Remedial Investigation/Feasibility Study Report – Marine Area

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 13, 2024

GeoEngineers
Earth Science + Technology

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/ Abbreviation	Description
2LAET	Second Lowest Apparent Effects Threshold
AC	Activated Carbon
Agreed Order	Agreed Order No. DE 8979
AIS	Automatic Identification System
ARAR	Applicable or Relevant and Appropriate Requirement
BA	biological assessment
BAZ	biologically active zone
bml	below mudline
BMP	best management practice
BNSF	Burlington Northern Santa Fe
BO	biological opinion
BSAF	biota-sediment accumulation factor
CAA	Clean Air Act
CAD	contained aquatic disposal
CAO	cleanup action objective
CAP	Cleanup Action Plan
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
City	City of Everett
CLARC	Cleanup Levels and Risk Calculation
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
Cs-137	cesium-137
CSO	combined sewer overflow
CSL	Cleanup Screening Level
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DAHP	Department of Archaeology and Historic Preservation
dbm	depth below mudline
DCAP	Draft Cleanup Action Plan

DHS	Federal Department of Homeland Security
DMMP	Dredged Material Management Program
DMMU	Dredged Material Management Unit
DNR	Department of Natural Resources
DOH	Washington Department of Health
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EHD	Environmental Health Disparities
EIM	Environmental Information Management
EIS	Environmental Impact Statement
EJScreen	Environmental Justice Screening and Mapping Tool
EMC	Everett Municipal Code
ENR	enhanced natural recovery
EPA	United States Environmental Protection Agency
ESP	Endangered Species Act
ER	exceedance ratio
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
FWCA	Fish and Wildlife Conservation Act
GeoEngineers	GeoEngineers, Inc.
GOIA	Governor's Office of Indian Affairs
HPA	Hydraulic Project Approval
HPAH	high molecular weight polycyclic aromatic hydrocarbons
IC	Institutional control
ID	Identification
IDP	Inadvertent Discovery Plan
IDW	inverse distance weighting
ISGP	General Stormwater Permit
J	estimated analyte result
JARPA	Joint Aquatic Resource Permit Application
LAET	Lowest Apparent Effects Threshold
LPAH	low molecular weight polycyclic aromatic hydrocarbons
MIG_R	Reference Mean Individual Growth
MIG_T	Treatment Mean Individual Growth
MLLW	mean lower low water

MNR	monitored natural recovery
M_R	Reference Mortality
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
M_T	Treatment Mortality
MTCA	Model Toxics Control Act
N_C	Control Mean Number Normal
N_R	Reference Mean Number Normal
N_T	Treatment Mean Number Normal
n/a	not applicable
NCD	Nearshore Confined Disposal
NE	not established
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NWP	Nationwide Permit
OC	organic carbon normalized
OHW	Ordinary High Water
OSHA	Occupational Safety and Health Act
Port	Port of Everett
PAHs	polycyclic aromatic hydrocarbons
Pb-210	lead-210 cesium-137 (Cs-137)
PCBs	polychlorinated biphenyls
PCUL	proposed cleanup level
PLP	Potentially Liable Person/Party
PMA	Port Management Agreement
POCs	points of compliance
POTW	Publicly Owned Treatment Water
PSEP	Puget Sound Estuary Program
PQL	practical quantitation limit
QA/QC	Quality Assurance/Quality Control
RAG	Risk Assessment Guidance
Rambol	Rambol Environ
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RI	Remedial Investigation
RL	reporting limit

RME	reasonable maximum exposure
SCO	Sediment Cleanup Objective
SCUM	Sediment Cleanup Users’ Manual
SEPA	State Environmental Policy Act
Site	Weyerhaeuser Mill A Former
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standard
SOC	Substance of Concern
SPI	sediment profile imaging
SQS	Sediment Quality Standard
SVOC	semi-volatile organic compound
SWAC	Surface Weighted Average Concentration
SWL	Sulfur Waste Liquor
SWPPP	Stormwater Pollution Prevention Plan
TBE	Teledyne-Brown Engineering
TBT	tributyltin
TEQ	toxicity equivalency quotients (refers to concentration basis)
TOC	Total organic carbon
TS	Total solids
TVS	Total volatile solids
U	not detected at the reported concentration
U&A	Usual and Accustomed
U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USFWS	United States Fish and Wildlife Service
UTL	Upper Tolerance Limit
VOC	volatile organic compound
WAC	Washington Administrative Code
Weyerhaeuser	Weyerhaeuser Company
WISHA	Washington Industrial Safety and Health Act
WFSW	Washington Department of Fish and Wildlife

Units

cm	centimeter
ft	feet
mg/kg	milligram per kilogram
mg-N/kg	milligrams of nitrogen per kilogram
mg/L	milligram per liter
mg-N/L	milligrams of nitrogen per liter
ng/kg	nanogram per kilogram
pg/g	picogram per gram
µg/kg	microgram per kilogram
µg/L	micrograms per liter

EXECUTIVE SUMMARY

In accordance with Agreed Order (Agreed Order) No. DE 8979 issued by the Washington State Department of Ecology (Ecology), this Remedial Investigation/Feasibility Study (RI/FS) Report has been prepared for the Marine Area portion of the Former Weyerhaeuser Mill A cleanup site (Site) in Everett, Washington. The RI/FS for the Marine Area was completed by the Port of Everett (Port) pursuant to the Agreed Order. The Site is currently listed in Ecology's database of confirmed and suspected contaminated sites under Facility/Site No. 1884322 and Cleanup Site ID No. 2146.

This Marine Area RI/FS Report was prepared under the direction of Ecology to document the findings from the Marine Area RI to define the nature and extent of contamination. The results of the Marine Area RI inform the Marine Area FS and are used to develop Cleanup Action Objectives (CAOs), screen potential remedial technologies, develop remedial alternatives to address contaminated media of concern, evaluate the remedial action alternatives relative to the Model Toxics Control Act (MTCA) and Sediment Management Standard (SMS) minimum requirements, and identify the remedial alternative that is permanent to the maximum extent practicable.

Site Description and Operational History

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. In 1983, the Mill A property was purchased by the Port, and between 1983 and the mid-2000s, was used by Port (or their lessees) for log handling and storage. 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 over-dredging 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.

The shoreline in and between the terminal areas is characterized by bulkheads and/or armored slopes extending to the approximate base of the navigation area. A public open space with access to the adjacent beach area is located at the southern end of the Site.

Site Characterization

Previous Sediment Quality Studies

In addition to the work completed for the RI, multiple environmental studies have been completed by the Port, Ecology and other parties between 2007-2014 to assess sediment quality in and near the Marine Area. Since the initial RI investigation of the Marine Area in 2015, additional sampling and analysis was completed in 2015, 2016 2018, and 2021 in the Marine Area to fill data gaps identified by Ecology and to characterize dredged material within navigation areas.

Pacific Terminal Interim Action Dredging

An interim cleanup action was completed offshore of the Pacific Terminal under a separate Agreed Order (Agreed Order No. DE 13119) between the Port, Weyerhaeuser and Ecology between August 2016 and February 2017 to remove contaminated sediment and wood debris located southwest of the wharf. The interim action resulted in the removal of approximately 23,000 cubic yards of contaminated sediment and wood debris. Sediment contamination and/or wood debris remaining in-place southwest of the interim action area (i.e., transitional slopes) were capped with armor rock pending completion of the RI/FS and implementation of the final selected Marine Area cleanup action. After completion of the contaminant removal by the interim action, approximately 14,000 cubic yards of material suitable for open water disposal were dredged to meet the navigation depth requirements in the interim action footprint. However, the dredging of open water suitable material was not part of the interim action.

Remedial Investigation Field Activities

As required by the Agreed Order, the RI field investigation activities were completed to fill gaps in the existing data and to define the nature and extent of contamination in the Marine Area. The Marine Area RI included the following investigation activities to meet the objectives of the RI/FS Work Plan (GeoEngineers 2014a) and subsequent RI/FS Work Plan Addenda (GeoEngineers 2016, 2017, 2018a and 2019a):

- Bathymetric survey to characterize the elevations.
- Sampling and analysis of surface and subsurface sediment to evaluate sediment stratigraphy, sediment quality, and delineate the nature and extent of contamination.
- Bioassay testing to evaluate potential toxic effects of hazardous substances on the benthic community.
- Geochronology study to evaluate the sedimentation rate.
- Scour study to evaluate the potential scour impacts of vessel navigation on Marine Area sediment.

Surface samples were collected from the upper 10 centimeters (cm) of sediment to provide information on the lateral extent of contamination within the biologically active zone. Subsurface samples were collected to provide information on the vertical extent of contamination. In addition, Ecology required that the general type and extent of wood debris in the Marine Area be visually characterized in the samples collected.

Remedial Investigation Results

Based on information from the RI as well as previous studies, sediments in the Marine Area are comprised of native sediments and more recently deposited silts, sands and wood debris deposited since industrial development of the Everett waterfront in the late 1800s (see Figures 13 through 16). The recently deposited sediments range up to approximately 20 feet in thickness and are comprised of a specific type of material (e.g., silts, sands, sawdust, etc.) or are present in layers of more than one type. These deposits contain contaminants of concern (COCs; further discussed below). In addition to anthropogenic sources to the recent sediment deposits, new sediment is added to the Marine Area through natural processes and in the outer reaches of the Site. Geochronology cores indicate an approximate average sedimentation rate of 1.27 cm per year. Sediment located within the navigation area and at elevations shallower than the estimated maximum scour depth can be disturbed by vessel activity, thus affecting the net sedimentation rate in these areas. The recently deposited sediments are generally underlain by native sediments that that predate the industrial activities at the Site, though in some areas, native sediments are exposed at the surface in areas that have been previously dredged to support marine terminal operations or that have been scoured by vessel propeller wash. The native sediments do not contain COCs, however, the data show that native material that has been redistributed as a result of scour can become contaminated.

Identification of Contaminants of Concern

In the Marine Area, COCs in the recently deposited sediment were detected at concentrations greater than the proposed cleanup levels (PCULs) that are based on protection of benthic organisms (Benthic) and human health and higher trophic level ecological receptors (Human Health). Based on PCUL exceedances identified by the RI, the COCs identified for Marine Area include the following:

- Metals including arsenic, cadmium, copper, lead, mercury, and zinc;
- Semi-volatile organic compounds (SVOCs) including low molecular weight polynuclear aromatic hydrocarbons (LPAHs), high molecular weight PAHs (HPAHs), chlorinated hydrocarbons, phthalates, phenols and miscellaneous extractable compounds;
- Total carcinogenic PAHs (cPAHs) based on their toxicity equivalence quotient (TEQ);
- Total polychlorinated biphenyls (PCBs) including total dioxin-like PCBs based on their TEQ; and
- Dioxins and furans based on their TEQ.

Compliance Interval and Driver Contaminants of Concern

At the request of Ecology, COCs exceeding the Benthic and Human Health PCULs were further evaluated to identify Driver COCs for the applicable compliance intervals for the Marine Area. Driver COCs with consideration for benthic organism home-range, and current and future Site use were used to both define the Marine Area boundary and to calculate area-weighted concentrations for bioaccumulative compounds as part of the remedial alternative evaluation process.

In accordance with Sediment Cleanup Users' Manual (SCUM: Ecology 2021) (in addition to the surface sediment exposure-based compliance interval), site-specific conditions that would result in potential exposure of subsurface contaminants to human and ecological receptors were also considered to determine the applicable compliance intervals and associated Driver COCs. Such site-specific conditions included potential scour within the navigational areas of the Site as determined by the scour study (Appendix P) and in consideration of current and future Site uses (Appendix F), both of which required consideration of subsurface contamination. As a result, COCs in subsurface sediment that may be exposed by these conditions were included. Driver COCs identified within the applicable compliance intervals include:

- **Benthic** – Mercury, phenols compounds including 2,4-dimethylphenol, 2-methylphenol, 4-methylphenol and phenol, miscellaneous extractables including dibenzofuran (primary contaminant), hexachlorobutadiene, benzoic acid and benzyl alcohol, and PCBs.
- **Human Health** – cPAHs, and dioxins and furans.

In addition, wood debris is identified as a substance of concern (SOC) and a driver due to its potential adverse effects to the benthic community. Currently, wood debris is managed by Ecology under SMS as a deleterious substance (Washington Administrative Code [WAC] 173-204). In accordance with Ecology's guidance for wood waste cleanup (Ecology 2013), sufficient quantities can negatively impact the benthic community from its physical presence, by-products and oxygen reduction due to microbial decomposition and tendency to sequester organic contaminants. Wood debris greater than 15 percent by volume are considered a SOC.

Nature and Extent of Contamination

The highest concentrations of COCs exceeding the Benthic and/or Human Health PCULs are present in the subsurface sediment adjacent to areas where historical milling operations discharged wood debris and process effluent to the Marine Area. Contaminants in this area include metals which are present at up to 192 times the PCUL, SVOCs which are present at up to 427 times the PCUL, cPAH TEQs which are present at up to 105 times the PCUL, dioxin-like PCB TEQs which are present at up to 83 times the PCUL, and dioxin and furan TEQs which are present at up to 37 times the PCUL.

Wood debris that is predominantly comprised of sawdust and chips is present in the recently deposited sediment (up to 20-foot thick) within the Marine Area adjacent to, and northwest of the South Terminal where sawmill, and pulp and paper mill wood debris was discharged and where log handling occurred. Tree bark, although present, comprises only a small amount of the wood debris that was observed. Secondary indicators of wood debris, or wood debris degeneration byproducts, including total organic carbon (TOC), total volatile solids (TVS), phenols, ammonia and sulfide generally coincide with the area of highest observed wood debris by volume. In places, the wood debris comprises up to 100 percent of the recently deposited sediments and contains phenols which are present at up to 76 times the PCUL and miscellaneous extractables (benzoic acid and benzyl alcohol) at up to 11 times the PCUL.

The nature and extent of COCs also indicates that the area affected by contamination from Mill A is separate from the East Waterway cleanup site to the northwest. In addition, the RI sampling results show that COCs do not exceed PCULs in the native sediments that are underlying the recently deposited sediment or exposed at the sediment surface.

Conceptual Site Model

Historically, wood milling and lumber production occurred at the Site between 1896 and 1933. During this time, mill operations involved receiving and storing rafted logs, hauling the logs onshore, sorting and debarking the logs, cutting the logs, drying the cut lumber, and storing lumber prior to shipment. Early mill operations were completed over the water on piers supported by pilings. Milling operations were fueled by burning wood debris generated as a result of milling operations. Boilers fueled by wood debris were used to power multiple mill operations. Wood debris was lost to the marine environment at the mill facilities as a result of the log raft handling and storage, log haul out, debarking, and other milling activities. Following the decline in lumber demand in the 1920s, Weyerhaeuser converted wood milling and lumber production at Mill A to production of unbleached sulfite pulp in 1936. In 1975, the sulfite pulp mill operation was converted into a thermomechanical mill, a process using heat and friction to produce pulp by grinding wood chips between refiner discs. Pulp was manufactured until the mill operations at the Site ceased in 1980. The pulp produced by the mill after the early- to mid-1940s was bleached with a chlorine solution. Following purchase of the Mill A facility by the Port, the Site was used for log handling and storage by Port (or their lessees) from 1983 to approximately the mid-2000s. Currently, the marine terminals are used to support cargo shipping and handling operations.

Contamination at the Site is predominantly associated with historical mill operations. Other more recent sources of contamination at the Site may include, Port-tenant log handling and storage operations, Port marine terminal operations, industrial waterway marine traffic, combined sewer outfall (CSO) and stormwater discharges, and atmospheric emissions from Site and off-site sources.

Wood Debris

The wood debris mound adjacent to, and northwest of the South Terminal was deposited in the Marine Area over the approximate 80 years of lumber and pulp and paper production, is comprised of sawdust and other forms of mill wastes and is up to 20 feet thick adjacent to the former mill. This indicates that the discharge and subsequent burial rate was high compared to average sedimentation rates in Port Gardiner Bay due to the releases of wood waste from the mill's operations. As described below, the wood debris mound and other areas with significant amounts of wood debris are also the areas containing the highest concentrations of COCs. Another source of wood debris is from historic Port-tenant log rafting and storage activities for approximately 20 years after mill operations ceased. Only a small amount of bark is present in the broader wood debris deposit indicating that log rafting may have been a relatively minor contributor to the wood deposits.

Effluent and Stormwater Discharges

The RI identified that the main area of sediment chemical contamination is generally co-located with the wood debris mound. When mill operations were converted to pulp and paper production in the mid-1930s, a group of outfalls discharged large quantities of untreated process effluent to the Marine Area in the approximate vicinity of the wood debris mound.

North and south of the mill outfalls, Site stormwater and CSO outfalls discharged much smaller quantities to the Marine Area as compared to the volume of mill effluent. Based on the data collected during the RI, chemical contamination from stormwater and CSO outfalls appears to be localized to the immediate vicinity of the outfalls.

Co-Location of Wood Debris and Other COCs

Because the wood debris was deposited in the same general vicinity as the discharge of untreated effluent from the mill outfalls, the wood debris and highest concentrations of COCs in the Marine area are generally co-located. Wood debris has physical properties that assisted in the sorption and entrainment of the Site COCs. For example, organic COCs tend to sorb to organic material such as wood debris and organic carbon in the environment. The rapid deposition and burial of wood debris during Site operations would act to sorb organic chemicals discharged from outfalls and entrain them in the Marine Area sediments. Non-organic COCs, such as metals would be entrained in the Marine Area sediments by a separate mechanism where the discharge and subsequent rapid burial of wood debris would act to physically confine contaminants. As a result of these processes, the highest concentrations of COCs are generally co-located with the highest volume of wood debris.

Wood Debris Degradation

The degradation of wood in the aquatic environment results in the production of identified Marine Area COCs including phenols and miscellaneous extractable compounds such as benzoic acid and benzyl alcohol. These compounds were found in the Marine Area at levels that exceed the PCULs in areas generally corresponding to the significant wood debris deposits. The co-location of accumulated wood debris and concentrations of these COCs at the Site indicates that the source of the COCs is also attributable to degradation of the wood debris deposited at the Site since the beginning of industrial operations.

Feasibility Study Development and Remedial Alternative Evaluation

Based on the RI results and Conceptual Site Model (CSM) for the Marine Area, remediation technologies to address the Marine Area contamination were identified and screened to develop a range of remedial alternatives. CAOs, alternatives considered and the selected remedial alternative for the Marine Area are discussed below.

Cleanup Action Objectives

The CAOs for the Marine Area are to eliminate, reduce, or otherwise control (to the extent feasible and practicable) unacceptable risks to the benthic community, human health and higher trophic level ecological receptors posed by the identified COCs and SOCs that are located within the compliance intervals of the Marine Area in accordance with the MTCA Cleanup Regulation (WAC 173-340), SMS regulations (WAC 173-204) and other applicable regulatory requirements.

Sediment Management Areas

To assist in the development and evaluation of remedial alternatives, the Marine Area was subdivided into seven sediment management areas (SMAs) based on the nature and extent COC/SOCs and compliance intervals identified for the Marine Area to meet the scour and current and future Site use conditions. The SMAs include the following:

- **SMA-1** – Includes the subtidal portion of the Marine Area deeper than -55 feet MLLW (below the depth of potential scour). Because SMA-1 is deeper than the depth of potential scour by vessel activity and outside of the navigation area, surface sediment (0-10 cm) is identified as the compliance interval in which the CAOs must be met.
- **SMA-2** – Includes the subtidal portion of the Marine Area shallower than -55 feet MLLW. The eastern limit of SMA-2 is defined by the existing bathymetric contour line of -52 feet MLLW (future navigational elevation at the South Terminal) in front of South Terminal and contour line of -44 feet MMLW (Port's current/future navigational elevation at the Pacific Terminal) in front of Pacific Terminal, and the western limit is defined by the existing bathymetric contour line of -55 feet MLLW (the maximum scour elevation). Because SMA-2 is within the depth of potential scour by vessel activity, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.
- **SMA-3** – Includes the subtidal portion of the Marine Area shallower than -44-foot elevation contour which is the current and future navigation depth for Pacific Terminal. SMA-3 is located adjacent to the

Pacific Terminal. Because SMA-3 is within the navigation area and shallower than the depth of potential scour by vessel activity, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.

- **SMA-4** – Is the subtidal portion of the Marine Area shallower than -44-foot elevation contour which is the current and future navigation depth for Pacific Terminal. SMA 4 is the area of the interim action that was completed in 2016 and 2017. As a result of the Pacific Terminal Interim Action, previously identified Benthic and Human Health PCULs were removed from the Marine Area and the current exposed surface is native sediment. Because SMA-4 is within the navigation area and shallower than the depth of potential scour by vessel activity, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.
- **SMA-5** – Includes the intertidal and subtidal portion of the Marine Area identified for future cargo handling to support the Port's marine terminal operations. The southeastern extent of SMA-5 is defined by bulkhead which also is the boundary between the upland and marine portions of the Site. The northeastern extent of SMA-5 is defined by SMA-4 and the leading edge of the Pacific Terminal Wharf. The northwestern extent is defined by a line parallel to the South Terminal Wharf pier face. The southwestern extent is defined by the edge of the South Terminal Wharf. Because SMA-5 represents the transitional slope between the Uplands Area and the South/Pacific Terminal navigation areas, surface sediment and up to 10' below current mudline may be subject to scour based on the results of a 2019 Mott MacDonald Vessel Propeller Wash Scour Analysis (Appendix N). The cleanup action in this area must also consider the future use of this area for cargo handling and ensure that the facility can be expanded unencumbered by the presence of contamination or wood debris. As a result, surface sediment (0-10 cm) and subsurface sediment to the elevation of the native contact within the limits of the SMA is identified as the compliance interval for this area in which the CAOs must be met.
- **SMA 6** – Includes the intertidal and subtidal portion of the Marine Area shallower than the future navigation depth of -52 feet MLLW for South Terminal. The northern limit is defined by SMA-2 and SMA3. The eastern limit is defined by SMA-5 and the South Terminal Wharf. The southern limit is defined by the future navigation depth of South Terminal and the transition slope extending up from this depth toward the Pigeon Creek intertidal area. Because SMA-6 is within the navigation area and shallower than the depth of potential scour by vessel activity, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.
- **SMA 7** – SMA-7 includes the intertidal and subtidal portion of the Marine Area located adjacent to the armored southern shoreline of South Terminal and the Public Open Space between the elevations of +9 feet MLLW and 0 feet MLLW. SMA-7. The western limit is defined by the estimated horizontal extent of contamination based on the RI data for this area. Because SMA-7 is located in an area accessible by the general public, the compliance interval considers that a human receptor, shell fisher or burrowing organism may dig down to 40 cm below the sediment surface.

Remedial Technology Screening and Alternative Development

The range of remedial technologies evaluated included those listed in SMS (WAC 173-204- 570[4][b]) for the cleanup of contaminated sediment, Environmental Protection Agency (EPA) publications, vendor information, and professional experience gained at similar sites. The screening process determined the most appropriate technologies and process options based on their expected implementability, reliability, effectiveness, and relative cost. Screening also considered criteria associated with current and future land uses, consideration of potential historical and archaeological remains, and impacts to existing habitat resources. Remedial technologies retained based on this evaluation included:

- Institutional Controls
- Monitored Natural Recovery (MNR)
- Enhanced Natural Recovery (ENR)
- Dynamic Sand Capping
- Containment
- Removal

From the retained remedial technologies, a total of ten remedial alternatives were developed for the Marine Area to meet the CAOs ranging from an emphasis on ENR to an emphasis on removal. Each remedial alternative includes a collection of remedial technologies retained through the screening process for each individual SMA. The design parameters used to develop the alternatives were based on both engineering judgment and the current knowledge of Site conditions and are conceptual-level designs for the implementation of the individual technologies. In accordance with the requirements of WAC 173-340-350 and WAC 173-340-360, remedial alternatives were evaluated against the MTCA and SMS minimum requirements. In portions of the Marine Area contained within the navigation area subject to potential scour by vessel activity, and current and future use assumptions, removal by dredging was the only retained remedial technology that met the MTCA and SMS minimum requirements.

A MTCA disproportionate cost analysis (DCA) was then completed to determine which remedial alternative is permanent to the maximum extent practicable (i.e., meets the MTCA/SMS minimum requirements and achieves the highest level of environmental benefit while not being disproportionate in cost relative to the other alternatives). As a result of this evaluation, Remedial Alternative 8 emerged as permanent to the maximum extent practicable and, therefore, the preferred alternative. Remedial Alternative 8 will meet CAOs through a combination of full removal within the South and Pacific Terminal navigation areas (SMA-2, SMA-3 and SMA-6), containment within the future cargo handling area (SMA-5) and a combination of dynamic sand capping, ENR and MNR in the offshore and Public Open Space areas (SMA-1 and SMA-7). The total costs estimated for the remedial alternatives ranged from $201.9 million to $258 million. The estimated cost of the preferred remedial alternative, Remedial Alternative 8, is $209.8 million.

This Executive Summary should be used only in the context of the full report for which it is intended.

1.0 INTRODUCTION

This report presents the results of the Remedial Investigation/Feasibility Study (RI/FS) completed for the Marine Area portion of the Weyerhaeuser Mill A Former (Mill A) Site (Site) located in Everett, Washington (Figure 1). The RI/FS for the Marine Area was completed by the Port of Everett (Port) pursuant to Agreed Order No. DE 8979 (Agreed Order) issued by the Washington State Department of Ecology (Ecology). Mill A is currently listed in Ecology's database of confirmed and suspected contaminated sites under Facility/Site No. 1884322 and Cleanup Site Identification (ID) No. 2146. This Marine Area RI/FS Report documents the nature and extent of contamination and evaluation of cleanup alternatives for the Marine Area portion of the Site.

In accordance with the Agreed Order dated August 9, 2012, as modified on July 26, 2019 (Ecology 2019), the completion of the RI/FS and draft Cleanup Action Plan (DCAP) for the Site has been broken into two phases. The first phase includes completion of this RI/FS Report and DCAP for the Marine Area portion of the Site. The second phase includes preparation of a separate RI/FS and DCAP for the Upland Area portion of the Site. The phased approach is being completed to allow completion of the RI/FS and DCAP for the Marine Area while additional data is being collected from the Upland Area to fill data gaps in advance of completing the Upland Area RI/FS.

1.1. General Site Information

1.1.1. 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. An overview of the Site and surrounding area is shown in Figure 2. The current Site layout, features and facilities are shown in Figure 3. The sub-sections below describe the current features and uses of the marine terminal. Future Site use is described in Section 1.4.

1.1.1.1. Marine Area

The Marine Area is the portion of the Site below OHW that generally includes areas offshore of the South and Pacific Terminals. The Marine Area is comprised of land owned by the Port and Washington State-owned aquatic lands and is generally situated between Port Gardner Bay and the East Waterway. Washington State-owned aquatic lands located between the Inner and Outer Harbor Lines in the Marine Area are being managed by the Port under Port Management Agreement (PMA) No. 20-080027.

Southwest of the Site, a freshwater creek (Pigeon Creek) discharges to Port Gardner Bay. Where Pigeon Creek discharges to Port Gardner Bay, deltaic deposits have created a shallow and relatively flat intertidal area. Located between the mouth of Pigeon Creek and the marine terminal is a public beach (Public Beach). The Public Beach is comprised of gravel from approximately +16 feet mean lower low water (MLLW) to approximately +8 feet MLLW, mixed cobble and sand from approximately +8 MLLW to +7 MLLW, and fine sand and silt with occasional gravel is generally located waterward from the +7 MLLW line.

Along the northwest shoreline, the Port currently operates three vessel berths within the Marine Area portion of the Site that include the following:

- **South Terminal** features a 700-foot-long wharf (historically referred to as Berth 1) that accommodates heavy lifts, roll-on/roll-off, breakbulk and container cargo including aerospace, military, agricultural, cars, trucks, mining, energy and construction equipment. The Port recently completed upgrades of the South Terminal Wharf to accommodate larger and heavier cargo as required by current aerospace customers and has added two 100-foot gauge post-panamax container cranes for use on aerospace and commercial container products. South Terminal Wharf now also has the ability for vessels to plug into a shore power source (cold ironing) for shore side power to eliminate diesel emissions while in port.
- **Pacific Terminal** features a 650-foot-long wharf that accommodates breakbulk and container cargo for the aerospace, construction, manufacturing, energy and agriculture industries. Pacific Terminal has two 50-foot gauge container cranes.
- **Pier 1** features a 675-foot-long wharf and is one of two finger piers offering berth space to support container, break-bulk, roll-on/roll-off and forest product cargo. Pier 1 is situated between the Pacific Terminal and Hewitt Terminal. Pier 1 has four rail tracks that accommodate direct vessel to rail car heavy lifts.

The shoreline in the marine terminal areas is typically comprised of bulkheads and/or armored slopes extending to the approximate base of the navigation area which is currently being maintained to an approximate elevation of -42 feet MLLW to facilitate navigation and moorage. During the 1970s, dredging was completed during construction of the wharf at South Terminal to facilitate larger vessels. During the 1990s, dredging was completed between Pier 1 and 3, and southwest of Pier 1 as part of the Pacific Terminal development. Recently, dredging activities were completed during the 2016/2017 in-water work window as part of an interim action to expedite part of the environmental cleanup at the Site and facilitate increased navigational access for larger vessels along the Pacific Terminal Wharf. Site development is further discussed in Section 1.2. Interim Action dredging is further discussed in Section 2.3. As noted above, the shoreline in the vicinity of the Public Beach is comprised of sand and gravel which transitions to deltaic deposits in the Pigeon Creek intertidal area. To the north and south of the Public Beach, the shoreline slope is armored with heavy stone from approximately +16 feet MLLW to the base of the slope.

1.1.1.2. Upland Area

The Upland Area is the portion of the Site that is above OHW and landward of the Marine Area. The Upland Area is bounded to the southeast by the Burlington Northern Santa Fe (BNSF) rail lines, to the northwest by Port Gardner Bay, and to the northeast by a line extending landward on the southwestern side of Pier 1. In general, the Upland Area is comprised of the South and Pacific Terminal areas which are zoned M-2 (Heavy Manufacturing). The Upland Area is relatively flat with a ground surface elevation ranging between approximately +17 and +22 feet MLLW. Most of the Upland Area is paved with asphalt or concrete. It is used by the Port for operations supporting container and breakbulk cargo handling, storage, and shipping. A limited portion of the Upland Area is not paved with asphalt or concrete but has a crushed gravel working surface for equipment laydown and storage (Equipment Storage Area). The southwestern end of the Upland Area is zoned O-S (Open Space) and is accessible to the public via a 0.6-mile asphalt paved pathway situated along the southeastern boundary of the Pacific and South Terminals and adjacent to the BNSF rail lines. Chain link fences are on either side of the pathway to prevent entry onto the marine terminal and the BNSF rail lines. A gate at the northeast end of the path restricts access to the pathway and beach. The gate (and Public Open Space with access to the Public Beach) is open generally between dawn and dusk (i.e., approximately 12 hours a day).

Prior to 2003, the area that now comprises the Public Open Space and Public Beach was restricted to public access and was generally part of the Port's Equipment Storage Area. Between 2003 and 2004, Kimberly-Clark and the City of Everett (City) installed a new outfall (Outfall 001) and deep-water diffuser and imported fill sand to restore the beach area. In conjunction with this project, agreements between the Port and City of Everett resulted in the establishment of the Public Open Space (and adjacent Public Beach) with a pathway for pedestrian access. Currently, the Public Open Space includes asphalt pavement where the public access path enters this area, native grasses, shrubs and trees are located between the asphalt and top of the shoreline slope. Maintenance of the Public Open Space is currently completed by the City.

Southeast of the Site (and BNSF railroad tracks), a steep and wooded bluff extends from the local ground surface to over 200 feet MLLW. From the wooded bluff, freshwater from Pigeon Creek and two unnamed creeks (Unnamed Creek No. 1 and 2; Figure 3) discharges to Port Gardner Bay at the southwest end of the Site. Freshwater from Pigeon Creek enters Port Gardner Bay from a culvert that extends beneath BNSF railroad tracks. Freshwater from Unnamed Creek 1 enters Port Gardner Bay from a culvert that extends beneath BNSF railroad tracks and the Equipment Storage Area. Freshwater from Unnamed Creek No. 2 discharges to Port Gardner Bay from Outfall 001. Additionally, a man-made drainage feature conveying stormwater collected from South Terminal also discharges to Port Gardner Bay through Outfall 001 located at the southwest end of the Site. This drainage feature was historically referred to as Mill A Creek but was improved in the 2000s to function as a stormwater treatment bioswale for terminal stormwater. In recent years, the Port separated the Unnamed Creek No. 2 water from the stormwater bioswale in an effort to reduce bioswale maintenance costs. The Port manages the terminal stormwater under an Ecology Industrial General Stormwater Permit (ISGP).

The Port's terminal facilities in the Upland Area are secured by fencing and gates. Access to the terminal areas is controlled by the Port in accordance with the Federal Department of Homeland Security (DHS) and Federal Emergency Management Agency (FEMA) regulations. Chain link fencing also exists on both sides of the pathway from the entrance of the Port's marine terminal to the Public Open Space.

1.1.2. Location and Legal Description

The Site is located at the southern end of the City of Everett waterfront. Its address is 3500 Terminal Avenue, Everett, Snohomish County, Washington. As previously noted, the Site is comprised of both upland and marine areas. Coordinates for the centroid of the Site are Latitude N47.97515° and Longitude W122.22536°. The Site lies within the following Townships and Ranges:

- Northwest quarter of Section 30, Township 29 North, Range 5 East.
- Northeast quarter of Section 25, Township 29 North, Range 4 East.

Figure 4 shows the general vicinity of the Site relative to the established parcel boundaries, inner and outer harbor lines, and parts of the Washington State-owned aquatic lands located within the Marine Area that are managed by the Port under PMA No. 20-080027.

1.2. Area and Site Development

The following sections describe the general development history of the Site and surrounding area. Figure 5 presents a series of aerial photographs illustrating Site development from 1947 through its current use. Historical photographs of the Site and surrounding Everett waterfront, as well as diagrams illustrating the development of the Everett waterfront and former Weyerhaeuser Mill A Facility, are presented in Appendix A and B.

1.2.1. Development of the Everett Waterfront and East Waterway

In 1883, the United States Army Corps of Engineers (USACE) began to remove obstructions from the local waterways and started conducting maintenance dredging for a new harbor at Port Gardner to accommodate vessel navigation for early lumber operations. To alleviate problems of siltation from the Snohomish River, the USACE began work in 1885 on a training dike, which forms the east side of the present-day Jetty Island, to divert river flow and create a protected harbor in Port Gardner. Since the late 1880s, the Everett waterfront, situated in the eastern portion of Port Gardner Bay at the mouth of the Snohomish River, has been used for log raft storage and handling, wood processing (i.e., milling and pulp production), and other marine commerce.

By the early 1890s, construction of the Great Northern Railroad was completed beside Port Gardner Bay, leading to considerable waterfront development (Dilgard and Riddle 1973). The Snohomish River navigation channel was completed by the USACE in 1903. The training dike was completed in 1905[1]. By 1918, the Port was established.

During the 1940s, development of the area continued and by the end of World War II, more than 40 sawmills operated in the Everett Harbor area. From the 1930s through the 1970s, infilling of former mudflats north of the Site effectively completed the major landforms that comprise the East Waterway.

1.2.2. Site Development

Early development of the Site first began around 1896 with the construction of the Bell-Nelson Sawmill (today, the location of South Terminal). The surrounding areas were developed shortly thereafter, with the construction of a shingle mill, shipyard, and Puget Sound Wire Nail and Steel Company (today, the location of Pier 1). In 1902, the Weyerhaeuser Company (Weyerhaeuser) purchased the Bell-Nelson Sawmill. Between 1904 and 1924, Weyerhaeuser purchased the adjacent shingle mill and shipyards to expand its sawmill operations. In 1926, Weyerhaeuser completed its acquisitions of surrounding properties by purchasing a lumber mill that was located on a former Puget Sound Wire Nail and Steel Company property. Lumber milling continued at the Site 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. In the early 1940s simple bleaching facilities were added to the Mill A operations. During this time, Weyerhaeuser also constructed a shoreline bulkhead at the same approximate location of the current bulkhead (Figure 3). The area behind the bulkhead was subsequently infilled. A cargo dock constructed sometime between 1919 and 1931 using treated timber piling was located offshore of the bulkhead. It was connected to the shoreline by a series of bridges. During the 1970s, Weyerhaeuser created additional land and constructed a dock southwest of the initial dock structure (current location of the South Terminal Wharf) on timber piles and using dredged fill material placed behind a containment berm. Although not confirmed, the source of the dredged fill material was likely material

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[1] A gap was later cut in the dike to reduce the volume of water (and sediment) flowing into Port Gardner.

dredged from the South Terminal berthing area. Dredging activities and development of South Terminal Wharf are further discussed below.

In 1975, Weyerhaeuser converted the mill operations from a sulfite to a thermomechanical pulping process. Mill A operations continued until 1980, at which time the mill was dismantled. Above ground features were removed, leaving foundations in place. In 1983, the Port purchased the land containing the Mill A facility. The aquatic lands leased by Weyerhaeuser from the State for docks and aids to navigation were assigned to the Port in 1984 and in 2002, and the Port entered into a PMA (No. 20-080027) with the Washington State Department of Natural Resources (DNR) that included the aquatic lands previously leased by Weyerhaeuser. Between 1983 and 1987, the Site was used for log handling and storage by Port. After 1987 and until the mid-2000s, the portion of the Site comprising the South Terminal was used by the Port (or their lessees) as a log sorting yard. Whole logs were stored and loaded for export.

The Pacific Terminal area (Figure 3) was historically a log pond that was used for log rafting and handling at Mill A. The former log pond, and adjacent marine area, was a shallow embayment where log rafts were stored and subsequently removed from the water by log haul out facilities located on the southwest shoreline of the embayment. Multiple bulkheads and a seawall containing an opening to allow the transfer of rafted logs to the mill were present in this area. In the mid-1990s, the Port conducted a major cleanup action under the oversight of Ecology that included dredging the log pond and creating a Nearshore Confined Disposal (NCD) facility for contaminated sediment removed from area offshore of the log pond (southwest of Pier 1) and from between Pier 1 and Pier 3 After filling the NCD, the area was paved and a 650-foot shipping terminal (Pacific Terminal Wharf) was constructed. Dredging of the log pond and adjacent marine area to create the Pacific Terminal removed contaminated sediment from mill operations and most of the wood debris deposited by log rafting and handling associated with historical milling and later Port tenant log storage activities. Development of Pacific Terminal, including the cleanup actions and subsequent monitoring, is further discussed below.

1.2.2.1. South Terminal Wharf Development

The South Terminal Wharf (historically referred to as Berth 1) was constructed in the 1970s by Weyerhaeuser. The wharf is supported by concrete piling and dredged fill material retained behind a containment berm built adjacent to the west bulkhead (Figure 3). As-built drawings (Appendix C) indicate that the berth area was dredged from an approximate elevation of -2 MLLW at the west bulkhead down to elevations ranging between -40 and -42 feet MLLW at the current pier face. A berm was then constructed, and fill was placed behind the berm to form a new upland terminal (South Terminal Wharf; Figure 3).

Based on the as-built drawings, the construction berm generally consists of medium dense fine to coarse gravel with sand. The face of the berm from the top of the berm to elevation -20 MLLW is armored with heavy rip rap (i.e., a minimum 24-inch-diameter rock) and horizontally oriented concrete pile pieces. The face of the berm below elevation -20 MLLW is armored with light rip rap (i.e., a minimum 18-inch-diameter rock). As part of the construction of the South Terminal Wharf, the waterward face of the bulkhead northeast of the South Terminal Wharf was also filled and armored using heavy rip rap.

1.2.2.2. Pacific Terminal Development

The construction of Pacific Terminal was an integration of major cleanup and terminal construction actions that was completed in 1997 that led to the creation of the NCD and Pacific Terminal infrastructure. Dredge material characterization and other sediment quality studies completed in 1993 and 1994 identified contaminated sediment in the area northeast and southwest of Pier 1 that did not meet Dredged Material

Management Program (DMMP) open-water disposal criteria. Results of the characterization studies indicated that the upper 2 to 6 feet of sediment in this area contained contaminants exceeding the open-water disposal criteria. However, the underlying native sediment in this area was determined to be suitable for open-water disposal.

Characterization study results indicated that the contaminated sediment contained low-molecular-weight polycyclic aromatic hydrocarbons (LPAHs), high-molecular-weight polycyclic aromatic hydrocarbon (HPAHs), metals, polychlorinated biphenyls (PCBs) and other organic contaminants in addition to elevated total organic carbon (TOC) and abundant wood debris[2]. Based on these results, in 1996 Ecology prepared a Sediment Management Standards (SMS) Cleanup Action Decision (Ecology 1996) to address known sediment contamination. The Cleanup Action Decision involved dredging of the contaminated sediment from the area northeast and southwest of Pier 1 to meet the cleanup action objective followed by dredging of the underlying clean native material to deepen the berth areas to meet the Port's navigational needs. Contaminated sediment was placed into the NCD constructed within the former log pond area. Because the Port was conducting a voluntary cleanup in conjunction with navigational dredging permitted under the Federal Clean Water Act and associated State and local permits, Ecology determined that the authority for the cleanup fell under the State Water Pollution Control Act (90.48 Revised Code of Washington [RCW]). Project documents prepared to meet the requirements of State and Federal permit processes were reviewed by Ecology to confirm that they provided information equivalent to cleanup study requirements of the SMS and provided enough information to make the statutory determinations required as part of the SMS Cleanup Action Decision.

As detailed in the information and drawings contained in the Cleanup Action Decision and As-Built drawings presented in Appendix D, the NCD was constructed by dredging the upper layer of contaminated sediment containing wood debris and underlying clean native sediment to meet the project requirements. The log pond was dredged to -25 feet MLLW to provide adequate capacity for disposal of the contaminated sediment. The area further offshore of the log pond was dredged to depths ranging between -30 and -42 feet MLLW to provide the base for construction of the NCD containment berm. The berm was constructed of sand and gravel. The waterward face was armored using 36-inch-diameter rip rap. Following construction of a containment berm, approximately 130,000 cubic yards of contaminated sediment dredged from the navigation area northeast and southwest of Pier 1 (Figure 3) was placed into the NCD and capped with approximately seven feet of clean dredged material. Dredged material that was determined to be suitable for open-water disposal from the berth areas and log pond was transferred to the Port Gardner open-water disposal site. After filling the NCD was complete, the area was paved and Pacific Terminal which includes a 650-foot-long shipping wharf (Pacific Terminal Wharf) supported on pre-stressed concrete piles was placed into operation.

In 2008, after 10-years of post-construction monitoring were completed for the NCD facility, Ecology issued a No Further Action (NFA) Letter to the Port confirming the completeness of the cleanup actions (Ecology 2008a). As a result of the confirmed effectiveness of the completed cleanup actions, Ecology determined that the Upland Area within the NCD limits was not subject to further RI investigation. However, groundwater from monitoring wells installed in the NCD containment berm at the northern boundary of the

[2] Testing for dioxins and furans were not completed as part of this DMMP characterization study. The first bioaccumulative standards were not implemented for the open-water disposal sites until 2010, specifically for dioxins/furans, which are ubiquitous in the environment.

NCD facility were to be evaluated as part of the RI for the Upland Area. Because the NCD facility is located within the historical Mill A facility footprint, Ecology determined that this area is part of the Site.

1.2.2.3. Public Open Space and Beach Area Development

Prior to 2003, the Public Open Space (and adjacent Public Beach) area was part of the Port's Equipment Storage Area with no public access. In 2003 Kimberly-Clark and the City excavated the area as part of installation of a new outfall (Outfall 100) and deep-water diffuser project (further discussed in Section 1.3.6). In 2004 the area was re-graded and sand fill was placed as part of a beach restoration and public access project. The Port allowed the City and Kimberly-Clark to install the pipe and beach restoration under a formal agreement, which assigns the long-term maintenance requirements on the City and Kimberly-Clark. With the closure of Kimberly-Clark's Everett operations, the City took over Kimberly-Clark's share of responsibility for the deep water outfall system, including the maintenance of the shoreline restoration area.

Following construction in 2004, wave action began to erode the fill sand, exposing the cobble and large rock armoring beneath. Further erosion due to a January 2012 storm threatened the stability of the slope at the western corner of the Equipment Storage Area. In December 2012, the threatened portion of the shoreline was armored with four feet of stone protection (300 cubic yards of armoring stone) over a 1-foot-thick layer of filter stone (75 cubic yards of filtering stone) as an initial phase to the beach repair project. The second phase of the beach repair project occurred in early 2014 and consisted of placing additional armoring on the shoreline slope to further protect the threatened portion of the shoreline and placement of an approximately 3-foot-thick layer of gravel (approximately 1.5- to 2.5-inch U.S. standard sieve size) over the upper beach area. The second phase of the beach repair project was completed in February 2014.

Appendix E contains a memorandum prepared by Anchor QEA describing the beach restoration construction activities and includes photographs of the shoreline before and after the beach restoration project.

1.3. Historical Operations and Site Use

1.3.1. Wood Milling

Wood milling and lumber production occurred at the Site between 1896 and 1933. During this time, mill operations involved receiving and storing rafted logs, hauling the logs onshore, sorting and debarking the logs, cutting the logs, drying the cut lumber, and storing lumber prior to shipment. Early mill operations were completed over the water on piers supported by pilings. Milling operations were fueled by burning wood debris generated as a result of milling operations. Boilers fueled by wood debris were used to power multiple mill operations. Wood debris was lost to the marine environment at the mill facilities as a result of the log raft handling and storage, log haul out, debarking, and other milling activities.

Prominent historical features related to wood milling and lumber production include:

- The log pond located in the northeastern portion of the Site (current location of Pacific Terminal);
- Crane sheds, a planing mill, dry kiln, machine shop, burner, sawmill, boiler house and fuel (wood) bin in the central portion of the Site; and
- Lumber piles in the southwestern portion of the Upland Area.

The general layout of the facility (circa 1965) including location of the log pond and other prominent historical features related to wood milling are shown relative to the current Site layout in Figure 6.

1.3.2. Pulp Production

Following the decline in lumber demand in the 1920s, Weyerhaeuser converted wood milling and lumber production at Mill A to production of unbleached sulfite pulp. Weyerhaeuser's sulfite pulp mill produced approximately 300 tons of pulp daily by digesting wood chips in a calcium sulfite solution. This process involved burning elemental sulfur to produce sulfur dioxide which was absorbed into a lime solution used as cooking liquor. Spent cooking liquor may also be referred to as sulfite waste liquor (SWL) or concentrated digester liquor. In 1975, the sulfite pulp mill operation was converted into a thermomechanical mill, a process using heat and friction to produce pulp by grinding wood chips between refiner discs. All pulp produced by the mill after the early- to mid-1940s was bleached with a chlorine solution.

Prominent historical features related to pulp production included:

- Log pond and log barker facilities located on the north portion of the Mill A facility;
- Boiler house, exhaust stack, and fuel storage facilities located on the northeast portion of the Mill A facility;
- Bleach plant, acid plant, and sulfur and digester facilities including blow pits located on the southeast/central portion of the Mill A facility;
- Machine room located on the southeast portion of the Mill A facility;
- Pulp processing and storage areas located on the northwest/central portion of the Mill A facility;
- Clarifier and UNOX treatment system (used to treat plant effluent before discharge) located on the southwest portion of the Mill A facility; and
- Research and Development Building and fuel storage tank located on the northwest portion of the Mill A facility.

The general layout of the facility (circa 1965) with prominent historical features related to pulp production is shown relative to the current Site layout in Figure 6.

1.3.3. Log Storage

The practice of log rafting and storage has occurred throughout the East Waterway since the late 1800s according to Port and DNR records. The available information primarily consists of historical photographs, a 1987 Port memorandum (Port 1987) and DNR lease records. The 1987 Port memorandum appears to represent the most comprehensive description of contemporary and historical log rafting practices in the East Waterway and at the Site and appears to have been intended to describe the general historical information concerning log rafting.

DNR records showed that between 1924 and 1984 Weyerhaeuser leased state owned tidelands in at least three areas adjacent to the former mill for log storage. The former leased areas are within log storage areas 1 through 3 shown in Figure 7 and include the area within the current South Terminal Wharf area (Lease Area 1), the area west of the former Mill A log haul out and log pond northeast of the current South Terminal Wharf (Lease Area 2), and within the current berthing area of Pacific Terminal and on the southwest side of the current Pier 1 (Lease Area 3).

The general size and shape of the log rafts in the storage areas varied depending on the product demand and supply. Representative configurations of rafted logs near the Site dating from 1947 are shown in the aerial photographs in Figure 5.

From 1983 through 1987, the Port operated a log yard that included three in-water log storage areas. The 1987 Port memorandum shows that three established in-water log storage areas were located in the vicinity of the former Mill A, that were used by tenants of the Port for log handling and storage until the mid-2000s (as described above). The log storage areas used by the tenants included:

- The current South Terminal Wharf area;
- West of the former Mill A log haul out and log pond located adjacent to the northeast portion of the current South Terminal; and
- Within the berthing area of the current Pacific Terminal and on the southwest side of the current Pier 1.

Between 1987 and mid-2000s, the South Terminal was used as a log sorting yard for receipt and storage of whole logs, as well as debarking, loading, and shipping of the logs for export; in-water log storage continued by the Port (or their lessees) until sometime in the mid-2000s.

1.3.4. Mill A Creek/Stormwater Bioswale

Limited information is available concerning the origin of the drainage feature identified as Mill A Creek. The drainage feature was likely created as a result of development and infilling activities during the early 1900s along the shoreline and bluff located on the southeast perimeter of the Site (further discussed in Section 1.2). Prior to development, water originating from the bluff likely flowed directly into Port Gardener Bay. As a result of development and filling at the Site and surrounding area, water originating from the bluff could no longer flow directly into Port Gardner Bay and required a drainage feature to transport the water.

During Mill A operations, surface water runoff from the southern portion of Mill A entered Mill A Creek prior to discharging to Port Gardner Bay at historical mill outfall WT004. Following the Port's purchase of Mill A, improvements were made to the Mill A Creek drainage feature that included installation of a concrete lined sediment trap and filtration swale consisting of rock substrate (i.e., quarry spalls) and vegetation for filtering stormwater water runoff from the current central and southwestern portions of the South Terminal. At the time of the construction of the filtration swale, historical mill outfall WT004 was abandoned and a new stormwater outfall, Outfall 001 was placed into operation. Discharge to Outfall 001 from the biofiltration swale (historically Mill A Creek) is regulated under an Ecology ISGP permit held by the Port.

The approximate location of Mill A Creek drainage feature and the approximate locations of historical mill outfalls WT004 (now abandoned) and Outfall 001 are shown in Figure 3. Historical industrial wastewater discharges from the Site are further discussed below. A description of the current stormwater management system is further described in Section 1.5.5.

1.3.5. Industrial Wastewater Discharge

Four historical mill shoreline outfalls, WT002, WT003, WT004, and WT006, previously discharged industrial wastewater and stormwater generated at Mill A (Tetra Tech 1988; Figure 3). Prior to 1951, historical mill outfalls WT002 and WT003 were reported to have discharged diluted SWL as well as untreated wastewater from washing, bleaching, and drying processes into the Marine Area on the northwest portion of the Site

(Pentec 1992; DOF and Pentec 1992; E&E 1992; Pentec et al. 1993). After 1951, a majority of the SWL was discharged through the deep-water diffuser (Section 1.3.6) while other wastewater discharges continued through historical mill shoreline outfalls WT002, WT003, WT004 and WT006. In addition, historical mill outfall WT004 was reported to have discharged limestone cleaning water as well as stormwater from the Mill A Creek drainage feature into the Marine Area in the southwest portion of the Site. Hydraulic debarking effluent as well as stormwater runoff was identified to be discharged through historical mill outfall WT006 into the former log pond embayment (current location of the NCD facility). Some of the reported discharge volumes associated with the industrial outfalls are described below.

- It was reported in 1949 that approximately 25 million gallons per day were discharged through outfalls WT002 and WT003. One of these outfalls reportedly discharged about 12 million gallons of diluted sulfite waste liquor per day while the other discharged waste from the bleaching process.
- In 1973, it was reported that about 14 million gallons per day were discharged through historical mill outfalls WT002 and WT003, and up to 1 million gallons per day through historical mill outfall WT004. Waste discharged at these locations included the saltwater used for cooling, wastes from the bleach plant and acid plant, and from the hydraulic debarker.

In 1975, historical mill outfalls WT002 and WT003 were sealed and abandoned when Mill A operations were converted to thermomechanical processes. After 1975, historical mill outfalls WT004 and WT006 were reportedly only used for discharge of stormwater runoff (Tetra Tech 1988). Outfall WT004 was abandoned as part of stormwater management upgrades at the South Terminal (further discussed in Section 1.5.5) and historical mill outfall WT006 was removed or buried during construction of the NCD facility completed in the late 1990s.

