI-66-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-69	SMA-1a	359251.5	1298253.3	-121.06	PRDI-67-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-70	SMA-1a	359467.0	1298186.4	-145.66	PRDI-68-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-71	SMA-1a	359720.0	1298475.4	-106.36	PRDI-69-S_ 0.0 - 10	Sediment	Power Grab	0	10	cm	X	X	X	X	X	X			
PRDI-72	SMA-7	357577.6	1298245.3	3.99	PRDI-70-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm	X	X	X	X	X	X			Collect surface sediment (0 to 10 cm) from new location to refine the horizontal extent of contamination and SMA boundary.
PRDI-73	SMA-7	357783.8	1298266.2	2.03	PRDI-71-S_ 0.0 - 40	Sediment	Power Grab	0	40	cm	X	X	X	X	X	X			

Sample Station Information[1]					Proposed Samples						Laboratory Analyses[3]								Objectives[10]
Sampling Station Identification	Sample Location / Sediment Management Area (SMA)	Sample Coordinates[2] Northing	Sample Coordinates[2] Easting	Mudline/Ground Surface Elevation (ft MLLW)	Sample Identification	Media	Collection Method	Sample Target Depth Interval[4] (Melow Mudline /Ground Surface) Top	Bottom	Unit	Total Organic Carbon (EPA 9060A)	Metals[5] (EPA 6020B/7471B & 200.8/1631E)	PAHs[6] (EPA 8270E-SIM & EPA 8270D-SIM)	SVOCs[7] (EPA 8270E/EPA 8081B & EPA 8270D)	PCBs Congeners (EPA 1668C)	Dioxins/Furans (EPA 1613B)	Elutriate and Leachate Testing[8]	Geotechnical Analyses[9]	
Environmental Subsurface Sediment and Surface Water Investigation (Figure 5)																			
PRDI-27	SMA-6	358080.5	1297937.9	-40.79	PRDI-27-C_ 0.0 - 0.7	Sediment	Vibracore/HSA/Sonic	0.0	0.7	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-27-C_ 0.7 - 1.7			0.7	1.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-27-C_ 1.7 - 2.7			1.7	2.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-27-C_ 2.7 - 3.7			2.7	3.7	feet	X	X	X	X	X	X		A	
					PRDI-27-C_ 3.7 - 4.7			3.7	4.7	feet	A	A	A	A	A	A		A	
					PRDI-27-C_ 4.7 - 5.7			4.7	5.7	feet	A	A	A	A	A	A		A	
PRDI-28	SMA-2a	358233.7	1297997.8	-45.52	PRDI-28-C_ 0.0 - 0.6	Sediment	Vibracore/HSA/Sonic	0.0	0.6	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-28-C_ 0.6 - 1.6			0.6	1.6	feet	X	X	X	X	X	X		A	
					PRDI-28-C_ 1.6 - 2.6			1.6	2.6	feet	A	A	A	A	A	A		A	
					PRDI-28-C_ 2.6 - 3.6			2.6	3.6	feet	A	A	A	A	A	A		A	
PRDI-29	SMA-6	358285.1	1298131.9	-43.76	PRDI-29-C_ 0.0 - 0.2	Sediment	Vibracore/HSA/Sonic	0.0	0.2	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-29-C_ 0.2 - 1.2			0.2	1.2	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-29-C_ 1.2 - 2.2			1.2	2.2	feet	X	X	X	X	X	X		A	
					PRDI-29-C_ 2.2 - 3.2			2.2	3.2	feet	A	A	A	A	A	A		A	
					PRDI-29-C_ 3.2 - 4.2			3.2	4.2	feet	A	A	A	A	A	A		A	
PRDI-30	SMA-6	358202.2	1298343.4	-25.56	PRDI-30-C_ 0.0 - 3.7	Sediment	Vibracore/HSA/Sonic	0.0	3.7	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-30-C_ 3.7 - 4.7			3.7	4.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-30-C_ 4.7 - 5.7			4.7	5.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-30-C_ 5.7 - 6.7			5.7	6.7	feet	X	X	X	X	X	X		A	
					PRDI-30-C_ 6.7 - 7.7			6.7	7.7	feet	A	A	A	A	A	A		A	
					PRDI-30-C_ 7.7 - 8.7			7.7	8.7	feet	A	A	A	A	A	A		A	
PRDI-31	SMA-6	358458.6	1298343.9	-48.64	PRDI-31-C_ 0.0 - 0.7	Sediment	Vibracore/HSA/Sonic	0.0	0.7	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-31-C_ 0.7 - 1.7			0.7	1.7	feet	X	X	X	X	X	X		A	
					PRDI-31-C_ 1.7 - 2.7			1.7	2.7	feet	A	A	A	A	A	A		A	
					PRDI-31-C_ 2.7 - 3.7			2.7	3.7	feet	A	A	A	A	A	A		A	
PRDI-32	SMA-6	358488.5	1298557.7	-34.88	PRDI-32-C_ 0.0 - 1.5	Sediment	Vibracore/HSA/Sonic	0.0	1.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-32-C_ 1.5 - 2.5			1.5	2.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-32-C_ 2.5 - 3.5			2.5	3.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-32-C_ 3.5 - 4.5			3.5	4.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-32-C_ 4.5 - 5.5			4.5	5.5	feet	X	X	X	X	X	X		A	
					PRDI-32-C_ 5.5 - 6.5			5.5	6.5	feet	A	A	A	A	A	A		A	
					PRDI-32-C_ 6.5 - 7.5			6.5	7.5	feet	A	A	A	A	A	A		A	
PRDI-33	SMA-2a	358721.2	1298574.2	-54.27	PRDI-33-C_ 0.0 - 4.7	Sediment	Vibracore/HSA/Sonic	0.0	4.7	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-33-C_ 4.7 - 5.7			4.7	5.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]	X	A	
					PRDI-33-C_ 5.7 - 6.7			5.7	6.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-33-C_ 6.7 - 7.7			6.7	7.7	feet	X	X	X	X	X	X		A	
					PRDI-33-C_ 7.7 - 8.7			7.7	8.7	feet	A	A	A	A	A	A		A	
					PRDI-33-C_ 8.7 - 9.7			8.7	9.7	feet	A	A	A	A	A	A		A	
PRDI-34	SMA-6	358769.5	1298762.3	-37.64	PRDI-34-C_ 0.0 - 6.2	Sediment	Vibracore/HSA/Sonic	0.0	6.2	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-34-C_ 6.2 - 7.2			6.2	7.2	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]	X	A	
					PRDI-34-C_ 7.2 - 8.2			7.2	8.2	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-34-C_ 8.2 - 9.2			8.2	9.2	feet	X	X	X	X	X	X		A	
					PRDI-34-C_ 9.2 - 10.2			9.2	10.2	feet	A	A	A	A	A	A		A	
					PRDI-34-C_ 10.2 - 11.2			10.2	11.2	feet	A	A	A	A	A	A		A	
PRDI-35	SMA-6	358900.9	1298745.2	-51.02	PRDI-35-C_ 0.0 - 7.1	Sediment	Vibracore/HSA/Sonic	0.0	7.1	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-35-C_ 7.1 - 8.1			7.1	8.1	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]	X	A	
					PRDI-35-C_ 8.1 - 9.1			8.1	9.1	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-35-C_ 9.1 - 10.1			9.1	10.1	feet	X	X	X	X	X	X		A	
					PRDI-35-C_ 10.1 - 11.1			10.1	11.1	feet	A	A	A	A	A	A		A	
					PRDI-35-C_ 11.1 - 12.1			11.1	12.1	feet	A	A	A	A	A	A		A	
PRDI-36	SMA-6	358990.6	1298925.5	-32.12	PRDI-36-C_ 0.0 - 16.4	Sediment	Vibracore/HSA/Sonic	0.0	16.4	feet							X	A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-36-C_ 16.4 - 17.4			16.4	17.4	feet	X	X	X	X	X	X		A	
					PRDI-36-C_ 17.4 - 18.4			17.4	18.4	feet	A	A	A	A	A	A		A	
					PRDI-36-C_ 18.4 - 19.4			18.4	19.4	feet	A	A	A	A	A	A		A	

Sample Station Information[1]					Proposed Samples						Laboratory Analyses[3]								
Sampling Station Identification	Sample Location / Sediment Management Area (SMA)	Sample Coordinates[2]		Mudline/Ground Surface Elevation (ft MLLW)	Sample Identification	Media	Collection Method	Sample Target Depth Interval[4] (Melow Mudline /Ground Surface)			Total Organic Carbon (EPA 9060A)	Metals[5] (EPA 6020B/7471B & 200.8/1631E)	PAHs[6] (EPA 8270E-SIM & EPA 8270D-SIM)	SVOCs[7] (EPA 8270E/EPA 8081B & EPA 8270D)	PCBs Congeners (EPA 1668C)	Dioxins/Furans (EPA 1613B)	Elutriate and Leachate Testing[8]	Geotechnical Analyses[9]	Objectives[10]
		Northing	Easting					Top	Bottom	Unit									
PRDI-37	SMA-2a	359145.0	1298896.1	-52.82	PRDI-37-C_ 0.0 - 9.5	Sediment	Vibracore/HSA/Sonic	0.0	9.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-37-C_ 6.5 - 7.5			6.5	7.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]	X		
					PRDI-37-C_ 7.5 - 8.5			7.5	8.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]			
					PRDI-37-C_ 8.5 - 9.5			8.5	9.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-37-C_ 9.5 - 10.5			9.5	10.5	feet	X	X	X	X	X	X		A	
					PRDI-37-C_ 10.5 - 11.5			10.5	11.5	feet	A	A	A	A	A	A		A	
					PRDI-37-C_ 11.5 - 12.5			11.5	12.5	feet	A	A	A	A	A	A		A	
PRDI-38	SMA-6	359216.7	1299124.6	-28.30	PRDI-38-C_ 0.0 - 13.1	Sediment	Vibracore/HSA/Sonic	0.0	13.1	feet							X	X	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-38-C_ 13.1 - 14.1			13.1	14.1	feet	X	X	X	X	X	X			
					PRDI-38-C_ 14.1 - 15.1			14.1	15.1	feet	A	A	A	A	A	A			
					PRDI-38-C_ 15.1 - 16.1			15.1	16.1	feet	A	A	A	A	A	A			
PRDI-39	SMA-6	1299115.4	1299115.4	-47.76	PRDI-39-C_ 0.0 - 6.7	Sediment	Vibracore/HSA/Sonic	0.0	6.7	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-39-C_ 6.7 - 7.7			6.7	7.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]	X	A	
					PRDI-39-C_ 7.7 - 8.7			7.7	8.7	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-39-C_ 8.7 - 9.7			8.7	9.7	feet	X	X	X	X	X	X		A	
					PRDI-39-C_ 9.7 - 10.7			9.7	10.7	feet	A	A	A	A	A	A		A	
					PRDI-39-C_ 10.7 - 11.7			10.7	11.7	feet	A	A	A	A	A	A		A	
PRDI-40	SMA-6	359600.5	1299231.4	-47.75	PRDI-40-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-40-C_ 0.5 - 1.5			0.5	1.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]	X	A	
					PRDI-40-C_ 1.5 - 2.5			1.5	2.5	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-40-C_ 2.5 - 3.5			2.5	3.5	feet	X	X	X	X	X	X		A	
					PRDI-40-C_ 3.5 - 4.5			3.5	4.5	feet	A	A	A	A	A	A		A	
					PRDI-40-C_ 4.5 - 5.5			4.5	5.5	feet	A	A	A	A	A	A		A	
PRDI-41	SMA-2a	359720.4	1299218.3	-54.42	PRDI-41-C_ 0.0 - 1.4	Sediment	Vibracore/HSA/Sonic	0.0	1.4	feet							X	A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-41-C_ 1.4 - 2.4			1.4	2.4	feet	X	X	X	X	X	X		A	
					PRDI-41-C_ 2.4 - 3.4			2.4	3.4	feet	A	A	A	A	A	A		A	
					PRDI-41-C_ 3.4 - 4.4			3.4	4.4	feet	A	A	A	A	A	A		A	
PRDI-42	SMA-3a	359766.6	1299399.2	-42.25	PRDI-42-C_ 0.0 - 0.8	Sediment	Vibracore/HSA/Sonic	0.0	0.8	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-42-C_ 0.8 - 1.8			0.8	1.8	feet	X	X	X	X	X	X		A	
					PRDI-42-C_ 1.8 - 2.8			1.8	2.8	feet	A	A	A	A	A	A		A	
					PRDI-42-C_ 2.8 - 3.8			2.8	3.8	feet	A	A	A	A	A	A		A	
PRDI-43	SMA-2b	359889.0	1299332.2	-52.23	PRDI-43-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-43-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-43-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-43-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-44	SMA-3a	360008.5	1299556.4	-42.00	PRDI-44-C_ 0.0 - 1.0	Sediment	Vibracore/HSA/Sonic	0.0	1.0	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-44-C_ 1.0 - 2.0			1.0	2.0	feet	X	X	X	X	X	X		A	
					PRDI-44-C_ 2.0 - 3.0			2.0	3.0	feet	A	A	A	A	A	A		A	
					PRDI-44-C_ 3.0 - 4.0			3.0	4.0	feet	A	A	A	A	A	A		A	
PRDI-45	SMA-2b	360136.6	1299443.3	-53.04	PRDI-45-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet							X	A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-45-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-45-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-45-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-46	SMA-2b	360474.6	1299295.1	-53.29	PRDI-46-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-46-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-46-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-46-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-47	SMA-2b	360510.9	1299468.2	-51.40	PRDI-47-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-47-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-47-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-47-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	

Sample Station Information[1]					Proposed Samples						Laboratory Analyses[3]								
Sampling Station Identification	Sample Location / Sediment Management Area (SMA)	Sample Coordinates[2]		Mudline/Ground Surface Elevation (ft MLLW)	Sample Identification	Media	Collection Method	Sample Target Depth Interval[4] (Melow Mudline /Ground Surface)			Total Organic Carbon (EPA 9060A)	Metals[5] (EPA 6020B/7471B & 200.8/1631E)	PAHs[6] (EPA 8270E-SIM & EPA 8270D-SIM)	SVOCs[7] (EPA 8270E/EPA 8081B & EPA 8270D)	PCBs Congeners (EPA 1668C)	Dioxins/Furans (EPA 1613B)	Elutriate and Leachate Testing[8]	Geotechnical Analyses[9]	Objectives[10]
		Northing	Easting					Top	Bottom	Unit									
PRDI-48	SMA-2b	360358.3	1299469.2	-54.00	PRDI-48-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet							X	A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification, evaluate water quality within CDF following placement of the contaminated dredged material and the potential for contaminant release from the dredged material over-time following placement into CDF, and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-48-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-48-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-48-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-49	SMA-2b	360461.9	1299627.7	-52.05	PRDI-49-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-49-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-49-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-49-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-50	SMA-2b	360205.8	1299683.0	-46.00	PRDI-50-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-50-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-50-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-50-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-51	SMA-3b	359609.6	1299727.7	-41.00	PRDI-51-C_ 0.0 - 1.0	Sediment	Vibracore/HSA/Sonic	0.0	1.0	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-51-C_ 1.0 - 2.0			1.0	2.0	feet	X	X	X	X	X	X		A	
					PRDI-51-C_ 2.0 - 3.0			2.0	3.0	feet	A	A	A	A	A	A		A	
					PRDI-51-C_ 3.0 - 4.0			3.0	4.0	feet	A	A	A	A	A	A		A	
PRDI-52	SMA-3b	359697.1	1299809.1	-41.10	PRDI-52-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-52-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-52-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-52-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-53	SMA-3c	359939.2	1300114.4	-44.00	PRDI-53-C_ 0.0 - 0.5	Sediment	Vibracore/HSA/Sonic	0.0	0.5	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-53-C_ 0.5 - 1.5			0.5	1.5	feet	X	X	X	X	X	X		A	
					PRDI-53-C_ 1.5 - 2.5			1.5	2.5	feet	A	A	A	A	A	A		A	
					PRDI-53-C_ 2.5 - 3.5			2.5	3.5	feet	A	A	A	A	A	A		A	
PRDI-54	SMA-6	358037.4	1298107.3	-25.61	PRDI-54-C_ 0.0 - 8.3	Sediment	Vibracore/HSA/Sonic	0.0	8.3	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-54-C_ 8.3 - 9.3			8.3	9.3	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-54-C_ 9.3 - 10.3			9.3	10.3	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-54-C_ 10.3 - 11.3			10.3	11.3	feet	X	X	X	X	X	X		A	
					PRDI-54-C_ 11.3 - 12.3			11.3	12.3	feet	A	A	A	A	A	A		A	
					PRDI-54-C_ 12.3 - 13.3			12.3	13.3	feet	A	A	A	A	A	A		A	
PRDI-55	SMA-6	358115.4	1298291.6	-18.67	PRDI-55-C_ 0.0 - 6.4	Sediment	Vibracore/HSA/Sonic	0.0	6.4	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-55-C_ 6.4 - 7.4			6.4	7.4	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-55-C_ 7.4 - 8.4			7.4	8.4	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-55-C_ 8.4 - 9.4			8.4	9.4	feet	X	X	X	X	X	X		A	
					PRDI-55-C_ 9.4 - 10.4			9.4	10.4	feet	A	A	A	A	A	A		A	
					PRDI-55-C_ 10.4 - 11.4			10.4	11.4	feet	A	A	A	A	A	A		A	
PRDI-56	SMA-6	359407.3	1299286.4	-27.99	PRDI-56-C_ 0.0 - 6.6	Sediment	Vibracore/HSA/Sonic	0.0	6.6	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-56-C_ 6.6 - 7.6			6.6	7.6	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-56-C_ 7.6 - 8.6			7.6	8.6	feet	A[11]	A[11]	A[11]	A[11]	A[11]	A[11]		A	
					PRDI-56-C_ 8.6 - 9.6			8.6	9.6	feet	X	X	X	X	X	X		A	
					PRDI-56-C_ 9.6 - 10.6			9.6	10.6	feet	A	A	A	A	A	A		A	
					PRDI-56-C_ 10.6 - 11.6			10.6	11.6	feet	A	A	A	A	A	A		A	
PRDI-74	SMA-6	358145.1	1298173.5	-38.23	PRDI-74-C_ 0.0 - 4.9	Sediment	Vibracore/HSA/Sonic	0.0	4.9	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-74-C_ 4.9 - 5.9			4.9	5.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 5.9 - 6.9			5.9	6.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 6.9 - 7.9			6.9	7.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 7.9 - 8.9			7.9	8.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 8.9 - 9.9			8.9	9.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 9.9 - 10.9			9.9	10.9	feet	X	X	X	X	X	X		A	
					PRDI-74-C_ 9.9 - 10.9			10.9	11.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 10.9 - 11.9			11.9	12.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 12.9 - 13.9			12.9	13.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 13.9 - 14.9			13.9	14.9	feet	A	A	A	A	A	A		A	
					PRDI-74-C_ 14.9 - 15.9			14.9	15.9	feet	A	A	A	A	A	A		A	

Sample Station Information[1]					Proposed Samples							Laboratory Analyses[3]								
Sampling Station Identification	Sample Location / Sediment Management Area (SMA)	Sample Coordinates[2] Northing	Sample Coordinates[2] Easting	Mudline/Ground Surface Elevation (ft MLLW)	Sample Identification		Media	Collection Method	Sample Target Depth Interval[4] (Melow Mudline /Ground Surface) Top	Bottom	Unit	Total Organic Carbon (EPA 9060A)	Metals[5] (EPA 6020B/7471B & 200.8/1631E)	PAHs[6] (EPA 8270E-SIM & EPA 8270D-SIM)	SVOCs[7] (EPA 8270E/EPA 8081B & EPA 8270D)	PCBs Congeners (EPA 1668C)	Dioxins/Furans (EPA 1613B)	Elutriate and Leachate Testing[8]	Geotechnical Analyses[9]	Objectives[10]
PRDI-75	SMA-6	358011.9	1298200.0	-3.08	PRDI-75-C_ 0.0 - 7.2		Sediment	Vibracore/HSA/Sonic	0.0	7.2	feet								A	Confirm the estimated base elevation of contamination and provide data for dredge depth verification and evaluate the physical characteristics of sediment for CDF and landfill disposal.
					PRDI-75-C_ 7.2 - 8.2				7.2	8.2	feet	A	A	A	A	A	A		A	
					PRDI-75-C_ 8.2 - 9.2				8.2	9.2	feet	A	A	A	A	A	A		A	
					PRDI-75-C_ 9.2 - 10.2				9.2	10.2	feet	A	A	A	A	A	A		A	
					PRDI-75-C_ 10.2 - 11.2				10.2	11.2	feet	X	X	X	X	X	X		A	
					PRDI-75-C_ 11.2 - 12.2				11.2	12.2	feet	A	A	A	A	A	A		A	
					PRDI-75-C_ 12.2 - 13.2				12.2	13.2	feet	A	A	A	A	A	A		A	
					PRDI-75-C_ 13.2 - 14.2				13.2	14.2	feet	A	A	A	A	A	A		A	
SW-01	SMA-6	359014.3	1298958.1	--	SW-01_ Month Day Year		Surface Water	Peristaltic or Submersible Pump	Minimum 3 feet below water surface				X	X	X	X	X	X		Evaluate water quality within CDF following placement of the contaminated dredged material.
Geotechnical Subsurface Sediment and Soil Investigation (Figures 7 and 8)																				
PRDI-33	SMA-2a	358721.2	1298574.2	-54.27	PRDI-33-C_	See Objectives	Sediment	Mud Rotary/Sonic/HSA	0	120	feet								X	Geotechnical samples will be collected at 5-foot intervals. Recovered material will be reviewed and classified visually before appropriate tests can be assigned. See Section 3.8.2.1 of the Sampling and Analysis Plan/Quality Assurance Project Plan for the number of analysis each boring or groups of borings.
PRDI-35	SMA-6	358900.9	1298745.2	-51.02	PRDI-35-C_		Sediment	Mud Rotary/Sonic/HSA	0	120	feet								X	
PRDI-54	SMA-6	358037.4	1298107.3	-25.61	PRDI-54-C_		Sediment	Mud Rotary/Sonic/HSA	0	120	feet								X	
PRDI-55	SMA-6	358115.4	1298291.6	-18.67	PRDI-55-C_		Sediment	Mud Rotary/Sonic/HSA	0	120	feet								X	
PRDI-56	SMA-6	359407.3	1299286.4	-27.99	PRDI-56-C_		Sediment	Mud Rotary/Sonic/HSA	0	120	feet								X	
PRDI-57	SMA-5	359039.2	1299160.4	-6.00	PRDI-57-C_		Sediment	Mud Rotary/Sonic/HSA	0	120	feet								X	
PRDI-58	Upland	358499.3	1299010.9	18.41	PRDI-58-B_		Soil	Mud Rotary/Sonic/HSA	0	120	feet								X	
PRDI-59	Upland	359039.2	1299461.1	17.65	PRDI-59-B_	See Objectives	Soil	Mud Rotary/Sonic/HSA	0	120	feet								X	Geotechnical samples will be collected at 5-foot intervals. Recovered material will be reviewed and classified visually before appropriate tests can be assigned. See Section 3.8.2.1 of the Sampling and Analysis Plan/Quality Assurance Project Plan for the number of analysis each boring or groups of borings.
PRDI-60	Upland	359306.6	1299755.1	18.75	PRDI-60-B_		Soil	Mud Rotary/Sonic/HSA	0	120	feet								X	
PRDI-61	SMA-6	358508.3	1298562.1	-37.41	PRDI-61-C_		Sediment	CPT	0	100	feet								X	
PRDI-62	SMA-6	359119.6	1299068.8	-23.93	PRDI-62-C_		Sediment	CPT	0	100	feet								X	
PRDI-63	SMA-5	359342.7	1299420.4	-15.00	PRDI-63-C_		Sediment	CPT	0	100	feet								X	
PRDI-64	Upland	358693.0	1299158.4	18.75	PRDI-64-B_		Soil	CPT	0	100	feet								X	
PRDI-65	Mitigation Site	353319.4	1288512.5	-27.88	PRDI-65-C_		Sediment	Mud Rotary/Sonic/HSA	0	25	feet								X	
PRDI-66	Mitigation Site	353111.7	1288588.1	-13.51	PRDI-66-C_		Sediment	Mud Rotary/Sonic/HSA	0	25	feet								X	

Notes:

[1] Approximate sample station locations are shown on Figures 4, 5, 7 and 8.

[2] Coordinates are presented in North America Datum (NAD) of 1983, Washington State Plane North.

[3] Sediment samples are to be submitted to Analytical Resources, Inc (ARI) of Tukwila, Washington for chemical analysis and water samples are to be submitted to ALS Environmental (ALS) of Kelso, Washington, with the exception of samples taken for dioxins/furans and PCBs, which will completed at Enthalpy Analytical in El Dorado Hills, California.

[4] Depth is presented in centimeters (cm) or feet (ft) below mudline (bml)/ground surface (bgs) for samples.

[5] Metals include arsenic, cadmium, copper, lead, mercury, and zinc.

[6] PAHs include 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h.i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, and pyrene.

[7] SVOCs include 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, hexachlorobenzene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, diethyl phthalate, 2,4-dimethylphenol, 2-methylphenol, 4-methyl phenol, phenol, dibenzofuran, hexachlorobutadiene, benzoic acid, and benzyl alcohol. EPA 8081B applies to hexachlorobenzene only. EPA 8270E applies to the remaining SVOCs.

[8] For the elutriate and leachate testing, a single composite test sample will be prepared using subsurface sediment samples collected within the proposed dredge prism that are known to contain the highest levels of contamination, based on existing RI data (PRDI-33 through PRDI-41, PRDI-45, and PRDI-48). For the elutriate testing, a surface water sample will be collected at location SW-01. Field sample collection will be completed under a separate mobilization following review of the chemical analytical sediment data to identify sample intervals representative of the dredge prism.

[9] For geotechnical analyses, the compositing plan will be determined after the sediment cores have been collected and evaluated. Sediment within the dredge prism will be composited based on material type and sample location. Discrete samples from PRDI-8, PRDI-10, PRDI-12 and PRDI-17 through PRDI-19 will be evaluated for moisture content below the dynamic sand cap.

[10] See PRDI Work Plan for further detail of sampling and analysis data objectives.

[11] Sample collection for potential archive analysis will be completed if visual wood by volume of less than 15% is observed.

CPT = Cone Penetration Test

EPA = U.S. Environmental Protection Agency

HSA = Hollow-Stem Auger

PAHs = Polycyclic Aromatic Hydrocarbons

PCBs - Polychlorinated Biphenyls

PRDI = Pre-Remedial Design Investigation

SIM = Selective Ion Monitoring

SVOCs = Semi Volatile Organic Compounds

X = Sample for initial analysis

A = Archive sample for potential analysis

Table 2

Sediment Analytical Methods, Sample Size, Containers, Preservation and Holding Times

Weyerhaeuser Mill A Former Site

Everett, Washington

Analyte Group	Analytical Method	Minimum Sample Size (dry weight)	Container Size and Type	Sample Preservation Technique	Holding Time for Indicated Preservation Technique
Total Organic Carbon	EPA 9060A	125 g	8-oz WM-Glass or HDPE	Cool, 4°C	14 days
				Freeze, -18°C	6 months
Metals (Arsenic, Cadmium, Copper, Lead, and Zinc)	EPA 6020B	50 g	4-oz WM Glass	Cool, 4°C	6 months
				Freeze, -18°C	2 years
Mercury (Hg)	EPA 7471B			Freeze, -18°C	28 days
SVOCs (PAHs, Chlorinated Hydrocarbons, Phthalates, Phenols, and Misc. Extractables)	EPA 8081B/ 8270E/8270E-SIM	150 g	8-oz WM-Glass	Cool, 4°C	14 days until extraction 40 days after extraction
				Freeze, -18°C	1 year until extraction
PCB Congeners	EPA 1668C	50 g	4-oz WM-Amber Glass	Cool, 4°C	1 year until extraction
				Freeze, -18°C	
Dioxins and Furans	EPA 1613B	50 g	4-oz WM-Amber Glass	Cool, 4°C	1 year until extraction
				Freeze, -18°C	
Elutriate Testing	Modified Elutriate Test (USACE 2003)	--	Five 1-gallon Glass	Cool, 4°C	See Above for Holding Times
Leachate Testing	EPA 1314	--	Six 2-gallon Plastic	Cool, 4°C	See Above for Holding Times

Notes:

°C = degrees centigrade
ASTM = American Society for Testing and Materials
EPA = United States Environmental Protection Agency
g = gram
HDPE = High-density polyethylene
oz = ounce
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated biphenyls
SIM = Selective Ion Monitoring
SM = Standard Method
SVOC = Semi-Volatile Organic Compound
WM = wide mouth
TBD = To be determined
USACE = United States Army Corps of Engineers

Table 3

Analytical Methods, Sample Size Containers, Preservation and Holding Times for Surface Water, Elutriate Test Water and Leachate Test Water

Weyerhaeuser Mill A Former Site
Everett, Washington

Analyte Group	Analytical Method	Sample Containers	Sample Preservation	Holding Time
Metals (Arsenic, Cadmium, Copper, Lead and Zinc)	EPA 200.8	500 mL HDPE	Cool 6°C, HNO_3	180 days
Mercury	EPA 1631E	125 mL Fluoropoly	Cool 6°C, HCL	28 days
SVOCs	EPA 8270D-Low Level	Two 1 L amber glass with Teflon-lined lid	Cool 6°C	7 days to extraction 40 days from extraction to analysis
SVOCs - SIM	EPA 8270D/SIM	Two 500 mL amber glass with Teflon-lined lid	Cool 6°C	7 days to extraction 40 days from extraction to analysis
PCB Congeners	EPA 1668C	Two 1 L amber glass with Teflon-lined lid	Cool 6°C	1 year
Dioxins and Furans	EPA 1613B	Two 1 L amber glass with Teflon-lined lid	Cool 6°C	1 year

Notes:

°C = degrees centigrade
EPA = Environmental Protection Agency
HCL = hydrochloric acid
HDPE = High-density polyethylene
HNO_3 = nitric acid
L = Liter
mL = Milliliter
PCB = Polychlorinated biphenyls
SIM = Selected ion mode
SVOCs = Semivolatile organic compounds
TBD = To be determined

Table 4

Quality Control Procedures for Conventional Analyses[1,2,3]

Weyerhaeuser Mill A Former Site
Everett, Washington

Analyte Group	Initial Calibration	Continuing Calibration	Calibration Blanks	Laboratory Control Samples	Matrix Spikes	Field Duplicates	Laboratory Duplicates	Method Blank
Total Organic Carbon	Correlation Coefficient ≥ 0.995	70-110% Recovery	Analyte Concentration ≤ PQL	80-120% Recovery	75-125% Recovery	1 per 10 Samples (RPD ≤ 50%)	20% RSD	Analyte Concentration ≤ PQL

Notes:

[1] EPA and PSEP control limits are not available for conventional analytes. The control limits provided above are suggested limits only and are on EPA control limits for metals analyses (Table 5), and in accordance with the Sediment Cleanup User's Manual (SCUM; Ecology 2021), include consideration of the expected analytical accuracy using PSEP methodology.

[2] Corrective actions to be taken when control limits are exceeded is left to the Project Manager's discretion .The corrective action indicated for metals in Table 5 may be applied to conventional analytes in accordance with SCUM.

[3] When applicable, the QA/QC procedures indicated in this table should be completed at the same frequency as for metals analyses in Table 5 in accordance with SCUM.

% = percent

EPA = United States Environmental Protection Agency

PESP = Puget Sound Estuary Program

QA/QC = Quality Assurance/Quality Control

RPD = relative percent difference

RSD = relative standard deviation

SCUM = Sediment Cleanup User's Manual

Table 5

Quality Control Procedures and Acceptance Criteria for Metals Analyses[1,2,3]

Weyerhaeuser Mill A Former Site
Everett, Washington

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Instrument Quality Assurance/Quality Control			
Initial Calibration	Daily.	Correlation coefficient ≥0.995.	Laboratory to optimize and recalibrate the instrument and reanalyze any affected samples.
Initial Calibration Verification	Immediately after initial calibration.	90-110% recovery for ICP-AES, ICP-MS and GFAA (80-120% for Mercury), or method based.	Laboratory to resolve discrepancy prior to sample analysis.
Continuing Calibration Verification	After every 10 samples or every 2 hours, whichever is more frequent, and after the last sample.	90-110% recovery for ICP-AES, ICP-MS and GFAA (80-120% for Mercury), or method based.	Laboratory to recalibrate and reanalyze affected samples.
Initial and Continuing Calibration Blanks	Immediately after initial calibration, then 10% of samples or every 2 hours, whichever is more frequent, and after the last sample.	Analyte concentration ≤ PQL.	Laboratory to recalibrate and reanalyze affected samples.
ICP Interelement Interference Check Samples	At the beginning and end of each analytical sequence or twice per 8-hour shift, whichever is more frequent.	80-120% of the true value.	Laboratory to correct problem, recalibrate, and reanalyze affected samples.
Method Quality Assurance/Quality Control			
Holding Times	All samples.	See reference preservation method(s) and hold time(s) in Tables 2 and 3.	Laboratory to qualify results if holding times are exceeded. Data validator will use professional judgment to qualify results as estimated or reject data.
Method Detection Limits	Update method detection limit studies annually.	See reference method(s) in Tables 2 and 3.	Revise detection limits.
Method Blanks	One per sample batch or every 20 samples, whichever is more frequent.	Analyte concentration ≤ PQL. Control limits are not applicable if sample concentrations are < MDL.	Laboratory to re-extract and reanalyze samples.
Laboratory Duplicates and Matrix Spike Duplicates	One duplicate analysis with every sample batch or every 20 samples, whichever is more frequent. Use analytical replicates when samples are expected to contain target analytes. Use matrix spike duplicates when samples are not expected to contain target analytes.	Analyte and matrix specific. Use intra-laboratory control chart results if sufficient data are available to generate control charts. Otherwise use analytical method default criteria.	Laboratory to re-extract and reanalyze samples if analytical problems are suspected, or to qualify the data if sample homogeneity problems are suspected and the project manager is consulted.

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Matrix Spikes	One per sample batch or every 20 samples, whichever is more frequent.	75-125% recovery applied when the sample concentration is ≤4 times the spiked concentration for a particular analyte.	Laboratory may be able to correct or minimize problem, or qualify and accept data.
Laboratory Control Samples	One per analytical batch or every 20 samples, whichever is more frequent.	80 - 120% recovery, or performance based intra-laboratory control limits, whichever is lower.	Laboratory to correct problem to verify the analysis can be performed in a clean matrix with acceptable precision and recovery; then re-extract and reanalyze affected samples.
Certified or Standard Reference Material	Project specific requirement or at project manager's discretion.	Analyte specific, recovery should be within accepted control or advisory limits.	Laboratory to re-extract and reanalyze samples if analytical problems suspected, or to qualify the data after consultation.
Field Quality Assurance/Quality Control			
Field Duplicates	One per every 10 samples.	RPD ≤ 50%	Modify field sample homogenization procedures.
Field Blanks	At project manager's discretion.	Analyte concentration ≤ PQL.	Compare to method blank results to rule out laboratory contamination. Modify sample collection and equipment decontamination procedures. Qualify associated data.

Notes:

[1] Instrument and method QA/QC to monitor the performance of the instrument and sample preparation procedures are the responsibility of the analytical laboratory. When an instrument or method control limit is exceeded, the laboratory is responsible for correcting the problem and reanalyzing the samples.

[2] Instrument and method QA/QC results reported in the final data package should always meet control limits with a very small number of exceptions that apply to difficult analytes as specified by EPA CLP. If instrument and method QA/QC procedures meet control limits, laboratory procedures are deemed to be adequate.

[3] Matrix and field QA/QC procedures monitor matrix effects, field procedures, and variability. Although poor analytical procedures may also result in poor spike recovery or duplicate results, the laboratory is not held responsible for meeting control limits for these QA/QC samples.

% = percent

CLP = Contract Laboratory Program

EPA = United States Environmental Protection Agency

GFAA = graphite furnace atomic absorption

ICP-AES = inductively coupled plasma/atomic emission spectrometry

ICP-MS = inductively coupled plasma/mass spectrometry

MDL = method detection limit

PQL = practical quantification limit

QA/QC = Quality Assurance/Quality Control

RPD = relative percent difference

Table 6

Quality Control Procedures and Acceptance Criteria for Organic Analyses[1,2,3]

Weyerhaeuser Mill A Former Site
Everett, Washington

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Instrument Quality Assurance/Quality Control			
Initial Calibration	Before sample analysis and when continuing calibration does not meet method requirements.	See reference method(s) in Tables 2 and 3.	Laboratory to recalibrate and reanalyze affect samples.
Continuing Calibration	Method-specific. See reference method(s) in Tables 2 and 3.	Method-specific. See reference method(s) in Tables 2 and 3.	Laboratory to recalibrate if correlation coefficient or response factor does not meet requirements.
Method Quality Assurance/Quality Control			
Holding Times	All samples.	See reference preservation method(s) and hold time(s) in Tables 2 and 3.	Laboratory to qualify results if holding times are exceeded. Data validator will use professional judgment to qualify results as estimated or reject data.
Method Detection Limits	Update method detection limit studies annually.	See reference method(s) in Tables 2 and 3.	Revise detection limits.
Method Blanks	One per sample batch or every 20 samples, whichever is more frequent, or when there is a change in reagents.	Analyte concentration ≤ PQL. Control limits are not applicable if sample concentrations are < MDL.	Laboratory to eliminate or greatly reduce laboratory contamination due to glassware, or reagents, or analytical system. Re-extract and reanalyze affected samples.
Laboratory Duplicates and Matrix Spike Duplicates	One duplicate analysis with every sample batch or every 20 samples, whichever is more frequent. Use analytical replicates when samples are expected to contain target analytes. Use matrix spike duplicates when samples are not expected to contain target analytes.	Compound and matrix specific. Use intra-laboratory control chart results if sufficient data are available to generate control charts. Otherwise use analytical method default criteria.	Laboratory to re-extract and reanalyze samples if analytical problems are suspected, or to qualify the data if sample homogeneity problems are suspected and the project manager is consulted. Otherwise, see Matrix Spike corrective actions below.
Matrix Spikes	One per sample batch or every 20 samples, whichever is more frequent. Spiked with the same analytes at the same concentration as the laboratory control sample.	Compound and matrix specific, recovery should not exceed method or performance -based intra-laboratory control chart limits.	If results are outside the acceptable limits, re-evaluate data to find source(s) of difference (i.e., matrix affect or analytical error). If it is analytical error that cannot be corrected (i.e., calculation error), samples should be re-extracted and reanalyze samples. Outliers should be noted in the Case Narrative.

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Surrogate Spikes	Added to every organics sample as specified in analytical protocol.	Compound specific, recovery should not exceed the control limits specified in the method or performance-based intra- laboratory control limits.	Follow corrective actions specified in analytical method.
Laboratory Control Samples	One per analytical batch or every 20 samples, whichever is more frequent.	Compound specific, recovery should not exceed performance- based intra-laboratory control limits.	Laboratory to correct problem to verify the analysis can be performed in a clean matrix with acceptable precision and recovery; then re-extract and reanalyze affected samples.
Certified or Standard Reference Material	Project specific requirement or at project manager's discretion.	Compound specific, recovery should be within accepted control or advisory limits.	Laboratory to re-extract and reanalyze samples if analytical problems suspected, or to qualify the data after consultation.
Field Quality Assurance/Quality Control			
Field Duplicates	One per every 10 samples.	RPD ≤ 50%	Modify field sample homogenization procedures.
Field Blanks	At project manager's discretion.	Analyte concentration ≤ PQL.	Compare to method blank results to rule out laboratory contamination. Modify sample collection and equipment decontamination procedures. Qualify associated data.

Notes:

[1] Instrument and method QA/QC to monitor the performance of the instrument and sample preparation procedures are the responsibility of the analytical laboratory. When an instrument or method control limit is exceeded, the laboratory is responsible for correcting the problem and reanalyzing the samples.

[2] Instrument and method QA/QC results reported in the final data package should always meet control limits with a very small number of exceptions that apply to difficult analytes as specified by EPA CLP. If instrument and method QA/QC procedures meet control limits, laboratory procedures are deemed to be adequate.

[3] Matrix and field QA/QC procedures monitor matrix effects, field procedures, and variability. Although poor analytical procedures may also result in poor spike recovery or duplicate results, the laboratory is not held responsible for meeting control limits for these QA/QC samples.

CLP = Contract Laboratory Program

EPA = United States Environmental Protection Agency

MDL = method detection limit

PQL = practical quantification limit

QA/QC = Quality Assurance/Quality Control

RPD = relative percent difference

Table 7

Quality Control Procedures and Acceptance Criteria for Dioxin and Furan Analyses[1,2]

Weyerhaeuser Mill A Former Site
Everett, Washington

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Instrument and Method Quality Assurance/Quality Control			
Ongoing Precision and Recovery	One per sample batch or every 20 samples, whichever is more frequent.	Recovery within Method 1613B requirements.	Laboratory to check calculation and re-extract and reanalyze batch.
Stable-isotope labeled compounds	Spiked into each sample for every target analyte	Recovery within Method 1613B requirements.	Laboratory to check calculation and qualify all associated results and estimated.
		Ion abundance ratios must be within Method 1613B requirements.	Laboratory to reanalyze specific samples and reject all affected results outside the criteria. Alternatively, use of secondary ions that meet appropriate theoretical criteria is allowed if interferences are suspect with Ecology approval.
Holding Times	All samples.	See reference preservation method(s) and hold time(s) in Table 2.	Laboratory to qualify results if holding times are exceeded. Data validator will use professional judgment to qualify results as estimated or reject data.
Method Blanks	One per sample batch or every 20 samples, whichever is more frequent.	Analyte concentration ≤ PQL.	If the method blank results are greater than the reporting limit, halt analysis, find the source of contamination, and reanalyze batch. Report project samples as non-detect for results ≤ to the reported method blank values.
GC/MS Tune	At the beginning of each 12 hour shift; must start and end each analytical sequence.	> 10,000 resolving power @ m/z304.9825. Exact mass of 380.9760 within 5 ppm of theoretical values.	Laboratory to reanalyze specific samples and reject all data not meeting method requirements.
Initial Calibration	Initially and when continuing calibration fails.	Five point curve for all analytes. TSD must meet method requirements for all target compounds and labeled compounds. Signal to noise ratio (S/N) >10. Ion abundance (IA) ratios within method specified limits.	
Window Defining/Column Performance Mix	Before every initial and continuing calibration.	Valley < 25% for all peaks near 2378-TCDD/F peaks.	
Continuing Calibration	Must start and end each analytical sequence.	% must meet method limits for target compounds & labeled compounds. S/N >10. IA ratios within method specified limits.	

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Confirmation of 2,3,7,8-TCDF	For all primary column detections of 2,3,7,8-TCDF.	Confirmation presence of 2,3,7,8-TCDF in accordance with Method 1613B requirements.	Failure to verify presence of 2,3,7,8- TCDF by second column confirmation or use of an alternative primary column that meets resolution criteria requires qualification of associated 2,3,7,8-TCDF results as non-detected at the associated value.
Sample data not achieving target reporting limits or method performance in presence of possibly interfering compounds	Not Applicable.	Not Appliable.	Rather than simply diluting an extract to reduce interferences, the lab should perform additional cleanup techniques identified in the method to insure minimal matrix effects and background interference. Thereafter, the lab can dilute the extract. If reanalysis is required, the laboratory shall report both initial and re-analysis results.
Sediment Reference Material	Project specific requirement or at project manager's discretion.	Results must be within 20% of the 95% confidence interval.	Extraction and analysis should be evaluated by the lab and reanalysis performed of the entire sample batch once performance criteria can be met. If analysis accompanies several batches with acceptable RM results, then the laboratory can narrate possible reason for RM outliers.
Field Quality Assurance/Quality Control			
Field Duplicates	One per every 10 samples.	RPD ≤ 50%	Modify field sample homogenization procedures.
Field Blanks	At project manager's discretion.	Analyte concentration ≤ PQL.	Compare to method blank results to rule out laboratory contamination. Modify sample collection and equipment decontamination procedures. Qualify associated data.

Notes:

[1] Instrument and method QA/QC to monitor the performance of the instrument and sample preparation procedures are the responsibility of the analytical laboratory. When an instrument or method control limit is exceeded, the laboratory is responsible for correcting the problem and reanalyzing the samples.

[2] Instrument and method QA/QC results reported in the final data package should always meet control limits with a very small number of exceptions that apply to difficult analytes as specified by EPA CLP. If instrument and method QA/QC procedures meet control limits, laboratory procedures are deemed to be adequate.

% = percent
CLP = Contract Laboratory Program
EPA = United States Environmental Protection Agency
GC/MS = gaschromatography/mass spectrometry
IA = ion abundance
ppm = parts per million
PQL = practical quantification limit
QA/QC = Quality Assurance/Quality Control
RM = reference material
S/N = signal to noise ratio
RPD = relative percent difference

Table 8

Sediment Methods of Analysis and Target Reporting Limits

Weyerhaeuser Mill A Former Site
Everett, Washington

Analyte Group	CAS Number[1]	Analytical Method	Target Reporting Limit (PQL[2])	Marine Area Sediment Cleanup Level[3]			
				Protection of Benthic Organisms		Protection of Human Health and Higher Trophic Ecological Receptors	
				Sediment Management Standard[4] (SMS)	Apparent Effects Threshold (AET) Criteria[5]	Intertidal Sediment (Above -3 ft MLLW)	Subtidal Sediment (Below -3 ft MLLW)
Conventionals							
Total Organic Carbon (%)	--	SW 9060A	0.02	--	--	--	--
Metals			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic	7440-38-2	EPA 6020B	0.2	57	57	12	12
Cadmium	7440-43-9	EPA 6020B	0.1	5.1	5.1	0.8	0.8
Copper	7440-50-8	EPA 6020B	0.5	390	390	8,000	90,000
Lead	7439-92-1	EPA 6020B	0.1	450	450	21	21
Mercury	7439-97-6	EPA 7471B	0.025	0.41	0.41	0.2	0.2
Zinc	7440-66-6	EPA 6020B	6	410	410	60,000	700,000
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)			µg/kg	mg/kg OC	µg/kg	µg/kg	µg/kg
Total LPAH	--	--	5	370	5,200	--	--
2-Methylnaphthalene	91-57-6	EPA 8270E-SIM	5	38	670	320,000	4,500,000
Acenaphthene	83-32-9	EPA 8270E-SIM	5	16	500	4,800,000	67,000,000
Acenaphthylene	208-96-8	EPA 8270E-SIM	5	66	1,300	4,800,000	67,000,000
Anthracene	120-12-7	EPA 8270E-SIM	5	220	960	24,000,000	340,000,000
Fluorene	86-73-7	EPA 8270E-SIM	5	23	540	3,200,000	40,000,000
Naphthalene	91-20-3	EPA 8270E-SIM	5	99	2,100	1,600,000	22,000,000
Phenanthrene	85-01-8	EPA 8270E-SIM	5	100	1,500	24,000,000	340,000,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)			µg/kg	mg/kg OC	µg/kg	µg/kg	µg/kg
Total HPAH	--	--	5	960	12,000	--	--
Benz(a)anthracene	56-55-3	EPA 8270E-SIM	5	110	1,300	see Total cPAH TEQ	see Total cPAH TEQ
Benzo(a)pyrene	50-32-8	EPA 8270E-SIM	5	99	1,600	see Total cPAH TEQ	see Total cPAH TEQ
Benzofluoranthenes (b, j ,k)	205-99-2/ 205-82-3/ 207-08-9	EPA 8270E-SIM	15	230	3,200	see Total cPAH TEQ	see Total cPAH TEQ
Benzo(g,h,i)perylene	191-24-2	EPA 8270E-SIM	5	31	670	2,400,000	30,000,000
Chrysene	218-01-9	EPA 8270E-SIM	5	110	1,400	see Total cPAH TEQ	see Total cPAH TEQ
Dibenz(a,h)anthracene	53-70-3	EPA 8270E-SIM	5	12	230	see Total cPAH TEQ	see Total cPAH TEQ
Fluoranthene	206-44-0	EPA 8270E-SIM	5	160	1,700	3,200,000	45,000,000
Indeno(1,2,3-c,d)pyrene	193-39-5	EPA 8270E-SIM	5	34	600	see Total cPAH TEQ	see Total cPAH TEQ
Pyrene	129-00-0	EPA 8270E-SIM	5	1000	2,600	2,400,000	30,000,000
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)			µg/kg	mg/kg OC	µg/kg	µg/kg	µg/kg
Total cPAH TEQ	--	--	--	NE	NE	56	56
Chlorinated Hydrocarbons			µg/kg	mg/kg OC	µg/kg	µg/kg	µg/kg
1,2-Dichlorobenzene	95-50-1	EPA 8270E	20	23	35	21,000,000	230,000,000
1,2,4-Trichlorobenzene	120-82-1	EPA 8270E	20	0.81	31	38,000	88,000
Hexachlorobenzene (HCB)	118-74-1	EPA 8081B	0.5	0.38	22	690	1,600
Phthalates			µg/kg	mg/kg OC	µg/kg	µg/kg	µg/kg
Diethyl phthalate	84-66-2	EPA 8270E	20	61	200	49,000,000	700,000,000
Butyl benzyl phthalate	85-68-7	EPA 8270E	20	4.9	63	180,000	460,000
Bis(2-ethylhexyl) phthalate	117-81-7	EPA 8270E	50	47	1300	24,000	60,000
Phenols			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Phenol	108-95-2	EPA 8270E	100	420	420	18,000,000	260,000,000
2-Methylphenol	95-48-7	EPA 8270E	20	63	63	3,000,000	44,000,000
4-Methylphenol	106-44-5	EPA 8270E	20	670	670	6,000,000	90,000,000
2,4-Dimethylphenol	105-67-9	EPA 8270-SIM	25	29	29	1,200,000	18,000,000
Miscellaneous Extractables			µg/kg	mg/kg OC	µg/kg	µg/kg	µg/kg
Dibenzofuran	132-64-9	EPA 8270E	20	15	540	170,000	2,000,000
Hexachlorobutadiene	87-68-3	EPA 8081B	1	3.9	11	14,000	33,000
			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Benzyl alcohol	100-51-6	EPA 8270E	20	57	57	6,000,000	90,000,000
Benzoic acid	65-85-0	EPA 8270E	200	650	650	240,000,000	3,500,000,000
Polychlorinated Biphenyl (PCB) Congeners			ng/kg	mg/kg OC	ng/kg	ng/kg	ng/kg
PCB-1	2051-60-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-2	2051-61-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-3	2051-62-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-4/PCB-10	13029-08-8	EPA 1668C	5.0	NE	NE	NE	NE
PCB-5/PCB-8	16605-91-7	EPA 1668C	5.0	NE	NE	NE	NE
PCB-6	25569-80-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-7/PCB-9	33284-50-3	EPA 1668C	5.0	NE	NE	NE	NE
PCB-11	2050-67-1	EPA 1668C	15.0	NE	NE	NE	NE
PCB-12/PCB-13	2974-92-7	EPA 1668C	5.0	NE	NE	NE	NE
PCB-14	34883-41-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-15	2050-68-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-16/PCB-32	38444-78-9	EPA 1668C	10.0	NE	NE	NE	NE
PCB-17	37680-66-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-18	37680-65-2	EPA 1668C	10	NE	NE	NE	NE
PCB-19	38444-73-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-20/PCB-21/PCB-33	38444-84-7	EPA 1668C	7.5	NE	NE	NE	NE
PCB-22	38444-85-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-23	55720-44-0	EPA 1668C	2.5	NE	NE	NE	NE
PCB-24/PCB-27	55702-45-9	EPA 1668C	5.0	NE	NE	NE	NE
PCB-25	55712-37-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-26	38444-81-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-28	7012-37-5	EPA 1668C	5	NE	NE	NE	NE
PCB-29	15862-07-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-30	35693-92-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-31	16606-02-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-34	37680-68-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-35	37680-69-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-36	38444-87-0	EPA 1668C	2.5	NE	NE	NE	NE

Analyte Group	CAS Number[1]	Analytical Method	Target Reporting Limit (PQL[2])	Marine Area Sediment Cleanup Level[3]			
				Protection of Benthic Organisms		Protection of Human Health and Higher Trophic Ecological Receptors	
				Sediment Management Standard[4] (SMS)	Apparent Effects Threshold (AET) Criteria[5]	Intertidal Sediment (Above -3 ft MLLW)	Subtidal Sediment (Below -3 ft MLLW)
PCB-37	38444-90-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-38	53555-66-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-39	38444-88-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-40	38444-93-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-41/64/71/72	52663-59-9	EPA 1668C	10	NE	NE	NE	NE
PCB-42/59	36559-22-5	EPA 1668C	5.0	NE	NE	NE	NE
PCB-43/49	70362-46-8	EPA 1668C	5.0	NE	NE	NE	NE
PCB-44	41464-39-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-45	70362-45-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-46	41464-47-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-47	2437-79-8	EPA 1668C	10	NE	NE	NE	NE
PCB-48/75	70362-47-9	EPA 1668C	5.0	NE	NE	NE	NE
PCB-50	62796-65-0	EPA 1668C	2.5	NE	NE	NE	NE
PCB-51	68194-04-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-52/69	35693-99-3	EPA 1668C	5.0	NE	NE	NE	NE
PCB-53	41464-41-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-54	15968-05-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-55	74338-24-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-56/60	41464-43-1	EPA 1668C	5.0	NE	NE	NE	NE
PCB-57	70424-67-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-58	41464-49-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-61/70	33284-53-6	EPA 1668C	5.0	NE	NE	NE	NE
PCB-62	54230-22-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-63	74472-34-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-65	33284-54-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-67	73575-53-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-68	73575-52-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-73	74338-23-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-74	32690-93-0	EPA 1668C	2.5	NE	NE	NE	NE
PCB-76/66	70362-48-0	EPA 1668C	5.0	NE	NE	NE	NE
PCB-78	70362-49-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-79	41464-48-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-80	33284-52-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-82	52663-62-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-83	60145-20-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-84/92	52663-60-2	EPA 1668C	5.0	NE	NE	NE	NE
PCB-85/116	65510-45-4	EPA 1668C	5.0	NE	NE	NE	NE
PCB-86	55312-69-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-87/117/125	38380-02-8	EPA 1668C	7.5	NE	NE	NE	NE
PCB-88/91	55215-17-3	EPA 1668C	5.0	NE	NE	NE	NE
PCB-89	73575-57-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-90/101	68194-07-0	EPA 1668C	5.0	NE	NE	NE	NE
PCB-93	73575-56-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-94	73575-55-0	EPA 1668C	2.5	NE	NE	NE	NE
PCB-95/98/102	38379-99-6	EPA 1668C	7.5	NE	NE	NE	NE
PCB-96	73575-54-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-97	41464-51-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-99	38380-01-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-100	39485-83-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-103	60145-21-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-104	56558-16-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-106/118	70424-69-0	EPA 1668C	5.0	NE	NE	NE	NE
PCB-107/109	70424-68-9	EPA 1668C	5.0	NE	NE	NE	NE
PCB-108/112	70362-41-3	EPA 1668C	5.0	NE	NE	NE	NE
PCB-110	38380-03-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-111/115	39635-32-0	EPA 1668C	5.0	NE	NE	NE	NE
PCB-113	68194-10-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-119	56558-17-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-120	68194-12-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-121	56558-18-0	EPA 1668C	2.5	NE	NE	NE	NE
PCB-122	76842-07-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-124	70424-70-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-127	39635-33-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-128/162	38380-07-3	EPA 1668C	5.0	NE	NE	NE	NE
PCB-129	55215-18-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-130	52663-66-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-131/133	61798-70-7	EPA 1668C	5.0	NE	NE	NE	NE
PCB-132/161	38380-05-1	EPA 1668C	5.0	NE	NE	NE	NE
PCB-134/143	52704-70-8	EPA 1668C	5.0	NE	NE	NE	NE
PCB-135	52744-13-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-136	38411-22-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-137	35694-06-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-138/163/164	35065-28-2	EPA 1668C	7.5	NE	NE	NE	NE
PCB-139/149	56030-56-9	EPA 1668C	5.0	NE	NE	NE	NE
PCB-140	59291-64-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-141	52712-04-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-142	41411-61-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-144	68194-14-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-145	74472-40-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-146/165	51908-16-8	EPA 1668C	5.0	NE	NE	NE	NE
PCB-147	68194-13-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-148	74472-41-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-150	68194-08-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-151	52663-63-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-152	68194-09-2	EPA 1668C	2.5	NE	NE	NE	NE

Analyte Group	CAS Number[1]	Analytical Method	Target Reporting Limit (PQL[2])	Marine Area Sediment Cleanup Level[3]			
				Protection of Benthic Organisms		Protection of Human Health and Higher Trophic Ecological Receptors	
				Sediment Management Standard[4] (SMS)	Apparent Effects Threshold (AET) Criteria[5]	Intertidal Sediment (Above -3 ft MLLW)	Subtidal Sediment (Below -3 ft MLLW)
PCB-153	35065-27-1	EPA 1668C	10	NE	NE	NE	NE
PCB-154	60145-22-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-155	33979-03-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-158/160	74472-42-7	EPA 1668C	5.0	NE	NE	NE	NE
PCB-159	39635-35-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-166	41411-63-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-168	59291-65-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-170	35065-30-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-171	52663-71-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-172	52663-74-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-173	68194-16-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-174	38411-25-5	EPA 1668C	2.5	NE	NE	NE	NE
PCB-175	40186-70-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-176	52663-65-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-177	52663-70-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-178	52663-67-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-179	52663-64-6	EPA 1668C	2.5	NE	NE	NE	NE
PCB-180	35065-29-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-181	74472-47-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-182/187	60145-23-5	EPA 1668C	5.0	NE	NE	NE	NE
PCB-183	52663-69-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-184	74472-48-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-185	52712-05-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-186	74472-49-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-188	74487-85-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-190	41411-64-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-191	74472-50-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-192	74472-51-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-193	69782-91-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-194	35694-08-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-195	52663-78-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-196/203	42740-50-1	EPA 1668C	5.0	NE	NE	NE	NE
PCB-197	33091-17-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-198	68194-17-2	EPA 1668C	2.5	NE	NE	NE	NE
PCB-199	52663-75-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-200	52663-73-7	EPA 1668C	2.5	NE	NE	NE	NE
PCB-201	40186-71-8	EPA 1668C	2.5	NE	NE	NE	NE
PCB-202	2136-99-4	EPA 1668C	2.5	NE	NE	NE	NE
PCB-204	74472-52-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-205	74472-53-0	EPA 1668C	2.5	NE	NE	NE	NE
PCB-206	40186-72-9	EPA 1668C	2.5	NE	NE	NE	NE
PCB-207	52663-79-3	EPA 1668C	2.5	NE	NE	NE	NE
PCB-208	52663-77-1	EPA 1668C	2.5	NE	NE	NE	NE
PCB-209	2051-24-3	EPA 1668C	2.5	NE	NE	NE	NE
Total PCBs	--	EPA 1668C	--	12 (mg/kg OC)	130,000	190,000	490,000
Dioxin-Like Polychlorinated Biphenyls (PCBs)			ng/kg	ng/kg	ng/kg	ng/kg	ng/kg
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	32598-13-3	EPA 1668C	2.5	NE	NE	NE	NE
3,4,4'5,-Tetrachlorobiphenyl (PCB 81)	70362-50-4	EPA 1668C	2.5	NE	NE	NE	NE
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	32598-14-4	EPA 1668C	2.5	NE	NE	NE	NE
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	74472-37-0	EPA 1668C	2.5	NE	NE	NE	NE
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)/106	31508-00-6	EPA 1668C	5.0	NE	NE	NE	NE
2',3,4,4',5-Pentachlorobephenyl (PCB 123)	65510-44-3	EPA 1668C	2.5	NE	NE	NE	NE
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	57465-28-8	EPA 1668C	2.5	NE	NE	NE	NE
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	38380-08-4	EPA 1668C	2.5	NE	NE	NE	NE
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	69782-90-7	EPA 1668C	2.5	NE	NE	NE	NE
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	52663-72-6	EPA 1668C	2.5	NE	NE	NE	NE
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	32774-16-6	EPA 1668C	2.5	NE	NE	NE	NE
2,3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 189)	39635-31-9	EPA 1668C	2.5	NE	NE	NE	NE
Total Dioxin-like PCB Congener TEQ	--	EPA 1668C	--	NE	NE	0.38	0.38
Dioxins and Furans			ng/kg	ng/kg	ng/kg	ng/kg	ng/kg
2,3,7,8-TCDD	9014-42-0	EPA 1613B	0.5	NE	NE	NE	NE
1,2,3,7,8-PeCDD	40321-76-4	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,4,7,8-HxCDD	39227-28-6	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,6,7,8-HxCDD	57653-85-7	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,7,8,9-HxCDD	19408-74-3	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,4,6,7,8-HxCDD	39227-28-6	EPA 1613B	2.5	NE	NE	NE	NE
OCDD	3268-87-9	EPA 1613B	5.0	NE	NE	NE	NE
2,3,7,8-TCDF	51207-31-9	EPA 1613B	0.5	NE	NE	NE	NE
1,2,3,7,8-PeCDF	57117-41-6	EPA 1613B	2.5	NE	NE	NE	NE
2,3,4,7,8-HxCDF	70648-26-9	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,4,7,8-HxCDF	70648-26-9	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,6,7,8-HxCDF	57117-44-9	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,7,8,9-HxCDF	72918-21-9	EPA 1613B	2.5	NE	NE	NE	NE
2,3,4,6,7,8-HxCDF	60851-34-5	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,4,5,6,8-HpCDF	67562-39-4	EPA 1613B	2.5	NE	NE	NE	NE
1,2,3,4,7,8,9-HPCDF	55673-89-7	EPA 1613B	2.5	NE	NE	NE	NE
OCDF	39001-02-0	EPA 1613B	5.0	NE	NE	NE	NE
Total Dioxins/Furans TEQ	--	EPA 1613B	--	5	5	5	5

Notes:

[1] Chemical abstract service registry number.

[2] Practical Quantitation Limit (PQL) values from ARI of Tukwila, Washington and Enthalpy Analytical in El Dorado Hills, California.

[3] Sediment cleanup levels referenced from the Cleanup Action Plan (CAP; Ecology 2024)

[5] Sediment Management Standards (SMS) (Chapter 173-204 WAC). Lowest of Sediment Quality Objective (SQO) and Cleanup Screening Level (CSL) is used.

[5] Apparent Effects Threshold (AET) Criteria from Table 8-1 of the Sediment Cleanup Users Manual (Ecology 2021). Lowest of LAET and 2 LAET is used.

[5] Sediment Management Standards (SMS) (Chapter 173-204 WAC). Lowest of Sediment Quality Objective (SQO) and Cleanup Screening Level (CSL) is used.

[6] Ecology-recommended PQL of 5 pptr (parts per trillion, dry-weight) toxicity equivalent quotient (TEQ).

-- = No criteria is currently available for this analyte

NE = Screening level not established

mg/kg = milligram per kilogram

µg/kg = microgram per kilogram

ng/kg = nanogram per kilogram

mg/kg OC = milligram per kilogram normalized to organic carbon

Table 9

Surface Water, Elutriate Test Water, and Leachate Test Water Methods of Analysis and Target Reporting Limits

Weyerhaeuser Mill A Former Site

Everett, Washington

Analyte Group	CAS Number[1]	Analytical Method	Target Reporting Limit (PQL[2])	Surface Water Screening Level[3]
Metals (µg/L)				
Arsenic	7440-38-2	EPA 200.8	0.5	8
Cadmium	7440-43-9	EPA 200.8	0.02	7.9
Copper	7440-50-8	EPA 200.8	0.1	3.1
Lead	7439-92-1	EPA 200.8	0.02	8.1
Mercury	7439-97-6	EPA 1631E	0.0005	0.025
Zinc	7440-66-6	EPA 200.8	2.0	81
Semivolatile Organic Compounds (SVOCs) (µg/L)				
1,2,4-Trichlorobenzene	120-82-1	EPA 8270D-Low Level	0.2	0.2
1,2-Dichlorobenzene	95-50-1	EPA 8270D-Low Level	0.2	800
2,4-Dimethylphenol	105-67-9	EPA 8270D-Low Level	4.0	97
Benzoic acid	65-85-0	EPA 8270D-Low Level	5	NE
Benzyl alcohol	100-51-6	EPA 8270D-Low Level	0.5	NE
bis(2-Ethylhexyl)phthalate	117-81-7	EPA 8270D-Low Level	1.0	1.0
Butylbenzylphthalate	85-68-7	EPA 8270D-Low Level	0.2	0.2
Dibenzofuran	132-64-9	EPA 8270D-Low Level	0.2	NE
Diethylphthalate	84-66-2	EPA 8270D-Low Level	0.2	200
Hexachlorobenzene	118-74-1	EPA 8270D-Low Level	0.2	0.2
Hexachlorobutadiene	87-68-3	EPA 8270D-Low Level	0.2	0.5
o-Cresol (2-Methylphenol)	95-48-7	EPA 8270D-Low Level	0.5	NE
p-Cresol (4-Methylphenol)	106-44-5	EPA 8270D-Low Level	0.5	NE
Phenol	108-95-2	EPA 8270D-Low Level	0.5	70,000
Non-carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs) (µg/L)				
2-Methylnaphthalene	91-57-6	EPA 8270D-SIM	0.02	NE
Acenaphthene	83-32-9	EPA 8270D-SIM	0.02	30
Acenaphthylene	208-96-8	EPA 8270D-SIM	0.02	NE
Anthracene	120-12-7	EPA 8270D-SIM	0.02	100
Benzo[g,h,i]perylene	191-24-2	EPA 8270D-SIM	0.02	NE
Fluoranthene	206-44-0	EPA 8270D-SIM	0.02	6.0
Fluorene	86-73-7	EPA 8270D-SIM	0.02	10
Naphthalene	91-20-3	EPA 8270D-SIM	0.02	4,900
Phenanthrene	85-01-8	EPA 8270D-SIM	0.02	NE
Pyrene	129-00-0	EPA 8270D-SIM	0.02	8.0
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) (µg/L)				
Benzo[a]anthracene	56-55-3	EPA 8270D-SIM	0.02	see Total cPAH TEQ
Benzo[a]pyrene	50-32-8	EPA 8270D-SIM	0.02	see Total cPAH TEQ
Benzo[b]fluoranthene	205-99-2	EPA 8270D-SIM	0.02	see Total cPAH TEQ
Benzo[k]fluoranthene	207-08-9	EPA 8270D-SIM	0.02	see Total cPAH TEQ
Chrysene	218-01-9	EPA 8270D-SIM	0.02	see Total cPAH TEQ
Dibenz[a,h]anthracene	53-70-3	EPA 8270D-SIM	0.02	see Total cPAH TEQ
Indeno[1,2,3-c,d]pyrene	193-39-5	EPA 8270D-SIM	0.02	see Total cPAH TEQ
Total cPAHs TEQ	--	EPA 8270D-SIM	--	0.03
Polychlorinated Biphenyl (PCB) Congeners (pg/L)				
PCB-1	2051-60-7	EPA 1668C	10	10
PCB-2	2051-61-8	EPA 1668C	20	20
PCB-3	2051-62-9	EPA 1668C	15	15
PCB-4/PCB-10	13029-08-8	EPA 1668C	10	10
PCB-5/PCB-8	16605-91-7	EPA 1668C	10	10
PCB-6	25569-80-6	EPA 1668C	5	5
PCB-7/PCB-9	33284-50-3	EPA 1668C	10	10
PCB-11	2050-67-1	EPA 1668C	20	20
PCB-12/PCB-13	2974-92-7	EPA 1668C	10	10
PCB-14	34883-41-5	EPA 1668C	5	5
PCB-15	2050-68-2	EPA 1668C	5	5
PCB-16/PCB-32	38444-78-9	EPA 1668C	10	10
PCB-17	37680-66-3	EPA 1668C	5	5
PCB-18	37680-65-2	EPA 1668C	15	15
PCB-19	38444-73-4	EPA 1668C	5	5
PCB-20/PCB-21/PCB-33	38444-84-7	EPA 1668C	15	15
PCB-22	38444-85-8	EPA 1668C	5	5
PCB-23	55720-44-0	EPA 1668C	5	5
PCB-24/PCB-27	55702-45-9	EPA 1668C	10	10
PCB-25	55712-37-3	EPA 1668C	5	5
PCB-26	38444-81-4	EPA 1668C	5	5
PCB-28	7012-37-5	EPA 1668C	10	10
PCB-29	15862-07-4	EPA 1668C	5	5
PCB-30	35693-92-6	EPA 1668C	5	5
PCB-31	16606-02-3	EPA 1668C	10	10

Analyte Group	CAS Number[1]	Analytical Method	Target Reporting Limit (PQL[2])	Surface Water Screening Level[3]
PCB-34	37680-68-5	EPA 1668C	5	5
PCB-35	37680-69-6	EPA 1668C	5	5
PCB-36	38444-87-0	EPA 1668C	5	5
PCB-37	38444-90-5	EPA 1668C	5	5
PCB-38	53555-66-1	EPA 1668C	5	5
PCB-39	38444-88-1	EPA 1668C	5	5
PCB-40	38444-93-8	EPA 1668C	5	5
PCB-41/64/71/72	52663-59-9	EPA 1668C	20	20
PCB-42/59	36559-22-5	EPA 1668C	10	10
PCB-43/49	70362-46-8	EPA 1668C	10	10
PCB-44	41464-39-5	EPA 1668C	15	15
PCB-45	70362-45-7	EPA 1668C	5	5
PCB-46	41464-47-5	EPA 1668C	5	5
PCB-47	2437-79-8	EPA 1668C	10	10
PCB-48/75	70362-47-9	EPA 1668C	10	10
PCB-50	62796-65-0	EPA 1668C	5	5
PCB-51	68194-04-7	EPA 1668C	10	10
PCB-52/69	35693-99-3	EPA 1668C	20	20
PCB-53	41464-41-9	EPA 1668C	5	5
PCB-54	15968-05-5	EPA 1668C	5	5
PCB-55	74338-24-2	EPA 1668C	5	5
PCB-56/60	41464-43-1	EPA 1668C	10	10
PCB-57	70424-67-8	EPA 1668C	5	5
PCB-58	41464-49-7	EPA 1668C	10	10
PCB-61/70	33284-53-6	EPA 1668C	10	10
PCB-62	54230-22-7	EPA 1668C	5	5
PCB-63	74472-34-7	EPA 1668C	5	5
PCB-65	33284-54-7	EPA 1668C	5	5
PCB-67	73575-53-8	EPA 1668C	5	5
PCB-68	73575-52-7	EPA 1668C	5	5
PCB-73	74338-23-1	EPA 1668C	10	10
PCB-74	32690-93-0	EPA 1668C	5	5
PCB-76/66	70362-48-0	EPA 1668C	10	10
PCB-77	32598-13-3	EPA 1668C	5	5
PCB-78	70362-49-1	EPA 1668C	5	5
PCB-79	41464-48-6	EPA 1668C	5	5
PCB-80	33284-52-5	EPA 1668C	5	5
PCB-81	70362-50-4	EPA 1668C	5	5
PCB-82	52663-62-4	EPA 1668C	5	5
PCB-83	60145-20-2	EPA 1668C	5	5
PCB-84/92	52663-60-2	EPA 1668C	10	10
PCB-85/116	65510-45-4	EPA 1668C	10	10
PCB-86	55312-69-1	EPA 1668C	5	5
PCB-87/117/125	38380-02-8	EPA 1668C	15	15
PCB-88/91	55215-17-3	EPA 1668C	10	10
PCB-89	73575-57-2	EPA 1668C	5	5
PCB-90/101	68194-07-0	EPA 1668C	10	10
PCB-93	73575-56-1	EPA 1668C	5	5
PCB-94	73575-55-0	EPA 1668C	5	5
PCB-95/98/102	38379-99-6	EPA 1668C	15	15
PCB-96	73575-54-9	EPA 1668C	5	5
PCB-97	41464-51-1	EPA 1668C	5	5
PCB-99	38380-01-7	EPA 1668C	10	10
PCB-100	39485-83-1	EPA 1668C	5	5
PCB-103	60145-21-3	EPA 1668C	5	5
PCB-104	56558-16-8	EPA 1668C	5	5
PCB-105	32598-14-4	EPA 1668C	5	5
PCB-106/118	70424-69-0	EPA 1668C	10	10
PCB-107/109	70424-68-9	EPA 1668C	10	10
PCB-108/112	70362-41-3	EPA 1668C	10	10
PCB-110	38380-03-9	EPA 1668C	5	5
PCB-111/115	39635-32-0	EPA 1668C	10	10
PCB-113	68194-10-5	EPA 1668C	5	5
PCB-114	74472-37-0	EPA 1668C	5	5
PCB-119	56558-17-9	EPA 1668C	5	5
PCB-120	68194-12-7	EPA 1668C	5	5
PCB-121	56558-18-0	EPA 1668C	5	5
PCB-122	76842-07-4	EPA 1668C	5	5
PCB-123	65510-44-3	EPA 1668C	5	5
PCB-124	70424-70-3	EPA 1668C	5	5
PCB-126	57465-28-8	EPA 1668C	5	5
PCB-127	39635-33-1	EPA 1668C	5	5
PCB-128/162	38380-07-3	EPA 1668C	10	10

Analyte Group	CAS Number[1]	Analytical Method	Target Reporting Limit (PQL[2])	Surface Water Screening Level[3]
PCB-129	55215-18-4	EPA 1668C	5	5
PCB-130	52663-66-8	EPA 1668C	5	5
PCB-131/133	61798-70-7	EPA 1668C	10	10
PCB-132/161	38380-05-1	EPA 1668C	10	10
PCB-134/143	52704-70-8	EPA 1668C	10	10
PCB-135	52744-13-5	EPA 1668C	5	5
PCB-136	38411-22-2	EPA 1668C	5	5
PCB-137	35694-06-5	EPA 1668C	5	5
PCB-138/163/164	35065-28-2	EPA 1668C	15	15
PCB-139/149	56030-56-9	EPA 1668C	10	10
PCB-140	59291-64-4	EPA 1668C	5	5
PCB-141	52712-04-6	EPA 1668C	5	5
PCB-142	41411-61-4	EPA 1668C	5	5
PCB-144	68194-14-9	EPA 1668C	5	5
PCB-145	74472-40-5	EPA 1668C	5	5
PCB-146/165	51908-16-8	EPA 1668C	10	10
PCB-147	68194-13-8	EPA 1668C	5	5
PCB-148	74472-41-6	EPA 1668C	5	5
PCB-150	68194-08-1	EPA 1668C	5	5
PCB-151	52663-63-5	EPA 1668C	5	5
PCB-152	68194-09-2	EPA 1668C	5	5
PCB-153	35065-27-1	EPA 1668C	5	5
PCB-154	60145-22-4	EPA 1668C	5	5
PCB-155	33979-03-2	EPA 1668C	5	5
PCB-156	38380-08-4	EPA 1668C	5	5
PCB-157	69782-90-7	EPA 1668C	5	5
PCB-158/160	74472-42-7	EPA 1668C	10	10
PCB-159	39635-35-3	EPA 1668C	5	5
PCB-166	41411-63-6	EPA 1668C	5	5
PCB-167	52663-72-6	EPA 1668C	5	5
PCB-168	59291-65-5	EPA 1668C	5	5
PCB-169	32774-16-6	EPA 1668C	5	5
PCB-170	35065-30-6	EPA 1668C	5	5
PCB-171	52663-71-5	EPA 1668C	5	5
PCB-172	52663-74-8	EPA 1668C	5	5
PCB-173	68194-16-1	EPA 1668C	5	5
PCB-174	38411-25-5	EPA 1668C	5	5
PCB-175	40186-70-7	EPA 1668C	5	5
PCB-176	52663-65-7	EPA 1668C	5	5
PCB-177	52663-70-4	EPA 1668C	5	5
PCB-178	52663-67-9	EPA 1668C	5	5
PCB-179	52663-64-6	EPA 1668C	5	5
PCB-180	35065-29-3	EPA 1668C	5	5
PCB-181	74472-47-2	EPA 1668C	5	5
PCB-182/187	60145-23-5	EPA 1668C	10	10
PCB-183	52663-69-1	EPA 1668C	5	5
PCB-184	74472-48-3	EPA 1668C	5	5
PCB-185	52712-05-7	EPA 1668C	5	5
PCB-186	74472-49-4	EPA 1668C	5	5
PCB-188	74487-85-7	EPA 1668C	5	5
PCB-189	39635-31-9	EPA 1668C	5	5
PCB-190	41411-64-7	EPA 1668C	5	5
PCB-191	74472-50-7	EPA 1668C	5	5
PCB-192	74472-51-8	EPA 1668C	5	5
PCB-193	69782-91-8	EPA 1668C	5	5
PCB-194	35694-08-7	EPA 1668C	5	5
PCB-195	52663-78-2	EPA 1668C	5	5
PCB-196/203	42740-50-1	EPA 1668C	10	10
PCB-197	33091-17-7	EPA 1668C	5	5
PCB-198	68194-17-2	EPA 1668C	5	5
PCB-199	52663-75-9	EPA 1668C	5	5
PCB-200	52663-73-7	EPA 1668C	5	5
PCB-201	40186-71-8	EPA 1668C	5	5
PCB-202	2136-99-4	EPA 1668C	5	5
PCB-204	74472-52-9	EPA 1668C	5	5
PCB-205	74472-53-0	EPA 1668C	5	5
PCB-206	40186-72-9	EPA 1668C	5	5
PCB-207	52663-79-3	EPA 1668C	5	5
PCB-208	52663-77-1	EPA 1668C	5	5
PCB-209	2051-24-3	EPA 1668C	10	10
Total PCB Congeners	--	EPA 1668C	--	0.01

Analyte Group	CAS Number[1]	Analytical Method	Target Reporting Limit (PQL[2])	Surface Water Screening Level[3]
Dioxins and Furans (pg/L)				
2,3,7,8-TCDD	9014-42-0	EPA 1613B	5	see Total D/F TEQ
1,2,3,7,8-PeCDD	40321-76-4	EPA 1613B	25	see Total D/F TEQ
1,2,3,4,7,8-HxCDD	39227-28-6	EPA 1613B	25	see Total D/F TEQ
1,2,3,6,7,8-HxCDD	57653-85-7	EPA 1613B	25	see Total D/F TEQ
1,2,3,7,8,9-HxCDD	19408-74-3	EPA 1613B	25	see Total D/F TEQ
1,2,3,4,6,7,8-HxCDD	39227-28-6	EPA 1613B	25	see Total D/F TEQ
OCDD	3268-87-9	EPA 1613B	50	see Total D/F TEQ
2,3,7,8-TCDF	51207-31-9	EPA 1613B	5	see Total D/F TEQ
1,2,3,7,8-PeCDF	57117-41-6	EPA 1613B	25	see Total D/F TEQ
2,3,4,7,8-HxCDF	70648-26-9	EPA 1613B	25	see Total D/F TEQ
1,2,3,4,7,8-HxCDF	70648-26-9	EPA 1613B	25	see Total D/F TEQ
1,2,3,6,7,8-HxCDF	57117-44-9	EPA 1613B	25	see Total D/F TEQ
1,2,3,7,8,9-HxCDF	72918-21-9	EPA 1613B	25	see Total D/F TEQ
2,3,4,6,7,8-HxCDF	60851-34-5	EPA 1613B	25	see Total D/F TEQ
1,2,3,4,5,6,8-HpCDF	67562-39-4	EPA 1613B	25	see Total D/F TEQ
1,2,3,4,7,8,9-HPCDF	55673-89-7	EPA 1613B	25	see Total D/F TEQ
OCDF	39001-02-0	EPA 1613B	50	see Total D/F TEQ
Total dioxin/furan TEQ - human health/mammal	--	--	--	32

Notes:

[1] Chemical abstract service registry number.