1.3.6. Deep-Water Diffuser Discharge

On April 6, 1951, Soundview Pulp Company (predecessor to Scott Paper Company and Kimberly-Clark) and Weyerhaeuser jointly placed in operation a deep-water diffuser (outfall SW001; Figure 3) for discharging SWL and wash water from both mill facilities (Pentec 1992; DOF and Pentec 1992). The deep-water outfall extended about 3,000 feet offshore west of the Weyerhaeuser Mill A facility. It discharged at depths from approximately 300 to 340 feet. After 1951, a majority of the SWL from Mill A was discharged through the deep-water diffuser. However, other untreated wastewater from washing, bleaching and drying processes, as well as limestone cleaning water and stormwater runoff continued to be discharged through historical mill shoreline outfalls (Section 1.3.5). Mill A stopped discharging to outfall SW001 in 1980 when the Weyerhaeuser Mill closed. Scott Paper/Kimberly-Clark continued to discharge through the deep-water diffuser (outfall SW001) until 2004.

In 2004, a new deep-water diffuser (Outfall 100; Figure 3) was installed in the area west of the Site (see Section 1.2.2.3). Water that was discharging to outfall SW001 from Scott Paper was rerouted to Outfall 100. Kimberly-Clark discharged to Outfall 100 until 2012. Currently, only the City of Everett and City of Marysville discharge water to the deep-water diffuser through Outfall 100. Historical records indicate that the Mill A facility never discharged to Outfall 100.

Between 1982 and 1995, sediment sampling and analysis were completed in the general area of Outfall SW001 according to a review of Ecology's environmental information management (EIM) database. The results of these investigations identified Sediment Quality Standard (SQS) screening level exceedances for phenol, 4-methylphenyl, and N-nitrosodiphenylamine. However, subsequent sediment investigations completed in 2004 and 2008 (Anchor 2004 and SAIC 2009) showed that contaminants of concern either were not detected or were detected at concentrations less than SQS screening levels. As a result, Ecology determined that the deep-water diffuser area was not part of the Site and was not subject to the RI.

1.3.7. Combined Sewer Overflow Discharge – City of Everett

Historically, the City sewer system discharged directly into Port Gardner Bay, including into the former Mill A log pond and Pigeon Creek intertidal area through outfalls E005, E006 and E007 (Figure 3). In the 1960s, a system of gravity sewers, pump stations, regulators, and force mains were built to intercept most of these outfalls and convey the sewage to treatment lagoons (Tetra Tech 1988). Currently, one combined sewer outfall (CSO; Outfall 006) discharges to the Marine Area between Pacific Terminal and Pier 1 (Figure 3). Historical untreated sewage discharges are expected to have occurred from outfalls E005, E006 and E007 prior to the construction of the City sewer system in the 1960s.

1.4. Current and Future Land Use

The Site is zoned for heavy manufacturing (M-2) and is currently used for shipping and marine terminal operations break-bulk cargo and other goods. South and Pacific Terminals are deep-water marine terminals on Port Gardner Bay that are an important component in the west coast marine transportation network. Consistent with the Port's Master Plan, the use of the Site will be for maritime commerce. Acknowledging global shipping trends and the continued increase in vessel size, the Port will be required to provide deeper navigational depths and longer berths in order to maintain the viability of their marine terminals. Additional details on the Port's current and future use and designations relevant to seaport operations at the South Terminal portion of the Marine Area, operational considerations that affect those uses, and expected evolution of terminal uses in the reasonably foreseeable future (10-15 years post-cleanup) are presented in Appendix F. The current and future Site use assumptions are shown in Figure 8.

Consistent with the Master Plan of Terminal Improvements (Port 2008) to facilitate current and future operations, the Port has completed recent improvements to their marine terminal facilities, including:

- **Pacific Terminal** – Dredging to expand the navigational approach at Pacific Terminal[3] to accommodate larger vessels.
- **South Terminal** – Strengthening of the wharf, installation of crane rail, the addition of two 100-foot gauge gantry cranes, and the installation of dock side electrical system to support larger, post-Panamax class vessels.
- **Operational Equipment** – Acquisition of a heavy-lift rubber-tired harbor crane designed to efficiently handle both containerized and breakbulk cargoes.

To keep pace with the changing shipping industry and its current customer requirements, the Port will need to continue to make improvements to the marine terminals to support cargo operations, including:

- At the South Terminal, deepening of the berth area is needed to allow post-Panamax class vessels to access the berth and cranes. The anticipated berth to facilitate post-Panamax vessels is in excess of

[3] Near-term improvements for the Pacific Terminal expansion were performed under an Interim Action as described in Section 2.3 to remove shallow sediment and increase the navigable area within the facility approach.

1,200 feet in length and would require a navigation depth of up to -50 feet MLLW to allow sufficient draft depths over a range of tide conditions and will require a 2-foot over dredging allowance for ongoing maintenance. As such, the future use assumption for the South Terminal Berth and associated navigation areas is -52 feet MLLW.

- The navigation depths at the Pacific Terminal and Pier 1 will need to be maintained at -42 feet MLLW to allow sufficient draft depths over a range of tide conditions and will require a 2-foot over dredging allowance for ongoing maintenance. As such, the future use assumption for the Pacific Terminal Berth and associated navigation areas is -44 feet MLLW.
- As part of the future use assumptions, the Port also anticipates expansion of cargo handling in the Marine Area located to the south of the South Terminal Wharf.

Southwest of the marine terminals, existing Site features including the Public Open Space and adjacent Public Beach, armored slopes and bulkheads will be maintained to prevent destabilization of the shoreline separating the Upland and Marine Areas. Maintenance of the Public Open Space and Public Beach areas will continue to be completed by the City consistent with the agreement it has with the Port.

1.5. Environmental Setting

Key elements of the environmental setting of the Site, including climate, geologic and hydrologic setting, physical conditions, shoreline features, stormwater outfalls, potential for climate change and sea level rise are summarized in the following sections.

1.5.1. Climate

The climate for Everett is characterized by mild winters and cool summers. The warm season is from June to September, with an average daily high temperature above 70 degrees Fahrenheit (°F). The hottest days of the year generally occur in August with average daily high temperatures of 77°F and low of 56°F. The cool season is from November to February, with an average daily high temperature below 50°F. The coldest days of the year generally occur in December, with an average daily high of 45°F and low of 36°F.

The prevailing wind direction varies throughout the year and is often from the from the south during the spring and fall months, from the north during the summer months and from the east during the winter months. During late spring and summer, a prevailing westerly and northwesterly flow of air into Puget Sound brings a dry season beginning in May which reaches a peak in July. In late fall and winter, a prevailing southwesterly and westerly air flow from the Pacific Ocean results in a wet season beginning in October which lasts until the beginning of the dry season in May. During winter, the combined influence of low-pressure systems off the Pacific Ocean and cold air from the Fraser River Canyon produce strong northeasterly winds. Although it is not uncommon to have 30- to 40-knot winds under these conditions, the relatively short fetch in Port Gardner Bay area usually limits wind generated wave heights to no more than 6 feet.

Precipitation for the area is light during the summer with an average total accumulation of 0.7 inches or less. During the late fall and winter months, precipitation is frequent. Most of the fall is during the 31 days centered around November 21, with an average total accumulation of 8.7 inches.

1.5.2. Potential for Climate Change

1.5.2.1. Sea Level Rise

Absolute sea level for Puget Sound is projected to change. Coastal areas are expected to experience varying increases in sea level due to changes in global climate. Since the time of the last glacial maximum about 20,000 years ago, the sea level has been on the rise at varying rates. Global sea level has been rising over the past century, and the rate has increased in recent decades. In 2014, global sea level was 2.6 inches above the 1993 average and continues to rise at a rate of about ⅛ of an inch per year (NOS 2019).

Global warming is thought to cause the two main mechanisms contributing to sea level rise which include: 1) thermal expansion (ocean water expands as it warms); and 2) melting stores of ice sheets and glaciers. Local application of global projections of sea level rise are complicated by multiple factors such as atmospheric circulation patterns and tectonic movement. Considering these variables, the National Research Council has made projections of anticipated sea level rise for California, Oregon, and Washington. For the coast of Washington, the projected rise is up to 9 inches by 2030, up to 19 inches by 2050, and up to 56 inches by 2100 (NAP 2012).

To evaluate extreme high tide levels that are currently anticipated, graphs provided by the National Oceanic and Atmospheric Administration (NOAA) compare 10 percent and 1 percent exceedance probability levels, which correspond to tide levels that would be exceeded ten times and one time per century (i.e., the probability of an extreme tide level occurring on a 10-year interval and the probability of an extreme tide level occurring on a 100-year interval). Extreme levels are a combination of astronomical tide, storm surge, and limited wave setup caused by breaking waves.

Rising sea levels combined with high tide, storm surges, and subsidence could contribute to:

- An increase in the elevation, depth, or extent of inundation along the marine and coastal shorelines;
- An amplification of the inland reach of high tides, resulting in increased flooding further inland of the coastline, especially when compounded by severe storm events;
- An increase in the movement of the saltwater wedge further upstream in tidally influenced rivers;
- An increase in saltwater intrusion into groundwater; and
- An increase in landslide risk or rates of erosion along coastal bluffs.

Currently, mean higher high water (MHHW) for Everett is 11.09 feet (datum for Everett Tide Station 9447659). NOAA tide predictions for a 10-year tidal level exceedance is 2.8 feet and 3.2 feet for a 100-year tidal level exceedance. For the purpose of cleanup action planning, a 3.2-foot tide level exceedance over the next 100 years will be assumed, resulting in a projected MHHW elevation of 14.29 feet.

1.5.2.2. Changing Weather Patterns

In addition to changes in sea level, seasonal precipitation patterns are expected to be amplified. By the 2080s, extreme precipitation events (i.e., 24-hour rain events) are projected to increase in intensity by 22 percent on average, as well as frequency when compared to the 1980s (Ecology 2017). Winter precipitation is expected to fall as rain instead of snow, and snowmelt is expected to begin earlier in the spring as a result of predicted increases in annual air temperatures for the Puget Sound region. By the 2050s, average air temperatures are projected to increase by 4.2 °F to 5.5 °F. These warming-driven changes are expected to result in a shorter snow season on average and earlier peak streamflow in rivers with a significant snowmelt component.

These changing precipitation and temperature patterns could contribute to:

- Flow changes in major snowmelt-influenced rivers, with higher flows in winter and lower flows in summer;
- More frequent and severe river flooding;
- Increased landslide risk due to saturation of soil;
- Increased erosion and riverine sediment transport in fall, winter, and spring;
- Warmer water temperatures in Puget Sound, estuaries, and freshwater bodies;
- More severe drought and potentially lower groundwater tables;
- More frequent and intense heat waves in summer; and
- Less frequent and intense cold events in winter.

Cleanup action planning will need to account for the potential for increased and more frequent storm events and the potential for shoreline erosion including the maintenance of existing armor rock and placement of additional shoreline armor to prevent erosion.

1.5.3. Geological Setting

1.5.3.1. Local Geology

The United States Geological Survey (USGS) map of the Everett quadrangle (Minard 1985) was reviewed for geologic information in the vicinity of the Site. Mapped soils at this location include recent alluvium along the shoreline and transitional beds overlying deposits of the Whidbey formation near the base of the bluff adjacent to the shoreline. The Whidbey formation and undifferentiated sediments extend to depths of approximately 400 feet. Areas of fill are also present along the shoreline including fill at former Mill A.

Based on previous investigations (Dames & Moore 1973; GeoEngineers 2010) the South Terminal was constructed on fill material placed on recent alluvium and marine deposits to expand the shoreline and create additional land to support historical operations. Fill material at the South Terminal generally consists of fill soil (sand and gravel) that contain demolition debris (concrete, brick, metal, etc.) and wood debris (sawdust, wood chips, etc.) with varying amounts of silt and sand. Recent alluvium and marine deposits consist of generally unconsolidated, stratified clay, silt and fine sand with a loose/soft consistency. Transitional beds underlying the recent alluvium consist of clay, silt and fine sand and are typically of a dense/hard consistency. Deeper deposits of the Whidbey formation and undifferentiated sediments are similar to the transitional beds, although hard gray silt is common in this formation at the base of slopes within the Everett area.

The sediment stratigraphy for the Marine Area based on the results of the RI are further discussed in Section 5.1.

1.5.3.2. Geologic Hazards

The Site is located within the Puget Sound region, which is seismically active. Seismicity in this region is attributed primarily to the interaction between the Pacific, Juan de Fuca and North American plates. The

Juan de Fuca Plate is subducting beneath the North American Plate. It is thought that the resulting deformation and breakup of the Juan de Fuca Plate accounts for the deep focus earthquakes in the region. Research has concluded that historical, large magnitude, subduction-related earthquake activity has occurred along the Washington and Oregon coasts. Evidence suggests several large magnitude earthquakes (Richter magnitude 8 to 9) have occurred in the last 1,500 years, the most recent of which occurred about 300 years ago. No earthquakes of this magnitude have been documented during the recorded history of the Pacific Northwest.

Landslides involving downslope ground movement, such as rockfalls, deep slope failure, shallow debris flows, and avalanches are a geologic hazard for the Everett shoreline southeast of Port Gardner Bay. Gravity acting on a slope is the primary cause of landslides, but there are other important and dynamic factors that serve as triggers, including:

- Saturation of slopes by precipitation (rain or snowmelt) that weakens soil by reducing cohesion and increasing the pressure in pore spaces, pushing grains away from each other;
- Erosion and undercutting of slopes by streams, wind and/or waves resulting in increased slope angles and decrease slope stability;
- Earthquakes that create stresses that weaken slopes and physically cause slope movement; and
- Perhaps most significant from a management perspective, the over weighting, and/or under cutting of slopes for facilities, roads, railways and other man-made structures change the natural slope equilibrium and cause slopes to fail.

In recent years, several landslides have occurred in the vicinity of the Site along the bluff area of the Everett shoreline with the largest occurring in December 2012 which resulted in the closure of the rail corridor between Everett and Seattle and derailment of several freight train cars.

Other geologic hazards for the region include liquefaction based on the presence of artificial fill. Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore pressures in saturated soils and subsequent loss of strength. This can result in vertical oscillations and/or lateral spreading of the affected soils, with accompanying surface subsidence (sinking) and/or heaving. In general, soils that are susceptible to liquefaction include loose to medium dense clean to silty sands that are saturated (i.e., below the water table).

1.5.3.3. Topography and Bathymetry

A significant part of the Upland Area of the Site rests on historically filled tidelands. Upland Area surface elevations range from +11.09 feet MLLW along the shoreline to an elevation ranging between approximately +17 and +22 feet MLLW in the terminal area. Southeast of the Site, a steep bluff rises from the local ground surface to elevations ranging from approximately 100 to 200 feet above sea level.

The shoreline in the terminal areas (i.e., Pacific Terminal Wharf, South Terminal Wharf, and Pier 1) is generally steep and slopes to the northwest down to elevations of approximately -40 feet MLLW to provide vessel access to the berthing areas. The seafloor continues to slope northwest into Port Gardner Bay beyond the berth areas to depths greater than -300 feet MLLW. South of the South Terminal, a shallow flat intertidal area largely created by deltaic deposits from Pigeon Creek is present.

Topography and bathymetry in the vicinity of the Site is shown in Figure 3.

1.5.4. Hydrological Setting

1.5.4.1. Surface Water Bodies

The Site is located on the southern shoreline of Port Gardner Bay which is an inlet of Possession Sound on which the City of Everett is located. Possession Sound is part of Puget Sound and is positioned between Whidbey Island and the coastline of Snohomish County and connects the main Puget Sound basin to the south with Saratoga Passage and Port Susan to the north. North of the Site, the Snohomish River flows into Possession Sound at Port Gardner Bay.

The Snohomish River forms at the confluence of the Snoqualmie and Skykomish Rivers just west of Monroe. Both of these rivers originate in the Cascades and drain the west slopes of the mountains in southeastern Snohomish County and northeastern King County. The Snohomish River flows generally northwestward from the confluence through a broad floodplain that features wetlands and tide flats spread out across various islands and arms of the river prior to discharging to Port Gardner Bay on the eastern boundary of the City of Everett.

South of the Site, a small freshwater stream (Pigeon Creek) enters Port Gardner Bay forming a small intertidal delta at the shoreline. Sources to Pigeon creek originate between the View Ridge Madison and the Glacier View neighborhoods of Everett, southeast of the Site. In addition to Pigeon Creek, two small unnamed creeks (Unnamed Creek No. 1 and 2; Figure 3) originating from the bluff area southeast of the Site discharges to Port Gardner Bay through a buried 36-inch culvert located beneath the Equipment Storage Area (Unnamed Creek No. 1) and at Outfall 001 (Unnamed Creek No. 2). To the north of the Site, a water body referred to as the East Waterway makes up the Everett Harbor and is a listed cleanup site under Ecology's Puget Sound Initiative (Cleanup Site ID: 4297).

1.5.4.2. Local Hydrology

Groundwater conditions observed during Site investigations indicate the presence of a shallow groundwater unit and a deep groundwater unit that are separated by a wood debris unit that acts as a semi-confining layer. Measured depth to groundwater in the Upland Area ranges from approximately 4 to 10 feet below ground surface (bgs; approximately +11 to +8 feet MLLW) with a general groundwater flow direction that is to the northwest toward Port Gardner Bay.

Within the shallow groundwater unit, the groundwater elevation varies seasonally, with observed wet season elevations being higher than dry season by up to approximately 2 feet. Recharge to the shallow groundwater unit occurs from precipitation falling onto and infiltrating into soil southeast of the Site. As described above, the marine terminal area is mostly covered with asphalt and concrete pavement except in a small portion of the Equipment Storage Area and in portions of the Open Space Area (Figure 3). The asphalt and concrete pavement inhibit the infiltration of precipitation across a predominant portion of the Upland Area. Precipitation falling on the asphalt and concrete pavement is captured in catch basins and transported to a biofiltration swale (historically Mill A Creek) and/or oil-water separators prior to discharge to Port Gardner Bay through outfalls (further discussed below). Precipitation falling on the gravel and soil surfaces of the Equipment and Open Space Areas infiltrates into the ground and recharges shallow groundwater within these areas or drains from the area as surface water runoff. Recharge to the deep aquifer likely occurs from deeper geologic units southeast of the Site. A limited degree of recharge to the deep aquifer may also occur at the Site margins where the wood debris layer is not present and where precipitation may infiltrate to the deep groundwater unit.

The tidal study completed at the Site indicates that the bulkhead separating the Upland and Marine Areas (Figure 3) is inhibiting tidal influence on the upland groundwater. In addition, the observed wood layer present between the shallow and deep groundwater units (approximately 5 to 8 feet in thickness) is also inhibiting tidal influence between shallow and deep groundwater units at the Site. As a result, groundwater from the Site discharges to surface water through diffuse flow and seepages along the shoreline in the southern portion of the Site (area in which the bulkhead is not present) and through a break in the bulkhead located just south of Pacific Terminal Wharf which was created for the installation of a log hoist to support log haul out operations between the mid-1980s and mid-2000s.

Groundwater at the Site is not currently a source of drinking water or considered a future source of drinking water due to the availability of a municipal water supply and City ordinances requiring parties within the city limits to connect to the municipal water supply, which effectively preclude the use of the Site for groundwater as a drinking water source.

1.5.5. Stormwater Management

Stormwater management at the Site is currently regulated by Ecology under the Industrial Stormwater General Permit (ISGP – Permit Number WAR001207). A Stormwater Pollution Prevention Plan (SWPPP) is maintained as a condition of the ISGP (Herrera 2019). A detailed layout of the stormwater drainage network for South and Pacific Terminals is shown in Figure 9.

At the Site, stormwater runoff is divided into stormwater runoff collected from the South Terminal and stormwater runoff collected from Pacific Terminal. Stormwater runoff from the majority of the South Terminal area flows across paved surfaces, enters catch basins, is pumped to a filtration swale, and ultimately discharges to Port Gardner Bay at Outfall 001. Stormwater runoff from the South Terminal Wharf area flows across paved surfaces, enters catch basins or trench drains, and ultimately discharges to Port Gardner Bay at Outfalls 002 and 003, including treatment by a Modular Wetland Biofiltration System, and an oil-water separator, respectively. The Port recently installed the Modular Wetland Treatment System as part of the South Terminal Wharf strengthening project to treat stormwater from most of the South Terminal Wharf area.

Stormwater runoff from Pacific Terminal flows across paved surfaces, enters catch basins, flows through stormwater pipes, and ultimately discharges to Port Gardner Bay at Outfalls 004 and Outfall 006. In addition to stormwater runoff from Pacific Terminal, wastewater from the City's CSO comingles with stormwater runoff collected from Pacific Terminal before discharging to Port Gardner Bay. Outfall 004 was formerly located inland from its present location before the NCD was constructed. The discharge pipe was extended from the historical location of Outfall 004 to the current location of Outfall 004 when the NCD was constructed. Outfalls 005, PT-OF-02, PT-OF-04 and PT-OF-05 (Figure 3) formerly discharged collected stormwater runoff from Pacific Terminal but have since been abandoned in place. Stormwater that previously discharged from Outfalls 005, PT-OF-02, PT-OF-04 and PT-OF-05 are currently routed to Outfall 006. Oil-water separators are incorporated into the treatment system for each of these stormwater outfalls.

1.6. Ecological Setting

1.6.1. Listed Species and Critical Habitat

The following federally listed species and/or their habitat are known to occur, or potentially occur, in the vicinity of the Site. Possible presence of listed species and critical habitat in the general vicinity of the Site were compiled from data provided by the United States Fish and Wildlife Service (USFWS) for terrestrial and freshwater species, and the NMFS for marine species (USFWS 2018; NOAA-NMFS 2018 and WDFW 2018).

- Washington/Oregon/California Distinct Population Segment (DPS) marbled murrelet *(Brachyramphus marmoratus)*
- Puget Sound Coastal DPS bull Trout *(Salvelinus confluentus)*
- Puget Sound evolutionarily significant unit (ESU) Chinook salmon *(Oncorhynchus tshawytscha)*
- Puget Sound DPS steelhead *(Oncorhynchus mykiss)*
- Southern Resident DPS orcas (*Orcinus orca)*
- Puget Sound/Georgia Basin DPS bocaccio *(Sebastes paucispinis)*
- Puget Sound/Georgia Basin DPS yelloweye rockfish *(Sebastes ruberrimus)*

The following Endangered Species Act (ESA) listed species may occur in Port Gardener and/or Puget Sound but are not expected to occur in the vicinity of the Site.

- Yellow billed cuckoo (Coccyzus americanus)
- North American Wolverine (Gulo gulo luscus)
- Streaked Horned Lark (Eremophila alpestris strigata)
- Humpback whale (Megaptera novaeangliae)
- Golden paintbrush (Castilleja levisecta)

1.6.2. Natural Resources

1.6.2.1. Marine Area

The Marine Area is situated in the eastern portion of Port Gardner Bay near the mouth of the Snohomish River, southwest of the East Waterway (Figure 1). The East Waterway is an urban embayment with commercial, industrial and recreational uses. Pigeon Creek discharges to Port Gardner Bay at the southwestern end of the Marine Area (Figure 3). A shallow, flat intertidal area largely created by deltaic deposits from Pigeon Creek exists where Pigeon Creek discharges into Port Gardner Bay. The approximately 900-acre Pigeon Creek drainage basin extends from Port Gardner Bay to Highway 526, and includes areas zoned as public park, residential, general commercial, heavy commercial-light industrial, and office and industrial park.

A public beach is located between the mouth of Pigeon Creek and the marine terminal area. The public beach area is comprised of gravel from approximately +16 feet MLLW to approximately +8 feet MLLW, mixed cobble and sand from approximately +8 MLLW to +7 MLLW, and fine sand and silt with occasional gravel is generally located waterward from the +7 MLLW line. A bulkhead and/or armored slopes are present along the shoreline in the terminal areas as well as on the southwest perimeter of the Upland Area northeast of the beach area. The shoreline in the terminal areas (i.e., Pacific Terminal Wharf, South Terminal Wharf, and Pier 1) is generally steep and slopes northwest down to elevations between approximately -40 and -45 feet MLLW. The mudline surface continues to slope northwest into Port Gardner Bay beyond the terminal areas.

Port Gardner (including the East Waterway) provides juvenile and adult habitat for various marine fish, *anadromous salmonids* and invertebrate species of commercial and recreational value. The area also provides seasonal adult habitat for marine mammals, seabirds and other waterfowl.

On September 7, 2022, Grette Associates (Grette) completed a shoreline habitat survey to assess the existing shoreline habitat conditions of the Site (habitat survey results are presented in Appendix G). The shoreline habitat survey was completed in two phases with the first phase focused on identifying the vegetation, substrate types and extents, slopes, and structural characteristics of the Marine Area shoreline visible above or just below the water level during a -1.4-foot MLLW tide. The second phase of the habitat survey was completed to characterize submerged habitat, assess the areal coverage and density of eelgrass, and collect information on macroalgae, debris, and substrates in the nearshore portion of the Marine Area. Overall, the habitat survey encompasses approximately 102 acres of shoreline and aquatic habitat. Observed conditions include the following:

- **Pacific Terminal Wharf** – Includes the shoreline habitat beneath the Pacific Terminal Wharf and the main terminal surface south of Pier 1. The shoreline area is covered by pile-supported wharf and consists of a steep riprap slope of large angular rock (ranging from 4 inches to 4 feet in diameter). Based on bathymetry data, the steep riprap slope (2H:1V) below 0 feet MLLW. The survey results indicate that this portion of the shoreline is completely void of eelgrass, macroalgae, and upland vegetation due to decreased light availability from the wharf structure and frequent traffic from large vessels.
- **Between Pacific and South Terminal Wharfs** – Includes the shoreline habitat between the Pacific Terminal Wharf and South Terminal Wharf. The shoreline area consists of a bulkhead and armored riprap slope, with a mix of smaller materials and substrates. The riprap is composed of large angular rock, typically ranging in size from 2 feet to 5 feet in diameter. Smaller materials intermixed with the large riprap include small angular rock, quarry spalls, and cobble. A vertical timber bulkhead is present along the upper intertidal shoreline. Watermarks on the timber bulkhead indicate that during high tides, this portion of the shoreline is inundated. At the base of the riprap, there is a break in the slope which becomes more gradual, and materials typically transitioned to smaller sediments. Within the upper intertidal zone, macroalgae is attached to most of the riprap. Where macroalgae coverage is low, there is a high coverage of barnacles or mussels. Eelgrass beds were observed running parallel to most of the area starting at approximately -3 feet MLLW and extending as deep as -13 feet MLLW. Eelgrass beds in this area cover a total of approximately 1.27 acres.
- **South Terminal Wharf** – The Central Terminal Shoreline includes the shoreline habitat beneath the South Terminal Wharf. The area is covered by pile-supported wharf and consists of a steep riprap slope of large angular rock (ranging from 4-inches to 4 feet in diameter). Based on bathymetry data, the steep riprap slope (2H:1V) continues below 0 feet MLLW. The survey results indicate that this portion of the shoreline is completely void of eelgrass, macroalgae, and upland vegetation due to decreased light availability from the wharf structure and frequent traffic from large vessels.

- **South of South Terminal Wharf** – Most of the area is a mudflat, consisting of a mix of soft silt and sand. This mudflat is partially formed as the delta from the input of Pigeon Creek. Upper intertidal areas include areas of gravel and shell hash. Armored slopes are present along the majority of this shoreline which separates the marine terminal and BNSF railroad line. In general, the size of materials decreases along with decreases in slope angle. A distinct break in slope occurs between approximately +3 and +6 feet MLLW along the armored portion of shoreline adjacent to the BNSF railroad line, and +9 to +10 feet MLLW along the armored portion of shoreline adjacent to South Terminal. At this break, the substrate typically transitions to mud. In this area vegetation is sparse and primarily present above the shoreline armoring, consisting of blackberry, occasional trees, and assorted grasses and weeds. No aquatic vegetation within the mudflat area was observed. Eelgrass is visible on Site during low tide adjacent to the southern edge of the South terminal, however majority of eelgrass beds exists between approximately -3 feet MLLW -10 feet MLLW covering approximately 0.31 acres. Eelgrass was not observed south of Pigeon Creek.

1.6.2.2. Upland Area

The upland portion of the Site provides little to no wildlife habitat and natural resources as it is an active, industrial marine terminal. The approximately 45-acre upland portion of the terminal area is paved with the exception of a portion of the Equipment Storage Area which has a compacted gravel operational surface measuring approximately 0.8 acres, and the Public Open Space which is covered with sod, shrubs and trees measuring less than 1 acre. The marine terminal area is bordered to the southeast by an asphalt paved public pathway, Mill A Creek, and multiple rail lines operated by BNSF. The bluff located southeast of the Site and southeast of the rail lines is wooded and likely contains disturbed forested habitat for wildlife.

1.6.3. Cultural Resources

Port Gardner Bay is identified as a high-priority, “early-action” cleanup area under the Puget Sound Initiative. Ecology is working with stakeholders, including tribes, to keep them informed of the cleanup of contaminated sites and sediments in the vicinity Port Gardner Bay and the Snohomish River Estuary. Local tribes engaged by Ecology under the Puget Sound Initiative include the Tulalip, Suquamish, Swinomish and Lummi.

Based on Ecology’s discussion with the tribes and information provided in a 1973 Historical Survey of Everett (Dilgard and Riddle 1973), people have inhabited the Port Gardner Bay area for thousands of years. For centuries, the northwest point of the peninsula (i.e., Preston Point) was the site of Hibulb, the principal village of the Snohomish Tribe (now a part of the Tulalip Tribes). Its location near the mouth of the Snohomish River and next to Port Gardner Bay provided both abundant food and transportation. Native tribes used the Everett shoreline in part for subsistence activities such as shellfish collection, hunting, plant gathering and fishing. Currently, no archaeological or culturally important sites are known to exist at the Site. Some sources indicate that, in the past, there may have been a long house located south of the Site.

1.7. Regulatory Framework

Ecology has issued Agreed Order No. DE 8979 pursuant to the authority of the Model Toxics Control Act (MTCA), Revised Code of Washington (RCW) 70.105D.050(1). The effective date of the Order is August 9, 2012. Parties to the Order include the Port, Weyerhaeuser, and DNR. Under the Order, as modified on July 26, 2019, the Port, Weyerhaeuser and DNR are required to prepare an RI and FS, per WAC 173-340-350 and WAC 173-204-560 and a DCAP per WAC 173 340-350 through 173-340-380 and WAC 173-204-560 through WAC 173-204-580, addressing contamination in the Marine Area. A separate

RI/FS and DCAP are required to be prepared for contamination in the Upland Area under the modified Order. Completion of the RI/FS and DCAP for the Site was broken into two phases to allow completion of the RI/FS and DCAP for the Marine Area while additional data is being collected from the Upland Area.

The final cleanup action for the Marine Area, as determined by the final Cleanup Action Plan (CAP) is anticipated to be completed under a Consent Decree with Ecology.

2.0 SITE CHARACTERIZATION STUDIES

2.1. Previous Sediment Quality Studies

Multiple environmental studies were previously completed to assess sediment quality in and near the Marine Area, including:

- Former Mill A Sediment Study (Geomatrix 2007)
- Port Gardner and Lower Snohomish Estuary Sediment Study (SAIC 2009)
- Whidbey Basin Sediment Study (Ecology 2013a)
- Port Gardner and East Waterway Sediment Study (Ecology 2013b)
- Port Gardner Bay Regional Background Sediment Study (Ecology 2014)

The sediment characterization studies listed above resulted in the collection of surface samples from 28 stations and the completion of 21 sediment cores in and near the Marine Area. Selected samples obtained during these studies were submitted for a combination of analyses including TOC, total solids (TS), grain size, SMS metals and semi-volatile organic compounds (SVOCs), PCBs, pesticides, guaiacols, resin acids, dioxins and furans, and bioassays.

The schedule of laboratory analysis for the sediment samples collected as part of the previous studies is summarized in Table 1. Sediment sample locations from previous studies are shown in Figure 10. The results of sediment samples collected from the previous studies are presented in Tables H-1 and H-2 in Appendix H and are summarized in the following sections. Available sediment core logs from these studies are presented in Appendix I.

2.1.1. Former Mill A Sediment Study

In May 2007, Geomatrix collected surface (0-10 centimeters [cm]) sediment samples from eight sampling locations (ST-24, ST-29, ST-30, ST-32, ST-34, ST-37, ST-39 and ST-42) and subsurface samples from sediment cores completed at 10 sampling locations (ST-02, ST-03, ST-05, ST-08, ST-09, ST-14, ST-15, ST-17, ST-20 and ST-43; Figure 10) advanced to depths of up to 20 feet below the mudline in the Marine Area (Geomatrix 2007). The purpose of this study was to evaluate the potential presence of contamination and to evaluate what potential cleanup actions, if any, would be required by the Port prior to or in conjunction with expansion of the South Terminal facility. Select samples collected as part of this study were submitted for a combination of metal, SVOC, PCB and dioxin and furan analysis (Table 1).

The 2007 sediment study identified approximately 4 feet of recently deposited loose or soft sands and silts containing various amounts of wood debris within the area sampled. In the nearshore area between the South Terminal Wharf and Pacific Terminal, significant deposits of wood debris (up to 19 feet thick) consisting of layers of sediment mixed with wood debris as well as layers comprised of 100 percent wood (sawdust, wood chips, and/or bark) were identified. Underlying the woody debris layer and sediment deposits were well sorted historical sandy deposits.

Chemical analytical results identified detections of metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc), LPAHs, HPAHs, chlorinated hydrocarbons, phthalates, phenols, miscellaneous extractables, PCBs, and dioxins and furans in sediment samples collected as part of this study. The sediment sample locations are shown in Figure 10 and the results for this study are summarized in Tables H-1 through H-3 (Appendix H).

2.1.2. Port Gardner and Lower Snohomish Estuary Sediment Study

Science Applications International Corporation (SAIC) completed a sediment study of Port Gardner Bay and the lower Snohomish estuary area on behalf of Ecology in August 2008 (SAIC 2009). As part of this study, surface (0-10 cm) and subsurface sediment samples were collected and analyzed from one location (A1-24) within the Marine Area and seven locations (A1-15, A1-17, A1-18, A1-20, A1-23, A1-31 and A1-31B) in the general vicinity of the Site (Figure 10). This study also included plan view photography, sediment profile imaging (SPI) and video probing. Select samples collected as part of this investigation were submitted for a combination of metal, SVOC, PCB, pesticide, guaiacol, resin acid, and dioxin and furan analysis (Table 1). In addition, the surface sample obtained from location A1-24 was also subject to bioassay testing.

SPI was used to determine the horizontal extent of woody debris in surface sediments and assess the relative health of the benthic habitat in Port Gardner. Plan view images were used to supplement the SPI data to help determine the presence or absence of wood debris and to identify physical and biological surface sediment features. In the vicinity of the Site, the sediment was observed to consist primarily of grey to black silt and sand. In addition, SPI images showed the presence of wood debris with accumulation as high as 15 percent at the locations evaluated. Wood debris identified in surface sediment generally consisted of wood chips/fragments, bark pieces and other small woody material.

Chemical analytical results identified concentrations of metals (arsenic, cadmium, chromium, copper, lead, mercury and zinc), LPAHs and HPAHs, phthalates, phenols, PCBs, dioxins and furans, and abietic acid in sediment samples collected as part of this study. Pesticides were not detected in any of the sediment samples submitted for chemical analysis. The sediment sample locations are shown in Figure 10 and the results for this study are summarized in Tables H-1 through H-3 (Appendix H).

2.1.3. Whidbey Basin Sediment Study

In June 2007, Ecology completed a study throughout the Whidbey Basin region to evaluate the overall sediment quality (Ecology 2013a). The Whidbey Basin region extends from Possession Sound to Deception Pass in Puget Sound. This region previously had been studied in a baseline survey conducted jointly by Ecology and the National Oceanic and Atmospheric Administration (NOAA) in 1997 (Long et al. 2005). The purpose of this study was to assess changes in sediment quality over a ten-year period. As part of this study, a surface (0-30 cm) sample was collected and analyzed from one location (SP-151) located in the general vicinity of the Site. This sample was submitted for metal, SVOC, PCB and pesticide analysis (Table 1).

Chemical analytical results identified detections of metals (arsenic, cadmium, chromium, copper, lead, mercury and zinc), LPAHs and HPAHs, phenols, and miscellaneous extractables in sediment at location

SP-151. When compared to the 1997 data, the concentrations of these contaminants generally decreased over time throughout the region. The sediment sample locations are shown in Figure 10 and results for this study are summarized in Tables H-1 through H-3 (Appendix H).

2.1.4. Port Gardner and East Waterway Sediment Study

In June 2012, Ecology completed an investigation of the Port Gardner East Waterway to characterize surface sediment (Ecology 2013b). In the vicinity of the Site, surface sediment samples (0-17 cm) were collected from three locations (EW-12-05 through EW-12-07; Figure 10) for metal, SVOC, PCB, and dioxin and furan analysis (Table 1).

Chemical analytical results identified detections of metals (arsenic, cadmium, chromium, copper, lead, mercury, silver and zinc), LPAHs and HPAHs, phthalates, phenols, miscellaneous extractables, PCBs and dioxins and furans in sediment samples collected as part of this study. The sediment sample locations are shown in Figure 10 and results for this study are summarized in Tables H-1 through H-3 (Appendix H).

2.1.5. Port Gardner Bay Regional Background Sediment Study

Between March 2013 and April 2014, Ecology competed a regional background study for Port Gardner Bay (Ecology 2014). As part of this study, a total of 30 surface (0-10 cm) samples were collected for chemical analysis. The purpose of this study was to establish regional background concentrations for selected analytes including arsenic, cadmium, mercury, cPAHs, PCBs, and dioxins and furans in Port Gardner Bay.

In the vicinity of the Site, a surface sediment sample was collected from location PG-62 and submitted for chemical analysis (Table 1) to evaluate regional background conditions. Arsenic, cadmium, mercury, cPAHs, PCBs, and dioxins and furans were detected in the surface sediment collected at this location. The location of PG-62 is shown in Figure 10 and the results for this sample are summarized in Tables H-1 through H-3 (Appendix H).

2.2. Dredged Material Characterization Studies

In addition to the previous environmental studies listed above, sediment sampling and analysis has been completed in the Marine Area to characterize dredged material within navigation areas. Recent dredged material characterization studies completed in the Marine Area include the following:

- Pacific Terminal Interim Action Dredged Material Characterization Study (GeoEngineers 2015a)
- South Terminal Dredged Material Characterization Study (GeoEngineers 2019b)

Sampling and analysis completed for the dredged material characterization studies were completed in accordance with the requirements specified in the Dredged Material Evaluation and Disposal Procedures (DMMP User Manual; USACE 2016) and in coordination with Ecology to meet the requirements of the Agreed Order. The dredged material characterization studies resulted in the collection of surface samples from nine locations and the completion of 23 sediment cores in the Marine Area in the nearshore area of the Pacific and South Terminals. Selected samples obtained during these investigations were submitted for DMMP conventional and chemical parameters. In addition, PCB congener analysis was completed in accordance with the RI/FS Work Plan to further evaluate sediment quality in the Marine Area. Sampling and analysis completed as part of the studies are summarized in the following sections[4].

The schedule of laboratory analysis for sediment samples collected as part of the dredged material characterization studies is summarized in Table 1. The sediment sample locations are shown in Figure 10 and the results are presented in Tables H-1 through H-3 (Appendix H). Sediment core logs for these studies are presented in Appendix I.

2.2.1. Pacific Terminal Interim Action Dredged Material Characterization Study

In January 2015, a dredged material characterization study was completed at the Pacific Terminal to characterize sediment and wood debris to be removed as part of an interim action. The interim action was a combined project to expedite part of the environmental cleanup at the Site and facilitate needed terminal navigational improvements (GeoEngineers 2015a). Characterization activities were completed to evaluate whether material within the proposed dredge prism was suitable for open water disposal. Additionally, subsurface samples were collected at the final surface exposed by dredging to inform management practices to contain exposed subsurface contamination on the transition slope. As part of the characterization, sediment cores were collected at 14 sampling locations (PT-01 through PT-14) to depths ranging between 10 and 30 feet below the mudline surface.

Chemical analytical and biological testing of the samples collected showed biological toxicity generally occurred within the Dredged Material Management Units (DMMUs) containing wood debris and non-bioaccumulative chemical contamination exceeding DMMP open-water disposal guideline values. Additionally, chemical analytical results showed that the sediment deposits underlying the wood debris deposits were less than the DMMP guideline values and were determined to be suitable for open water disposal at the Port Gardner Bay disposal site. Interim action dredging completed at the Pacific Terminal are further discussed in Section 2.3.

2.2.2. South Terminal Dredged Material Characterization

In October 2018, a dredged material characterization study was completed for the South Terminal Maintenance Dredging Project (GeoEngineers 2019b). The characterization was completed in an area that had been historically dredged in the 1970s as part of the construction of the South Terminal Wharf. Characterization activities were completed to evaluate whether material within the proposed dredge prism was suitable for open water disposal. Discrete surface (0 -10 cm) samples were collected from each sample location to characterize surface sediment within the proposed maintenance dredging area. The surface sediment samples were submitted for laboratory analysis to provide data to meet the objectives of the RI/FS Work Plan. Additionally, subsurface samples were collected to evaluate sediment conditions at the surface that would be exposed by dredging at the base of the dredge prism and the transition slope extending up from the base of the navigation channel. As part of the characterization study, sediment cores

[4] In addition to the recent Pacific and South Terminal dredged material characterization studies, historical characterization studies were completed to evaluate dredged material suitability in the vicinity of Pier 1 and Pier 3 to support marine terminal development projects as well as construction of the NCD facility at Pacific Terminal (see Section 1.2.2). Details of the historical dredge material characterization activities are presented in the RI/FS Work Plan. Although the sediment represented by the historical dredged material characterization was removed from the Site, the results from these investigations were evaluated for the purposes of identifying contaminants of potential concern (COPCs) for analysis as part of the Marine Area RI.

were collected at nine sampling locations (ST-101 through ST-109) to depths ranging between 10 and 19 feet below the mudline surface.

Analysis of the samples representing the DMMUs, identified LPAHs and HPAHs, phenols, miscellaneous extractables, and dioxins and furans in sediment samples exceeding DMMP open-water disposal guideline values within the proposed dredge prism as well as, the transition slope that would be exposed by dredging.

The schedule of laboratory analysis for sediment samples collected as part of the dredged material characterization study for the South Terminal Maintenance Dredging Project is summarized in Table 1. Sediment sample locations for the study are shown in Figure 10 and the results are presented in Tables H-1 through H-3 (Appendix H).

2.3. Pacific Terminal Interim Action Dredging

Interim action dredging activities were completed at the southwest end of Pacific Terminal (Figure 3) between August 2016 and February 2017 to remove contaminated sediment and wood debris identified during dredged material characterization (Section 2.2.1). Interim action dredging activities were completed to expedite part of the environmental cleanup at the Site and facilitate increased navigational access for larger vessels. The Interim Action was completed in accordance with the Ecology-approved Interim Action Work Plan (GeoEngineers 2015b) and under a separate Agreed Order (DE 13119) between the Port, Weyerhaeuser and Ecology. Details of the interim action dredging are presented in the construction completion report (GeoEngineers 2018a; Appendix J).

As discussed in Section 2.2.1, dredged material characterization for the interim action was completed in January 2015 to characterize sediment in accordance with DMMP procedures and Ecology requirements to address specific MTCA cleanup considerations. The interim action was completed during the 2016/2017 in-water work window. Dredging was completed to remove material to a depth of -42 feet MLLW (the base of the interim action area). A 2-foot horizontal to 1-foot vertical (2H:1V) slope was constructed to transition from the base depth (-42 feet MLLW) to the existing mudline elevations along the southwest and southeast limits of the dredge prism. Approximately 3 feet of armor rock was placed on the transition slope to prevent slope failure and to isolate contaminated sediment at the surface of the transition slope. The work was completed using a barge mounted crane with a clam shell bucket and two dredge material barges. Best management practices and water quality monitoring were implemented to comply with the Department of Ecology issued Clean Water Act, Section 401 Water Quality Certification for the project.

The project included dredging and disposing of both open-water suitable material and non-open water suitable material. Dredged material within the interim action area not meeting the DMMPs open-water disposal criteria was offloaded to the uplands and transported to Republic Service's Roosevelt Regional Solid Waste Landfill. Dredged material within the interim action area meeting the DMMP open-water disposal criteria was transported to and placed at the Port Gardner non-dispersive open-water disposal site. Interim action dredging at Pacific Terminal resulted in the removal of approximately 23,000 cubic yards of contaminated sediment that did not meet the DMMP open-water disposal criteria and approximately 14,000 cubic yards of sediment meeting DMMP open-water disposal criteria.

Sediment that was exposed at the base of the dredge prism was characterized by Z-Layer samples collected during the 2015 Dredged Material Characterization Study. The results from Z-layer samples are being used to support characterization of the nature and extent of contamination as part of the Marine Area RI. The

Z-Layer sample locations within the interim action area that are being used in the Marine Area RI are shown in Figure 10. Z-Layer sample results representative of the post-dredge surface collected as part of the Pacific Terminal Dredged Material Characterization Study are presented in Tables H-1 through H-3 (Appendix H).

2.4. Remedial Investigation Field Activities

As required by the Agreed Order, RI field investigation activities were completed to characterize sediment conditions in the Marine Area to fill gaps in the existing data and overall, define the nature and extent of contamination. The initial sediment sample locations identified in the RI/FS Work Plan were selected based on previous environmental study results, outfall locations associated with current and historical Mill A operations, and to provide comprehensive coverage in the Marine Area portion of the Site. Additional investigation activities were completed as part of the Marine Area RI as approved by Ecology to fill data gaps identified by Ecology and further define the nature and extent of contamination in the Marine Area.

The Marine Area RI included the following investigation activities to meet the objectives of the RI/FS Work Plan:

- Bathymetric surveys;
- Sampling and analysis of surface and subsurface sediment to evaluate sediment stratigraphy, sediment quality, and delineate the nature and extent of contamination;
- Bioassay testing to define potential toxic effects of hazardous substances on the benthic community;
- Geochronology study to evaluate sedimentation rate; and
- Scour study to evaluate the potential scour impacts of vessel navigation on Marine Area sediment.

Marine Area investigation activities completed in accordance with the Ecology-approved RI/FS Work Plan and subsequent RI/FS Work Plan Addenda (GeoEngineers 2016, 2017, 2018a and 2019a) are summarized in the following sections.

2.4.1. Marine Area Bathymetric Surveys

Bathymetric surveys were completed during the RI to characterize the current elevations in the Marine Area. Between September 8 and 11, 2014, a multibeam survey encompassing the intertidal and subtidal portions of the Marine Area between Pier 1 and the Pigeon Creek delta was completed by Pacific Geomatic Services, Inc., Mountlake Terrace, Washington. The bathymetry of areas below the Pacific and South Terminal Wharfs were surveyed by Tetra Tech, Bothell, Washington (Tetra Tech) in December 2015. Additionally, a multibeam survey was completed of the intertidal and subtidal portions of interim action area on February 21 and 22, 2017 by Tetra Tech following completion of the interim action dredging. The February 2017 bathymetric survey was completed to document the post-construction elevations in the interim action area.

The 2014, 2015 and 2017 surveys have been merged to represent the current bathymetry for the Marine Area. The bathymetry recorded by the merged surveys is presented in Figure 3 and in subsequent figures in the RI. Copies of the individual bathymetric surveys completed in the Marine Area are presented in Appendix K.

2.4.2. Sediment Sampling and Analysis

Sediment sampling and analysis was completed in accordance with the Ecology-approved Marine Area Sampling and Analysis Plan (Marine Area SAP; Attachment 2 to the RI/FS Work Plan). Based on the results of the initial sediment investigation activities, supplemental investigation activities were completed to further evaluate the nature and extent of contamination in the Marine Area and evaluate potential impacts to benthic organisms based on the distribution of observed wood debris and contaminants identified in sediment. Supplemental sampling and analysis were also completed in the East Waterway to identify the boundary between the Marine Area and East Waterway and within the intertidal area adjacent to the Public Open Space. Details of the supplemental sediment investigation activities are summarized in the Ecology-approved RI/FS Work Plan Addenda No. 1, No. 4 and No. 6 (GeoEngineers 2016, 2018a and 2019a, respectively).

Surface and subsurface sediment sampling activities are summarized in the following sections. Sediment sampling locations for the Marine Area and adjacent East Waterway are shown in Figures 11 and 12. Field procedures including sample collection and handling, equipment decontamination and field screening are presented in Appendix L.

2.4.2.1. Surface Sediment Sample Collection

Surface sediment samples were collected from the upper 10 cm of sediment to provide information on the lateral extent of contamination within the biologically active zone in accordance with the RI/FS Work Plan and following the procedures outlined in the Marine Area SAP. Initially, a total of 36 surface sediment samples were collected from locations MAF-01 through MAF-36 (Figure 11) in October 2015. In September 2016, an additional 18 surface sediment samples (MAF-37 through MAF-54; Figures 11 and 12) were collected in accordance with RI/FS Work Plan Addendum No. 1 following review of the initial sample results and with Ecology review and approval to further define the nature and extent of contamination in the Marine Area. In November 2018, an additional seven surface sediment samples were collected in the Marine Area offshore of South Terminal Wharf in accordance with RI/FS Work Plan Addendum No. 4 to further define the nature and extent of contamination. All surface sediment samples were collected using a power grab sampler deployed from research vessels owned and operated by Gravity Marine Consulting.

For surface sample collection, the recovered sample material was examined to ensure that minimum surface sediment acceptance criteria were met, including:

- The jaws of the power grab sampler were closed;
- Sediment was below the top of sampler;
- Minimal observed leakage and sample disturbance; and
- The target penetration depth was achieved.

Surface sediment samples meeting the minimum acceptance requirements were photographed and visually evaluated for the presence of wood debris and wood debris type(s), if present, and classified in accordance with ASTM International (ASTM) D 2488 methods and the Unified Soil Classification System (ASTM D 2487). Then the samples for porewater ammonia, sulfide and tributyltin were collected and placed into appropriate laboratory-prepared sample containers prior to homogenization of the sample. The samples were then homogenized in a stainless-steel bowl to a uniform color and texture and placed into laboratory-prepared sample containers for all other analyses. The field screening results, a description of the material encountered including the observed wood type and quantity, if present, are summarized on exploration logs presented in Appendix L.

2.4.2.2. Subsurface Sediment Sampling

Subsurface samples were collected to provide information on the vertical extent of contamination in accordance with the RI/FS Work Plan and following the procedures outlined in the Marine Area SAP. Initially, a total of 22 sediment cores were collected from locations MAF-07 through MAF-30 (Figure 11) in October 2015 using a vibracore sampler deployed from a research vessel owned and operated by Gravity Marine Consulting. In addition, sediment cores were completed at locations MAF-01 through MAF-05 in November 2015 using a sonic drill rig deployed from a barge. Sonic drilling methods were used in portions of the Marine Area where previous studies indicated the presence of wood debris deposits approximately 5- to 20-feet-thick to ensure adequate penetration and collection of core samples in accordance with the RI/FS Work Plan and Marine Area SAP. In November 2018, an additional seven sediment cores (MAF-55 through MAF-61; Figure 11) were collected using a vibracore sampler in accordance with RI/FS Work Plan Addendum No. 4 following review of the initial sample results and with Ecology review and approval to further define the nature and extent of contamination in the Marine Area.

For the core sample collection, the recovered sample material was examined to ensure that minimum sediment core acceptance criteria were met, including:

- Intact material at the top of the core tube with overlying water;
- A minimum of 75 percent recovery in the core/linear compaction (compression) not greater than 25 percent;
- Intact core tube without obstructions or blockage; and
- Achievement of the target penetration depth.

Sediment core samples meeting the minimum acceptance requirements were either transferred to an upland work area for processing (i.e., vibracore samples) or were processed following collection on the sampling platform (i.e., sonic core samples). Sediment from each core location was photographed and visually evaluated for the presence of wood debris and wood debris type(s), if present, and classified in accordance with ASTM D 2487 and ASTM D 2488 methods. The cores were then sectioned into 2-foot sample intervals after correction for sample recovery (decompressed) and the sulfide samples were placed in laboratory-prepared sample containers prior to homogenization. Core samples were then homogenized in a stainless-steel bowl to a uniform color and texture and placed into laboratory-prepared sample containers for all other analyses. The field screening results, a description of the material encountered including the observed wood type and volume estimate, if present, are summarized on exploration logs presented in Appendix L.

2.4.2.3. Supplemental Public Open Space and Public Beach Area Investigation

After review of the preliminary Upland Area RI data, it was determined by Ecology that additional investigation activities were required to further evaluate the nature and extent contamination. In accordance with RI/FS Work Plan Addendum No. 6, four additional borings were completed for the intertidal area adjacent to the Public Open Space to further evaluate Site conditions and potential for human health and higher trophic level ecological receptor exposure.

Sediment from each additional intertidal sampling location was photographed and visually evaluated for the presence of wood debris and wood debris type(s) and classified in accordance with ASTM D 2487 and ASTM D 2488 methods. In general accordance with RI/FS Work Plan Addendum No. 6, the intertidal samples were collected using hand tools at 1-foot sample intervals. Upon collection, the samples were homogenized in a stainless-steel bowl to a uniform color and texture and placed into laboratory-prepared sample containers for analysis. The field screening results, a description of the material encountered including the observed wood type and volume estimate, if present, are summarized on exploration logs presented in Appendix L.

2.4.2.4. Conventional and Chemical Analysis

Sediment samples collected as part of the Marine Area RI were submitted to Analytical Resources, Inc. (ARI) located in Tukwila, Washington and/or Frontier Analytical (Frontier) located in Eldorado Hills, California. Selected samples were submitted for a combination of conventional and chemical analysis in accordance with the RI/FS Work Plan and RI/FS Work Plan Addenda. The schedule of laboratory analysis for sediment samples collected as part of Marine Area RI is summarized in Table 1.

Laboratory analysis included:

Conventional Analyses:

- Grain size by Puget Sound Estuary Program (PSEP) 1997 protocol or ASTM-Mod;
- Total organic carbon (TOC) by PSEP protocol 1997;
- Total volatile solids (TVS) by PSEP protocol 1997/ASTM D2974;
- Ammonia in porewater by United States Environmental Protection Agency (EPA) Method 350.1 M;
- Sulfides in porewater by Standard Method (SM) 4500-S2;
- Tributyltin in porewater by EPA Method 8270D-SIM/KRONE;
- pH in porewater by SM 4500-H;
- Total ammonia in sediment by EPA Method 350.3; and
- Total sulfide in sediment by EPA Method 376.2 or PSEP 1997.

Chemical Analyses:

- SMS Metals by EPA Method 6000/7000 series;
- SMS SVOCs by EPA Method 8270;
- Polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270 SIM;
- Guaiacols, chlorinated phenols and resin acids by EPA Method 8270D;
- Pesticides by EPA Method 8081B;
- Herbicides by EPA Method 8151;
- PCB congeners by EPA Method 1668A; and
- Dioxins/Furans by EPA Method 1613.

The conventional and chemical analyses completed on sediment samples collected as part of the Marine Area RI as well as the previous environmental studies are summarized in Table 1. In accordance with the

RI/FS Work Plan, surface and subsurface samples not initially selected for analysis were archived for potential follow-up analysis to further evaluate the nature and extent of contamination and fill identified data gaps in consultation with Ecology.

2.4.3. Bioassay Testing

Surface sediment sampling activities were completed for bioassay testing in accordance with RI/FS Work Plan Addendum No. 1 at locations MAF-09 through MAF-12, MAF-20 through MAF-22, MAF-31 and MAF-35 on September 13, 2016. Bioassay testing was completed to further characterize potential toxic effects to benthic organisms. Sample locations for bioassay testing were selected where the surface wood debris content was estimated to be greater than 15 percent and/or chemical concentrations from the initial Marine Area sampling and analysis exceeded the SMS Sediment Cleanup Objectives (SCO) based on protection of the benthic organisms.

The locations selected for bioassay testing were re-occupied and samples were collected using a power grab sampler deployed from a research vessel owned and operated by Gravity Marine Consulting. Field collection and processing methods, bioassay specific Quality Assurance/Quality Control (QA/QC), and data reporting procedures were in accordance with Puget Sound Protocols and Guidelines (PSEP 1995). Bioassay tests completed on the surface sediment samples included the following:

- 10-day amphipod mortality test (acute toxicity);
- 20-day juvenile infaunal growth test (chronic toxicity); and
- Sediment larval test (acute toxicity) using the resuspension method.

Rambol Environ (Rambol), an Ecology-certified laboratory located in Port Gamble, Washington completed the bioassay testing services and collected reference area sediment samples from the Carr Inlet in general accordance with PSEP (1995), the Sediment Cleanup User's Manual (SCUM; Ecology 2021) and programmatic updates provided in the Sediment Management Annual Review Meeting (SMARM) technical papers.

The laboratory report for bioassay testing is provided in Appendix M. The bioassay laboratory data were subject to a data quality review. The results of the data quality review are presented in a Data Quality Review Report provided in Appendix N.

2.4.4. Geochronology Investigation

A geochronology investigation was completed to evaluate net sedimentation rates in the deeper areas of the Marine Area to support identification and evaluation of future remedial actions. Sampling and analysis completed as part of the geochronology investigation was completed in accordance with the Ecology-approved RI/FS Work Plan Addendum No. 2 (GeoEngineers 2017).

In February 2017, a total of three sediment cores were collected from locations MAF-GC-01 through MAF-GC-03 (Figure 11) using a vibracore sampler deployed from a research vessel owned and operated by Gravity Marine Consulting. Upon retrieval of the sediment cores, the recovered sample material was examined to ensure that the minimum sediment core acceptance criteria (described in Section 2.4.2.2 above) were met. The sediment core from each location exhibiting the least amount of disturbance, highest recovery, and least amount of anthropogenic material was visually classified in accordance with ASTM D

2487 and D 2488 methods and sectioned into approximately 2 cm (decompressed) sample intervals. The sample intervals were then homogenized to a uniform color and texture and placed into laboratory-prepared sample containers for lead-210 (Pb-210) and cesium-137 (Cs-137) analysis at Teledyne-Brown Engineering (TBE) laboratory located in Knoxville, Tennessee.

Specific details of the geochronology investigation including sample collection, processing, laboratory analysis and results are presented in the Weyerhaeuser Mill A Former Site Sediment Geochronology Study Report provided in Appendix O.

2.4.5. Scour Study

At the request of Ecology, following review of the initial RI sediment data a vessel scour analysis was completed for the Pacific and South Terminal navigation areas. The purpose of the scour study was to evaluate the potential scour impacts of vessel navigation on Marine Area sediments and included the area adjacent to the South Terminal Wharf and Pacific Terminal Wharf for consideration in the evaluation of the cleanup point of compliance and remedial alternatives.

Automatic Identification System (AIS) vessel tracking data was utilized to identify vessel and tug types and operations within the study area to use for the purposes of the scour analysis modeling. Vessel approach, mooring and departure scenarios for identified vessels and tugs were developed. These scenarios were subsequently evaluated using FLOW-3D model software to evaluate potential scour from ship and tug operations. Appendix P presents the Vessel Propeller Wash Scour Analysis completed by Mott MacDonald (2019) including detailed descriptions of how the scour analysis was completed. The scour study utilized parameters for a range of tug and cargo vessels representative of the current operations at South and Pacific Terminals. The scour study did not consider larger future cargo vessels that may operate at the marine terminals since the parameters of these vessels are vessel-specific and therefore, difficult to predict. However, the tugs that are currently in operation are expected to be similar to those that will service the larger cargo vessels in the future.

2.4.6. RI/FS Work Plan Deviations

Deviations to the Ecology-approved RI/FS Work Plan and subsequent RI/FS Work Plan Addenda (Addendum No. 1, Addendum No. 2, Addendum No. 4 and Addendum No. 6) for surface and subsurface sample collection and analysis include the following:

- The marine research vessel Seahorse was unable to access sediment core sample location MAF-SC-02 due to the vessels limited maneuverability and presence of pilings within the nearshore portion of the Marine Area. MAF-SC-02 was repositioned approximately 70 feet west of the proposed sampling location. At this new location, the sampling objectives for MAF-SC-02 were achieved.
- At sediment core sample location MAF-SC-04, an additional core was advanced to collect an adequate sample volume for PCB analysis for the 0- to 2-foot sample interval.
- Surface and sediment core samples were not completed at location MAF-SS/SC-06 in consultation with Ecology as MAF-SS/SC-06 was located in the Pacific Terminal interim action dredge area and interim action dredging would remove the material to be sampled.
- Due to limited recovery and penetration depth at core sample location MAF-SC-14 following multiple attempts, this sediment core sampling location was repositioned approximately 45 feet west of the

proposed sampling location. At this new location, multiple additional attempts were completed with limited recovery and penetration depth. Sediment core sample location MAF-SC-14 was repositioned an additional 45 feet (approximate) west of the secondary sampling location (approximately 90 feet west of the original location). At this new location, the sampling objectives for MAF-SC-14 were achieved. Large rock encountered at shallow depths at the first two attempted sampling locations limited recovery and penetration depth.

- The marine research vessel Tieton was unable to access sediment core sample location MAF-SC-27 due tidal limitations within the nearshore portion of the Marine Area. MAF-SC-27 was repositioned approximately 45 feet west of the proposed sampling location. At this new location, the sampling objectives for MAF-SC-27 were achieved.
- Due to access limitations including the presence of beach logs and soft substrate, soil borings EDP62 through EDP65 were completed using hand tools to a maximum depth of 3 feet bgs. Because contaminants of concern were not encountered at these locations at the initial target sample intervals, therefore, additional investigation at these locations to achieve deeper sample intervals was not warranted.

2.5. Environmental Data Used for the RI

2.5.1. Remedial Investigation Dataset

Data sources for the Marine Area RI include data collected in general accordance with the Ecology-approved RI/FS Work Plan and subsequent RI/FS Work Plan Addenda to fulfil the requirements of the Agreed Order. The analytical laboratory data reports for samples collected by GeoEngineers for the Marine Area RI are provided in Appendix M. Laboratory data for samples collected by GeoEngineers were subject to a United States Environmental Protection Agency (EPA)-defined Stage 2B or Stage 4 data validation (EPA Document 540-R-08-005; EPA 2009). The results of the data quality review are presented in the Validation Reports provided in Appendix N.

Marine Area RI data collected from the Site have been entered into Ecology's Environmental Information Management (EIM) System under Study ID AODE8979.

2.5.2. Other Environmental Data

Environmental data collected during previous investigations (Section 2.1), Z-Layer samples from the Pacific Terminal dredged material characterization representative of the post-interim action dredged surface (Section 2.2.1) and South Terminal dredged material characterization study results (Sections 2.2.2) are also being used define the nature and extent of contamination in the Marine Area. These data are referenced from the EIM under the following Study IDs:

- 2007 Former Mill A Sediment Investigation – SOTERM07
- 2007 Whidbey Basin Sediment Investigation – PSAMP_SP
- 2008 Port Gardner and Lower Snohomish Estuary Sediment Investigation – PortGardner_08
- 2012 Port Gardner and East Waterway Sediment Investigation – EPAX019F
- 2014 Port Gardner Bay Regional Background Sediment Investigation – UWI
- 2015 Pacific Terminal Dredge Material Characterization – PEWMA15

- 2018 South Terminal Dredge Material Characterization – AODE8979

Environmental data from these studies were previously reviewed for quality assurance and are reported under Ecology's EIM database as "Level 2: Data Verified", "Level 4: Data Verified and Assessed for Usability in a Formal Study Report" or "Level 5: Data Verified and Assessed for Usability in a Peer-Reviewed Study Report". Based on this technical review, the data was determined to be of acceptable quality, as qualified, for use as part of the Marine Area RI data set.

3.0 CONCEPTUAL SITE MODEL

A preliminary conceptual site model (CSM) was developed for the Site as part of the RI/FS Work Plan. The preliminary CSM was developed based on the physical conditions of the Site, potential contaminant source and release mechanisms, transport processes, and exposure routes by which receptors may be affected based on previous environmental studies and serves as the basis for the development of the cleanup standards presented in Section 4.0. The CSM for the Marine Area has been revised to incorporate the results of the investigation activities completed at the Site (further discussed in Section 5.0). The CSM for the Marine Area is presented in three cross-sections shown in Figures 13 through 15 that represent the general range of conditions for the Site. The generalized cross-sections were prepared to illustrate the CSM for the range of physical conditions and potential contaminant transport and exposure pathways present. The CSM was utilized for development of the Cleanup Standards (Section 4.0) to screen environmental data and evaluate contaminant nature and extent. The following sections describe the specific elements of the Marine Area CSM.

3.1. Physical Setting

The Site is currently used as a marine terminal with operations in both the Upland and Marine Areas except for in the public pathway, Open Space and Public Beach areas. In the Marine Area, the South Terminal Wharf and Pacific Terminal Wharf berth areas are in use to support the Port's marine terminal operations. Dredging between 1970 and 2017 has been completed in these berths and adjacent berth approach areas to elevations ranging between -40 to -42 feet MLLW. The shoreline adjacent to the shipping berths is generally steep and armored with large rock or with a bulkhead separating Upland Area soil from Marine Area sediment. The shoreline on the southwest end of the South Terminal is generally a flat intertidal area largely created by deltaic deposits from Pigeon Creek. An armored bank is present along parts of the southwest shoreline except for the Public Beach area which is sand and gravel sloping up to the Public Open Space. The Upland Area is paved except for a portion of the Equipment Storage Area and Public Open Space (which includes the Public Beach) at the southwest end of the South Terminal. Security fencing surrounds the perimeter of the Upland Area. Access to the Public Open Space and adjacent beach area is controlled by the Port. Stormwater runoff from the majority of the Upland Area flows across paved surfaces, enters catch basins, is conveyed through stormwater pipes, passes through a biofiltration swale (historically Mill A Creek) and/or oil-water separators and ultimately discharges to surface water in the Marine Area through outfalls. Within the newly strengthened South Terminal Wharf, the Port installed a Modular Wetland Treatment System to treat stormwater from a majority of the South Terminal wharf area. In the unpaved areas at the Equipment Storage Area and Public Open Space, stormwater either infiltrates or flows as sheet flows towards the Marine Area.

Based on a review of historical development of the Site and information gathered during the 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 as discussed in Section 5.1. 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 Terminal Wharf and the interim action area southwest of Pacific Terminal.

The stratigraphy of the adjacent Upland Area at the South and Pacific Terminals generally consists of fill material overlying native sediments. The specific sources of the fill material at the South Terminal are generally unknown but likely include debris and wood from historical 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 fill and contaminated sediment dredged from between Piers 1 and 3 in the mid-1990s placed into the NCD facility at Pacific Terminal and imported material. As stated above, the fill material in the Upland Area is separated from the Marine Area by a bulkhead, containment berms, and/or shoreline armoring.

3.2. Media of Concern

Marine Area sediment is the media of concern as identified as part of the development of the RI/FS Work Plan. As previously discussed, a separate RI/FS will be developed for the Upland Area in which an evaluation of soil and groundwater (other Site media of concern) will be presented.

3.3. Contaminants of Potential Concern

Contaminants of potential concern (COPCs) for Marine Area sediment were identified as part of the development of the RI/FS Work Plan. Based on review of the analytical data from previous sediment quality studies (see Section 2.1), comparison of the data to the sediment screening levels developed as part of the RI/FS Work Plan and considering historical/current uses of the Site (see Sections 1.3 and 1.4). COPCs and the rationale for their selection are summarized in the following table.

MARINE AREA CONTAMINANTS OF POTENTIAL CONCERN

Contaminant of Potential Concern (COPC)	Rationale
Arsenic	Exceeded preliminary cleanup levels protective of human health and higher trophic level ecological receptors in surface (0-10 cm) and/or subsurface sediment at locations A1-24 and ST-34 in the Marine Area.
Cadmium	Exceeded preliminary cleanup levels protective of human health and higher trophic level ecological receptors in surface (0-10 cm) and/or subsurface sediment at locations A1-24, ST-34 and ST-39 in the Marine Area.
Lead	Exceeded preliminary cleanup levels protective of human health and higher trophic level ecological receptors in surface (0-10 cm) and/or subsurface at locations A1-24, ST-29, ST-34 and ST-39 in the Marine Area.

Contaminant of Potential Concern (COPC)	Rationale
Mercury	Exceeded preliminary cleanup levels protective of human health and higher trophic level ecological receptors in subsurface sediment at location A1-24 in the Marine Area.
Zinc	Exceeded preliminary cleanup levels protective of benthic organisms in surface (0-10 cm) sediment at location A1-24 in the Marine Area.
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)	Exceeded preliminary cleanup level protective of benthic organisms and/or human health and higher trophic level ecological receptors in surface (0-10 cm) and subsurface sediment at multiple locations in the Marine Area.
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)	Exceeded preliminary cleanup level protective of benthic organisms and/or human health and higher trophic level ecological receptors in surface (0-10 cm) and subsurface sediment at multiple locations in the Marine Area.
Total PCBs	Exceeded preliminary cleanup level protective of benthic organisms and/or human health and higher trophic level ecological receptors in surface (0-10 cm) sediment and subsurface samples at multiple locations within the Marine Area.
Dioxins/Furans	Exceeded preliminary cleanup level protective of human health and higher trophic level ecological receptors in surface (0-10 cm) sediment at A1-24 and subsurface samples at locations A1-24, ST-5, ST-9, ST-15 and ST-17 in the Marine Area.

In addition to the COPCs identified above, chromium, copper and silver, cPAHs, phenols, phthalates, chlorinated organics and miscellaneous extractables were identified as COPCs by the RI/FS Work Plan and included as part of the RI for consistency with the SMS. In addition, Ecology required that additional data be collected for pesticides, herbicides, tributyltin, chlorinated phenols, guaiacols and resin acids due to limited data available for these constituents for both surface and subsurface sediment in the Marine Area.

Evaluation of wood debris was also required by Ecology as part of the RI given that the existing data identified up to 95 percent wood by volume based on visual observation estimates in surface sediment, and up to 100 percent by volume in subsurface sediment in parts of the Marine Area. Secondary indicators of the presence and potential impacts of wood debris (i.e., TOC, TVS, ammonia, sulfide, and biological toxicity testing) were not available prior to the RI. Therefore, Ecology required that these additional data be collected to better identify the presence, quantity, and potential impacts of wood debris in sediment at the Site.

3.4. Potential Sources of Contamination

Historically, wood milling and lumber production occurred at the Site between 1896 and 1933. During this time, mill operations involved receiving and storing rafted logs, hauling the logs onshore, sorting and debarking the logs, cutting the logs, drying the cut lumber, and storing lumber prior to shipment. Early mill operations were completed over the water on piers supported by pilings. Boilers fueled by wood debris were used to power multiple mill operations. Additionally, wood debris was lost to the marine environment at the mill facilities as a result of the log raft handling and storage, log haul out, debarking, and other milling activities.

Following the decline in lumber demand in the 1920s, Weyerhaeuser converted wood milling and lumber production at Mill A to production of unbleached sulfite pulp in 1936. As previously discussed, diluted SWL as well as untreated wastewater from washing, bleaching, and drying processes were discharged to the Marine Area prior to 1951 from historical mill outfalls. After 1951, a majority of the SWL was discharged through the deep-water diffuser (Section 1.3.6) while other wastewater discharges into the Marine Area continued through historical mill shoreline outfalls and/or the Mill A Creek drainage.

In 1975, the sulfite pulp mill operation was converted into a thermomechanical mill, a process using heat and friction to produce pulp by grinding wood chips between refiner discs. Pulp was manufactured until the mill was dismantled in 1980. During this period, pulp produced by the mill after the early- to mid-1940s was bleached with a chlorine solution. In 1983, the Port purchased the Mill A facility and between 1983 and 1987, the Site was used for log handling and storage by Port tenants. After 1987 and until the mid-2000s, the portion of the Site comprising the South Terminal was used as a log sorting yard. Whole logs were stored and loaded for export. Wood debris was released to the marine environment as a result of these log raft handling, storage, and log yard activities. Currently, the marine terminals are being used to support breakbulk cargo operations.

Other potential sources of contamination include the transport of hazardous substances sorbed to particulates entrained in the water column from off-site sources and/or atmospheric deposition of particulates from current/historical combustion (vehicle and marine vessel emissions, hog fuel burner, etc.) and/or industrial operations.

3.5. Receptors and Exposure Pathways

3.5.1. Human Receptors

Based on the current and anticipated future land use and Site characteristics, the following are potential human receptors for the Marine Area:

- On-Site industrial and construction workers;
- On-Site subsistence and recreational fish and shellfish consumers;
- Public Open Space beach area users;
- Indian Tribes; and
- Vulnerable Populations and Overburdened Communities.

Each of these potential human receptors is described in the following sections.

3.5.1.1. On-Site Industrial and Construction Workers

Current and future on-Site industrial workers are considered potential receptors based on use of the Site for work. Industrial workers include persons involved with current and future terminal operations. Construction may include shoreline work, dredging, and other activities involving contact with sediment that contain hazardous substances.

3.5.1.2. On-Site Subsistence and Recreational Fish and Shellfish Consumers

Current and future on-Site subsistence and recreational fish and shellfish consumers are potential receptors based on their potential to contact hazardous substances in sediment and/or ingest fish or shellfish that contain hazardous substances.

3.5.1.3. Public Open Space Beach Area Users

The Public Open Space with beach access is located at the southwest end of the South Terminal. Current and future users of this area, including children and adults, may come into direct contact with hazardous substances. Exposure scenarios for human health typically assume activities such as beach play and clam digging that may involve exposure to sediment at least as deep as targeted shellfish species are found.

3.5.1.4. Indian Tribes

Indian Tribes potentially interested in or affected by the Site include the Tulalip Tribes and the Suquamish Tribe, both of which are signatories to the 1855 Treaty of Point Elliott and serve as the Tribal trustees for assessment and restoration of natural resource damages for the Port Gardner area under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Additional discussion regarding Indian Tribes potentially affected is presented in Section 10.4.

3.5.1.5. Vulnerable Populations and Overburdened Communities

Pursuant to WAC 173-340-350 vulnerable populations and overburdened communities determined to be potentially affected by remedial actions at the Site were evaluated. Additional discussion regarding vulnerable populations and overburdened communities potentially affected by the Site is presented in Section 10.4.

3.5.2. Ecological Receptors

Aquatic wildlife found in the Marine Area are potential ecological receptors. Ecological receptors include benthic (i.e., sediment-dwelling) invertebrates (e.g., worms, crabs, clams, etc.), fish (e.g., salmonids), and mammals (e.g., waterfowl, harbor seals, etc.).

3.5.3. Exposure Pathways

The following are potential complete exposure pathways by human and ecological receptors (Sections 3.5.1 and 3.5.2, respectively) for contaminants in Marine Area sediment:

- Direct contact (dermal exposure) with sediment by humans and ecological receptors;
- Incidental ingestion of sediment by humans and ecological receptors;
- Exposure of benthic organisms, which may result in acute or chronic effects, to hazardous substances. This may also result in the uptake and bioaccumulation of contaminants in these organisms;
- Ingestion of contaminated benthic organisms as prey by higher trophic level organisms in the food chain (e.g., foraging fish, aquatic birds, marine mammals, etc.); and
- Human ingestion of marine organisms contaminated by hazardous substances.

4.0 CLEANUP STANDARDS

In accordance with MTCA, the cleanup standards for the Site include:

- Cleanup levels that are protective of human health and the environment;
- The point of compliance at which the cleanup levels must be met; and

- Additional regulatory requirements, specified in applicable state and federal laws, that apply to a cleanup action because of the type of action and/or the location of the Site including consideration of Indian Tribes, vulnerable populations and overburdened communities potentially affected by the cleanup action (further discussed in Section 10.4).

The following sections describe the screening levels that were developed for the Ecology-approved RI/FS Work Plan to evaluate the COPCs. In accordance with the SMS preliminary cleanup levels for protection of benthic organisms and human health and higher trophic level ecological receptors were initially developed to screen the sediment data.

To identify contaminants of concern (COCs), and to evaluate the nature and extent of COCs in the Marine Area, proposed cleanup levels (PCULs) were selected from the preliminary screening levels as discussed below.

4.1. Sediment Screening Levels

Initially, sediment screening levels were developed for the Ecology-approved RI/FS Work Plan to evaluate COPCs in the Marine Area. COPCs for the Marine Area were established based on review of the existing analytical data (described above) and consideration of historical/current uses of the Site. During development of the RI/FS Work Plan, health-based numeric criteria for the benthic invertebrate community provided in WAC 173-204-562 were established as screening levels for the protection of benthic organisms. Established screening levels for the protection of human health and higher trophic level ecological receptors were calculated for exposure to sediment via ingestion and dermal contact using equations and input parameters provided in Ecology's SCUM guidance. As specified by Ecology (in an email from Andy Kallus of Ecology dated October 9, 2014), the following dermal absorption fractions (ABS) were used to calculate human health screening levels during development of the RI/FS Work Plan:

- Arsenic – 0.03;
- PAHs, including cPAHs, LPAHs and HPAHs – 0.13;
- Total PCBs – 0.14; and
- Pentachlorophenol – 0.25.

In addition, gastrointestinal (GI) absorption conversion factors for cadmium (0.025) and chromium (0.013) as specified by Ecology (in an email from Andy Kallus of Ecology dated October 9, 2014) were also used to calculate human health screening levels during development of the RI/FS Work Plan. The source for these dermal absorption fractions and GI absorption conversion factors is the EPA Risk Assessment Guidance (RAGs) Part E, Dermal Risk Assessment dated July 2004, Exhibits 4-1 and 3-4, respectively.

During the RI, Ecology required that the sediment screening levels be revised to meet the current standards published in SCUM and Ecology's Cleanup Levels and Risk Calculation (CLARC) master data table (Ecology 2023). This included revising the default values for body weight (75 kilograms [kg] vs 70 kg in the RI/FS Work Plan) and non-cancer averaging time for adults (25,550 days vs 10,950 days in the RI/FS Work Plan) for the calculation of the subsistence adult clam digging and net fishing screening values. In addition, screening levels for background (natural and regional) developed by Ecology were adopted to screen sediment data for the Marine Area.

The updated sediment screening levels used for screening the RI data for protection of benthic organisms and protection of human health and higher trophic level ecological receptors are presented in Tables 2 and 3, respectively. COPCs established for the Marine Area RI are discussed in Section 3.3. Preliminary cleanup levels for the protection of benthic organisms and protection of human health and higher trophic level ecological receptors initially developed to screen the COPCs are discussed below.

4.1.1. Preliminary Sediment Cleanup Levels for the Protection of Benthic Organisms

In accordance with SCUM (Figure 7-1), a two-tier framework was used to develop sediment preliminary cleanup levels for benthic invertebrate community health to establish the SCO and Cleanup Screening Level (CSL), where:

- The SCO is the long-term sediment quality objective that will result in no adverse effects to the benthic community (WAC 173-204-562); and
- The CSL is used to identify sediment cleanup sites and is the maximum chemical concentration or biological effects level allowed as a sediment cleanup level (WAC 173-204-560(4)).

The SCO and CSL for the Marine Area are the numeric chemical benthic criteria for marine sediment based on acute and chronic toxicity to the benthic community (i.e., benthic risk; WAC 173-204-562 through 173-204-563; Table 8-1, SCUM). For polar organics including metals, phenols, benzoic acid, benzyl alcohol and dibenzofuran, the analytical results are compared to the dry-weight SCO and CSL chemical criteria. For nonpolar organics, the analytical results are compared to the organic carbon-normalized SCO and CSL chemical criteria when the TOC concentration for a sample range from 0.5 to 3.5 percent (inclusive). Analytical results for nonpolar organics with TOC concentrations that are outside of the 0.5 to 3.5 percent range are compared to the Lowest Apparent Effects Threshold (LAET) chemical criteria (i.e., SCO) or second LAET (2LAET) chemical criterial (i.e., CSL) on a dry-weight basis. Marine Area preliminary cleanup levels for the protection of benthic community health are presented in Table 2.

4.1.2. Preliminary Sediment Cleanup Levels for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Preliminary cleanup levels for the protection of human health and higher trophic level ecological receptors by way of ingestion and dermal contact were developed utilizing equations and parameter values from Ecology's SCUM guidance with consideration for potential Site receptors and exposure pathways as discussed in Section 3.5. The preliminary cleanup levels for human health and higher trophic level receptors are presented in Table 3 and were developed for the following exposure scenarios:

- A child exposed during beach play;
- An adult exposed during clam digging (subsistence harvesting); and
- An adult exposed during net fishing (subsistence harvesting).

For evaluating exposure scenarios, the intertidal area is defined as beach above -3 feet MLLW and the subtidal area is defined as the sediment areas below -3 feet MLLW. Children exposed to sediment during beach play and adults exposed to sediment during clam digging are assumed to be exposed primarily to intertidal sediment. The potential exposure scenario for net fishing assumes exposure could occur to both intertidal and subtidal sediment.

Tissue data do not exist for the Site and site-specific biota-sediment accumulation factors (BSAFs) are not available to back-calculate site-specific risk-based sediment cleanup levels. Therefore, a simplified approach using Option 1 of SCUM, Section 9.2 where the SCO and CSL for bioaccumulative chemicals such as dioxins/furans, total dioxin-like PCBs, cPAHs, arsenic, cadmium, lead and mercury are established at background (natural or regional, respectively) or practical quantitation limit (PQL), whichever value is higher. Marine Area preliminary cleanup levels for the protection of human health and higher trophic level ecological receptors based on calculated risk-based concentrations via ingestion and dermal contact using equations and input parameters provided in Ecology's SCUM guidance (summarized above), natural background concentrations based on the 90/90 Upper Tolerance Limit (UTL) from the entire Bold Plus dataset (DMMP 2009; Table 10-1, SCUM), regional background based on the Port Gardner Bay Background Study (Ecology 2014; Table 10-2, SCUM) and PQL are presented in Table 3. Consistent with the SCUM guidance, where the risk-based value is lower than background or the PQL, the preliminary cleanup level defaults to the higher of the natural background concentration (SCO), regional background concentration (CSL) or the PQL value for that contaminant.

4.1.3. Wood Waste Screening Level

Studies conducted in Washington State (Kathman et al. 1984; Kirkpatrick et al. 1998; Floyd|Snider 2000; and SAIC 1999) and followed by Ecology show that wood debris in marine environment could negatively impact the benthic community. These adverse impacts are caused by:

- The physical presence of wood debris, which prevents biota from thriving and recruiting in and on native, healthy substrate.
- Decreased dissolved oxygen due to microbial decomposition, which can create an unhealthy or toxic environment for biota.
- Decomposition by-products such as sulfides, ammonia, and phenols, which can cause or contribute to toxicity.

Ecology manages wood debris and resultant sediment impacts under the SMS as a deleterious substance (WAC 173-204, Ecology 2013). The degree that wood debris impacts the benthic community depends on factors such as physical attributes or form of the wood debris (i.e., bark, scraps, chips, sawdust, logs, or dimensional lumber), degree of incorporation into sediment, volume present, water currents and flushing in the area, type of habitat present, source of the wood debris and degree of decomposition and weathering.

Although there is no current sediment cleanup level established for wood debris, a screening level of 15 percent by volume for visual wood content is used to evaluate wood debris within the Marine Area and sediment compliance interval (further discussed in Section 4.3). A screening level of 15 percent is supported by sediment bioassay data which identified bioassay failures in sediment with visual wood debris of 15 percent or greater (i.e., sample MAF-SS-12_0-10). With a visual wood debris content of 10 percent or less (i.e., samples MAF-SS-20_0-10, MAF-SS-21_0-10, MAF-SS-31_0-10 and MAF-SS-35_0-10), the SCO and CSL bioassay test criteria were not exceeded.

4.2. Identification of Proposed Cleanup Levels and Contaminants of Concern

PCULs were selected for the protection of benthic organisms and for protection of human health and higher trophic level ecological receptors from the preliminary cleanup levels presented in Tables 2 and 3, respectively. The PCULs were selected from the SCO which is the long-term sediment quality goal and is the lower end of the range of chemical concentrations or biological effects level used to establish a sediment cleanup level (WAC 173-204-560[3]) and the CSL which is the maximum chemical concentration or biological effects level allowed (WAC 173-204-560(4)). The SMS states that the sediment cleanup level is initially established at the SCO but may be adjusted upwards to the CSL based on technical possibility or net adverse environmental benefit (Ecology 2021).

The PCULs selected for protection of benthic organisms (Benthic PCULs) are the SCOs (i.e., benthic risk; WAC 173-204-562 through 173-204-563; Table 8-1, SCUM). The PCULs selected for protection of human health and higher trophic level ecological receptors (Human Health PCULs) are also the SCOs except for arsenic, cPAHs and total dioxin-like PCBs. Arsenic, cPAHs and total dioxin-like PCBs are bioaccumulative compounds for which regional background values have been established by Ecology and are the CSL. The regional background values were chosen as the PCULs for arsenic, cPAHs and total dioxin-like PCBs because cleanup to a concentration less than regional background is not likely to be maintained in a reliable and effective manner. Therefore, the CSL was chosen as the PCUL based on technical possibility as allowed under SMS (WAC 173-204-560). As described above (Section 4.1.3), a visual screening level of 15 percent by volume is used for the Marine Area to identify wood debris which can cause or contribute to sediment impacts based on bioassay results (further discussed in Section 5.3.3).

Sediment data presented in Tables H-1 through H-3, Appendix H were then compared to the Benthic and Human Health PCULs (Tables 4 and 5, respectively) to identify Marine Area COCs. A contaminant was retained as a COC if the detected concentration of the contaminant exceeded the PCUL. Table 4 identifies which contaminants were detected at concentrations exceeding the Benthic PCULs and Table 5 summarizes which contaminants were detected at concentrations exceeding the Human Health PCULs. Tables 4 and 5 also present the magnitude by which a contaminant exceeded the corresponding PCUL which is termed the “exceedance ratio”. The exceedance ratio (ER) is derived by dividing the detected contaminant concentration by the corresponding PCUL concentration. A contaminant was retained as a COC if an ER greater than 1 (i.e., PCUL exceedance) was identified.

4.2.1. Contaminants of Concern for Benthic Organisms

The following COCs are identified for protection of benthic organisms based on exceedance of the Benthic PCUL:

- **Metals** – Metals including arsenic, copper, mercury and zinc are identified as COCs for Marine Area sediment. The frequency of Benthic PCUL exceedances for arsenic, copper, mercury and zinc was less than 0.1 percent with maximum ERs ranging between 1.2 and 93.9 (Table 4).
- **LPAHs** – LPAHs including 2-methylnaphthalene, acenaphthene, anthracene, fluorene, naphthalene, phenanthrene and sum of LPAHs are identified as COCs for Marine Area sediment based on detected concentrations of individual LPAHs greater than the Benthic PCULs as well as total LPAH concentrations greater than the Benthic PCUL. The frequency of Benthic PCUL exceedances for individual and total LPAHs ranges between 5.4 and 19 percent with maximum ERs ranging between 19.4 and 427.1 (Table 4).
- **HPAHs** – HPAHs including benzo(a)anthracene, benzo(a)pyrene, total benzofluoranthenes, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene and sum of HPAHs are identified as COCs for Marine Area sediment based on detected concentrations of individual HPAHs greater than the Benthic PCULs as well as total HPAH

concentrations greater than the Benthic PCUL. The frequency of Benthic PCUL exceedances for individual and total HPAHs ranges between 0.6 and 8.5 percent with maximum ERs ranging between 2.1 and 44.7 (Table 4).

- **Chlorinated Hydrocarbons** – Chlorinated hydrocarbons including 1,2,4-trichlorobenzene, 1,2-diclorobenze and hexachlorobenzene are identified as COCs for Marine Area sediment. The frequency of Benthic PCUL exceedances for chlorinated hydrocarbon COCs ranges between 0.6 and 1.3 percent with maximum ERs ranging between 2.7 and 17.1.
- **Phthalates** – Phthalates including bis (2-ethylhexyl) phthalate, butyl benzyl phthalate and diethyl phthalate are identified as COCs for Marine Area. The frequency of Benthic PCUL exceedances for phthalate COCs ranges between 0.6 and 3.1 percent with maximum ERs ranging between 1.7 and 10.3.
- **Phenols** – Phenols including 2,4-dimethylphenol, 2-methylphenol, 4-methyphenol and phenol are identified as COCs for Marine Area sediment. The frequency of Benthic PCUL exceedances for phenol COCs ranges between less than 4.7and 30.7 percent with a maximum ERs ranging between 5.5 and 76.1.
- **Miscellaneous Extractables** – Miscellaneous extractables including dibenzofuran, hexachlorobutadiene, benzoic acid and benzyl alcohol are identified as COCs for Marine Area sediment. The frequency of Benthic PCUL exceedances for miscellaneous extractable COCs ranges between 2.4 and 24 percent with a maximum ER ranging between 8.9 and 31.5.
- **PCBs** – PCBs are identified as COCs for Marine Area sediment. The frequency of Benthic PCUL exceedances is 8.6 percent with a maximum ER of 40.

4.2.2. Contaminants of Concern for Human Health and Higher Trophic Level Ecological Receptors

The following COCs are identified for protection of human health and higher trophic level ecological receptors based on exceedance of the Human Health PCUL:

- **Metals** – Metals including arsenic, cadmium, lead and mercury are identified as COCs for Marine Area sediment. The frequency of Human Health PCUL exceedances for cadmium, lead and mercury ranges between 16.1 and 38.1 percent with maximum ERs ranging between 2.6 and 192.5. The frequency of exceedance for arsenic based on the regional background is 28 percent with a maximum ER of 5.8 (Table 5).
- **Total cPAH TEQ** – Total cPAHs calculated using the TEQ methodology is identified as a COC for Marine Area sediment. The frequency of exceedance for total cPAH TEQ based on regional background is 58.7 percent with a maximum ER of 105.6 (Table 5).
- **PCBs** – Total PCBs and dioxin-like PCBs are identified as COCs for Marine Area sediment. The frequency of PCUL exceedances for total PCBs is 6.3 percent with a maximum ER of 10.6. The frequency of exceedance for dioxin-like PCB congeners based on regional background is 24 percent with a maximum ER of 82.8 (Table 5).
- **Dioxins and Furans** – Total dioxin and furans calculated using the TEQ methodology are identified as a COC for Marine Area sediment. The frequency of PCUL exceedance for total dioxin/furan TEQ is 47 percent with a maximum ER of 37.4 (Table 5).

4.2.3. Substances of Concern

Under SMS, wood debris which causes or contributes to sediment impacts is managed by Ecology as a deleterious substance. Based on the bioassay test data for the Marine Area (Section 5.3.3), visual wood debris greater than 15 percent by volume was identified as a Substance of Concern (SOC) for the Marine Area. The percentage of visual wood debris and description of the wood types encountered are provided on the exploration logs presented in Appendix I and L and as referenced by previous investigation reports (see Section 2.1). The percentage of observed visual wood debris by volume relative to the sediment analytical results for protection of benthic organisms is summarized in Table 6.

4.3. Identification of Points of Compliance

In accordance with SMS requirements, the point of compliance must be protective of benthic organisms, human health and higher trophic level receptors. SMS requires that the point of compliance consider site-specific parameters such as the potential to be disturbed by scour by vessel activity, wave action, anchor drag, etc., that may extend deeper than the typical depth for the exposure pathway for receptors of concern. Scour and other disturbances act to destabilize near surface sediment resulting in the exposure and redistribution of underlying subsurface contamination, if present.

Considerations for determination of the compliance interval for the intertidal and subtidal areas are described in the following sections (Sections 4.3.1 and 4.3.2). Points of compliance for the intertidal and subtidal portions of the Marine Area based on these considerations are presented in Section 4.3.3.

4.3.1. Considerations for Establishing Point of Compliance in Intertidal Areas

Intertidal portions of the Site that can reasonably be accessed by the general public are located within the Public Open Space/Beach Area south of the South Terminal. In this part of the Site, the compliance interval for the intertidal area considered both the depth of the biologically active zone (BAZ) and harvestable resources to ensure protection of the environment and human health including consideration of Indian Tribes, vulnerable populations and overburdened communities potentially affected by the cleanup action (further discussed in Section 10.4). Exposure scenarios for human health typically assume activities such as beach play and clam digging that may involve exposure to sediment at least as deep as the depth at which targeted shellfish species are found.

Based on the results of the RI, evidence of biota was observed withing the upper 1-foot of intertidal sediment (approximately 30.5 cm) in samples collected from RI locations MAF-16, MAF-17, MAF-24, MAF-26, MAF-29 and MAF-30. As a conservative estimate and as indicated by Ecology in an email correspondence from Andy Kallus on September 23, 2019, the compliance interval in areas where human contact with sediments would most likely occur (i.e., the Public Beach and intertidal area located southwest of the Public Open Space) is the upper 40 cm of sediment. This sediment interval considers both the BAZ and depth needed to be protective of humans under shellfish harvest and beach play scenarios.

4.3.2. Considerations for Establishing Point of Compliance in Subtidal Areas

For subtidal sediment, SCUM states that the exposure depth is the same for benthic and bioaccumulative endpoints, as it is assumed that fish are consuming the benthic community and that both sets of receptors are exposed to chemicals over the BAZ for benthic organisms. SMS also requires that the point of compliance consider site-specific circumstances such as the current and future site uses and potential for the sediments to be disturbed by scour by vessel activity (further discussed in Section 2.4.5) and consideration of Indian Tribes, vulnerable populations and overburdened communities potentially affected by the cleanup action (further discussed in Section 10.4). These considerations for establishment of the point of compliance for the subtidal portion of the Marine Area are described below:

- **Navigation and Berth Area** – The navigation and berth areas are the parts of the Site where vessel activities related to the marine terminals occur and these areas are expected to be used for these activities in the future (Appendix F). As part of the RI, Mott MacDonald completed a Vessel Propeller Wash Scour analysis for the Marine Area to evaluate the degree of potential scour impacts from vessels operating at the Site (Appendix P). The purpose of the scour study was to evaluate the potential scour impacts of vessel navigation on Marine Area sediments and included the area adjacent to the South Terminal and Pacific Terminal for consideration in the evaluation of the cleanup point of compliance and remedial alternatives. The scour study results showed potential for scour from vessel operations at the South and Pacific Terminals at elevations shallower than -55 feet MLLW. As a result of the current and future uses and the potential for scour in the navigation and berth area, the compliance interval for the navigation and berth area must extend to the maximum depth of scour (-55 feet MLLW), which is inclusive of the current and future dredge depths of -44 feet MLLW for Pacific Terminal and -52 feet MLLW for South Terminal.
- **Future Cargo Handling Area** – The future cargo handling area (Figure 8) is the transitional slope between the Uplands Area and the South/Pacific Terminal navigation areas where sediment up to 10 feet below current mudline may be subject to scour based on the results of Vessel Propeller Wash Scour Analysis (Appendix P). The cleanup action in this area must also consider the future use of this area for cargo handling and ensure that the future use is unencumbered by the presence of contamination or wood debris. As a result, the point of compliance must extend to the full depth of contamination or native contact.
- **Offshore Areas Located Below the Scour Depth** – The offshore areas that are located below the scour depth are currently used for navigation and this use is anticipated for the future, however, the potential for scour is low. The compliance interval for the offshore areas that are located deeper than the maximum scour depth must consider the depth of the BAZ for a typical subtidal, soft-bottom marine sediment based on the fish consumption exposure pathway. According to SCUM, the exposure potential and sediment unit of concern is the BAZ (often the top 10 cm). Past studies in Puget Sound have demonstrated that the majority of benthic macroinvertebrates are generally found within the uppermost 10 cm of sediment (Ecology 2008b). Although some species may be found at greater depths below the sediment surface, 10 cm is generally assumed by Ecology to represent a reasonable estimate of the BAZ. Additionally, based on the results of the SPI imaging completed on behalf of Ecology in general proximity to the Site as part of the Port Gardner Bay Investigation (SAIC 2009), sediment at the majority of stations contained an apparent redox potential discontinuity (RPD) depth ranging from approximately 2 to 4 cm. The RPD is generally considered as evidence of the burrowing depth of benthic communities present. Because results of the scour study indicate that the sediment is not subject to scour in areas deeper than an elevation of -55 feet MLLW, a BAZ of 10 cm is assumed for the offshore portions of the Marine Area.

4.3.3. Marine Area Points of Compliance

Based on considerations discussed in Section 4.3.1 and 4.3.2, the following are the points of compliance (compliance intervals) for the Marine Area:

- **Public Open Space/Beach Area (Intertidal Area)** – The compliance interval for intertidal area south of South Terminal that could reasonably be accessed by the general public is 0-40 cm. This compliance interval considers the BAZ, potential exposure to a human receptor engaged in beach play and/or shell fishing, and burrowing organisms that may dig down to 40 cm below the sediment surface in this area.
- **Navigation and Berth Area (Subtidal Area)** – The compliance interval for the navigation and berth area is -55 feet MLLW. This compliance interval considers the results of the scour study in addition to the current and future dredge depths of -44 feet MLLW for Pacific Terminal and -52 feet MLLW for South Terminal.
- **Future Cargo Handling Area (Subtidal Area)** – The compliance interval for the future cargo handling area is the full depth of sediment contamination or native contact to ensure that future use is unencumbered by the presence of contamination or wood debris.
- **Offshore Areas Below the Scour Depth (Subtidal Area)** – The compliance interval for the offshore areas located below the scour depth (areas deeper than the mudline elevation of -55 feet MLLW) is 0-10 cm. This compliance interval is the BAZ for a typical Puget Sound subtidal, soft-bottom marine sediment based on the fish consumption exposure pathway. Results of the scour study indicate that the sediment is not subject to scour in areas deeper than an elevation of -55 feet MLLW.

5.0 REMEDIAL INVESTIGATION RESULTS

5.1. Sediment Stratigraphy

The sediment stratigraphy in the Marine Area was characterized based on observations of materials encountered in explorations completed as part of the RI and information provided by sediment cores collected during previous sediment quality and dredged material characterization studies (Sections 2.1 through 2.4). The information from the sediment explorations was used to prepare cross-sections illustrating the sediment stratigraphy in the Marine Area. Cross-section locations in the Marine Area are shown in Figure 11. Cross-sections illustrating sediment stratigraphy are presented in Figures 16 through 19.

Based on data collected from the sediment investigations completed during the RI as well as previous studies, the stratigraphy within the Marine Area generally consists of a combination of native alluvial sediment from the Snohomish Basin that predates the industrial development of the Everett waterfront and more recently deposited sediment comprised of silts, sands and wood debris. The recently deposited sediments are representative of the period of industrial development on the Everett Waterfront since the late 1800s and vary in thickness from 1-2 feet farther offshore up to approximately 20 feet thick in the nearshore area between South and Pacific Terminal Wharfs (Figures 16 through 19) and are comprised of a specific type of material (e.g., silts, sands, sawdust, etc.) or layers of more than one material. The upper 10 cm surface sediments within the Marine Area are typically comprised of recently deposited sediment however, the interim action dredging completed on the southwest end of the Pacific Terminal in 2016/2017, previous dredging for the construction of the South Terminal Wharf and in the area offshore of Pacific Terminal and propeller scour has exposed native sediments at the surface.

5.1.1. Recently Deposited (Non-Native) Sediment

Recently deposited sediment is 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 the periods of pre-Weyerhaeuser operations, Weyerhaeuser mill operations, and Port and Port-tenant log yard and marine terminal operations. Specific components of the recently deposited sediment include the following:

- 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, up to 20 feet of wood debris containing up to 100 percent wood are present. The wood deposits decrease in thickness with increased distance from the shoreline (Figures 17 and 18). The source of wood debris to the Site is historical milling and log rafting operations and includes varying amounts of sawdust, wood chips, bark, twigs, fibers and dimensional lumber. This unit is characterized by fine, granular, degraded (dark colored) wood particles and non-degraded (light colored) angular wood chips (0.5 inch or larger) containing variable amounts of silt, sand and shell fragments, which are minor components of this unit.
- Mixed sand and silt with variable amounts of shell fragments. The mixed sand and silt may also contain wood debris and grade into adjacent units without an obvious horizon or interface (Figures 17 and 18). The mixed sand and silt with shell fragments is likely the result of redeposition following sediment bed disturbances (i.e., wave action, propeller scour, bioturbation, etc.).
- Unconsolidated sand and silt showing evidence of disturbance (i.e., wave action, propeller scour, bioturbation, etc.; Figures 16 through 19) Unconsolidated sand and silt typically contain shell fragments and less than 15 percent wood debris.
- Sediment originating from Pigeon Creek is comprised of brown silt and sand and forms an intertidal delta southwest of the Equipment Storage Area (Figure 16). Wood debris less than 15 percent is periodically observed in the Pigeon Creek intertidal sediment.
- Imported sand and gravel, comprising the Public Beach restoration area was placed by the City and Kimberly-Clark between 2012 and 2014 to stabilize the shoreline and prevent erosion of the shoreline southwest of the Equipment Storage Area (i.e., Public Beach and surrounding shoreline area).

5.1.2. Native Sediment

Native sediments at the Site are comprised of alluvial sediment deposits from the Snohomish River Basin that pre-date the industrial development of the Everett waterfront. These sediments are generally comprised of gray, moderately dense, poorly graded sand, silty sand, sandy silt to moderately soft silts representing alluvial sediments from the Snohomish Basin. This unit may contain shells or shell fragments. In addition, this unit may contain trace amounts (less than 5 percent) of wood and/or other organics (Figures 16 through 19). Native sediments are characterized as not containing COCs or anthropogenically sourced wood debris as evidenced by sampling data (see Section 5.3).

5.2. Net Sedimentation Rate

During the RI, sediment cores were advanced at three locations in the deeper areas of the Site that were identified as less likely to have been disturbed by the marine terminal activities to evaluate net sedimentation rates within the Marine Area. The sediment cores from each location were divided in approximate 2-cm sample intervals. Every third sample interval from the mudline surface to approximately

100 cm below the mudline from each core location were submitted to the TBE laboratory located in Knoxville, Tennessee for the following isotope analysis:

- Cesium-137 (Cs-137)
- Lead-210 (Pb-210)

Cs-137 and Pb-210 results were evaluated to calculate sedimentation rates for the Marine Area. Two methodologies, one using a Pb-210 radioactive decay coefficient and a second using Pb-210 radioactive decay constant, were selected to evaluate deposition rates using the results of Pb-210 analyses. CS-137 results were not used to evaluate deposition rates as described below. Details of the sediment core collection, processing, and sedimentation rate evaluation is presented in the Sediment Geochronology Study report (Appendix O). The results of the evaluation are summarized in the following sections. The offshore sediment core locations (MAF-GC-01 through MAF-GC-03) used for collecting samples for the geochronology investigation are shown in Figure 11.

The results of the geochronology study are not applicable to parts of the Marine Area that are subject to disturbance of the sediment bed such as by wave action and/or scour by vessel activity.

5.2.1. Sedimentation Rate Based on Cs-137 Activity

Cs-137 occurrence in sediment is associated with historical atmospheric fallout from testing of nuclear weapons. The initial occurrence of Cs-137 marks the first use of nuclear weapons in 1954 which was followed by a Cs-137 peak marking the height of nuclear weapon testing in 1963. Based on a review of the Cs-137 activity in the sediment cores, peaks associated with atmospheric fallout of nuclear weapons testing were not identified and therefore, the sedimentation rate based on Cs-137 activity could not be determined.

5.2.2. Sedimentation Rate Based on the Pb-210 Radioactive Decay

Pb-210 is a natural isotope that is produced in the decay series of Uranium-238. In general, sediment contains a background level of Pb-210 that is "supported" by the decay of Radium-226; however, in recent sediment deposits there is also an excess of "unsupported" Pb-210 that is produced by the decay of Radon-222 gas that is incorporated into sediment through atmospheric fallout. The excess ("unsupported") activity in the sediment cores were used to estimate the sedimentation rate.

Based on the pattern of Pb-210 occurrence in the sediment cores, an average sedimentation rate of 1.27 cm per year was calculated for the Marine Area.

5.3. Nature and Extent of Contamination

The following sections present the nature and extent of wood debris, conventional parameters and COCs for protection of benthic organisms and human health and higher trophic level ecological receptors. Table 6 presents the sediment data for the Marine Area COCs compared to the Benthic PCULs. Table 7 presents the sediment data for the Marine Area COCs compared to the Human Health PCULs.

In general accordance with SCUM, the spatial distribution of contaminants is presented in the RI using inverse distance weighting (IDW) to characterize nature and extent of wood debris, conventional parameters and COCs on a point-by-point basis. IDW includes use of a GIS application (Arc GIS Pro version 3.2.0) and interpolation methods with algorithms to interpret the influence of multiple neighboring points, their concentrations, and distances from one another to estimate the spatial distribution of a given parameter within the environment[5].

IDW mapping of observed wood debris, TOC, TVS, ammonia and sulfides in the surface sediment (0-10 cm) and subsurface sediment are shown in Figures 20 through 31. In addition, IDW mapping of COCs for the protection of benthic organisms in surface and subsurface sediment are shown in Figures 32 through 53. Bioassay test results for the Marine Area are shown in Figure 54. IDW mapping of COCs for the protection of human health and higher trophic level ecological receptors in surface and subsurface sediment are shown in Figures 55 through 71. Additionally, IDW mapping of conventional parameters (observed wood debris, TOC, TVS, ammonia and sulfides), Benthic COCs and Human Health COCs was completed at 2-foot intervals extending from the mudline surface to 22 feet below the mudline surface (the deepest sediment core sections collected) at the request of Ecology. IDW mapping of the RI results at 2-foot intervals is presented in Appendix Q.

5.3.1. Observed Wood Content and Conventional Parameters

The results of observations of the presence of wood debris and analyses for conventional parameters are summarized in Table 6. As discussed in Section 4.0, there is no established sediment cleanup level for wood debris under the SMS, however, as agreed with Ecology, a screening level of 15 percent is being used to identify wood debris in the Marine Area that could negatively impact the benthic community. The nature and extent of wood in the Marine Area as well as secondary indicators of the potential presence and potential impacts from wood (TOC, TVS, ammonia and sulfide) are summarized in the following sections.

5.3.1.1. Observed Wood Content

The observed wood content in the Marine Area in surface and subsurface sediment are shown in Figures 20 and 21, respectively. Description of the types of wood debris observed at each sample location are summarized in the exploration logs provided in Appendix I and L. Wood debris was observed to be comprised of sawdust, fibers, chips, chunks, twigs, bark, fibers and dimensional lumber in samples collected from the Site. The distribution of observed wood debris by volume in surface and subsurface sediment are described below.