[2] Practical Quantitation Limit (PQL) values from ALS Environmental of Kelso, Washington and Enthalpy Analytical in El Dorado Hills, California.

[3] Screening level is based on lowest of Federal and State marine surface water concentrations protective of aquatic life and human health - consumption of aquatic life. (including MTCA Method B standard formula values for carcinogens and non-carcinogens), adjusted for the PQL.

TEQ = Toxic equivalency quotient

-- = No criteria is currently available for this analyte

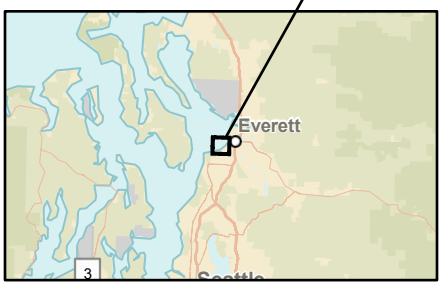
µg/L = Micrograms per liter

pg/L = Picogram per liter

NE = Cleanup level not established

D/F = Dioxin and Furan

Figures



N

0 2,000

Feet

Vicinity Map

Weyerhaeuser Mill A Former Site
Everett, Washington

GeoEngineers

Figure 1

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 10N

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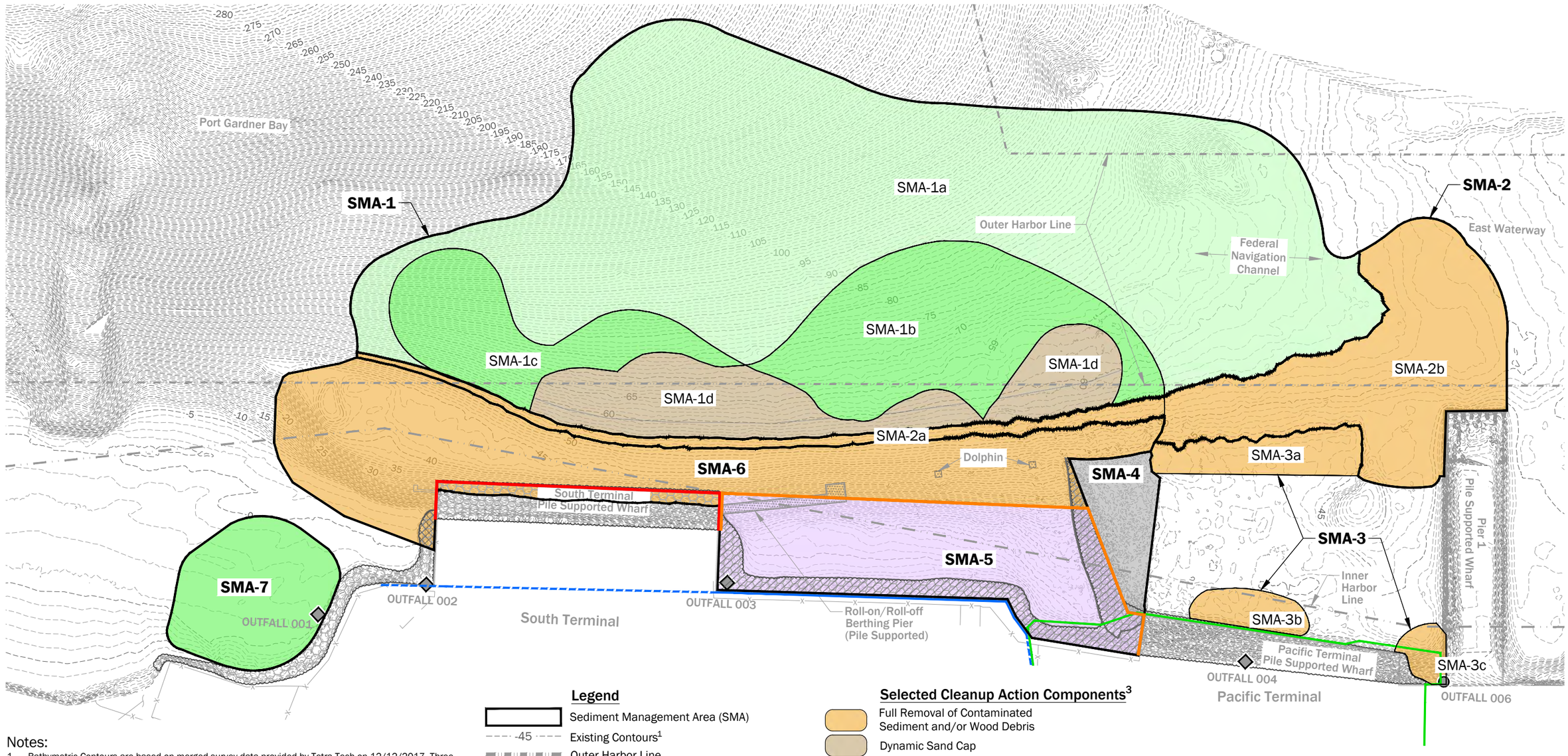


Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall

Selected Cleanup Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Dynamic Sand Cap
- Enhanced Natural Recovery (ENR)
- Monitored Natural Recovery (MNR) Temp
- Containment/Confined Disposal Facility (CDF)
- Remove Existing Pile-Supported Roll-on/Roll-off Berthing Pier and Dolphins
- Remove Existing Armor
- Remove and Replace Existing Armor
- No Action
- New South Terminal Wharf Toe Wall
- New Containment/Confined Disposal Facility (CDF) Wall

250 0 250
Feet

N W E S

Ecology Selected Cleanup Action Plan

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

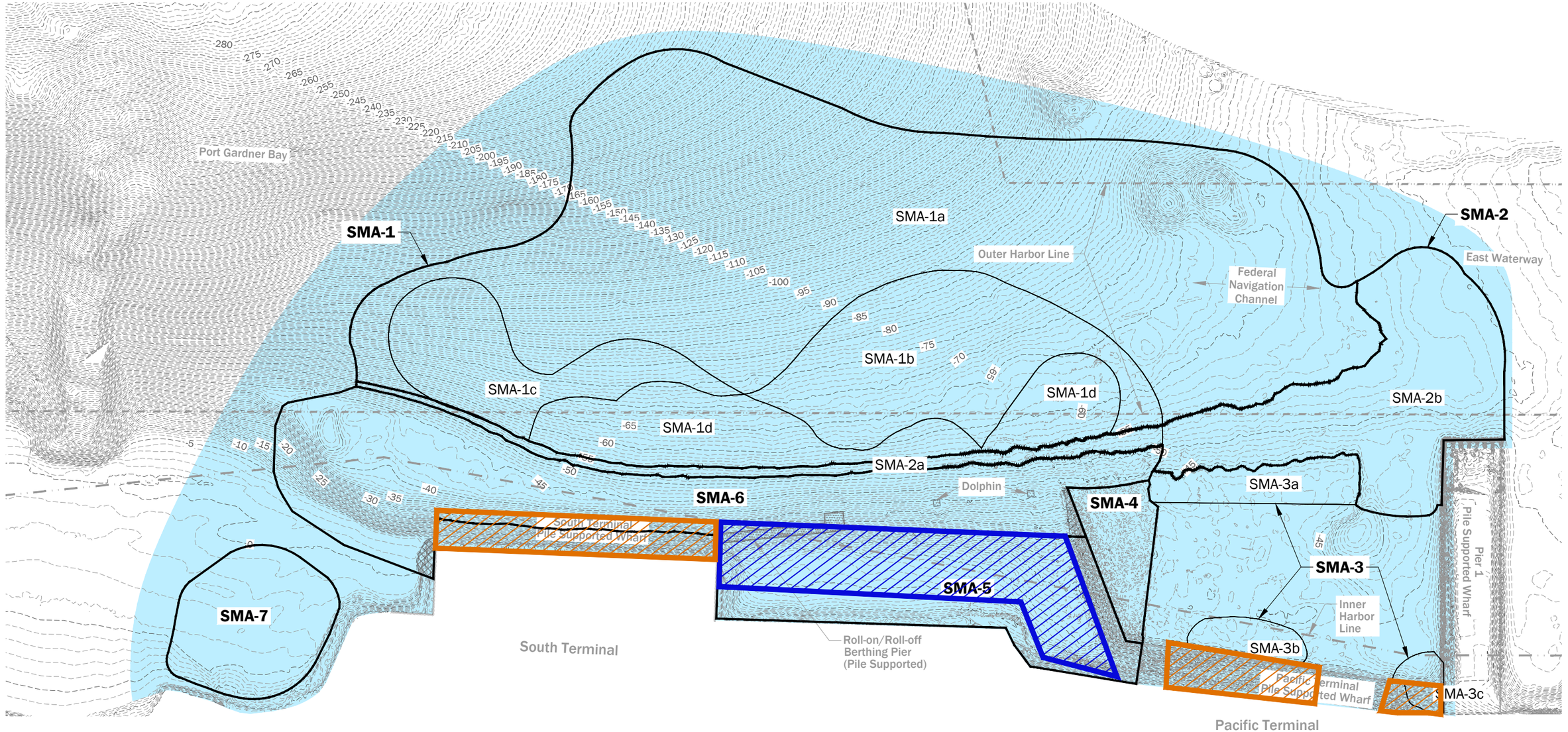
Figure 2

Notes:

1. Bathymetric Contours are based on merged survey data provided by Tetra Tech on 12/12/2017. Three surveys were merged by Tetra Tech - 1) Tetra Tech survey dated February 2017 presenting bathymetry of the marine areas adjacent to the South Terminal, 2) Tetra Tech survey dated December 2015 presenting bathymetry of areas underneath the Pacific/South Terminal Wharfs, and 3) Pacific Geomatic Services, Inc. survey dated October 2014 presenting the bathymetry of the rest of the marine areas of the site except for Pacific Terminal Interim Action Dredge Area. The bathymetry for the Pacific Terminal Interim Action Dredge Area is based on Tetra Tech survey dated February 2017 and was merged by GeoEngineers.
2. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Cleanup Action Plan.
3. The locations of all features shown are approximate.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: See Notes 1 and 2.

Horizontal Datum: North American Datum (NAD) 1983/1991, WA State Plane, N Zone, US Foot
Vertical Datum: Mean Lower Low Water (MLLW)
Vertical Datum Conversion (based on NOAA's Publication Sheet (944-7659), dated 09/29/1988):
MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW



Notes:

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Data Source: See Note 1

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MHHW = +11.11 feet MLLW
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Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Bathymetric Survey Area - Establish Pre-Construction Conditions for Design and Volumetric Calculations
- Subsurface Profiling Area - Identify Possible Buried Piling Associated with the Former Pier Structure
- Diver Survey Area - Evaluate Sediment Thickness on Top of Slope Armoring

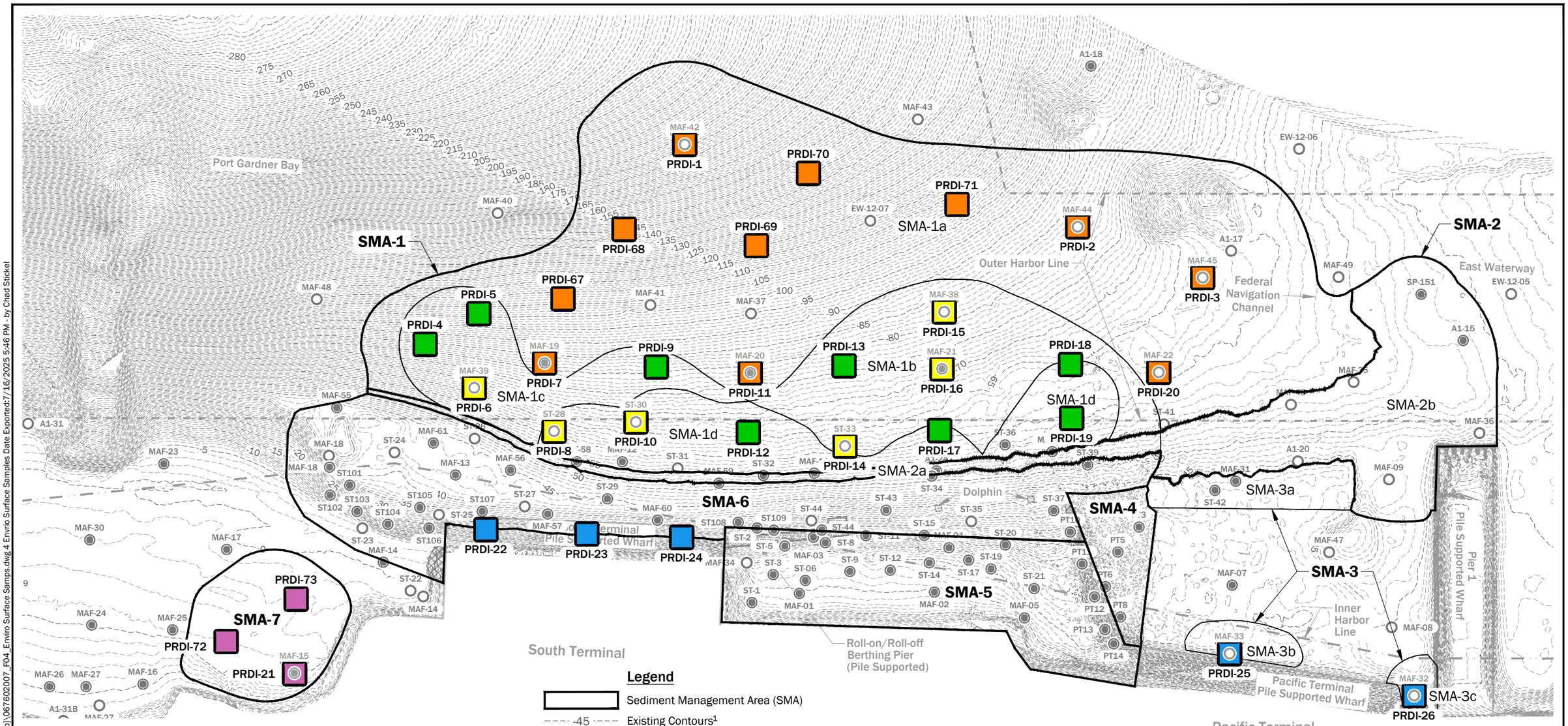
250 0 250
Feet

Marine Area Surveys

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 3



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Previous Sediment Surface Sample
- Previous Sediment Core Sample

Proposed Surface Sediment Sampling Locations

- Re-Occupy Previous Surface Sediment Location to Evaluate Changes in Contaminant Concentrations Over Time (0 to 10 cm) and to Refine the Horizontal Extent of Contamination and SMA boundary
- Re-Occupy Previous Surface Sediment Location or New Location to Evaluate Changes in Contaminant Concentrations Over Time (0 to 10 cm) and New Sediment Quality (0 to 2 cm) and to Refine the Horizontal Extent of Contamination and SMA boundary
- Re-Occupy Previous Surface Sediment Location or New Location to Evaluate Changes in Contaminant Concentrations Over Time (0 to 40 cm) and to Refine the Horizontal Extent of Contamination and SMA boundary
- Collect Surface Sediment (0 to 10 cm) from New Location to Refine the Horizontal Extent of Contamination and SMA Boundary
- Collect Diver Assisted Surface Sediment (0 to 10 cm) from New Location to Evaluate Sediment Conditions Along the South Terminal and Pacific Terminal Armored Slopes

Notes:

1. Bathymetric Contours are based on merged survey data provided by Tetra Tech on 12/12/2017. Three surveys were merged by Tetra Tech - 1) Tetra Tech survey dated February 2017 presenting bathymetry of the marine areas adjacent to the South Terminal, 2) Tetra Tech survey dated December 2015 presenting bathymetry of areas underneath the Pacific/South Terminal Wharfs, and 3) Pacific Geomatic Services, Inc. survey dated October 2014 presenting the bathymetry of the rest of the marine areas of the site except for Pacific Terminal Interim Action Dredge Area. The bathymetry for the Pacific Terminal Interim Action Dredge Area is based on Tetra Tech survey dated February 2017 and was merged by GeoEngineers.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: See Note 1

Horizontal Datum: North American Datum (NAD) 1983/1991, WA State Plane, N Zone, US Foot
Vertical Datum: Mean Lower Low Water (MLLW)
Vertical Datum Conversion (based on NOAA's Publication Sheet (944-7659), dated 09/29/1988):
MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

Environmental Investigation Surface Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 4

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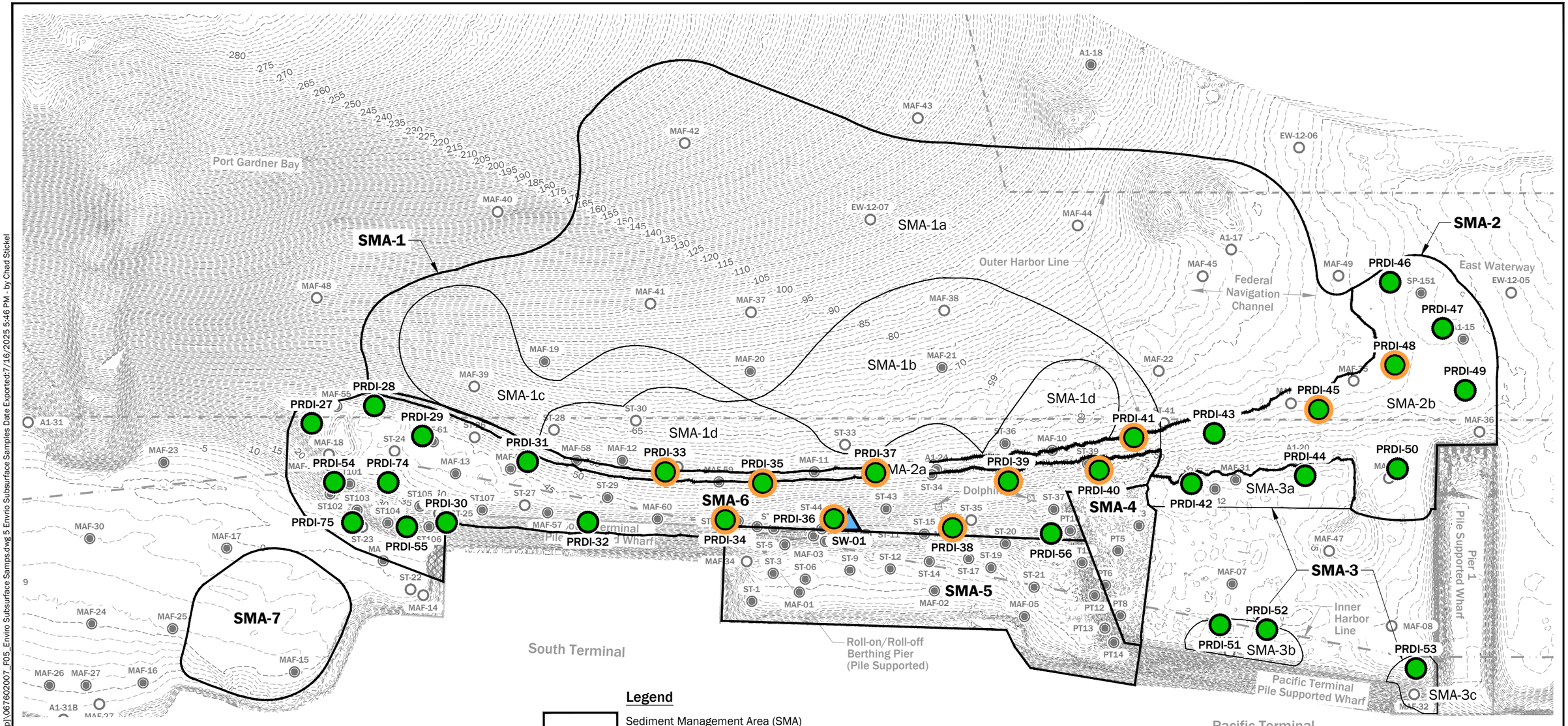

Notes:

1. Bathymetric Contours are based on merged survey data provided by Tetra Tech on 12/12/2017. Three surveys were merged by Tetra Tech - 1) Tetra Tech survey dated February 2017 presenting bathymetry of the marine areas adjacent to the South Terminal, 2) Tetra Tech survey dated December 2015 presenting bathymetry of areas underneath the Pacific/South Terminal Wharfs, and 3) Pacific Geomatic Services, Inc. survey dated October 2014 presenting the bathymetry of the rest of the marine areas of the site except for Pacific Terminal Interim Action Dredge Area. The bathymetry for the Pacific Terminal Interim Action Dredge Area is based on Tetra Tech survey dated February 2017 and was merged by GeoEngineers.
2. The locations of all features shown are approximate.
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Data Source: See Note 1

Horizontal Datum: North American Datum (NAD) 1983/1991, WA State Plane, N Zone, US Foot
Vertical Datum: Mean Lower Low Water (MLLW)
Vertical Datum Conversion (based on NOAA's Publication Sheet (944-7659), dated 09/29/1988):
MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Previous Sediment Surface Sample
- Previous Sediment Core Sample

Proposed Subsurface Sediment and Surface Water Sampling Locations

- Sediment core (Vibracore, Sonic, or Hollow Stem Auger) will be completed to confirm the estimated base elevation of contamination and provide data for dredge depth verification. Additionally, from select core locations dredged material composite samples will be collected to evaluate material characterization for dredge dewatering and placement in the Confined Disposal Facility (CDF).
- Sediment core location for leachate testing composite sample
- Surface water will be collected and used as eluent in elutriate and leachate tests

250 0 250
Feet

N W E S

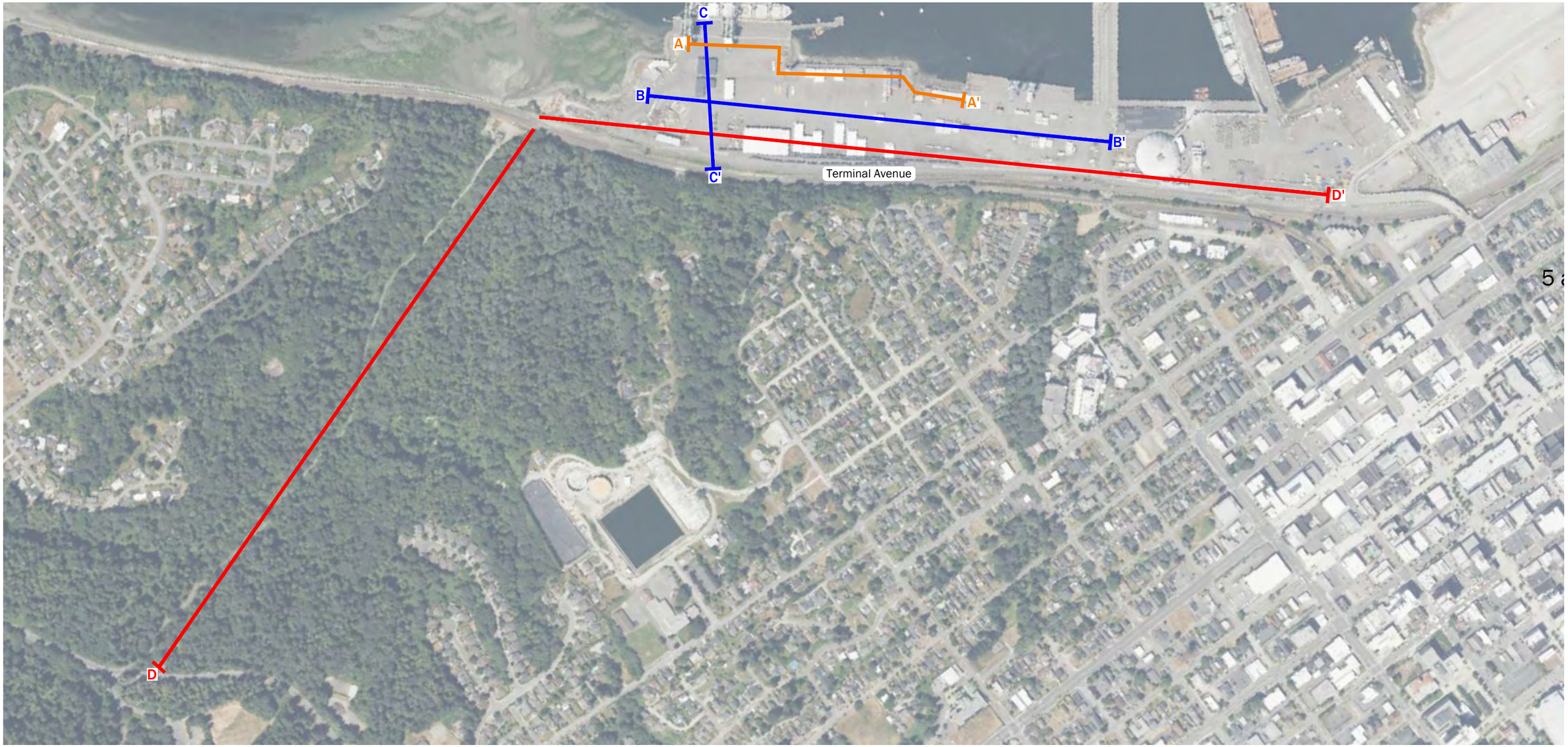
Environmental Investigation Subsurface and Surface Water Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 5

P:\0676020\CAD\07\task 3000 [prdi work plan]\appendix a [sap qapp]\067602007_F05_Enviro Subsurface Samps.dwg 5 Enviro Subsurface Samps Date Exported:7/16/2025 5:46 PM - by Chad Stickel



Legend

Proposed Geophysical Survey Transects:

- A — A' Multi-Channel Analysis of Surface Waves (MASW)
- B — B' Local Microtremor Array Method (MAM)
- D — D' Regional Microtremor Array Method (MAM)

250 0 250
Feet

N W E S

Geophysical Survey Transects

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

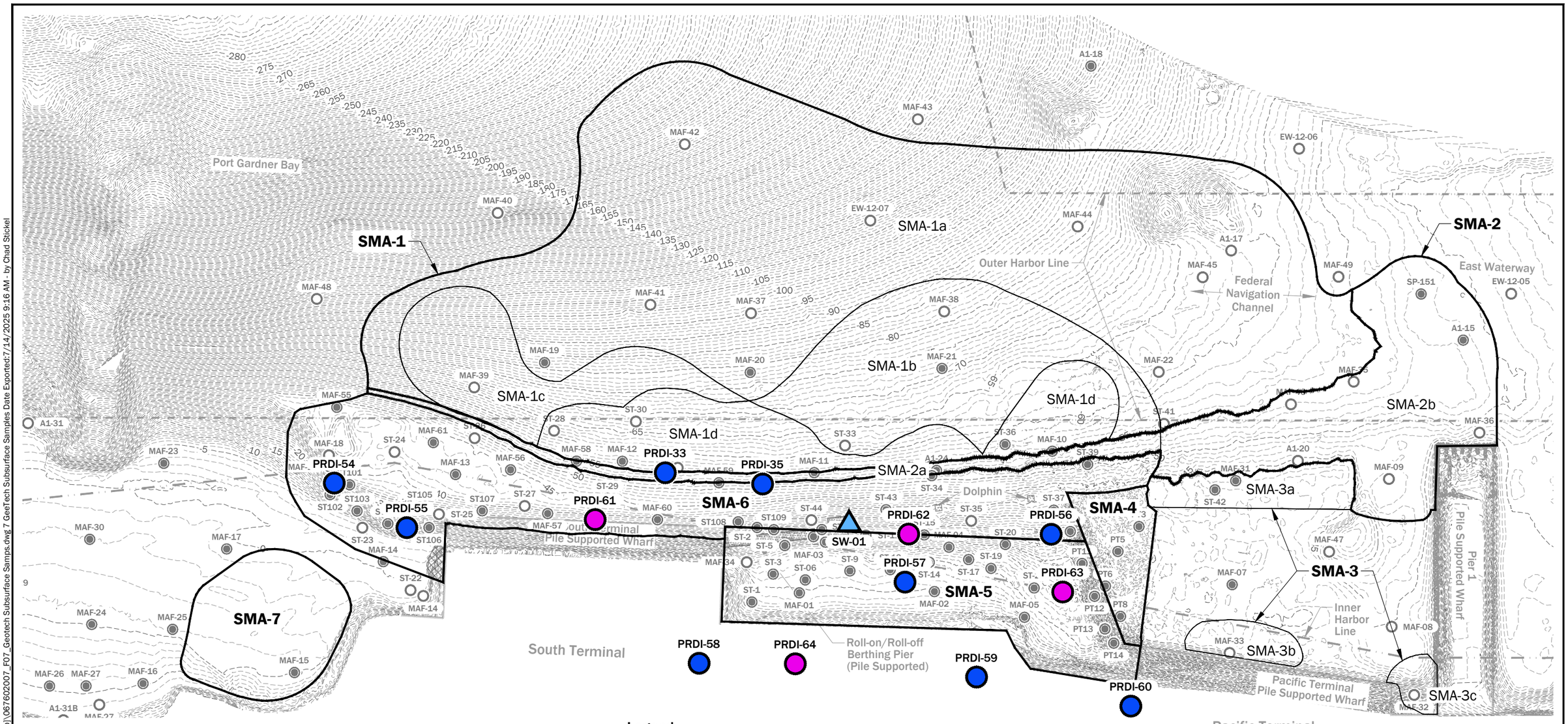
Figure 6

Notes:

1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Microsoft Bing, 2024

p:\0\0676020\CAD\07\task 3000 [prdi work plan]\appendix a [sap qapp]\0676020007_F06_Geophysics Survey.dwg 6 Geophysical Survey Date Exported:7/11/2025 3:03 PM- by Chad Stickel



Notes:

1. Bathymetric Contours are based on merged survey data provided by Tetra Tech on 12/12/2017. Three surveys were merged by Tetra Tech - 1) Tetra Tech survey dated February 2017 presenting bathymetry of the marine areas adjacent to the South Terminal, 2) Tetra Tech survey dated December 2015 presenting bathymetry of areas underneath the Pacific/South Terminal Wharfs, and 3) Pacific Geomatic Services, Inc. survey dated October 2014 presenting the bathymetry of the rest of the marine areas of the site except for Pacific Terminal Interim Action Dredge Area. The bathymetry for the Pacific Terminal Interim Action Dredge Area is based on Tetra Tech survey dated February 2017 and was merged by GeoEngineers.
2. The locations of all features shown are approximate.
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Data Source: See Note 1

Horizontal Datum: North American Datum (NAD) 1983/1991, WA State Plane, N Zone, US Foot
Vertical Datum: Mean Lower Low Water (MLLW)
Vertical Datum Conversion (based on NOAA's Publication Sheet (944-7659), dated 09/29/1988):
MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1]
- Outer Harbor Line
- Inner Harbor Line
- Previous Sediment Surface Sample
- Previous Sediment Core Sample

Proposed Subsurface Sediment Sampling Locations

- Standard Penetration Test (Mud Rotary, Sonic or Hollow Stem Auger Drilling Methods) will be Completed to Evaluate Geotechnical Properties
- Cone Penetration Test will be Completed to Evaluate Geotechnical Properties

250 0 250
Feet

N W E S

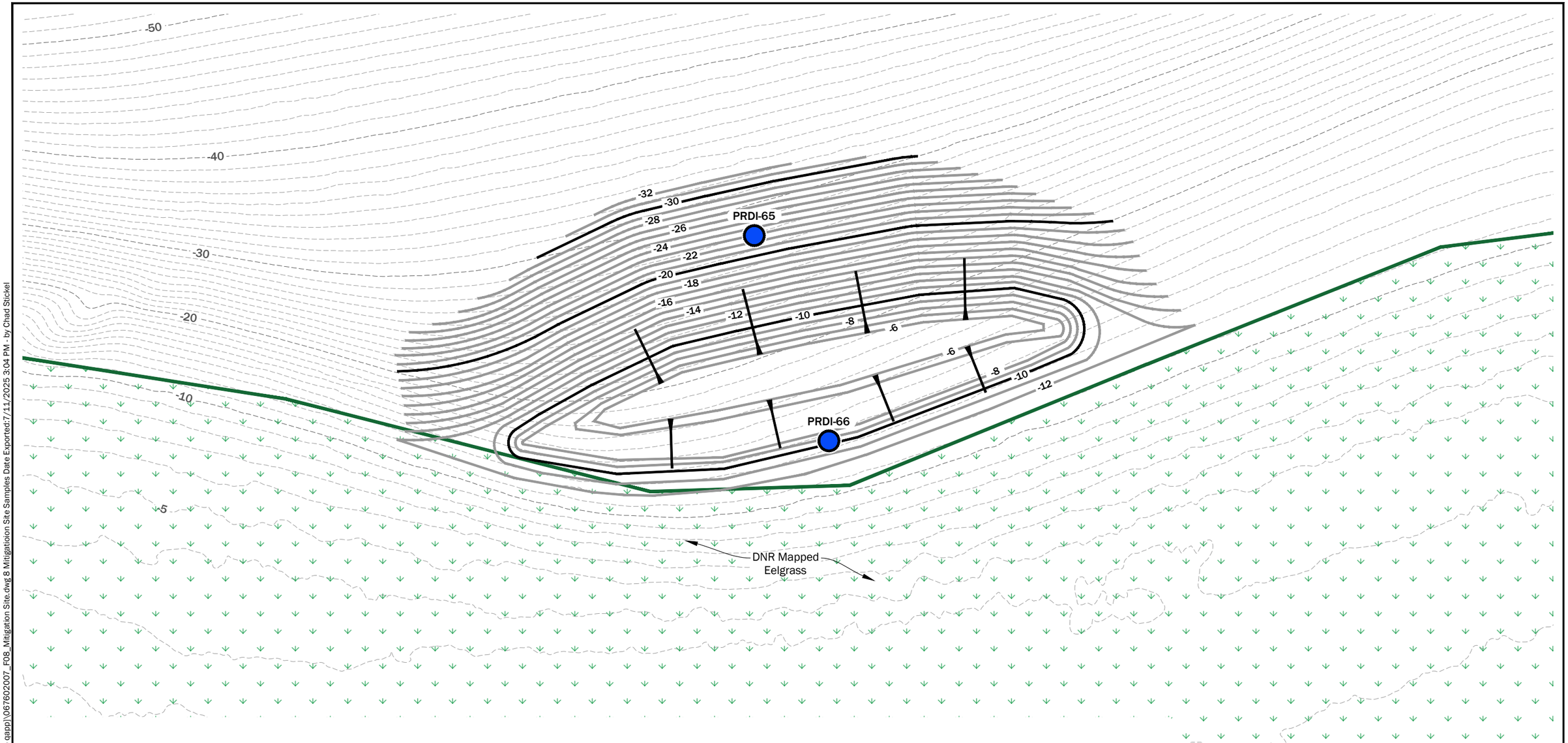
GeoTechnical Investigation
Subsurface Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 7

P:\0\0676020\CAD\07\task 3000 [prdi work plan]\appendix a [sap qapp]\0676020007_F07_Geotech Subsurface Samps.dwg 7 GeeTech Subsurface Samples Date Exported:7/14/2025 9:16 AM - by Chad Stickel



Legend

-20 Proposed Finish Grade Major Contours

-18 Proposed Finish Grade Minor Contours

-45 Existing Contours

DNR Mapped Eelgrass

Proposed Subsurface Sediment Sampling Locations

(Location of the Eelgrass Mitigation Site is shown on Figure 1)

Standard Penetration Test (Mud Rotary, Sonic or Hollow Stem Auger Drilling Methods) will be Completed to Evaluate Geotechnical Properties

100 0 100
Feet

W N S E

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Sources:

- Bathymetric Survey by Tetra Tech, dated February 2024
- Proposed Layout by Grette, dated 12/13/2024

Horizontal Datum: North American Datum (NAD) 1983/2011, WA State Plane, N Zone, US Foot
Vertical Datum: Mean Lower Low Water (MLLW)
Vertical Datum Conversion (based on NOAA's Publication Sheet (944-7659), dated 09/29/1988):
MHHW = +11.11 feet MLLW
NGVD 1929 = +5.93 MLLW
NAVD 1988 = +2.25 MLLW

GeoTechnical Investigation Subsurface Sampling Locations - Eelgrass Mitigation Site

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 8

p:\0\0676020\CAD\07\task 3000 [prdi work plan]\appendix a [sap qapp]\0676020007_F08_Mitigation Site.dwg 8 Mitigation Site Samples Date Exported:7/11/2025 3:04 PM - by Chad Stickel

Appendix B

Health and Safety Plan

Marine Area Pre-Remedial Design Investigation
Site Health & Safety Plan

Weyerhaeuser Mill A Former
Everett, Washington
Ecology Agreed Order No. DE 8979

for

Washington State Department of Ecology
on Behalf of Port of Everett

September 15, 2025

2101 4th Avenue, Suite 950
Seattle, Washington 98101
206.278.2674

GeoEngineers

Health and Safety Plan

Weyerhaeuser Mill A Former
Everett, Washington
Agreed Order No. DE 8979

File No. 0676-020-07
September 15, 2025

Approved By:

Signature:  Date: September 15, 2025

Robert S. Trahan, LG, Associate Environmental Scientist, GeoEngineers

Signature:  Date: September 15, 2025

Neil F. Morton, Senior Environmental Scientist, GeoEngineers

Signature:  Date: September 15, 2025

Chad Kean, Health and Safety Manager, GeoEngineers

JMH:RST:CK:atk

Table of Contents

Appendices

Employee Acknowledgment
Weyerhaeuser Mill A Former Site
GEI File No. 0676-020-07

I hereby verify that a copy of the Health and Safety Plan has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge an understanding of the safety procedures and protocol for my responsibilities on site. I agree to comply with all required specified safety regulations and procedures.