- **Surface Sediment** – In surface sediment (Figure 20), wood debris is observed at or greater than 15 percent by volume in the nearshore area adjacent to the South Terminal with the highest percentages observed at locations ST-30, ST-35, MAF-04 and MAF-11. Wood debris (identified as bark) with percentages of 25 and 40 percent by volume were also observed in surface sediment southwest of Pier 1 at locations MAF-09 and MAF-32, respectively. Further offshore of the marine terminals, wood debris greater than 15 percent by volume was observed at locations MAF-44, A1-17, A1-18 and A1-23. However, based on the location relative to the mill (Figure 20) the wood debris in this area is not likely

[5] For the IDW interpolations, default parameters used by the GIS mapping application were modified using professional judgment to illustrate the RI data results. For this application, the default parameter for the power function ("Power") was increased from 2 to 6 to limit the overall influence that a single data point has with increased distance from that point (i.e., only the immediate surrounding data points are influencing the prediction) so as to not project a result into areas with little or no data. The default parameter for search neighborhood ("Neighbors") of 12 remained unchanged, Additionally, a fixed radius ("Radius") of 300 feet was established for the application to limit the predicted into areas with little or no data. A radius of 300 feet is the approximate maximum distance between sampling locations within the Marine Area. Input values used for the IDW mapping application are presented in the notes in Figures 20 through 53, Figures 55 through 71 and figures presented in Appendix Q.

associated with historical mill discharges and is most likely associated with other historical log storage activities. In the intertidal area southwest of the Public Open Space and along transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, wood debris in surface sediment is not observed.

- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 21), wood debris (identified as sawdust and chips) are predominantly observed at or greater than 15 percent by volume in the nearshore area adjacent to South Terminal. In the area between the South Terminal Wharf and the Pacific Terminal Interim Action area, wood debris up to 100 percent by volume was observed from the surface to depths ranging between approximately 8 and 20 feet below the mudline. With increased distance from the shoreline, the thickness and percent volume of wood debris decreases (Figures 17 and 18). Offshore of the Public Open Space area, limited amounts of wood debris (identified as bark, twigs and chips) less than 5 percent are observed in subsurface sediment to a depth of approximately 2 feet below mudline (bml). Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, wood debris (identified as twigs, fibers, bark and chips) up to 10 percent by volume extend to approximately 16 feet below the mudline surface.

  In native subsurface sediment, wood debris in the Marine Area was typically observed to be less than 1 percent and not observed to be greater than 5 percent by volume. Wood debris contained in the native sediment, where observed is typically identified as twigs.

5.3.1.2. Total Organic Carbon

The distribution of TOC in surface sediment and subsurface sediment are shown in Figures 22 and 23, respectively, and are described below.

- **Surface Sediment** – In surface sediment (Figure 22), TOC is generally below 3.5 percent. In the nearshore area between the South Terminal Wharf and Pacific Terminal Interim Action area and area offshore of the Pacific Terminal (northwest of the historical dredge area), TOC up to 20.2 percent was observed in surface sediment with the highest percent at location MAF-04. Further offshore of the marine terminals, TOC in surface sediment ranges between approximately 1.5 and 6.5 percent. In the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, TOC is generally less than 0.5 percent in surface sediment.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 23), TOC is generally detected at concentrations greater than 7 percent in the nearshore area adjacent to South Terminal. In the area between the South Terminal Wharf and the Pacific Terminal Interim Action area, TOC ranges between approximately 7.1 and 52.5 percent. The area of higher TOC concentrations generally coincides with sediment containing the greatest percent of observed wood which is adjacent to the South Terminal between the wharf and the interim action area at the southwest end of the Pacific Terminal. Further offshore of the marine terminals, the TOC generally ranges between 0.5 and 3.5 percent in the recently deposited sediments. Southwest of the Public Open Space Area, TOC is generally less than 0.5 percent. However, along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, TOC ranges between approximately 1.4 and 3.3 percent to a depth of approximately 14 feet below the mudline surface.

  In native sediment, TOC is generally less than 0.5 percent throughout the Marine Area.

5.3.1.3. Total Volatile Solids

The distribution of TVS in surface sediment and subsurface sediment are shown in Figures 24 and 25, respectively, and are described below.

- **Surface Sediment** – In surface sediment (Figure 24), TVS greater than 8 percent is detected in the nearshore area between the South Terminal Wharf and Pacific Terminal Interim Action area and offshore of the Pacific Terminal (northwest of the historical dredge area) with the highest concentrations at MAF-04 and MAF-11. Further offshore of the marine terminals, TVS in surface sediment is less than 8 percent. In the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, TVS in surface sediment is less than 4 percent.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 25), TVS greater than 16 percent is generally detected in the nearshore area adjacent to the South Terminal with the highest TVS concentrations between the South Terminal Wharf and the Pacific Terminal Interim Action area. Similar to TOC, the area of higher TVS in recently deposited sediments generally coincides with sediment areas containing the greatest percent of wood debris. Further offshore of the marine terminals, the TVS generally ranges between 4 and 7 percent. In the intertidal area southwest of the Public Open Space, TVS in shallow subsurface sediment (0 to 2 feet bml) is generally less than 4 percent. However, along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, TVS ranges between approximately 4 and 7.2 percent to a depth of approximately 12 feet below the mudline surface.

  In the native sediment, TVS is generally less than 4 percent throughout the Marine Area.

5.3.1.4. Ammonia

The distribution of ammonia in surface and subsurface sediment are shown in Figures 26 through 28, respectively, and are described below.

- **Surface Sediment** – In surface sediment (Figure 26), porewater ammonia concentrations generally range from 10 to 25 milligrams of nitrogen per liter (mg-N/L) adjacent to the South and Pacific Terminals and is predominantly less than 10 mg-N/L. Porewater ammonia concentrations in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area are generally less than 10 mg-N/L. However, at the mouth of Pigeon Creek, porewater ammonia was detected at a concentration of 69.1 mg-N/L in surface sediment which is likely the result of bio-degradation of organic materials other than wood as no wood debris was observed in the sediment from the Pigeon Creek delta. Near Outfall 002, porewater ammonia concentrations are also elevated at 24.5 mg-N/L in surface sediment and may be the result of groundwater seepage through localized breaks in the bulkhead resulting from bio-degradation of organic materials (wood waste) contained in the Upland Area.

  Total (bulk) ammonia concentrations in surface sediment (Figure 27) range from 10.5 to 42.2 milligrams of nitrogen per kilogram (mg-N/kg) in the nearshore area adjacent to South Terminal and is less than 10 mg-N/kg in the area offshore of the marine terminal and the intertidal area southwest of the Public Open Space.

- **Subsurface Sediment** – In the recently deposited subsurface sediment, porewater ammonia was not analyzed. However, total ammonia concentrations (Figure 28) in the recently deposited sediment adjacent to the South Terminal range from approximately 25 to 100 mg-N/kg. The highest concentration (102 mg-N/kg) was detected at a depth of approximately 6 to 8 feet bml in composite sample DMMP-2D-COMP represented by sample locations ST-108 and ST-109 located northeast of the South Terminal Wharf. A total ammonia concentration of 85 mg-N/kg was detected southwest of the South Terminal Wharf in sample DMMU-1F-COMP represented by sample location ST-103 between approximately 10 and 14 feet bml. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, total ammonia in subsurface surface sediment is less than approximately 5.5 mg-N/kg to a depth of approximately 4 feet bml. Between approximately 4 and 14 feet bml, concentrations of total ammonia ranging between 11 and 85 mg-N/kg are observed.

In the native sediment, the concentration of total ammonia is generally less than 10 mg-N/kg.

5.3.1.5. Sulfides

The distribution of sulfides in surface sediment and subsurface sediment are shown in Figures 29 through 31, respectively and are described below.

- **Surface Sediment** – In surface sediment (Figure 29), porewater sulfide concentrations are typically less than 1 milligram per liter (mg/L). Offshore of the Pacific Terminal, porewater sulfide was detected at a maximum concentration of 30.5 mg/L at MAF-31. Offshore of the South Terminal Wharf, porewater sulfide was detected at a maximum concentration of 17.3 mg/L at MAF-12. In the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, porewater sulfide was not detected greater than 1 mg/L.

  In the nearshore area of South Terminal, detected concentrations of total sulfide in surface sediment range between 22.3 and 1,980 mg/kg with the highest detected concentration at location ST-108 located adjacent to the South Terminal Wharf (Figure 30). Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, total sulfide was detected at a concentration ranging between 22 and 320 mg/L. In the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, concentrations of total sulfide are less than 6 mg/kg.

- **Subsurface Sediment** – In the recently deposited subsurface sediment, porewater sulfide was not analyzed. However, total sulfide concentrations in the recently deposited sediment (Figure 31) located adjacent to the South Terminal generally ranged between 100 and 1,200 milligrams per kilogram (mg/kg) with a maximum concentration of 6,350 mg/kg at a depth of 0 to 2 feet bml at MAF-03 located between the South Terminal Wharf and the Pacific Terminal Interim Action area. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, total sulfide in subsurface surface sediment ranges between approximately 10 and 643 mg/kg to a depth of approximately 12 feet bml. In the intertidal area southwest of the Public Open Space, total sulfide was not analyzed in the samples that were submitted for chemical analysis.

  In native sediment, the total sulfide is generally less than 10 mg/kg. At location MAF-58, total sulfide was detected at a concentration of 70 mg/kg at approximately 2 to 4 feet bml which may be the result of mixing with recently deposited sediment from the surrounding area due to sediment bed disturbances (e.g., propeller scour).

5.3.2. Protection of Benthic Organisms

Sediment data for the Marine Area compared to the PCULs for the protection of benthic organisms are presented in Table 6. Metals (arsenic, copper, mercury and zinc), LPAHs, HPAHs, chlorinated hydrocarbons, phthalates, phenols, miscellaneous extractables and PCBs are identified as Marine Area COCs for protection of benthic organisms (Section 4.2) based on a point-by-point evaluation. IDW mapping of the ER (i.e., analyte concentration divided by the PCUL) based on comparison to the Benthic PCUL (ER_B) was completed to evaluate the spatial distribution of the Benthic COCs and characterize the nature and extent of contamination. IDW mapping of Benthic COCs in surface sediment and subsurface sediment are shown in Figures 32 through 53. IDW mapping of Benthic COCs at 2-foot intervals extending from the mudline surface up to 22 feet below the mudline surface (the deepest sediment core sections collected) is presented in Appendix Q.

A description of the nature and extent of the Benthic COCs in surface and subsurface sediment is presented in the following sections. A description of the results of bioassay testing used to further define the nature and extent for protection of benthic organisms is presented in Section 5.3.3.

5.3.2.1. Metals

The distribution of metals including arsenic, copper, mercury and zinc (Benthic COCs; Section 4.2.1) in surface and subsurface sediment compared to the Benthic PCUL are shown in Figures 32 through 39 and are described below.

- **Surface Sediment** – In surface sediment (Figures 32, 34, 36 and 38) the ER_B for metals (arsenic, copper, mercury and zinc) is generally less than 1.0 throughout the Marine Area. However, the ER_B for arsenic (1.53), copper (2.67) and zinc (1.12) was greater than 1.0 in surface sediment at locations MAF-3, EW-12-05 and A1-24, respectively, located northeast of the marine terminals. The ER_B for copper at EW-12-05 located northwest of Pier 1 is likely not associated with the Site based on the spatial distribution and ER_B for metals observed within the Marine Area (i.e., the ER_B for copper was less than 1.0 throughout the Marine Area except for this location as shown on Figures 34 and 35). In the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B for metals is less than 1.0 in surface sediment at all locations submitted for chemical analysis.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figures 33, 35, 37 and 39), metals generally have an ER_B of 1.0 or less. However, arsenic in shallow subsurface sediment (0 to 2 feet bml) had an ER_B of 1.23 at MAF-11. The ER_B for mercury ranged from 1.26 to 93.9 in subsurface sediment from 6 to 8 feet bml northeast of the South Terminal Wharf (Figure 37). In addition, an ER_B for zinc ranging between approximately 1.13 and 2.46 was identified in the nearshore area of South Terminal at locations MAF-02, MAF-03, MAF-11 and ST-108 from 0 to 10 feet bml (Figure 39). In general, metals with an ER_B greater than 1.0 are located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. Offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for metals in all subsurface samples submitted for chemical analysis.

  In native sediment, the ER_B is less than 1.0 for metals in all samples submitted for chemical analysis.

The sample locations where the metals ER_B is greater than 1.0 in surface and subsurface sediment in the nearshore area of South Terminal are bounded by multiple sample locations, including MAF-12, MAF-20, MAF-21 and MAF-10, which have an ER_B for metals less than 1.0.

5.3.2.2. Low Molecular Weight Polycyclic Aromatic Hydrocarbons

The distribution of LPAH compounds including 2-methylnaphthalene, acenaphthene, anthracene, fluorene, naphthalene, phenanthrene and sum of LPAHs (Benthic COCs; Section 4.2.1) in surface sediment and subsurface sediment compared to the Benthic PCUL are shown in Figures 40 and 41, respectively and are described below.

- **Surface Sediment** – In surface sediment (Figure 40), the ER_B for LPAHs range between approximately 1 and 5 and increases to a maximum ER_B of 5.4 at MAF-03 in the nearshore area adjacent to the marine terminals and between the South Terminal Wharf and the Pacific Terminal Interim Action area. In addition, the ER_B for acenaphthene at MAF-33 (1.06) in surface sediment adjacent to the Pacific Terminal Wharf is also slightly greater than 1.0. Offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B for LPAHs is less than 1.0 in surface sediment at all locations submitted for chemical analysis.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 41), the ER_B for LPAHs ranges between approximately 1 and 15 and increases to a maximum ER_B of 427 at ST-43 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_B for LPAHs greater than 1.0 extends from the mudline to at least approximately 8 feet below the mudline surface. Offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for LPAHs in subsurface sediment.

  In native sediment, the ER_B is less than 1.0 for LPAHs in all samples submitted for chemical analysis.

The sample locations where the LPAH ER_B is greater than 1.0 in surface and subsurface sediment in the nearshore area of South Terminal are bounded by multiple sample locations, including MAF-12, MAF-20, EW-12-07 and MAF-22, with an ER_B for LPAHs less than 1.0. In addition, the ER_B for acenaphthene at MAF-33 (1.06) in surface sediment located adjacent to Pacific Terminal is bound by sample locations PT-08, MAF-07 and MAF-08 that bound MAF-33 with an ER_B for LPAHs less than 1.0.

5.3.2.3. High Molecular Weight Polycyclic Aromatic Hydrocarbon

The distribution of HPAH compounds including benzo(a)anthracene, benzo(a)pyrene, total benzofluoranthenes, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene and sum of HPAHs (Benthic COCs; Section 4.2.1) in surface and subsurface sediment compared to the Benthic PCUL are shown in Figures 42 and 43, respectively and are described below.

- **Surface Sediment** – In surface sediment (Figure 42), the ER_B for HPAHs range between approximately 1 and 2 and increases to a maximum ER_B of 4.24 at MAF-03 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. Offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B for HPAHs is less than 1.0 in surface sediment at all locations submitted for chemical analysis.

- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 43), the ER_B for HPAHs range between approximately 1 and 10 and increases to a maximum ER_B of 44.76 at ST-43 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_B for HPAHs greater than 1.0 extends from the mudline to approximately 16 feet below the mudline surface. Offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for HPAHs in subsurface sediment.

  In native sediment, the ER_B is less than 1.0 for HPAHs in all samples submitted for chemical analysis.

The sample locations where the HPAHs ER_B is greater than 1.0 in surface and subsurface sediment in the nearshore area of South Terminal are bounded by multiple sample locations, including MAF-59, MAF-20, MAF-21 and MAF-10, with an ER_B less than 1.0.

5.3.2.4. Chlorinated Hydrocarbons

The distribution of chlorinated hydrocarbon compounds including 1,2,4-trichlorobenzene, 1,2-diclorobenze and hexachlorobenzene (Benthic COCs; Section 4.2.1) in surface sediment and subsurface sediment compared to the Benthic PCUL are shown in Figures 44 and 45, respectively and are described below.

- **Surface Sediment** – The ER_B is less than 1.0 for chlorinated hydrocarbons in the surface sediment throughout the Marine Area (Figure 44).
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 45), the ER_B for chlorinated hydrocarbons range between approximately 1 and 3 and increases to a maximum ER_B of 17.09 at MAF-03 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_B for chlorinated hydrocarbons greater than 1.0 is located between approximately 4 and 8 feet below the mudline surface. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, non-detect organic carbon normalized concentrations of 1,2,4-trichlorobenzene in samples DMMU-1A-COMP through DMMU-1C-COMP (representative of sample locations ST-102 through ST-104), and non-detect organic carbon normalized concentrations of 1,2,4-trichlorobenzene and 1,2-dichlorobenzene in sample DMM-1-Keyway (representative of sample locations ST-101 and ST-105) exceeded the PCUL. However, dry weight concentrations for each of these samples were less than the PCUL. Offshore of the marine terminals and in the intertidal area southwest of the Public Open Space, the ER_B is less than 1.0 for chlorinated hydrocarbons in subsurface sediment.

  In native sediment, the ER_B is less than 1.0 for chlorinated hydrocarbons in all samples submitted for chemical analysis.

The sample locations where the chlorinated hydrocarbon ER_B is greater than 1.0 in subsurface sediment in the nearshore area of South Terminal are bounded by multiple sample locations, including MAF-59, MAF-20, MAF-21 and MAF-10, with an ER_B less than 1.0.

5.3.2.5. Phthalates

The distribution of phthalate compounds including bis(2-ethylhexyl) phthalate, butyl benzyl phthalate and diethyl phthalate (Benthic COCs; Section 4.2.1) in surface sediment and subsurface sediment compared to the Benthic PCUL are shown in Figures 46 and 47, respectively and are described below.

- **Surface Sediment** – The ER_B is less than 1.0 for phthalates in the surface sediment throughout the Marine Area (Figure 46).
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 47), the ER_B for phthalates range between approximately 2 and 6 and increases to a maximum ER_B of 10.32 at ST-08 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_B for phthalates greater than 1.0 extends from the mudline to approximately 16 feet below the mudline surface. Offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for phthalates in subsurface sediment.

  In native sediment, the ER_B is less than 1.0 for phthalates in all samples submitted for chemical analysis.

The sample locations where the phthalate ER_B is greater than 1.0 in subsurface sediment in the nearshore area of South Terminal are bounded by multiple sample locations, including MAF-59, MAF-11, MAF-20, MAF-21, A1-24 and ST-34, with an ER_B for phthalates less than 1.0.

5.3.2.6. Phenols

The distribution of phenol compounds including 2,4-dimethylphenol, 2-methylphenol, 4-methyphenol and phenol (Benthic COCs; Section 4.2.1) in surface sediment and subsurface sediment compared to the Benthic PCUL are shown in Figures 48 and 49, respectively and are described below.

- **Surface Sediment** – In surface sediment (Figure 48), the ER_B for phenols range between approximately 1 and 6 and increases to a maximum ER_B of 11.03 at MAF-03 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. Additionally, the ER_B for phenols ranges between approximately 1 and 2 in surface sediment in the offshore area northwest of Pacific Terminal. In other offshore areas, the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for phenols in surface sediment.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 49), the ER_B for phenols range between approximately 1 and 5 and increases to a maximum ER_B of 76.12 at MAF-03 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_B for phenols greater than 1.0 extends from the mudline to approximately 16 feet below the mudline surface. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B for phenols in subsurface sediment ranges between approximately 1 and 3 with the highest ER_B at ST-103 (represented by sample DMMU-1E-COMP) at a depth ranging from approximately 8 and 10 feet bml. Offshore of Pier 1, the ER_B for 2,4-dimethylphenol in shallow subsurface sediment (0-2 feet bml) at SP-151 slightly exceeded 1.0. However, 2,4-dimethylphenol was not detected in the duplicate sample at SP-151. Using the average ER of 2,4-dimethylphenol at SP-151 for the parent sample (1.17) and

duplicate sample (0.56 [non-detected ER_B]), the resulting ER at this location is below 1.0. In other offshore areas and the intertidal area southwest of the Public Open Space, the ER_B is less than 1.0 for phenols in subsurface sediment.

In native sediment, the ER_B is less than 1.0 for phenols in all samples submitted for chemical analysis.

The sample locations where the phenol ER_B is greater than 1.0 in surface sediment and subsurface sediment offshore of the South Terminal are bounded by multiple sample locations including MAF-05, ST-30, MAF-37, MAF-38, A1-18 and A1-15 with an ER_B for phenols less than 1.0. The sample locations where the phenol ER_B is greater than 1.0 in subsurface recently deposited sediment located southwest of the South Terminal Wharf are also bounded by multiple sample locations including MAF-17, MAF-18, ST-24 and MAF-13 with an ER_B for phenols less than 1.0.

5.3.2.7. Miscellaneous Extractables

The distribution of miscellaneous extractable compounds including dibenzofuran, hexachlorobutadiene, benzoic acid and benzyl alcohol (Benthic COCs; Section 4.2.1) in surface sediment and subsurface sediment compared to the Benthic PCUL are shown in Figures 50 and 51, respectively and are described below.

- **Surface Sediment** – In surface sediment (Figure 50), the ER_B for miscellaneous extractables range between approximately 1 and 7 with the highest ER_B at location ST-108 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In addition, there are several individual locations with an ER_B greater than 1.0 for miscellaneous extractables including MAF-10 and MAF-31 outside of this area. In other offshore areas, the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for miscellaneous extractables in surface sediment.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 51), the ER_B for miscellaneous extractables range between approximately 1 and 25 and increase to a maximum ER_B of 35.71 at ST-43 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_B for miscellaneous extractables greater than 1.0 extends from the mudline to approximately 16 feet below the mudline surface. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, an ER_B of 1.64 for hexachlorobutadiene was detected in sample DMMP--1E-COMP (representative of location ST-103) southeast of the South Terminal Wharf at a depth of 8 to 10 feet bml. In addition, at SP-151 located northwest of Pier 1, the ER_B for benzoic acid slightly exceeded 1.0 in shallow subsurface sediment (0 to 2 feet bml). However, benzoic acid was not detected in the duplicate sample at SP-151. Using the average ER_B of benzoic acid at SP-151 for the parent sample (1.03) and duplicate sample (0.4 [non-detected ER]), the resulting ER_B at this location is below 1.0. In other offshore areas and the intertidal area southwest of the Public Open Space, the ER_B is less than 1.0 for miscellaneous extractables in subsurface sediment.

  In native sediment, the ER_B is less than 1.0 for miscellaneous extractables in all samples submitted for chemical analysis.

The sample locations where the miscellaneous extractable ER_B is greater than 1.0 in surface sediment and subsurface sediment offshore of the South Terminal are bounded by multiple sample locations including

MAF-58, ST-30, MAF-20, MAF-21 and MAF-22 with an ER_B for miscellaneous extractable compounds is less than 1.0. In addition, the ER_B for dibenzofuran at MAF-33 (1.13) is slightly greater than 1.0. Sample locations where the dibenzofuran ER_B is less than 1.0 include PT-08, MAF-07 and MAF-08 that bound MAF-33.

5.3.2.8. Polychlorinated Biphenyls

The distribution of PCBs in surface and subsurface sediment compared to the Benthic PCUL are shown in Figures 52 and 53, respectively and are described below.

- **Surface Sediment** – In surface sediment (Figure 52), the ER_B for PCBs (total Aroclors or Congeners) in the surface sediment range between approximately 1 and 2 with the highest ER_B of 2.52 at location MAF-01 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In addition, an ER_B of 1.63 at location MAF-12 located offshore of this area was detected. In other offshore areas, the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for PCBs in surface sediment.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 53), the ER_B for PCBs (total Aroclors or Congeners) range between approximately 1 and 23 and increase to a maximum ER_B of 40 at location ST-34 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_B for PCBs greater than 1.0 extends from the mudline to approximately 4 feet below the mudline surface. Offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_B is less than 1.0 for PCBs in subsurface sediment.

  In native sediment, the ER_B is less than 1.0 for PCBs (total Aroclors or Congeners) in all samples submitted for chemical analysis.

The sample locations where the PCB ER_B is greater than 1.0 in surface sediment and subsurface sediment in the nearshore area of South Terminal are generally bounded by multiple sample locations, including MAF-59, MAF-20, MAF-21, and MAF-10, with an ER_B for PCBs less than 1.0. However, there are several individual locations with a PCB ER_B greater than 1.0 including ST-39 and PT-12 outside of this area.

5.3.3. Bioassays

Surface sediment sampling activities were completed for bioassay testing at locations MAF-09 through MAF-12, MAF-20 through MAF-22, MAF-31 and MAF-35. Bioassay testing was completed to further characterize potential toxic effects from wood debris and COPCs on benthic organisms. Sample locations for bioassay testing were selected where the surface wood debris content was estimated to be greater than 15 percent and/or chemical concentrations from initial Marine Area sampling and analysis exceeded the SCO numerical criteria based on protection of the benthic organisms. The bioassay test results for surface sediment samples are presented in Tables H-4 through H-6 in Appendix H, are summarized in Table 6 and shown in Figure 54.

Similar to results for chemical analyses on Site COPCs, the bioassay test results were compared to SCO and CSL criteria. Under the SMS, the biological benthic criteria are the confirmatory criteria. This means bioassay results can override chemistry results. Bioassay tests passed the SCO and CSL biological criteria at locations MAF-09, MAF-11, MAF-20, MAF-21, MAF-31, and MAF-35 (Figure 54). Samples from MAF-10, MAF-12, and MAF-22 failed the SCO biological criteria for the larval development test.

The results of bioassay testing are used to refine the extent of impact from contaminated sediment on the benthic community in the Surface Sediment. Bioassay test results at locations MAF-09, MAF-11, MAF-20, MAF-21, MAF-31 and MAF-35 (Table 6 and Figure 54) met both the PCUL and SCO/CSL biological criteria indicating that contaminant concentrations at these locations, even if the concentrations are greater than the numerical PCUL, are protective of benthic organisms. This includes the concentrations of phenols at MAF-09, MAF-11, MAF-20, MAF-21 and MAF-31 and concentrations of miscellaneous extractables at MAF-31. Bioassay test failures of the SCO biological criteria at MAF-10, MAF-12 and MAF-22 do not change the outcome based on comparison of the chemical analytical results to numerical criteria as one or more chemical contaminants exceeded the numerical criteria at these locations.

5.3.4. Protection of Human Health and Higher Trophic Level Ecological Receptors

Sediment data for the Marine Area compared to the Human Health PCULs are summarized in Table 7. Human Health PCULs by way of ingestion and dermal contact (further discussed in Section 4.1.2) were developed utilizing equations and parameter values from Ecology's SCUM guidance with consideration for potential Site receptors and exposure pathways as discussed in Section 3.5 and Indian Tribes, vulnerable populations and overburdened communities further discussed in Section 10.4. Metals, cPAHs, PCBs and dioxins and furans are identified as Marine Area Human Health COCs (Section 4.2). IDW mapping of the ER (i.e., analyte concentration divided by the PCUL) based on comparison to the Human Health PCUL (ER_{HH}) was completed to evaluate the spatial distribution of COCs and characterize the nature and extent of contamination. In addition, the area weighted average concentrations for bioaccumulative compounds were also evaluated. IDW mapping of Human Health COCs and corresponding area weighted concentrations in surface sediment and subsurface sediment in the Marine Area are shown in Figures 55 through 71. IDW mapping of Human Health COCs and corresponding area weighted concentrations at 2-foot intervals extending from the mudline surface to 22 feet below the mudline surface (the deepest sediment core sections collected) is presented in Appendix Q.

A description of the nature and extent of the Human Health COCs is presented in the following sections.

5.3.4.1. Metals

The distribution of metals including arsenic, cadmium, lead and mercury (Human Health COCs; Section 4.2.2) in surface sediment and subsurface sediment compared to the Human Health PCUL are shown in Figures 55 through 62 and are described below.

- **Surface Sediment** – In surface sediment located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and Pacific Terminal Interim Action Area, the ER_{HH} for arsenic, cadmium, lead and mercury exceeded 1.0 as follows:
  - The ER_{HH} for arsenic ranges between approximately 1 and 5 with the highest ER_{HH} at location MAF-03 (ER_{HH} of 5.0; Figure 55).
  - The ER_{HH} for cadmium ranges between approximately 1 and 2 with the highest ER_{HH} at location MAF-03 (ER_{HH} of 2.25; Figure 57).
  - The ER_{HH} for lead ranges between approximately 1 and 5 with the highest ER_{HH} at location MAF-03 (ER_{HH} of 5.48; Figure 59).
  - The ER_{HH} for mercury was slightly greater than 1.0 at location MAF-03 (ER_{HH} of 1.1; Figure 61).

Additionally, the ER_{HH} for arsenic, cadmium and/or lead is greater than 1.0 at MAF-31 (1.38), MAF-32 (1.08) and MAF-33 (1.17) adjacent to Pacific Terminal. In other portions of the Marine area, including the area offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} is less than 1.0 for metals in surface sediment.

- **Subsurface Sediment** – In the recently deposited subsurface sediment in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and Pacific Terminal Interim Action Area, the ER_{HH} for arsenic, cadmium and lead exceeded 1.0 as follows:
  - The ERHH for arsenic ranges between approximately 1 and 6 with the highest ERHH at location MAF-11 (ERHH of 5.83) from a depth of 0 to 2 feet bml (Figure 56).
  - The ERHH for cadmium ranges between approximately 1 and 3 with the highest ERHH at location ST-39 (ERHH of 2.63) from a depth of 2 to 6 feet bml (Figure 58).
  - The ERHH for lead ranges between approximately 1 and 7 with the highest ERHH in composite sample DMMU-2D-Comp (ERHH of 7.1) represented by sample locations ST-108 and ST-109 from a depth of 6 to 8 feet bml (Figure 60). In addition, lead with a maximum ERHH of 3.08 was identified at ST-104 southwest of the South Terminal Wharf at a depth of 10 to 12 feet bml.
  - The ERHH for mercury ranges between approximately 1 and 2 with the highest ERHH at location MAF-04 (ERHH of 1.4) from a depth of 0 to 10 feet bml (Figure 62). However, an isolated mercury exceedance (ERHH of 192.5) was detected at location MAF-59 in the sample collected from 6 to 8 feet bml.

  In other portions of the Marine area, including the area offshore of the marine terminals, in the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{B} is less than 1.0 for metals in subsurface sediment.

  In native sediment, the ER_{B} is less than 1.0 for metals in all samples submitted for chemical analysis.

The sample locations where the metals ER_{HH} is greater than 1.0 in surface sediment and subsurface sediment around the South Terminal are bounded by multiple sample locations including MAF-25, MAF-17, ST-24, A1-23, EW-12-07, A1-18 and EW-12-06 with an ER_{HH} for metals less than 1.0. Additionally, lead had an ER_{HH} greater than 1.0 at location EW-12-05 located northwest of Pier 1. However, the exceedance at EW-12-05 is not likely associated with historical operations at Mill A based on the spatial distribution of metals observed within the Marine Area.

5.3.4.2. Polycyclic Aromatic Hydrocarbons

The distribution of total cPAH TEQ (Human Health COC; Section 4.2.2) in surface sediment and subsurface sediment compared to the Human Health PCUL (regional background concentration) are shown in Figures 63 and 64. Given the wide-spread distribution of cPAHs within Port Gardner Bay, a PCUL based on regional background is most appropriate for evaluating nature and extent for the Marine Area. In addition, Figure 65 presents the gradient in cPAH concentrations for samples collected from the area adjacent to the South and Pacific Terminals and within the East Waterway to define the Site boundary of the Marine Area. As shown in Figure 65, the total cPAH TEQ concentration gradient substantially decreases northwest of Pier 1 between the Marine Area and the East Waterway. The presence of the lower concentration “trough” provides evidence that the total cPAH TEQ concentrations within the Marine Area are likely from a different source than the observed total cPAH TEQ concentrations located within the East Waterway. Based on the

RI data, the trough in total cPAH TEQ concentrations at sample locations MAF-49, A1-15, EW-12-05 and EW-12-06 defines a boundary between the Mill A Site and East Waterway.

The distribution of total cPAH TEQ in the surface sediment and subsurface sediment is further described below.

- **Surface Sediment** – In surface sediment (Figure 63), the ER_{HH} for total cPAH TEQs in the nearshore area adjacent to the marine terminals and offshore of the marine terminals between the South Terminal Wharf and Pacific Terminal Interim Action Area ranges from between approximately 2 and 6 and increases to a maximum ER_{HH} of 17.14 at location ST-109. Additionally, the ER_{HH} was greater than 1.0 at locations MAF-09 (ER_{HH} of 1.54) MAF-32 (ER_{HH} of 2.09) and MAF-33 (ER_{HH} of 1.93) adjacent to Pacific Terminal. Offshore of Pacific Terminal, the ER_{HH} at location MAF-45 is 6.41. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} ranges from 1.06 to 1.93. In the intertidal area southwest of the Public Open Space, the ER_{HH} is less than 1.0.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 64), the ER_{HH} for total cPAH TEQs in the nearshore and offshore area northwest of the marine terminals between the South Terminal Wharf and Pacific Terminal Interim Action Area ranges from between approximately 1 and 15 and increases to a maximum ER_{HH} of 105.63 at location ST-11. In this area, the ER_{HH} for cPAHs greater than 1.0 extend from the mudline to approximately 16 feet below the mudline surface. Along the South Terminal navigational area, the ER_{HH} for total cPAH TEQs range between 1.1 and 5.7 from the mudline surface to a depth of approximately 6 feet bml. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} for total cPAH TEQs range between 1.1 and 3.02 from the mudline surface to a depth of approximately 10 feet bml. In the intertidal area southwest of the Public Open Space, the ER_{HH} is 1.39 in subsurface sediment to a depth of approximately 2 feet below the mudline surface.

  In native sediment, the ER_{HH} is less than 1.0 for total cPAH TEQ in all samples submitted for chemical analysis.

The sample locations where the total cPAH TEQs ER_{HH} is greater than 1.0 in surface sediment and the subsurface sediment around the South and Pacific Terminals are bounded by sample locations including MAF-25, MAF-17, MAF-16, MAF-55, MAF-48, MAF-40, MAF-43, EW-12-06 and EW-12-05 with an ER_{HH} for total cPAH TEQs less than 1.0.

5.3.4.3. Polychlorinated Biphenyls

The distribution of PCBs (Human Health COC; Section 4.2.2) in surface sediment and subsurface sediment compared to the Human Health PCUL are shown in Figures 66 and 67, respectively and are described below.

- **Surface Sediment** – The ER_{HH} is less than 1.0 for PCBs in the surface sediment (Figure 66).
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 67), the total PCB ER_{HH} is predominantly less than 1.0. In the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area, the ER_{HH} for total PCBs is 5.14 and 8.96 at locations MAF-03 and ST-34 with the highest ER_{HH} at location ST-34. In this area, the ER_{HH} for PCBs greater than 1.0 extends from the mudline to approximately 4 feet below the mudline surface. In

other portions of the Marine Area including the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} is less than 1.0 for PCBs in surface sediment.

In native sediment, the ER_{HH} is less than 1.0 for PCBs in all samples submitted for chemical analysis.

The results for dioxin-like PCB TEQ (Human Health COC; Section 4.2.2) in surface sediment and subsurface sediment compared to the Human Health PCUL (regional background concentration) are shown in Figures 68 and 69, respectively and are described below. Given the wide-spread distribution of dioxin-like PCB within Port Gardner Bay, a PCUL based on regional background is most appropriate for evaluating nature and extent for the Marine Area.

- **Surface Sediment** – In surface sediment (Figure 68), the ER_{HH} for dioxin-like PCBs ranges between approximately 1 to 15 and increases to a maximum ER_{HH} of 19.51 at location MAF-03 located in the nearshore area adjacent to the marine terminals between the South Terminal wharf and the Pacific Terminal Interim Action area. Additionally, the ER_{HH} was greater than 1.0 at location MAF-35 (ER_{HH} of 7.29) southwest of Pier 1. In other portions of the Marine Area including the intertidal area southwest of the Public Open Space and along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} is less than 1.0 for dioxin-like PCBs in surface sediment.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 69), the ER_{HH} for dioxin-like PCBs ranges from approximately 1 and 5 and increases to a maximum ER_{HH} of 83.18 at location MAF-03 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. In this area, the ER_{HH} for dioxin-like PCBs greater than 1.0 extends from the mudline to approximately 6 feet below the mudline surface. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} for dioxin-like PCBs ranges between approximately 1 and 3 to a depth of approximately 14 feet bml. In other portions of the Marine Area including the intertidal area southwest of the Public Open Space, the ER_{HH} is less than 1.0 for PCBs in sediment.

  In native sediment, the ER_{HH} is less than 1.0 for dioxin-like PCBs in all samples submitted for chemical analysis.

The sample locations where the dioxin-like PCBs ER_{HH} is greater than 1.0 in surface sediment and the subsurface sediment around the South Terminal are bounded by sample locations including MAF-14, MAF-17, MAF-19, MAF-20, MAF-38, MAF-22 and MAF-31 with an ER_{HH} for dioxin-like PCBs less than 1.0. Additionally, an ER_{HH} of 7.3 and 1.4 were detected at locations MAF-35 and MAF-36, respectively, northwest of Pier 1. Locations MAF-35 and MAF-36 are generally separated from the area with a dioxin-like PCB ER_{HH} greater than 1.0 at South Terminal by locations MAF-22, MAF-31 and MAF-46. The dioxin-like PCB exceedances at MAF-22 and MAF-31 are bounded by sample locations including MAF-09, MAF-46, MAF-49 with an ER_{HH} for dioxin-like PCBs less than 1.0.

5.3.4.4. Dioxins and Furans

The distribution of total dioxin and furan TEQ (Human Health COCs; Section 4.2.2) in surface sediment and subsurface sediment compared to the Human Health PCUL are shown in Figures 70 and 71, respectively and are described below.

- **Surface Sediment** – In surface sediment (Figure 70), the ER_{HH} for the total dioxin and furan TEQ in the nearshore and offshore areas adjacent to the marine terminals ranges between approximately 1 and 6 with the highest ER_{HH} at location MAF-35 (5.58) located southwest of Pier 1. Southwest of the Public Open Space, an ER_{HH} of 4.8 was observed in at MAF-15. In other portions of the Marine Area including the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} for dioxins and furans was less than 1.0.
- **Subsurface Sediment** – In the recently deposited subsurface sediment (Figure 71), the ER_{HH} for the total dioxin and furan TEQ ranges between approximately 1 and 10 and increases to a maximum ER_{HH} of 24 at ST-17 located in the nearshore area adjacent to the marine terminals between the South Terminal Wharf and the Pacific Terminal Interim Action area. Along the transition slope between the Pigeon Creek intertidal area and the South Terminal navigational area, the ER_{HH} ranges between approximately 1 and 6 with the highest ER_{HH} detected at locations ST-101 and ST-105 (represented by sample DMMP-1-Keyway). In other portions of the Marine Area, the ER_B is less than 1.0 for total dioxin and furan TEQ in samples submitted for chemical analysis.

  In native sediment, the ER_{HH} is less than 1.0 for dioxins and furans in all samples submitted for chemical analysis.

The sample locations where the total dioxin and furan TEQ ER_{HH} is greater than 1.0 in surface and sediment around the South Terminal are bounded by sample locations including MAF-25, MAF-55, MAF-40, EW-12-07, A1-18, MAF-49 and EW-12-05 with an ER_{HH} for total dioxin and furan TEQ less than 1.0.

5.4. Contaminant Sources

In the Marine Area, IDW mapping was used to characterize the spatial distribution of Benthic and Human Health COCs (discussed in Section 5.3)) including metals (arsenic, cadmium, copper, lead, mercury and zinc), SVOCs (LPAHs, HPAHs, cPAHs, chlorinated hydrocarbons, phthalates, phenols and miscellaneous extractables), PCBs, dioxin-like PCBs, and dioxins and furans. In addition, the nature and extent of wood in the Marine Area as well as secondary indicators of the potential presence and potential impacts from wood (TOC, TVS, ammonia and sulfide) were evaluated to define nature and extent. Sources of wood debris and COCs (Benthic and/or Human Health) in the Marine Area based on the results of the RI are further discussed below.

5.4.1. Wood Debris

As previously discussed in Section 4.1.3, wood debris in sufficient quantities can negatively impact the benthic community. As a result, wood debris is managed by Ecology under the SMS as a deleterious substance (WAC 173-204). The results of the RI identified wood deposits in the nearshore area between the South Terminal Wharf and interim action area southwest of Pacific Terminal up to 20 feet thick with decreasing thickness and volumes offshore of the marine terminals. Wood debris located between the South Terminal Wharf and the Pacific Terminal is comprised predominantly of sawdust and chips from the former mill operations. Minor quantities of bark and other log rafting debris were also observed in the Marine Area.

5.4.2. Metals

Metals including arsenic, cadmium, copper, lead, mercury and zinc are present in surface and/or subsurface sediment at concentrations exceeding the Benthic and/or Human Health PCUL. In general, metals concentrations are ubiquitous and do not appear to be attributable to a point source. The highest concentrations generally coincide with the location of the wood debris mound. Due to their physical-chemical properties, metals tend to sorb to materials with high organic matter like wood.

5.4.3. Polycyclic Aromatic Hydrocarbons

LPAHs, HPAHs and cPAHs are present in surface and subsurface sediment at concentrations exceeding the Benthic and/or Human Health PCUL. Similar to the observed distribution of metals in the Marine Area, the highest LPAH, HPAH and cPAH concentrations coincide with the location of the wood debris mound. Due to their physical-chemical properties, PAH compounds have a strong tendency to sorb onto materials with high organic matter.

Although cPAHs are present throughout the Marine Area, a “trough” in concentrations northwest of Pier 1 provides evidence that the cPAHs in the Marine Area are likely from a different source than the observed cPAHs located within the East Waterway. A source of PAH contamination to the Marine Area could be from the effluent discharged from historical mill outfalls WT002, WT003, WT004 and historical and current Outfall 003 located on the shoreline northwest of the South Terminal Wharf. Additional sources likely include historical combustion of fossil fuels from machinery (boiler, power, etc.), vehicles and marine vessels operating at the Site and atmospheric deposition onto Site surfaces and runoff into the Marine Area.

5.4.4. Phthalates, Phenols, Chlorinated Hydrocarbons and Miscellaneous Extractables

Phthalates, phenols, chlorinated hydrocarbons and miscellaneous extractables are present in surface and/or subsurface sediment at concentrations exceeding the Benthic PCUL. In the Marine Area, the highest concentrations coincide with the location of the wood debris mound. Due to their physical-chemical properties, phthalates, phenols, chlorinated hydrocarbons and miscellaneous extractables tend to sorb to materials with high organic matter. In addition, degradation of the wood debris in the marine environment results in phenols and methylated phenols, benzoic acid and benzyl alcohol.

5.4.5. Polychlorinated Biphenyls

Concentrations of PCBs including dioxin-like PCBs exceed the Benthic and/or Human Health PCUL are present in surface and subsurface sediment. Similar to the observed distribution of metals and PAHs in the Marine Area, the highest PCB and dioxin-like PCB concentrations coincide with historical mill wastewater outfalls located on the shoreline northeast of the South Terminal Wharf. The highest PCB and dioxin-like PCBs concentrations also coincide with the location of wood debris mound. Due to their physical-chemical properties, PCBs have a strong tendency to sorb to materials with high organic matter.

5.4.6. Dioxins and Furans

Concentrations of dioxins and furans exceeding the Human Health PCUL are present in surface and subsurface sediment. Dioxins and furans are commonly associated with pulp and paper mill discharges where chlorination is used during processing and where waste incinerators such as hog fuel burners combust materials that contain salt (e.g., wood transported in marine water). The distribution of dioxin and furan contamination in the Marine Area coincides with the historical mill wastewater discharge outfalls on the shoreline northeast of the South Terminal Wharf and southwest of the South Terminal and adjacent to historical outfall WT004 and current Outfall 001 southwest of the South Terminal. The highest dioxin and furan concentrations also coincide with the location of wood debris. Due to their physical-chemical properties, dioxins and furans have a strong tendency to sorb to materials with high organic matter.

5.5. Fate, Transport and Bioaccumulation

The fate and transport of contaminants are affected by their chemical properties and the physical, chemical, and biological processes which they are exposed to at the Site. These properties and how they impact the fate and transport of the Site contaminants are discussed in the following sections.

5.5.1. Environmental Fate

The environmental fate of COCs identified for the Marine Area are largely dependent on physical-chemical properties that affect their distribution, mobility and persistence in the environment. These chemical properties have a strong influence on the potential for benthic organisms, humans and ecological receptors to be exposed to the COCs. Factors that influence the environmental fate of wood debris, organic compounds (i.e., PAHs, phthalates, phenols, chlorinated hydrocarbons, miscellaneous extractables, PCBs, and dioxins and furans), and non-organic compounds (i.e., metals including arsenic, cadmium, copper, lead, mercury and zinc) are described in the following sections.

5.5.1.1. Wood Debris

As wood debris in sediment degrades, the sediment's biochemical oxygen demand increases, which reduces or removes dissolved oxygen from the water column and porewater in sediment. Dissolved oxygen loss reduces benthic abundance and shifts benthic diversity toward species that are tolerant of low oxygen environments. Decaying wood in the marine environment can release by-product compounds that are toxic to aquatic life, such as ammonia, sulfide, phenols, benzoic acid, and benzyl alcohol. The generation and release of these compounds may reduce the quality of the marine environment and limit the survival of benthic organisms.

5.5.1.2. Organic Compounds

Organic compounds identified in the Marine Area at concentrations exceeding the Benthic PCUL include LPAHs, HPAHs, phthalates, phenols, chlorinated hydrocarbons, miscellaneous extractables, and PCBs. Compounds identified at concentrations exceeding the Human Health PCUL include cPAHs, PCBs, and dioxins and furans. The nature and extent of Site COCs is discussed in Section 5.3.

PAHs, PCBs, and dioxins and furans generally are nonpolar compounds that have a strong affinity for bonding to sediment particles, whereas phthalates, phenols, chlorinated hydrocarbons, and miscellaneous extractables are generally polar compounds that have a lower affinity for bonding to sediment particles. The relative affinity of a particular COC for bonding to sediment particles has important implications for the mobility and bioavailability of the COC. Chemicals with a strong affinity for sediment are less mobile and bioavailable than chemicals with a lower affinity for sediment. However, the decreased mobility of chemicals with a strong affinity for sediment may result in long-term exposure to benthic organisms and human and ecological receptors. In addition, sediment with strongly sorbed COCs can function as an ongoing source of contaminants to porewater and surface water as sediment-bound chemicals partition into water, or if sediments are resuspended.

The relative distribution of an organic compound between sediment and water is described by the compound's partition coefficient (K_d). The partition coefficient of a chemical is the ratio of the concentration of the chemical in a solid phase to the corresponding aqueous phase concentration. Chemicals with high partition coefficients such as PAHs, PCBs, and dioxins and furans typically have much higher concentrations in sediment than in porewater or the overlying water column. In addition, sediments with high organic carbon concentrations (e.g., the wood debris area between South Terminal Wharf and Pacific Terminal) will tend to have higher chemical concentrations than sediments with lower organic carbon concentrations (e.g., the area offshore of the South Terminal).

Degradation processes for organic compounds in aqueous systems include photodegradation, hydrolysis, and biodegradation. Some organic compounds including PCBs, dioxins, and PAHs are relatively hard to degrade because of their chemical stability in the environment. HPAHs tend to persist in sediments, with half-lives ranging from months to years, while other semi-volatile compounds, such as phenol and some LPAHs, are less persistent and have much shorter half-lives. For example, the half-life for phenols range from less than one day in fresh water to nine days in estuarine water (ATSDR 1998).

5.5.1.3. Non-Organic Compounds

Non-organic compounds identified in the Marine Area at concentrations exceeding the Benthic and/or Human Health PCUL f include the metals arsenic, cadmium, copper, lead, mercury, and zinc. The nature and extent of Site COCs are further discussed in Section 5.3.

In general, the fate of metals in the environment is primarily driven by speciation of the metal, which is a function of a number of variables, including oxidation and reduction potential, pH, salinity, temperature, and type and concentration of available organic and inorganic ligands (i.e., chemicals, either in solution or precipitated, capable of bonding with metal ions, such as sulfate, iron oxides, or natural organic matter). Equilibrium constants and kinetics also determine whether a metal will be associated primarily with the particulate or dissolved phase. The dissolved speciation and sorption of metals to solids affect their bioavailability and subsequent toxicity. Arsenic, copper, cadmium, copper, lead, mercury, and zinc are generally considered to be persistent in the environment because they cannot be degraded by natural processes and are not volatile.

Organo-metallic compounds such as mercury can be methylated by sulfate-reducing bacteria in anaerobic sediments to produce methylmercury, potentially increasing its bioaccumulation potential compared to inorganic mercury. The production of methylmercury is linked to the production and degradation of carbon within a specific area. High concentrations of organic carbon in sediment (e.g., the wood debris area between South Terminal Wharf and Pacific Terminal) can result in greater areas of anaerobic conditions and subsequently higher rates of mercury methylation. Organo-metallic compounds such as methylmercury have properties associated with both organic and inorganic chemicals and are more easily bioaccumulated than the other metallic compounds.

Metals including arsenic, cadmium, copper, mercury, and zinc may form insoluble hydroxide precipitates, especially in environments with high pH. As pH decreases, the solubility (and thus mobility) of these hydroxide precipitates increases. Metal ions may bond with natural organic compounds such as humic and fulvic acid molecules to form metal-ligand complexes and thus can be more mobile in environments with high dissolved organic carbon concentrations. Metal ions may also adsorb onto clay and oxide minerals because of negative charges on their surface. Ion exchange may also occur at the particle surface, where metal ions of one element replace those of another element because of different properties of the element or environmental conditions. The oxidation state of the metal ion influences the speciation of the metal. Reduced metal species (e.g., iron and manganese) are soluble, whereas oxidized forms of these metals are in the particulate form and tend to also sorb other metals to their surface.

Although microorganisms do not degrade metals in the environment, they can play an important role in altering the mobility of metals. In marine sediment, microbial oxidation of natural and anthropogenic carbon consumes available oxygen, sulfate, and carbon dioxide within a short distance below the sediment-water interface, creating strong reducing conditions (Moore et al. 1988). Reducing conditions can mobilize arsenic, and other metals naturally present in or sorbed to sediment particles, although if sufficient sulfide is present, the precipitation of sulfides can be effective in decreasing the mobility of metals. In oxic conditions, the mobility of these metals is generally decreased through sorption to or coprecipitation with iron and manganese hydroxides. The combination of these processes can create a metals sequestering area in the transition zone between the deeper anoxic sediments at depth and the oxic sediments near the sediment/surface water interface.

5.5.2. Environmental Transport

The general range of release and transport mechanisms for Site contaminants to sediment are presented in Figures 13 through 15. The specific release and transport mechanisms by which Site contaminants have been, and may continue to be, transported at the Site include the following:

- Direct deposition of wood debris to the sediment surface from historically rafted logs that were used to support wood milling operations and pulp production at the Site from the late 1800s to 1980 and rafted logs, which were delivered to the Site and pulled ashore, sorted and stacked in the Upland Area for temporary storage pending shipment by loading onto vessels between 1983 and the mid-2000s.
- Direct deposition from industrial wastewater discharges, including SWL and untreated wastewater from washing, bleaching, and drying processes and stormwater generated during Mill A operations into the Marine Area through historical mill shoreline outfalls WT002, WT003, WT004 and WT006.
- Direct deposition from combined sewer overflow discharges by the City into the Marine Area through historical mill shoreline outfalls E005, E006 and E007.
- Direct deposition from stormwater discharges by the Port into the Marine Area through current shoreline Outfalls 001, 002, 003, 004, and 006.
- Direct deposition from current and historical ship traffic and berthing in the Marine Area and navigation channel including drips, spills and the incidental release of contaminants contained onboard.
- Resuspension of sediment and wood debris through bioturbation or disturbance (i.e., wave and current action, propeller scour and vessel anchors, maintenance dredging, etc.). A scour study completed for the Site indicates that vessel scour occurs as a result of ship and tug operation in the Marine Area to a depth of -55 feet MLLW based on current Site use. Details of the scour study are presented in Appendix N.
- Transport of hazardous substances sorbed to particulates entrained in the water column from off-site sources.
- Gases and particulates released to the atmosphere from current and historical combustion (vehicle and marine vessel emissions, hog fuel burner, etc.) and/or industrial operations that may contain concentrations of metals, PAHs, dioxin and furans and/or other contaminants. Contaminants released to the atmosphere may be deposited in settling particulates or precipitation directly to waterbodies or land surfaces at the Site and surrounding area. Secondary transport mechanisms of atmospheric deposition include stormwater runoff from land, roads, rooftops and parking lots into catch basins and/or resuspension into the atmosphere by wind prior to deposition to the sediment surface.
- Direct deposition of upland contamination to sediments as a result of shoreline bank erosion.

5.5.3. Bioaccumulation

Hydrophobic organic compounds, such as PAHs, PCBs, and dioxins and furans, bind strongly to sediments with elevated organic carbon. Due to the physical properties of these compounds (Section 5.5.1), these organic contaminants do not easily biodegrade and may accumulate in areas such as the area wood debris adjacent to the South Terminal where higher TOC has been measured (Figures 22 and 23). In addition, contaminants with low water solubility tend to accumulate in the sediment where they can be taken up and accumulated by benthic organisms. The consumption of these organisms by larger fish, shellfish, and wildlife provides a mechanism for the contaminants to move from the sediment and water up through the food chain. PCBs, cPAHs, dioxins/furans, and metals such as arsenic are examples of COCs in the sediment that are potentially subject to uptake and movement through the food chain. Contaminants with the highest bioconcentration factors, such as PCBs, and dioxins and furans are more likely to bioaccumulate in benthic organisms.

5.6. Sediment Driver Contaminants of Concern

Driver COCs for the protection of benthic organisms and for the protection of human health and higher trophic level ecological receptors were selected using the Marine Area RI surface sediment sampling and analysis results. In general accordance with WAC 173-340-703, a COC was retained as a Driver COC if:

- The COC exceeded the Benthic PCUL (point-by-point basis) at the compliance interval (see Section 4.3.1).
- The COC in which the area weighted average concentration[6] exceeded the Human Health PCUL at the compliance interval (see Section 4.3.2).
- The COC with the greatest aerial extent exceeding the PCUL (Benthic or Human Health) at the compliance interval.

Selection of Driver COCs for protection of benthic organism and human health and higher trophic level ecological receptors are further discuses below. Driver COCs for protection of benthic organisms and human health and higher trophic level ecological receptors were considered as part of the remedial action evaluation in addition to other factors such as the scour depth and the current and future use navigation depth assumptions (-52 feet MLLW for the South Terminal Berth and associated navigation areas and -44 feet MLLW for Pacific Terminal Berth) and associated navigation area and the extent of the corresponding transition slopes extending up from these navigation depths.

5.6.1. Benthic Driver Contaminants of Concern

COCs exceeding the Benthic PCUL at the compliance interval within the Marine Area are shown in Figure 72 and include arsenic, mercury, zinc, LPAHs, HPAHs, chlorinated hydrocarbons, phthalates, phenols, miscellaneous extractables and total PCBs. The concentrations of arsenic, zinc, LPAHs, HPAHs, chlorinated

[6] The area weighted average area shown on Figures 55 through 71 and on Figures Q-199 through Q-286 (Appendix Q) was developed with Ecology by initially evaluating the smallest home-range for crab species. The home-range for crab species has a minimum radius of 2 kilometers which extends well beyond the RI data set. As a conservative approach, Ecology agreed that the area weighted average boundary should be set to encompass the outer most limit of Benthic and Human Health PCUL exceedances within the Marine Area. In addition, the future use assumptions on navigation depth (including transitional slopes from the future navigation depth) for the South and Pacific Terminal areas, and compliance interval were also considered when developing the boundary used to calculate the area weighted average for bioaccumulative compounds within the Marine Area.

hydrocarbons and phthalates at the compliance interval are contained within the aerial extent of miscellaneous extractables (Figure 72). As a result, these COCs are not identified as Benthic Driver COCs for the Marine Area. The remaining COCs include mercury, phenol compounds (2,4-dimethylphenol, 2-methylphenol, 4-methylphenol [primary contaminant] and phenol), miscellaneous extractable compounds (hexachlorobutadiene, benzoic acid and benzyl alcohol and dibenzofuran [primary contaminant]; Table 4) and PCBs are identified as the Benthic Driver COCs.

As discussed in Section 4.1.3, there is no current sediment cleanup level established for wood debris. However, wood debris is managed by Ecology as a deleterious substance under the SMS due to the potential impacts on the benthic community (WAC 173-204). Wood debris in the Marine Area at the compliance interval associated with historical Site use exceeding 15 percent by volume is identified as a SOC and is shown in Figure 72.

5.6.2. Human Health Driver Contaminants of Concern

COCs exceeding the Human Health PCUL at the compliance interval within the Marine Area are shown in Figure 73 and include arsenic, total cPAHs, total dioxin-like PCBs and total dioxins and furans. Because area weighted average concentration of cadmium, lead, mercury and PCBs the compliance interval was less than Human Health PCUL (Figures 57 through 60 and 66 and 67), cadmium, lead and PCBs are not identified as a Human Health COC or as a Driver COC. In addition, concentrations of arsenic, and total dioxin-like PCBs in the sediment compliance interval are contained within the aerial extent of total cPAHs and/or total dioxin and furans (Figure 73) and therefore, are also not identified as Driver COCs for the Marine Area.

Near historical outfall WT004, total dioxins and furans were detected in surface sediment (0-10 cm) at 4.8 times the PCUL. In shallow subsurface sediment, concentrations of arsenic, total cPAHs were detected at concentrations slightly exceeding the PCUL (ER_{HH} or 1.01 and 1.4, respectively). Because total cPAHs encompasses the same approximate area as arsenic and was detected with at higher ER_{HH}, arsenic is not identified as Driver COC at this location. Although, total dioxins and furans in this area are encompassed by total cPAHs, total dioxins and furans are identified as a Driver COCs given the relative magnitude of exceedance as compared to total cPAHs.

Human Health Driver COCs for the Marine Area include total cPAHs and total dioxin and furans.

5.7. Depth of Contamination

An estimation of the depth of contamination for the identified Benthic and Human Health Driver COCs (Figures 72 and 73) was completed to support the quantity and cost calculations for the remedial alternatives for the Marine Area FS. Remedial alternatives developed for the Marine Area are further discussed in Section 9.0. The estimated depth of contamination for the Marine Area is shown in Figure 74.

Available sediment data (chemical analytical results and sediment core logs; summarized in Table 8) was utilized to estimate the depth of contamination. For this evaluation, Ecology required that the that the depth of contamination be projected to the native contact where chemical analytical data was not available to confirm a clean sediment contact. Additional considerations to estimate the depth of contamination and native contact included:

- **Navigation Areas** – Within the navigational areas subject to potential scour (see Section 4.3.2), sediment deposits initially classified as "native" during the RI were found to contain one or more COCs greater than the PCUL indicating evidence of redistribution (i.e., suspension and redeposit due to scour). In these cases, the material was determined to not be native due to the presence of anthropogenic contamination. Without supporting chemical analytical data, the depth of the PCUL exceedance (Benthic and/or Human Health) in these areas would be underestimated if the native sediment contact was determined by visual observations alone, particularly given the potential for reworking of the sediment by vessel scour to result in deposits that visually appear as native but may be contaminated. In these areas, chemical analytical data that did not identify the base of contamination were not used to define vertical extent of contamination. Only those sediment core logs identifying native contact that could be reliably confirmed by chemical analytical data were used to determine the vertical extent of contamination for these areas.
- **Transitional Slope between the South Terminal Wharf and the Pacific Terminal Wharf** – Wood debris up to 100% was identified to a depth of approximately 20 feet below the existing mudline. Contained within the wood debris were deposits of silt and sand with varying wood content. As noted above, sediment deposits resembling native sediment were found to contain one or more COCs greater than the Benthic and/or Human Health PCUL. Additionally, silt and sand layers contained within wood deposits are by definition, not native. Therefore, reliance on visual determination of the material condition alone was insufficient to identify the native sediment contact.
- **Use of Upland Area Investigation Results** – Under natural conditions sediments in Marine Area would be deposited uniformly. Because the native contact in the Upland Area was deposited through the same process as the Marine Area prior to filling, the stratigraphy from upland boring locations near the South Terminal shoreline were used to estimate the native contact which correlate with the offshore condition (i.e., natural/uniform depositional processes for native sediments within the Marine Area).
- **Areas Not Influenced by Vessel Scour** – The depth of contamination in areas not influenced by vessel scour was determined based on the native contact as identified in sediment core logs. In these areas, the potential for reworking of sediment is low because they are outside the -55-foot MLLW scour elevations/navigational channel. Therefore, observed conditions for offshore locations MAF-10 through MAF-12, MAF-14, MAF-15, MAF-19 through MAF-21, MAF-58 and MAF-59 were used. In offshore locations where sediment core data was not available, the depth of contamination was assigned to be 0.5-ft – the approximate depth of the surface sample interval rounded to the nearest ½ foot.

Additionally, the depth of contamination could not be estimated for all of the RI sampling locations within the Marine Area (including those completed more than a decade ago as noted in Table 8) because of one or more of the following reasons.

- The sample location does not have accompanying chemical analytical data to support the confirmation of the native sediment contact. Due to the potential for reworking of the sediment bed by vessel scour, visual determination of the material condition alone was determined to be insufficient to identify the native contact.
- Due to the dynamic nature within a scour environment, relying on data that is more than a decade old would increase the uncertainty in estimating the depth of contamination as a result of high potential of reworking due to scour. Therefore, these locations were not considered in estimating the depth of contamination.

- Sediment core logs were not available at all locations and the only data available was surficial sediment data.

Table 8 presents a summary of the available information utilized and rationale used to estimate the depth of contamination within the Marine Area for each sampling location.

6.0 BASIS FOR THE CLEANUP ACTION

6.1. Cleanup Action Objectives

The CAOs for the Marine Area (initially developed as part of the RI/FS Work Plan) are to eliminate, reduce, or otherwise control to the extent feasible and practicable, unacceptable risks to human health and the environment posed by Site-related hazardous substances in marine sediment in accordance with the MTCA Cleanup Regulation (WAC 173-340), SMS regulations (WAC 173-204) and other applicable regulatory requirements including consideration of Indian Tribes, vulnerable populations and overburdened communities potentially affected by the cleanup action (further discussed in Section 10.4). CAOs consist of location-, chemical- and media-specific goals for protecting human health and the environment. CAOs are dependent on the chemicals and pathways that represent a risk to people and natural resources associated with a site. Development of CAOs involves 1) identification of potentially applicable or relevant and appropriate requirements (ARARs) that set the framework and requirements for the development of cleanup standards and implementation of a cleanup action; 2) development of cleanup levels and points of compliance at which an acceptable risk level can be attained; and 3) identification of the locations and media requiring cleanup based on selected cleanup standards.

The CAO for the Marine Area portion of the Site is to mitigate risks associated with the Site SOC and COCs discussed in Section 5.3 and to address potential exposure routes and receptors discussed in Section 3.5 based on known subsurface conditions, and current and future land use. Specifically, the objective of the Marine Area cleanup action is to mitigate risks associated with the following potential exposure routes and receptors:

- Contact (dermal or incidental ingestion) by residents, visitors, workers and other Site users with hazardous substances in sediment;
- Human ingestion of marine organisms that are contaminated by Site-related hazardous substances in sediment;
- Exposure of benthic organisms and higher trophic level ecological receptors to Site-related hazardous substances in the compliance interval of sediment; and
- Ingestion of benthic organisms that are contaminated by Site-related hazardous substances by aquatic organisms and higher trophic level ecological receptors.

PCULs and points of compliance for sediment considered for the development of the Marine Area CAOs are discussed in Section 4.0 and are expected to be adopted as final PCULs by Ecology for the CAP. Areas and media requiring cleanup and ARARs considered for the development of the CAOs are discussed in the following sections (Section 6.2 and 6.3).

6.2. Contaminated Media, Contaminants of Concern and Substances of Concern

As part of the RI, sampling and analysis was completed to identify Benthic and Human Health COCs for the Marine Area and to delineate the extend of wood debris (SOC) as described in Section 2.4. In addition, the RI utilized investigation results from previous sediment quality studies (Section 2.1) and dredged material characterization studies (Section 2.2) to define the vertical and lateral extent of COCs/SOCs exceeding the Benthic and/or Human Health PCULs and screening level for wood at the compliance interval with consideration for future use assumptions. Benthic COCs (including Driver COCs) and wood debris at the compliance interval are shown in Figure 72. Human Health COCs (including Driver COCs) at the compliance interval is shown in Figure 73. The estimated depth of contamination within the Marine Area is shown in Figure 74. Contaminant nature and extent is further discussed in Section 5.0.

As part of this evaluation, the RI data was compared to Benthic and Human Health PCULs developed for the Marine Area (Tables 2 and 3) to identify the Marine Area COCs. A COC (Benthic or Human Health) was retained for further evaluation if the corresponding concentration was detected greater than the PCUL. A statistical analysis of the RI data to identify COC is presented in Tables 4 and 5. Additionally, as described in Section 4.1.3, wood debris which has the potential to cause or contribute to sediment impacts is managed by Ecology under SMS as a deleterious substance. Based on the bioassay test results for the Marine Area (Section 5.3.3), visual wood debris greater than 15 percent by volume is identified as a SOC for the Marine Area.

In consultation with Ecology, sediment data collected as part of the Marine Area RI in accordance with the RI/FS Work Plan and subsequent addenda were determined to be sufficient to define contaminant nature and extent to support development and evaluation of the remedial alternatives. Although there is sufficient data to define the nature and extent COC and SOCs for the Marine Area, additional data collection following the approval of the Marine Area CAP may be collected as part of a remedial design investigation to help further refine the horizontal and vertical extent of contamination, limits of the remedial action, and support the design and implementation of the selected remedy. The descriptions of SMAs presented in Section 7.0 identify additional data collection needs to support the remedial design and implementation of the selected remedy within each identified SMA.

For the Marine Area portion of the Site, sediment containing Benthic and/or Human Health COCs and wood debris (SOC) is identified as the media of concern.

6.3. Potentially Applicable or Relevant and Appropriate Requirements

Under WAC 173-340-710, MTCA requires that cleanup actions comply with all legally applicable local, state and federal laws, and requirements that are legally applicable and determined by Ecology to be relevant and appropriate requirements for the cleanup site. Legally "applicable" requirements under MTCA are those cleanup standards, standards of control, and other human health and environmental protection requirements, criteria, or limitations adopted under state or federal law that specifically address a hazardous substance, cleanup action, location, or other circumstance at a site (WAC 173-340-200). "Relevant and appropriate" requirements include those cleanup standards, standards of control, and other human health and environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site (WAC 173-340-200).

In accordance with WAC 173 340-710(9)(b), cleanup actions conducted by Ecology under MTCA are exempt from most procedural requirements of state and local laws, and related permitting requirements. Although exempt from procedural requirements of certain state and local laws and related permitting requirements, pertinent substantive compliance requirements remain applicable to the cleanup actions. Because the MTCA exemption only applies to local and state laws and regulations, the anticipated cleanup action will need to comply with both substantive and procedural requirements of applicable federal laws. Potentially applicable local, state and federal laws, ARARs and their descriptions/applicability are presented in Table 9.

7.0 SEDIMENT MANAGEMENT AREAS

To assist in the development and evaluation of remedial alternatives, the Site has been divided into sediment management areas (SMA) based on environmental conditions and other factors that affect the applicability of specific remediation technologies and the feasibility of their implementation as shown in Figure 75.

Ecology's SCUM guidance Section 6.7 outlines the process to divide sediment sites into management areas. The SCUM guidance SMAs as the classification for splitting a large site into manageable parts. The SCUM guidance approach is used for the Site.

7.1. Factors Used to Delineate Sediment Management Areas

According to SCUM guidance, larger complex sediment sites may be divided into discrete SMAs, which represent the smallest area for which individual cleanup decisions are made. Marine Area SMAs were delineated using the following considerations that affect remedy implementation and performance:

- Current and future site use assumptions presented in Section 1.4 and in a memorandum from the Port to Ecology (Port 2021; Appendix F) were one of the primary factors in delineating the SMAs to ensure that the remedial action is compatible with the current and future Site uses. Key assumptions for the Marine Area include future navigational elevation of -52 feet MLLW in the navigation area of the South Terminal, future navigational elevation of -44 feet MLLW in the navigation area of the Pacific Terminal, and the location of future cargo handling area located between the South and Pacific Terminals[7].
- COC distribution and magnitude of concentrations including the following:
  - Estimated horizontal and vertical extent of wood debris with percentage greater than the proposed cleanup level for wood debris.
  - Estimated horizontal and vertical extent of one of more COCs with concentrations greater than Benthic PCULs.
  - Estimated horizontal and vertical extent of one of more COC with concentrations greater than Human Health PCULs.
- Physical attributes of the sediment, sediment bed, water depth and the area in which the sediments are located.

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[7] The future navigational elevations reflect the long-term planning by the Port. The dredge depths for full removal considered in the remedial alternatives are based on the extent of contamination and necessary extent of dredging that is required to achieve the cleanup objectives. Dredging beyond what is required to remove contamination is not included in the remedial alternatives.

- Potential for scour from vessel operations. The results of scour study completed at part of the RI showed potential for scour from vessel operations at the South and Pacific Terminals to an elevation of -55 feet MLLW (the maximum scour elevation).

7.2. Sediment Management Area–1

SMA-1 comprises a subtidal area that is approximately 40.2 acres in size (Figure 75). The eastern and northeastern limits of SMA-1 is defined by the existing bathymetric contour line of -55 feet MLLW (the maximum scour elevation) and the northern, western and southern limits are defined by the estimated horizontal extent of contamination as identified in Section 5.3. The horizontal extent of contamination in SMA-1 is estimated to extend to an approximate elevation of -215 feet MLLW. SMA-1 is divided into four subareas SMA-1a through SMA-1d based on the nature of contamination in sediment as described in Sections 7.2.1 through 7.2.4, respectively.

The existing surfaces within SMA-1 are deeper than the maximum scour elevation and therefore, remedial actions that will be implemented in SMA-1 are not expected to be subject to vessel scour. Because SMA-1 is deeper than the depth of potential scour by vessel activity and outside of the navigation area, surface sediment (0-10 cm) is identified as the compliance interval in which the CAOs must be met.

The environmental investigations completed within SMA-1 include 16 surface sediment sampling locations (ST-28, ST-30, ST-31, ST-33, ST-36, ST-41, A1-17, EW-12-07, MAF-22, MAF-37, MAF-38, MAF-39, MAF-41, MAF-42, MAF-44 and MAF-45) and 5 sediment cores (MAF-10, MAF-12, MAF-19, MAF-20, MAF-21) completed to depths ranging from approximately 4.5 to 12 feet bml. The sediment sampling locations and estimated depth of contamination are summarized in Table 8 and shown on Figure 76. The horizontal and vertical limits of contamination in SMA-1 are estimated based on limited data density given the relatively large size of the area. While sufficient data is available for evaluation of the remedial alternatives as noted in Section 6.2, additional data collection following the selection of remedial action will help to further refine the horizontal and vertical extent of contamination, limits of the SMA and support the design and implementation of the selected remedy.

7.2.1. Sediment Management Area–1a

SMA-1a is approximately 26.8 acres in size and is located between Elevations -55 feet to approximately -215 feet MLLW (Figure 75).

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-1a:

- Arsenic, cadmium, lead, cPAHs, and dioxins and furans were detected at concentrations greater than the Human Health PCULs.
- 4-methylphenol was detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is not present.
- The depth of contamination is estimated to be up to approximately 4 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 25,790 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media

volume in SMA-1a is approximately 112,340 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.2.2. Sediment Management Area–1b

SMA-1b is approximately 5.7 acres in size and is located between Elevations -55 feet to approximately -90 feet MLLW (Figure 75).

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-1b:

- Arsenic, cadmium, lead, mercury, cPAHs, dioxin-like PCBs, and dioxin and furans were detected at concentrations greater than the Human Health PCULs.
- LPAHs and phenols were detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is estimated to be up to approximately 8 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 26,980 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-1b is approximately 45,430 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.2.3. Sediment Management Area–1c

SMA-1c is approximately 3.2 acres in size and is located between Elevations -55 feet to approximately -115 feet MLLW (Figure 75).

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-1c:

- cPAHs were detected at concentrations greater than the Human Health PCULs.
- Benthic data is not available at the investigation completed within this SMA.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is estimated to be up to approximately 4 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 5,970 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-1c is approximately 16,330 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.2.4. Sediment Management Area–1d

SMA-1d is approximately 4.5 acres in size and is located between Elevations -55 feet to approximately -75 feet MLLW (Figure 75).

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-1d:

- Arsenic, cadmium, lead, cPAHs, dioxin-like PCBs, and dioxin and furans were detected at concentrations greater than the Human Health PCULs.
- LPAHs, phenols, miscellaneous extractables, and PCBs were detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is estimated to be up to approximately 9 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 36,320 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-1d is approximately 50,720 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.3. Sediment Management Area–2

SMA-2 is a subtidal area that is approximately 7.4 acres in size (Figure 75). The eastern limit of SMA-2 is defined by the existing bathymetric contour line of -52 feet MLLW (future navigational elevation at the South Terminal) and contour line of -44 feet MMLW (Port's current/future navigational elevation at the Pacific Terminal), and the western limit is defined by the existing bathymetric contour line of -55 feet MLLW (the maximum scour elevation). The northern and southern limits are defined by the estimated horizontal extent of contamination as identified in the RI. SMA-2 is divided into two subareas SMA-2a and SMA-2b based on their locations relative of Pacific and South Terminals as described in Sections 7.3.1 and 7.3.2, respectively. SMA-2a is located offshore of the South Terminal between -52 feet MLLW (future navigational elevation at the South Terminal) and -55 feet MLLW (the maximum scour elevation). SMA-2b is located offshore of the Pacific Terminal between -44 feet MLLW (current/future navigational elevation at the Pacific Terminal) and -55 feet MLLW (the maximum scour elevation).

The existing surfaces within SMA-2 are shallower than the maximum scour elevation and therefore, are subject to vessel scour. Vessel scour can impact integrity and effectiveness of a remedial action and therefore remedy(s) selected for SMA-2 must account for such potential impacts. Because SMA-2 is within the depth of potential propeller scour, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.

The environmental investigations completed within SMA-2 include five surface sediment sampling locations (A1-20, MAF-09, MAF-35, MAF-36 and MAF-46) and six sediment cores (ST-32, SP-151, A1-15, A1-24, MAF-11 and MAF-58) completed to depths ranging from approximately 1 to 11 feet bml. The sediment sampling locations are presented in the RI and summarized in Figure 76. The horizontal and vertical limits of contamination in SMA-2 are estimated based on limited data density given the relatively large size of the area. While sufficient data is available for evaluation of the remedial alternatives as noted in Section 6.2, additional data collection in each of the sub areas following the selection of remedial action may be completed to help further refine the horizontal and vertical extent of contamination, limits of the SMA and support the design and implementation of the selected remedy.

7.3.1. Sediment Management Area–2a

SMA-2a is approximately 1.2 acres in size and is located offshore of the South Terminal between Elevations -52 feet MLLW and -55 feet MLLW (Figure 75).

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-2a:

- Arsenic, cadmium, lead, mercury, cPAHs, dioxin-like PCBs, and dioxins and furans were detected at concentrations greater than the Human Health PCULs.
- Arsenic, zinc, mercury, LPAHs, phenols and miscellaneous extractables detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is estimated to be up to approximately 10 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 10,490 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-2a is approximately 14,480 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.3.2. Sediment management Area–2b

SMA-2b is approximately 6.2 acres in size and is located offshore of the Pacific Terminal between Elevations -44 feet MLLW and -55 feet MLLW (Figure 75). The pile-supported wharf structure of Pier 1 is adjacent to the northwest portion of SMA-2b.

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-2b:

- cPAHs, dioxin-like PCBs and dioxins and furans were detected at concentrations greater than the Human Health PCULs.
- Phenols and miscellaneous extractables were detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is estimated to be up to approximately 1-foot bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 3,760 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-2b is approximately 23,670 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.4. Sediment Management Area–3

SMA-3 is a subtidal area that is approximately 2 acres in size. SMA-3 is the location of the current and future vessel berth and navigational area at the Pacific Terminal and the future site use identifies an elevation of -44 feet MLLW (including overdredge allowance) as the anticipated navigational elevation requirement in this area. The existing surfaces within SMA-3 extend approximately from Elevation -5 feet MLLW to the current/future navigational elevation at the Pacific Terminal (-44 feet MLLW). SMA-3 is divided into three subareas SMA-3a through SMA-3c since contamination present in these subareas are physically isolated from each other. Additional description on SMA-3a through SMA-3c are presented in Sections 7.4.1 through 7.4.3, respectively.

SMA-3 is subject to vessel scour since it is the location of an active vessel berth, and the existing surfaces are shallower than the maximum scour elevation (-55 feet MLLW). Vessel scour can impact integrity and effectiveness of a remedial action and therefore remedy(s) selected for SMA-3 must account for such potential impacts. Because SMA-3 is within the navigation area and shallower than the depth of potential propeller scour, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.

The environmental investigations completed within SMA-3 include three surface sediment sampling locations (MAF-31, MAF-32 and MAF-33) and one sediment core (ST-42) completed to a depth of approximately 12 feet bml. Approximate sediment sampling locations are presented in the RI and summarized in Figure 76. The horizontal and vertical limits of contamination in SMA-3 are estimated based on limited data density. While sufficient data is available for evaluation of the remedial alternatives as noted in Section 6.2, additional data collection at each of the sub areas following selection of remedial action may be completed to help further refine the horizontal and vertical extent of contamination, limits of the SMA and support the design and implementation of the selected remedy.

7.4.1. Sediment Management Area–3a

SMA-3a is approximately 1.1 acres in size and is located offshore of the Pacific Terminal approximately between Elevations -42 and -44 feet MLLW.

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-3a:

- Cadmium, lead, cPAHs, and dioxin and furans were detected at concentrations greater than the Human Health PCULs.
- Phenols and miscellaneous extractables were detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is not present.
- The depth of contamination is estimated to be up to approximately 1-foot bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 1,120 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-3a is approximately 4,800 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA in Figure 76.

7.4.2. Sediment Management Area–3b

SMA-3b is approximately 0.6 acres in size and is located in front of the pile-supported wharf of the Pacific Terminal approximately between Elevations -34 and -41 feet MLLW. The eastern edge of SMA-3b is adjacent to the pile-supported wharf structure of the Pacific Terminal and the armored slopes of the Pacific Terminal Wharf/Nearshore Confined Disposal (NCD) facility. The extent of the toe of the armored slopes is unknown and therefore, there is a potential that armored slopes may be present below the contaminated media at SMA-3b.

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-3b:

- Arsenic and cPAHs were detected at concentrations greater than the Human Health PCULs.
- LPAHs and miscellaneous extractables were detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is not present.
- The depth of contamination is assumed to be 0.5 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 460 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-3b is approximately 2,290 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.4.3. Sediment Management Area–3c

SMA-3c is approximately 0.3 acres in size and is located adjacent to the shoreline between the Pacific Terminal and Pier 1 approximately between Elevations -5 and -44 feet MLLW. SMA-3c is surrounded by the pile-supported wharf structure of Pier 1 in the north, subtidal navigable areas in the west, and the pile-supported wharf structure of the Pacific Terminal and the armored slopes of the Pacific Terminal Wharf/NCD facility in the south and southeast. Approximately the eastern half of SMA-3c is within the footprint of the Pacific Terminal NCD boundary. The extent of the toe of the armored slopes is unknown and therefore, there is a potential that armored slopes may be present below the contaminated media at SMA-3c. The existing conditions in the eastern part of SMA-3c are unknown but anticipated to be a pile-supported wharf structure that adjoins the adjacent upland areas.

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-3c:

- Arsenic and cPAHs were detected at concentrations greater than the Human Health PCULs.
- COCs detected at concentrations greater than the Benthic PCULs are not present.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is assumed to be 0.5 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 260 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-3c is approximately 1,290 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.5. Sediment Management Area–4

SMA-4 is a subtidal area that is approximately 1.2 acres in size and is the location of 2016 Pacific Terminal Interim Action dredge base and the location of the current and future vessel berth and navigational area at the Pacific Terminal. SMA-4 is surrounded by subtidal navigable areas in the north and west, the armored dredge slopes of the Pacific Terminal Interim Action in the south and southeast, and the armored slopes of the Pacific Terminal Wharf/NCD facility in the east. The pile-supported wharf structure of the Pacific Terminal is in the northeast corner of SMA-4 and the Pacific Terminal NCD facility is adjacent to the eastern edge of SMA-4. Because SMA-4 is within the navigation area and shallower than the depth of potential propeller scour, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.

As part of the IA, dredging was completed within SMA-4 to the approximate elevations of -42 to -44 feet MLLW (the current/future navigational elevation at the Pacific Terminal). As a result of the IA, contamination was completely removed from SMA-4. Additional remedial action is not needed in this area. The dredging activities completed as part of the IA are described in the Ecology approved Construction Completion Report (GeoEngineers 2018). This area is retained for completeness.

7.6. Sediment Management Area–5

SMA-5 is an intertidal and subtidal area that is approximately 6 acres in size. The future site use identified for the location of SMA-5 is cargo handling. The eastern limit of SMA-5 is defined by the upland areas and existing creosote-treated timber bulkhead that is located along a portion of the eastern edge of SMA-5. The as-built details of this bulkhead, including the depth of the structure, are unknown. It appears though that the treated timber bulkhead was constructed to support mill operations and occurred at some time prior to the Port's 1984 acquisition of the property. The northern limit of SMA-5 is defined by the edge of the pile-supported wharf structure of the Pacific Terminal and the toe of the armored dredge slopes of the Pacific Terminal Interim Action (GeoEngineers 2018). The western limit is defined by the current/future navigational area at the South Terminal and the southern limit is defined by the edge of South Terminal pile-supported wharf structure and upland areas. A portion of the South Terminal pile-supported roll-on/roll-off berthing pier is in the southwest portion of SMA-5. The existing surfaces within SMA-5 transition from an approximate elevation of +18 feet MLLW in the east (adjacent to the uplands) to approximate elevations of -23 to -34 feet MLLW in the west (adjacent to the current/future navigational area at the South Terminal) and approximate elevations of -42 to -44 feet MLLW in the northwest (adjacent to the current/future navigational area at the Pacific Terminal).

Armored slopes are present within SMA-5 along the northern, southern and eastern portions as shown in Figure 75. The armoring in the north was placed as part of the Pacific Terminal Interim Action to cover the dredged slopes containing contaminated sediment and wood debris. The armoring along the southern and eastern portions of SMA-5 was placed as part of the construction of the South Terminal facility, Pacific Terminal Wharf/NCD facility and upland area/retaining wall. The quantity of armoring within SMA-5 covering potentially contaminated sediment and/or wood debris is estimated to be 19,000 cubic yards.

Because SMA-5 represents the transitional slope between the Uplands Area and the South/Pacific Terminal navigation areas, surface sediment and up to 10' below current mudline may be subject to scour based on the results of the Vessel Propeller Wash Scour Analysis (Appendix N). The cleanup action in this area must also consider the future use of this area for cargo handling and ensure that the facility can be expanded unencumbered by the presence of contamination or wood debris. As a result, surface sediment (0-10 cm) and subsurface sediment to the elevation of the native contact within the limits of the SMA is identified as the compliance interval for this area in which the CAOs must be met.

The environmental investigations completed within SMA-5 include one surface sediment sampling location (MAF-34) and 23 sediment cores (ST-1, ST-3, ST-5, ST-6, ST-8, ST-9, ST-11, ST-12, ST-14, ST-17, ST-19, ST-20, ST-21, ST-109, MAF-01, MAF-02, MAF-03, MAF-04, MAF-05, PT11, PT12, PT13 and PT14) completed to depths ranging from approximately 4 feet to 25 feet bml. In general, environmental conditions within SMA-5 are well characterized except for areas of existing armored slopes located along the southern and eastern portions. No environmental data has been collected within these armored slopes and therefore, it is unknown if contaminated media is present underneath these armored slopes. For the purposes of the FS, it is estimated that contaminated media may be present underneath these armored slopes, based on the depth of contamination information available in SMA-5 and the adjacent upland areas. While sufficient data is available for evaluation of the remedial alternatives as noted in Section 6.2, additional data collection within the footprint of the armored slopes in the south and east following selection of the remedial action may be completed to help further refine the horizontal and vertical extent of contamination, limits of the SMA and support the design and implementation of the selected remedy.

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-5:

- Arsenic, cadmium, lead, mercury, cPAHs, dioxin-like PCBs, PCBs and dioxins and furans were detected at concentrations greater than the Human Health PCULs.
- LPAHs, HPAHs, phthalates, phenols, miscellaneous extractables and PCBs were detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is estimated to be up to approximately 24 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 131,800 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-5 is approximately 151,190 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.7. Sediment Management Area–6

SMA-6 is an intertidal and subtidal area that is approximately 9.7 acres in size. SMA-6 is the location of the current and future vessel berth and navigational area at the South Terminal and the future site use identifies an elevation of -52 feet MLLW (including overdredge allowance) as the future navigational elevation in this area. The western limit of SMA-6 is defined by the existing bathymetric contour line -52 feet MLLW. The northern limit is defined by the limits of adjacent SMAs 2b, 3a and 4. A portion of the eastern limit is defined by the limits of adjacent remedial action SMA-5. A portion of the eastern limit and the southern limit are defined based on the estimated horizontal extent of contamination as identified in the RI. A portion of the South Terminal pile-supported roll-on/roll-off berthing pier is in the eastern portion of SMA-6, including associated pile supported dolphins.

Armored slopes are present within SMA-6 along the northern and eastern portions as shown in Figure 75. The armoring in the north was placed as part of Pacific Terminal Interim Action to cover the dredge slopes containing contaminated sediment and wood debris. The armoring along the eastern portions includes an area underneath the South Terminal pile-supported wharf and an area along the southern end of South Terminal facility.

For the purposes of the FS, the quantity of armoring within SMA-6 covering potentially contaminated sediment and/or wood debris is estimated to be 1,750 cubic yards.

SMA-6 is subject to vessel scour since it is the location of active vessel berth, and the existing surfaces are shallower than the maximum scour elevation (-55 feet MLLW). Vessel scour can impact integrity and effectiveness of a remedial action and therefore, the remedy selected for SMA-6 must account for such potential impacts. Because SMA-6 is within the navigation area and shallower than the depth of potential propeller scour, surface sediment (0-10 cm) and subsurface sediment to an elevation of -55 feet MLLW is identified as the compliance interval in which the CAOs must be met.

The environmental investigations completed within SMA-6 include seven surface sediment sampling locations (ST-23, ST-24, ST-25, ST-26, ST-27, ST-35 and ST-44) and 26 sediment cores (ST-2, ST-15, ST-29, ST-34, ST-37, ST-39, ST-43, ST-44, ST-101, ST-102, ST-103, ST-104, ST-105, ST-106, ST-107, ST-108, MAF-13, MAF-14, MAF-18, MAF-55, MAF-56, MAF-57, MAF-59, MAF-60, MAF-61 and PT10) completed to depths ranging from approximately 6 feet to 20 feet bml. While sufficient data is available for evaluation of the remedial alternatives as noted in Section 6.2, additional data collection within SMA-6 including the footprint of the armored slopes below the South Terminal and in the southeast portion of SMA-6 along the side slope following the selection of remedial action may be completed to help further refine the horizontal and vertical extent of contamination, limits of the SMA and support the design and implementation of the selected remedy.

Since no environmental data is available within the footprint of the armored slopes below the South Terminal and in the southeast portion of SMA-6 along the side slope, the following assumptions are made:

- SMA-6 is assumed to include the lower portions of armored slopes located below the South Terminal pile-supported wharf. It is assumed that contaminated sediment has been deposited in this area on top of the slope armoring below Elevation -25 feet MLLW. The area of contaminated sediment is estimated to be 0.5 acres. Environmental data representative of the surficial sediment is not available.
- In the southeastern portion of SMA-6, the horizontal extent of contamination is not well defined. Sediment cores ST-101 through ST-106 completed in southeastern portion identify presence of contamination. However, environmental data to define horizontal extent of contamination identified by ST-101 through ST-106 in the south and southeastern direction was not collected as part of the RI. It is assumed that the contamination does not extent outside the southeastern limits of SMA-6 as shown in Figure 76.

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-6:

- Arsenic, cadmium, lead, mercury, cPAHs, dioxin-like PCBs, and dioxins and furans were detected at concentrations greater than the Human Health PCULs.
- Zinc, LPAHs, HPAHs, phthalates, phenols and miscellaneous extractables were detected at concentrations greater than the Benthic PCULs.
- SOC (wood debris) greater than 15 percent by volume is present.
- The depth of contamination is estimated to be up to approximately 18.5 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 94,190 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-6 is approximately 123,880 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

7.8. Sediment Management Area–7

SMA-7 is an intertidal and subtidal area that is approximately 2.9 acres in size and is located approximately between the elevations of +9 feet MLLW and 0 feet MLLW. SMA-7 is located adjacent to the armored shoreline in the southern area of the Site, offshore of the Public Open Space. The northeastern and eastern limits are defined by the shoreline armoring and the southern, western and northwestern limits are defined by the estimated horizontal extent of contamination as identified in the RI.

Vessel scour is not considered to be a concern for SMA-7 since mudline within SMA-7 is shallow and not suitable for vessel navigation and it is away from other navigable areas at the Site. Because SMA-7 is located in an area accessible by the general public, the compliance interval considers that a human receptor, shell fisher or burrowing organism may dig down to 40 cm below the sediment surface.

The environmental investigations completed within SMA-7 include only one sediment core (MAF-15) completed to a depth of approximately 7.5 feet bml. As such, the horizontal and vertical limits of contamination in SMA-7 are estimated based on limited data. While sufficient data is available for evaluation of the remedial alternatives as noted in Section 6.2, additional data collection following selection of the remedial action may be completed to help further refine the horizontal and vertical extent of contamination, limits of the SMA and support the design and implementation of the selected remedy.

Based on the environmental data presented in Section 5.0 and Table 8, the following is the summary of contamination present in SMA-7:

- Arsenic, cPAHs, and dioxins and furans were detected at concentrations greater than the Human Health PCULs.
- COCs detected at concentrations greater than the Benthic PCULs are not present.
- SOC (wood debris) greater than 15 percent by volume is not present.
- The depth of contamination is assumed to be 4 feet bml as shown in Figure 76.
- The estimated in-place volume of contaminated media is approximately 18,100 cubic yards. For dredging alternatives, a 2-foot overdredge allowance is included and the total contaminated media volume in SMA-7 is approximately 27,150 cubic yards. The volumes are calculated using the estimated depth of contamination presented for each SMA as shown in Figure 76.

8.0 SCREENING AND APPLICABILITY OF REMEDIAL TECHNOLOGIES

8.1. Technology Screening Process

Under MTCA, the remedial alternatives are developed using a collection of remedial technologies that have been screened and identified as capable of meeting cleanup requirements for the Site. The goal of the technology screening process is to ensure that the alternative evaluation process is based on technologies that are effective and implementable for the conditions at the Site.

The MTCA procedures for conducting feasibility studies do not directly address screening of technologies but do allow for screening out technologies prior to assembly and evaluation of the remedial alternatives (WAC 173-340-350(8)(b)). The technology screening process considers Site specific parameters such as the complexity of contaminant distribution, contaminated media properties, physical setting in which the contaminated media is preset, the current and future use assumptions identified in Section 1.4 and Appendix F and other conditions that affect the applicability and performance of remediation technologies. The technologies that are identified to be technically effective, implementable, and cost-effective to address the specific parameters at the Site are retained. Technologies are not retained for further evaluation if they are not effective, directly applicable to Site conditions or are anticipated to be technically too difficult or costly to implement.

The remediation technology screening evaluation is summarized in Table 10.

8.1.1. Technology Screening Criteria

Multiple remediation technologies were identified and evaluated independently as well as relative to other similar technologies with respect to the three primary screening criteria—effectiveness, implementability, and relative cost.

- **Effectiveness** – The effectiveness evaluation was based on the ability of a technology to achieve the established cleanup objectives, the degree to which the technology protects human health and the environment during construction and implementation, and likely effectiveness considering Site-specific conditions.
- **Implementability** – The implementability evaluation focused on the technical and administrative feasibility of a technology. The implementability evaluation was based on the availability of support products, services, and equipment needed to implement the technology safely and effectively, degree to which the technology has been demonstrated to be implementable at other sites, institutional aspect of implementation, including ability to obtain necessary permits, regulatory and public acceptance, and compatibility with future uses of the Site.
- **Cost** – This criterion was used to compare capital and operation and maintenance (O&M) costs of the technology. Relative capital and O&M costs between alternatives were used in the technology screening. Each technology was evaluated based on whether relative costs (based on engineering judgment) are expected to be low, moderate, or high compared to other remedial technologies.

8.1.2. Range of Remedial Technologies Evaluated

The range of remedial technologies evaluated was drawn from those listed in SMS (WAC 173-204-570[4][b]) for cleanup of contaminated sediment, EPA publications, vendor information, and professional experience gained at similar sites.

The technologies screened for the Marine Area are identified in Table 10 and include the following:

- No Action.
- Institutional controls (ICs), including proprietary controls (restrictive covenant/deed restrictions), governmental controls (notices in local zoning or building department records describing land use restrictions, commercial fishing bans and sports/recreational fishing limits posed by governmental agencies), informational devices (warning signage and health advisories) and access restrictions (fencing).
- Natural recovery, including monitored natural recovery (MNR) and enhanced natural recovery (ENR).

- Capping, including conventional sand caps and amended/reactive caps, with and without armoring, and dynamic sand caps.
- In-place containment.
- Removal through excavation or dredging.
- Disposal, including off-site landfill, confined disposal facility (CDF), contained aquatic disposal (CAD), aquatic open water disposal, and beneficial reuse.
- Ex-situ sediment treatment, including bioremediation, incineration, sediment washing, and solidification/stabilization.
- In-situ sediment treatment including chemical treatment.

8.2. Screening of Remedial Technologies

Potentially applicable remedial technologies for addressing Marine Area contamination were screened using the process described above. Because of the wide range of conditions across the Marine Area and range of applicable of technologies, the screening process considered the applicability of remediation technologies to the specific conditions within each of the SMAs identified rather than for broad application across the Site. This approach results in greater clarity for assembling remedial alternatives for the Site. The remediation technology screening is described in the following sections and is summarized in Table 10.

8.2.1. No Action

No action is retained as it is applicable to SMA-4, which is the location of 2016 Pacific Terminal Interim Action. As discussed in Section 2.3, as a result of the 2016 interim action, contamination was completely removed from SMA-4 and additional remedial action is not needed. No action is not considered appliable to other SMAs because it will not meet minimum requirements of the SMS (WAC 173204-570[3]) and CAOs.

8.2.2. Institutional Controls

Institutional controls are required by MTCA when cleanup actions leave contamination in place. Institutional controls are actions to limit or prohibit activities that may interfere with the integrity of the cleanup action or that may result in exposure to contamination. Institutional controls may include propriety controls, governmental controls, informational devices, and access restrictions. The SMS (WAC 173-204-570(3((h)) however, does not allow cleanup actions at the Site to rely exclusively on institutional controls and monitoring.

Institutional controls with the exception of access restrictions, as described in Table 10, are retained as a component of remedial alternatives and will be identified following completion of the cleanup action, based on the as-built condition of the remedial action.

8.2.3. Natural Recovery and Enhanced Natural Recovery

Natural recovery refers to the chemical and biological degradation, natural deposition, physical mixing and bioturbation processes that result in reduced contaminant concentrations in surface sediment over time. Natural recovery relies on a net depositional environment and therefore is not suited for areas that are subject to scour or other disturbances at the sediment surface that would inhibit sediment accumulation.

MNR is utilized when sediments are expected to meet cleanup standards within a reasonable restoration time period (10-years as defined in SMS) through natural recovery processes. MNR requires long-term monitoring and contingency plan components to verify that recovery is occurring as expected and to respond accordingly if recovery is not meeting the anticipated rate over time.

Where natural sediment recovery rates are too low or where existing sediment concentrations are too high to achieve preliminary cleanup standards within a reasonable restoration time period solely by natural deposition processes, natural recovery can be accelerated by utilizing ENR. ENR can enhance natural recovery processes and reduce contaminant concentrations in a shorter timeframe to meet the cleanup standards within the reasonable restoration time period. ENR involves placement of a mass of clean material on the surface of the recovery area. The material placed as part of ENR is not intended to isolate contaminants as in the case of capping. Rather, the clean material physically mixes with the in-place sediments through wave action, currents, and bioturbation. ENR placement targets delivering a calculated mass of clean material over a given area to achieve desired contaminant reduction factors. ENR placement does not require the same precision as cap construction. As a result, ENR can be reliably implemented in deeper water. As with MNR, ENR includes both monitoring and contingency plan components.

MNR and ENR are both retained given that the calculated sedimentation rates for the Marine Area outside of the areas that are subject to scour are anticipated to deposit new sediment at a thickness that is equivalent to or greater than the thickness of the compliance interval within a 10-year reasonable restoration period as summarized in Section 5.2. ENR and MNR can be reliably implemented outside of the identified scour areas at the Marine Area. Additionally, natural recovery is evidenced by preliminary review of existing surface sediment investigation results which show a reduction in concentrations of one or more COCs between historic (2007) and more recent (2016) sediment sampling events at locations that are generally near each other in the northwest portion of SMA-1a. Additional evidence for favorable natural recovery conditions at the Marine Area is that a significant portion of the historically dredged area located adjacent to Pacific Terminal and Pier 1, although subject to vessel scour, has remained below the cleanup standards since the 1990s, indicating that new sediment that may have been deposited in this area meets cleanup standards. Uncertainties in the chemical quality of the newly deposited sediment and further evaluation of the sedimentation rates will be completed as part of the remedial design process to confirm the time period for recovery and the degree of clean material enhancement that is necessary.

MNR and ENR are applicable to SMA-1 because this area is expected to be net depositional due to it being outside of the identified scour areas at the Marine Area (deeper than -55 feet MLLW). MNR and ENR are also applicable to SMA-7 because this area is located at a distance away from scour influence and is part of the depositional delta feature emanating from Pigeon Creek. MNR and ENR are not applicable to other SMAs because they are located within areas of the Marine Area that are subject to scour.

As discussed above, ENR enhances natural recovery process, and reduces contaminant concentrations and the timeframe required to meet the cleanup standards. Based on the clean material concentrations agreed to with Ecology, placement of a 6-inch equivalent mass of sand is estimated to result in the reduction of compliance layer (upper 10 cm) contaminant concentrations by 50 percent.

ENR is identified as applicable to SMA-1 (1a through 1d) and SMA-7. The following is the summary of the reduction in contaminant concentrations that are expected to result by implementing ENR in SMA-1 (1a through 1d) and/or SMA-7 in addition to implementing the technologies in the remaining SMAs included in the range of remedial alternatives:

- Implementation of ENR in SMAs-1b, 1c, 1d and 7 is expected reduce dioxin/furan concentrations and result in a site-wide Surface Weighted Average Concentration (SWAC) that is below the cleanup standard for the protection of human health and higher trophic level ecological receptors, as presented in Appendix R. The implementation of ENR in SMAs-1b, 1c, 1d and/or 7 will result in a reduction in contaminant concentrations, however the site-wide SWAC for cPAHs will remain above the cleanup standards with a relatively low ER of up to 1.22. Further contaminant concentration reduction is expected to occur over time as the result of mixing and sedimentation processes.
- Implementation of ENR in SMAs-1a, 1b, 1c, 1d and 7 is expected reduce dioxin/furan and cPAHs concentrations and result in a site-wide SWACs for these contaminants that are below cleanup standards for the protection of human health and higher trophic level ecological receptors, as presented in Appendix R.
- COCs exceeding the cleanup standards for the protection of benthic organisms are not present in 1c and SMA-7. The implementation of ENR in SMA-1 a, 1b and 1d is expected to reduce concentrations of COCs exceeding the cleanup standards for the protection of benthic organisms in SMA-1d (PCBs, LPAHs, phenols and miscellaneous extractables) below the cleanup standards.
- Wood debris exceeding cleanup standards is not present in SMA-1a and SMA-7. The implementation of ENR in SMAs-1b, 1c and 1d is expected to further reduce concentration of wood debris below the cleanup standards.

8.2.4. Capping

8.2.4.1. Conventional and Amended/Reactive Capping

Conventional and amended/reactive caps are common capping technologies that involve precision placement of clean material over in-place sediment and wood debris to contain and confine contamination. Conventional and amended/reactive caps can be implemented with and without armoring to protect the cap from erosive forces. Conventional and amended/reactive caps act to stabilize the underlying sediment and prevent disturbance, resuspension, and transport of contaminants and to reduce migration of dissolved contaminants to the sediment biologically active zone and the water column to prevent exposure to ecological and human receptors. Conventional and amended/reactive caps are intended to meet cleanup standards on completion of construction. Caps may be a sole response action or combined with removal technologies that leave some contaminated sediment in place that requires isolation.

Conventional caps typically consist of a layer of clean sand or other granular material with a thickness that varies based on site-specific conditions. An amended/reactive sand cap includes the use of specialized materials (i.e., amendments) to enhance chemical isolation capacity (i.e., ability of the cap to treat/sequester dissolved contaminants migrating through the cap) or otherwise decrease the thickness of caps compared to sand cap. Specialized material may include various types of amendments such as activated carbon and organoclay or engineered layers that attenuate the flux of contaminants from the underlying contaminated sediment to the overlying water column.

Cap placement technologies for conventional and amended/reactive caps vary based on the location and type of material used and require a high degree of precision to ensure that the engineered cap is built to specification and is effective. Typical placement techniques for cap material involve direct placement on the bottom by releasing material at the surface or within the water column and allowing it to settle to the bottom. Cap placement methods include dumping from a barge or hopper, hydraulic spreading (washing from a barge), broadcasting, use of a tremie tube and pumping a slurry through a pipeline or diffuser. If amendment or treatment materials are to be incorporated in the cap, additional mixing or handling may be required prior to placement. Cap placement methods for conventional and amended/reactive caps are most effective in shallow and moderate water depths[8] where the ability to accurately place the cap material to a specific thickness is increased and the potential for losses of materials in the water column is reduced.

Short-term risks associated with cap placement include misplacement and rehandling of capping material, losses of cap materials to the water column during placement, disturbance and resuspension of contaminated sediment or porewater on impact with the bottom and smothering of benthic communities and aquatic vegetation. The degree of water column loss and resuspension is affected by the type of material being placed, the method of placement, the degree of consolidation of the in-place sediment and impact of the capping material with bottom materials. The ability to effectively construct a cap is dependent on water depth as materials placement in deeper water presents significant challenges to controlling and preventing loss of materials in the water column and accurate and precise placement of cap materials on the sediment surface. Long-term risks associated with capping include potential release of contamination left in place, should the integrity of the cap be compromised and ability to maintain or repair the cap. Water depth is also a consideration for the effectiveness of long-term maintenance of the cap.

Caps that are constructed directly on the sediment surface decrease water depth and, due to permanence requirements, prevent future dredging or other modification to the capped area. As a result, placement of caps above the future site navigation elevations or within areas anticipated to be developed by the Port is incompatible with the current and future Site uses and, therefore, is not considered. Caps constructed directly on current sediment surfaces are also not considered in shallow areas where modification to existing elevations adversely impact habitat.

Conventional and amended/reactive caps are not considered applicable for the Marine Area for the reasons discussed below:

- Significant portions of SMAs-1 (1a through 1d) are located in the deepest parts of the Marine Area and as a result conventional and reactive/amended capping within these SMAs is not applicable due to the significant challenges to precision construction and maintenance Water depths within SMA-1d are less deep than in SMAs-1a, 1b and 1c, although range up to -75 feet MLLW.
- Capping without armoring is not applicable within SMAs-2, 3 and 6 because these areas are subject to vessel scour. Armored caps are not applicable within SMAs-2, 3 and 6 because placement of caps in these areas of the Site will decrease navigation elevations and prevent future dredging which is inconsistent with the current and anticipated future uses of the Site. A dredge and cap approach to place an armored cap is not considered applicable within SMAs-2, 3 and 6 because dredging to accommodate the cap thickness will either result in complete removal of contamination to meet armored cap thickness requirements or result in leaving only a small volume of contamination in-place that would be more expensive to cap than to completely remove.
- Capping is not applicable in SMA-4 as this SMA does not require further remedial actions.

[8] Based on Port's experience implementing other marine cleanup projects. Paul Fuglevand, PE, Senior Principal Engineer, Dalton Olmsted Fuglevand (nationally recognized expert in the characterization of sediments and the design of remedial actions for cleanup of contaminated sediments) was consulted and confirmed this based on his experience.

- Capping is not applicable in SMA-5 as this area is identified as a future cargo handling area and capping contaminated sediment and wood debris in this area will pose limitations or restrictions to the potential future site uses in this area of the Site. Capping is not applicable in SMA-7 because it will raise the grade in this shallow, intertidal area and impact the existing critical habitat elevations. A dredge and cap approach is not applicable in SMA-7 because dredging to accommodate the required cap thickness will result in complete removal of contamination.

8.2.4.2. Dynamic Sand Capping

Dynamic sand capping includes placement of clean imported sand on top of the existing sediment surface on a mass per area basis with individual materials placements overlapping each other to achieve cap thickness that is equivalent to or greater than the thickness of the compliance zone (i.e., 10 cm) at the time of construction. Dynamic sand caps are expected to meet cleanup standards on completion of construction. The thickness of dynamic sand cap is not expected to be evenly distributed following the placement of materials during construction. However, the dynamic sand cap materials are expected to be distributed over time by current action to achieve a more even thickness. The distribution of the placed dynamic sand cap materials across the placement area is expected reach equilibrium within a 10-year reasonable restoration timeframe. A 3-foot thickness equivalent mass of sand over the area of placement is assumed on a mass per area basis under this technology. To allow the dynamic sand caps to distribute within the placement area, they are not armored and, therefore, do not provide erosion protection.

Similar to conventional and amended/reactive caps, dynamic sand caps act to stabilize the underlying sediment, prevent disturbance, resuspension and transport of contaminants, and reduce migration of dissolved contaminants to the sediment biologically active zone and the water column to prevent exposure to ecological and human receptors. Dynamic sand caps may be a sole response action or combined with removal technologies that leave some contaminated sediment in place.