Print Name Signature Date

Subcontractor Acknowledgment
Weyerhaeuser Mill A Former Site
GEI File No. 0676-020-07

I verify that a copy of the Health and Safety Plan has been provided by GeoEngineers, Inc. to inform us of the potential hazards, and procedures and protocols that will be used.

Print Name	Signature	Firm	Date

1.0 Introduction

This Health and Safety Plan (HASP) has been prepared for use at the Weyerhaeuser Mill A Former (Mill A) Site (Site) during field investigation activities to collect supplemental data for use in the engineering analysis and design of the planned cleanup action for the Marine Area of the Site. **This Health and Safety Plan (HASP) is to be used in conjunction with current standards and policies outlined in the GeoEngineers Inc. (GeoEngineers) Health and Safety Programs.** Together, the written GeoEngineers' safety programs and this HASP constitute the site safety plan for this subject Site. This HASP is required by the Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation (29 CFR 1910.120) when preforming mandatory or voluntary clean-up operations and initial investigations conducted to determine the presence or absence of hazardous substances unless the employer can demonstrate that the work does not involve employee exposure to safety and health hazards from hazardous substances at the site. This HASP is to be used by GeoEngineers personnel. A copy of this HASP must be available on site.

GENERAL PROJECT INFORMATION

PROJECT NAME	Weyerhaeuser Mill A Former (Mill A)
PROJECT NUMBER	0676-020-07
TYPE OF PROJECT	Marine Sediment and Upland Soil Investigation
START/COMPLETION	To Be Determined (TBD)
SUBCONTRACTORS	Gravity Consulting, Analytical Resources, LLC, Enthalpy Analytical, Hollow-Stem Auger (HSA)/Sonic Driller (TBD), Geotech Driller and Barge (TBD), and Geophysics Subcontractor (TBD)
CLIENT	Port of Everett

Liability Clause: If requested by subcontractors, this site HASP may be provided for informational purposes only. In this case, the Subcontractor Acknowledgment shall be signed, and a copy of this record retained by GeoEngineers. Please be advised that this site-specific HASP is intended for use by GeoEngineers employees only. Nothing herein shall be construed as granting rights to GeoEngineers' subcontractors or any other contractors working on this site to use or legally rely on this HASP. GeoEngineers specifically disclaims any responsibility for the health and safety of any person not employed by the company.

2.0 Background

Detailed information regarding background information, including Site location, physical description, use history, summary of previous environmental investigations and identification of preliminary hazardous substances are presented in the Marine Area Cleanup Action Plan, Weyerhaeuser Mill A Former dated November 2024.

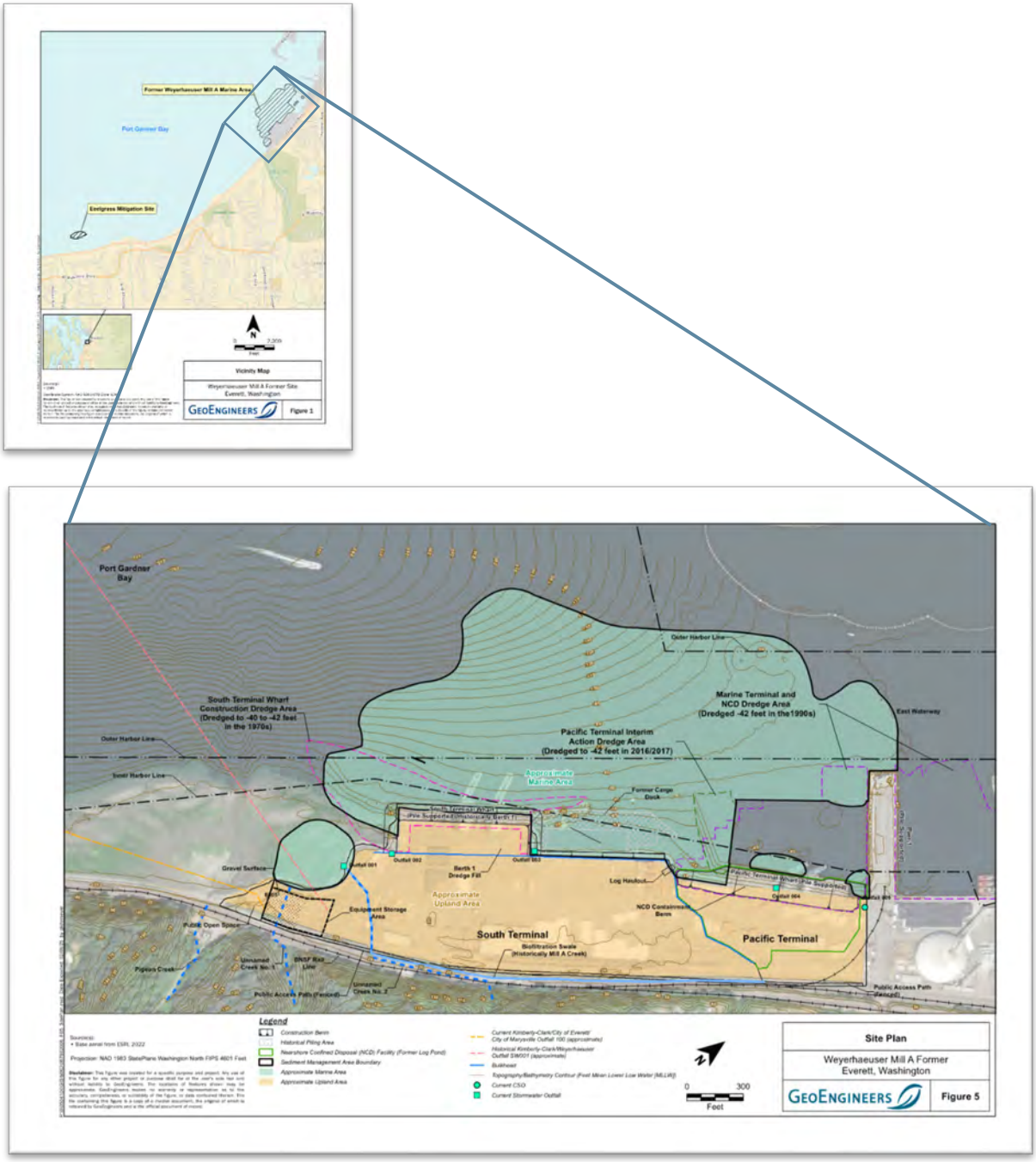
2.1 GENERAL SITE DESCRIPTION

The Site is comprised of two sub-areas: the Marine Area and the Upland Area. The boundary between the Marine and the Upland Areas is the ordinary high water (OHW) elevation along the shoreline. The Marine Area is comprised of land owned by the Port of Everett and Washington State-owned aquatic lands and is generally situated between Port Gardner Bay and the East Waterway. The Port has a Port Management Agreement (PMA) with the Washington State Department of Natural Resources (DNR) for an area situated between the Port's property line and the outer-harbor line.

Historical industrial activities at the Site have included pulp manufacturing, saw milling, ship building, shingle milling, log storage and log handling since the early 1900s. In 1926, the Weyerhaeuser Company (Weyerhaeuser) completed acquisition of the properties that comprise the Site for lumber milling. Lumber milling continued until around 1933 at which time Weyerhaeuser closed and dismantled the lumber mill and began construction of an unbleached sulfite pulp mill known as Mill A. Construction of Mill A was completed in 1936 and in the early 1940s bleaching facilities were added to the Mill A operations. The Weyerhaeuser Mill A operations ceased in 1980, and the facilities were subsequently demolished. The Port purchased the property in 1983. In 1987, the Port developed the property for use as a log sorting yard for receipt, storage and export of whole logs. Log handling operations by the Port's tenants continued at the property until the mid-2000s. From the mid-2000s to the present, the Site has been used by the Port for break bulk, container cargo storage and other shipping operations.

The Port currently operates three vessel berths within the Marine Area including the South Terminal Wharf, Pacific Terminal Wharf and Pier 1. The ship berths associated with each of the wharfs are maintained to an approximate elevation of -40 feet mean lower low water (MLLW) to facilitate navigation and moorage. However, future uses of the terminal areas will require the Port to provide deeper navigational depths and longer berths in order to maintain the viability of their marine terminals. At the South Terminal, the future navigation needs of the berth require deepening to -50 feet MLLW (-52 feet MLLW with a 2-foot overdredging allowance) to allow sufficient navigation depths for larger ships over a range of tide conditions. The future navigation depths at the Pacific Terminal and Pier 1 berths will be maintained at -42 feet MLLW (-44 feet MLLW with a 2-foot over-dredging allowance) to facilitate operations at the facility.

2.2 SITE MAP


Former Weyerhaeuser Mill A Marine Area
Port Gardner Bay
Ecologress Mitigation Site
Vicinity Map
Weyerhaeuser Mill A Former Site
Everett, Washington
GeoEngineers
Figure 1
Port Gardner Bay
Outer Harbor Line
South Terminal Wharf Construction Dredge Area (Dredged to -40 to -42 feet in the 1970s)
Marine Terminal and NCD Dredge Area (Dredged -42 feet in the1990s)
East Waterway
Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet in 2016/2017)
Inner Harbor Line
Approximate Marine Area
Former Cargo Dock
Gravel Surface
Outfall 001
Outfall 002
Outfall 003
Berth 1 Dredge Fill
Log Haulout
Outfall 004
Approximate Upland Area
Equipment Storage Area
NCD Containment Berm
Public Open Space
South Terminal
Pacific Terminal
Bioltration Swale (Historically Mill A Creek)
Pigeon Creek
Unnamed Creek No. 1
BNSF Rail Line
Unnamed Creek No. 2
Public Access Path (Fenced)
Legend
Construction Berm
Historical Piling Area
Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
Sediment Management Area Boundary
Approximate Marine Area
Approximate Upland Area
Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (approximate)
Historical Kimberly-Clark/Weyerhaeuser Outfall 59001 (approximate)
Bulkhead
Topography/Bathymetry Contour (Feet Mean Lower Low Water (MLLW))
Current CSO
Current Stormwater Outfall
0
300
Feet
Site Plan
Weyerhaeuser Mill A Former
Everett, Washington
GeoEngineers
Figure 5

3.0 Work Plan

The Pre-Remedial Design Investigation (PRDI) for the Marine Area of the Site will include sampling and analysis of Marine Area sediment and Upland Area soil to collect supplemental data for use in the engineering analysis and design of the planned cleanup action for the Marine Area of the Site. The overall objectives of the investigation include the following:

- Collect surface sediment samples to evaluate change in contaminant concentrations over time, evaluate new sediment quality, and refine the horizontal extent of contamination and sediment management area boundaries.
- Confirm the estimated base elevation of contamination and provide data for dredge depth verification.
- Evaluate the physical characteristics of sediment that will be dredged to provide information for confined disposal facility and landfill disposal.
- Evaluate geotechnical properties of sediment and soil to support the design of the Toe and Confined Disposal Facility (CDF) walls.
- Evaluate geotechnical properties of the eelgrass mitigation site.

ANTICIPATED FIELD ACTIVITIES

FIELD ACTIVITIES (CHECK ALL ANTICIPATED FIELD ACTIVITIES TO BE COMPLETED)	
☐ Site Reconnaissance	☐ Product Sample collection
☒ Surveying	☐ Recovery of Free Product
☒ Soil Sampling	☐ Remedial Excavation
☒ Sediment Sampling	☐ Groundwater Depth and Free Product Measurement
☐ Vapor Sampling	☒ Other: Over-Water Work
☐ Test Pit Exploration	☒ Other: Sample Transport and Delivery
☐ Direct Push Exploration	☒ Other: Power Grab Sampling
☐ Hollow-Stem Auger Exploration	☒ Other: Vibracore Sampling
☐ Construction Monitoring	☒ Other: Mud Rotary Sampling
☐ UST Site Check/Site Assessment	☒ Other: Upland Geophysical Survey
☐ UST Removal Observation	☒ Other: Hollow-Stem Auger or Sonic Sampling

GEOENGINEERS FIELD PERSONNEL QUALIFICATIONS AND READINESS STATUS

NAME OF EMPLOYEE ON SITE	LEVEL OF HAZWOPER TRAINING (24-HR/40-HR)	DATE OF LAST 8-HR REFRESHER TRAINING	LAST FIRST AID/ CPR TRAINING DATE	SITE SPECIFIC TRAINING OR LICENSE REQUIREMENT	HAZWOPER MEDICAL SURVEILLANCE REQUIRED?
Nathan Solomon	40-Hr	Mar-2023	Oct-2023	n/a	n/a
Michael Ysaguirre	40-Hr	Mar-2024	TBD	n/a	n/a
Divya Khandelwal	40-Hr	April-2024	July-2024	n/a	n/a
Geotechnical field staff – TBD					

GEOENGINEERS FIELD PERSONNEL REQUIRING RESPIRATOR USE ON THIS PROJECT

NAME OF EMPLOYEE REQUIRING A RESPIRATOR	RESPIRATOR FIT TEST DATE	MEDICAL EVALUATION DATE	RESPIRATOR CLEARANCE DATE	DATE OF ANNUAL REFRESHER TRAINING	APPROVED RESPIRATOR TYPE

Site safety meetings ("tailgate meeting") must be completed at the beginning of each day of site activity and/or at a minimum, weekly for similar activities performed during consecutive days. The site safety meetings should include a discussion of emergency response, site communications and site hazards associated with the planned activities. Personnel attending the Site Safety Meeting shall complete the **Site Safety Meeting Record** (Appendix A).

4.0 Chain of Command

The chain of the command for the site investigation has been established to provide the **hierarchical structure** in which field personnel reports potential issues or concerns if working conditions change that may affect on-site and off-site health and safety. The project chain of command and functional responsibility for key individuals are presented below.

PROJECT CHAIN OF COMMAND AND CONTACT INFORMATION

CHAIN OF COMMAND	TITLE	NAME	TELEPHONE NUMBERS
1	Current Owner	Port of Everett (Erik Gerking)	425.388.0604
2	Principal In Charge	John Herzog	206.406.6431 (c) 206.239.3232 (o)
3	Health and Safety Program Manager	Chad Kean	425.515.5340 (c) 425.284.7256 (o)
4	Project Manager	Robert Trahan	206.240.2300 (c) 206.239.3253 (o)
5	Client Assigned Site Supervisor/Contractor	n/a	n/a
6	Environmental Field Coordinator/ Site Safety Officer	Robert Trahan	206.240.2300 (c) 206.239.3253 (o)
	Geotechnical Field Coordinator/ Site Safety Officer	Michelle Deng	206.308.9309 (c) 206.448.4297 (o)
7	Field Engineer/Geologist	Nathan Solomon Micheal Ysaguirre Divya Khandelwal	206.437.6819 (c) 612.382.1274 (c) 823.230.7331 (c)
	Geotechnical Field Staff	TBD	TBD
8	Gravity Consulting HSA/Sonic Driller Geotech Driller and Barge Geophysics Subcontractor Analytical Resources, LLC Enthalpy Analytical	Shawn Hinz TBD TBD TBD Sue Dunnihoo Kathy Zipp	425.281.1471 (c) TBD TBD TBD 206.695.6200 (o) 916.673.1520 (o)

The **Functional Responsibility** of individual roles within GeoEngineers health and safety program are described in Appendix B.

5.0 Hazard Analysis

A hazard analysis has been completed as part of preparation of this HASP. The hazard analysis was performed taking into account the known and potential hazards at the Site and surrounding areas, as well as the planned work activities. The results of the hazard analysis are presented in this section. The hazard assessment will be evaluated each day before beginning work. Updates will be made as necessary to this HASP if new or previous unidentified hazards are encountered. Procedures for reporting incidents involving work-related injuries, illnesses, property damage, or near-miss events and guidelines for investigating and implementing corrective measures to prevent reoccurrence is presented in GeoEngineers **Incident Reporting and Investigation Program** (Appendix C).

Known and/or anticipated hazards are discussed in the following sections.

5.1 JOB HAZARD ANALYSIS

The following presents potential job hazards and mitigation procedures/steps should be followed prior to leaving to the job site, while enroute to the job site and following arrival to the job site to reduce/eliminate these hazards. Prior to departure:

- Use only vehicles appropriate for the work needs and the driving conditions expected.
- Inspect the work vehicle, including:
  - ☐ Check for tire cuts, fluid leaks, flat tires, body damage, windshield cracks, and other damage.
  - ☐ Check lights, wipers, fluid levels, and seat belts.
  - ☐ Check for vehicle warning indicators.
  - ☐ Check for current vehicle registration and insurance.
  - ☐ Ensure the vehicle has fuel to get to and from your destinations.
  - ☐ Ensure the vehicle has a complete and current first aid kit and fire extinguisher.
- Study the area maps, photos, driving routes.
- Be familiar with GPS use and compass skills (if remote work location).
- Identify the safest spot to park field vehicles.
- Place heavy objects behind a secure safety cage if they must be carried in a passenger compartment.

Discuss potential job, biological, physical, chemical, and ergonomic hazards with Project Manager prior to departure.

ANTICIPATED JOB HAZARDS

JOB HAZARDS (CHECK ALL ANTICIPATED HAZARDS)	
☒ Highway Driving	☐ Unfamiliar Project Location
☐ Driving on Unimproved Roads	☐ Unfamiliar Task
☐ Poor/Inclement Weather Conditions	☐ Unfamiliar Tools or Sampling Equipment
☐ Traveling on Foot	☐ Other: Click here to enter text.
☐ Remote Location/Project Site	☐ Other: Click here to enter text.
☒ Communication	☐ Other: Click here to enter text.
☒ Unfamiliar Project Crew	☐ Other: Click here to enter text.

Measures to mitigate potential/anticipated job hazards including the following:

- **Highway Driving** – Potential hazards include unfamiliar roads, mechanical failure, flat tires, vehicle fire, vehicle collision.
  - ☐ Inform your Project Manager of your destination and estimated time of return.
  - ☐ Carry extra food, water, and clothing.
  - ☐ Drive defensively.
  - ☐ Inspect vehicle prior to departure (see Pre-Job Activities)

- **Unfamiliar Crew and Tasks** – Potential hazards include crew does not notify Site owner/manager, unaware of the job site hazards and steps to prevent injury, appropriate personnel protective equipment not worn.
  - ☐ Conduct a tailgate safety meeting discussing the jobs, the hazards and actions that will be taken to prevent injury.
  - ☐ Discuss "Stop Work Authority" as it applies to each project member.
  - ☐ Discuss appropriate Personal Protection Equipment (PPE) including high visibility clothing such as reflective vest.
  - ☐ Notify attendant and/or Site owner/manager of work activities and location.
  - ☐ Discuss appropriate PPE including high visibility clothing such as reflective vest.
  - ☐ Set up exclusion zone surrounding work area.
- **Communication** – Potential hazards include lack of cell phone coverage, use heavy equipment, large job site without clear address or entrance for emergency crews.
  - ☐ Verify cell phone is working.
  - ☐ Maintain communication with Project Manager throughout job task.
  - ☐ Maintain communication and line of sight with heavy equipment operators.
  - ☐ Verify location and contact numbers for emergency medical assistance or 911.
  - ☐ Verify designated job site entrance/exit and job site emergency procedures.
  - ☐ Review job site health and safety plan.

ELEVATED RISK ACTIVITIES

Does this project have Elevated Risk Activities? Yes ☒ or No ☐

ELEVATED RISK ACTIVITIES	ASSOCIATED PRIMARY FIELD TASK(S)	SEPARATE ERA JHA COMPLETED?
Heat/Cold Injury Risk	Sediment/Soil Sampling	See Sections 5.1.1 and 5.1.2
Work Over/Near Water	Sediment/Soil Sampling	See Section 5.1.3

5.1.1 Cold Stress Prevention

Working in cold environments presents many hazards to site personnel and can result in frost nip (superficial freezing of the skin), frost bite (deep tissue freezing) or hypothermia (lowering of the core body temperature). The combination of wind and cold temperatures increases the degree of cold stress experienced by site personnel. Site personnel shall be trained on the signs and symptoms of cold-related illnesses, how the human body adapts to cold environments, and how to prevent the onset of cold-related illnesses. Heated break areas and warm beverages shall be provided during periods of cold weather.

Additional details of GeoEngineers' **Cold Stress Prevention Program** are presented in Appendix D.

5.1.2 Heat Stress Prevention

State and federal OSHA regulations provide specific requirements for handling employee exposure to heat stress. GeoEngineers' program complies with these requirements and will be implemented in all areas where heat stress is identified as a potential health issue.

Site personnel shall be trained on the signs and symptoms of heat-related illnesses, how the human body adapts to hot environments, and how to prevent the onset of heat-related illnesses. When employee exposure is at or above an applicable temperature listed in the Heat Stress table below, Project Managers will ensure that:

- A sufficient quantity of drinking water is readily accessible to employees at all times; and
- All employees have the opportunity to drink at least one quart of drinking water per hour.
- A cooled, shaded rest area should be available to workers.

HEAT STRESS

TYPE OF CLOTHING	OUTDOOR TEMPERATURE ACTION LEVELS
Nonbreathing clothes including vapor barrier clothing or PPE such as chemical resistant suits	52°
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°
All other clothing	89°

Additional details of GeoEngineers' **Heat Stress Prevention Program** are presented in Appendix E.

5.1.3 Boat, Over Water and Near Water Safety Program

Use of a boat for work requires safe boating practices, good equipment, and training. These procedures are not meant to replace the safety manuals that are provided by the U.S. Coast Guard. Instead, they should highlight some of the areas of concern and address specific GeoEngineers, Inc. work procedures. While working near water over waist deep or while on a boat, use a Coast Guard approved flotation device should be used. Remember that being submersed in water increases the chance of hypothermia. It is recommended to have a dry set of clothes and work with a buddy if you are working around water. If an employee is required to work in the water, they should wear appropriate gear including a wet suit or dry suit if necessary for safe accomplishment of the task.

Additional details of GeoEngineers' **Working Over Water Safety Program** are presented in Appendix F.

5.2 PHYSICAL HAZARDS

Physical hazards potentially at the Site and mitigation measures and/or procedures for addressing potential physical hazards are summarized below.

ANTICIPATED PHYSICAL HAZARDS

PHYSICAL HAZARDS (CHECK ALL ANTICIPATED HAZARDS)	
☒ Drill Rig and Support Truck	☐ Overhead Hazards/Power Lines
☐ Backhoe	☒ Tripping/Puncture/Pinch Hazards
☐ Trackhoe	☐ Unusual Traffic Hazard
☐ Crane	☐ Noise
☐ Front End Loader	☒ Other: Research Vessel/Barge/Over-Water Work
☐ Excavations/Trenching (1:1 Slopes for Type B soil)	☐ Other:
☐ Shored/Braced Excavation (Greater than 4' Deep)	☐ Other:

Measures to mitigate potential/anticipated physical hazards including the following:

- High-visibility vests and life jackets will be worn by on-site personnel to ensure they can be seen by equipment operators. Use proper lighting of the work areas.
- Field personnel will be aware at all times of the location and motion of equipment in the area of work to ensure a safe distance between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating equipment only when they are certain the operator has indicated that it is safe to do so through hand signal or other acceptable means.
- Personnel will avoid tripping hazards and other hazardous encumbrances.

5.3 BIOLOGICAL HAZARDS

Biological hazards potentially at the Site and mitigation measures and/or procedures for addressing potential biological hazards are summarized below.

ANTICIPATED BIOLOGICAL HAZARDS

BIOLOGICAL HAZARDS (CHECK THE HAZARDS ANTICIPATED FOR THE PROJECT)
☒ Wildlife (insects, snakes, etc.)
☒ Animal Waste
☐ Hypodermic needles or other infectious hazards
☐ Poison Ivy or other vegetation
☐ Other:

Measures to mitigate potential/anticipated biological hazards including the following:

- Wildlife Hazards:
  - Use insect repellant as necessary.
  - If employee has bee sting allergy, carry epi-pen.
  - Avoid areas where salmon carcasses accumulate.
  - Stay alert and safe distance away from any other biological hazards (e.g. otters, seals, hunters).
  - Wear appropriate PPE including gloves, long sleeves and pants, mosquito hats and waders if probability of encountering biting or stinging insects.
- Animal Hazards
  - Use insect repellant as necessary.
  - If employee has bee sting allergy, carry epi-pen.
  - Avoid areas where salmon carcasses accumulate.
  - Stay alert and safe distance away from any other biological hazards (e.g. otters, seals, hunters).
  - Wear appropriate PPE including gloves, long sleeves and pants, mosquito hats and waders if probability of encountering biting or stinging insects.

5.4 ERGONOMIC HAZARDS

Ergonomic hazards potentially at the Site and mitigation measures and/or procedures for addressing potential ergonomic hazards are summarized below.

ANTICIPATED ERGONOMIC HAZARDS

ERGONOMIC HAZARDS (CHECK THE HAZARDS ANTICIPATED FOR THE PROJECT)
☒ Heavy Lifting
☒ Repetitive Motion
☐ Force
☐ Awkward Positioning Held for a Long Time
☐ Contact Stress
☐ Vibration
☐ Other:

Measures to mitigate potential/anticipated ergonomic hazards including the following:

- Minimize reaching by keeping frequently used items within arm's reach, moving your whole body as close as possible to the object.
- Avoid overextending by standing up when retrieving objects on shelves.
- Keep your back in shape with regular stretching exercises.
- Get help from a coworker or use a hand truck if the load is too heavy or bulky to lift alone.
- Proper Lifting Techniques:
  - Face the load; don't twist your body. Stand in a wide stance with your feet close to the object.
  - Bend at the knees, keeping your back straight. Wrap your arms around the object.
  - Let your legs do the lifting.
  - Hold the object close to your body as you stand up straight. To set the load down, bend at the knees, not from the waist.

5.5 CHEMICAL HAZARDS

The following tables presents a summary of the chemicals known to be historically or currently present at the Site of regulatory concern and their range of detected concentrations based on previous investigations and their associated occupational exposure limits (OEL). GeoEngineers typically uses the most conservative (lowest) of the limits published for the protection of its' workers. Note that additional contaminants of concern in addition to those listed may be present. Additional information regarding the listed chemical compounds is presented in Appendix G. Associated OEL for listed chemical compounds are presented in Appendix H.

ANTICIPATED CHEMICAL HAZARDS, EXPOSURE ROUTES AND SYMPTOMS

CHEMICAL COMPOUND	MAXIMUM DETECTED CONCENTRATION	UNIT	MEDIA OF CONCERN	EXPOSURE ROUTES	SYMPTOMS OF EXPOSURE
Arsenic	70	mg/kg	Sediment	Inhalation, ingestion, skin and/or eye contact	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin. Target organs: liver, kidneys, skin, lungs, lymphatic system (lung and lymphatic cancer)
Copper	1,040	mg/kg	Sediment	Inhalation, ingestion, skin and eye contact	Lassitude; insomnia; anorexia; weight loss; malnutrition; constipation; abdominal pain; colic; anemia, gingival lead line; tremor; wrist and ankle paralysis; encephalopathy; kidney disease; irritated eyes
Mercury	39	mg/kg	Sediment	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritated eyes and skin, coughing, chest pain, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion), stomatitis, salivation, gastrointestinal disturbance, anorexia, weight loss, proteinuria
Zinc	1,010	mg/kg	Sediment	Inhalation, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]
Carcinogenic Polycyclic Aromatic Hydrocarbons PAHs (cPAHs)	5.92	mg/kg	Sediment	Ingestion, inhalation, skin and/or eye contact	Dermatitis, bronchitis, potential carcinogen
Polychlorinated biphenyls (PCBs),	5.2	mg/kg	Sediment	Skin absorption, ingestion, inhalation	Immunological (Immune System), Neurological (Nervous System), Skin, thyroid, stomach and liver damage, EPA: Probable human carcinogen
Dioxin/Furans	187	ng/kg	Sediment	See Below	See Below.

Notes:

mg/kg = milligram per kilogram

ng/kg = nanogram per kilogram

5.5.1 Dioxins/Furans

Generally, dioxin exposures to humans are associated with increased risk of severe skin lesions such as chloracne and hyperpigmentation, altered liver function and lipid metabolism, general weakness associated with drastic weight loss, changes in activities of various liver enzymes, depression of the immune system, and endocrine- and nervous-system abnormalities. It is a potent teratogenic and fetotoxic chemical in animals. A very potent promoter in rat liver cancers, 2,3,7,8-tetrachlorodibenzo-pdioxin (2,3,7,8-TCDD) causes cancers of the liver and other organs in animals. Populations occupationally or accidentally exposed to chemicals contaminated with dioxin have increased incidences of soft-tissue sarcoma and non-Hodgkin's lymphoma.

Dioxin-contaminated soil may result in dioxins occurring in a food chain. This is especially important for the general population. It has been estimated that about 98 percent of exposure to dioxins is through the oral route. Exposure as a vapor is normally negligible because of the low vapor pressure typical of these compounds. In the 1980s, a concentration level of 1 ppb 2,3,7,8-TCDD in soil was specified as "a level of concern," based on cancer effects. However, recent studies indicate that end points other than cancer (such as those listed above) are also of concern based on a projected intake from 1 ppb 2,3,7,8-TCDD in soil. Human studies have shown alteration in delayed-type hypersensitivity after exposure to dioxins. National Institute of Occupational Safety & Health (NIOSH) recommends respiratory protection at the "lowest feasible level." Very little human toxicity data from exposure to tetrachlorodibenzodioxins (TCDDs) and/or polychlorinated dibenzodioxins (PCDDs) are available. Health-effect data obtained from occupational settings in humans are based on exposure to chemicals contaminated with dioxins. It produces a variety of toxic effects in animals and is considered one of the most toxic chemicals known. Most of the available toxicity data are from high-dose oral exposures to animals (including tumor production, immunological dysfunction, and teratogenesis).

Very little dermal and inhalation exposure data are available in the literature. It is important for field personnel to remember that although dioxins are toxic and carcinogenic, most of the information is based on exposure to high doses of liquid product. These products are not very volatile, so the major concern is on skin protection and inhalation/ingestion of soil particles. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a 20 ppm threshold limit value (TLV) for 1,4-dioxane (an example of numerous dioxin compounds), lists it as being absorbed through the skin, and lists it as potentially carcinogenic as well as toxic to liver and kidneys. This is typical of health effects for dioxin/furan compounds. Care should be taken especially in sampling product from drums and wells known to contain detectable levels of dioxins. Emphasis will be on working outside in well-ventilated areas using proper PPE (as discussed later in this plan). There is significant variability in dioxin lethality in animals. The signs and symptoms of dioxin poisoning in humans, however, are analogous to those observed in animals.

6.0 Personal Protective Equipment

The appropriate personal protective equipment (PPE) will be selected on a daily or task-specific basis. These PPE selections will be communicated to field personnel during the pre-work briefing, **before the start** of site operations. PPE ensemble shall be selected daily or before each separate task to provide protection against known or anticipated hazards. To obtain maximum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE.

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears or other signs of punctures. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

ANTICIPATED PERSONAL PROTECTIVE EQUIPMENT FOR USE

ANTICIPATED PPE FOR THE PROJECT (CHECK ALL THAT APPLY)
Head Protection
☒ Hard Hat
☐ Climbing Helmut
☐ Sunhat
☐ Other:
Eye & Face Protection
☒ Safety Glasses
☐ Face Shield
☐ Goggles
☒ Sunglasses
☐ Other:
Ear & Hearing Protection
☒ Ear Plugs
☒ Ear Muffs
☐ Flanges
☐ Other:
Hand Protection
☒ Nitrile
☐ Latex
☐ Liners
☐ Leather
☒ Cut resistant/Kevlar
☐ Other:
Feet Protection
☒ Leather Boot (steel toe)
☒ Rubber Boot (steel toe)
☐ Hiking Boot
☐ Hip Wader
☐ Chest Wader
☐ Other:

ANTICIPATED PPE FOR THE PROJECT (CHECK ALL THAT APPLY)
Protective Clothing
☒ High-vis Vest
☐ Tyvek (if dry conditions are encountered, Tyvek is sufficient) (modified Level D or Level C)
☐ Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue) (modified Level D or Level C)
☐ Snake Chaps
☐ Fire Retardant Clothing
☒ Rain gear (as needed)
☐ Long Sleeve Shirt
☒ Layered warm clothing (as needed)
☒ Other: Life Jacket

Additional details of GeoEngineers' **Personal Protective Equipment Program** are presented in Appendix I.

7.0 Personnel Medical Surveillance

Field personnel on this job are ☐; are not ☒ entered in a GeoEngineers provided medical surveillance program.

GeoEngineers employees are required to be in a medical surveillance program when they fall into the category of "Employees Covered" in OSHA 1910.120(f)(2) (or Chapter 296-842 WAC). This includes:

- All employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year.
- All employees who wear a respirator for 30 days or more a year or as required by state and federal regulations.
- All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.
- Members of HAZMAT teams.

8.0 Air Monitoring Plan

Air monitoring for personal exposures will ☐, will not ☒ be implemented as part of this HASP.

Due to the nature of the media of concern (i.e., sediment) and sampling methodology (i.e., grab samples), inhalation of volatiles and/or dust particulates is not expected as sampling activities will be performed under saturated conditions. Other potential exposure routes (skin absorption, ingestion, and eye contact) will be mitigated through the use of PPE and safe work practices.

9.0 Site Control Plan

9.1 TRAFFIC OR VEHICLE ACCESS CONTROL PLAN

Traffic or Vehicle Access Control Plan will ☐, will not ☒ be implemented as part of this HASP.

Sampling equipment utilized for implementation of the field activities requires the use of a research vessel. Therefore, a Traffic/Vehicle Access Control Plan has **not** been developed as part of this HASP.