Dynamic sand cap placement methods are similar to conventional sand cap and include dumping sand from a barge or hopper, hydraulic spreading (washing from a barge), broadcasting, use of a tremie tube and pumping a slurry through a pipeline or diffuser. Since dynamic sand caps are placed on a mass per area basis and rely on current action to further distribute the material, they do not require precise placement techniques such as are used for the construction of conventional or amended/reactive sand caps. Therefore, dynamic sand caps are expected to be reasonably effectively implemented in moderately deep water, where placement of conventional or amended/reactive sand caps is very challenging.

Short-term risks associated with dynamic sand cap placement include misplacement and rehandling of capping material, losses of cap materials to the water column during placement, disturbance and resuspension of contaminated sediment or porewater on impact with the bottom and smothering of benthic communities and aquatic vegetation. The degree of water column loss and resuspension is affected by the method of placement and depth of water column, the degree of consolidation of the in-place sediment and impact of the capping material with bottom materials. The ability to effectively construct a cap is dependent on water depth as materials placement in deeper water presents challenges to controlling and preventing loss of materials in the water column. Long-term risks associated with capping include potential release of contamination left in place, should the integrity of the cap be compromised.

Caps that are constructed directly on the sediment surface decrease water depth and, due to permanence requirements, prevent future dredging or other modification to the capped area. As a result, placement of caps above the future Site navigation elevations or within areas anticipated to be developed by the Port is incompatible with the current and future Site uses and, therefore, is not considered. Caps constructed directly on current sediment surfaces are also not considered in shallow areas where modification to existing elevations adversely impact habitat.

In general, dynamic sand capping is retained for parts of the Marine Area where construction of such a cap can be effectively implemented and its presence will not impede navigation or adversely impact habitat. Based on these factors (as explained further below), dynamic sand capping was considered for SMA-1 but is retained only for SMA-1d.

As discussed above, dynamic sand cap placement does not require the same level of precision as the placement of conventional or amended/reactive cap materials so the technology is expected to be reasonably implemented in moderately deep areas (up to -75 feet MLLW) of SMA-1d. SMA-1d is shallow enough that placement of a dynamic sand cap will require partial dredging to ensure that the cap material is situated deeper than the -55 MLLW scour depth. In contrast, significant portions of SMAs-1a, -1b and -1c are in the deepest part of the Site (up to 215 feet, 90 feet and 115 feet MLLW, respectively) and as a result, dynamic sand capping is expected to be challenging to implement due to potential losses of cap materials to the water column and lack of materials control during placement and therefore, is not considered applicable in these SMAs. Dynamic sand caps cannot be armored and therefore, are not applicable within SMAs-2, 3 and 6 because these areas are subject to vessel scour where a cap without armoring would not be effective.

Dynamic sand capping is not applicable in SMA-4 as this SMA does not require further remedial actions. Dynamic sand capping is not applicable in SMA-5 as this area is identified as a future cargo handling area and capping contaminated sediment and wood debris in this area will pose limitations or restrictions to the potential future site uses in this area of the Site. Dynamic sand capping is not applicable in SMA-7 because it will raise the grade in this shallow, intertidal area and impact the existing critical habitat elevations. A dredge and cap approach is not applicable in SMA-7 because dredging to accommodate the required cap thickness will result in complete removal of contamination.

8.2.5. Containment

Containment involves construction of a low permeability barrier around a contaminant mass to isolate the material from exposure pathways and the environment. Containment is implemented to prevent the migration of in-place contaminants and can provide cost effectiveness by allowing contaminated material to remain in place, reducing the need for removal, disposal or other remediation technologies. Containments require periodical inspections to ensure the structural integrity remains intact and that the technology is functioning as designed.

For the alternatives considered, containment involves installation of a wall around the contaminated sediments located in SMA-5. The wall is assumed to be made of steel piling and will be designed and constructed in a manner that provides a high degree of permanence, ability to be monitored and maintained, capability to withstand design-level seismic events and avoid contaminant losses. The top of the structure will extend above the waterline to allow the top of the containment to be sealed for prevention of seawater and stormwater infiltration to reduce the potential for contaminant mobility. The area within the containment located between the mudline and the mean groundwater elevation in the adjacent upland areas will serve a double purpose by allowing for placement and consolidation of dredged material from other parts of the Marine Area (see CDF technology in Section 8.2.7 below).

Placement of the containment within SMA-5 is compatible with the future use assumption that this area of the Site is identified as future cargo handling area. The containment structure will be designed to ensure that, after completion of the remedial actions at the Marine Area, future cargo handling can be accommodated in this area. The containment structure will also eliminate the need to replace the existing bulkhead located along the shoreline of SMA-5 which could benefit the future cleanup actions in the Upland Area of the Site.

In-place containment is retained for SMA-5 as a compatible element of the CDF technology (see also Section 8.2.7). In-place containment by using structures is not applicable to other SMAs given the potential for incompatibility with future uses of the Site.

8.2.6. Removal

Removal is a common technology that is applied to dredge or excavate in-place contaminated sediment and wood debris for disposal. Removal methods applicable to the Marine Area include mechanical dredging from land-based or water-based platforms and diver-assisted hydraulic dredging in under-pier areas. Due to the presence of extensive wood debris and limitations on space for dewatering, hydraulic dredging is considered applicable only to limited access areas such as the under-pier portion of SMA-6.

Mechanical dredging is conducted by lowering a bucket to the sediment surface and when the dredge is retracted, it digs into the surface to retain material. The retained material is then lifted through the water column and placed onto a barge where the sediment is dewatered. Different types of dredge buckets are used for different purposes. Open clamshell buckets can remove consolidated sediment and debris efficiently and provide high productivity. Closed clamshell buckets reduce losses of dredged material to the water column and are most effective in soft sediment and where debris is not present. Mechanical dredging incorporates less water to the dredged material as compared to hydraulic dredging, thereby reducing the amount of water that must be treated and disposed. Dredging is typically implemented using best management practices such as silt curtains, real-time monitoring, and operational controls to protect water quality.

Hydraulic dredging involves deployment of a suction hose outfitted with or without a cutter head. Water is entrained into the dredged material as it is removed to create a pumpable slurry. Hydraulic pumps are used to draw the dredged material slurry through the suction hose and deliver it to a dewatering facility or directly deposit the material at the disposal location. Small scale hydraulic dredges can be operated by divers to reach limited access areas, such as under piers.

Full removal is intended to meet cleanup standards on completion of construction. The effectiveness of the removal technology relies on stable side cuts and/or shoring systems to allow dredging to achieve complete removal while protecting adjacent structures that are located in the vicinity of the dredging activity. Based on a preliminary engineering review, installation of a toe wall along the face of the South Terminal wharf is assumed to be required to complete full removal of the contaminated sediment within SMA-6 and protect the existing South Terminal structure as the depth of contamination exceeds the original dredge depths assumed for the design of the structure. Structural support to the existing shoreline bulkhead wall between the South and Pacific Terminals within SMA-5 is also assumed to be required to provide structural stability to the existing bulkhead and to facilitate the full removal of contaminated material along the shoreline. Due to its construction, location, and the degree of removal required in its vicinity, protection of the existing dolphin berth to facilitate dredging is not feasible. It is assumed that this structure will be demolished and replaced to facilitate the cleanup in the vicinity of the structure. No structural shoring has been identified to complete the removal actions in the vicinity of the Pacific Terminal.

Short-term risks associated with removal include resuspension of sediment at the point of dredging and loss of contaminants through the water column as the dredge is retracted. Long-term risks include incomplete removal and contaminated dredging residuals. Dredging is most effectively implemented in water depths where the dredge bucket can be reliably deployed to precise locations and elevations repeatedly. Removal effectiveness reduces with increasing water depth due to the diminished ability to repetitively position and control the dredging bucket with accuracy and precision. Loss of accuracy and precision on the dredge bucket deployment results in the need for additional passes over the removal area, incomplete dredging and contaminated dredging residuals – all of which lower the overall effectiveness of the technology and increases costs. Deeper water increases the potential for contaminant losses to the water column as the dredged material is raised to the surface and poses limits on the lift power and retrieval volume of the dredge due to the increased weight of the dredging cable to reach greater depths.

The thickness of the contaminated layer is also a consideration for removal effectiveness. An over dredge allowance is used to ensure that dredge bucket fully digs to and removes sediment completely to the target elevation. The over dredge allowance increases the disposal volume due to the mixing of the contaminated and underlying clean material within the dredge bucket and on the disposal barge. As a result, cost effectiveness of removal decreases as the thickness of the contaminated layer becomes the same or less than the over dredging allowance thickness. For example, the disposal volume and associated disposal cost to remove a two-foot-thick contaminated layer could be up to doubled when a two-foot over dredge allowance is applied. Additionally, the reduced effectiveness due to the over dredge allowance is exacerbated by lower accuracy and precision that comes with increased water depths.

Significant portions of SMAs-1a, -1b and -1c are located in the deepest areas of the Marine Area (up to -215 feet, -90 feet and -115 feet MLLW, respectively) and contain relatively large areas where the thickness of contamination and wood debris is on the order of thickness of the over dredge allowance. The water depth and removal thickness conditions in SMAs-1a, 1b and 1c make removal technically challenging, ineffective, and disproportionately costly. As a result, removal is not applicable in these SMAs. Water depths within SMA-1d are less deep than in SMAs-1a, 1b and 1c, although they still range up to mudline elevation of -75 feet MLLW. As a result, removal is assumed to be applicable to SMA-1d, although still difficult to implement and raises the same risks of ineffectiveness due to water depth. Removal is applicable in SMAs-2, 3, 5, 6 and 7 as the mudline in these SMAs is relatively shallow which increases the ability to deploy and control the dredge bucket with greater precision, which in turn increases the overall effectiveness of removal. Within SMA-7, removal is followed by backfilling to restore elevations and mitigate impacts to critical habitat elevations.

8.2.7. Disposal

Disposal technologies for the contaminated dredged material include off-Site landfill, construction of an on-Site CDF, CAD, aquatic open water disposal, and beneficial reuse.

The off-Site landfill technology is retained given that it is a common and proven method for the long-term management of contaminated sediments and wood debris. Off-Site landfill technology involves offloading from the dredged material barges, dewatering, and transport of contaminated sediment and wood debris to a permitted facility. Transport from the Site is anticipated to involve trucking the contaminated material to a rail facility where it is then transported by train to the landfill. At some landfills, the dredged material could also be directly transported to the facility by truck. Prior to disposal, waste characterization is required for disposal approval by the landfill facility. Due to the large volume of dredged material at the Site, the overall production rates for the offsite landfill technology may be limited by both the transportation capacity (e.g., availability of trucks, containers, and train cars) and landfill capacity (e.g., daily disposal volume limits given by the landfill facility) which will lengthen the construction schedule. Multiple landfill facilities may be required to at least partially offset throughput limitations and facilitate timely completion of the project. However, landfill options are hard to predict in advance and may also compete with other remediation projects.

Construction of an on-Site CDF is retained for SMA-5 to dispose of dredged sediment from outside SMA-5 and to contain SMA-5 sediments and wood debris in place, given that the technology is effective for the permanent and long-term containment of dredged material. Dredged material removed from areas outside SMA-5 will placed into the CDF and on top of the in-situ SMA-5 sediments and wood debris, CDF structures have been successfully used at the Site (Pacific Terminal) and at other sediment cleanups in the Puget Sound. Within the Marine Area, a CDF structure can be constructed in SMA-5 and remain compatible with the current and future uses. Construction of the CDF will be required prior to implementation of sediment removal. The in-place contaminated sediments located within the CDF footprint (SMA-5) will be permanently contained within the structure and, therefore, will effectively not require additional remedial actions. Additionally, protection of the existing wooden bulkhead structure located along the shoreline in SMA-5 will not be required since contaminated material within SMA-5 will not be removed. A CDF can reduce potential schedule delays, cost, traffic impacts, spills, and carbon emissions by significantly reducing the need for offsite transportation and disposal of dredged material.

Aquatic open water disposal, CAD and beneficial reuse technologies are not retained due to the absence of a suitable location to implement the technologies, the potential for the need for secondary treatment and the unlikelihood of timely regulatory approval.

8.2.8. Ex-situ Treatment

Ex-situ treatment involves removal or breakdown of contaminants through application of treatments processes. Ex-situ treatments include bioremediation, incineration, sediment washing, and solidification/stabilization. Ex-situ or upland treatment options for dredged sediments are limited, particularly due to complicating factors such as salt in marine sediment, the need for dewatering, and the presence of debris. According to Ecology guidance, many of these technologies have limited effectiveness for sediment (Ecology 2019).

The range of ex-situ treatment methods are not retained given that they would be difficult to implement at the Site due to lack of adequate space, overall lack of proven effectiveness at the scale of the Marine Area cleanup, and potential for the need for secondary treatment. Furthermore, ex-situ treatments may not be appropriate to address the full range of Marine Area contaminants or wood debris and would likely result in higher costs.

8.2.9. In-situ Treatment

In-situ treatment entails the direct application or placement of amendments into the sediment and/or adding mixing reagents with the sediment cap substrate. Additives are mixed with the sediment in-situ to encapsulate the sediment and/or reduce the solubility, mobility, toxicity, and/or bioavailability of the contaminants. Selection of appropriate *in-situ* treatment methodologies requires evaluating available options to determine which amendments and distribution methods are likely to be most effective for treatment of the Marine Area COCs residing within the site sediment. Typical applications involve the placement of activated carbon or other types of reagents that bind certain organic and/or metal contaminants.

In-situ treatment is not retained because it is not applicable to wood debris, may pose risks to the marine environment and habitats and is an emerging technology that has not been utilized at the scale of the Marine Area.

8.3. Summary of Retained Remedial Technologies

The applicability of retained remedial technologies was evaluated for each SMA. The SMAs and applicable remedial technologies used in the development of alternatives are summarized below and also described relative to the technology screening in Table 10:

- SMA-1:
  - 1a: MNR and ENR
  - 1b: MNR and ENR
  - 1c: MNR and ENR
  - 1d: MNR, ENR, Dynamic Sand Capping, and Removal
- SMA-2:
  - 2a: Removal
  - 2b: Removal
- SMA-3:
  - 3a: Removal
  - 3b: Removal
  - 3c: Removal
- SMA-4: No Action
- SMA-5: Removal and Containment/CDF
- SMA-6: Removal
- SMA-7: MNR, ENR, and Removal with Backfill

Additionally, the following technologies are applicable to the Marine Area under the circumstances described below:

- Institutional controls are applicable if other remedies implemented at the Marine Area leave contamination in place.
- Off-site transport and disposal of contaminated dredged material is applicable if other remedies implemented at the Marine Area involve removal of contaminated material and a CDF is not utilized or volume is in excess of the CDF capacity.

- Disposal of contaminated dredged material into an on-Site CDF is applicable if remedies implemented in other areas involve removal of contaminated material and the CDF facility can be constructed in a manner that does not conflict with the future Site uses.

9.0 REMEDIAL ALTERNATIVES

This section describes the remedial alternatives that were developed using the retained remedial technologies presented in Section 8.0. The remedial alternatives are established to achieve the CAOs, meet MTCA and SMS minimum requirements and comply with the current and future use requirements at the Site. The alternatives are presented in sufficient detail to allow for a comparative evaluation and to identify a preferred alternative.

Alternatives 1 through 5 were developed by applying the range of the retained remedial technologies to the applicable SMAs and then forming combinations of the remedial technologies on a SMA-by-SMA basis into unique Marine Area-wide combinations to form the slate of remedial options. For the Alternatives 1 through 5, an offsite transportation and disposal option for dredged material is assumed. Alternatives 6 through 10 generally parallel the range of remedial technologies established in Alternatives 1 through 5, respectively, with the exception that an on-site disposal option is added for the disposal of dredged material. The on-site disposal option is established in SMA-5 as a CDF that both contains the in-place contamination that is located within SMA-5 and creates capacity for disposal of dredged material from other SMAs.

The following Is a summary of remedial technologies selected for the SMAs under each alternative. Institutional Controls are anticipated to be part of all alternatives and will be determined following completion of construction based on the built condition of the remedy. Alternatives 1 through 5 assume off-site transport and disposal of contaminated dredged material at a landfill. Alternatives 6 through 10 assume that on-site disposal of contaminated dredged material in a CDF and off-site transport and disposal of the dredged material that cannot be accommodated into the CDF .

- **Alternative 1 –** MNR in SMAs-1 and -7, Full Removal in SMA-2, -3, -5 and -6, and No Action in SMA-4.
- **Alternative 2 –** MNR in SMA-1a, ENR in SMA-1b through -1d and -7, Full Removal in SMA-2, -3, -5 and -6, and No Action in SMA-4.
- **Alternative 3 –** MNR in SMA-1a, ENR in SMA-1b, -1c and -7, Dynamic Sand Capping in SMA-1d, Full Removal in SMA-2, -3, -5 and -6, and No Action in SMA-4.
- **Alternative 4 –** MNR in SMA-1a, ENR in SMA-1b, -1c and -7, Full Removal in SMA-1d, -2, -3, -5 and -6, and No Action in SMA-4.
- **Alternative 5 –** ENR in SMA-1a through -1c, Full Removal in SMA-1d, -2, -3, -5 and -6, Full Removal and Backfill in SMA-7, and No Action in SMA-4.
- **Alternative 6 –** MNR in SMA-1 and -7, Full Removal in SMA-2, -3 and -6, Containment/CDF in SMA-5, and No Action in SMA-4.
- **Alternative 7 –** MNR in SMA-1a, ENR in SMA-1b through -1d and -7, Full Removal in SMA-2, -3 and -6, Containment/CDF in SMA-5, and No Action in SMA-4.
- **Alternative 8 –** MNR in SMA-1a, ENR in SMA-1b, -1c and -7, Dynamic Sand Capping in SMA-1d, Full Removal in SMA-2, -3 and -6, Containment/CDF in SMA-5, and No Action in SMA-4.

- **Alternative 9 –** MNR in SMA-1a, ENR in SMA-1b, -1c and -7, Full Removal in SMA-1d, -2, -3 and -6, Containment/CDF in SMA 5, and No Action in SMA 4.
- **Alternative 10 –** ENR in SMA-1a through -1c, Full Removal in SMA-1d, -2, -3 and -6, Containment/CDF in SMA-5, Full Removal and Backfill in SMA-7, and No Action in SMA-4.

Remedial technologies common to all alternatives include full removal of contaminated media from SMA-2, -3 and -6, no action in SMA-4 and institutional controls, as identified above. The other common elements for the alternatives include installation of South Terminal toe wall and removal and off-site disposal of the existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal. The South Terminal toe wall will be required to facilitate full removal of contaminated media in SMA-6 and protect the adjacent wharf structure and underlying armored slopes during dredging activities as discussed further under the description of each alternative. The pile-supported roll-on/roll-off berthing pier and associated dolphins will be removed to facilitate implementation of remedial actions selected for SMA-5 and -6 under each alternative as discussed further under the description of each alternative.

The range of alternatives and their estimated cost were developed at a concept-design level to complete a comparative evaluation of alternatives and identify a preferred alternative for cleanup of the Marine Area. The final design for the selected alternative may differ from the alternative descriptions presented in this document based on agency decisions, permit requirements, further evaluation of existing conditions, detailed engineering analysis, coordination requirements of current and future uses and construction activities, and collection of supplemental data that may be needed to support the design of the cleanup action.

The sections below describe the approach and primary components of each alternative, along with key assumptions and rationale for the comparative evaluation.

9.1. Description of Alternative 1

The components of Alternative 1 are described below and summarized in Figures 77 through 81.

- Implement MNR in SMA-1 (1a through 1d) and SMA-7. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. Because the requirement to remove the roll-on/roll-off berthing pier could not be mitigated to achieve the cleanup objectives, the structure will require rebuilding following completion of the cleanup action to meet the current and future Site use requirements.
- Complete full removal of contaminated material from SMA-2 (2a and 2b), -3 (3a through 3c), -5 and -6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, -1b and -1c is not assumed since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed except for in the area of armored slopes at the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated

depths of contamination in these areas are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:

  - Remove existing armoring located within SMA-5 and from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
  - Install upland retaining wall and necessary ground improvements along the southern, eastern and northern limits of SMA-5 to facilitate full removal of contaminated material in SMA-5 and protect the adjacent upland areas and wharf structures from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
  - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.

- Transload contaminated dredged material to the upland area. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal facility for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Transport and disposal of the contaminated dredged material at a permitted upland landfill facility. Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall. Implement institutional controls, as necessary.

At the completion of construction of Alternative 1, cleanup standards will be met in SMAs where full removal is implemented. As a result of MNR being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs and SOC exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- cPAHs and dioxin/furans exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.51 and 1.32, respectively in SMA-1 (1a through 1d) and -7 as presented in Appendix R.

- PCB, LPAHs, phenols and miscellaneous extractables exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.6, 1.7, 1.5, and 1.5, respectively, in SMA-1 (1a, 1b and 1d).
- Wood debris in excess of 15 percent in SMA-1c and 1d.

9.2. Description of Alternative 2

The components of Alternative 2 are described below and summarized in Figures 82 through 86.

- Implement MNR in SMA-1a. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement ENR in SMA-1b, -1c, -1d and -7. ENR includes placement of a thin layer of clean imported sand over the surface of the area. The equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. Because the requirement to remove the roll-on/roll-off berthing pier could not be mitigated to achieve the cleanup objectives, the structure will require rebuilding following completion of the cleanup action to meet the current and future Site use requirements.
- Complete full removal of contaminated material from SMA-2 (2a and 2b), -3 (3a through 3c), -5 and -6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, -1b and -1c is not assumed since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in these areas are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:
    - Remove existing armoring located within SMA-5 and from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
    - Install upland retaining wall and necessary ground improvements along the southern, eastern and northern limits of SMA-5 to facilitate full removal of contaminated material in SMA-5 and protect the adjacent upland areas and wharf structures from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
    - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be

keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.

- Transload contaminated dredged material to the upland area. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal facility for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Transport and disposal of the contaminated dredged material at a permitted upland landfill facility.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 2, cleanup standards will be met in SMAs where full removal is implemented. As a result of MNR and ENR being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- cPAHs exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.22 and in SMA-1 (1a through 1d) and -7 as presented in Appendix R.
- 4-methylphenol exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.2 in SMA-1a.

9.3. Description of Alternative 3

The components of Alternative 3 are described below and summarized in Figures 87 through 91.

- Implement MNR in SMA-1a. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement ENR in SMAs-1b, -1c and -7. ENR includes placement of a thin layer of clean imported sand over the surface of the area. The equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement dynamic sand capping in SMA-1d. A 3-foot equivalent thickness of sand will be placed over SMA-1d on a mass per area basis with individual materials placements overlapping each other to

achieve a cap thickness that is equivalent to or greater than the thickness of the compliance zone (i.e., 10 cm) at the time of construction. The dynamic sand cap materials are then expected to be distributed over time by current action to achieve a more even thickness. A baseline surface sediment sampling and analysis event will be completed prior to placement of capping material to document contaminant concentrations that will be capped. Periodic surface sediment sampling and analysis of COCs will be completed to evaluate the effectiveness of the dynamic sand cap. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.

- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. Because the requirement to remove the roll-on/roll-off berthing pier could not be mitigated to achieve the cleanup objectives, the structure will require rebuilding following completion of the cleanup action to meet the current and future Site use requirements.
- Complete full removal of contaminated material from SMA-2 (2a and 2b), -3 (3a through 3c), -5 and -6. Dredge in SMA-1d to provide stable transition slopes to allow full removal in adjacent SMA-2a and to remove contaminated sediment in SMA-1d above elevation -60 feet MLLW which will ensure that the dynamic sand cap placed in SMA-1d is not located above the maximum scour elevation (i.e., -55 feet MLLW). Side slope dredging in SMA-1a, 1b and 1c is not assumed since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in these areas are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:
  - Remove existing armoring located within SMA-5 and from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
  - Install upland retaining wall and necessary ground improvements along the southern, eastern and northern limits of SMA-5 to facilitate full removal of contaminated material in SMA-5 and protect the adjacent upland areas and wharf structures from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
  - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
- Transload contaminated dredged material to the upland area. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal facility for off-Site transport. It is also assumed that the necessary dewatering of dredged material will

be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.

- Transport and disposal of the contaminated dredged material at a permitted upland landfill facility.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 3, cleanup standards will be met in SMAs where full removal is implemented. As a result of MNR, ENR and dynamic sand capping being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- cPAHs exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.12 and in SMAs-1a through -1c and -7 as presented in Appendix R.
- 4-methylphenol exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.2 in SMA-1a.

9.4. Description of Alternative 4

The components of Alternative 4 are described below and summarized in Figures 92 through 96.

- Implement MNR in SMA-1a. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement ENR in SMA-1b, -1c and -7. ENR includes placement of a thin layer of clean imported sand over the surface of the area. The equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. Because the requirement to remove the roll-on/roll-off berthing pier could not be mitigated to achieve the cleanup objectives, the structure will require rebuilding following completion of the cleanup action to meet the current and future Site use requirements.
- Complete full removal of contaminated material from SMA-1d, -2 (2a and 2b), -3 (3a through 3c), -5 and -6. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed

except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in these areas are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:

- Remove existing armoring located within SMA-5 and from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
- Install upland retaining wall and necessary ground improvements along the southern, eastern and northern limits of SMA-5 to facilitate full removal of contaminated material in SMA-5 and protect the adjacent upland areas and wharf structures from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
- Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.

- Transload contaminated dredged material to the upland area. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal facility for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Transport and disposal of the contaminated dredged material at a permitted upland landfill facility.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 4, cleanup standards will be met in SMAs where full removal is implemented. As a result of MNR and ENR being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- cPAHs exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.13 and in SMAs-1a through 1c and 7 as presented in Appendix R.

- 4-methylphenol exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.2 in SMA-1a.

9.5. Description of Alternative 5

The components of Alternative 5 are described below and summarized in Figures 97 through 101.

- Implement ENR in SMA-1a, -1b and -1c. ENR includes placement of a thin layer of clean imported sand over the surface of the area. The equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. Because the requirement to remove the roll-on/roll-off berthing pier could not be mitigated to achieve the cleanup objectives, the structure will require rebuilding following completion of the cleanup action to meet the current and future Site use requirements.
- Complete full removal of contaminated material from SMA-1d, -2 (2a and 2b), -3 (3a through 3c), -5, -6 and -7. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in these areas are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:
    - Remove existing armoring located within SMA-5 and from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
    - Install upland retaining wall and necessary ground improvements along the southern, eastern and northern limits of SMA-5 to facilitate full removal of contaminated material in SMA-5 and protect the adjacent upland areas and wharf structures from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
    - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
- Transload contaminated dredged material to the upland area. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal facility for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.

- Transport and disposal of the contaminated dredged material at a permitted upland landfill facility.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Backfill SMA-7 to restore existing critical habitat elevations.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 5, cleanup standards will be met at the Marine Area.

9.6. Description of Alternative 6

The components of Alternative 6 are described below and summarized in Figures 102 through 106.

- Implement MNR in SMA-1 (1a through 1d) and SMA-7. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. The roll-on/roll-off berthing pier would not be replaced due to the presence of the containment and CDF structure as discussed below.
- Install a containment and CDF wall along the western, northern and a portion of the southern limits of SMA-5 to contain the contaminated material located within SMA-5 and provide confined space for on-Site disposal of contaminated dredged material generated from the other SMAs. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
- The contaminated material located within SMA-5 will be contained in place within the containment and CDF structure. The installation of the containment and CDF wall eliminates the need to install shoring along the existing timber bulkhead in SMA-5 because the contamination within SMA-5 will be contained in place and dredging along the existing bulkhead will not be necessary.
- Complete full removal of contaminated material from SMA-2 (2a and 2b), -3 (3a through 3c) and -6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed for full removal activities except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in the Marine Area are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:

- Remove existing armoring from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
- Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.

- Unload contaminated dredged material from material barges and dispose directly into the CDF. Complete material management such that the disposed material is evenly distributed within the CDF facility below the water table. It is assumed that the CDF facility will be filled with contaminated dredged material up to an approximate elevation of +9 feet MLLW, which is the mean groundwater elevation in the adjacent upland areas. This will allow for contaminated dredged material including wood debris to remain under water and therefore, minimize decomposition and phase change. Ground improvement activities will be completed to provide seismic stability to the containment/CDF.
- Cover the CDF area with a cap to isolate the contaminated dredge material and prevent stormwater infiltration and exposure. The cap will contain a layer of clean imported fill material overlain by an asphalt surface with a stormwater management system.
- Transload contaminated dredged material that cannot be accommodated inside the CDF facility to the upland area for transport and disposal at an approved upland facility. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal wharf for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Upland transport and disposal of contaminated dredged material that cannot be accommodated inside the CDF facility at a permitted upland landfill.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Complete long-term monitoring of the CDF. It is assumed that yearly monitoring events will be completed for a period of 10 years.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 6, cleanup standards will be met in SMAs where full removal is implemented. As a result of MNR being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs and SOC exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- cPAHs and dioxin/furans exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.51 and 1.32, respectively in SMA-1 (1a through 1d) and 7 as presented in Appendix R.
- PCB, LPAHs, phenols and miscellaneous extractables exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.6, 1.7, 1.5, and 1.5, respectively, in SMA-1 (1a, 1b and 1d).
- Wood debris in excess of 15 percent in SMA-1c and 1d.

9.7. Description of Alternative 7

The components of Alternative 7 are described below and summarized in Figures 107 through 111.

- Implement MNR in SMA-1a. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement ENR in SMA-1b, -1c, -1d and -7. ENR includes placement of a thin layer of clean imported sand over the surface of the area. The equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. The roll-on/roll-off berthing pier would not be replaced due to the presence of the containment and CDF structure as discussed below.
- Install a containment and CDF wall along the western, northern and a portion of the southern limits of SMA-5 to contain the contaminated material located within SMA-5 and provide confined space for on-Site disposal of contaminated dredged material generated from the other SMAs. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination in the west and north adjacent areas along the structure.
- The contaminated material located within SMA-5 will be contained in place within the containment and CDF structure. The installation of the containment and CDF wall eliminates the need to install shoring along the existing timber bulkhead in SMA-5 because the contamination within SMA-5 will be contained in place and dredging along the existing bulkhead will not be necessary.
- Complete full removal of contaminated material from SMA-2 (2a and 2b), -3 (3a through 3c) and -6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Full removal in SMA-6 includes removal of surficial contaminated material from the top of armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed for full removal activities except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not

applicable. The estimated depths of contamination in the Marine Area are summarized In Sections 5.7 and 7.0. Prior to full removal, complete the following activities:

  - Remove existing armoring from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
  - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.

- Unload contaminated dredged material from material barges and dispose directly into the CDF. Complete material management such that the disposed material is evenly distributed within the CDF facility below the water table. It is assumed that the CDF facility will be filled with contaminated dredged material up to an approximate elevation of +9 feet MLLW, which is the mean groundwater elevation in the adjacent upland areas. This will allow for contaminated dredged material including wood debris to remain under water and therefore, minimize decomposition and phase change. Ground improvement activities will be completed to provide seismic stability to the containment/CDF.
- Cover the CDF area with a cap to isolate the contaminated dredge material and prevent stormwater infiltration and exposure. The cap will contain a layer of clean imported fill material overlain by an asphalt surface with a stormwater management system.
- Transload contaminated dredged material that cannot be accommodated inside the CDF facility to the upland area for transport and disposal at an approved upland facility. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal wharf for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Upland transport and disposal of contaminated dredged material that cannot be accommodated inside the CDF facility at a permitted upland landfill.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Complete long-term monitoring of the CDF. It is assumed that yearly monitoring events will be completed for a period of 10 years.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 7, cleanup standards will be met in SMAs where full removal is implemented. As a result of MNR and ENR being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- Total cPAHs exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.22 and in SMA-1 (1a through 1d) and 7 as presented in Appendix R.
- 4-methylphenol exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.2 in SMA-1a.

9.8. Description of Alternative 8

The components of Alternative 8 are described below and summarized in Figures 112 through 116.

- Implement MNR in SMA-1a. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement ENR in SMAs-1b, -1c and -7. ENR includes placement of a thin layer of clean imported sand over the surface of the area. The equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement dynamic sand capping in SMA-1d. A 3-foot equivalent thickness of sand will be placed over SMA-1d on a mass per area basis with individual materials placements overlapping each other to achieve cap thickness that is equivalent to or greater than the thickness of the compliance zone (i.e., 10 cm) at the time of construction. The dynamic sand cap materials are then expected to be distributed over time by current action to achieve a more even thickness. A baseline surface sediment sampling and analysis event will be completed prior to placement of capping material to document contaminant concentrations that will be capped. Periodic surface sediment sampling and analysis of COCs will be completed to evaluate the effectiveness of the dynamic sand cap. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. The roll-on/roll-off berthing pier would not be replaced due to the presence of the containment and CDF structure as discussed below.
- Install a containment and CDF wall along the western, northern and a portion of the southern limits of SMA-5 to contain the contaminated material located within SMA-5 and provide confined space for on-Site disposal of contaminated dredged material generated from the other SMAs. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination in the west and north adjacent areas along the structure.
- The contaminated material located within SMA-5 will be contained in place within the containment and CDF structure. The installation of the containment and CDF wall eliminates the need to install shoring

along the existing timber bulkhead in SMA-5 because the contamination within SMA-5 will be contained in place and dredging along the existing bulkhead will not be necessary.

- Complete full removal of contaminated material from SMA-2 (2a and 2b), -3 (3a through 3c) and -6. Dredge in SMA-1d to provide stable transition slopes to allow full removal in adjacent SMA-2a and to remove contaminated sediment in SMA-1d above elevation -60 feet MLLW which will ensure that the dynamic sand cap placed in SMA-1d is not above the maximum scour elevation (i.e., -55 feet MLLW). Side slope dredging in SMA-1a, 1b and 1c is not assumed since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed for full removal activities except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in the Marine Area are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:
    - Remove existing armoring from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
    - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
- Unload contaminated dredged material from material barges and dispose directly into the CDF. Complete material management such that the disposed material is evenly distributed within the CDF facility below the water table. It is assumed that the CDF facility will be filled with contaminated dredged material up to an approximate elevation of +9 feet MLLW, which is the mean groundwater elevation in the adjacent upland areas. This will allow for contaminated dredged material including wood debris to remain under water and therefore, minimize decomposition and phase change. Ground improvement activities will be completed to provide seismic stability to the containment/CDF.
- Cover the CDF area with a cap to isolate the contaminated dredge material and prevent stormwater infiltration and exposure. The cap will contain a layer of clean imported fill material overlain by an asphalt surface with a stormwater management system.
- Transload contaminated dredged material that cannot be accommodated inside the CDF facility to the upland area for transport and disposal at an approved upland facility. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal wharf for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Upland transport and disposal of contaminated dredged material that cannot be accommodated inside the CDF facility at a permitted upland landfill.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.

- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Complete long-term monitoring of the CDF. It is assumed that yearly monitoring events will be completed for a period of 10 years.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 8, cleanup standards will be met in SMAs where full removal and capping are implemented. As a result of MNR and ENR being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- Total cPAHs exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.12 and in SMAs-1a through -1c and -7 as presented in Appendix R.
- 4-methylphenol exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.2 in SMA-1a.

9.9. Description of Alternative 9

The components of Alternative 9 are described below and summarized in Figures 117 through 121.

- Implement MNR in SMA-1a. MNR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Implement ENR in SMA-1b, -1c and -7. ENR includes placement of a thin layer of clean imported sand over the surface of the area. the equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. The roll-on/roll-off berthing pier would not be replaced due to the presence of the containment and CDF structure as discussed below.
- Install a containment and CDF wall along the western, northern and a portion of the southern limits of SMA-5 to contain the contaminated material located within SMA-5 and provide confined space for on-Site disposal of contaminated dredged material generated from the other SMAs. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination in the west and north adjacent areas along the structure.

- The contaminated material located within SMA-5 will be contained in place within the containment and CDF structure. The installation of the containment and CDF wall eliminates the need to install shoring along the existing timber bulkhead in SMA-5 because the contamination within SMA-5 will be contained in place and dredging along the existing bulkhead will not be necessary.
- Complete full removal of contaminated material from SMA-1d, -2 (2a and 2b), -3 (3a through 3c) and -6. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed for full removal activities except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in the Marine Area are summarized in Section s 5.7 and 7.0. Prior to full removal, complete the following activities:
    - Remove existing armoring from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
    - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
- Unload contaminated dredged material from material barges and dispose directly into the CDF. Complete material management such that the disposed material is evenly distributed within the CDF facility below the water table. It is assumed that the CDF facility will be filled with contaminated dredged material up to an approximate elevation of +9 feet MLLW, which is the mean groundwater elevation in the adjacent upland areas. This will allow for contaminated dredged material including wood debris to remain under water and therefore, minimize decomposition and phase change. Ground improvement activities will be completed to provide seismic stability to the containment/CDF.
- Cover the CDF area with a cap to isolate the contaminated dredge material and prevent stormwater infiltration and exposure. The cap will contain a layer of clean imported fill material overlain by an asphalt surface with a stormwater management system.
- Transload contaminated dredged material that cannot be accommodated inside the CDF facility to the upland area for transport and disposal at an approved upland facility. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal wharf for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Upland transport and disposal of contaminated dredged material that cannot be accommodated inside the CDF facility at a permitted upland landfill.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.

- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.
- Complete long-term monitoring of the CDF. It is assumed that yearly monitoring events will be completed for a period of 10 years.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 9, cleanup standards will be met in SMAs where full removal is implemented. As a result of MNR and ENR being implemented in the remaining SMAs, cleanup standards are expected to be met throughout the Marine Area within a 10-year restoration timeframe. The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include:

- cPAHs exceeding the cleanup standards for the protection of human health and higher trophic level ecological receptors with SWAC ER of 1.13 and in SMAs-1a through -1c and -7 as presented in Appendix R.
- 4-methylphenol exceeding the cleanup standards for the protection of benthic organisms with ER of up to 1.2 in SMA-1a.

9.10. Description of Alternative 10

The components of Alternative 10 are described below and summarized in Figures 122 through 126.

- Implement ENR in SMA-1a, -1b and -1c. ENR includes placement of a thin layer of clean imported sand over the surface of the area. the equivalent of a 6-inch layer of sand is assumed for ENR. ENR includes a baseline and periodic surface sediment sampling and analysis of COCs to evaluate the natural recovery processes. Eight periodic monitoring events are assumed to be completed following construction to demonstrate compliance.
- Complete removal and off-site disposal of existing pile-supported roll-on/roll-off berthing pier and associated dolphins, located north of the South Terminal to facilitate implementation of other remedial actions. The roll-on/roll-off berthing pier would not be replaced due to the presence of the containment and CDF structure as discussed below.
- Install a containment and CDF wall along the western, northern and a portion of the southern limits of SMA-5 to contain the contaminated material located within SMA-5 and provide confined space for on-Site disposal of contaminated dredged material generated from the other SMAs. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent upland areas. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination in the west and north adjacent areas along the structure.
- The contaminated material located within SMA-5 will be contained in place within the containment and CDF structure. The installation of the containment and CDF wall eliminates the need to install shoring along the existing timber bulkhead in SMA-5 because the contamination within SMA-5 will be contained in place and dredging along the existing bulkhead will not be necessary.

- Complete full removal of contaminated material from SMA-1d, -2 (2a and 2b), -3 (3a through 3c) and -6. Full removal in SMA-6 includes removal of surficial contaminated material from the top of the armored slopes of the South Terminal pile-supported wharf. A 2-foot overdredge allowance is assumed for full removal activities except for in the area of armored slopes of the South Terminal pile-supported wharf. Within this area it is assumed that the sediment will be removed to the top of armored slope and therefore, the 2-foot overdredge allowance is not applicable. The estimated depths of contamination in the Marine Area are summarized in Sections 5.7 and 7.0. Prior to full removal, complete the following activities:
  - Remove existing armoring from the northern (adjacent to SMA-4) and southern portions (south of the South Terminal) of SMA-6 to provide access to the underlying contaminated material. Temporarily stockpile the removed armoring in the upland portions of the Site for reuse.
  - Install South Terminal toe wall along the western, northern and southern face of the terminal to facilitate full removal of contaminated material in SMA-6 and protect the adjacent wharf structure and underlying armored slopes from dredging activities. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes. The design of the wall will be based on the need to achieve full removal at the maximum estimated depth of contamination along the structure.
- Unload contaminated dredged material from material barges and dispose directly into the CDF. Complete material management such that the disposed material is evenly distributed within the CDF facility below the water table. It is assumed that the CDF facility will be filled with contaminated dredged material up to an approximate elevation of +9 feet MLLW, which is the mean groundwater elevation in the adjacent upland areas. This will allow for contaminated dredged material including wood debris to remain under water and therefore, minimize decomposition and phase change. Ground improvement activities will be completed to provide seismic stability to the containment/CDF.
- Cover the CDF area with a cap to isolate the contaminated dredge material and prevent stormwater infiltration and exposure. The cap will contain a layer of clean imported fill material overlain by an asphalt surface with a stormwater management system.
- Transload contaminated dredged material that cannot be accommodated inside the CDF facility to the upland area for transport and disposal at an approved upland facility. It is assumed that the material will be transloaded from material barges directly into trucks and trailers (or containers) at the South Terminal wharf for off-Site transport. It is also assumed that the necessary dewatering of dredged material will be accomplished on the material barges and the water will be released back to the marine waters in accordance with the requirements of the permits.
- Upland transport and disposal of contaminated dredged material that cannot be accommodated inside the CDF facility at a permitted upland landfill.
- Collect sediment samples from post-dredge sediment surface to meet the compliance monitoring requirements of MTCA and SMS. Analyze sediment samples for Marine Area COCs.
- Complete progress and post-construction bathymetric surveys of dredged areas for quality control purposes and to document as-built conditions.
- Following the removal of contaminated material, reuse the stockpiled armoring to restore armored slopes in the southern portion of the South Terminal that are not protected by the toe wall.

- Complete long-term monitoring of the CDF. It is assumed that yearly monitoring events will be completed for a period of 10 years.
- Implement institutional controls, as necessary.

At the completion of construction of Alternative 10, cleanup standards will be met at the Marine Area.

9.11. Cost Estimate

For each alternative, a concept-level cost estimate was developed using a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual), construction cost estimates solicited from applicable vendors and contractors, review of actual costs incurred during similar projects and professional engineering judgment. The FS-level cost estimates include cost for construction, professional/technical services and long-term monitoring, and is inclusive of a 30 percent contingency. The accuracy of FS-level cost estimate is assumed to be -30 to +50 percent as per EPA's FS cost estimate guidance (EPA 2000).

A detailed cost estimate for each alternative is presented in Appendix T. The following is a summary of the estimated total cost for each alternative.

- **Alternative 1** – $230.9 million
- **Alternative 2** – $233.1 million
- **Alternative 3** – $238.8 million
- **Alternative 4** – $243.7 million
- **Alternative 5** – $258.0 million
- **Alternative 6** – $201.9 million
- **Alternative 7** – $204.0 million
- **Alternative 8** – $209.8 million
- **Alternative 9** – $214.7 million
- **Alternative 10** – $229.0 million

10.0 EVLAUATION OF REMEDIAL ALTERNATIVES

Cleanup actions completed under the SMS are evaluated based on the minimum requirements specified in WAC 173204-570[3]. The minimum requirements are summarized below:

- Protect human health and the environment.
- Comply with all applicable laws, as defined in WAC 173-204-505(2).
- Comply with sediment cleanup standards specified in WAC 173-204-560 through 173-204-564.
- Use permanent solutions to the maximum extent practicable, as specified in WAC 173-204-570(4).
- Provide a reasonable restoration timeframe with a preference on those alternatives that, while equivalent in other respects, can be implemented in a shorter period of time. Alternatives that achieve

cleanup standards within 10 years of completion of construction of the active components of the cleanup action are presumed to have a reasonable restoration timeframe (Ecology 2021).

- Implement effective source controls where needed with preference for source control measures more effective at minimizing future accumulation of contaminants in sediment caused by discharges.
- Meet the requirements for implementation of a sediment recovery zone (WAC 173-204-590) if cleanup standards cannot be achieved within 10 years.
- Provide for a permanent cleanup action where technically feasible instead of relying exclusively on MNR or institutional controls and monitoring. Where institutional controls are used, they must comply with WAC 173-340-440 to include measures that control exposures and ensure the integrity of the cleanup action.
- Provide an opportunity for review and comment by affected landowners and the general public consistent with the public participation plan, and consider concerns identified in these comments.
- Include adequate monitoring to ensure remedy effectiveness.
- Provide periodic review of remedy effectiveness where elements of a cleanup action include containment, enhanced or natural recovery, institutional controls, sediment cleanup levels based on practical quantitation limits, or sediment recovery zones.

In addition to the above minimum requirements, SMS stipulates that the evaluation of sediment cleanup actions shall provide sufficient information to fulfill the state environmental policy act (SEPA) requirements (Chapter 43.21C Revised Code of Washington [RCW]) for the proposed preferred remedy. A SEPA analysis of environmental impacts will be undertaken for the cleanup action ultimately selected by Ecology. The SEPA evaluation and determination will be provided for public review in parallel with public review of the DCAP.

Table 11 presents the SMS evaluation criteria (minimum requirements) for the ten remedial alternatives. As identified in Table 11, the ten remedial alternatives meet the SMS minimum requirements for sediment cleanup actions. With regard to the minimum requirement that cleanup actions use permanent solutions to the maximum extent practicable, this is determined by a disproportionate cost analysis (DCA) of the alternatives as described in the following sections.

10.1. Disproportionate Cost Analysis Process

One of the minimum requirements of cleanup actions under MTCA and SMS is to use permanent solutions to the maximum extent practicable (WAC 173-204-570[4]). By definition (WAC 173-340-200), permanent remedies, once implemented, require no additional action to meet cleanup standards. A practicable cleanup action is designed, constructed, and implemented in a reliable, cost-effective manner. A cleanup action is not considered practicable if the incremental costs are disproportionate to the incremental benefits when compared to lower-cost alternatives.

The tool specified in MTCA and SMS to achieve this is the disproportionate cost analysis (DCA), which compares the benefits and costs of the remedial alternatives to determine which alternative uses permanent solutions to the maximum extent practicable. Consistent with MTCA and SMS, the DCA process for this RI/FS evaluates benefits and costs to make a relative comparison of remedial alternatives, identifying the alternative whose incremental costs are not disproportionate to its incremental benefits. The identified preferred remedial alternative is permanent to the maximum extent practicable.

10.1.1. Evaluation Criteria

The following criteria defined in WAC 173-340-360(3)(f) and WAC 173-204-570(4) are used to evaluate and compare each remedial alternative when conducting the DCA, six benefit criteria plus a cost criterion:

- Protectiveness
- Permanence
- Long-term effectiveness
- Management of short-term risks
- Technical and administrative implementability
- Consideration of public concerns
- Cost

These criteria form the basis of the DCA evaluation and alternatives comparison to determine whether a cleanup action is permanent to the maximum extent practicable. The individual criteria are described below.

- **Protectiveness** – Considers the overall protection of human health and the environment. Specific factors considered as contributing to overall protection of human health and the environment, include the degree to which existing risks are reduced, time required to reduce risk at the facility and attain cleanup standards, on-site and offsite risks resulting from implementing the alternative, improvement of the overall environmental quality, and the potential risks to the integrity of the remedy from climate change impacts.
- **Permanence** –The degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.
- **Long-Term Effectiveness** – Long-term effectiveness considers the degree of certainty that an alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-site at concentrations that exceed cleanup levels, including magnitude of residual risks to human health and aquatic life following implementation of the alternative, the effectiveness of controls required to manage treatment residues or remaining wastes.
- **Management of Short-Term Risks** – Addresses the risk to human health and the environment associated with the alternative during construction and implementation and considers the effectiveness of the measures that will be taken to manage risks. Risks can occur from worker or public exposure to contaminants, other releases of contaminants to the environment, and physical hazards created by construction and related materials management.
- **Technical and Administrative Implementability** – Addresses the technical likelihood that an alternative can be implemented. Technical implementability factors include the degree to which the alternative uses proven technologies, the availability of materials and services, the operation and maintenance

requirements, and the integration with existing operations and other cleanup actions. Administrative implementability factors include the potential for landowner cooperation and access, administrative and regulatory requirements such as permitting.

- **Consideration of Public Concerns** – Assesses the degree to which community concerns are addressed and the ways in which the alternative addresses those public concerns. Prior to public review of the RI/FS, it is difficult to judge the response by the public to each alternative. For the purposes of completing this RI/FS for public review, it is assumed that protectiveness is the greatest public concern and therefore, the score for protectiveness is considered in developing the score for the consideration of public concerns. It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. These additional considerations are also used to establish the benefits score for consideration of public concerns. This criterion will be re-evaluated following public review of the RI/FS.

- **Cost** – The analysis of remedial alternative costs under MTCA includes the costs associated with implementing an alternative, including design, construction, long-term monitoring, and institutional controls. Costs are intended to be comparable among different alternatives to assist in the overall analysis of relative costs and benefits of the alternatives.

10.1.2. Benefit Scoring and Weighting Factors

The benefits of an alternative are evaluated based on the six benefit criteria. For each criterion, an alternative is scored on a scale of 1 to 10: a score of 1 indicates the alternative is considered to satisfy the elements of the criterion to the lowest degree and a score of 10 indicates the alternative is considered to satisfy the elements of the criterion to the highest degree. For each alternative, the individual criterion scores are then weighted to emphasize more critical criteria, as outlined in Ecology's SCUM guidance (Ecology 2021):

- Protectiveness Weighting Factor – 30%
- Permanence Weighting Factor – 20%
- Long-term effectiveness Weighting Factor – 20%
- Management of short-term risks – 10%
- Technical and administrative Implementability – 10%
- Consideration of public concerns – 10%

Consistent with other MTCA aquatic remediation projects, the criteria that are most directly associated with the primary goals and objectives of the cleanup (e.g., protectiveness, permanence, long-term effectiveness) are more heavily weighted than the other criteria. The weighted benefit scores for each alternative are then summed to create a total weighted benefit score for each alternative.

10.1.3. Relative Benefit-to-Cost Ratio

A relative benefit-to-cost ratio is used to compare the remedial alternatives to determine whether costs are disproportionate to benefits. To calculate the relative benefit-to-cost ratio for each alternative, the total weighted relative benefit score is divided by the cost. Alternatives are then compared from least cost to highest cost. Alternatives whose incremental benefits are disproportionate to the incremental cost produce lower relative benefit/cost ratios. The remedial alternative with the highest benefit/cost ratio is permanent to the maximum extent practicable.

10.2. Evaluation and Comparison of Remedial Alternatives

Evaluation of remedial alternatives against the benefit criteria are provided in this section along with a discussion of costs associated with the alternatives.

The ten alternatives described in Section 9.0 are evaluated against the benefit criteria described in Section 10.1, with each criterion scored on a scale from 1, the lowest to 10, the highest degree of satisfying the criteria. The raw relative benefit scores and rationale for the scores for each criterion are presented in Table 12. For each alternative, scores for the individual benefit criteria are then weighted according to the factors described in Section 10.1.2, and then summed to develop a total weighted relative benefit score for the alternative. The raw relative benefit scores, weighted scores, cost and relative benefit/cost ratio for each alternative are summarized in Table 13. Total weighted scores, total costs and relative benefit/cost ratios are graphically presented in Figure 127, for all alternatives. A summary of the scoring considerations for each criterion is presented in the following sections.

10.2.1. Protectiveness

Each alternative was evaluated for protectiveness and the details of the evaluation are presented in Table 12. The evaluation and comparative analysis between alternatives for protectiveness is summarized below. Each of the ten alternatives utilizes different combinations of the retained remedial technologies to achieve a moderate-high to high degree of protectiveness. Each of the ten alternatives implement full removal in SMAs-2, -3, and -6 and no action in SMA-4 and therefore, in these areas of the Site the protectiveness benefits are comparable. The relative differences in the protectiveness for the alternatives are the result of differences between the technologies implemented in SMA-1, -5 and -7.

Alternatives 1 through 5 are generally similar to Alternatives 6 through 10 with the exception of the technologies utilized in SMA-5 and the dredged material disposal approach. Alternatives 1 through 5 implement full removal in SMA-5 and assume that all of the dredged material from the Site is disposed at a permitted off-site landfill. Alternatives 6 through 10 implement containment/CDF technologies in SMA-5, which results in containment of the in-place contamination located in SMA-5 and provides for disposal of dredged material from the Site within the on-site CDF. For Alternatives 6 through 10, 70 to 99 percent of the dredged material can be disposed of in the on-site CDF. As a result, the quantity of contaminated dredged material transported off-site is reduced significantly relative to Alternatives 1 through 5, under which 100 percent of the material is exported to a landfill facility. The contaminated dredged material volume estimated to be generated from Alternatives 1 through 5, and Alternatives 6 through 10 are presented Tables S-5 and S-6, respectively, of Appendix S. As a result of the lower offsite export, Alternatives 6 through 10 achieve a higher degree in overall environmental quality and received greater protectiveness scores than Alternatives 1 through 5 due to the reduction of carbon emissions and lower potential for accidental spills during transportation.

Under protectiveness criterion, impacts of climate change (e.g., sea level rise and higher intensity storms [Section 1.6]) were also considered. The SMAs located along the shoreline including SMA-3, -5, -6 and -7 are subject to the impacts of climate change. Remedial technologies implemented in SMA-3, -5 and -6 as part of all alternatives include full removal and/or containment/CDF and these technologies are not affected by climate change. Full removal is not affected by climate change since it will result in a complete removal of contaminated media. The top of the upland retaining wall, which is required to facilitate full removal in SMA-5, and containment/CDF wall are planned to be constructed at an elevation that is at or above the adjacent upland areas where Port terminal facilities are located, and therefore, climate change is not expected to impact upland retaining wall or CDF. Port terminal facilities are well above sea level and are not expected to be impacted by sea level rise in the foreseeable future. The South Terminal toe wall that will be constructed to facilitate full removal in SMA-6 is an underwater structure and therefore is not anticipated to be impacted by climate change. The potential for impact due to climate change is similar for Alternatives 1 through 4 and 6 through 9 because these alternatives rely on natural recovery processes in SMA-7, where climate change has a potential of disrupting the natural recovery processes. Alternatives 5 and 10 implement full removal of contaminated media and backfilling in SMA-7 and therefore, the potential for climate change to impact these alternatives is reduced. These considerations are considered in scoring the protectiveness criterion as presented below.

Under protectiveness criterion, loss of aquatic habitat and waters of the State was also evaluated. The SMAs that contain critical habitat elevations include SMA-3c, -5, -6 and -7. As part of each alternative, remedial technologies implemented in SMA-3c and -6 include full removal, which will result in the loss of aquatic habitat. As part of Alternatives 1 through 5, remedial technology implemented in SMA 5 includes full removal, which will result in the loss of aquatic habitat. As part of Alternatives 6 through 10, remedial technology implemented in SMA 5 includes containment/CDF, which will result in the loss of aquatic habitat and waters of the State. As part of each alternative, remedial technologies implemented for SMA 7 include MNR, ENR or full removal and backfill. None of these technologies affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat or waters of the State. The loss of aquatic habitat and waters of the Site resulting from each alternative are comparable and will be mitigated as part of the project permitting process and, therefore, do not result in a significant differentiating factor in the scoring of protectiveness criterion. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat and/or waters of the State resulting from the selected alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action. Additional mitigation activities that may be considered include placement of fill at an off-site location to achieve depths suitable for eelgrass growth, placement of thin layer of material in an on-site or off-site area that is already at an appropriate depth for eelgrass to increase substrate stability to facilitate eelgrass colonization/persistence, and/or dredging to achieve appropriate depth for eelgrass at an appropriate on-site location.

- **Alternative 1 (7.0) and Alternative 6 (7.5)** – Alternative 1 utilizes MNR in SMA-1 (1a through 1d) and -7. MNR utilizes natural recovery processes to reduce the existing risks and relies on a restoration timeframe to meet cleanup standards. Alternative 1 is scored the lowest (7.0) of the alternatives for protectiveness due to the expanse of area utilizing MNR and the risk that the technology may not meet cleanup standards within the reasonable restoration timeframe. Alternative 6 utilizes the same degree of MNR as Alternative 1, but the relative protectiveness is scored higher for Alternative 6 (7.5) due to the higher environmental quality achieved through on-site disposal in the CDF, as described above. Additional details for the evaluation of Alternatives 1 and 6 are presented in Table 12.
- **Alternative 2 (7.5) and Alternative 7 (8.0)** – Alternative 2 implements MNR in SMA-1a and ENR in SMAs-1b, 1c, 1d and 7. ENR reduces contaminant concentrations and the timeframe required to meet

cleanup standards through the placement of clean sand. The risk of not meeting cleanup standards for ENR is lower than that for MNR due to the application of clean sand. In comparison to Alternative 1, the risk of not meeting cleanup standards within the restoration timeframe is reduced in Alternative 2 due to the reduction in the reliance on MNR by utilization of ENR in SMAs-1b, 1c, 1d and 7. Alternative 2 is scored higher (7.5) than Alternative 1 (7.0) because the area relying on MNR is reduced and the potential for meeting cleanup standards is increased by utilization of ENR. Alternative 7 utilizes the same degree of MNR and ENR as Alternative 2 and the relative protectiveness score is higher for Alternative 7 (8.0) due to the higher environmental quality achieved through on-site disposal in the CDF, as described above. Additional details for the evaluation of Alternatives 2 and 7 are presented in Table 12.

- **Alternative 3 (8.0) and Alternative 8 (8.5)** – Alternative 3 implements MNR in SMA-1a, ENR in SMA-1b, -1c and -7 and dynamic sand capping in SMA-1d. Dynamic sand capping acts to lower risks by isolating contaminated media from marine environment. In comparison to Alternative 2, risks are further reduced in Alternative 3 by use of dynamic sand capping in place of ENR in SMA-1d since dynamic sand cap uses a larger mass of sand as compared to ENR and provides for isolation of the contaminated layer below the placed sand. As a result, Alternative 3 is scored higher (8.0) than Alternative 2 (7.5). Alternative 8 utilizes the same degree of MNR, ENR and dynamic sand capping as Alternative 3 and the relative protectiveness score is higher for Alternative 8 (8.5) due to the higher environmental quality achieved through on-site disposal in the CDF, as described above. Additional details for the evaluation of Alternatives 3 and 8 are presented in Table 12.
- **Alternative 4 (8.0) and Alternative 9 (8.5)** – Alternative 4 implements MNR in SMA-1a, ENR in SMA-1b, -1c and -7 and full removal in SMA-1d. Full removal eliminates contaminated media from exposure pathways and therefore reduces existing risks. However, full removal in deep water conditions poses significant challenges for accurate and complete removal, and therefore lessens protectiveness to a certain degree. As a result, the protectiveness due to dynamic sand capping or removal in SMA-1d are rated the same. Alternative 4 is scored the same (8.0) as Alternative 3 (8.0). Alternative 9 utilizes the same degree of MNR, ENR and removal as Alternative 4 and the relative protectiveness score is higher for Alternative 9 (8.5) due to the higher environmental quality achieved through on-site disposal in the CDF as described above. Additional details for the evaluation of Alternatives 4 and 9 are presented in Table 12.
- **Alternative 5 (9.0) and Alternative 10 (9.5)** – Alternatives 5 implements ENR in SMA-1a, -1b, and -1c, full removal in SMA-1d and a combination of full removal and backfilling in SMA-7. In comparison to Alternative 4, risks are further reduced in Alternative 5 by adding ENR in SMA-1a and full removal and backfilling in SMA-7 due to the reduction in the area relying on MNR and reduced potential for climate change impacts[9] result from implementing removal in SMA 7. As a result, Alternative 5 is scored higher (9.0) than Alternative 4 (8.0). Alternative 10 utilizes the same degree of ENR and removal as Alternative 5 and the relative protectiveness score is higher for Alternative 10 (9.5) due to the higher environmental

[9] The potential for impact due to climate change is similar for Alternatives 1 through 4 and 6 through 9 because these alternatives rely on natural recovery processes in the intertidal areas of the Site (i.e., portions of SMA-7), where climate change (e.g., sea level rise and higher intensity storms) has a potential of disrupting the natural recovery processes. Alternatives 5 and 10 implement full removal of contaminated media and backfilling in SMA-7 and therefore, the potential for climate change to impact these alternatives is reduced.

quality achieved through on-site disposal in the CDF as described above. Additional details for the evaluation of Alternatives 5 and 10 are presented in Table 12.

10.2.2. Permanence

Each alternative was evaluated for permanence and the details of the evaluation are presented in Table 12. The evaluation and comparative analysis of alternatives for permanence is summarized below.

Each of the 10 alternatives utilize different combinations of the retained remedial technologies to achieve a moderate to high degree of permanence. Each of the ten alternatives implement full removal in SMA-2, -3, and -6 and no action in SMA-4 and therefore, in these areas of the Site the permanence benefits are comparable. The relative differences in the benefit scoring for permanence are the result of differences between the technologies implemented in SMA-1, -5 and -7.

Alternatives 1 through 5 are generally similar to Alternatives 6 through 10 with the exception of the technologies implemented in SMA-5 and the dredged material disposal approach. Alternatives 1 through 5 implement full removal in SMA-5 and assume that the dredged material is disposed at a permitted off-site landfill. Alternatives 6 through 10 implement containment/CDF technologies in SMA-5, which results in containment of the in-place contamination located in SMA-5 and provides for the disposal of dredged material removed from the other SMAs within the CDF. Contaminated media contained and disposed within the CDF will remain on Site, even though removed from the exposure pathways, and therefore, Alternatives 6 through 10 result in lower permanent reduction in the volume of contaminated media at the Site as compared to Alternative 1 through 5. As a result of the greater permanent reduction of volume at the Site, Alternatives 1 through 5 received increased benefit scores for permanence as compared to Alternatives 6 through 10.

- **Alternative 1 (6.5) and Alternative 6 (6.0)** – Alternative 1 utilizes MNR in SMAs-1 (1a through 1d) and -7. MNR relies on natural recovery processes and restoration timeframe to meet the cleanup standards where permanent reduction of mobility, toxicity and volume of contaminated media is expected to happen over time. Therefore, Alternative 1 is scored low (6.5). Alternative 6 utilizes the same degree of MNR as Alternative 1 however, the relative permanence score is lower for Alternative 6 (6.0) due to the lower reduction in volume of contaminated media at the Site resulting from the implementation of containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 1 and 6 are presented in Table 12.
- **Alternative 2 (7.0) and Alternative 7 (6.5)** – Alternative 2 implements MNR in SMA-1a and ENR in SMAs-1b, -1c, -1d and -7. Due to the placement of clean sand to enhance natural recovery processes, ENR is expected to reduce the timeframe required for permanent reduction of mobility, toxicity and volume of contaminated media in SMAs-1b, -1c, -1d and -7 as compared to MNR, which is implemented in these SMAs as part of Alternative 1. As a result of the reduced area relying on MNR, Alternative 2 is scored higher (7.0) than Alternative 1 (6.5). Alternative 7 utilizes the same degree of MNR and ENR as Alternative 2 however, the relative permanence score is lower for Alternative 7 (6.5) due to the lower reduction in volume of contaminated media at the Site resulting from the implementation of containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 2 and 7 are presented in Table 12.
- **Alternative 3 (7.5) and Alternative 8 (7.0)** – Alternative 3 implements MNR in SMA-1a, ENR in SMAs-1b, -1c and -7 and dynamic sand capping in SMA-1d. Dynamic sand capping will result in a

reduction in mobility of the contaminated media located in SMA-1d. Dynamic sand capping does not immediately reduce toxicity and volume of contaminated media but prevents exposure through isolation. Due to reduction in mobility and prevention of exposure to contaminated media located in SMA-1d through dynamic sand capping, Alternative 3 scores higher (7.5) than Alternative 2 (7.0). Alternative 8 utilizes the same degree of MNR, ENR and dynamic sand capping as Alternative 3 however, the relative permanence score is lower for Alternative 8 (7.0) due to the lower reduction in volume of contaminated media at the Site resulting from the implementation of containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 3 and 8 are presented in Table 12.

- **Alternative 4 (8.0) and Alternative 9 (7.5)** – Alternative 4 implements MNR in SMA-1a, ENR in SMAs-1b, -1c and -7 and full removal in SMA-1d. Full removal will result in immediate reduction in mobility, toxicity and volume of contaminated media located in SMA-1d. Due to immediate reduction in mobility, toxicity and volume of contaminated media located in SMA-1d through full removal, Alternative 4 scores higher (8.0) than Alternative 3 (7.5). Alternative 9 utilizes the same degree of MNR, ENR and removal as Alternative 4 however, the relative permanence score is lower for Alternative 9 (7.5) due to the lower reduction in volume of contaminated media at the Site resulting from the implementation of containment/CDF technology as described above. Additional details for the evaluation of Alternatives 4 and 9 are presented in Table 12.
- **Alternative 5 (8.5) and Alternative 10 (8.0)** – Alternative 5 implements ENR in SMA-1a, -1b, and -1c, full removal in SMA-1d and a combination of full removal and backfilling in SMA-7. In comparison to Alternative 4, a higher degree of permanence is achieved in Alternative 5 by use of ENR in SMA-1a and full removal and backfilling in SMA-7, and as a result, Alternative 5 is scored higher (8.5) than Alternative 4 (8.0). Alternative 10 utilizes the same degree of ENR and removal as Alternative 5 however, the relative permanence score is lower for Alternative 10 (8.0) due to the lower reduction in volume of contaminated media at the Site resulting from the implementation of containment/CDF technology as described above. Additional details for the evaluation of Alternatives 5 and 10 are presented in Table 12.

10.2.3. Long-term Effectiveness

Each alternative was evaluated for long-term effectiveness and the details of the evaluation are presented in Table 12. The evaluation and comparative analysis between alternatives for long-term effectiveness is summarized below.

Each of the 10 alternatives utilizes different combinations of the retained remedial technologies to achieve a moderate to high degree of long-term effectiveness. Each of the ten alternatives implement full removal in SMAs-2, -3, and -6 and no action in SMA-4 and therefore, in these areas of the Site the long-term effectiveness is comparable. The relative differences in the benefit scoring for long-term effectiveness are the result of differences between the technologies implemented in SMAs-1, -5 and -7.

Alternatives 1 through 5 are generally similar to Alternatives 6 through 10 with the exception of the technologies implemented in SMA-5 and the dredged material disposal approach. Alternatives 1 through 5 implement full removal in SMA-5 and assume that the dredged material is disposed at a permitted off-site landfill. Alternatives 6 through 10 implement containment/CDF technologies in SMA-5, which results in containment of the in-place contamination located in SMA-5 and provides for the disposal of dredged material removed from the other SMAs within the CDF. The potential for failure of the containment/CDF is recognized for Alternatives 6 through 10 and results in a reduction of long-term effectiveness benefits relative to Alternatives 1 through 5, even though the risk will be managed to the maximum degree practicable by engineering the structure to perform its containment function and completing long-term monitoring and maintenance of the structure over time.

- **Alternative 1 (7.0) and Alternative 6 (6.5) –** Alternative 1 utilizes MNR in SMA-1 (1a through 1d) and -7. MNR utilizes natural recovery processes to reduce the existing risks. The exposure risk to contamination will remain in SMAs where MNR is implemented until the cleanup standards are achieved over the restoration timeframe. Moreover, there is also a risk that MNR may not meet cleanup standards within the reasonable restoration timeframe, which reduces the degree of certainty for success. Therefore, Alternative 1 is scored low (7.0) for long-term effectiveness. Alternative 6 utilizes the same degree of MNR as Alternative 1 however, the relative long-term effectiveness score is lower for Alternative 6 (6.5) due to risks associated with containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 1 and 6 are presented in Table 12.
- **Alternative 2 (7.0) and Alternative 7 (6.5) –** Alternative 2 implements MNR in SMA-1a and ENR in SMAs-1b, 1c, 1d and 7. Both Alternative 1 and 2 implement remedial technologies in SMA-1 and -7 that rely on natural attenuation processes to meet cleanup standards and therefore long-term effectiveness score for Alternative 2 (7.0) is same as Alternative 1 (7.0). Alternative 7 utilizes the same degree of MNR and ENR as Alternative 2 however, the relative long-term effectiveness score is lower for Alternative 7 (6.5) due to risks associated with containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 2 and 7 are presented in Table 12.
- **Alternative 3 (7.5) and Alternative 8 (7.0) –** Alternative 3 implements MNR in SMA-1a, ENR in SMAs-1b, -1c and -7 and dynamic sand capping in SMA-1d. Dynamic sand capping acts to lower risks by isolating contaminated media from marine environment and meets cleanup standards following placement. Dynamic sand capping scores higher for long-term effectiveness as compared to ENR, which is implemented in SMA-1d as part of Alternative 2, due the placement of a larger mass of sand to isolate contaminated media. ENR involves placement of a smaller mass of sand to promote natural attenuation. Therefore, Alternative 3 is scored higher (7.5) than Alternative 2 (7.0). Alternative 8 utilizes the same degree of MNR, ENR and dynamic sand capping as Alternative 3 however, the relative long-term effectiveness score is lower for Alternative 8 (7.0) due to risks associated with containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 3 and 8 are presented in Table 12.
- **Alternative 4 (8.0) and Alternative 9 (7.5) –** Alternative 4 implements MNR in SMA-1a, ENR in SMA-1b, -1c and -7 and full removal in SMA-1d. Unlike dynamic sand capping, which is implemented in SMA-1d as part of Alternative 3, full removal does not leave contamination in place thereby, reducing long-term risks as compared to dynamic sand capping in SMA-1d. Therefore, Alternative 4 scores higher (8.0) than Alternative 3 (7.5). Alternative 9 utilizes the same degree of MNR, ENR and removal as Alternative 4 however, the relative long-term effectiveness score is lower for Alternative 9 (7.5) due to risks associated with containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 4 and 9 are presented in Table 12.
- **Alternative 5 (8.5) and Alternative 10 (8.0) –** Alternatives 5 implements ENR in SMA-1a, -1b, and -1c, full removal in SMA-1d and a combination of full removal and backfilling in SMA-7. In comparison to Alternative 4, a higher degree of certainty for success and long-term effectiveness is achieved in Alternative 5 by use of ENR in SMA-1a and full removal and backfilling in SMA-7, and as a result,

Alternative 5 is scored higher (8.5) than Alternative 4 (8.0). Alternative 10 utilizes the same degree of ENR and removal as Alternative 5 however, the relative long-term effectiveness score is lower for Alternative 10 (8.0) due to risks associated with containment/CDF technology, as described above. Additional details for the evaluation of Alternatives 5 and 10 are presented in Table 12.

10.2.4. Management of Short-term Risks

Each alternative was evaluated for the management of short-term risks and the details of the evaluation are presented in Table 12. The evaluation and comparative analysis between alternatives for the management of short-term risks is summarized below.

The construction methods proposed are common and used for sediment remediation with moderate risks that can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. Each alternative consists of full removal of contaminated media within the active navigational areas and adjacent to Port infrastructure at the Site and therefore, pose a risk to the integrity of the existing structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure for construction. Short-term risks associated with the construction of the structures at the Site are comparable between alternatives because each of the alternatives involves the same or comparable structural elements. For example, short-term risks associated with the construction of upland retaining wall as part of Alternatives 1 through 5 are generally comparable to short-term risks associated with the construction of containment/CDF wall as part of Alternatives 6 through 10. The relative benefit scores for the management of short-term risks range from moderate to high.

- **Alternatives 1 (7.5), 2(7.0), 3 (6.5), 4(6.0) and 5 (5.5)** – Alternative 5 will result in the highest quantity of contaminated material transported off Site and clean material imported on Site which increases the short-term risks associated with transport of material including accidental spills/releases, traffic impacts, and construction delays due to capacity limitations on transportation and landfill disposal. As a result, Alternative 5 is scored lowest (5.5) relative to the other alternatives for the short-term risk category. Alternatives 4, 3, 2, and 1 are scored incrementally higher than Alternative 5 as they involve incrementally lower quantities of materials import and export due to the differences in technologies applied in SMAs 1, 5 and 7 which result in incremental lowering short-term risks. Additional details for the evaluation of Alternatives 1 through 5 are presented in Table 12.
- **Alternatives 6 (9.5), 7 (9.0), 8 (8.5), 9 (8.0) and 10 (7.5)** – Alternative 6 will result in lowest quantity of material transported and imported due to its reliance on CDF disposal, and therefore, the above-mentioned short-term risks will be lowest as compared to other alternatives and this alternative is scored highest (9.5). Alternatives 7, 8, 9 and 10 also utilize CDF disposal and are scored incrementally lower than Alternative 6 as they involve incrementally higher quantities of materials import and export due to the differences in technologies applied in SMAs 1, 5 and 7 which result in incremental increases in short-term risk. Additional details for the evaluation of Alternatives 6 through 10 are presented in Table 12.

10.2.5. Technical and Administrative Implementability

Each alternative was evaluated for technical and administrative implementability and the details of the evaluation are presented in Table 12. The evaluation and comparative analysis between alternatives for technical and administrative implementability is summarized below.

Administrative implementability is expected to be similar among the alternatives and will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. Achieving acceptance from stakeholders and permitting agencies will require coordination during planning, permitting and design phases of the project.

The criterion of technical and administrative implementability considers the availability of necessary off-site facilities, services and materials. Alternatives 1 through 5 rely significantly on off-site landfill facility and transportation services to manage and dispose contaminated dredged material volumes ranging from 424,520 to 519,310 tons. The schedule and sequence challenges associated with potential capacity limitations on transportation and landfill disposal may require the construction to be phased over multiple years and multiple transportation and landfill alternatives may be necessary to minimize disruptions to throughput continuity. Conversely, for Alternatives 6 through 10 the reliance on off-site landfill facility and transportation services is significantly reduced due to the use of the on-site CDF for disposal of contaminated dredged material with a volume ranging from 1,770 to 96,560 tons. Due to lower volume of contaminated dredged material requiring management and disposal at an off-site facility, the technical implementability challenges associated with capacity limitations on transportation and landfill disposal are expected to be lower for Alternatives 6 through 10 as compared to Alternatives 1 through 5 and the relative benefits for the alternatives are scored accordingly.

Alternatives 4, 5, 9 and 10 receive decreased relative benefit scores for the implementability because they require more risky construction methods due to lower precision to complete dredging in the deep-water areas at the Site. Dredging in deep water conditions poses an increased risk for inaccurate or incomplete removal and residual contamination residuals due to lower precision performance of dredging equipment.

- **Alternatives 1 (8.5) and 6 (9.5)** – Alternatives 6 receives the highest score (9.5) for implementability as this alternative implements less complex MNR in deep-water areas of the Site, in addition to its low reliance on off-site facilities and services, as described above. MNR does not involve active construction but rather relies on monitoring natural recovery processes, and therefore, can be implemented with limited challenges. Alternative 1 is generally similar to Alternative 6 and implements MNR in deep-water areas of the Site. However, due to higher reliance on off-Site facilities and services, as described above, Alternative 1 is scored lower (8.5) than Alternative 6 (9.5). Additional details for the evaluation of Alternatives 1 and 6 are presented in Table 12.
- **Alternatives 2 (8.0) and 7 (9.0)** – Alternative 7 receives a lower score (9.0) as compared to Alternative 6 (9.5) because Alternative 7 implements ENR in deep-water SMAs-1b, 1c and 1d where Alternative 6 implements MNR. The placement of ENR sand in deep water column is not expected to pose significant technical challenges since sand placed for ENR purposes does not require a precision operation as discussed in Section 8.2. However, as compared to MNR, which does not involve active construction, technical challenges associated with the placement of ENR sand are higher. Alternative 2 is generally similar to Alternative 7 and implements ENR in deep-water SMAs-1b, 1c and 1d. However, due to higher reliance on off-Site facilities and services, as described above, Alternative 2 is scored lower (8.0) than Alternative 7 (9.0). Additional details for the evaluation of Alternatives 2 and 7 are presented in Table 12.
- **Alternatives 3 (7.5) and 8 (8.5)** – Alternative 8 implements dynamic sand capping in deep-water SMA-1d where Alternative 7 implements ENR. The placement of dynamic sand cap material in deep water column of SMA-1d is not expected to pose significant technical challenges since dynamic sand

cap placement does not require a precision operation as discussed in Section 8.2. However, as compared to ENR, which involves placement of a smaller mass of sand (6-inch-thick equivalent) to promote natural attenuation, dynamic sand capping poses higher technical challenges associated with the placement of a larger mass of sand (3-foot thick equivalent) to cover and isolate contaminated media. Therefore, Alternative 8 is scored lower (8.5) than Alternative 7 (9.0). Alternative 3 uses dynamic sand capping in deep-water areas of the Site, similar to Alternative 8; however, due to higher on off-site facilities and services, as described above, Alternative 3 is scored lower (7.5) than Alternative 8 (.5). Additional details for the evaluation of Alternatives 3 and 8 are presented in Table 12.

- **Alternatives 4 (6.5) and 9 (7.5) –** Alternative 9 implements full removal in deep-water areas of the Site where Alternative 8 implements dynamic sand capping. Unlike dynamic sand capping, full removal in deep water conditions poses significant challenges for accurate and complete removal. Therefore, Alternative 9 is scored lower (7.5) than Alternative 8 (8.5). Alternative 4 uses full removal in deep-water areas of the Site, similar to Alternative 9; however, due to higher reliance on off-site facilities and services, as described above, Alternative 4 is scored lower (6.5) than Alternative 9 (7.5). Additional details for the evaluation of Alternatives 4 and 9 are presented in Table 12.
- **Alternatives 5 (6.0) and 10 (7.0) –** Alternative 10 implements more complex remedial technologies in SMA-1a and -7 as compared to Alternative 9 and therefore, has greater potential for implementability challenges. Alternative 10 implements ENR in SMA-1a, where Alternative 9 implements MNR. Alternative 10 implements a combination of full removal and backfilling in SMA-7, where Alternative 9 implements ENR. Therefore, Alternative 10 is scored lower (7.0) than Alternative 9 (7.5). Alternative 5 utilizes the same degree of ENR and full removal as Alternative 10; however, due to higher reliance on off-site facilities and services, as described above, Alternative 5 is scored lower (6.0) than Alternative 10 (7.0). Additional details for the evaluation of Alternatives 5 and 10 are presented in Table 12.

10.2.6. Consideration of Public Concerns

Public concerns are not yet known as the RI/FS has not been subject to public review. For the purposes of completing this RI/FS for public review, it is assumed that protectiveness is the greatest public concern and therefore, the score for protectiveness is considered in developing the score for the consideration of public concerns. It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. These additional considerations are also used to establish the benefits score for consideration of public concerns. The relative benefit scores for the public concern criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS. The benefit scores for the public concern criterion for Alternatives 1 through 10 are described below.

- **Alternatives 1 (6.5), 2 (7.0), 3 (7.5), 4 (7.5) and 5 (8.5) –** The scores for protectiveness criterion were modified lower in developing the scores for this criterion for Alternatives 1 through 5 due to the potential for public concerns regarding traffic and noise disturbances and the potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highways. All of the contaminated dredged material generated in these alternatives will be transported off-site by trucks on public streets and/or highways since this alternative solely relies on the use of off-site landfill facilities for the disposal of contaminated dredged material.

- **Alternatives 6 (7.5), 7 (8.0), 8 (8.5), 9 (8.5) and 10 (9.5)** – The scores under the consideration of public concerns criterion for Alternatives 6 through 10 are same as the scores under the protectiveness criterion. Unlike Alternatives 1 through 5, the protectiveness scores were not modified because Alternatives 6 through 10 do not raise to the same level, the public concerns regarding traffic and noise disturbances and the potential exposure to contaminated material resulting from accidental release during transportation due to the use of the containment/CDF, which enables majority of contaminated dredged material generated from these alternatives to be disposed on Site in the CDF.

10.2.7. Cost

Remedial alternative costs were developed consistent with the requirements of WAC 173-340-360(3)(f)(iii) for the DCA analysis and are detailed in Section 9.11. The total costs estimated for alternatives are listed below, rounded to the nearest $100,000:

- **Alternative 1** – $230.9 million
- **Alternative 2** – $233.1 million
- **Alternative 3** – $238.8 million
- **Alternative 4** – $243.7 million
- **Alternative 5** – $258.0 million
- **Alternative 6** – $201.9 million
- **Alternative 7** – $204.0 million
- **Alternative 8** – $209.8 million
- **Alternative 9** – $214.7 million
- **Alternative 10** – $229.0 million

10.3. Disproportionate Cost Analysis – Remedial Alternatives Relative Benefit-to-Cost Ratios

In accordance with Section 10.1.3 above, a relative benefit-to-cost ratio is used to compare the remedial alternatives to determine whether costs are disproportionate to benefits. The relative benefit-to-cost ratio for each alternative is calculated by dividing the total weighted relative benefit score by the cost. Alternatives whose incremental benefits are disproportionate to the incremental cost produce lower benefit-to-cost ratios. The remedial alternative with the highest benefit to-cost-ratio is permanent to the maximum extent practicable.

Table 13 and Figure 127 present the total weighted relative benefit score for each alternative calculated using the raw benefit score and respective weighting factor for each criterion. Also presented in Table 13, and in Figure 127, are the costs for each alternative and the relative benefit-to-cost ratio.

The total weighted relative benefit scores for the alternatives range from 7.1 (Alternative 1) to 8.5 (Alternative 10) as shown on Table 13, and Figure 127. The relatively close range of benefits is the result of the similarity in remedial technologies implemented in SMA-2, -3, -4 and -6 as part of each alternative. The range of benefits is achieved by the range of remedial technologies implemented in SMA-1, -5 and -7 as part of each alternative. The relatively close range in benefit score also reflects that all alternatives meet the minimum requirements of MTCA and SMS and use technologies that achieve relatively similar levels of protectiveness, permanence and long-term effectiveness (i.e., the most heavily weighted criteria) as described below.

Under MTCA and SMS, costs must be considered when selecting the alternative that is permanent to the maximum extent practicable. As described in Section 10.2.7, the estimated costs for the ten alternatives range from $201.9 million (Alternative 6) to $258.0 million (Alternative 5). In accordance with MTCA, “costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of lower cost alternative” (WAC 173-340-360[3][e][i]). Graphically, this concept is illustrated in Figure 127 by comparing the benefit-to-cost ratios, as expressed by the formula:

$$Benefit/Cost\ Ratio = Total\ Weighted\ Relative\ Benefit\ Score\ \div (Cost \div \$201.9\ Million)$$

The cost for each alternative was normalized to the cost of the lowest cost alternative to generate a range of values similar to the range of the total benefit scores and avoid benefit to cost ratios with a millionth decimal place.

The resulting benefit-to-cost ratios for the ten alternatives are shown in Table 13 and plotted in Figure 127 with the corresponding values for the total weighted relative benefit scores and cost. Alternative 8 has the highest benefit-to-cost ratio (7.60) and Alternative 1 has the lowest (6.16) benefit-to-cost ratio. Although the total weighted relative benefit scores for Alternatives 5, 9 and 10 are marginally higher than the total weighted relative benefit score for Alternative 8, the incremental cost required to achieve the marginally higher benefits for Alternatives 5, 9 and 10 are disproportionate, as indicated by the respective benefit-to-cost ratios. Therefore, Alternatives 5, 9 and 10 are disproportionately more costly relative to Alternative 8 and not considered to be practicable. Alternatives 1, 2, 3, 4, 6 and 8 provide lower benefits than Alternative 8, but also have lower benefit-to-cost ratios (range of 6.16 to 7.52), indicating that Alternative 8 is also not disproportionately costly relative to these alternatives.

Based on this analysis, Alternative 8 is identified to be permanent to the maximum extent practicable.

10.4. Indian Tribes, Vulnerable Populations and Overburdened Communities

Pursuant to the requirements of WAC 173-340-351, WAC 173-340-360 and WAC 173-340-370, remedial alternatives were also evaluated for their possible effects on Indian Tribes, vulnerable populations, and overburdened communities.

10.4.1. Identification of Potentially Affected Indian Tribes and Likely Vulnerable Populations and Overburdened Communities

Indian Tribes potentially interested in, or affected by the cleanup action were initially identified based on the proximity of their reservation lands, traditional ceded lands, hunting areas, and usual and accustomed (U&A) fishing grounds and stations to the Site, as well as by use of the Department of Archeology and Historic Preservation (DAHP) Map of Tribal Areas of Interest. These Indian Tribes included the Tulalip Tribes, Suquamish Tribe, Swinomish Indian Tribal Community, Stillaguamish Tribe of Indians, Snoqualmie Indian Tribe, Sauk-Suiattle Indian Tribe, and Muckleshoot Indian Tribe. Engagement with these Indian Tribes consistent with WAC 173-340-620 confirmed the final list of Indian Tribes considered in this Site-specific analysis, and include the Tulalip Tribes and the Suquamish Tribe, both of which are signatories to the 1855 Treaty of Point Elliott. Additionally, the Tulalip Tribes and the Suquamish Tribe serve as the Tribal trustees for assessment and restoration of natural resource damages for the Port Gardner area under the CERCLA, MTCA, Chapter 90.48 RCW, the federal Clean Water Act, and the federal Oil Pollution Act of 1990. Possible impacts specific to these two Indian Tribes were evaluated primarily through review of information related to their exercise of tribal Treaty rights, reserved rights, and activities and measures identified from the Washington Department of Health (DOH) Environmental Health Disparities (EHD) Mapping Tool[10].

Likely vulnerable populations and overburdened communities potentially affected by the Site and/or cleanup action were identified using the EHD Mapping Tool and the EPA Environmental Justice Screening and Mapping Tool (EJScreen[11]). In accordance with Ecology's Implementation Memorandum No. 25 (Ecology 2024), a vulnerable population or overburdened community has the potential to be exposed if any one of the following three criteria is met in census tracts located at the Site or along transportation routes used for the cleanup action:

- The potentially exposed population is located in a census tract that ranks a 9 or 10 on the EHD Index from the EHD Map.
- The potentially exposed population is located in a census tract that is at or above the 80th Washington State percentile of the Demographic Index from EJScreen.
- The potentially exposed population is located in a census tract that is at or above the 80th Washington State percentile of the Supplemental Demographic Index from EJScreen.

Likely vulnerable populations and overburdened communities potentially affected by the cleanup action were evaluated using the EHD Index from the EHD Map, and the Demographic Index and Supplemental Demographic Index from EJScreen. Census tract information regarding EHD, Demographic and Supplemental Demographic Indexes for areas potentially affected by the Site and/or cleanup action and potential transportation routes are shown in Figures T-1 through T-3 (Appendix T). An analysis of the potential impacts to potentially affected Indian Tribes and likely vulnerable populations and overburdened communities is further discussed below in Sections 10.4.2 and 10.4.3.

10.4.2. Analysis of Potential Impacts to Potentially Affected Indian Tribes

The Marine Area portion of the Site lies within the U&A of multiple Tribes. Because the Marine Area lies significantly waterward of the historical shoreline, it is not expected that submerged Tribal cultural resources will be encountered as part of the chosen remedy. However, the selected remedy will include an Inadvertent Discovery Plan (IDP) consistent with WAC 173-340-815.

Each of the remedial alternatives evaluated (Sections 10.2) are considered to have similar post-construction benefits related to tribal consumption of fish and shellfish at the Site. Each alternative would remediate sediment contamination to concentrations which meet human health cleanup levels protective of seafood consumption. The calculation of these levels utilized the SMS default reasonable maximum exposure (RME) scenario (WAC 173-204-561(2)(b)), which is based on a tribal exposure scenario (Sections 3.3.4.2 and 9.2 of SCUM). It is assumed that potential exposures at the Site, through fishing activities will not exceed the RME and therefore are considered protective of fishing activities by Indian

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[10] Washington Environmental Health Disparities Map – https://fortress.wa.gov/doh/wtnibl/WTNIBL/

[11] EPA Environmental Justice Screening and Mapping Tool (EJScreen) – https://www.epa.gov/ejscreen

Tribes. Other benefits of the alternatives were considered uniform because land use is expected to remain the same for the foreseeable future. Additionally, the intertidal area adjacent to the public access area at the south end of the Site will remain accessible following the cleanup.

Current land use is assumed to remain unchanged, therefore impacts under each alternative are likely to be the same. Impacts to the Tulalip Tribes and the Suquamish Tribe were also evaluated for construction impacts and post-construction effects. Specifically:

- Alternatives 1 through 5 were determined to primarily impact tribal communities through emissions from off-Site truck and rail transportation of contaminated material. Net impacts from emissions due to off-Site truck and rail transportation for disposal are greater for Alternatives 1 through 5 as compared to Alternatives 6 through 10. This is the result of the increased volume of contaminated material requiring transportation off-Site for disposal and the resulting emissions as compared to on-site disposal which will not require the same level of off-Site transportation. To the extent Tribal members live in the vicinity of the offsite disposal transportation routes, they would be impacted in the same manner as described below for vulnerable populations and overburdened communities (see Section 10.4.3). Some emissions will be generated as part of importing materials for the construction of the CDF under Alternatives 6 through 10. However, the number of truck and rail loads is expected to be significantly lower than what will be required for the offsite disposal.
- Each alternative will have impacts on tribal interests from the loss of aquatic habitat. Such impacts can be mitigated on or off-Site, however the type and location of the mitigation will be determined as part of the federal permitting process for the cleanup action.

It is anticipated that additional information regarding Tribal interests will be gathered through government-to-government consultation and public notice and comment associated with the federal permitting process. The lead federal agency is expected to be the USACE. Any information shared with the State prior to implementation of the selected cleanup action will be considered.

10.4.3. Analysis of Potential Impacts to Likely Vulnerable Populations and Overburdened Communities

Impacts and benefits to vulnerable populations and overburdened communities were evaluated for construction impacts, post-construction effects, and land use impacts. Census tract information for areas potentially affected by the Site and/or cleanup action (including potential transportation routes) have an EHD Index rank of 7 or higher (Figure T-1; Appendix T) and has a Washington State Demographic Index and Supplemental Demographic Index at or greater than the 80th percentile for diesel emissions from EJScreen (Figure T-2 and T-3; Appendix T). This census tract information indicates that potentially exposed vulnerable populations or overburdened communities are along transportation routes in accordance with Ecology Implementation Memorandum No. 25. Because County tax records indicate that parcels immediately adjacent to or overlooking the Site are either uninhabited industrial (e.g., railroad right of way) or affluent (high value residential), this report assumes that these areas do not contain vulnerable populations and overburdened communities. As such, analysis of construction benefits and impacts was limited to transportation routes.

Because it is assumed the alternatives will require varying degrees of truck transport for import of construction materials and export of materials for upland disposal of contaminated material, truck traffic was utilized as the metric for gauging impacts to vulnerable populations and overburdened communities. Specifically, DOH and EPA health maps were consulted to identify communities along potential haul routes that experience higher impacts from diesel emissions (Figures T-1 through T-3; Appendix T). Alternatives 1 through 5 were determined to have a greater net impact to vulnerable populations and overburdened communities due to diesel emissions from off-Site truck and rail transportation for disposal as compared to Alternatives 6 through 10. This is the result of the increased volume of contaminated material requiring transportation off-Site as compared to the on-Site disposal of the contaminated material within the CDF. As indicated above, it is assumed that some emissions will be generated for the import of materials to construction of the CDF. However, the number of truck and rail loads is expected to be significantly lower than what will be required for the off-Site disposal.

All remedial alternatives were considered to have similar post-construction benefits for vulnerable populations and overburdened communities related to subsistence fishing and shellfish harvesting. Each alternative would remediate sediment contamination to concentrations which meet human health cleanup levels protective of seafood consumption. Calculation of these cleanup levels utilized the SMS default RME scenario (WAC 173-204-561(2)(b)), which is based on a tribal exposure scenario. The cleanup values are therefore considered protective of fishing activities by vulnerable populations and overburdened communities since their potential exposure, through fishing, can reasonably be assumed to be less than the RME Other land use benefits and impacts were determined to be neutral for all alternatives because overall land use is not anticipated to change.

10.5. Preferred Marine Area Remedial Alternative

Remedial Alternative 8 will meet cleanup standards through a combination of full removal, containment/CDF, dynamic sand capping, and enhanced and monitored natural recovery. The estimated cost is $209.8 million. At the completion of construction of Alternative 8, cleanup standards will be met in the areas where full removal is implemented, and marginal exceedances will remain in the remaining parts of the Marine Area. Through natural recovery and distribution of dynamic sand cap, the marginal exceedances are expected to attenuate or become isolated within a 10-year restoration timeframe to levels where the cleanup standards are met throughout the Marine Area.

Remedial Alternative 8 meets the minimum requirements for sediment cleanup actions (WAC 173-204-570(3)), as described in Section 10.0 and Table 11. The minimum requirements are summarized below:

- Protect human health and the environment;
- Comply with all applicable laws;
- Comply with sediment cleanup standards;
- Use permanent solutions to the maximum extent practicable;
- Provide a reasonable restoration timeframe;
- Implement effective source controls;
- Provide for permanent cleanup action where technically feasible;
- Provide an opportunity for review and comment by affected landowners and the general public;
- Include long-term monitoring to ensure remedy effectiveness; and
- Provide periodic review of remedy effectiveness.

With regard to the minimum requirement to use permanent solutions to the maximum extent practicable, this was evaluated through the DCA process described in Section 10.2 and presented in Tables 13 and Figure 127. The DCA compared benefits and costs for all alternatives and determined that Alternative 8 has the highest degree of benefit without disproportionate costs and therefore, is permanent to the maximum extent practicable and is the preferred remedial alternative for the Marine Area of the Site.

11.0 NEXT STEPS IN THE CLEANUP PROCESS

This RI/FS will be made available for a public review period. Once public review comments on the RI/FS are received, the document will be finalized. Ecology will then select a cleanup action for the Marine Area based on the information in the RI/FS. The selected cleanup action will be described in a CAP and will be issued for public review along with the draft legal agreement for the design and implementation of the CAP. Following approval of the CAP, permitting and design of the cleanup action will be completed, including preparation of an Engineering Design Report (EDR) for Ecology review and approval. A remedial design investigation of the Marine Area is anticipated to further refine the extent of contamination and remedial action approach. The cleanup action will be implemented when the design is approved by Ecology and project permits are received. Work is expected to be conducted over multiple years within the allowable in-water work windows. Monitoring and periodic review of the Marine Area will be completed following completion of construction.

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TABLES

GeoEngineers

Table 1

Schedule of Laboratory Analysis for Sediment Investigations

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]	Sample Identification	Date Sampled	Sample Interval	Sample Type	Conventional Analyses[2]								Chemical Analyses[2]																Bioassay[3]
					TOC	TVS	TS	Total Ammonia	Porewater Ammonia	Total Sulfides	Porewater Sulfides	Grain Size	TBT	Metals	LPAHs	HPAHs	cPAHs	Chlorinated Hydrocarbons	Phthalates	Phenols	Miscellaneous Extractables	PCB Aroclors	PCB Congeners	Dioxin-Like PCB Congeners	Dioxins and Furans	Chlorinated Phenols, Guaiacols, Resin Acids	Pesticides	Herbicides	
2007 Former Mill A Sediment Investigation (Geomatrix 2007)																													
ST-02	13116000038	05/14/07	5 - 6 ft	Subsurface	●		●								●	●	●	●	●	●	●								
ST-03	13116000004	05/07/07	3.5 - 6.2 ft	Subsurface	●		●								●	●	●	●	●	●	●								
	13116000006	05/07/07	14 - 15.9 ft	Subsurface	●		●								●	●	●	●	●	●	●								
ST-05	13116000007	05/07/07	0.9 - 2.5 ft	Subsurface																					●				
ST-08	13116000029	05/11/07	7.3 - 10.5 ft	Subsurface	●		●								●	●	●	●	●	●	●								
ST-09	13116000019	05/08/07	10.1 - 12 ft	Subsurface																					●				
ST-11	13116000010	05/07/07	0 - 6.2 ft	Subsurface	●		●								●	●	●	●	●	●	●								
ST-14	13116000021	05/08/07	3.4 - 4.6 ft	Subsurface	●		●								●	●	●	●	●	●	●								
	13116000023	05/08/07	9.4 - 10.5 ft	Subsurface	●		●								●	●	●	●	●	●	●								
ST-15	13116000013	05/07/07	0.8 - 2.2 ft	Subsurface																					●				
ST-17	13116000037	05/14/07	5.9 - 7.1 ft	Subsurface																					●				
ST-20	13116000014	05/07/07	9.9 - 11.2 ft	Subsurface	●		●								●	●	●	●	●	●	●								
	13116000015	05/07/07	14 - 15.5'	Subsurface	●		●								●	●	●	●	●	●	●								
ST-21	13116000027	05/11/07	9.1 - 11.2 ft	Subsurface	●		●								●	●	●	●	●	●	●								
ST-24	13116000100	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
	13116000101	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
ST-29	13116000103	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
ST-30	13116000102	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
ST-32	13116000104	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
ST-34	13116000105	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
	13116000025	05/09/07	0 - 2.8 ft	Subsurface	●		●							●	●	●	●	●	●	●	●	●							
ST-37	13116000106	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
ST-39	13116000107	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
	13116000033	05/14/07	0 - 4 ft	Subsurface	●		●							●	●	●	●	●	●	●	●	●							
ST-42	13116000108	05/15/07	0 - 10 cm	Surface	●		●							●	●	●	●	●	●	●	●	●							
ST-43	13116000031	05/11/07	5.7 - 7.2 ft	Subsurface	●		●								●	●	●	●	●	●	●								
2007 Whidbey Basin Sediment Investigation (Ecology 2013a)																													
SP-151	7234276	06/12/07	0 - 30 cm	Subsurface	●							●		●	●	●	●	●	●	●	●	●							
	7234277	06/12/07	0 - 30 cm	Subsurface	●							●		●	●	●	●	●	●	●	●	●							
2008 Port Gardner and Lower Snohomish Estuary Sediment Investigation (SAIC 2009)																													
A1-15	A1-15-S	08/01/08	0 - 10 cm	Surface	●	●	●			●		●	●	●	●	●	●	●	●	●	●	●							
	A1-15-C1-3	08/13/08	1 - 3 ft	Subsurface	●	●	●			●		●		●	●	●	●	●	●	●	●	●							
	A1-15-C3-5	08/13/08	3 - 5 ft	Subsurface	●	●	●			●		●		●	●	●	●	●	●	●	●	●							
A1-18	A1-18-S	09/04/08	0 - 10 cm	Surface	●	●	●			●		●		●	●	●	●	●	●	●	●	●			●				
	A1-18-C1-3	08/14/08	1 - 3 ft	Subsurface	●	●	●			●		●		●	●	●	●	●	●	●	●	●							
	A1-18-C3-5	08/14/08	3 - 5 ft	Subsurface	●	●	●			●		●		●	●	●	●	●	●	●	●	●							

Sample Location[1]	Sample Identification	Date Sampled	Sample Interval	Sample Type	Conventional Analyses[2]								Chemical Analyses[2]																Bioassay[3]
					TOC	TVS	TS	Total Ammonia	Porewater Ammonia	Total Sulfides	Porewater Sulfides	Grain Size	TBT	Metals	LPAHs	HPAHs	cPAHs	Chlorinated Hydrocarbons	Phthalates	Phenols	Miscellaneous Extractables	PCB Aroclors	PCB Congeners	Dioxin-Like PCB Congeners	Dioxins and Furans	Chlorinated Phenols, Guaiacols, Resin Acids	Pesticides	Herbicides	
A1-23	A1-23-S	08/04/08	0 - 10 cm	Surface	●	●	●			●		●		●	●	●	●	●	●	●	●	●							
A1-24	A1-24-S	09/04/08	0 - 10 cm	Surface	●	●	●			●		●		●	●	●	●	●	●	●	●	●			●				
	A1-24-C1-3	09/04/08	1 - 3 ft	Subsurface	●	●	●			●		●		●	●	●	●	●	●	●	●	●			●				
	A1-24-C3-5	08/14/08	3 - 5 ft	Subsurface	●	●	●			●		●		●	●	●	●	●	●	●	●	●							
A1-31	A1-31-S	08/04/08	0 - 10 cm	Surface	●	●	●			●																			
A1-31B	A1-31B-S	09/04/08	0 - 10 cm	Surface	●	●	●			●		●		●	●	●	●	●	●	●	●	●			●				
2012 Port Gardner and East Waterway Sediment Investigation (Ecology 2013b)																													
EW-12-05	EPAX019F24	06/19/12	0 - 17 cm	Surface	●	●	●	●		●		●		●	●	●	●	●	●	●	●	●			●				
EW-12-06	NAVHP85EDS404XX	06/19/12	0 - 17 cm	Surface	●	●	●	●		●		●		●	●	●	●	●	●	●	●	●			●				
EW-12-07	BNWS008DBPS28	06/19/12	0 - 17 cm	Surface	●	●	●	●		●		●		●	●	●	●	●	●	●	●	●			●				
2014 Port Gardner Bay Regional Background Sediment Investigation (Ecology 2014)																													
PG-62	RB14-PG-62-S	04/22/14	0 - 10 cm	Surface	●	●								●			●					●			●				
2015 Pacific Terminal Dredged Material Characterization (GeoEngineers 2016)																													
PT-3	PT-3-43.0-44.0	01/13/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-5	PT-5-43.0-44.0	01/13/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-6	PT-6-43.0-44.0	01/13/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-8	PT-8-43.0-44.0	01/12/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-10	PT-10-36.0-37.0	01/14/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-11	PT-11-36.0-37.0	01/15/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-12	PT-12-30.0-31.0	01/15/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-13	PT-13-29.0-30.0	01/15/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
PT-14	PT-14-29.0-30.0	01/15/15	0 - 1 ft	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●				
2018 South Terminal Dredged Material Characterization (GeoEngineers 2018)																													
ST-101	ST-101S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1A	10/23/18	0 - 2.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1B	10/23/18	2.2 - 4.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1C	10/23/18	4.2 - 6.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1D	10/23/18	6.2 - 7.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1 Keyway	10/23/18	7.2 - 13.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-101C_13.2-14.2	10/23/18	13.2 - 14.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-102	ST-102S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1A	10/23/18	0 - 2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1B	10/23/18	2 - 4 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1C	10/23/18	4 - 5.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-102C_6.3-7.3	10/23/18	6.3 - 7.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-102C_7.3-8.3	10/23/18	7.3 - 8.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-102C_9.3-10.3	10/23/18	9.3 - 10.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-103	ST-103S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1A	10/23/18	0 - 3.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1B	10/23/18	3.7 - 5.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1C	10/23/18	5.7 - 7.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1D	10/23/18	7.7 - 9.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		

Sample Location[1]	Sample Identification	Date Sampled	Sample Interval	Sample Type	Conventional Analyses[2]								Chemical Analyses[2]																	Bioassay[3]
					TOC	TVS	TS	Total Ammonia	Porewater Ammonia	Total Sulfides	Porewater Sulfides	Grain Size	TBT	Metals	LPAHs	HPAHs	cPAHs	Chlorinated Hydrocarbons	Phthalates	Phenols	Miscellaneous Extractables	PCB Aroclors	PCB Congeners	Dioxin-Like PCB Congeners	Dioxins and Furans	Chlorinated Phenols, Guaiacols, Resin Acids	Pesticides	Herbicides	
ST-103	DMMU-1E	10/23/18	9.7 - 11.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1F	10/23/18	11.7 - 13.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-104	ST-104S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1A	10/26/18	0 - 2.1 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1B	10/26/18	2.1 - 4.1 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1C	10/26/18	4.1 - 6.1 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1D	10/26/18	6.1 - 6.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-104C_7.3-8.3	10/26/18	7.3 - 8.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-104C_8.3-9.3	10/26/18	8.3 - 9.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-104C_10.3-11.3	10/26/18	10.3 - 11.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-105	ST-105S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1A	10/26/18	0 - 2.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1B	10/26/18	2.2 - 4.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1C	10/26/18	4.1 - 6.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1D	10/26/18	6.2 - 6.8 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1 Keyway	10/26/18	6.8 - 10.8 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-105C_11-12	10/26/18	11 - 12 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-106	ST-106S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1A	10/26/18	0 - 1.7 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-106C_3.1-4.1	10/26/18	3.1 - 4.1 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-106C_4.1-5.1	10/26/18	4.1 - 5.1 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-106C_6.1-7.1	10/26/18	6.1 - 7.1 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-107	ST-107S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1A	10/25/18	0 - 1.9 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1B	10/25/18	1.9 - 3.9 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-1C	10/25/18	3.9 -4.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-107C_4.2-5.2	10/25/18	4.2 -5.2 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-107C_9.3-10.3	10/25/18	9.3 - 10.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-108	ST-108S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-2D	10/25/18	6.2 - 6.6 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-108C_6.6-7.6	10/25/18	6.6 - 7.6 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-108C_8.6-9.6	10/25/18	8.6 - 9.6 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
ST-109	ST-109S_0-10	10/24/18	0 - 10 cm	Surface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	DMMU-2D	10/25/18	7.4 - 9.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-109C_8.3-9.3	10/25/18	8.3 - 9.3 ft	Subsurface	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
	ST-109C_11.3-12.3	10/25/18	11.3 - 12.3 ft	Subsurface	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●		●	●	●		●		
2015-2018 Marine Area Remedial Investigation																													
MAF-01	MAF-SS-01_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●		●			
	MAF-SS-DUP-01	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●					●			
	MAF-SC-01_0-2	11/11/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-DUP-01	11/11/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●								
	MAF-SC-01_2-4	11/11/15	2 - 4 ft	Subsurface																						●			