9.2 SITE WORK ZONES

The work zone for the project is considered to be all working areas onboard the research vessel. Employees should work upwind of the machinery if possible. To the extent practicable, use the buddy system. Do not approach heavy equipment unless you are sure the operator sees you and has indicated it is safe to approach. For this project, the following are established:

- **Exclusion Zone** – An exclusion zone will be established as all working spaces onboard the research vessel/barge. Only persons with the appropriate training will enter this perimeter while work is being conducted in these exclusion zones. Drinking, eating and smoking are not allowed.
- **Reduction Zone** – The reduction zone is established as the at which personnel exit the working area of the research vessel/barge. Used PPE (gloves, rags, etc.) must be placed in a garbage bag prior to exiting the reduction zone. Personnel should wash hands before eating or leaving the reduction zone. Drinking, eating, and smoking are not allowed.
  - ☐ Decontamination, at a minimum, should include removing and disposing of PPE when exiting the exclusion zone and washing your hands. Decontamination may also consist of removing outer protective gloves and washing soiled boots and gloves using bucket and brush provided on site in the contamination reduction zone. If needed, inner gloves will then be removed, and hands and face will be washed in either a portable wash station or a bathroom facility at the site. Employees will perform decontamination procedures and wash before eating, drinking or leaving the site.
  - ☐ Reusable equipment decontamination will include:
    a. Seawater rinse over equipment to dislodge and remove any sediment (deionized water will be used for the samples collected on land);
    b. Washing with a brush and non-phosphate detergent solution (e.g., Liqui-Nox and distilled water);
    c. Distilled water rinse.
- **Support Zone** – The support zone is established as the shoreline or dock areas. Drinking, eating, smoking and using phones are allowed.

9.3 BUDDY SYSTEM

Personnel on site should use the buddy system (pairs), particularly whenever communication is restricted. If only one GeoEngineers employee is on site, a buddy system can be arranged with subcontractor/ contractor personnel.

- Positive communications (within sight and hearing distance or via radio) should be maintained between workers on site, with the pair remaining in proximity to assist each other in case of emergencies. The field team should prearrange other emergency signals for communication when voice communication becomes impaired (including cases of dropped cell phone or radio breakdown) and an agreed upon location for an emergency assembly area.
- All personnel from GeoEngineers and subcontractor(s) should be made aware of safety features during safety tailgate meeting (vessel/barge safety, drill rig shutoff switch, location of fire extinguishers, cell phone numbers, etc.).
- On-site personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus only when they are certain the operator has indicated it is safe to do so. ("Show My Hands Technic" or another agreed sign language).

9.4 SPILL CONTAINMENT PLANS

Will spill containment contingencies be needed on this project? Yes ☐ or No ☒

9.5 SAMPLING, MANAGING AND HANDLING DRUMS AND CONTAINERS

There will be drums or sealed containers on site during this project? Yes ☒ or No ☐

Drums and containers used during the investigation and/or cleanup activities shall meet the appropriate Department of Transportation (DOT), OSHA, U.S. Environmental Protection Agency (EPA) and applicable state regulations for the waste that they contain. Site operations shall be organized to minimize the number of drums or container on-site temporary storage and movement. When practicable, drums and containers shall be inspected, and their integrity shall be ensured before they are moved. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled. Before the drums or containers are moved, all employees involved in the transfer operation shall be warned of the potential hazards associated with the contents. Personnel involved with the coordination of the drum or container's off-site disposal shall ensure that the off-site disposal facility is approved by the GEO Project manager and the Client.

Drums or containers and suitable quantities of proper absorbent shall be kept available and used where spills, leaks or rupturing may occur. Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

Fire extinguishing equipment shall be on hand and ready for use to control incipient fires.

INVESTIGATIVE DERIVED WASTE (IDW) DISPOSAL OR STORAGE

IDW TYPE	ACTION
Sediment	☒ Secured (list method): Contained in an area designated by the Port facility within sealed and secured 35/55-gallon drum
	☒ Other (describe destination, responsible parties): Disposal pending chemical analysis and disposal vendor subcontracting.

9.6 SANITATION

Sanitary facilities are available at Port facilities and local restaurants/businesses and onboard the research vessel/barge.

9.7 LIGHTING

Work is anticipated to be performed during daylight hours. Work may extend slightly into the evening provided adequate lighting is used (e.g. portable flood lights).

10.0 Emergency Response Plan

EMERGENCY EVENT	RESPONSE PLAN
Medical	Call 911.
High Winds	Maritime small vessel restrictions are in effect.
Heavy Rain	Use rain gears as appropriate.

10.1 GENERAL RESPONSE GUIDANCE

- If any member of the field crew experiences any adverse exposure symptoms while on site or an injury, the entire field crew should immediately halt work and act according to the instructions provided by the Site Safety Officer.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team, contact of the PM, and re-evaluation of the hazard and the level of protection required.
- As soon as feasible, notify GeoEngineers' PM and follow the GeoEngineers' Incident Reporting and Investigation Program, and Health and Safety Injury Management Procedures Flowchart (see copy attached to this HASP).
- If an accident occurs, the Site Safety Officer and the injured person are to complete, within 24 hours, an Incident Report (Appendix C) for submittal to the PM, the HSPM, and HR. The PM should ensure that follow-up action is taken to correct the situation that caused the accident or exposure.

10.2 STANDARD EMERGENCY PROCEDURES

- Get help.
  - ☐ Send another worker to phone 9-1-1 (if necessary)
  - ☐ As soon as feasible, notify the GeoEngineers' Project Manager and/or GeoEngineers HSM and follow the GeoEngineers' Incident Reporting and Investigation Program, and Health and Safety Injury Management Procedures Flowchart (see copy attached to this HASP).
- Reduce risk to injured person.
  - ☐ Turn off equipment.
  - ☐ Move person from injury location to safer area (if in life-threatening situation only)
  - ☐ Keep person warm
  - ☐ Perform CPR (if necessary)

- Transport injured person to medical treatment facility (if necessary).
  - By ambulance (if necessary) or GeoEngineers vehicle.
  - Stay with the person at the medical facility.
  - Keep GeoEngineers Project Manager apprised of situation and notify Human Resources Manager of situation.
  - Accidents involving injuries requiring professional medical attention must be reported as soon as feasible to the Site Safety Officer and/or Health and Safety Team.
  - First aid cases not involving professional medical attention must be reported within 24 hours after occurrence.
  - Incidents involving property damage must be reported within 24 hours of occurrence.
  - After-hours illnesses must be reported within 24 hours (i.e. flu, rashes).

Emergency/Hospital Contact Information and Directions are presented in Appendix J.

Appendix A
Site Safety Meeting Record

Site Safety Meeting Record (Daily or Weekly)

Project Name:_____ Project Location:_____
File No.:_____

Site Safety meetings should include a discussion of emergency response, communications and hazards associated with the planned activities. Site safety meeting should be completed prior implementing activities at a minimum in the beginning of each day and/or at a minimum weekly for similar activities performed few consecutive days.

- Use in conjunction with the HASP Hazard Review and ERA Job Hazard Analyses (JHA) Form 3 to help identify hazards with the planned activities and activities performed concurrently by others at the site in the vicinity of the working areas.

Date: _____ **Site Safety Officer (SSO):**_____

Topics: _____

_____

Attendees:

Print Name	**Company**	**Signature**

Appendix B
Functional Responsibility

Appendix B
Functional Responsibility

HEALTH AND SAFETY MANAGER (HSM)

GeoEngineers' Health and Safety Manager (HSM) is responsible for implementing and promoting employee participation in the company Health and Safety Program. The HSM has overall responsibility for the general health and safety of GeoEngineers personnel. The HSM issues directives, advisories and information regarding health and safety to the technical staff. Additionally, the HSM has the authority to audit on-site compliance with HASPs, suspend work or modify work practices for safety reasons, and dismiss from the site any GeoEngineers or subcontractor employees whose conduct on the site endangers the health and safety of themselves or others.

HEALTH AND SAFETY SPECIALIST (HSS)

GeoEngineers' Health and Safety Specialist (HSS) is a designated safety specialist. The HSS provides technical support to the PM and Site Safety Officer (SSO) to ensure that GeoEngineers staff are following GeoEngineers safety program and safe work practices during site activities. The HSS works with the PM and SSO to ensure the subcontractors' crews are following the site general HASPs, the activities HASP/JHAs and safe work practices. The HSS may periodically go on-site to perform safety observations and mentor on-site personnel on safety behavior practices. Additionally, the HSS has the authority to suspend work or modify work practices for safety reasons and dismiss from the site any GeoEngineers or subcontractor employees whose conduct on the site endangers the health and safety of themselves or others. The HSS shall keep the PM and HSM informed of the project's health- and safety-related matters, as necessary.

HEALTH AND SAFETY AUTHORIZED CONSULTANT (HSC)

GeoEngineers' Health and Safety Authorized Consultant is a GeoEngineers employee who is given written authorization to act in the role of a Consultant with regard to Health and Safety on project sites. The HSC provides technical support to the PM and Site Safety Officer (SSO) to ensure that GeoEngineers staff follow GeoEngineers safety program and safe work practices during site activities. The HSC works with the PM and SSO to ensure the subcontractors' crews are following the site general HASPs, the activities HASP/JHAs and safe work practices. The HSC may periodically go on-site to perform safety observations and mentor on-site personnel on safety behavior practices. Additionally, the HSC has the authority to suspend work or modify site work practices for safety reasons and dismiss from the site any GeoEngineers or subcontractor employees whose conduct on the site endangers the health and safety of themselves or others. The HSC shall keep the PM, HSS, and HSM informed of the project's health- and safety-related matters, as necessary.

PROJECT MANAGER (PM)

A PM is assigned to manage the activities of various projects and is responsible to the principal-in-charge of the project. The PM has the responsibility of ensuring the safety of all GeoEngineers personnel on job sites. The PM is responsible for assessing the hazards present at a job site and incorporating the appropriate safety measures for field staff protection into the field briefing and/or Site Safety Plan. He or she is also responsible for assuring that appropriate HASPs are developed. The PM will provide a summary of chemical analysis to personnel completing the HASP. PMs shall also see that their project budgets

consider health and safety costs. The PM shall keep the HSM and HSS or HSC informed of the project's health- and safety-related matters as necessary. The PM shall designate the project Site Safety Officer (SSO) and help the SSO implement the specifications of the HASP. The PM is responsible for communicating information in site safety plans and checklists to appropriate field personnel. Additionally, the PM and SSO shall hold a site safety briefing before any field activities begin. The PM is responsible for transmitting health and safety information to the Site Safety Officer (SSO) when appropriate.

SITE SAFETY OFFICER/HAZWOPER (SSO)

The SSO will have the on-site responsibility and authority to modify and stop work or remove GeoEngineers personnel from the site if working conditions change that may affect on-site and off-site health and safety. The SSO will be the main contact for any on-site emergency situation. The SSO is First Aid and CPR qualified and has current Hazardous Waste Operations and Emergency Response (HAZWOPER) training when working at hazardous waste sites. The SSO is responsible for implementing and enforcing the project safety program and safe work practices during site activities. The SSO shall conduct daily safety meetings, perform air monitoring as required, conduct site safety inspections as required, coordinate emergency medical care, and ensure personnel are wearing the appropriate personal protective equipment (PPE). The SSO shall have advanced fieldwork experience and shall be familiar with health and safety requirements specific to the project. The SSO has the authority to suspend site activities if unsafe conditions are reported or observed.

Duties of the SSO include the following:

- Implementing the HASP in the field and monitoring staff compliance with its guidelines.
- Ensuring that all GeoEngineers field personnel have met the training and medical examination requirements. Advising other contractor employees of these requirements.
- Maintaining adequate and functioning safety supplies and equipment at the site.
- Setting up work zones, markers, signs and security systems, if necessary.
- Performing or supervising air quality measurements. Communicating information on these measurements to GeoEngineers field staff and subcontractor personnel.
- Lead the pre-entry briefing (at the beginning of the site activities) and the site safety meetings (daily and/or weekly), with onsite personnel. These meetings should include a discussion of emergency response, site communications and site hazards associated with the planned activities
- Communicating health and safety requirements and site hazards to field personnel, subcontractors and contractor employees, and site visitors.
- Directing personnel to wear PPE and guiding compliance with all health and safety practices in the field.
- Consulting with the PM regarding new or unanticipated site conditions, including emergency response activities. If monitoring detects concentrations of potentially hazardous substances at or above the established exposure limits, notify/consult with the PM. Consult with the PM, the HSC or HSS, and the HSM regarding new or unanticipated site conditions, including emergency response activities. If field monitoring indicates concentrations of potentially hazardous substances at or above the established exposure limits, the HSM must be notified, and corrective action taken.

- Documenting all site accidents, injuries, illnesses and unsafe activities or conditions and/or near misses, and reporting them to the PM, HSC or HSC and the HSM as soon as practical, but no later than the end of the day.
- Directing decontamination operations of equipment and personnel.

FIELD EMPLOYEES

All employees working on site that have the potential of coming in contact with hazardous substances or chemical, biological, and/or physical hazards are responsible for participating in the health and safety program and complying with the site-specific health and safety plans. These employees are required to:

- Read, participate and be familiar with the GeoEngineers health and safety programs located in SharePoint. Attend to applicable specific safety training.
- Notify the SSO that when there is need to stop work to address an unsafe situation.
- Comply with the HASP and acknowledge understanding of the plan discussed during the health and safety pre-entry briefing
- Review applicable Job Hazard Analysis (JHAs) prior starting a new activity and follow the recommended critical actions to mitigate hazards.
- Think through potential hazards at the beginning of a new task, before changing tasks, and when conditions changes and after a near miss or incident.
- Report to the SSO, PM or HSM any unsafe conditions and all facts pertaining to near misses, incidents or accidents that could result in physical injury or exposure to hazardous materials and/or equipment damage.
- Participate in health and safety training, including initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) course, annual 8-hour HAZWOPER refresher, and First Aid/cardiopulmonary resuscitation (CPR) training.
- Participate in the medical surveillance program, if applicable.
- Any field employee working on site may stop work if the employee believes the work is unsafe.

GEOENGINEERS LABORATORY MANAGER

When GeoEngineers lab use is anticipated, the Laboratory Manager will coordinate the receipt of samples for analysis with the Project Manager. The communication will include historical environmental data and/or field screening results. The Laboratory Manager will ensure all laboratory staff are following SOPs for the soils type or limited chemical constituents. SOPs will be developed and maintained under the direction of the Laboratory Manager and the HSM.

CONTRACTORS UNDER GEOENGINEERS SUPERVISION

Contractors working on the site directly for the Client will have their own Health and Safety Plans or Job Hazard Analysis. Sub-contractors working on the site under GeoEngineers supervision that have the potential of coming in contact with hazardous substances or chemical, biological and/or physical hazards shall have their own health and safety programs and safety plan that is generally consistent with the requirements of this HASP.

Appendix C

Incident Reporting and Investigation Program

GeoEngineers

Incident Reporting and Investigation Program

Revised September 2022

GeoEngineers
Health & Safety World
GEO-CENTRIC BEHAVIOR ACCEPTED SAFETY RULES
HAZARD AWARENESS INDIVIDUAL BEHAVIORS & TALENTS

Table of Contents

Attachments

Incident Reporting and Investigation Program

Purpose

The purpose of the Incident Reporting and Investigation Program is to establish procedures for reporting incidents involving work-related injuries, illnesses, property damage, or near-miss events and guidelines for investigating and implementing corrective measures to prevent reoccurrence. GeoEngineers is committed to the prevention of jobsite engineering, personnel, and security-related incidents and correcting the cause behind any such incidents which occur through easy, safe, and effective incident reporting and investigation programs.

Scope

This program applies to all GeoEngineers employees, project and office locations, unless the Health and Safety Manager grants a variance from the requirements.

Responsibilities

Principals/Associates/Project Managers/Group Leaders/Site Supervisors—Responsible for ensuring that the provisions of this program are implemented and followed at locations in which they have oversight and influence. Including:

- Ensuring employees are aware of incident reporting procedures.
- Immediately reporting up all workplace related injuries, illnesses, and jobsite security incidents which occur in their area of responsibility. Provide written reports of all investigations and planned corrective actions to the Health and Safety Manager.
- Correct identified workplace hazards found in the risk assessment or report up deficiencies they cannot correct.
- Communicate key health and safety regulations to affected employees and ensuring they are aware of jobsite security incidents and reporting procedures.

Health and Safety Manager—GeoEngineers' Health and Safety Manager (HSM) shall monitor and evaluate the Incident Report and Investigation Program for compliance and effectiveness. Improvement opportunities and changes in regulations or other legal requirements shall be promptly addressed. Additional duties include:

- Conduct worksite evaluations in cooperation with supervisors and employees to identify potential hazards and the ways to avoid or correct them to prevent injuries.
- Establish a system for communicating with employees in readily understandable methods relevant and up to date information related to their safety and health.
- Maintain records of activities and training related to incident reporting.
- Review the effectiveness of the incident reporting system and investigation programs with supervisor and employee input at least annually.

Employees—GeoEngineers employees are responsible and accountable for complying with this program. Including:

- Attending all required training programs provided.

- Reporting known or suspected safety hazards to their Supervisor or Safety Coordinator through incident reporting procedures, including injuries and jobsite security incidents, immediately.
- Reporting all workplace related injuries or illnesses to their supervisor.

Definitions

Occupational Safety and Health Administration (OSHA)—part of the United States Depart of Labor and is the agency assigned to enforce the regulations of the Occupational Safety and Health Act of 1970.

OSHA Recordable Incident—an injury or illness that is work related and results in one of the following:

- Death
- Days away from work
- Restricted work activity
- Transfer to another job
- Medical treatment beyond first aid
- Loss of consciousness
- Significant injury or illness diagnosed by a Licensed Health Care Provider (LHCP)

The following are generally considered first-aid treatment (e.g., one-time treatment and subsequent observation of minor injuries) and are not OSHA recordable if the work-related injury does not involve loss of consciousness or any of the case types listed above.

First Aid Treatment: (This is a limited list)

- Using non-prescription medications at non-prescription strength;
- Tetanus immunizations;
- Cleaning, flushing, or soaking surface wounds;
- Wound coverings, butterfly bandages, steri-strips;
- Hot or cold therapy;
- Non-rigid means of support;
- Temporary immobilization device used to transport accident victims;
- Drilling of fingernail or toenail, draining fluid from blister;
- Eye patches;
- Removing foreign bodies from eye using irrigation or cotton swab;
- Removing splinters or foreign material from areas other than the eye by irrigation, tweezers, cotton swabs, or other simple means;
- Finger guards;
- Massages;
- Drinking fluids for relief of heat stress;
- Visits to a Licensed Health Care Provider for observation or counseling;

If first aid, but no medical treatment was given to the injured employee, the incident is not OSHA recordable.

Root Cause Analysis (RCA)—an investigative procedure which helps to determine the most basic cause that can reasonably be identified, that management has control to fix, and for which effective corrective actions for preventing recurrence can be generated.

General Requirements

Work related near-misses, injuries and illnesses must be reported at the time of the incident or as soon as possible afterwards (see flowchart on page 3). Fatalities must be reported within 8 hours and all other incidents within 24 hours. Timely and accurate reporting is necessary for documenting incident details, evaluating preventive and corrective actions, enabling post-incident management and to comply with OSHA recordkeeping requirements.

Whenever possible, reporting should be done online through GeoEngineers Safety Hub website so that the report will be sent out to all relevant parties and archived. Safety Hub can be reached through connect.geoengineers.com or though this link.

An incident investigation shall be conducted for all OSHA defined recordable incidents and work-related incidents resulting in property damage – with or without injuries. First aid and near-misses will also be investigated as necessary by the Health and Safety Manager, for use in sharing lessons learned with the Company. All investigation will be documented in an incident report and if necessary published.

Implementation

Incident Reporting Procedures

Work related injuries and illnesses must be reported at the time of the incident to the affected employee's supervisor, the job site supervisor, project manager, or if none of those are available the current HSM. Initial notification should be verbal, though later reports may be digital or written. If Emergency Medical Services (EMS) are required, dial 911 for an ambulance. If an ambulance is not required, the injured/ill employee should drive or be driven to the medical facility as follows:

- As soon as safe to do so incidents are reported using the Safety Hub Incident Reporting system.
- An employee with a non-emergency illness such as poison ivy or a skin rash, for example can transport him/herself to a facility that provides medical attention.
- Injuries/illness of a more serious nature may require that the employee be driven for medical treatment by another GeoEngineers employee or other available individual.
- Serious accidents (such as those involving fatal injury, staff admitted to a hospital, or excessive property damage) should also be reported to the building or property owner, the police, and the appropriate OSHA or State approved authority. The scene should be left secured and undisturbed, if possible, for the purposes of follow-up investigation.
- Attachment A. Health and Safety Injury Management Procedures Flowchart presents the process for response to an incident utilizing the Safety Hub Incident reporting system.

After an employee is involved in an incident that causes injury or a significant near miss, the employee involved must verbally report it to their Project Manager or Supervisor. The Project Manager or Supervisor shall notify the HSM within one (1) hour of the event or as soon as possible. This must be done regardless of whether there appears to be a significant injury at the time. The employee submits the Incident Report Form using the Safety Hub Incident Reporting system. The employee fills out sections of this form that they know at the time. Based on the type of incident, the employee will receive documents that will be required

for insurance purposes: Vehicle Accidents (Enclosure 1); Property Damage (Enclosure 2); Stolen Equipment (Enclosure 3). A witness statement form is included in Enclosure 1.

Project Manager /Supervisor Immediate Response

When a Project Manager (PM) or Supervisor learns that an employee has been involved in an incident, the priority is to ensure the health and well-being of the employee involved and others on site.

The supervisor also helps to ensure that the incident scene is not disturbed to the extent possible; and that preserving the scene does not interfere with the immediate treatment of any employees. An undisturbed accident scene will provide the best answers as to the cause of the accident during the investigation phase. The scene should be marked off by cones, tape, or guards if necessary to prevent contamination or alteration. If the accident is potentially serious, the Supervisor should, after discussion with PM/HSM, discontinue work until the accident has been investigated and the cause of the accident corrected.

After the injured employee has recovered to the point that they can complete paperwork, they must complete the Employee's section of the Incident Report Form. If medical care is sought, the employee must also complete a claim form for Worker's Compensation.

If the incident caused a fatality, probable fatality, or the hospitalization of two or more persons, the PM or Supervisor shall immediately notify their supervisor, the HSM and Human Resources. The HSM must make a report to State/OSHA within eight (8) hours. In addition to the Company's own internal investigation, State/OSHA may also conduct one as well. The accident scene must be blocked off and left undisturbed until State/OSHA arrives, unless it is necessary to move something to treat the victim(s).

Incident Investigations

Injuries to people, accidents, significant near misses, unsafe conditions and unsafe practices shall be investigated by the HSM or their qualified designee. RCA process shall be used to investigate an incident and implement corrective measures to prevent reoccurrence. All members of the investigation team will be trained and competent in investigations.

Prior to the investigation beginning, all emergency response procedures must be completed, and the incident site must be safe and secure for entry and investigation. All evidence must be recorded and preserved.

An incident investigation should include a thorough review of the following areas:

- Physical conditions at the time of the incident;
- Location of the incident;
- Action of the person injured;
- A description of the injury;
- The methods/procedures in use while conducting work;
- Training of personnel involved;
- Experience level of personnel;
- Date, time, and shift on which incident occurred;
- Other person(s) involved (including subcontractors or client);
- Unusual job conditions

- Routine/Non-routine work;
- Property damage or vehicle;
- Vehicle: To fast? Other causes?

A tool/equipment accident investigation will include a thorough review of the following physical conditions:

- Machines; Guarded? Adjusted? Maintained? Right one for the job?
- Tools: Portable equipment? Proper materials? Proper handling of equipment? Proper tool for job? Condition and correct use of the equipment?
- Environment; Lighting? Floor surface? Vapors, smoke, fumes? Layout – crowded or congested? Noise? Hot or cold?

Basic questions to ask:

- Has a Job Hazard Analysis (JHA) or Health and Safety Plan (HASP) been developed for the job?
- Was the JHA/HASP followed?
- Should changes have been made to procedures?
- Who was involved?
  - Who is the principal lead and/or PM?
  - Who was the incident victim any?
  - What subcontractor(s) were involved?
- What was the incident?
  - Any severe injuries?
  - Name of the project it happened on?
  - Who witnessed the injury?
  - What hospital was the injured person taken to?
  - Any equipment involved?
- When did the incident occur?
  - During work hours or off time?
  - Start of project, middle, or end?
  - Any new employees on site?
- Where did the incident occur?
  - What state?
  - In city or rural? Along road?
    - Traffic Safety Control Plan?
  - What work site?
- Why did the incident happen? (speculate)
  - Where conditions unusual?

- What was the weather like?
- Has the subcontractor been used before?
- What is the safety record on site?
- Did employees receive all safety training for site?

Resources: (Found on Health and Safety Department page)

- Incident Report Form;
- Root Cause Analysis Form;
- Job Hazard Analysis (JHA);
- Safety regulations – OSHA regulations, GeoEngineers Health and Safety Program, Client policies;
- Health and safety training records (Ask Health and Safety Administrator or Office Manager).

When conducting RCA:

- Let people talk, don't ask leading questions;
- Allow for personality traits and don't assign blame;
- Be specific when questioning;
- Get all sides of the story;
- Establish specific corrective actions and dates to prevent a reoccurrence.
- Remember – a copy of the incident investigation report may be requested by external parties (e.g., regulatory agencies, clients, insurance companies, judges, lawyers, etc.). The report must be prepared professionally and must only contain incident facts, not supposition.

GeoEngineers Return to Work program will be referred to, as necessary. Attachment C, Return to Work Arrangements worksheet, is provided for use when an incident requires a doctor's visit or when other than first aid is provided.

Investigation recommendations will be given to the PM of the site of the injury and if beneficial further distributed to relevant employees for educational purposes. Corrective actions will be documented in the investigation report and implemented by the PM and site supervisors.

Training and Record Keeping

Awareness training regarding this program shall be provided during new employee orientation, a manager webinar or brown bag meeting, and periodically through other forms of electronic communication (such as feature safety articles). Additionally, employees working at client sites may need to complete client specific training pertaining to accident/injury prevention and investigation. Training will be documented in Ascent.

Attachments

The following forms shall be used for documenting activities associated with this procedure:

- Attachment A. Health and Safety Injury Management Procedures Flowchart
- Attachment B. Incident Report Form
  - Insurance Report Enclosure 1 — Vehicle Accident
  - Insurance Report Enclosure 2 — Property Damage
  - Insurance Report Enclosure 3 – Stolen Equipment
- Attachment C. Return to Work Arrangements Form

Issued March 1, 2014
Revised August, 2018
Revised September 7, 2022

Attachment A

Health and Safety Injury Management Procedures Flowchart

Key Contacts

HEALTH & SAFETY TEAM

Chad Kean, CIH, CHMM, CPSWQ.....425.284.7256 (desk)
425.515.5340 (cell)

Connor Jordan, H&S Specialist 253.722.2426

OFFICE CONTACTS

OFFICE CONTACTS

Baton Rouge/Houston, Nikki Landry 225.293.2460

Bellingham, Susan Arrigoni 360.647.1510

Boise, Michelle Skow.....208.433.8098

Boston/Southborough, Dawn Tosca/Natalia Lebedeva 617.749.9220/508.283.6354

Portland/Lake Oswego, Colleen Baker.....503.624.9274

Redmond, Jackie Weber.....425.861.6000

Seattle/Tacoma, Lisa Huston 253.383.4940

Springfield, Karla Burgbacher 417.831.9700

Spokane/Kennewick, Laura McCulluch 509.363.3125

INSURANCE QUESTIONS

Emily Dahl.....206.239.3229

GeoEngineers
Health & Safety World
GEO-CENTRIC BEHAVIOR ACCEPTED SAFETY RULES
HAZARD AWARENESS INDIVIDUAL BEHAVIORS & TALENTS

Quick Guide to Incident Response & Reporting

1 Assess

– Call 911 if there is an injury that requires emergency medical treatment.

– Use a first aid kit for injuries that do not require professional medical treatment.

IN A VEHICLE ACCIDENT

Call the police if the roadway is blocked or causing a backup, there are uncooperative parties or significant property damage.

Turn your ignition off, use flashers/ leave lights on and remain in the vehicle (if it's dark).

Don't argue, accuse anyone or admit fault. Keep calm!

*Collect information about the other driver, witness(es) and responding officer (if applicable) for insurance purposes (**see Incident Report—Enclosure 1**) for what to collect.*

If the accident occurs in your personal vehicle, provide your personal contact information to the other driver

Take photos of the vehicle(s), damaged area(s) and license plate(s).

2 Notify

Call Lucas Miller, H&S Manager
509.209.2830 (desk) or 208.451.5307 (cell)
If you cannot reach Lucas, contact Connor Jordan: 253.722.2426

– Call your Group Leader and/or Supervisor if an injury requires professional medical treatment

– Call your Administrative Services Manager if you need assistance with a vehicle after an incident.

3 Document

– Fill out the Incident Report Form via Safety Hub.

– If the Incident Report was successfully submitted via Safety Hub, you should receive a confirmation email. Follow up as needed with the Health and Safety Team, Project Manager and other relevant parties.

GeoEngineers

Health and Safety Injury Management Procedures Flowchart

Assess **Notify** **Document**

Incident Report Documentation

- Incident Report Form
- Vehicle Accident Insurance Enclosure 1
- Property Damage Insurance Enclosure 2
- Stolen Equipment Insurance Enclosure 3
- Root Cause Analysis
- Return to Work Arrangements
- Incident Reporting and Investigation Program

1. Vehicle Accidents

All vehicle incidents/accidents (meaning any damage to a vehicle resulting in marking, scraping, or denting) involving GeoEngineers employees or vehicles, regardless of seriousness, vehicle weight, vehicle ownership, or fault shall be reported as soon as practical, but always within 24 hours.

Serious accidents and accidents involving commercial motor vehicles (those greater than 10,000 lbs) must be reported at the time of the accident. A "serious accident" is one that involves minor or major injuries to a GeoEngineers employee, the general public and/or causes any resultant property damage greater than $1,000.

If the employee is a technical person, report the incident to the Project Manager. The Project Manager will tell the employee's supervisor. If the employee is a non-technical person, report it to their Supervisor.

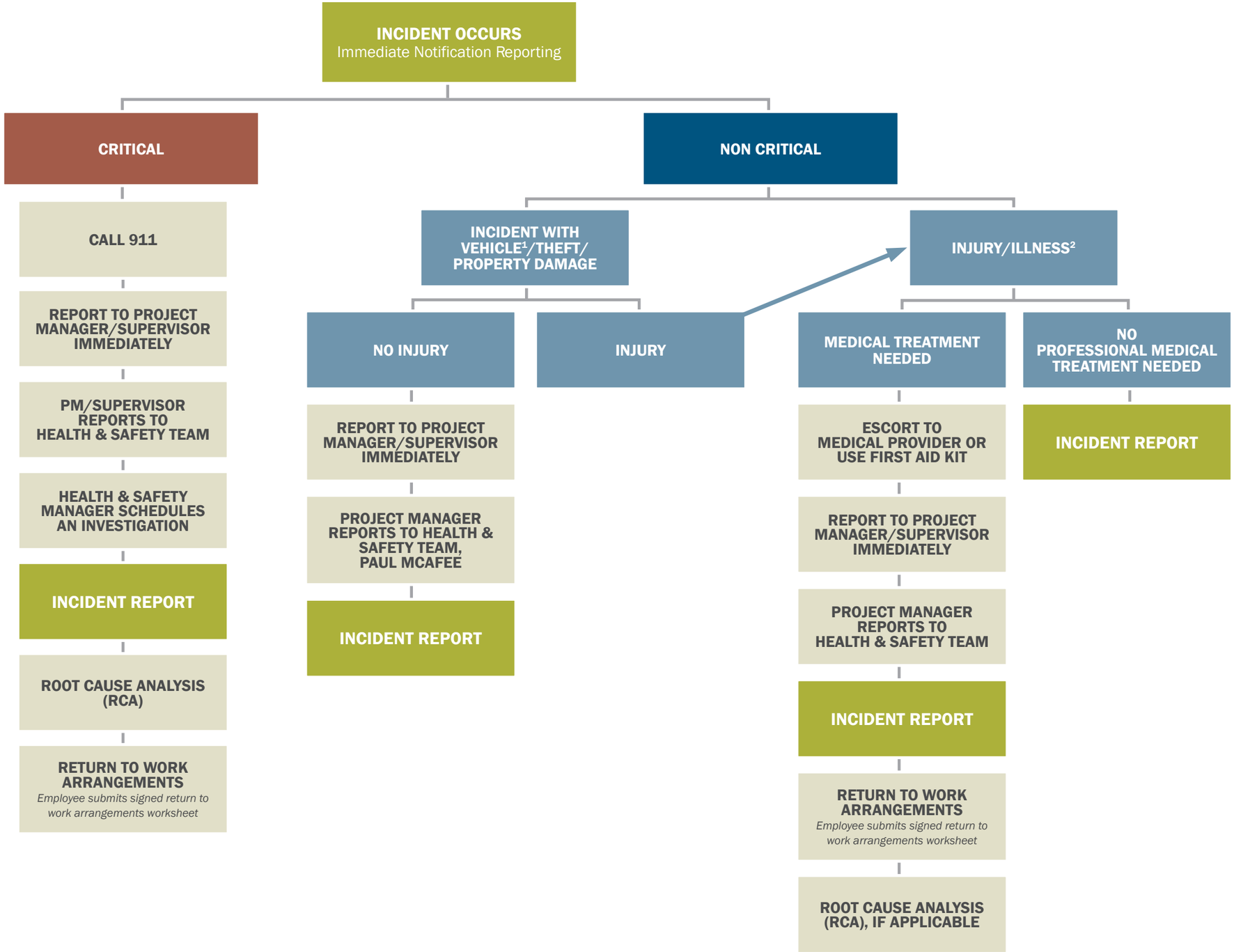
2. Incidents

If Emergency Medical Services (EMS) are required, dial 911 from a cell phone. (Do not use Skype)

If an ambulance is not required, the employee should drive or be driven to the medical facility as follows:

- An employee with a non-emergency illness, such as poison ivy or a skin rash, can transport him/herself for medical attention.
- Injuries/illnesses of a more serious nature require the employee be driven for medical treatment by another GeoEngineers employee, preferably the employee's supervisor.
- Injuries/illnesses that require modified work duties need Return to Work paperwork filled out by physician.

If the employee is a technical person, report the incident to the Project Manager. The Project Manager will tell the employee's supervisor. If the employee is a non-technical person, report it to their Supervisor.



Attachment B
Incident Report Form

Incident Report

INCIDENT INFORMATION

Business Unit:	☐ South ☐ West ☐ Puget Sound ☐ Pipeline ☐ Performance Based Design ☐ Corporate		
Injured/Ill Person's Name:		☐ Employee ☐ Other	
Employee Submitting Report: (if not same)			
Incident Location:		Job Number:	☐ N/A
Incident Date and Time:	☐ AM ☐ PM	Supervisor Name:	
Time Employee Started Work:	☐ AM ☐ PM	Date & Time Supervisor Notified:	☐ AM ☐ PM
Notified Project Manager/PA?	☐ YES ☐ NO ☐ N/A	PM/PA Notified:	
Client Notification Required?	☐ YES ☐ NO ☐ N/A	Person Notified:	

INCIDENT DETAILS

What happened? Describe how the incident occurred. Where the employee was located at the time of incident?			
Describe the activity as well as the tools, equipment, or material being used.			
Describe the part of the body that was affected and how. ☐ N/A			
What level of medical treatment was received?	☐ First Aid ☐ Clinic/Physician ☐ Emergency Room ☐ Refused/None		
State the primary cause and contributing factors.			
Was a JHA/HASP prepared?	☐ YES ☐ NO	Did you perform a TSA before starting work?	☐ YES ☐ NO
How do you think this type of incident could be prevented or avoided in the future?			

INSURANCE DETAILS (CHECK ALL APPLICABLE ITEMS)

Vehicular Accident ☐ (**Complete** Insurance Enclosure 1)	Property (Non-Vehicle) Damage ☐ (**Complete** Insurance Enclosure 2)	
☐ Company Owned	☐ Company (owned, leased rented)	☐ Fire
☐ Rental	☐ Client/Subcontractor	☐ Explosion
☐ Personal	☐ Other	☐ Flash
Stolen Equipment ☐ (**Complete** Insurance Enclosure 3)		

SUPERVISOR COMMENTS

Supervisor Name:		Date:	

PROJECT MANAGER COMMENTS

Project Manager Name:		Date:	

HEALTH & SAFETY REPRESENTATIVE COMMENTS

H&S Representative Name:		Date:	

CORRECTIVE ACTION

H&S Representative Name:		Date:	

Insurance Report Enclosure 1 — Vehicle Accident

Insurance Report—Enclosure 1

VEHICLE ACCIDENT

Accident Information

Employee Name:			
Date of Accident:		Time:	☐ AM ☐ PM
Accident Location (City, State):			

Driver and Vehicle

Name (if not same):			
Office:		Phone Number:	
VIN:			
Vehicle Year/Make/ Model:	☐ Company Owned ☐ Rental ☐ Personal		
Driver's License No.:		License Plate No.:	
Vehicle Damage:			
Estimated Level of Damage	☐ Light ☐ Moderate ☐ Severe		

Witness(es) N/A ☐

Witness 1 Name:			
Phone (Home):		Phone (Work):	
Address:			
Where located at time of accident:			

Witness 2 Name:			
Phone (Home):		Phone (Work):	
Address:			
Where located at time of accident:			

Police N/A ☐

Notified or investigated?	☐ Yes ☐ No	When?	
Name of Officer:			
Station:			
Jurisdiction:	☐ Police ☐ State Patrol ☐ Sheriff		
Badge #:		Case or Report #:	
Was anyone cited?	☐ Yes ☐ No	For what reason?	

Other Vehicle and Driver *N/A* ☐

Name:		Age:	
Phone (Home):		Phone (Work):	
Address:			
Driver's License No.:		License Plate No.:	
Owner's Name *(if different than operator):*			
Phone (Home):		Phone (Work):	
Address:			
Vehicle insured?	☐ Yes ☐ No	By what company?	
Insurance Agent Name:		Agent Phone Number:	
Vehicle Make/Model/ Year			
Damage to other vehicle or property:			
Where can insured vehicle be seen by adjuster?			

Injured Person(s) *N/A* ☐

Injured Name 1:		Age:	
Phone (Home):		Phone (Work):	
Address:			
Nature of Injury:			
Which vehicle were they in?:			
Pedestrian?	☐ Yes ☐ No	Were they treated at the scene or removed by medical aid?	☐ At Scene ☐ Removed

Injured Name 2:		Age:	
Phone (Home):		Phone (Work):	
Address:			
Nature of Injury:			
Which vehicle were they in?:			
Pedestrian?	☐ Yes ☐ No	Were they treated at the scene or removed by medical aid?	☐ At Scene ☐ Removed

Accident Description

What happened just before and at the time of the accident?	
In what direction were you proceeding?	
At what speed?	
Weather?	
Any unsafe conditions contributing to the accident (such as faulty brakes, inclement weather, road obstructions, etc.)?	
Any unsafe acts contributing to the accident (such as turning from wrong lane, speeding, failing to signal, etc.)?	
Who do you believe is at fault for this accident?	

Witness Statement (if applicable)

Witness Name:		Employee Involved Name:	
Accident Date:		Approximate Time of Accident:	☐ AM ☐ PM
Describe the incident in as much detail as possible (attach additional pages if needed).			
Signature of Individual Providing Statement:			
Phone:		Date:	

Insurance Report Enclosure 2— Property Damage

Insurance Report—Enclosure 2

PROPERTY DAMAGE

Incident Information

Employee Name:			
Incident Date:		Time of Incident:	☐ AM ☐ PM
Incident Description:			
Incident Location			
Client Name *(if different than owner)*		Client Phone Number:	
Client Address:			
Contractor that repaired the property and charged for repairs:			
Name and contact information for witnesses:			
Check and attach the following documents, if available:	☐ Copy of contractor's invoice ☐ Pictures taken prior to and after the incident ☐ Copy of police report		

Insurance Report Enclosure 3— Stolen Equipment

Insurance Report—Enclosure 3

STOLEN EQUIPMENT

Incident Information

Employee Name:			
Incident Date:		Approximate Time of Incident:	☐ AM ☐ PM
Incident Location:			
Events leading up to the theft:			
Describe equipment or property, including model and serial number (where applicable):			
Check and attach the following documents, if available:	☐ Invoice for purchase of equipment stolen ☐ Invoice for purchase of replacement equipment ☐ Copy of police report		

Attachment C

Return to Work Arrangements Form

Return to Work Arrangements for GeoEngineers, Inc.

INJURED EMPLOYEE DETAILS

Employee Name:		Work Location:	
Pre-Injury Job Title:			
Pre-Injury Days/Work Hours:			

Describe the specific duties and tasks required. Include any physical and other requirements, e.g. lifting, sitting, rotation of tasks, etc. Employee check the duties that apply to your daily activities. Job Description Attached? □ YES □ NO

☐ Laboratory

- The ability to perform a wide range of physical activities and do heavy work including exerting up to 50 pounds of force occasionally.
- Ability to perform consistent work on PC.

☐ Field Duties

- The ability to perform a wide range of physical activities and do heavy work including exerting up to 50 pounds of force occasionally.
- Limited work-related driving duties.

☐ Roughneck

- Ability to perform a wide range of physical activities and perform heavy manual labor tasks,
- Ability to stand for long periods of time and exert up to 50 pounds of force repeatedly throughout the day as well as 100 pounds of force occasionally.
- Limited work-related driving duties.

☐ Office Duties

- Limited walking, bending, twisting, standing and reaching.
- Normal office environment with moderate noise levels, occasional lifting of up to 25 lbs., regular walking, sitting, bending, twisting, standing and reaching.
- Ability to perform consistent work on PC.

RETURN TO WORK ARRANGEMENTS

Are workplace supports, aids or modifications to be provided: ☐ YES ☐ NO ☐ N/A

Describe workplace supports, aids or modifications, e.g. rest breaks, buddy system, special tools, equipment, training, etc.

Are specific duties or tasks to be avoided: ☐ YES ☐ NO ☐ N/A

Describe the specific duties and tasks that are to be avoided or restricted, e.g. no loading pallets, tasks that are only to be undertaken with the assistance of another worker.

Are there medical restrictions: ☐ YES ☐ NO ☐ N/A

Describe the restrictions below. From what date or period(s) do these restrictions apply?

List hours of work and gradual increases in hours, if restrictions are recommended.								
Week	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**	**Total Hours**
1								
2								
3								
4								

KEY PEOPLE INVOLVED

Employee

I will participate in these return to work arrangements.

Name:		Signed:	
Phone:		Date:	

Physician

These return to work arrangements are consistent with the worker's capacity.

Name:		Signed:	
Phone:		Date:	

Health & Safety Manager

I will monitor and review these return to work arrangements.

Name:		Signed:	
Phone:		Date:	

Supervisor

I will implement these return to work arrangements in the work area.

Name:		Signed:	
Phone:		Date:	

ADDITIONAL INFORMATION

Please attach any supporting documentation e.g. medical reports, position description, photos etc. that support this form.

Please return completed form to:

Lucas Miller, GeoEngineers, Inc. Health and Safety Manager

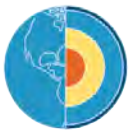
Telephone: (509) 209-2830 | Email: lmiller@geoengineers.com

Appendix D
Cold Stress Prevention Program

GeoEngineers

Cold Stress Prevention Program

Revised August 2020



GeoEngineers
Health & Safety World
GEO-CENTRIC BEHAVIOR ACCEPTED SAFETY RULES
HAZARD AWARENESS INDIVIDUAL BEHAVIORS & TALENTS

Table of Contents

Cold Stress Prevention Program

Purpose

This program establishes GeoEngineers' requirements for the prevention of work-related injuries and illnesses resulting from participating in outdoor field work during cold weather conditions.

Scope

This program applies in its entirety to GeoEngineers employees and locations unless the Health and Safety Program Manager grants a variance from the requirements.

Responsibilities

Principals/Associates/Project Managers—Responsible and accountable for ensuring that the provisions of this program are implemented and followed at all projects for which the Principal/Associate or Project Manager has oversight and responsibility.

Group Leaders/Field Supervisors—Responsible and accountable for ensuring compliance with this program within their areas of responsibility and at their work sites on a daily basis. All supervisors must lead by example to promote cold stress awareness and enact practices to protect their staff in high temperature conditions. Supervisors will be trained capable of identifying cold injury symptoms.

Health and Safety Coordinators—Responsible for assisting in the implementation of activities associated with this program.

Health and Safety Program Manager—GeoEngineers' HSM shall monitor and evaluate the Cold Stress Prevention Program for compliance and effectiveness. Improvement opportunities and changes in regulations or other legal requirements will be promptly incorporated under their direction.

Employees—GeoEngineers' employees are responsible and accountable for complying with this program. Employees who will be working in high cold and high risk conditions will be trained to detect cold injury symptoms and avoidance work procedures.

Definitions

Acclimatization—the physiological changes that take place after prolonged exposure to cold which help the body maintain a warm core temperature. Acclimatization takes place over several days, with the greatest benefit occurring during the first four to five days. However, acclimatization is reversible after cessation of exposure.

Abnormal Temperature—abnormal or extreme cold weather conditions that can expose workers to cold stress. In this condition, work performance is likely to become impaired before any clinical/observable effects are produced. Illnesses caused by exposure to temperature extremes are progressive and can be life-threatening.

Cold Stress—the condition that occurs when the rate of the body heat loss exceeds the rate of heat production. Meaning the body cannot adequately warm itself. Injuries related to cold stress include frostbite, chilblains and, when severe, hypothermia, which can result in death if not addressed.

Frostbite—the destruction of body tissues by freezing (usually exposed skin on the face, and extremities such as ears, fingers, and toes). Circulation of blood in these tissues is slowed and eventually stopped; the skin appears waxy white and becomes numb.

Hypothermia—a life-threatening condition in which the body's core temperature falls below the normal temperature of 98.6°F because of the sudden and radical lowering of body temperature or because of prolonged exposure to cold.

Chilblains—often mistaken for frostbite, chilblains is a medical condition which occurs in cold and humid conditions. The primary effects are tissue damage to the blood vessels, most often in extremities such as the fingers, nose, ears, and toes. Affected regions often appear swollen, inflamed, and red or dark blue with accompanying pain or itchy sensations.

Wind Chill— the result of the wind on still-air temperature that increases its cooling effect on exposed skin. Table 2 shows the wind chill for various still-air temperatures and wind speeds.

General Information

Staff become hypothermic from two primary sources: (1) the environmental conditions in which they work in and (2) from personal conditions including health and clothing worn.

Cold stress can occur even in temperatures one may not consider "cold". An individual's level of acclimatization affects their body's ability to handle cold conditions and how susceptible it is to cold stress injury. Employees who are acclimated to warm conditions must be given time to acclimate to cold conditions before serious exposure is risked. Acclimation can take up to two weeks for most individuals.

Signs and Symptoms of Cold-related illness

Table 1 below provides examples of cold-related illness, symptoms, and first aid measure to take to treat the illness. Project Managers and Supervisors should be familiar with these types of cold-related illnesses and the response measures to take to ensure staff safety.

Field Staff shall use the following as a guide for recognizing the signs and symptoms of cold-related illnesses to prevent the onset of cold-related injuries.

TABLE 1. COLD-RELATED DISORDERS INCLUDING SYMPTOMS, SIGNS, CAUSES AND STEPS FOR FIRST AID

Disorder	Symptoms	Signs	Causes	First Aid
Hypothermia	Chills; Pain in extremities; Fatigue or drowsiness.	Euphoria in late stages; Slow, weak pulse; Slurred speech: Collapse; Shivering; Unconsciousness; Body temperature < 95F (35C).	Excessive exposure, exhaustion or dehydration, subnormal tolerance, drug/alcohol abuse.	Move to warm area and remove wet clothing. Modest external warming (external hear packs, etc.). Drink warm, sweet fluids if conscious. Transport to hospital.

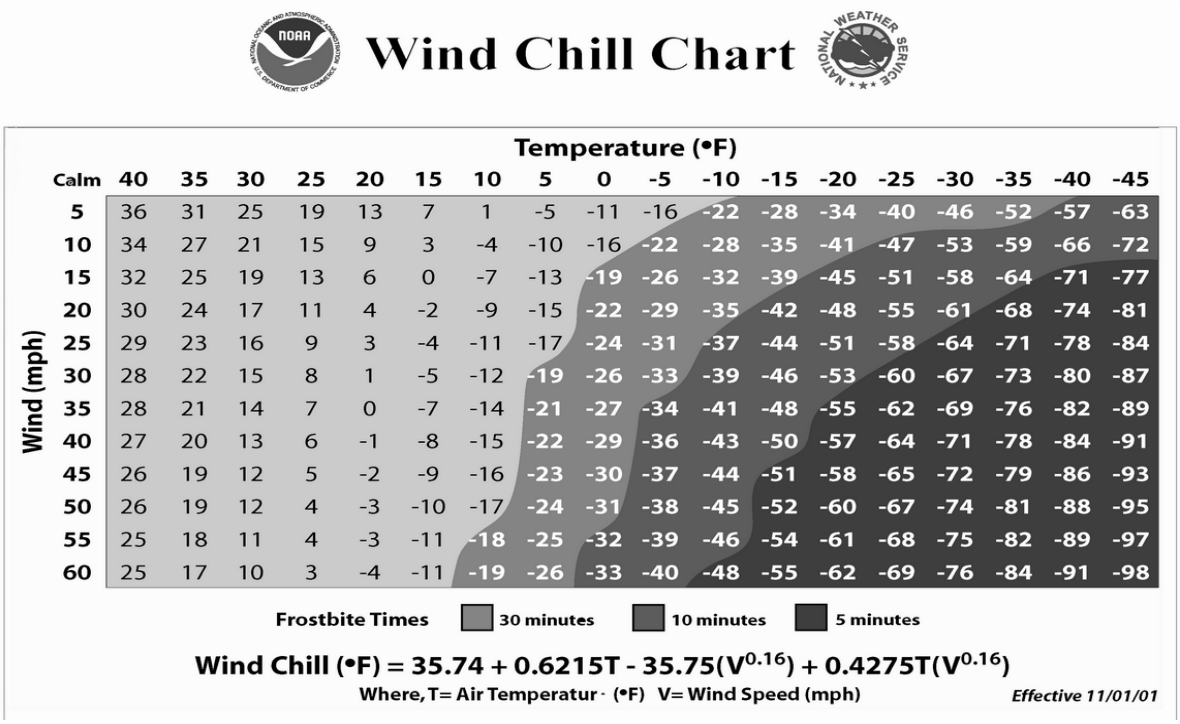
Disorder	Symptoms	Signs	Causes	First Aid
Frostbite	Burning sensation at first. Coldness, numbness, tingling.	Skin color white or grayish yellow to reddish violet to black. Blisters. Response to touch depends on depth of freezing.	Exposure to cold, vascular disease.	Move to warm area and remove wet clothing. Give external warming (put close to heat source, use body heat etc.). Drink warm, sweet fluids if conscious. Transport to hospital.
Frostnip	Possible itching or pain.	Skin color white	Exposure to cold (above freezing) and dampness.	Similar to frostbite.
Trench Foot	Severe pain; Tingling, itching.	Edema; Blisters; Response to touch depends on depth of freezing.	Exposure to cold (above freezing) and dampness. Can occur in conditions as warm as 60°F if the affected area is constantly wet.	Similar to frostbite.
Chilblains	Burning or itching sensation; Inflammation of affected areas (usually extremities);	Skin discoloration (red or dark blue); Blisters in affected area	Exposure to cold, poor blood circulation. Can occur in conditions as warm as 60°F if the affected areas are repeatedly exposed to cold.	Similar to frostbite. Can also warm affected area in warm water. Vitamin B improves circulation and may also be effective.

Determining Risk: Wind Chill

The actual temperature felt by employees working in the field will vary based on environmental conditions. Primarily the weather in the operational area. Windy and wet weather can increase the stress put on the body and further decrease the temperature an exposed field worker experiences.

Table 2 below shows how wind chill affects the actual temperature felt by an average, healthy individual without protective gear on. It also shows how long on average such a person can be exposed to that temperature before they start to suffer from frostbite. Project Managers and Supervisors should be familiar with the types of cold-related illnesses and symptoms and take appropriate measures to ensure employee safety.

TABLE 2. WIND-CHILL EQUIVALENT TEMPERATURES (°F)



Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperatur · (°F) V= Wind Speed (mph) *Effective 11/01/01*

National Oceanic and Atmospheric Administration and National Weather Service Wind Chill Chart.

Where acceptable temperature cannot be maintained, all outdoor work should be scheduled so as to minimize exposure to extreme temperatures. Consideration should be given to thermal conditions when new equipment or work processes are to be introduced into the workplace.

Temperature and conditions in the work area should be monitored. Job Hazard Analysis and Site Safety Plans include the following and will be discussed in the Field Briefing before the project starts and ensured in Task Safety Assessment that are a part of every jobs Job Hazard Analysis/Site Safety Plan:

- Walkways and travel ways shall be sanded, salted, or cleared of snow and ice as soon as possible.
- Cold weather supplies should be regularly inspected and restocked.
- Consider other factors that would exacerbate the situation (for example: wet clothing, wind chill).
- Employees working in cold weather conditions are under constant protective observation by a co-worker or supervisors. We work in teams of two to ensure safety.
- Warm beverages should be made available.

Employees are required to dress appropriately for the relevant working conditions, including normal weather extremes. Limiting the time of exposure and wearing protective clothing will reduce the dangers of exposure to cold. Clothing should:

- Be loose-fitting and multi-layered to trap warm air in layers;

- Allow perspiration to escape before condensation occurs; and
- Be weatherproof/rainproof.

Monitoring

Temperature and conditions in the work area that pose a risk should be monitored by the Project Manager or Supervisory personnel to prevent employees from being overexposed (See table 2).

Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) shall be used as appropriate.

- Gloves shall be made available when air temperatures fall below 60°F for sedentary work, 40°F for light work and 20°F for moderate work. When selecting gloves, be sure to purchase cold-condition gloves which are rated for the temperatures you will be facing. A good source for cold-condition gloves is found here.
- If work is to be performed with bare hands for more than 20 minutes in an environment <40°F, then the use of warm air jets, radiant heaters or contact warm plates should be evaluated and implemented to keep workers' hands warm.
- Total body protection is required when work is to be performed in environments with temperatures <20°F. This shall consist of clothing for the trunk and extremities and shall include an insulated head liner (providing head, ear and full face coverage), heavy socks, insulated steel-toed/steel-shank boots, insulated long underwear and insulated body coverall.
- If there is potential for clothing to become wet, then the outer layer of clothing shall be water repellent/proof.
- If body clothing is insufficient in preventing the sensation of cold or frostbite, then work activities shall be terminated until more appropriate clothing is obtained or weather conditions improve.
- Cold-weather footwear should be waterproof and insulated, with deep treads to enable grip on icy or snowy surfaces. Insulated and/or wool socks are also recommended.

Other Considerations

Depending on the situation, other considerations include:

- Shield the immediate work area with vehicles or tarps to reduce the cooling effects of the wind.
- Individuals suffering from diseases or who are taking medication which interferes with normal body temperature regulation shall not be allowed to work in temperatures <30°F. Employees shall notify supervisor when these conditions exist.
- Avoid overexertion. Cold weather itself, without any physical exertion, puts an extra strain on the heart. Take caution when shoveling snow, walking fast, cleaning tanks, etc.
- The insulating properties of protective clothing are greatly reduced when that clothing becomes wet, either from contact with water or from sweating. Therefore, wet clothing shall be immediately replaced.

- Remember to drink often to stay hydrated. The body expends extra energy to keep itself warm in cold environments, and all energy expenditures require water. An individual may not feel the need to drink in cold weather due to ambient conditions but should drink water regularly regardless. Warm water-based beverages are also acceptable.
- Icy or snowy conditions can create slip hazards for both pedestrian traffic and vehicular traffic. Even small amounts of ice or snow can cause an employee to lose footing or a vehicle to momentarily lose traction. To prevent this, employees should wear appropriate cold-weather boots with deep lug-soles which can provide better grip on icy or snowy surfaces. For vehicles, employees should keep on hand a vehicle-compatible set of chains or wires to install on their vehicles. It is recommended that employees practice putting on their chains/wires in non-emergency conditions prior to having to use them in an emergency. If hazardous slip conditions exist which might require crampons or heavy chains on vehicles, they should be avoided if possible.

Work Stoppage Requirements

In extreme conditions, cessation of work or early release from work may become necessary to ensure worker safety. Table 3, shown below, of this program provides an example for when cessation of work may be necessary based strictly on ambient temperature and wind conditions alone. Multiple other factors play a part in the decision to cease work due to extreme cold weather, including:

- Clothing worn or immediately available to employees in the event of an unforeseen weather shift.
- Road conditions and the distance employees must travel to return home.
- Levels of fatigue that employees on site are experiencing which may impede their driving abilities on the drive home.
- Weather reports for future which indicate un-mitigatable cold weather conditions are incoming.

Due to the varied conditions of GeoEngineers work sites, employee readiness, and the shifting nature of weather, set “limits” which when surpassed mean work on-site must cease must largely be calculated and implemented by the Health and Safety Coordinators or other supervisors on site with employee input.

TABLE 3. GENERIC WORK/WARM-UP SCHEDULE FOR 4 HOUR SHIFTS

Air Temperature -- Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C	°F	Max Work Period	# of Breaks	Max Work Period	# of Breaks	Max Work Period	# of Breaks	Max Work Period	# of Breaks	Max Work Period	# of Breaks
-26 to -28	-15 to -19	Normal Breaks		Normal Breaks		75 min	2	55 min	3	40 min	4
-29 to -31	-20 to -24	Normal Breaks		75 min	2	55 min	3	40 min	4	30 min	5
-32 to -34	-25 to -29	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35 to -37	-30 to -34	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38 to -39	-35 to -39	40 min	4	30 min	5	Non-emergency work should cease					
-40 to -42	-40 to -44	30 min	5	Non-emergency work should cease							
-43 & below	-45 & below	Non-emergency work should cease									

(Schedule applies to any 4-hour work period with moderate to heavy work activity; with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g. lunch) at the end of the 4-hour work period in a warm location.

Training

Awareness training may be provided to effected staff and managers through in-person training, Ascent, at staff meetings or field briefings. Select field personnel may receive annual training through HAZWOPER refresher or other expanded training

The training should cover the following issues:

- Identification of the causes, signs and prevention of cold stress.
- General awareness of personal factors that may increase susceptibility to cold-related illness including, but not limited to, an individual's age, degree of acclimatization, medical conditions, drinking water consumption, alcohol use, caffeine use, nicotine use and use of medications that affect the body's responses to cold. This information is for the employee's personal use.
- The importance of acclimatization.
- The importance of wearing proper cold-weather PPE.
- The importance of immediately reporting signs or symptoms of cold-related illness in either themselves or in co-workers to the person in charge and the procedures the employee must follow including appropriate emergency response procedures.

Recordkeeping

Training will be documented by a sign-in sheet, quiz, or other field-based form (to include a brief description of the training and trainer's name) and the date will be documented in site files and/or GeoEngineers' Ascent.

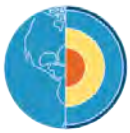
Revised December 2019
Revised April 2020
Revised August 2020

Appendix E
Heat Stress Prevention Program

GeoEngineers

Heat Stress Prevention Program

Revised April 2020



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GEO-CENTRIC BEHAVIOR ACCEPTED SAFETY RULES
HAZARD AWARENESS INDIVIDUAL BEHAVIORS & TALENTS

Table of Contents

Heat Stress Prevention Program

Purpose

This program establishes GeoEngineers guidelines for the prevention of work-related injuries and illnesses resulting from participating in outdoor field work during hot weather conditions.

Scope

This program applies in its entirety to all GeoEngineers employees and locations unless the Health and Safety Manager grants a variance from the requirements.

Responsibilities

Principals/Associates/Project Managers—Responsible and accountable for ensuring that the provisions of this program are implemented and followed at all projects for which the Principal/Associate or Project Manager has oversight and responsibility.

Group Managers/Field Supervisors—Responsible and accountable for ensuring compliance with this program within their areas of responsibility and at their work sites on a daily basis. All supervisors must lead by example to promote heat stress awareness and enact practices to protect their staff in high temperature conditions. Supervisors will be trained capable of identifying heat injury symptoms.

Health and Safety Coordinators—Responsible for assisting in the implementation of activities associated with this program.

Health and Safety Program Manager—GeoEngineers' HSM shall monitor and evaluate the Heat Stress Prevention Program for compliance and effectiveness. Improvement opportunities and changes in regulations or other legal requirements will be promptly incorporated under their direction.

Employees—GeoEngineers' employees are responsible and accountable for complying with this this program. Employees who will be working in high heat high risk conditions will be trained to detect heat injury symptoms and avoidance work procedures.

Definitions

Acclimatization—the positive physiological changes that take place after prolonged exposure to heat, which partly involve increased sweat production. Core body temperature can be controlled within acceptable limits, and the body then becomes accustomed to a hot environment. Acclimatization takes place over several days, with the greatest benefit occurring during the first four to five days.

Dehydration—the loss or deficiency of water in body tissues, which may be caused by perspiration, vomiting or diarrhea. Symptoms include excessive thirst, nausea and exhaustion.

Heat Cramps—often the first sign of heat stress or heat exhaustion. Symptoms include painful muscle spasms, sweaty skin and normal body temperature.

Heat Exhaustion—caused by stress on body organs and includes poor blood circulation from insufficient cardiovascular function or dehydration. Symptoms include moist, clammy skin, weakness and fatigue, nausea and vomiting, slightly elevated temperature, headache and disorientation.

Heat Index— also occasionally known as apparent temperature, is what the temperature feels like to the average human body in direct sunlight when relative humidity is combined with ambient temperature.

Heat Stress—there are three forms of heat stress: Heat Cramps, Heat Exhaustion and Heat Stroke. The risk of heat-related disorders and accidents increases substantially with increasing heat stress.

Heat Strain—the series of physiological responses to heat stress. These responses reflect the degree of heat stress. When the strain is excessive for the exposed individual, a feeling of discomfort or distress may result, and, finally, a heat disorder may ensue. The severity of strain will depend not only on the magnitude of the prevailing stress, but also on the age, physical fitness, degree of acclimatization and dehydration of the worker.

Heat Stroke—the most extreme and serious form of Heat Stress. In this life-threatening condition, the body's temperature regulation mechanism has failed, and the victim's temperature is rising to critically high levels. Symptoms include hot, dry, red skin, mental confusion, convulsions and possible loss of consciousness.

Humidity (Relative)—the ratio of the water vapor content of air to the maximum possible water vapor content of air at the same temperature and air pressure.

Wet Bulb Globe Temperature (WBGT)—a measure of relative heat stress in direct sunlight taking into account multiple factors including: temperature, humidity, wind speed, sun angle and cloud cover.

General Information

Staff become overheated from two primary sources: (1) the environmental conditions in which they work and (2) the internal heat generated by physical labor.

Heat-related illnesses occur when the body is not able to lose enough heat to balance the heat generated by external heat sources and/or physical work.

Signs and Symptoms of Heat-related Illness

Table 1. provides examples of heat-related Illness, symptoms and first aid measures to take in the event of heat overexposure. Project Managers and Supervisors should be familiar with these types of heat-related illnesses and the response measures to take to ensure staff safety.

Field Staff shall use the following as a guide for recognizing the signs and symptoms of heat-related illnesses to prevent the onset of heat-related injuries.

TABLE 1. HEAT-RELATED ILLNESSES: SYMPTOMS AND FIRST AID

Heat-related Illness	Symptoms	First Aid
Heat Fatigue	Weakness; impaired motor skills; reduced ability to concentrate	Take a short break in a cooler area. Pushing yourself to work through the condition can lead to a more serious illness.
Heat Cramps	Painful muscle spasms caused by salt imbalances in the body because of sweating	Drinking sodium (electrolyte) replacement liquids may not eliminate the pain but helps during recovery. Prevent by drinking small amounts of water every 15 to 20 minutes – even if you aren't thirsty.
Heat Rash	Irritation, especially where skin is wet with sweat or clothing is tight.	Move to cooler area. Wash and change clothing.
Heat Collapse	A person suddenly faints. Happens when the brain doesn't get enough oxygen because the blood has pooled in the victim's arms or legs.	Remove the victim to a cooler area to lie down during recovery. Do not give liquids to an unconscious person.
Heat Exhaustion	Headache, nausea, dizziness, thirst and giddiness. Can lead to vomiting and/or fainting. Victim has pale, clammy (moist) skin.	Remove victim to a cool, shaded area. Give water if the victim is alert and not nauseated. Don't leave the person alone. Cool the victim with a spray mist or wet cloth. If the person does not feel better in a few minutes, call for emergency help.
Heat Stroke	Victim has dry, pale skin (no sweating) or hot, red skin (looks like a sunburn) and is confused. Victim may have seizures and pass out.	Call for emergency assistance immediately. Remove the victim to lie down in a cool, shaded area. Don't leave the person alone. If the victim is alert and not nauseated, give water. Cool the person. Place ice packs under the arm pits and in groin area.

Determining Risk: The Heat Index Value

A Heat Index (HI) value is a measure of the synergistic effects of ambient temperature and humidity at a work area. This combined value better reflects the heat conditions as felt by field staff. Using a HI value is a superior metric to just using temperature alone when forecasting heat risk.

TABLE 2. HEAT INDEX VALUES

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

TABLE 3. HEAT INDEX VALUE RISK LEVEL DEFINITIONS

Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91°F to 103°F	Moderate	Implement precautions and heighten awareness
103°F to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive protective measures

To determine daily HI, obtain the expected peak ambient temperature and humidity for that workday. On the table above, find the junction between the row containing the peak humidity and the column of the peak temperature.

A HI's color reflects its' risk (Table 3.). A HI falling in the deep red zone indicates a need to enact the highest level of heat precautions for field staff. That HI value is the starting point for mitigative planning.

Additional risk factors should include:

- Work in direct sunlight - adds up to 15 degrees to the heat index.
- Performance of prolonged or strenuous work.
- Use of heavy protective clothing or impermeable suits dramatically increases heat stress risk.
- This information is also available for reference by downloading the OSHA-NIOSH Heat Safety APP here

For work occurring in Washington State (WAC 296-307-09710) between May 1 through September 30, heat related protections become required when the following clothing-influenced Outdoor Temperature Action Levels (Table 4) are met. Protective measures are discussed in the next section.

TABLE 4. WASHINGTON STATE HEAT STRESS PREVENTION ACTION LEVELS

Outdoor Temperature Action Levels	
All other clothing work clothing	89°F
Double-layer woven clothes including coveralls, jackets and sweatshirts	77°F
Nonbreathing clothes (raincoats) including vapor barrier clothing or PPE such as chemical resistant coveralls	52°F

Protecting Field Staff from Heat-related Illness

Whether planning for heat exposures based on HI values (Tables 2 and 3), or under Washington State regulations (Table 4), the same precautions will be met. GeoEngineers field Supervisors/Project Managers will ensure the following are performed:

1. Field Supervisors must be properly trained to and actively observe staff for alertness and signs/symptoms of heat illness prior to supervising employees.
2. Field Supervisors must maintain effective communication at all times with heat exposed employees.
3. GeoEngineers will have ensure that all effected staff will have access to sufficient drinking water throughout the shift; and will communicate the benefit of maintaining hydration.
4. Field Supervisors will consider the recommended Work/Rest Cycle when staffing projects.
5. Field Supervisors will be aware and plan accordingly when using newly hired or transferred field staff allowing for a heat acclimatization period when determined appropriate.

Hydration Requirements and Replenishing Sodium

Water loss should be balanced with water intake. To stay hydrated, a minimum consumption rate of 1 gallon of water per day is recommended. This rate may be elevated as exertion levels or clothing requirements increase sweat and respiration water loss. During exertive work, staff should drink 5 to 7 ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body. Additionally, some sodium must be replenished in the body daily to keep muscles and nerves working properly.

Keep these hydrations tips in mind when planning for hot weather field work:

- Fluids should be replaced frequently in amounts of at least 1 gallon per day.
- Offered water shall be kept cool.
- Sodium (electrolyte) replacement can be in the form of a commercial non-caffeinated sports drink. Salted food items may also be used so long as it is balanced with water intake.
- Avoid excessive caffeine (including coffee and tea), which may lead to dehydration.

When working in Washington, GeoEngineers is required to make up to 1 quart of water per hour available for workers regardless of actual consumption. This volume can be resupplied throughout a workday as needed.

Appropriate Dress

Staff should dress appropriately for the heat expected. Keeping clothing protective and comfortable but not overly heat retaining is the goal for all field work. General recommendations for clothing follow.

High Heat Work Clothing should be:

- Light colored
- Lightweight – as light as the work performed allows (PPE matches task)
- Natural breathable fibers
- Brimmed hats (when appropriate)
- Cooling vest, neck "gaiters" or cooling bandanas may be helpful in some cases

Rest Breaks and Acclimatization

When HI values are high or work tasks require medium to heavy exertion, breaks should be taken periodically throughout the day to avoid over-heating.

Every person on the job site may have a different tolerance for heat and exertion. Staff should be encouraged to know their personal limits and to take breaks as necessary. Field Supervisors should be knowledgeable of those limits and plan accordingly.

Heat acclimatization is a physiological process that allows workers to gradually take on larger workloads in higher than normal heat environments. Full acclimatization can take up to 2 weeks. If a previously acclimated staff member is away from heat for more than 2 weeks, they may need to undergo another acclimatization process.

The National Institute for Occupational for Safety and Health (NIOSH) recommendations for high HI work/rest cycles are provided in Table 5, below. Dark red boxes indicate the highest risk conditions for heat injury. Note the assumptions used to developed Table 5 listed beneath the table. If these assumptions are exceeded, refer to Table 6 for corresponding additive temperature adjustments.

TABLE 5. NIOSH WORK/REST CYCLE SCHEDULE RECOMMENDATIONS

Temperature (°F)	Light Work Minutes Work/Rest	Moderate Work Minutes Work/Rest	Heavy Work Minutes Work/Rest
90	Normal	Normal	Normal
91	Normal	Normal	Normal
92	Normal	Normal	Normal
93	Normal	Normal	Normal
94	Normal	Normal	Normal
95	Normal	Normal	45/15
96	Normal	Normal	45/15
97	Normal	Normal	40/20
98	Normal	Normal	35/25
99	Normal	Normal	35/25
100	Normal	45/15	30/30
101	Normal	40/20	30/30
102	Normal	35/25	25/35
103	Normal	30/30	20/40
104	**Normal**	**30/30**	**20/40**
105	Normal	25/35	15/45
106	45/15	20/40	**Caution**
107	40/20	15/45	**Caution**
108	**35/25**	**Caution**	**Caution**
109	30/30	**Caution**	**Caution**
110	15/45	**Caution**	**Caution**
111	**Caution**	**Caution**	**Caution**
112	**Caution**	**Caution**	**Caution**

Assumptions: workers are physically fit, well-rested, fully hydrated, under age 40, and environment has 30% humidity and perceptible air movement.

TABLE 6. TEMPERATURE ADJUSTMENTS FOR NIOSH WORK/REST CYCLE TABLE

Environmental Conditions	Humidity
Full sun (no clouds): Add 13 °F	40% Humidity: Add 3°F
Partly cloudy/overcast: Add 7 °F	50% Humidity: Add 6°F
In shade or at night: No adjustment	60% Humidity: Add 9°F

Shelter (Shade) from the Sunlight

Periodic access to shade should be available to staff as respite from heat generated by direct sunlight. Field tarps or canopies are acceptable whenever air-conditioned spaces/work vehicles are not available. Workers should be encouraged to take off unnecessary PPE when at rest to permit rapid cooling. Fans are also useful cooling aides, when feasible.

Additional Factors in Heat Management Planning

Project Managers and Field Staff should the following additional guidelines when planning field events:

- Consider a worker's physical condition when determining fitness to work in hot environments. Obesity, lack of conditioning, pregnancy and inadequate rest can increase susceptibility to heat stress.
- Schedule strenuous physical activity at the beginning and end of the day, when external temperatures may be cooler.
- Consider the effects of medications being taken (such as for heart conditions) or treatments (such as low-sodium diets) that can increase the risk from heat exposure.
- Seek medical advice when symptoms of heat stress appear. Contact your Project Manager or Health and Safety Manager for assistance if needed.
- Your plan for heat risk reduction should be part of your site-specific health and safety plan or job hazard analysis.
- Wet Bulb Globe Temperature (WBGT) Meters can be obtained on a per project basis if required. Contact your Project Manager for additional information if this is a contractual need.

Training

Awareness training may be provided to effected staff and managers through in-person training, Ascent, at staff meetings or field briefings. Select field personnel may receive annual training through HAZWOPER refresher or other expanded training.

The training should cover the following issues:

- The environmental factors that contribute to the risk of heat-related illness.
- General awareness of personal factors that may increase susceptibility to heat-related illness including, but not limited to, an individual's age, degree of acclimatization, medical conditions, drinking water consumption, alcohol use, caffeine use, nicotine use and use of medications that affect the body's responses to heat. This information is for the employee's personal use.
- The importance of removing heat-retaining personal protective equipment such as non-breathable chemical-resistant clothing during all breaks.
- The importance of frequent consumption of small quantities of drinking water or other acceptable beverages.
- The importance of acclimatization.

- The different types of heat-related illness, the common signs and symptoms of heat-related illness.
- The importance of immediately reporting signs or symptoms of heat-related illness in either themselves or in co-workers to the person in charge and the procedures the employee must follow including appropriate emergency response procedures.

Recordkeeping

Training will be documented by a sign-in sheet, quiz, or other field-based form (to include a brief description of the training and trainer's name) and the date will be documented in site files and/or GeoEngineers' Ascent.

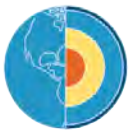
Issued January 1, 2010
Revised June 1, 2015
Revised April 6, 2020

Appendix F
Working Over Water Safety Program

GeoEngineers

Working Over Water Safety Program

Revised May 2022



GeoEngineers
Health & Safety World
GEO-CENTRIC BEHAVIOR ACCEPTED SAFETY RULES
HAZARD AWARENESS INDIVIDUAL BEHAVIORS & TALENTS

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Working Over Water Safety Program

Purpose

The purpose of the GeoEngineers Working Over Water Safety Program is to protect the health and safety of employees working on or near water.

Scope

This policy and procedure applies in its entirety to all GeoEngineers employees who have an actual or potential exposure to drowning.

Responsibilities

Principals/Associates/Project Managers/Health and Safety Coordinators—Responsible and accountable for ensuring that the provisions of this policy and procedure are implemented and followed at offices and projects in which they have oversight and responsibility.

Employees—GeoEngineers' employees are responsible and accountable for complying with this policy and procedure as it applies to them.

Health and Safety Program Manager—GeoEngineers' HSM shall monitor and evaluate for compliance, effectiveness and improvement opportunities and changes in regulations as needed.

Definitions

Boat Operator—the locally licensed individual responsible for operating the boat.

Bow—the bow of a boat is the front part of the vessel.

Coaming—any vertical surface on a ship designed to deflect or prevent entry of water. It usually refers to raised section of deck plating around an opening, such as a hatch. Coamings also provide a frame onto which to fit a hatch cover.

Dispatcher—the member of the boating team responsible for maintaining shore communication with the boat operator. The dispatcher will always remain on land and will track the boat's location.

Fender/ing—a cushioned place between boats or between a pier and a boat to prevent damage. Fendering is relying on said cushion to prevent impact damage to your boat when docking.

Freeboard—the minimum vertical distance from the surface of the water to the gunwale (upper edge of the boats sides.

Gunwale—the upper edge of the boat's sides that stay out of the water generally.

Hull—the body of the boat that remains in the water.

Hypothermia—a symptom of severe cold stress resulting from the body core temperature dropping below 95 degrees Fahrenheit. Signs of hypothermia include uncontrollable shivering, mental confusion, and fatigue. In extreme and untreated cases, a warm or euphoric feeling is experienced.

International Waters—areas of water outside the 12-mile offshore exclusive economic zone of any nation.

Inboard—towards the center of a vessel or dock.

Jacob's Ladder—a rope or metal ladder used to board vessels along its side.

Lee—the side of a vessel sheltered from the wind.

Outboard—towards the edges of a vessel or dock.

Personal Flotation Devices (PFDs) or Lifejacket Types—See Personal Floatation Device (PFD) Specifications Section.

Port—the left side of the boat from the perspective of looking forward in the boat.

Starboard—the right side of the boat from the perspective of looking forward in the boat.

Stern—the stern of a boat is the back part of the vessel.

Regulatory References

When working near water, over water or on a barge, Occupational Safety and Health Administration (OSHA) has authority. The U.S. Coast Guard has authority 12 miles off shore until international waters begin. The Coast Guard also has authority over operations on the Great Lakes.

This safety program is based on the following state and federal regulations:

- OSHA 1926.106 Working over or near water; 1926.605 Marine operations and equipment; Access to vessels 1915.74 and Access to barges and river towboats 1918.26 (Idaho, Missouri)
- Washington Administrative Code (WAC) 296-800-160 Personal Protective Equipment for PFD (Washington)
- OR-OSHA 1926 (Oregon)
- AAC Title 8 (Alaska)
- HIOSH Title 12 (Hawaii)
- Cal/OSHA Title 8 (California)

General Requirements

Use of a boat for work requires safe boating practices, good equipment, and training. These procedures are not meant to replace the safety manuals provided by the Coast Guard. Instead, they should highlight some of the areas of concern and address specific GeoEngineers. work procedures. While working near water that is over waist deep or while on a boat, always wear a Coast Guard approved personal flotation device. Remember that being submersed in water increases the chance of hypothermia. Have a dry set of clothes and work with a buddy if you are working around water. If an employee is required to work partially or fully immersed in the water for long periods of time, they

will wear appropriate gear including waders, a wet suit, or dry suit if necessary for safe accomplishment of the task.

The Coast Guard's Federal Requirements state, "All recreational boats must carry one wearable PFD (Type I, II, III, or Type V) for each person aboard… [and that] any boat 16 feet and longer (except canoes and kayaks) must also carry one throw-able Type IV PFD."

GeoEngineers' insurance for working over water is covered under the USL&H policy (worker's comp over water) and is not specific to the individuals participating. For work in arctic waters, an additional site safety plan will be created to address the additional hazards of working in extremely cold water. Refer to GeoEngineers Cold Stress Prevention Program for cold weather guidance.

For work on barges or boats or areas near water that have an OSHA standard height and strength guardrail, PFDs are not required while working behind the guardrail. The access to the barge or near water area also requires that the gangway be protected by guardrails. If employees are not wearing PFDs, there cannot be a risk of falling in the water. Fall protection rules can be utilized on projects where employees are not within 6 feet of a leading edge and there is no risk of falling in the water.

Implementation

Procedures for Using Boats

Three people will always be involved with the use of the boat. The boat operator, the assistant operator, and the dispatcher back on land. The boat operator will be locally licensed to operate the boat and should always plan a course of travel which is the safest and minimizes the distance to the shore. The dispatcher must be able to maintain communication with the boat operator while back on land. As a general courtesy, the boat should be cleaned up by the user after each day.

Maneuvering a Boat

- To move boat from dock, move stern away then bow (but not into waves or wind)
- Try not to depend on fendering, slow down
- Communicate with other person in boat when:
  - Increase or decrease speed
  - Dramatically change direction
  - Approach pilings/docking so hands and objects hanging off the side of the boat can be put inside

Right-of-Way

- Watch out for ferry traffic—large vessels have right of way and cannot stop
- Larger vessel has right of way over smaller
- With boats of similar size, sailboat have right of way
- When lights are visible, green has the right of way over red

Ferryboats

Do not cut off ferryboats or other vessels, they move much faster than they appear to. If the boat breaks down in a ferry lane, use radio, flares, and wave and make sure they see you until help arrives. See Emergency Procedures Section for additional details.

Load Limits

Cargo should be evenly distributed and there should be a safe amount of freeboard, which depends on water conditions. In more turbulent water, give the boat more freeboard. When loading up the boat for travel that goes beyond the protection of the pier, the employee should drive to the end of the pier and check wave conditions before entering. Check the boat's loading limits and safety information via the operator's manual.

Engine Use

When using an outboard motor, the boat operator will wear the tether kill switch. This will hook to the operator's wrist and turn off the engine if the boat operator were to be launched into the water.

Personal Floatation Device (PFD)

Type 1 PFDs will be worn in the boat at all times when on ocean or fast moving waters. PFDs will be the correct size for the wearer and will be securely fastened. The PFD should be inspected for damage prior to each use.

In you end up in water with PFD, to help prevent water from lowering body temperature:

- 1 person: cross arms pull knees up
- 2 or more persons: huddle together

The chances of swimming 100 yards or finding help in open water is not very good, so the best strategy is to stay with the boat. The boat should always be closer to shore than this distance during transport so the employee would be close enough to swim to shore.

Throwing Lines

- Make first two coils larger
- Kneel in boat
- Shoulder pointed to victim
- Throw over their head

Water on Board

- A five-gallon bucket will always be available on the boat to bale water that comes inside the boat

Towing

- Take time to set up
- Look at lines
- Stay in step with waves
- For logs, may want to tow from bow. Use timber hitch, shackle to weigh down
- Don't overstress lines

- Don't shock load lines
- Sea anchor—can use to slow down tow, make more controllable. For some situations, a sea anchor is not necessary and could make things worse.

Safety and Signals

- Horn blasts: 5 short signals danger
- Lights: Employees will not be traveling between terminals in the dark. If it becomes dark while working, the operator will moor the boat at that terminal for the night. A flashlight will be available in the waterproof box stored in the workboat.

Vessel, Barge or Platform Procedures

Any work within 6 feet of an unprotected leading edge will require a life jacket if water is below the leading edge. Railings must be present if a leading edge is above a hard surface. Refer to GeoEngineers' Fall Protection Program for additional details.

Employees shall not be permitted to walk along the sides of covered lighters or barges with coamings more than 5 feet high, unless there is a 3-foot clear walkway, or a grab rail, or a taut hand line is provided.

Employees shall not be permitted to walk over deck loads from rail to coaming unless there is a safe passage. If it is necessary to stand at the outboard or inboard edge of the deck load where less than 24 inches of bulwark, rail, coaming, or other protection exists, all employees shall be provided with a suitable means of protection against falling from the deck load.

The employer shall ensure that there is in the vicinity of each barge in use at least one Coast Guard-approved 30-inch life ring with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the employer shall furnish it during the time that he is working the barge.

Whenever practicable, a gangway of not less than 20 inches walking surface of adequate strength, maintained in safe repair and safely secured shall be used. If a gangway is not practicable, a substantial straight ladder, extending at least 36 inches above the upper landing surface and adequately secured against shifting or slipping shall be provided. When conditions are such that neither a gangway nor a straight ladder can be used, a double-rung or flat tread type of Jacob's ladder may be used. The Jacob's ladder must hang without slack from its lashings or be pulled up entirely when not in use.

Means of access and all work areas will be adequately illuminated at all times.

Loads of cargo will not pass over employees nor will they be stored over areas where employees may reasonably congregate.

Cranes/ Hoists/ Cables

Employees need to use caution when working in areas where cranes, hoists and cables are in use. Refer to the GeoEngineers' Drilling and Rigging Safety Program.

Working Near Water Procedures

GeoEngineers' employees working over or near water, where the danger of drowning exists, shall be provided with Coast Guard-approved life jacket or buoyant work vests. If the employee is over 6 feet away from the water, they will not be required to wear the life vest.

Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective units shall not be used.

Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet.

At least one lifesaving skiff or similar vessel shall be immediately available at locations where employees are working over or adjacent to water to perform rescue when necessary if the employee falls into the water.

Emergency Procedures

The following topics are items that are important for handling an emergency. The boat operator should know these procedures and follow them at all times.

Communication

The Marine Radio will be with the boat operator at all times. Before entering the boat, the operator will call in to the dispatcher and notify them of the location and destination of the boat. Each time an employee enters or exits the boat, this will be recorded by the dispatcher. This contact should occur at departure and arrival for long transits.

In the event the Coast Guard must be called for an emergency, use the following reporting procedure:

1. Tune the radio to Channel 16 (Coast Guard)
2. Clearly say MAYDAY three times for life threatening emergencies or PAN-PAN for non-life threatening emergencies
3. Give your vessels name and current position
4. Describe your vessel and give its registration number
5. Give the number of personnel on board
6. Describe the emergency
7. Say OVER and repeat process if no response
8. While waiting for rescue, blow horn five short times to signal danger near your location

Engine Problems

In the event of engine problems, contact the dispatcher and notify them of the situation immediately. Depending on the situation, a rescue could be dispatched by the Coast Guard, another employee, or a contractor. If a repair is made in the interim while waiting for the tow, call the dispatcher again and notify them of the situation. If the boat is mobile, head back to dock until the engine can be fully repaired or replaced.

Spare plugs will be in the waterproof kit for offshore engine problems only. The boat operator will be required to take a spare tank and line for fuel, thus eliminating the need for spare line.

Distress Flares

Distress flares will be located in the waterproof boxes that the boat operator will ensure are on the boat before each travel session. Boat operators should also make sure that they are familiar with the operation of these flares.

Person Overboard / Rescue

Boat operators should be familiar with in water rescue techniques. The following steps are a general procedure for rescuing individuals who have gone overboard.

1. Yell "Person Overboard!" to get everyone's attention
2. Designate one person to maintain visual contact with the victim
3. Position the boat downwind so the victim will naturally float towards the boat
4. Throw the victim bright, buoyant objects on a line. Ensure the line is secured prior to throwing
5. Turn the engine off during rescue to avoid possible injury
6. Slowly pull the victim in towards the boat
7. Dry and warm victim

If you go overboard, follow these guidelines to increase your chances of survival if rescue isn't immediate.

- Remain calm, try to conserve energy
- Pull your knees in and hold them to your chest to minimize body heat loss
- Don't try to swim to safety unless it is very close by and visible

Fire

Each workboat will be equipped with a 5 lb. ABC fire extinguisher located near the bow. The fire extinguisher should be checked each time the boat is used to ensure that it is ready to operate.

Work Related Injuries

Work related injuries that are not threatening to the safety of the persons on board should be reported to the Supervisor as soon as possible. Any work related injury that impairs operation of the boat should be called in to the GeoEngineers' office immediately. The office will call for the Coast Guard and or the Fire Department in the event of a serious injury.

Weather/Tides

If the visibility is very low due to fog or other conditions, the operator will not take the boat out.

Fog

If a boat gets trapped in fog, employees will stay within sight of the shoreline and/or head in and tie up. Employees are not likely to be caught unexpected in dense fog as long as they turn on all lights and use the boat horn. Remember, many boats cannot pick you up on radar and cannot stop quickly.

Rough Water

If possible, rough water should be avoided. However, if the boat operator is experienced, work will not be impeded by rough water, and such conditions were planned for appropriately in the JHA or HASP, work may be approved in rough water. Here are some basic tips for boating in rough water.

- Look for lee and stay in it if possible
- Head into swells, throttle up when approaching, throttle down when dropping down
- Check wave conditions before taking the boat out and regularly check for updates
- Head in at 45 degree angle at times, depending on wave size

Tides

Tidal changes in the Puget Sound and northern areas can be significant. Employees should always be aware of the tide changes and plan their work accordingly. There have been several instances where work under the docks became dangerous due to changing tides and lack of planning.

Storms

GeoEngineers employees will not work on boats in stormy weather. If stormy weather is reported as incoming or caught by unexpected stormy weather while on water, GeoEngineers employees will return to harbor as soon as safely possible.

List of Supplies

In addition to the list of supplies necessary for the project and those generated as necessary at the Maritime Training Center, the Coast Guard identified the following items to be critical for safe boating.

Items to be stored with the boat at all times:

- Oars and oarlocks
- Anchor
- Bucket for baling water
- Fire Extinguisher
- 1 spare fuel tank and line
- 1 change of dry clothes per person
- Emergency food and water

Items that will be brought onto the boat when in use:

- Marine radio
- Watertight box with first aid kit, flashlight, and flares
- Personal Floatation Device(s)
- Knife with serrated edge
- Tide book
- Spare plugs and wrench

Personal Floatation Device (PFD) Specifications

Personal Flotation Device (PFD) use applies to terminals and piers and employees working near other bodies of water. It also applies to all activities conducted by GeoEngineers employees at these facilities, including construction, maintenance, inspections, tours, and operations. Type I PFDs will be worn in the boats at all times. PFD will be the correct size for the wearer and will be securely fastened. The PFD should be inspected for damage prior to each use. Boats longer than 16 feet must carry at least one Type I, II, III, or V PFD for each person on board.

In addition, at least one Type IV (throw-able device) must be carried on the vessel for use in person overboard procedures. No one may not use a Type IV "flotation cushion" as the sole PFD in any situation.

PFDs are required for:

- Any employee in a boat/skiff/barge,
- Any employee is working on top of, or beyond the bull rail (a railing for docking the boat), or
- Employees working near water where the danger of drowning exists

PFDs are not specifically required when:

- Employees are working behind standard height and strength guardrails.
- Employees are working inside operating cabs or stations that eliminate the possibility of accidentally falling into the water.
- Employees are wearing an approved safety harness with a lifeline attached that prevents the possibility of accidentally falling into the water.
- Employees are working more than 6 feet from the edge.
- Working over shallow water (less than chest deep) where floatation would not be achieved (other protective measures required).

Provide your employees with PFDs approved by the Coast Guard for use on commercial or merchant vessels. The following are appropriate or allowable United States Coast Guard-approved PFDs:

Type of PFD	General Description
Type I	Off-Shore Life Jacket–effective for all waters or where rescue may be delayed. Should turn ALL wearers upright in water. Most buoyant.
Type II	Near-Shore Buoyant Vest–intended for calm, inland water or where there is a good chance of quick rescue. Will turn SOME wearers upright in water. Check weight category.
Type III	Flotation aid–good for calm, inland water, or where there is a good chance of rescue. Will NOT turn wearers upright in water.
Type IV	Flotation aid–(throwable device) rings, buoyant cushions, horseshoe buoys. Meant to supplement other PFDs or for pulling in for rescue.

Off-Shore Life Jacket (Type I PFD)
Best for open, rough, or remote water, where rescue may be slow coming.

- Advantages
  - Floats person the best
  - Turns most unconscious wearers face-up in water
  - Highly visible color
- Disadvantages
  - Bulky

Near-Shore Buoyant Vest (Type II PFD)
Good for calm, inland water, or where there is good chance for fast rescue.

- Advantages
  - Turns some unconscious wearers face-up in water
  - Less bulky, more comfortable than Off-Shore Life Jacket (Type I PFD)
  - Compromise between Type I PFD performance and wearer comfort
- Disadvantages
  - May be uncomfortable wearing for extended periods
  - Will not turn as many people face-up as a Type I PFD will
  - In rough water, a wearer's face may often be covered by waves
  - Not for extended survival in rough water

Flotation Aid (Type III PFD)
Good for calm, inland water, or where there is good chance of fast rescue.

- Advantages
  - Generally, the most comfortable type for continuous wear
  - Freedom of movement for water skiing, small boat sailing, fishing, etc.
  - Available in many styles, including vests and flotation coats
- Disadvantages
  - Not for rough water
  - Wearer may have to tilt head back to avoid face-down position in water

Flotation Aid Throwable Device (Type IV PFD)
Used for rescue during overboard procedures.

- Advantages
  - Easy to throw and grab onto
  - Don't have to be worn constantly.
- Disadvantages
  - Inadequate by themselves to keep individuals safely afloat
  - Require someone else to throw the PFD to the overboard individual

Training

Each state has specific boat training requirements. In addition, the Coast Guard can also be contacted for local training opportunities. All GeoEngineers employees operating a boat should have documented training and be locally licensed/certified.

GeoEngineers employees who will be working over water must review the GeoEngineers Working Over Water training module at least once prior to work commencing.

GeoEngineers employees working over or near water should be trained in the contents of the Working Over Water Safety Program. At the start of each project in which working over or near water presents a danger of drowning employees should have a tailgate safety meeting and discuss the following:

- The danger of drowning where it exists
- Use of Coast Guard-approved life jacket or buoyant work vests
- Life jacket or buoyant work vests inspections
- Location of ring buoys for emergency rescue operations
- Location of a lifesaving skiff for rescue if needed

Training shall be recorded in Ascent.

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Appendix G
TOXFAQS Guides

Arsenic - ToxFAQs™

CAS # 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic

CAS # 7440-38-2

compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Health and Human Services. Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Copper - ToxFAQs™

What is copper?

Copper (Cu) is an element and metal. It is found in rocks, soils, water, and air. Copper is an essential nutrient for humans and is in many foods. It's also essential to animals and plants. Copper and substances containing copper are used in many industries in the U.S.. Copper can be found in materials and products such as wiring, plumbing, pesticides, cookware, and dietary supplements, among others. Copper scrap can be combined with other metals to make brass and bronze pipes. In the U.S., copper is mined and recovered from metal through smelting.

What happens to copper in the environment?

- Copper is released from natural sources, such as windblown dusts, decaying vegetation, and from human activities like municipial solid waste management and fossil fuel burning.
- In air, copper usually attaches to particles (particulate matter) and can travel far from its source.
- In water, copper will usually attach to soils if possible, or dissolve.
- Copper attaches to soils, where it can be taken up by plants.
- Mollusks, such as clams and oysters, can build up copper in their bodies.
- Copper does not break down in the environment.

Ingesting copper in food is necessary for human health. Too much copper can be harmful.

How can I be exposed to copper?

- People ingest copper from drinking water and food, inhale copper from air, and may touch copper or products that contain copper.
- Drinking water can contain high levels of copper if your home has copper pipes and acidic water. This is more likely to occur in new or recently renovated buildings/homes using copper plumbing.
- Blue copper sulfate crystals are available to purchase and have been accidentally ingested by people who confused them for candy or toys.
- You may be exposed to copper fumes if you work or live near a site that uses copper in mining, agriculture, or in a facilitity that processes copper.
- Soils near mines, processing facilities, or waste dump sites may have a lot of copper.

How can copper affect my health?

It is essential for people to ingest small amounts of copper everyday in food and water. Ingesting too much or too little copper can lead to illness and/or disease. Ingesting a high amount of copper, usually in drinking water, can cause vomiting, nausea, abdominal pain, and/or diarrhea. Ingesting higher than recommended amounts of copper every day over time, such as in water or in copper supplements, can lead to severe illness, such as kidney and liver damage.

Breathing in copper dusts, sprays, or crystals can irritate your nose and throat, and cause dizziness and headaches. People who have ingested these substances have gotten very sick and/or died.

Copper is essential to the development of babies and children, and is found in breastmilk. Babies and children are expected to have symptoms similar to adults when exposed to high levels of copper in air, water, or food. If you have a disorder that causes copper to build up in your body, like Wilson's disease, you may be especially vulnerable to high copper levels in air, food, or water.

Copper

Can copper cause cancer?

The U.S. Department of Health and Human Services (DHHS) has not evaluated the carcinogenicity (whether it causes cancer) of copper.

The U.S. Environmental Protection Agency (EPA) has not classified if copper is carcinogenic (cancer causing) to humans.

The International Agency for Research on Cancer (IARC) has not evaluated the carcinogenicity of copper. IARC lists copper 8-hydroyquinoline as a group 3 agent indicating the carcinogenicity in humans cannot be classified due to lack of cancer studies in humans and animals.

Can I get a medical test to check for copper?

There are tests to measure the amount of copper in your blood, urine, nails, and hair. Your medical provider can help decide if a test is needed and which is the most appropriate for you. High levels of copper in these tests can show if you have been exposed to a lot of copper or if there is a problem with copper regulation in the body. These tests will not predict if you will have health problems. These tests are not part of standard health tests that are done at your doctor's office and are done through a special lab. If you think you may have been exposed to high levels of copper, talk to your doctor, nurse, or clinic, or call poison control.

How can I protect my family from copper exposure?

If your water is metallic or bitter in taste or smell, and/or is green-blue in color this may be a sign that there is too much copper in your drinking water. If you have copper piping, it can leach into water if your home is new or recently renovated, or if your water is corrosive. Regularly cleaning or flushing out your system can help avoid this. There are tests available to check if your water is corrosive or if copper levels in your water are high.

Safely store copper powders, crystals, or dusts away from children, pets, or other adults.

Monitor your copper intake if you are adding more copper to your diet, such as by taking dietary supplements with copper, to make sure you are not eating too much. Talk to your doctor, nurse, or clinic to figure out if you are taking the proper amount of copper.

If you work with copper, wear the necessary protective clothing and equipment, and always follow safety procedures. Shower and change your clothes before going home each day.

Want more information?

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for Copper

Go to ATSDR's Toxic Substances Portal: http://www.atsdr.cdc.gov/substances/index.asp

If you have any more questions or concerns, you can also find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

CHLORINATED DIBENZO-p-DIOXINS (CDDs)

Division of Toxicology and Environmental Medicine ToxFAQs™ February 1999

This fact sheet answers the most frequently asked health questions (FAQs) about dibenzo-p-dioxins. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chlorinated dibenzo-p-dioxins (CDDs) (75 chemicals) occurs mainly from eating food that contains the chemicals. One chemical in this group, 2,3,7,8-tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD, has been shown to be very toxic in animal studies. It causes effects on the skin and may cause cancer in people. This chemical has been found in at least 91 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are CDDs?

CDDs are a family of 75 chemically related compounds commonly known as chlorinated dioxins. One of these compounds is called 2,3,7,8-TCDD. It is one of the most toxic of the CDDs and is the one most studied.

In the pure form, CDDs are crystals or colorless solids. CDDs enter the environment as mixtures containing a number of individual components. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

CDDs are not intentionally manufactured by industry except for research purposes. They (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

What happens to CDDs when they enter the environment?

❑ When released into the air, some CDDs may be transported long distances, even around the globe.

❑ When released in waste waters, some CDDs are broken down by sunlight, some evaporate to air, but most attach to soil and settle to the bottom sediment in water.

❑ CDD concentrations may build up in the food chain, resulting in measurable levels in animals.

How might I be exposed to CDDs?

❑ Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.

❑ Breathing low levels in air and drinking low levels in water.

❑ Skin contact with certain pesticides and herbicides.

❑ Living near an uncontrolled hazardous waste site containing CDDs or incinerators releasing CDDs.

❑ Working in industries involved in producing certain pesticides containing CDDs as impurities, working at paper and pulp mills, or operating incinerators.

How can CDDs affect my health?

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of CDDs may induce longterm alterations in glucose metabolism and subtle changes in hormonal levels.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in

animals, such as weight loss, liver damage, and disruption of the endocrine system. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. Some animal species exposed to CDDs during pregnancy had miscarriages and the offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immune responses.

How likely are CDDs to cause cancer?

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD.
The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen.
The Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer.

How can CDDs affect children?

Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. We don't know if CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

How can families reduce the risk of exposure to CDDs?

❏ Children should avoid playing in soils near uncontrolled hazardous waste sites.
❏ Discourage children from eating dirt or putting toys or other objects in their mouths.
❏ Everyone should wash hands frequently if playing or working near uncontrolled hazardous waste sites.
❏ For new mothers and young children, restrict eating foods from the proximity of uncontrolled sites with known CDDs.
❏ Children and adults should eat a balanced diet preferably containing low to moderate amounts of animal fats including meat and dairy products, and fish that contain lower amounts of CDDs and eat larger amounts of fruits, vegetables, and grains.

Is there a medical test to determine whether I've been exposed to CDDs?

Tests are available to measure CDD levels in body fat, blood, and breast milk, but these tests are not routinely available. Most people have low levels of CDDs in their body fat and blood, and levels considerably above these levels indicate past exposure to above-normal levels of 2,3,7,8-TCDD. Although CDDs stay in body fat for a long time, tests cannot be used to determine when exposure occurred.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.00003 micrograms of 2,3,7,8-TCDD per liter of drinking water (0.00003 µg/L). Discharges, spills, or accidental releases of 1 pound or more of 2,3,7,8-TCDD must be reported to EPA. The Food and Drug Administration (FDA) recommends against eating fish and shellfish with levels of 2,3,7,8-TCDD greater than 50 parts per trillion (50 ppt).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological Profile for Chlorinated Dibenzo-p-Dioxins. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-62, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Chlorodibenzofurans (CDFs) - ToxFAQs™

What are chlorodibenzofurans (CDFs)?

Chlorodibenzofurans, or CDFs, are a family of chemicals that contain one to eight chlorine atoms attached to the carbon atoms of the parent chemical, dibenzofuran. There are 135 different types of CDFs called congeners. The different congeners have varying harmful health effects. CDF congeners that contain chlorine atoms at the 2,3,7,8- positions of the dibenzofuran molecule are known to be especially harmful.

There is no known use for these chemicals. Other than for research purposes, they are not deliberately produced by industry. Most CDFs are produced in small amounts as undesirable byproducts during the manufacturing of other chemicals. CDFs can also be released from incinerators and landfill fires.

What happens to CDFs in the environment?

CDFs in the environment can be found in air, soil, and sediment. Most CDFs are not soluble in water. In the air, CDFs are bound to particles or exist as vapors. CDFs can be removed from the air by snow or rain. CDFs bind to soil and sediment and are not likely to move into groundwater from soil. They accumulate in fish at much higher levels than levels found in the water or sediment. CDFs can also build up in other animals, birds, and people that are exposed to them in their food.

How can I be exposed to CDFs?

You could be exposed to very small amounts of CDFs in contaminated food, such as meat, fish, and dairy products. Consuming high amounts of fatty fish may result in exposure to higher levels of CDFs. You could also be exposed to CDFs in air, in drinking water, by using certain consumer products, or in soil in areas near incinerators or landfill fires, but these sources of exposure are less likely.

How can CDFs affect my health?

CDFs can stay in your body for a long time after you were exposed. Studies in animals show that CDFs with chlorine atoms in the 2,3,7,8 positions are the most harmful. The most harmful congener appears to be 2,3,4,7,8-pentaCDF (CDF with 5 chlorine atoms in the 2, 3, 4, 7, and 8 positions).

CDFs are persistent in the environment and body.

Most of the information on health problems comes from studies in people who were accidentally exposed to food contaminated with CDFs. The amount of CDFs was much higher than from environmental exposures or from a normal diet. CDFs caused skin and eye irritations, including severe acne, darkened skin color, and swollen eyelids with discharge from the eyes. CDF poisoning also caused vomiting and diarrhea, anemia, more frequent lung infections, numbness in arms and legs, and other effects on the nervous system.

Chlorodibenzofurans (CDFs)

Many of the same effects that occurred in people also occurred in laboratory animals that ate CDFs. Animals also had severe weight loss, and their stomachs, livers, kidneys, and immune systems were seriously damaged. Some animals had birth defects, and in severe cases, some animals died. These effects in animals were seen when they were fed large amounts of CDFs over a short time, or small amounts over several weeks or months.

Can CDFs cause cancer?

The U.S. Department of Health and Human Services (DHHS) has not evaluated the potential of CDFs to cause cancer in humans.

The U.S. Environmental Protection Agency (EPA) has not evaluated the potential of CDFs to cause cancer in humans.

The International Agency for Research on Cancer (IARC) has determined that 2,3,4,7,8-pentaCDF is carcinogenic to humans; other CDF congeners are not classifiable as to their carcinogenicity to humans.

Can I get a medical test to check for CDFs?

Tests are available to measure levels of CDFs in blood, body fat, and breast milk. These tests cannot predict whether you will have health problems from exposure to CDFs. Doctor's offices do not routinely offer these tests. If you think you have been exposed to CDFs, call your doctor, nurse, or poison control center.

How can I protect myself and my family from CDFs?

Most people don't need to take any special steps to avoid CDFs in their daily lives. Children should avoid playing in the dirt near hazardous waste sites to avoid coming in contact with CDFs.

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for CDFs: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=938&tid=194

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Mercury - ToxFAQs™

What is mercury?

Mercury is a naturally occurring element with a chemical symbol of Hg. Elemental mercury is a silver liquid at room temperature that can also evaporate into the air as a gas or become a solid at very low temperatures. It can combine with other substances to form solid compounds that are categorized into two groups: inorganic mercury salts and organic mercury compounds. Mercury and mercury compounds are odorless.

Mercury is used in a number of industries and products. It is primarily used in the manufacture of electronics, fluorescent-lighting, and production of chlorine-caustic soda. It is also used in dental products (fillings), although uses in dentistry are being phased-out. Other historical uses of mercury (batteries; thermometers and other scientific and medical devices; electronic switches and lighting applications; paints and pigments; fungicides and pesticides) have been eliminated or drastically reduced.

What happens to mercury in the environment?

Because mercury is a naturally occurring element, it can be found in the air, water, or soil. It can also be found in the environment due to industrial releases to air and water. Industrial releases to air have steadily decreased over the past few decades.

Mercury does not break down in the environment. In air, mercury may spread far from where it was released. Mercury seldom appears as a silver liquid in the environment. In water, mercury can evaporate into the air. In soil, it can adhere (stick) to soil and sediments (dirt deposits at the bottom of bodies of water). One type of organic mercury compound called methylmercury can build up in plants and fish.

How can I be exposed to mercury?

Most people are exposed to organic mercury compounds (typically methylmercury) in food (such as fish, seafood, rice) or to elemental mercury from dental fillings. Food is the most common form of exposure. Most people are not exposed to inorganic mercury salts. Industrial and dental workers who use mercury are primarily exposed to elemental mercury. Some cultures use mercury in traditional medicines or religious practices, although this is not recommended or approved for use in the United States.

How can mercury affect my health?

Mercury can affect the nervous system and kidneys. The health effects from exposure to mercury depend on a number of factors including the amount and form of mercury, route and length of exposure, and age.

All forms of mercury can affect the nervous system and the kidneys. Workers exposed to elemental mercury vapor and people who eat foods with high levels of methylmercury experienced tremors, incoordination, impaired vision, impaired learning and memory, and mood changes. Some children born in communities that ate food with high levels of organic mercury had learning, sensory, and movement problems. In people exposed to high levels of methylmercury in their diets, birth defects have occurred. Some humans and animals that ate mercury compounds had high blood pressure and alterations in their immune systems. Animals that breathed elemental mercury vapor or ate organic or inorganic mercury compounds in their diets showed nervous system effects and/or kidney damage. Animals that ate high levels of mercury compounds showed decreased fertility and/or birth defects.

Mercury

Can mercury cause cancer?

Rats that ate an inorganic mercury compound for a long period of time developed stomach or thyroid cancer. Rats and mice that ate organic mercury compounds for a long period of time developed kidney cancer.

The U.S. Department of Health and Human Services (DHHS) has not evaluated the potential of mercury or mercury compounds to cause cancer in people.

The U.S. Environmental Protection Agency (EPA) has determined that mercuric chloride (inorganic mercury salt) and methylmercury (organic mercury compound) are possible human carcinogens (cause cancer). The EPA did not classify the potential of elemental mercury to cause cancer in humans.

The International Agency for Research on Cancer (IARC) classified methylmercury compounds as possibly carcinogenic to humans. IARC designated inorganic mercury and elemental mercury as not classifiable for causing cancer in humans.

Can I get a medical test to check for mercury?

Mercury can be measured in your blood, urine, hair, or toenails. However, tests cannot determine which form of mercury you were exposed to. Tests also cannot predict whether you will have health problems. If you think you have been exposed to mercury, call your doctor, nurse, or poison control center.

How can I protect myself and my family from mercury?

People should avoid eating fish that contain high levels of methylmercury. This is particularly important for pregnant women and children. Follow your state's health advisories that tell you about whether it is okay to eat fish or wildlife caught in contaminated areas. Avoid all contact with spills of the liquid form of elemental mercury (the type of mercury found in old thermometers). If a spill occurs, refer to https://www.atsdr.cdc.gov/dontmesswithmercury for safe clean-up practices. Most people don't need to take any special steps to avoid exposure to inorganic mercury salts in their daily lives. Keep children from playing in areas near hazardous waste sites to avoid coming in contact with mercury.

For more information:

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxicological Profile for mercury: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=115&tid=24

Go to ATSDR's Toxic Substances Portal: https://wwwn.cdc.gov/TSP/index.aspx

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polychlorinated Biphenyls - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over

several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. PCBs have been classified as probably carcinogenic, and carcinogenic to humans (group 1) by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC), respectively.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risks of exposure to PCBs?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ZINC

CAS # 7440-66-6

Division of Toxicology ToxFAQs™ August 2005

This fact sheet answers the most frequently asked health questions (FAQs) about zinc. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Zinc is a naturally occurring element. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Low levels of zinc are essential for maintaining good health. Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels. Zinc has been found in at least 985 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is zinc?

Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal.

Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass, and bronze. A zinc and copper alloy is used to make pennies in the United States.

Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dyes, wood preservatives, and ointments.

What happens to zinc when it enters the environment?

❑ Some is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste.
❑ It attaches to soil, sediments, and dust particles in the air.
❑ Rain and snow remove zinc dust particles from the air.
❑ Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers.
❑ Most of the zinc in soil stays bound to soil particles and does not dissolve in water.
❑ It builds up in fish and other organisms, but it does not build up in plants.

How might I be exposed to zinc?

❑ Ingesting small amounts present in your food and water.
❑ Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
❑ Eating too many dietary supplements that contain zinc.
❑ Working on any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

How can zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. We do not know if high levels of zinc affect reproduction in humans. Rats that were fed large amounts of zinc became infertile.

Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. We do not know the long-term effects of breathing high levels of zinc.

Putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice caused skin irritation. Skin irritation will probably occur in people.

How likely is zinc to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity.

How can zinc affect children?

Zinc is essential for proper growth and development of young children. It is likely that children exposed to very high levels of zinc will have similar effects as adults. We do not know whether children are more susceptible to the effects of excessive intake of zinc than the adults.

We do not know if excess zinc can cause developmental effects in humans. Animal studies have found decreased weight in the offspring of animals that ingested very high amounts of zinc.

How can families reduce the risks of exposure to zinc?

❑ Children living near waste sites that contain zinc may be exposed to higher levels of zinc through breathing contaminated air, drinking contaminated drinking water, touching or eating contaminated soil.

❑ Discourage your children from eating soil or putting their hands in their mouths and teach them to wash their hands frequently and before eating.

❑ If you use medicines or vitamin supplements containing zinc, make sure you use them appropriately and keep them out of the reach of children.

Is there a medical test to determine whether I've been exposed to zinc?

There are tests available to measure zinc in your blood, urine, hair, saliva, and feces. These tests are not usually done in the doctor's office because they require special equipment. High levels of zinc in the feces can mean high recent zinc exposure. High levels of zinc in the blood can mean high zinc consumption and/or high exposure. Tests to measure zinc in hair may provide information on long-term zinc exposure; however, the relationship between levels in your hair and the amount of zinc you were exposed to is not clear.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 5 milligrams per liter of water (5 mg/L) because of taste. The EPA requires that any release of 1,000 pounds (or in some cases 5,000 pounds) into the environment be reported to the agency.

To protect workers, the Occupational Safety and Health Administration (OSHA) has set an average limit of 1 mg/m^3 for zinc chloride fumes and 5 mg/m^3 for zinc oxide (dusts and fumes) in workplace air during an 8-hour workday, 40-hour workweek.

Similarly, the National Institute for Occupational Safety and Health (NIOSH) has set the same standards for up to a 10-hour workday over a 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Zinc (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Appendix H

Occupational Exposure Limits (OEL) for Contaminants of Potential Concern

CHEMICAL HAZARD EXPOSURE LIMITS

COMPOUND/ DESCRIPTION	OSHA PEL EXPOSURE LIMIT	WA-DOSH PEL EXPOSURE LIMIT	ACGIH TLV EXPOSURE LIMITS	NIOSH REL EXPOSURE LIMITS
Arsenic, metallic grey solid/dust	PEL 0.010 mg/m³	PEL: 10 mg/m³	TLV: 0.01 mg/m³	REL 0.002 mg/m³ IDLH 5 mg/m³
Copper is a soft, malleable, and ductile metal. Freshly exposed surface of pure copper has a pinkish-orange color.	PEL: 1 mg/m³ as dust or 0.1 mg/m³ as fumes	No available data	1 mg/m³ as dust	No available data
Mercury (and inorganic compounds as mercury), silvery liquid metal in pure forms	No available data	No available data	No available data	No available data
Zinc, slightly brittle metal and has a silvery-greyish appearance when oxidation is removed	TLV/PEL none Treat as Particles not otherwise specified and maintain levels below 3 mg/m³ respirable and 10 mg/m³ inhalable	No available data	No available data	No available data
cPAHs* coal tar pitch volatiles	PEL: 0.2 mg/m³	0.2 mg/m³ (TWA) 0.6 mg/m³ (STEL)	0.2 mg/m³ (TLV)	0.1 mg/m³ (TWA) 80 mg/m³ (IDLH)
Polychlorinated biphenyls (PCBs), pale-yellow viscous liquids	No available data	No available data	TLV = 0.5 mg/ m³	No available data
Dioxins/Furans	No available data	No available data	No available data	No available data

Notes:

*If a State has established a PEL more restrictive than the OSHA limits, then the applicable State limit becomes the legal limit.
IDLH = immediately dangerous to life or health
OSHA = Occupational Safety and Health Administration
ACGIH = American Conference of Governmental Industrial Hygienists
NIOSH = National Institute of Occupational Safety & Health
mg/m³ = milligrams per cubic meter (dust or particulate conc.)
TWA = time-weighted average (Over 8 hrs.), basis of most exposure limits
PEL = permissible exposure limit, legally enforceable
TLV = threshold limit value (over 8 hrs)
REL= recommended exposure limit (over 10 hrs)
STEL = short-term exposure limit (15 min)
Ceiling (C) = concentration never to be exceeded
ppm = parts per million (vapor conc.)

Appendix I
Personal Protective Equipment Program

GeoEngineers

Personal Protective Equipment Program

Revised September 2023

GeoEngineers
Health & Safety World
GEO-CENTRIC BEHAVIOR ACCEPTED SAFETY RULES
HAZARD AWARENESS INDIVIDUAL BEHAVIORS & TALENTS

Table of Contents

Personal Protective Equipment Program

Purpose

The purpose of the GeoEngineers Personal Protective Equipment (PPE) Program is to reduce employee exposure to hazards through the use of PPE when engineering and administrative controls are not feasible or able to completely remove the hazards.

Scope

This program covers each employee who may need to wear PPE and ensures that they have been properly trained and/or retrained when the workplace changes; previous training becomes obsolete; the type of PPE changes; or when the employee demonstrates lack of use, improper use, or insufficient skill or understanding in using the PPE.

Responsibilities

Principals/Associates/Project Managers/Group Leaders/Site Supervisors—Responsible for ensuring that the provisions of this program are implemented and followed at locations in which they have oversight and influence. Including:

- Conducting worksite evaluations in cooperation with other supervisors and Health and Safety Program Managers to identify if PPE is being properly utilized.
- Ensuring effective first aid response and supplies are readily available.
- Ensuring employees are properly trained in safe worksite habits and understand how to use and the role of their PPE.
- Immediately reporting up all workplace related injuries and illnesses which occur in their area of responsibility. Provide written reports of all investigations and planned corrective actions to the Health and Safety Manager.
- Correct identified workplace hazards or report up deficiencies they cannot correct.
- Communicate key health and safety regulations to affected employees

Health and Safety Manager (HSM)—GeoEngineers' HSM shall monitor and evaluate the Program for compliance and effectiveness. Improvement opportunities and changes in regulations or other legal requirements shall be promptly addressed. Additional duties include:

- Conduct worksite evaluations in cooperation with supervisors and employees to identify workplace hazards and the ways to avoid or correct them to prevent injuries.
- Establish systems for ensuring supervisors and employees comply with the company or worksite PPE policy and utilize the safety tools, equipment, and safety training for their tasks.
- Establish a system for communicating with employees in readily understandable methods relevant and up to date information related to their safety and health.
- Provide training to employees and supervisors that allows them to identify workplace hazards so that they can prevent injuries.
- Maintain records of activities and training related to the PPE program.
- Review the effectiveness of the PPE program with supervisor and employee input at least annually.

Employees—GeoEngineers' employees are responsible and accountable for complying with this program, including:

- Attending all required training programs provided.
- Maintaining their PPE in good working condition and replacing PPE when necessary.
- Complying with worksite policies regarding safety and work practices.
- Reporting known or suspected safety hazards to their Supervisor or Safety Coordinator.
- Reporting all workplace related injuries or illnesses to their supervisor.

Definitions

Personal Protective Equipment (PPE)—includes a variety of devices and garments to protect workers from injuries. PPE is designed to protect Eyes/Face; Head; Ears/Hearing; Feet; Respiratory System and; Hands, Arms, and Whole Body. PPE includes such items as: Safety glasses; Goggles; Face shields; Hard hats; Safety shoes; Gloves; High Visibility Garments

General Requirements

This program provides guidance on the use, issuing, inspection, maintenance, and replacement of PPE and protective work clothing. All basic work-required PPE will be provided to GeoEngineers' employees at no cost to them in a sanitary and reliable condition. Additional PPE may be required based on the hazard or client requirements. PPE selected must be fitted to each affected employee. Defective and damaged equipment SHALL NOT be used.

GeoEngineers will provide reimbursement for an initial field clothing allowance for new employees who work in the field to purchase steel-toed work boots, rubber muck boots, and outerwear for protection from all weather conditions (rain, cold, heat, etc.), up to a combined total of $400. Employees who work in the field are eligible for subsequent $400 reimbursement every 2 years following their first year of employment, with the exception of field technicians and drillers, who will be eligible for the $400 reimbursement every year. Manager approval will be required for allowance exceedances.

GeoEngineers Safety Store provides pre-approved PPE for GeoEngineers' employees to order at no cost to them. The Safety Store is accessible on the Health and Safety Department page.

GeoEngineers field staff shall have in their possession and wear on project sites a full accompaniment of basic PPE including:

- Hard hat.
- Safety vest or similar high visibility clothing.
- Appropriate footwear to mitigate potential hazards associated with slips, falls (i.e., traction) and protection of the feet. Steel toed boots are required when working around or with heavy materials and equipment.

- Appropriate gloves (accounting for dexterity needs as well as potential chemical and/or sharp object protection) to mitigate potential hazards associated with cutting, grasping and hand exposures.
- Appropriate eye protection (e.g., safety glasses and/or face shields) to mitigate potential hazards associated with foreign objects or materials that could enter the eyes.
- Appropriate hearing protection (e.g., ear plugs and/or noise reducing ear muffs) to mitigate potential hearing damage from loud noises.

Implementation

Safety Glasses

Safety glasses worn by employees shall have permanent side shields and meet the requirements of ANSI/ISEA standard; Z87.1-2010, and ANSI Z87.1-2003, Occupational and Educational Personal Eye and Face Protection Devices.

In general, eye protection must:

- Fit comfortably.
- Be durable.
- Be easy to clean.
- Not restricting vision or movement.
- Not interfering with other PPE.
- Be inspected daily for damage and replaced as soon as possible if damaged.

Prescription Safety Glasses

Employees who wear prescription glasses may utilize a stipend to purchase prescription eye protection as well. Refer to GeoEngineers Expense Guidelines for the current reimbursable allowance provided for eye exams and glasses. Current reimbursement as of writing this program is $180 every 2 years. Employees who wear corrective lenses must wear eye protection which incorporates their prescription in its design. Ordinary corrective eyewear does not provide the required level of protection. Contact lenses should not be used in any hazardous environment.

Hard Hat

A hard hat shall be worn on project field sites as standard protection and to demonstrate to the public that we are conducting official business. The only exception is when the hard hat creates more of a hazard to wear it than not or during desk work in the field. In those situations, alternate head gear such as bump hats or skill hats should be discussed with the HSM.

- Where site-specific job safety analysis and PPE assessments have not been completed, hard hats are mandatory with the exception inside vehicle cabs and office areas.
- Hard hats are required in construction areas.
- Hard hats for electrical maintenance and construction work shall meet the applicable health and safety standards/requirements for limiting electric shock, burns or impact.
- Head protection is to be used in accordance with the manufacturer's instructions.

Protective hats must meet ANSI STD. Z89.1 – 2009 and ANSI STD Z89.1-2003. There are three general classes of head protection which have been updated.

Classifications Under Old and New Standards			
Z89.1 – 1986 (Old Standard)	Z89.1 – 1997 onward (New Standard)	Application	Test Voltage
A	G	General	2,200 Volts
B	E	Electrical	20,000 Volts
C	C	Conductive	Not Tested

Types and Classes

- Type 1 Hard Hat—These devices are intended only to reduce the force of impact resulting from a blow to the top of the head. Hard hats that meet the requirements of the Z89.1 - 2009 revision should meet this specification also. Both cap and hat design styles can be a Type 1.
- Type 2 Hard Hat—A Type 2 head protector is a hat or cap that provides side impact protection as well as the top or vertical impact protection of a Type 1 device. They are typically lined with high density foam on the inside.
- Class G (General)—Class G head protectors are intended to reduce the danger of contact exposure to low voltage conductors. Test samples are proof tested at 2,200 volts (phase to ground). These were formerly known as Class A hard hats.
- Class E (Electrical)—Class E helmets are intended to reduce the danger of contact exposure to low voltage conductors. Test samples are proof tested at 20,000 volts (phase to ground). These were formerly known as Class E hard hats.
- Class C (Conductive)—Class C hard hats are not intended to provide protection against contact with electrical conductors.
- Note: Neither the Class G nor Class E electrical insulation properties are intended as an indication of the voltage at which the hard hat will protect the wearer.
- Bump Caps—Bump caps do not meet the ANSI requirements. They are recommended for areas where protection is needed from head bumps and lacerations.

Hard Hat Maintenance

- Inspect your hard hat for dents, cuts, breaks, and other damage regularly.
- Do not put excessive stickers or paint on your hard hat unless approved by a supervisor.
- Replace your hard hat if it is involved in an impact collision.
- Replace your hard hat suspension system once a year.
- Replace your hard hat entirely every five years.

Safety Shoes

Safety shoes must be closed shoes which, at a minimum, provide both impact and compression protection in/around the toe area shall be worn as minimum foot protection when in the field, laboratory areas and construction areas.

- Footwear shall be non-porous and must cover the toes and instep.
- Selected safety footwear for personnel working in the field, should provide ankle support.
- Safety footwear shall have smooth leather uppers, (no suede). Soles may be leather, rubber, or composition with either a tread or rugged surface.
- When working in wet conditions rubber boots should be worn over the safety footwear.
- Where fall hazards are present steel-toed protection must meet or exceed ASTM F-2413-2005.

The following table gives PPE boot materials and the general benefits they provide.

Safety Feature	Benefits
Impact-resistant toes	Protects feet from falling objects or compression
Heat-resistant soles	Protects feet from extreme heat
Puncture resistant metal insoles	Protects the soles of the feet from sharp debris common on construction sites
Rubber	Provides traction and flexibility
Electrically conductive soles	Grounds the wearer to avoid static discharge in explosive environments
Electrically nonconductive soles	Insulates feet from electrically charged materials or surfaces

Purchase of Safety Shoes

Refer to GeoEngineers Expense Guidelines for the current reimbursable allowance provided for safety shoes and rubber boots. As of writing this program, the current stipend is $400 every 2 years for all self-purchased PPE, including safety shores. Field technicians and drillers are eligible for their 400$ PPE reimbursement every year instead of every 2 years.

Clothing

Long trousers must be worn (no shorts). Short-sleeve shirts must have a minimum of 4-inch sleeves (no sleeveless shirts or tank tops). Note: Personnel working with or in the vicinity of rotating equipment should not wear loose clothing (e.g., unbuttoned long sleeves, unfastened coveralls, un-tucked shirts, neck wear, etc.). Branded clothing is available on the GeoEngineers company store and may be subject to reimbursement or discounts upon purchase. See below for details.

High Visibility Clothing

High visibility clothing shall be provided by GeoEngineers and worn for field operations. High visibility vests are required on construction sites, on terminals, while conducting recons, working on roads, paths, and locations where there is moving equipment. Vest must be both bright in color and reflective.

Rain Gear

Refer to GeoEngineers Expense Guidelines for the current reimbursable allowance provided for rain gear. As of writing this program, rain gear may be purchased as PPE using the $400 self-purchased PPE stipend. Rain gear purchased from the Company Store by non-field employees receives a 50% discount.

Fire Retardant Clothing

Fire retardant clothing is required predominantly on oil and gas sites, but based on client requirement may also be required on other sites as well. Fire retardant clothing may be made from several types of thermal protective fabrics (see below). Fire retardant clothing required by the client shall be purchased by GeoEngineers and replaced when needed. An assessment process such as the Safety Conversation/Observation shall be used to maintain compliance.

THERMAL PROTECTIVE PERFORMANCE (TPP) OF VARIOUS FABRICS **

Fabric	Nominal Weight (oz/yd^2)	Ignites (Yes/No)	TPP (cal/cm^2)
NOMEX IIIA	4.5	NO	10.6
NOMEX IIIA	6.0	NO	13.1
NOMEX III (Without static-dissipative fiber)	6.0	NO	13.1
Cotton	6.5	YES	***
Polyester/Cotton Blend (65%/35%)	7.0	YES	***
Flame-Retardant Treated Cotton	6.0	NO	7.6
Flame Retardant Treated Cotton	9.0	NO	9.8

Notes:

Fabric was tested according to ASTM D-4108 recommended mounting procedures to test single-layer fabrics, using combined radiant and convective heat.

** Each fabric was home laundered five times prior to testing

*** Fabric ignited and did not pass the flame resistance test (vertical flame test), so meaningful TPP values could not be obtained.

As of writing this program, fire retardant clothing may be purchased by a GeoEngineers employee and reimbursed up to $500 every two years.

Hearing Protection

Hearing protection will be provided to employees to guard against noise levels in excess of 90 decibels (dBA) and is required to be worn. Employees whose daily noise exposure exceeds an 8 hour, time weighted average (TWA) of 85 dBA must wear hearing protection and must participate in the GeoEngineers hearing conservation program. Hearing protection standards and practices will be based on the most up to date guidance from Occupational Safety and Health Administration (OSHA) standard 1910.95 – Occupational Noise Exposure.

Additionally, if the average noise level over an 8-hour period is averaging 105 dBA or louder, double hearing protection is required. Meaning usage of both internal ear plugs and external ear muffs.

For more details on hearing protection, see GeoEngineers Hearing Conservation Program.

Gloves

Gloves made with a material(s) suitable for protection against specific hazards that may be encountered (e.g., chemical resistant gloves) should be worn or readily available when any task with potential hand hazards is undertaken. This would include handling contaminated soil or materials and handling items that could result in pinches, cuts, or scrapes, when drilling, sampling, or performing maintenance.

- Loose gloves should not be worn when working with rotating equipment (e.g., drill presses, shafts, sheaves, gears, sprockets, pedestal, grinders, and "in-rolling" pinch points, etc.) where there is a chance the glove "catches" and pulls an employee's arm into the equipment.
- When performing job specific tasks, which could require the gloves to be removed, they may be removed to perform that task and then put back on upon completion of the specific task. Examples would be writing, pressing small start/stop buttons, intricate electrical work, etc.
- Cut-resistant (Kevlar® or equivalent) gloves should be worn when working with knives, blades, razors, box-cutters, glass, or other sharp objects even for general office tasks.

The following table gives PPE glove materials and the general benefits they provide.

PPE	Benefits
Latex, butyl, nitrile, neoprene, synthetics	Protection against burns, chemical burns, biological hazards, irritation, and dermatitis (depending on the specific glove)
Metal mesh, leather, canvas	Protection against cuts, abrasions, punctures, and burns
Fabric and fabric-coated	Protection against dirt and abrasions
Rubber	Protection against cuts, punctures, and abrasions
Insulated	Protection against extreme heat or cold

Personal Flotation Devices (PFDs)

Personal Flotation Device (PFD) use applies to terminals and piers and employees working near other bodies of water. It also applies to activities conducted by GeoEngineers employees at these facilities, including construction, maintenance, inspections, tours and operations. As of June 26, 2002, the inflatable style PFD has not been approved by the Department of Labor and Industries. The regulations for PFDs are in three L&I locations: WAC 296-800-16070 Personal flotation devices, WAC 296-155-235 Working over or adjacent to water, and WAC 296-56-60115 – Other protective measures.

For more detailed information on working over water, see GeoEngineers Working Over Water program.

PFDs are required for the following:

- Any employee in a boat/skiff/barge,
- Any employee is working on top of, or beyond the bull rail

PFDs are not specifically required when:

- Working behind a guardrail of standard height and strength or other stable restraint
- A single person is working more than 6 feet from the edge
- Working over shallow water (less than chest deep) where floatation would not be achieved (other protective measures required).

Off-Shore Life Jacket (Type I PFD)
Best for open, rough, or remote water, where rescue may be slow coming.

Advantages

- Floats you the best
- Turns most unconscious wearers face-up in water
- Highly visible color

Disadvantages

- Bulky

Near-Shore Buoyant Vest (Type II PFD)
Good for calm, inland water, or where there is good chance for fast rescue.

Advantages

- Turns some unconscious wearers face-up in water
- Less bulky, more comfortable than Off-Shore Life Jacket (Type I PFD)
- Compromise between Type I PFD performance and wearer comfort

Disadvantages

- May be uncomfortable wearing for extended periods
- Will not turn as many people face-up as a Type I PFD will
- In rough water, a wearer's face may often be covered by waves
- Not for extended survival in rough water

Flotation Aid (Type III PFD)
Good for calm, inland water, or where there is good chance of fast rescue.

Advantages

- Generally, the most comfortable type for continuous wear
- Freedom of movement for water skiing, small boat sailing, fishing, etc.
- Available in many styles, including vests and flotation coats

Disadvantages

- Not for rough water
- Wearer may have to tilt head back to avoid face-down position in water

Respiratory Protection

Respiratory protection is covered in the GeoEngineers Respiratory Protection Program.

Employee-Owned Equipment

As a general rule, employees will not use employee-owned PPE. Exceptions must be approved by the Health and Safety Manager. Any approved employee-owned equipment shall be adequate, maintained and in good sanitary condition before use.

Maintenance and Replacement

Protective equipment must be routinely inspected and maintained/replaced if any damage or defects are identified. Mandatory protective work clothing and personal protective equipment must be maintained and replaced as necessary in accordance with the PPE program.

Site-Specific Hazard Assessments

Site-specific PPE Hazard Assessments shall be completed as part of job hazard analysis or health and safety plans.

Training

Training regarding this program shall be provided during new employee orientation, manager webinar or brown bag meetings, and periodically through other forms of communication such as feature safety articles and annual HAZWOPER Refresher. Training shall be documented in Ascent.

Proper training on PPE will include how to properly don, doff, adjust, and wear PPE. The limitations of PPE and proper care/maintenance, useful life expectancy of the PPE, and proper disposal. Retraining will take place when the workplace or type of PPE changes, or when employees display a lack of training in proper use of their PPE

Issued March 1, 2007
Revised September 1, 2015
Revised January 8, 2020
Revised April 25, 2023
Revised September 25, 2023

Appendix J

Emergency/Hospital Contact Information and Directions

HOSPITAL AND DIRECTIONS

HOSPITAL NAME	**Providence Regional Medical Center**
HOSPITAL ADDRESS	1700 13th Street, Everett, WA 98201
PHONE NUMBER (HOSPITAL ER)	425.261.2000
DRIVING DISTANCE	2.1 Miles
DRIVING DIRECTIONS	1. Head northeast on **Terminal Ave** toward **Pigeon Creek Trail** 2. Continue onto **Everett Avenue** 3. Turn **left** onto **Grand Avenue** 4. Turn **right** onto **19th Street** 5. Turn **left** onto **Colby Avenue** 6. Turn **right** onto **13th Street** 7. Turn **right** at destination
DRIVING MAP	

Appendix C

Inadvertent Discovery Plan

INADVERTENT DISCOVERY PLAN

PLAN AND PROCEDURES FOR THE DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

To request ADA accommodation, including materials in a format for the visually impaired, call Ecology at 360-407-6000 or visit https://ecology.wa.gov/accessibility. People with impaired hearing may call Washington Relay Service at 711. People with a speech disability may call TTY at 877-833-6341.

Site Name(s): Marine Area of the Weyerhaeuser Mill A Former Site

Location: Everett, WA

County: Snohomish

Project Lead/Organization: Port of Everett

If this Inadvertent Discovery Plan (IDP) is for multiple (batched) projects, ensure the location information covers all project areas.

1. INTRODUCTION

The IDP outlines procedures to perform in the event of a discovery of archaeological materials or human remains, in accordance with applicable state and federal laws. An IDP is required, as part of Agency Terms and Conditions for all grants and loans, for any project that creates disturbance above or below the ground. An IDP is not a substitute for a formal cultural resource review (Executive 21-02 or Section 106).

Once completed, **the IDP shall always be kept at the project site** during all project activities. All staff, contractors, and volunteers shall be familiar with its contents and know where to find it.

2. CULTURAL RESOURCE DISCOVERIES

A cultural resource discovery could be prehistoric or historic artifacts. Examples include (see images for further examples):

- An accumulation of shell, burned rocks, or other food related materials.
- Bones, intact or in small pieces.
- An area of charcoal or very dark stained soil with artifacts.
- Stone tools or waste flakes (for example, an arrowhead or stone chips).
- Modified or stripped trees, often cedar or aspen, or other modified natural features, such as rock drawings.
- Agricultural or logging materials that appear older than 50 years. These could include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, and many other items.
- Clusters of tin cans or bottles, or other debris that appear older than 50 years.
- Old munitions casings. ***Always assume these are live and never touch or move.***
- Buried railroad tracks, decking, foundations, or other industrial materials.
- Remnants of homesteading. These could include bricks, nails, household items,

toys, food containers, and other items associated with homes or farming sites.

The above list does not cover every possible cultural resource. When in doubt, assume the material is a cultural resource.

3. ON-SITE RESPONSIBILITIES

If any employee, contractor, or subcontractor believes that they have uncovered cultural resources or human remains at any point in the project, take the following steps to ***Stop-Protect-Notify***. **If you suspect that the discovery includes human remains, also follow Sections 5 and 6.**

STEP A: Stop Work.

All work must stop immediately in the vicinity of the discovery.

STEP B: Protect the Discovery.

Leave the discovery and the surrounding area untouched and create a clear, identifiable, and wide boundary (30 feet or larger) with temporary fencing, flagging, stakes, or other clear markings. Provide protection and ensure integrity of the discovery until cleared by the Department of Archaeological and Historical Preservation (DAHP) or a licensed, professional archaeologist.

Do not permit vehicles, equipment, or unauthorized personnel to traverse the discovery site. Do not allow work to resume within the boundary until the requirements of this IDP are met.

STEP C: Notify Project Archaeologist (if applicable).

If the project has an archaeologist, notify that person. If there is a monitoring plan in place, the archaeologist will follow the outlined procedure.

STEP D: Notify Project and Washington Department of Ecology (Ecology) contacts.

Project Lead Contacts

Primary Contact		Alternate Contact	
Name:	Erik Gerking	Name:	Robert Trahan
Organization:	Port of Everett	Organization:	GeoEngineers
Phone:	425.388.0604	Phone:	206.239.3253
Email:	erikg@portofeverett.com	Email:	rtrahan@geoengineers.com

Ecology Contacts (completed by Ecology Project Manager)

Ecology Project Manager		Alternate or Cultural Resource Contact	
Name:	Ryan Hardwick	Name:	Jon Klem
Program:	TCP-HQ	Program:	TCP-NWRO
Phone:	360.280.3895	Phone:	206.556.5584
Email:	ryan.hardwick@ecy.wa.gov	Email:	jon.klem@ecy.wa.gov

STEP E: Ecology will notify DAHP.

Once notified, the Ecology Cultural Resource Contact or the Ecology Project Manager will contact DAHP to report and confirm the discovery. To avoid delay, the Project Lead/Organization will contact DAHP if they are not able to reach Ecology.

DAHP will provide the steps to assist with identification. DAHP, Ecology, and Tribal representatives may coordinate a site visit following any necessary safety protocols. DAHP may also inform the Project Lead/Organization and Ecology of additional steps to further protect the site.

Do not continue work until DAHP has issued an approval for work to proceed in the area of, or near, the discovery.

DAHP Contacts:

Name:	Rob Whitlam, PhD
Title:	State Archaeologist
Cell:	360-890-2615
Email:	Rob.Whitlam@dahp.wa.gov
Main Office:	360-586-3065

Human Remains/Bones:

Name:	Guy Tasa, PhD
Title:	State Anthropologist
Cell:	360-790-1633 (24/7)
Email:	Guy.Tasa@dahp.wa.gov

4. TRIBAL CONTACTS

In the event cultural resources are discovered, the following tribes will be contacted. See Section 10 for Additional Resources.

Tribe:	Lummi Tribe
Name:	Lena Tso
Title:	Tribal Historic Preservation Officer
Phone:	360-312-2257
Email:	lenat@lummi-nsn.gov

Tribe:	Suquamish Tribe
Name:	Stephanie Trudel
Title:	Tribal Historic Preservation Officer
Phone:	360-394-8533
Email:	strudel@suquamish.nsn.us

Tribe:	Swinomish Tribe
Name:	Josephine Jefferson
Title:	Tribal Historic Preservation Officer
Phone:	360-466-7352
Email:	jjefferson@swinomish.nsn.us

Tribe:	Tulalip Tribes
Name:	Richard Young
Title:	Cultural Resources Director
Phone:	360-716-2652
Email:	ryoung@tulaliptribes-nsn.gov

Please provide contact information for additional tribes within your project area, if needed, in Section 11.

5. FURTHER CONTACTS (if applicable)

If the discovery is confirmed by DAHP as a cultural or archaeological resource, or as human remains, and there is a partnering federal or state agency, Ecology or the Project Lead/Organization will ensure the partnering agency is immediately notified

Federal Agency:	State Agency:
Agency:	Agency:
Name:	Name:
Title:	Title:
Phone:	Phone:
Email:	Email:

6. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL REMAINS

Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect. Follow the steps under ***Stop-Protect-Notify.*** For specific instructions on how to handle a human remains discovery, see: *RCW 68.50.645: Skeletal human remains—Duty to notify—Ground disturbing activities—Coroner determination—Definitions*.

Suggestion: If you are unsure whether the discovery is human bone or not, contact Guy Tasa with DAHP, for identification and next steps. Do not pick up the discovery.

Guy Tasa, PhD State Physical Anthropologist
Guy.Tasa@dahp.wa.gov
(360) 790-1633 (Cell/Office)

For discoveries that are confirmed or suspected human remains, follow these steps:

1. Notify law enforcement and the Medical Examiner/Coroner using the contacts below. **Do not call 911** unless it is the only number available to you.

   Enter contact information below (required):

   - Local Medical Examiner or Coroner name and phone: Snohomish County Medical Examiner (425-438-6200)
   - Local Law Enforcement main name and phone: Everett Police Department North Precinct (425-257-8400)
   - Local Non-Emergency phone number (911 if without a non-emergency number): 425-407-3999

2. The Medical Examiner/Coroner (with assistance of law enforcement personnel) will determine if the remains are human or if the discovery site constitutes a crime scene and will notify DAHP.
3. **DO NOT speak with the media, allow photography or disturbance of the remains, or release any information about the discovery on social media.**
4. If the remains are determined to be non-forensic, cover the remains with a tarp or other materials (not soil or rocks) for temporary protection and to shield them from being photographed by others or disturbed.

Further activities:

- Per RCW 27.44.055, RCW 68.50, and RCW 68.60, DAHP will have jurisdiction over non-forensic human remains. Ecology staff will participate in consultation. The Project Lead/Organization may also participate in consultation.
- Documentation of human skeletal remains and funerary objects will be agreed upon through the consultation process described in RCW 27.44.055, RCW 68.50, and RCW 68.60.
- When consultation and documentation activities are complete, work in the discovery area may resume as described in Section 8.

If the project occurs on federal lands (such as a national forest or park or a military reservation) the provisions of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) apply and the responsible federal agency will follow its provisions. Note that state highways that cross federal lands are on an easement and are not owned by the state.

If the project occurs on non-federal lands, the Project Lead/Organization will comply with applicable state and federal laws, and the above protocol.

7. DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS

Archaeological resources discovered during construction are protected by state law RCW 27.53 and assumed eligible for inclusion in the National Register of Historic Places under Criterion D until a formal Determination of Eligibility is made.

The Project Lead/Organization must ensure that proper documentation and field assessments are made of all discovered cultural resources in cooperation with all parties: the federal agencies (if any), DAHP, Ecology, affected tribes, and the archaeologist.

An archaeologist will record all prehistoric and historic cultural material discovered during project construction on a standard DAHP archaeological site or isolate inventory form. They will photograph site overviews, features, and artifacts and prepare stratigraphic profiles and soil/sediment descriptions for minimal subsurface exposures. They will document discovery locations on scaled site plans and site location maps.

Cultural features, horizons, and artifacts detected in buried sediments may require the archaeologist to conduct further evaluation using hand-dug test units. They will excavate units in a controlled fashion to expose features, collect samples from undisturbed contexts, or to interpret complex stratigraphy. They may also use a test unit or trench excavation to determine if an intact occupation surface is present. They will only use test units when necessary to gather information on the nature, extent, and integrity of subsurface cultural deposits to evaluate the site's significance. They will conduct excavations using standard archaeological techniques to precisely document the location of cultural deposits, artifacts, and features.

The archaeologist will record spatial information, depth of excavation levels, natural and cultural stratigraphy, presence or absence of cultural material, and depth to sterile soil, regolith, or bedrock for each unit on a standard form. They will complete test excavation unit level forms, which will include plan maps for each excavation level and artifact counts and material types, number, and vertical provenience (depth below surface and stratum association where applicable) for all recovered artifacts. They will draw a stratigraphic profile for at least one wall of each test excavation unit.

The archaeologist will screen sediments excavated for purposes of cultural resources investigation through 1/8-inch mesh, unless soil conditions warrant 1/4-inch mesh.

The archaeologist will analyze, catalogue, and temporarily curate all prehistoric and historic artifacts collected from the surface and from probes and excavation units. The ultimate disposition of cultural materials will be determined in consultation with the federal agencies (if any), DAHP, Ecology, and the affected tribe(s).

Within 90 days of concluding fieldwork, the archaeologist will provide a technical report describing any and all monitoring and resultant archaeological excavations to the Project Lead/Organization, who will forward the report to Ecology, the federal agencies (if any), DAHP, and the affected tribe(s) for review and comment.

If assessment activities expose human remains (burials, isolated teeth, or bones), the archaeologist and Project Lead/Organization will follow the process described in **Section 6**.

8. PROCEEDING WITH WORK

The Project Lead/Organization shall work with the archaeologist, DAHP, and affected tribe(s) to determine the appropriate discovery boundary and where work can continue.

Work may continue at the discovery location only after the process outlined in this plan is followed and the Project Lead/Organization, DAHP, any affected tribe(s), Ecology, and the federal agencies (if any) determine that compliance with state and federal laws is complete.

9. ORGANIZATION RESPONSIBILITY

The Project Lead/Organization is responsible for ensuring:

- This IDP has complete and accurate information.
- This IDP is immediately available to all field staff at the site and available by request to any party.
- This IDP is implemented to address any discovery at the site.
- That all field staff, contractors, and volunteers are instructed on how to implement this IDP.

10. ADDITIONAL RESOURCES

Informative Video

Ecology recommends that all project staff, contractors, and volunteers view this informative video explaining the value of IDP protocol and what to do in the event of a discovery. The target audience is anyone working on the project who could unexpectedly find cultural resources or human remains while excavating or digging. The video is also posted on DAHP's inadvertent discovery language website.

Ecology's IDP Video (https://www.youtube.com/watch?v=ioX-4cXfbDY)

Informational Resources

DAHP (https://dahp.wa.gov)

Washington State Archeology (DAHP 2003)
(https://dahp.wa.gov/sites/default/files/Field%20Guide%20to%20WA%20Arch_0.pdf)

Association of Washington Archaeologists (https://www.archaeologyinwashington.com)

Potentially Interested Tribes

Tribal Contacts: Interactive Map of Tribes by Area
(https://dahp.wa.gov/archaeology/tribal-consultation-information)

Tribal Contacts - WSDOT Tribal Contact Website
(https://wsdot.wa.gov/tribal/TribalContacts.htm)

11. ADDITIONAL INFORMATION

Please add any additional contact information or other information needed within this IDP.

Implement the IDP if you see…

Chipped stone artifacts.

Examples are:

- Glass-like material.
- Angular material.
- “Unusual” material or shape for the area.
- Regularity of flaking.
- Variability of size.

Stone artifacts from Oregon.

Stone artifacts from Washington.

Biface-knife, scraper, or pre-form found in NE Washington. Thought to be a well knapped object of great antiquity. Courtesy of Methow Salmon Rec. Foundation.

Implement the IDP if you see…

Ground stone artifacts.

Examples are:

- Unusual or unnatural shapes or unusual stone.
- Striations or scratching.
- Etching, perforations, or pecking.
- Regularity in modifications.
- Variability of size, function, or complexity.

Above: Fishing Weight - credit CRITFC Treaty Fishing Rights website.

Artifacts from unknown locations (left and right images).

Implement the IDP if you see…

Bone or shell artifacts, tools, or beads.

Examples are:

- Smooth or carved materials.
- Unusual shape.
- Pointed as if used as a tool.
- Wedge shaped like a “shoehorn”.
- Variability of size.
- Beads from shell (dentalium) or tusk.

Upper Left:*Bone Awls from Oregon.*

Upper Center: *Bone Wedge from California.*

Upper Right: *Plateau dentalium choker and bracelet, from Nez Perce National Historical Park, 19th century, made using Antalis pretiosa shells Credit: Nez Perce - Nez Perce National Historical Park, NEPE 8762, Public Domain.*

Above: *Tooth Pendants.*

Right: Bone Pendants. Both from Oregon and Washington.

Implement the IDP if you see…

Culturally modified trees, fiber, or wood artifacts.

Examples are:

- Trees with bark stripped or peeled, carvings, axe cuts, de-limbing, wood removal, and other human modifications.
- Fiber or wood artifacts in a wet environment.
- Variability of size, function, and complexity.

Left and Below: *Culturally modified tree and an old carving on an aspen (Courtesy of DAHP). These are examples of above ground cultural resources.*

Right, Top to Bottom: *Artifacts from Mud Bay, Olympia: Toy war club, two strand cedar rope, wet basketry*.

Implement the IDP if you see…

Strange, different, or interesting looking dirt, rocks, or shells.

Human activities leave traces in the ground that may or may not have artifacts associated with them. Examples are:

- "Unusual" accumulations of rock (especially fire-cracked rock).
- "Unusual" shaped accumulations of rock (such as a shape similar to a fire ring).
- Charcoal or charcoal-stained soils, burnt-looking soils, or soil that has a "layer cake" appearance.
- Accumulations of shell, bones, or artifacts. Shells may be crushed.
- Look for the "unusual" or out of place (for example, rock piles in areas with otherwise few rocks).

Shell Midden pocket in modern fill discovered in sewer trench.

Underground oven. Courtesy of DAHP.

Shell Midden with fire cracked rock.

Hearth excavated near Hamilton, WA.

Implement the IDP if you see…

Historic period artifacts (historic archaeology considered older than 50 years).

Examples are:

- Agricultural or logging equipment. May include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, etc.
- Domestic items including square or wire nails, amethyst colored glass, or painted stoneware.

Left: Top to Bottom: *Willow pattern serving bowl and slip joint pocket knife discovered during Seattle Smith Cove shantytown (45-KI-1200) excavation.*

Right: *Collections of historic artifacts discovered during excavations in eastern Washington cities.*

Implement the IDP if you see…

Historic period artifacts (historic archaeology considered older than 50 years).

Examples are:

- Railway tokens, coins, and buttons.
- Spectacles, toys, clothing, and personal items.
- Items helping to understand a culture or identity.
- Food containers and dishware.

Main Image: *Dishes, bottles, work boot found at the North Shore Japanese bath house (ofuro) site, Courtesy Bob Muckle, Archaeologist, Capilano University, B.C. This is an example of an above ground resource.*

Right, from Top to Bottom: *Coins, token, spectacles and Montgomery Ward pitchfork toy discovered during Seattle Smith Cove shantytown (45-KI-1200) excavation.*

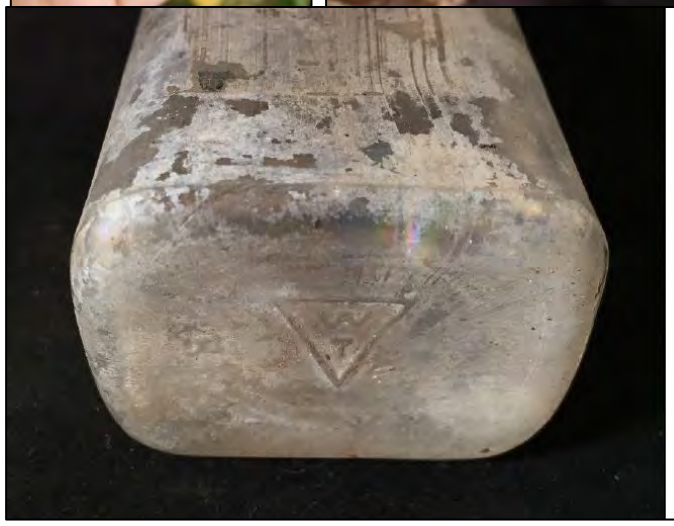
Implement the IDP if you see…

- Old munition casings – if you see ammunition of any type – ***always assume they are live and never touch or move!***
- Tin cans or glass bottles with an older manufacturer's technique – maker's mark, distinct colors such as turquoise, or an older method of opening the container.

Far Left: *.303 British cartridge found by a WCC planting crew on Skagit River.* ***Don't ever touch something like this!***

Left: *Maker's mark on bottom of old bottle.*

Right: *Old beer can found in Oregon. ACME was owned by Olympia Brewery. Courtesy of Heather Simmons.*



Logo employed by Whithall Tatum & Co. between 1924 to 1938 (Lockhart et al. 2016).

Can opening dates, courtesy of W.M. Schroeder.

Implement the IDP if you see…

Historic foundations or buried structures.

Examples are:

- Foundations.
- Railroad and trolley tracks.
- Remnants of structures.

Counter Clockwise, Left to Right: *Historic structure 45KI924, in WSDOT right of way for SR99 tunnel. Remnants of Smith Cove shantytown (45-KI-1200) discovered during Ecology CSO excavation, City of Spokane historic trolley tracks (above ground historic resources) uncovered during stormwater project, intact foundation of historic home that survived the Great Ellensburg Fire of July 4, 1889, uncovered beneath parking lot in Ellensburg.*

Implement the IDP if you see…

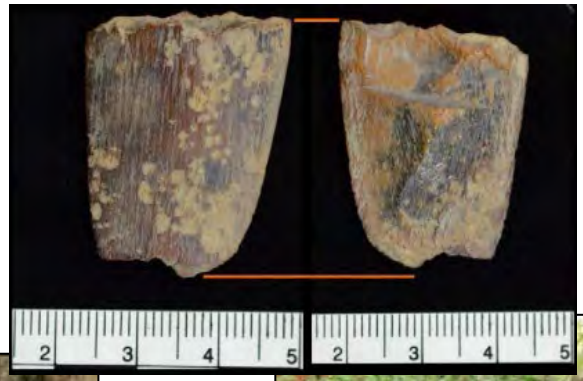
Potential human remains.

Examples are:

- Grave headstones that appear to be older than 50 years.
- Bones or bone tools--intact or in small pieces. It can be difficult to differentiate animal from human so they must be identified by an expert.
- These are all examples of animal bones and are not human.

Center: *Bone wedge tool, courtesy of Smith Cove Shantytown excavation (45KI1200).*

Other images (Top Right, Bottom Left, and Bottom) Center: Courtesy of DAHP.



Directly Above: *This is a real discovery at an Ecology sewer project site.*

What would you do if you found these items at a site? Who would be the first person you would call?

Hint: *Read the plan!*