Sample Location[1]	Sample Identification	Date Sampled	Sample Interval	Sample Type	Conventional Analyses[2]								Chemical Analyses[2]																	Bioassay[3]
					TOC	TVS	TS	Total Ammonia	Porewater Ammonia	Total Sulfides	Porewater Sulfides	Grain Size	TBT	Metals	LPAHs	HPAHs	cPAHs	Chlorinated Hydrocarbons	Phthalates	Phenols	Miscellaneous Extractables	PCB Aroclors	PCB Congeners	Dioxin-Like PCB Congeners	Dioxins and Furans	Chlorinated Phenols, Guaiacols, Resin Acids	Pesticides	Herbicides	
MAF-01	MAF-SC-01_4-6	11/11/15	4 - 6 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-01_20-22	11/11/15	20 - 22 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-DUP-02	11/11/15	20 - 22 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
MAF-02	MAF-SS-02_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●				●	●			
	MAF-SC-02_0-2	11/10/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●								
	MAF-SC-02_2-4	11/10/15	2 - 4 ft	Subsurface																						●			
	MAF-SC-02_4-6	11/10/15	4 - 6 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-02_20-22	11/10/15	20 - 22 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-DUP-10	11/10/15	20 - 22 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
MAF-03	MAF-SS-03_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●		●			
	MAF-SC-03_0-2	11/11/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-DUP-03	11/11/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-03_2-4	11/11/15	4 - 6 ft	Subsurface																						●			
	MAF-SC-03_4-6	11/11/15	4 - 6 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-03_8-10	11/11/15	8 - 10 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-03_21-23	11/11/15	21 - 23 ft	Subsurface	●	●	●							●	●	●		●	●	●	●		●	●					
MAF-04	MAF-SS-04_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●		●			
	MAF-SC-04_0-2	10/26/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-DUP-05	10/26/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●					●			
	MAF-SC-04_2-4	10/26/15	2 - 4 ft	Subsurface																						●			
	MAF-SC-DUP-06	10/26/15	2 - 4 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●		●	●		●			
	MAF-SC-04_4-6	10/26/15	4 - 6 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-04_8-10	10/26/15	8 - 10 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-04_16-18	11/10/15	16 - 18 ft	Subsurface	●	●	●								●	●	●			●	●		●	●					
MAF-05	MAF-SS-05_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-05_0-2	11/11/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-05_4-6	11/11/15	4 - 6 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-05_12-14	11/11/15	12 - 14 ft	Subsurface	●	●	●								●					●	●		●	●					
MAF-07	MAF-SS-07_0-10	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●					
MAF-08	MAF-SS-08_0-10	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●								
	MAF-SS-DUP-02	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●								
MAF-09	MAF-SS-09_0-10	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●					
MAF-10	MAF-SS-10_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				●
	MAF-SC-10_0-2	10/29/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-DUP-07	10/29/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-10_6-7.6	10/29/15	6 - 7.6 ft	Subsurface	●	●	●								●	●	●			●	●								
MAF-11	MAF-SS-11_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-11_0-2	10/28/15	0 - 2 ft	Subsurface	●	●	●	●		●		●		●	●	●	●	●	●	●	●								●
	MAF-SC-11_2-4	10/28/15	2 - 4 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●		●	●					
	MAF-SC-11_6-8	10/28/15	6 - 8 ft	Subsurface	●	●	●								●	●	●			●	●		●	●					
MAF-12	MAF-SS-12_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				●
	MAF-SC-12_0-2	10/28/15	0 - 2 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								

					Conventional Analyses[2]								Chemical Analyses[2]																
Sample Location[1]	Sample Identification	Date Sampled	Sample Interval	Sample Type	TOC	TVS	TS	Total Ammonia	Porewater Ammonia	Total Sulfides	Porewater Sulfides	Grain Size	TBT	Metals	LPAHs	HPAHs	cPAHs	Chlorinated Hydrocarbons	Phthalates	Phenols	Miscellaneous Extractables	PCB Aroclors	PCB Congeners	Dioxin-Like PCB Congeners	Dioxins and Furans	Chlorinated Phenols, Guaiacols, Resin Acids	Pesticides	Herbicides	Bioassay[3]
MAF-12	MAF-SC-12_2-4	10/28/15	2 - 4 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●		●	●					
MAF-13	MAF-SS-13_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
MAF-14	MAF-SS-14_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
MAF-15	MAF-SS-15_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●		●		
	MAF-SC-15_0-2	10/28/15	0 - 2 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-DUP-08	10/28/15	0 - 2 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
MAF-16	MAF-SS-16_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
MAF-17	MAF-SS-17_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●								
MAF-18	MAF-SS-18_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●								
MAF-19	MAF-SS-19_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
MAF-20	MAF-SS-20_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				●
	MAF-SC-20_1-2	10/29/15	1 - 2 ft	Subsurface	●	●	●								●	●	●			●	●		●	●					
MAF-21	MAF-SS-21_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				●
	MAF-SS-DUP-04	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-21_0-1	10/29/15	0 - 1 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-DUP-09	10/29/15	0 - 1 ft	Subsurface	●	●	●					●		●	●	●	●	●	●	●	●								
	MAF-SC-21_2-4	10/29/15	2 - 4 ft	Subsurface	●	●	●																●	●					
MAF-22	MAF-SS-22_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●			●	●	●			●	●		●	●	●				●
MAF-23	MAF-SS-23_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●									●								
MAF-24	MAF-SS-24_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●					
MAF-25	MAF-SS-25_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
MAF-26	MAF-SS-26_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●					
MAF-27	MAF-SS-27_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
MAF-28	MAF-SS-28-0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●																	
	MAF-SS-DUP-05	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●																	
MAF-29	MAF-SS-29_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●																	
MAF-30	MAF-SS-30_0-10	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●																	
	MAF-SS-DUP-03	10/21/15	0 - 10 cm	Surface	●	●	●		●		●	●																	
MAF-31	MAF-SS-31-0-10	10/19/15	0 - 10 cm	Surface	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●			●	●				●
MAF-32	MAF-SS-32_0-10	10/19/15	0 - 10 cm	Surface	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		●	●	
MAF-33	MAF-SS-33_0-10	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●								
	MAF-SS-DUP-06	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●		●	●	●				
MAF-34	MAF-SS-34_0-10	10/20/15	0 - 10 cm	Surface	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		●		
MAF-35	MAF-SS-35_0-10	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●			●	●	●				●		●	●	●				●
MAF-36	MAF-SS-36_0-10	10/19/15	0 - 10 cm	Surface	●	●	●		●		●	●		●	●	●	●	●	●	●	●		●	●	●				
MAF-37	MAF-SS-37_0-10	09/13/16	0 - 10 cm	Surface	●	●	●		●		●						●			●				●	●				
MAF-38	MAF-SS-38_0-10	09/13/16	0 - 10 cm	Surface	●	●	●		●		●						●			●				●	●				
	MAF-DUP-07	09/13/16	0 - 10 cm	Surface	●	●	●		●		●						●			●				●	●				
MAF-39	MAF-SS-39_0-10	09/13/16	0 - 10 cm	Surface													●												
	MAF-DUP-08	09/13/16	0 - 10 cm	Surface													●												
MAF-40	MAF-SS-40_0-10	09/13/16	0 - 10 cm	Surface													●								●				
MAF-41	MAF-SS-41_0-10	09/13/16	0 - 10 cm	Surface													●												

Sample Location[1]	Sample Identification	Date Sampled	Sample Interval	Sample Type	Conventional Analyses[2]								Chemical Analyses[2]																	Bioassay[3]
					TOC	TVS	TS	Total Ammonia	Porewater Ammonia	Total Sulfides	Porewater Sulfides	Grain Size	TBT	Metals	LPAHs	HPAHs	cPAHs	Chlorinated Hydrocarbons	Phthalates	Phenols	Miscellaneous Extractables	PCB Aroclors	PCB Congeners	Dioxin-Like PCB Congeners	Dioxins and Furans	Chlorinated Phenols, Guaiacols, Resin Acids	Pesticides	Herbicides	
MAF-42	MAF-SS-42_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-43	MAF-SS-43_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-44	MAF-SS-44_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-45	MAF-SS-45_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-46	MAF-SS-46_0-10	09/14/16	0 - 10 cm	Surface													●							●					
MAF-47	MAF-SS-47_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-48	MAF-SS-48_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-49	MAF-SS-49_0-10	09/14/16	0 - 10 cm	Surface													●							●	●				
MAF-50	MAF-SS-50_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-51	MAF-SS-51_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-52	MAF-SS-52_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-53	MAF-SS-53_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-54	MAF-SS-54_0-10	09/14/16	0 - 10 cm	Surface													●												
MAF-55	MAF-SS-55_0-10	11/13/18	0 - 10 cm	Surface													●								●				
MAF-56	MAF-SS-56_0-10	11/13/18	0 - 10 cm	Surface	●	●	●		●		●			●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-56_0-2	11/12/18	0 - 2 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-DUP-07	11/12/18	0 - 2 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-56_2-4	11/12/18	2 - 4 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
MAF-57	MAF-SS-57_0-10	11/14/18	0 - 10 cm	Surface	●	●	●		●		●			●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-57_0-2	11/13/18	0 - 2 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-57_2-4	11/13/18	2 - 4 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
MAF-58	MAF-SS-58_0-10	11/14/18	0 - 10 cm	Surface	●	●	●		●		●			●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-58_2-4	11/13/18	2 - 4 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
MAF-59	MAF-SS-59_0-10	11/14/18	0 - 10 cm	Surface	●	●	●		●		●			●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-59_2-4	11/12/18	2 - 4 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-59_6-8	11/12/18	6 - 8 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-59_10-12	11/12/18	10 - 12 ft	Subsurface										●											●				
MAF-60	MAF-SS-60_0-10	11/14/18	0 - 10 cm	Surface	●	●	●		●		●			●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-60_4-6	11/12/18	4 - 6 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
	MAF-SC-60_8-10	11/12/18	8 - 10 ft	Subsurface	●	●	●	●		●				●	●	●	●	●	●	●	●		●	●	●				
MAF-61	MAF-SS-61_0-10	11/14/18	0 - 10 cm	Surface													●								●				
	MAF-SS-DUP-11	11/14/18	0 - 10 cm	Surface													●								●				
2021 Marine Area Remedial Investigation																													
MAF-62	EDP62_0.0-1.0	04/27/21	0 - 1 ft	Subsurface													●								●				
	EDP62_2.0-3.0	04/27/21	2 - 3 ft	Subsurface													●								●				
MAF-63	EDP63_0.0-1.0	04/27/21	0 - 1 ft	Subsurface										●											●				
	EDP63_2.0-3.0	04/27/21	2 - 3 ft	Subsurface										●											●				
MAF-64	EDP64_0.0-1.0	04/27/21	0 - 1 ft	Subsurface										●											●				
	EDP64_2.0-3.0	04/27/21	2 - 3 ft	Subsurface										●											●				
MAF-65	EDP65_0.0-1.0	04/27/21	0 - 1 ft	Subsurface										●											●				
	EDP65_2.0-3.0	04/27/21	2 - 3 ft	Subsurface										●											●				

Notes:

[1] Surface (0 - 10 cm) sediment sample locations are shown in Figures 10 through 12.

[2] Laboratory results are summarized in Tables 6 and 7.

[3] Bioassay results are summarized in Table 6.

[4] Z-layer sediment sample collected during the dredged material characterization study represents the exposed sediment surface following dredging as part the of the Former Mill A Interim Action.

cm = centimeters

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

ft = feet

HPAHs = high molecular weight polycyclic aromatic hydrocarbons

LPAHs = low molecular weight polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

TBT = tributyltin

TOC = total organic carbon

TS = total solids

TVS = total volatile solids

● = Sample collected and submitted for laboratory analysis.

Table 2

Sediment Cleanup Levels for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Analyte	CAS Number	Units	Criteria for the Protection of Benthic Organisms				Preliminary Sediment Cleanup Levels for the Protection of Benthic Organisms[3]	
			Sediment Management Standard[1] (SMS)		Apparent Effects Threshold (AET) Criteria[2]			
			Sediment Cleanup Objective (SCO)	Cleanup Screening Level (CSL)	Lowest AET (LAET)	Second Lowest AET (2LAET)	SCO/ LAET	CSL/ 2LAET
Metals								
Arsenic	7440-38-2	mg/kg	57	93	57	93	57	93
Cadmium	7440-43-9	mg/kg	5.1	6.7	5.1	6.7	5.1	6.7
Chromium	16065-83-1	mg/kg	260	270	260	270	260	270
Copper	7440-50-8	mg/kg	390	390	390	390	390	390
Lead	7439-92-1	mg/kg	450	530	450	530	450	530
Mercury	7439-97-6	mg/kg	0.41	0.59	0.41	0.59	0.41	0.59
Silver	7440-22-4	mg/kg	6.1	6.1	6.1	6.1	6.1	6.1
Zinc	7440-66-6	mg/kg	410	960	410	960	410	960
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)								
Sum of LPAHs[4]	n/a	mg/kg OC	370	780	--	--	370	780
2-Methylnaphthalene	91-57-6	mg/kg OC	38	64	--	--	38	64
Acenaphthene	83-32-9	mg/kg OC	16	57	--	--	16	57
Acenaphthylene	208-96-8	mg/kg OC	66	66	--	--	66	66
Anthracene	120-12-7	mg/kg OC	220	1,200	--	--	220	1,200
Fluorene	86-73-7	mg/kg OC	23	79	--	--	23	79
Naphthalene	91-20-3	mg/kg OC	99	170	--	--	99	170
Phenanthrene	85-01-8	mg/kg OC	100	480	--	--	100	480
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)								
Sum of LPAHs[4]	n/a	µg/kg	--	--	5,200	5,200	5,200	5,200
2-Methylnaphthalene	91-57-6	µg/kg	--	--	670	670	670	670
Acenaphthene	83-32-9	µg/kg	--	--	500	500	500	500
Acenaphthylene	208-96-8	µg/kg	--	--	1,300	1,300	1,300	1,300
Anthracene	120-12-7	µg/kg	--	--	960	960	960	960
Fluorene	86-73-7	µg/kg	--	--	540	540	540	540
Naphthalene	91-20-3	µg/kg	--	--	2,100	2,100	2,100	2,100
Phenanthrene	85-01-8	µg/kg	--	--	1,500	1,500	1,500	1,500

Analyte	CAS Number	Units	Criteria for the Protection of Benthic Organisms: Sediment Management Standard[1] (SMS): Sediment Cleanup Objective (SCO)	Criteria for the Protection of Benthic Organisms: Sediment Management Standard[1] (SMS): Cleanup Screening Level (CSL)	Criteria for the Protection of Benthic Organisms: Apparent Effects Threshold (AET) Criteria[2]: Lowest AET (LAET)	Criteria for the Protection of Benthic Organisms: Apparent Effects Threshold (AET) Criteria[2]: Second Lowest AET (2LAET)	Preliminary Sediment Cleanup Levels for the Protection of Benthic Organisms[3]: SCO/ LAET	Preliminary Sediment Cleanup Levels for the Protection of Benthic Organisms[3]: CSL/ 2LAET
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)								
Sum of HPAHs[5]	n/a	mg/kg OC	960	5,300	--	--	960	5,300
Benzo(a)anthracene	56-55-3	mg/kg OC	110	270	--	--	110	270
Benzo(a)pyrene	50-32-8	mg/kg OC	99	210	--	--	99	210
Benzo[b]fluoranthene	205-99-2	mg/kg OC	--	--	--	--	NE	NE
Benzo[k]fluoranthene	207-08-9	mg/kg OC	--	--	--	--	NE	NE
Benzofluoranthenes[6] (Total)	n/a	mg/kg OC	230	450	--	--	230	450
Benzo(g,h,i)perylene	191-24-2	mg/kg OC	31	78	--	--	31	78
Chrysene	218-01-9	mg/kg OC	110	460	--	--	110	460
Dibenzo(a,h)anthracene	53-70-3	mg/kg OC	12	33	--	--	12	33
Fluoranthene	206-44-0	mg/kg OC	160	1,200	--	--	160	1,200
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg OC	34	88	--	--	34	88
Pyrene	129-00-0	mg/kg OC	1,000	1,400	--	--	1,000	1,400
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)								
Sum of HPAHs[5]	n/a	µg/kg	--	--	12,000	17,000	12,000	17,000
Benzo(a)anthracene	56-55-3	µg/kg	--	--	1,300	1,600	1,300	1,600
Benzo(a)pyrene	50-32-8	µg/kg	--	--	1,600	1,600	1,600	1,600
Benzo[b]fluoranthene	205-99-2	µg/kg	--	--	--	--	NE	NE
Benzo[k]fluoranthene	207-08-9	µg/kg	--	--	--	--	NE	NE
Benzofluoranthenes[6] (Total)	n/a	µg/kg	--	--	3,200	3,600	3,200	3,600
Benzo(g,h,i)perylene	191-24-2	µg/kg	--	--	670	720	670	720
Chrysene	218-01-9	µg/kg	--	--	1,400	2,800	1,400	2,800
Dibenzo(a,h)anthracene	53-70-3	µg/kg	--	--	230	230	230	230
Fluoranthene	206-44-0	µg/kg	--	--	1,700	2,500	1,700	2,500
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	--	--	600	690	600	690
Pyrene	129-00-0	µg/kg	--	--	2,600	3,300	2,600	3,300
Chlorinated Hydrocarbons (OC Normalized)								
1,2,4-Trichlorobenzene	120-82-1	mg/kg OC	0.81	1.8	--	--	0.81	1.8
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	mg/kg OC	2.3	2.3	--	--	2.3	2.3
1,3-Dichlorobenzene	541-73-1	mg/kg OC	--	--	--	--	NE	NE
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	mg/kg OC	3.1	9.0	--	--	3.1	9.0
Hexachlorobenzene	118-74-1	mg/kg OC	0.38	2.3	--	--	0.38	2.3

Analyte	CAS Number	Units	Criteria for the Protection of Benthic Organisms: Sediment Management Standard[1] (SMS): Sediment Cleanup Objective (SCO)	Cleanup Screening Level (CSL)	Apparent Effects Threshold (AET) Criteria[2]: Lowest AET (LAET)	Second Lowest AET (2LAET)	Preliminary Sediment Cleanup Levels for the Protection of Benthic Organisms[3]: SCO/ LAET	CSL/ 2LAET
Chlorinated Hydrocarbons (Dry Weight)								
1,2,4-Trichlorobenzene	120-82-1	µg/kg	--	--	31	51	31	51
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	µg/kg	--	--	35	50	35	50
1,3-Dichlorobenzene	541-73-1	µg/kg	--	--	--	--	NE	NE
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	µg/kg	--	--	110	110	110	110
Hexachlorobenzene	118-74-1	µg/kg	--	--	22	70	22	70
Phthalates (OC Normalized)								
Bis(2-Ethylhexyl) Phthalate	117-81-7	mg/kg OC	47	78	--	--	47	78
Butyl benzyl Phthalate	85-68-7	mg/kg OC	4.9	64	--	--	4.9	64
Dibutyl Phthalate	84-74-2	mg/kg OC	220	1,700	--	--	220	1,700
Diethyl Phthalate	84-66-2	mg/kg OC	61	110	--	--	61	110
Dimethyl Phthalate	131-11-3	mg/kg OC	53	53	--	--	53	53
Di-N-Octyl Phthalate	117-84-0	mg/kg OC	58	4,500	--	--	58	4,500
Phthalates (Dry Weight)								
Bis(2-Ethylhexyl) Phthalate	117-81-7	µg/kg	--	--	1,300	1,900	1,300	1,900
Butyl Benzyl Phthalate	85-68-7	µg/kg	--	--	63	900	63	900
Dibutyl Phthalate	84-74-2	µg/kg	--	--	1,400	1,400	1,400	1,400
Diethyl Phthalate	84-66-2	µg/kg	--	--	200	>1,200	200	>1,200
Dimethyl Phthalate	131-11-3	µg/kg	--	--	71	160	71	160
Di-N-Octyl Phthalate	117-84-0	µg/kg	--	--	6,200	6,200	6,200	6,200
Phenols (Dry Weight)								
2,4-Dimethylphenol	105-67-9	µg/kg	29	29	29	29	29	29
2-Methylphenol (o-Cresol)	95-48-7	µg/kg	63	63	63	63	63	63
4-Methylphenol (p-Cresol)	106-44-5	µg/kg	670	670	670	670	670	670
Pentachlorophenol	87-86-5	µg/kg	360	690	360	690	360	690
Phenol	108-95-2	µg/kg	420	1,200	420	1,200	420	1,200
Miscellaneous Extractables (OC Normalized)								
Dibenzofuran	132-64-9	mg/kg OC	15	58	--	--	15	58
Hexachlorobutadiene	87-68-3	mg/kg OC	3.9	6.2	--	--	3.9	6.2
N-Nitrosodiphenylamine (as Diphenylamine)	86-30-6	mg/kg OC	11	11	--	--	11	11

Analyte	CAS Number	Units	Criteria for the Protection of Benthic Organisms: Sediment Management Standard[1] (SMS): Sediment Cleanup Objective (SCO)	Criteria for the Protection of Benthic Organisms: Sediment Management Standard[1] (SMS): Cleanup Screening Level (CSL)	Criteria for the Protection of Benthic Organisms: Apparent Effects Threshold (AET) Criteria[2]: Lowest AET (LAET)	Criteria for the Protection of Benthic Organisms: Apparent Effects Threshold (AET) Criteria[2]: Second Lowest AET (2LAET)	Preliminary Sediment Cleanup Levels for the Protection of Benthic Organisms[3]: SCO/ LAET	Preliminary Sediment Cleanup Levels for the Protection of Benthic Organisms[3]: CSL/ 2LAET
Miscellaneous Extractables (Dry Weight)								
Dibenzofuran	132-64-9	µg/kg	--	--	540	540	540	540
Hexachlorobutadiene	87-68-3	µg/kg	--	--	11	120	11	120
N-Nitrosodiphenylamine (as Diphenylamine)	86-30-6	µg/kg	--	--	28	40	28	40
Benzoic Acid	65-85-0	µg/kg	--	--	650	650	650	650
Benzyl Alcohol	100-51-6	µg/kg	--	--	57	73	57	73
Polychlorinated Biphenyls (PCBs) (OC Normalized)								
Total PCBs (Total for Aroclors or Congeners)	1336-36-3	mg/kg OC	12	65	--	--	12	65
Polychlorinated Biphenyls (PCBs) (Dry Weight)								
Total PCBs (Total for Aroclors or Congeners)	1336-36-3	µg/kg	--	--	130	1,000	130	1,000

Notes:

[1] Sediment Management Standards (SMS; Washington Administrative Code [WAC] Chapter 173-204).

[2] Apparent Effects Threshold (AET) Criteria from Ecology's SCUM guidance (Table 8-1; Ecology 2021).

[3] The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[4] Total LPAHs are the total of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene and anthracene; 2-methylnapthalene is not included in the sum of LPAHs.

[5] Total HPAHs are the total of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

-- = Criterion not applicable or not available

µg/kg = microgram per kilogram

2LAET = Second Lowest Apparent Effects Threshold

CSL = Cleanup Screening Level

LAET = Lowest Apparent Effects Threshold

mg/kg = milligram per kilogram

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

n/a = not available

NE = not established

SCO = Sediment Cleanup Objective

Table 3

Sediment Cleanup Levels for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Analyte	CAS Number	Units	Criteria for the Protection of Human Health								PQL[5]	Preliminary Sediment Cleanup Levels for the Protection of Human Health and Higher Trophic Level Ecological Receptors[6,7,8]	
			Direct Contact via Beach Play[1]		Direct Contact via Clamming[1]		Direct Contact via Net Fishing[1]		Bioaccumulation via Consumption of Aquatic Organisms[2]				
			Carcinogenic (at 10^{-6} risk)	Non-Carcinogenic	Carcinogenic (at 10^{-6} risk)	Non-Carcinogenic	Carcinogenic (at 10^{-6} risk)	Non-Carcinogenic	Natural Background[3]	Regional Background[4]		Intertidal Sediment (Above -3 ft MLLW)	Subtidal Sediment (Below -3 ft MLLW)
Metals													
Arsenic	7440-38-2	mg/kg	2.0	80	0.80	360	1.8	830	11	12	5.0	12	12
Cadmium	7440-43-9	mg/kg	--	110	--	530	--	1,200	0.8	0.52	0.2	0.8	0.8
Chromium (as Chromium III)	16065-83-1	mg/kg	--	25,000	--	150,000	--	400,000	--	--	0.5	25,000	400,000
Copper	7440-50-8	mg/kg	--	8,000	--	38,000	--	90,000	--	--	0.2	8,000	90,000
Lead	7439-92-1	mg/kg	--	--	--	--	--	--	21	--	2.0	21	21
Mercury (as Mercuric Chloride)	7487-94-7	mg/kg	--	20	--	140	--	300	0.2	0.14	0.05	0.2	0.2
Silver	7440-22-4	mg/kg	--	200	--	1,400	--	4,000	--	--	0.3	200	4,000
Zinc	7440-66-6	mg/kg	--	60,000	--	280,000	--	700,000	--	--	1.0	60,000	700,000
Organometallic Compounds													
Tributyltin Ion (Bulk Sediment)	56-35-9	µg/kg	--	18	--	100	--	260	73[9]	--	3.9	73	73
Tributyltin Ion (Interstitial Water)	56-35-9a	µg/L	--	--	--	--	--	--	0.15[9]	--	0.0052	0.15	0.15
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)													
2-Methylnaphthalene	91-57-6	mg/kg	--	320	--	1,800	--	4,500	--	--	0.005	320	4,500
Acenaphthene	83-32-9	mg/kg	--	4,800	--	27,000	--	67,000	--	--	0.005	4,800	67,000
Acenaphthylene	208-96-8	mg/kg	--	4,800	--	26,600	--	67,300	--	--	0.005	4,800	67,300
Anthracene	120-12-7	mg/kg	--	24,000	--	130,000	--	340,000	--	--	0.005	24,000	340,000
Fluorene	86-73-7	mg/kg	--	3,200	--	18,000	--	40,000	--	--	0.005	3,200	40,000
Naphthalene	91-20-3	mg/kg	--	1,600	--	8,900	--	22,000	--	--	0.005	1,600	22,000
Phenanthrene	85-01-8	mg/kg	--	24,000	--	133,000	--	336,000	--	--	0.005	24,000	336,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)													
Benzo(a)anthracene	56-55-3	mg/kg	--	--	--	--	--	--	--	--	0.005	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	50-32-8	mg/kg	0.9	20	0.44	130	1.1	340	--	--	0.005	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes[10] (Total)	n/a	mg/kg	--	--	--	--	--	--	--	--	0.005	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	191-24-2	mg/kg	--	--	--	--	--	--	--	--	0.005	See cPAH TEQ	See cPAH TEQ
Chrysene	218-01-9	mg/kg	--	--	--	--	--	--	--	--	0.005	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--	--	--	--	--	--	--	--	0.005	See cPAH TEQ	See cPAH TEQ
Fluoranthene	206-44-0	mg/kg	--	3,200	--	18,000	--	45,000	--	--	0.005	3,200	45,000
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--	--	--	--	--	--	--	--	0.005	See cPAH TEQ	See cPAH TEQ
Pyrene	129-00-0	mg/kg	--	2,400	--	13,000	--	30,000	--	--	0.005	2,400	30,000
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)													
Total cPAHs - TEQ	see Benzo(a)pyrene	mg/kg	0.9	20	0.440	130	1.12	340	0.021	0.056	0.005	0.056	0.056

Analyte	CAS Number	Units	Criteria for the Protection of Human Health								PQL[5]	Preliminary Sediment Cleanup Levels for the Protection of Human Health and Higher Trophic Level Ecological Receptors[6,7,8]	
			Direct Contact via Beach Play[1]		Direct Contact via Clamming[1]		Direct Contact via Net Fishing[1]		Bioaccumulation via Consumption of Aquatic Organisms[2]				
			Carcinogenic (at 10^{-6} risk)	Non-Carcinogenic	Carcinogenic (at 10^{-6} risk)	Non-Carcinogenic	Carcinogenic (at 10^{-6} risk)	Non-Carcinogenic	Natural Background[3]	Regional Background[4]		Intertidal Sediment (Above -3 ft MLLW)	Subtidal Sediment (Below -3 ft MLLW)
Chlorinated Hydrocarbons													
1,2,4-Trichlorobenzene	120-82-1	mg/kg	90	2,300	38	11,000	88	26,000	--	--	0.2	38	88
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	mg/kg	--	21,000	--	100,000	--	230,000	--	--	0.2	21,000	230,000
1,3-Dichlorobenzene	541-73-1	mg/kg	--	--	--	--	--	--	--	--	0.2	NE	NE
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	mg/kg	500	16,000	200	77,000	474	180,000	--	--	0.2	200	474
Hexachlorobenzene	118-74-1	mg/kg	1.7	190	0.69	880	1.6	2,000	--	--	0.001	0.69	1.6
Phthalates													
Bis(2-Ethylhexyl) Phthalate	117-81-7	mg/kg	51	1,200	24	7,000	60	18,000	--	--	0.05	24	60
Butyl Benzyl Phthalate	85-68-7	mg/kg	370	12,000	180	70,000	460	180,000	--	--	0.02	180	460
Dibutyl Phthalate	84-74-2	mg/kg	--	6,000	--	34,000	--	90,000	--	--	0.02	6,000	90,000
Diethyl Phthalate	84-66-2	mg/kg	--	49,000	--	270,000	--	700,000	--	--	0.02	49,000	700,000
Dimethyl Phthalate	131-11-3	mg/kg	--	--	--	--	--	--	--	--	0.02	NE	NE
Di-N-Octyl Phthalate	117-84-0	mg/kg	--	600	--	3,400	--	9,000	--	--	0.02	600	9,000
Phenols													
2,4-Dimethylphenol	105-67-9	mg/kg	--	1,200	--	7,000	--	18,000	--	--	0.025	1,200	18,000
2-Methylphenol (o-Cresol)	95-48-7	mg/kg	--	3,000	--	17,000	--	44,000	--	--	0.02	3,000	44,000
4-Methylphenol (p-Cresol)	106-44-5	mg/kg	--	6,000	--	30,000	--	90,000	--	--	0.02	6,000	90,000
Pentachlorophenol	87-86-5	mg/kg	1.1	190	0.55	1,100	1.4	2,900	--	--	0.1	0.55	1.4
Phenol	108-95-2	mg/kg	--	18,000	--	100,000	--	260,000	--	--	0.1	18,000	260,000
Miscellaneous Extractables													
Dibenzofuran	132-64-9	mg/kg	--	170	--	800	--	2,000	--	--	0.02	170	2,000
Hexachlorobutadiene	87-68-3	mg/kg	35	230	14	1,100	33	2,600	--	--	0.001	14	33
N-Nitrosodiphenylamine (as Diphenylamine)	86-30-6	mg/kg	140	--	70	--	180	--	--	--	0.02	70	180
Benzoic Acid	65-85-0	mg/kg	--	240,000	--	1,400,000	--	3,500,000	--	--	0.2	240,000	3,500,000
Benzyl Alcohol	100-51-6	mg/kg	--	6,000	--	34,000	--	90,000	--	--	0.02	6,000	90,000
Polychlorinated Biphenyls (PCBs)													
Total PCBs (Aroclors or Congeners)	1336-36-3	mg/kg	0.4	1.4	0.19	7.7	0.49	20	--	--	0.000002	0.19	0.49
Total Dioxin-Like PCB Congeners TEQ	see Total Dioxins/Furans	ng/kg	15	120	6.5	590	16	1,400	0.20	0.38	0.2	0.38	0.38
Dioxins and Furans													
Total Dioxin/Furan TEQ	1746-01-6	ng/kg	17	130	7.6	690	19	17,200	4	3.9	5[11]	5	5

Notes:

[1] Sediment screening levels for the protection of human health via direct contact are calculated using equations and input parameters provided in Ecology's SCUM guidance (Ecology 2021). The toxicity equivalency factors (TEFs) used to calculate the screening levels are from Table 708-1 (chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans congeners) and Table 708-2 (cPAHs) of the Model Toxics Control Act (MTCA) Cleanup regulation (Chapter 173-340 WAC). Non-carcinogenic toxicity values are not currently available for acenaphthylene and phenanthrene and surrogate toxicity values were used for these analytes. The non-carcinogenic toxicity value for acenaphthene was used for acenaphthylene, and anthracene for phenanthrene. Additionally, the non-carcinogenic toxicity value for Aroclor 1254 was used for as a surrogate for total PCBs for Aroclors and PCB congeners. The dermal absorption fractions (ABS) specified by Ecology (in an email from Andy Kallus, Ecology, October 9, 2014) during development of the Work Plan are used for development of the screening levels for arsenic (0.03), PAHs, including cPAHs, LPAHs and HPAHs (0.13), total PCBs (0.14) and pentachlorophenol (0.25). The source of these dermal absorption fractions is Environmental Protection Agency (EPA) Risk Assessment Guidance (RAGs) Part E, Dermal Risk Assessment dated July 2004, Exhibit 3-4. The gastrointestinal absorption conversion factors (GI) specified by Ecology (in an email from Andy Kallus, Ecology, October 9, 2014) during development of the Work Plan are used for development of the screening levels for cadmium (0.025) and chromium (0.013). The source of the gastrointestinal absorption conversion factors is EPA RAGs Part E, Dermal Risk Assessment dated July 2004, Exhibit 4-1.

[2] Bioaccumulative chemicals include arsenic, cadmium, lead, mercury, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), dioxin-like polychlorinated biphenyls (PCBs), and dioxins/furans. Currently site-specific human health and ecological risk-based sediment screening levels have not been developed for bioaccumulative chemicals. Therefore, sediment screening levels for these chemicals are based on the natural background, regional background or the practical quantification limit (PQL), whichever is higher.

[3] Natural background values calculated as the 90/90 Upper Tolerance Limit from Ecology's SCUM guidance (Table 10-1; Ecology 2021).

[4] Regional background values for bioaccumulative compounds in Port Gardner sediment identified by Ecology in the Port Gardner Bay Regional Background Sediment Characterization report. The report identifies regional background values for arsenic, cadmium, mercury, cPAHs and dioxin-like PCBs based on the regional background study for Port Gardner Bay (Table 10-2; Ecology 2021).

[5] PQL values are from Analytical Resources, Inc. of Tukwila, Washington.

[6] The screening levels presented in this table are to provide a preliminary evaluation of human health and ecological risk for higher trophic level ecological receptors. Human health and higher trophic level ecological receptor screening levels are chosen from lowest of bioaccumulative and direct contact pathways. The risk-based value adjusted for the higher of natural background and PQL is the SCO. The risk-based value adjusted for the higher of regional background and PQL is the CSL. The human health screening level for intertidal areas includes marine areas at elevations higher than -3 feet mean lower low water (MLLW) and the applicable direct contact pathways include beach play, clamming and net fishing. The human health screening levels for subtidal areas include marine areas at elevations below -3 feet MLLW and the applicable direct contact pathway is net fishing.

[7] Natural and regional background (natural background/regional background) concentrations are being applied as preliminary cleanup levels. The SCO is the risk-based value adjusted for natural background and PQL, whichever is higher. The CSL is the risk-based value adjusted for regional background and PQL, whichever is higher. Final cleanup levels will be established in the Cleanup Action Plan.

[8] When natural background is greater than the regional background, the natural background concentration is being applied as preliminary cleanup level. Final cleanup levels will be established in the Cleanup Action Plan.

[9] Dredged Material Management Program (DMMP) Marine Guidelines Bioaccumulation Trigger value; from Dredged Material Evaluation and Disposal Procedures User Manual (DMMP User Manual) (Table 8-3; USACE 2021).

[10] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[11] PQL for total dioxin/furan TEQ is the programmatic PQL value from Ecology's SCUM guidance (Table 11-1; Ecology 2021).

-- = Criterion not applicable or not available

μg/kg = microgram per kilogram

μg/L = microgram per liter

mg/kg = milligram per kilogram

ng/kg = nanogram per kilogram

PQL = practical quantitation limit

TEQ = toxic equivalent quotient

Table 4

Proposed Cleanup Levels, Summary Statistics and Evaluation of Contaminants of Concern for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Contaminant of Potential Concern[1] (COPC)	CAS Number	Proposed Sediment Cleanup Level[2]	Units	Evaluation of RI Data Results[3]: Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Non-Detect Concentration	Maximum Detected Concentration	Non-Detect PCUL Exceedance Evaluation: Number of Non-detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)	SCO/AET Exceedance Evaluation[6]: Number of detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)	Contaminant of Concern[6] (COC) (Yes/No)	Comments
Metals																
Arsenic	7440-38-2	57	mg/kg	160	143	89%	40	70	0	n/a	0.7	2	1.3%	1.2	Yes	Retained as a COC
Cadmium	7440-43-9	5.1	mg/kg	160	129	81%	1	2.1	0	n/a	0.2	0	n/a	n/a	No	
Chromium	16065-83-1	260	mg/kg	159	159	100%	n/a	60	0	n/a	n/a	0	n/a	n/a	No	
Copper	7440-50-8	390	mg/kg	159	159	100%	n/a	1040	0	n/a	n/a	1	0.6%	2.7	Yes	Retained as a COC
Lead	7439-92-1	450	mg/kg	159	156	98%	20	176	0	n/a	<0.1	0	n/a	n/a	No	
Mercury	7439-97-6	0.41	mg/kg	158	148	94%	0.06	38.5	0	n/a	0.1	2	1.3%	93.9	Yes	Retained as a COC
Silver	7440-22-4	6.1	mg/kg	159	66	42%	2	0.39	0	n/a	0.3	0	n/a	n/a	No	
Zinc	7440-66-6	410	mg/kg	159	159	100%	n/a	1010	0	n/a	n/a	8	5.0%	2.5	Yes	Retained as a COC
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)																
Total LPAHs[7]	n/a	370	mg/kg OC	168	157	93%	n/a	327	0	n/a	<0.1	30	17.9%	113.4	Yes	LPAHs are retained as COCs based on individual LPAHs and total LPAHs exceeding the SCO/LAET PCUL.
	n/a	5,200	µg/kg				20	589,910								
2-Methylnaphthalene	91-57-6	38	mg/kg OC	168	142	85%	2.5	30	0	n/a	<0.1	23	13.7%	19.4		
	91-57-6	670	µg/kg				20	13,000								
Acenaphthene	83-32-9	16	mg/kg OC	168	140	83%	2.5	51	0	n/a	0.2	32	19.0%	44.0		
	83-32-9	500	µg/kg				20	22,000								
Acenaphthylene	208-96-8	66	mg/kg OC	168	133	79%	2.5	12.5	0	n/a	<0.1	0	n/a	n/a		
	208-96-8	1,300	µg/kg				20	1,200								
Anthracene	120-12-7	220	mg/kg OC	168	139	83%	2.5	24.6	0	n/a	<0.1	9	5.4%	427.1		
	120-12-7	960	µg/kg				20	410,000								
Fluorene	86-73-7	23	mg/kg OC	168	139	83%	2.5	40	0	n/a	0.1	32	19.0%	96.3		
	86-73-7	540	µg/kg				20	52,000								
Naphthalene	91-20-3	99	mg/kg OC	168	153	91%	1.8	130	0	n/a	<0.1	31	18.5%	20.5		
	91-20-3	2,100	µg/kg				20	43,000								
Phenanthrene	85-01-8	100	mg/kg OC	168	151	90%	n/a	80	0	n/a	<0.1	24	14.3%	60		
	85-01-8	1,500	µg/kg				20	90,000								
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)																
Sum of HPAHs[8]	n/a	960	mg/kg OC	165	150	91%	n/a	570	0	n/a	<0.1	5	3.0%	12.3	Yes	HPAHs are retained as COCs based on individual HPAHs and total HPAHs exceeding the SCO/LAET PCUL.
	n/a	12,000	µg/kg				20	147,610								
Benzo(a)anthracene	56-55-3	110	mg/kg OC	168	139	83%	n/a	39.8	0	n/a	0.3	2	1.2%	8.5		
	56-55-3	1,300	µg/kg				340	11,000								
Benzo(a)pyrene	50-32-8	99	mg/kg OC	168	131	78%	n/a	23.6	0	n/a	0.2	2	1.2%	2.4		
	50-32-8	1,600	µg/kg				340	3,900								
Benzo[b]fluoranthene	205-99-2	NE	mg/kg OC	1	0	0%	n/a	n/a	0	n/a	<0.1	0	n/a	n/a		
	205-99-2	NE	µg/kg				n/a	n/a								
Benzo[k]fluoranthene	207-08-9	NE	mg/kg OC	1	0	0%	n/a	n/a	0	n/a	<0.1	0	n/a	n/a		
	207-08-9	NE	µg/kg				n/a	n/a								
Benzofluoranthenes[9] (Total)	n/a	230	mg/kg OC	168	135	80%	n/a	61	0	n/a	0.1	2	1.2%	2.8		
	n/a	3,200	µg/kg				340	8,800								
Benzo(g,h,i)perylene	191-24-2	31	mg/kg OC	165	121	73%	3.4	10.2	0	n/a	0.5	1	0.6%	2.1		
	191-24-2	670	µg/kg				340	1,400								
Chrysene	218-01-9	110	mg/kg OC	168	143	85%	n/a	184	0	n/a	<0.1	4	2.4%	12.1		
	218-01-9	1,400	µg/kg				24	17,000								
Dibenzo(a,h)anthracene	53-70-3	12	mg/kg OC	168	96	57%	4	4.65	2	1.2%	1.5	1	0.6%	1.7		
	53-70-3	230	µg/kg				340	390								
Fluoranthene	206-44-0	160	mg/kg OC	165	149	90%	n/a	130	0	n/a	<0.1	14	8.5%	44.7		
	206-44-0	1,700	µg/kg				20	76,000								
Indeno(1,2,3-c,d)pyrene	193-39-5	34	mg/kg OC	168	127	76%	2.5	11.7	0	n/a	0.6	1	0.6%	2.5		
	193-39-5	600	µg/kg				340	1,500								
Pyrene	129-00-0	1,000	mg/kg OC	165	148	90%	n/a	105	0	n/a	<0.1	5	3.0%	13.8		
	129-00-0	2,600	µg/kg				20	36,000								

Contaminant of Potential Concern[1] (COPC)	CAS Number	Proposed Sediment Cleanup Level[2]	Units	Evaluation of RI Data Results[3]: Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Non-Detect Concentration	Maximum Detected Concentration	Non-Detect PCUL Exceedance Evaluation: Number of Non-detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)	SCO/AET Exceedance Evaluation[6]: Number of detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)	Contaminant of Concern[6] (COC) (Yes/No)	Comments
Chlorinated Hydrocarbons																
1,2,4-Trichlorobenzene	120-82-1	0.81	mg/kg OC	159	16	10%	3.88	0.079	44	27.7%	6.4	2	1.3%	17.1	Yes	Retained as a COC
	120-82-1	31	µg/kg				198	530								
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	2.3	mg/kg OC	159	33	21%	5	0.56	15	9.4%	5.7	1	0.6%	2.7	Yes	Retained as a COC
	95-50-1	35	µg/kg				198	96								
1,3-Dichlorobenzene	541-73-1	NE	mg/kg OC	0	0	n/a	n/a	n/a	0	n/a	<0.1	0	n/a	n/a	No	
	541-73-1	NE	µg/kg				n/a	n/a								
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	3.1	mg/kg OC	159	40	25%	5	0.34	7	4.4%	1.8	0	n/a	n/a	No	Not retained as a COC. Non-detect PCUL exceedances generally observed in areas containing elevated wood content.
	106-46-7	110	µg/kg				198	39								
Hexachlorobenzene	118-74-1	0.38	mg/kg OC	159	4	3%	2.5	0.12	34	21.4%	7.3	1	0.6%	2.7	Yes	Retained as a COC
	118-74-1	22	µg/kg				160	59								
Phthalates																
Bis(2-Ethylhexyl) Phthalate	117-81-7	47	mg/kg OC	159	68	43%	9.68	51.1	0	n/a	0.4	2	1.3%	1.7	Yes	Retained as a COC
	117-81-7	1,300	µg/kg				495	2,200								
Butyl Benzyl Phthalate	85-68-7	4.9	mg/kg OC	159	22	14%	3.88	4.85	4	2.5%	3.1	5	3.1%	10.3	Yes	Retained as a COC
	85-68-7	63	µg/kg				198	650								
Dibutyl Phthalate	84-74-2	220	mg/kg OC	159	28	18%	13.5	30.5	0	n/a	0.5	0	n/a	n/a	No	
	84-74-2	1,400	µg/kg				650	520								
Diethyl Phthalate	84-66-2	61	mg/kg OC	159	34	21%	3.88	7.12	2	1.3%	2.1	1	0.6%	3.9	Yes	Retained as a COC
	84-66-2	200	µg/kg				420	780								
Dimethyl Phthalate	131-11-3	53	mg/kg OC	159	3	2%	3.88	5.7	9	5.7%	9.2	0	n/a	n/a	No	
	131-11-3	71	µg/kg				650	66								
Di-N-Octyl Phthalate	117-84-0	58	mg/kg OC	159	5	3%	3.88	5.03	0	n/a	0.1	0	n/a	n/a	No	
	117-84-0	6,200	µg/kg				650	56								
Phenols																
2,4-Dimethylphenol	105-67-9	29	µg/kg	170	89	52%	230	1,800	3	1.8%	7.9	42	24.7%	62.1	Yes	Retained as a COC
2-Methylphenol (o-Cresol)	95-48-7	63	µg/kg	170	47	28%	230	1,600	6	3.5%	3.7	21	12.4%	25.4	Yes	Retained as a COC
4-Methylphenol (p-Cresol)	106-44-5	670	µg/kg	170	127	75%	20	51,000	0	n/a	<0.1	52	30.6%	76.1	Yes	Retained as a COC
Pentachlorophenol	87-86-5	360	µg/kg	170	30	18%	3,300	330	7	4.1%	9.2	0	n/a	n/a	No	
Phenol	108-95-2	420	µg/kg	170	119	70%	76	2,300	0	n/a	0.2	8	4.7%	5.5	Yes	Retained as a COC
Miscellaneous Extractables																
Dibenzofuran	132-64-9	15	mg/kg OC	167	135	81%	4	96.2	1	0.6%	0.2	40	24.0%	31.5	Yes	Retained as a COC
	132-64-9	540	µg/kg				20	17,000								
Hexachlorobutadiene	87-68-3	3.9	mg/kg OC	167	7	4%	5	6.41	35	21.0%	18.0	4	2.4%	15.5	Yes	Retained as a COC
	87-68-3	11	µg/kg				198	170								
N-Nitrosodiphenylamine (as Diphenylamine)	86-30-6	11	mg/kg OC	165	3	2%	4	3.4	9	5.5%	35.7	0	n/a	n/a	No	Not retained as a COC. Detected concentrations less than the SCO PCUL and non-detect PCUL exceedances generally observed in areas containing elevated wood content.
	86-30-6	28	µg/kg				1,000	10.4								
Benzoic Acid	65-85-0	650	µg/kg	165	79	48%	1,900	7,100	2	1%	2.9	8	4.8%	11	Yes	Retained as a COC
Benzyl Alcohol	100-51-6	57	µg/kg	168	41	24%	650	510	17	10%	11.4	13	7.7%	8.9	Yes	Retained as a COC
Polychlorinated Biphenyls (PCBs)																
Total PCBs (Aroclors or Congeners)	1336-36-3	130	µg/kg	128	112	88%	20	5,200	0	n/a	0.2	11	8.6%	40.0	Yes	Retained as a COC
	1336-36-3	12	mg/kg OC				2	30								
Chlorinated Phenols and Guaiacols																
2,3,4,6-Tetrachlorophenol	58-90-2	NE	µg/kg	11	2	18%	230	16	0	n/a	n/a	0	n/a	n/a	No	Chlorinated phenols and guaiacols are not retained as COCs based on limited detections at low concentrations and the lack of established screening levels.
2,4,5-Trichlorophenol	95-95-4	NE	µg/kg	11	0	0%	1,200	n/a	0	n/a	n/a	0	n/a	n/a		
2,4,6-Trichlorophenol	88-06-2	NE	µg/kg	11	3	27%	1,200	79	0	n/a	n/a	0	n/a	n/a		
2,4-Dichlorophenol	120-83-2	NE	µg/kg	11	1	9%	1,200	50	0	n/a	n/a	0	n/a	n/a		
Guaiacol (2-Methoxyphenol)	90-05-1	NE	µg/kg	11	6	55%	94	1,700	0	n/a	n/a	0	n/a	n/a		
Tetrachloroguaiacol	2539-17-5	NE	µg/kg	11	0	0%	460	n/a	0	n/a	n/a	0	n/a	n/a		
3,4,5-Trichloroguaiacol (Ac)	57057-83-7	NE	µg/kg	11	0	0%	230	n/a	0	n/a	n/a	0	n/a	n/a	No	Chlorinated phenols and guaiacols are not retained as COCs based on limited detections at low concentrations and the lack of established screening levels.
3,4,6-Trichloroguaiacol (Ac)	57057-83-7	NE	µg/kg	11	0	0%	230	n/a	0	n/a	n/a	0	n/a	n/a		
4,5,6 Trichloroguaiacol	2668-24-8	NE	µg/kg	11	0	0%	230	n/a	0	n/a	n/a	0	n/a	n/a		

Contaminant of Potential Concern[1] (COPC)	CAS Number	Proposed Sediment Cleanup Level[2]	Units	Evaluation of RI Data Results[3]											Contaminant of Concern[6] (COC) (Yes/No)	Comments
									Non-Detect PCUL Exceedance Evaluation			SCO/AET Exceedance Evaluation[6]				
				Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Non-Detect Concentration	Maximum Detected Concentration	Number of Non-detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)	Number of detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)		
Resin Acids																
Linolenic Acid	463-40-1	NE	µg/kg	12	0	0%	2,900	n/a	0	n/a	n/a	0	n/a	n/a	No	Resin acids are not retained as COCs based on limited detections at low concentrations and the lack of established screening levels.
Pimaric Acid	127-27-5	NE	µg/kg	12	0	0%	2,900	n/a	0	n/a	n/a	0	n/a	n/a		
Sandaracopimaric Acid	471-74-9	NE	µg/kg	12	4	33%	2,900	270	0	n/a	n/a	0	n/a	n/a		
Isopimaric Acid	5835-26-7	NE	µg/kg	12	7	58%	2,900	1,000	0	n/a	n/a	0	n/a	n/a		
Dehydroabietic Acid	1740-19-8	NE	µg/kg	12	12	100%	n/a	94,000	0	n/a	n/a	0	n/a	n/a		
Palustric Acid	1945-53-5	NE	µg/kg	12	0	0%	2900	n/a	0	n/a	n/a	0	n/a	n/a		
Abietic Acid	514-10-3	NE	µg/kg	12	12	100%	n/a	7,700	0	n/a	n/a	0	n/a	n/a		
Neoabietic Acid	471-77-2	NE	µg/kg	12	1	8%	2,900	74	0	n/a	n/a	0	n/a	n/a		
9,10-Dichlorostearic acid	31135-63-4	NE	µg/kg	12	0	0%	2,900	n/a	0	n/a	n/a	0	n/a	n/a		
12-Chlorodehydroabietic Acid	65310-45-4	NE	µg/kg	12	5	42%	1,500	3,000	0	n/a	n/a	0	n/a	n/a		
14-Chlorodehydroabietic Acid	65281-76-7	NE	µg/kg	12	3	25%	1,500	1,200	0	n/a	n/a	0	n/a	n/a		
Dichlorodehydroabietic Acid	57055-39-7	NE	µg/kg	12	0	0%	2,900	n/a	0	n/a	n/a	0	n/a	n/a		
Pesticides																
4,4'-DDD	72-54-8	NE	µg/kg	37	1	3%	9.73	18.8	0	n/a	n/a	0	n/a	n/a	No	Pesticides are not retained as COCs based on limited detections at low concentrations and the lack of established screening levels.
4,4'-DDE	68679-99-2	NE	µg/kg	37	0	0%	9.8	n/a	0	n/a	n/a	0	n/a	n/a		
4,4'-DDT	50-29-3	NE	µg/kg	37	1	3%	61.9	3.09	0	n/a	n/a	0	n/a	n/a		
Total DDT (4,4 isomers)	n/a	NE	µg/kg	37	2	5%	22	18.8	0	n/a	n/a	0	n/a	n/a		
Aldrin	309-00-2	NE	µg/kg	37	0	0%	5.3	n/a	0	n/a	n/a	0	n/a	n/a		
Alpha-Chlordane (cis)	5103-71-9	NE	µg/kg	36	0	0%	19.7	n/a	0	n/a	n/a	0	n/a	n/a		
Beta or Gamma-Chlordane (trans)	5103-74-2	NE	µg/kg	36	1	3%	19.7	1.95	0	n/a	n/a	0	n/a	n/a		
Chlordane[9] (Total)	n/a	NE	µg/kg	37	1	3%	185	1.95	0	n/a	n/a	0	n/a	n/a		
Dieldrin	60-57-1	NE	µg/kg	37	0	0%	9.73	n/a	0	n/a	n/a	0	n/a	n/a		
Heptachlor	76-44-8	NE	µg/kg	37	0	0%	11.4	n/a	0	n/a	n/a	0	n/a	n/a		
Herbicides																
2,4,5-T	93-76-5	NE	µg/kg	1	0	0%	65	n/a	0	n/a	n/a	0	n/a	n/a	No	Herbicides are not retained as COCs based on limited detections at low concentrations and the lack of established screening levels.
2,4-D	94-75-7	NE	µg/kg	1	0	0%	65	n/a	0	n/a	n/a	0	n/a	n/a		
2,4-DB	94-82-6	NE	µg/kg	1	0	0%	65	n/a	0	n/a	n/a	0	n/a	n/a		
Dalapon (DPA)	75-99-0	NE	µg/kg	1	0	0%	65	n/a	0	n/a	n/a	0	n/a	n/a		
Dicamba	1918-00-9	NE	µg/kg	1	0	0%	65	n/a	0	n/a	n/a	0	n/a	n/a		
Dichlorprop	7547-66-2	NE	µg/kg	1	0	0%	65	n/a	0	n/a	n/a	0	n/a	n/a		
Silvex (Fenoprop or 2,4,5-TP)	93-72-1	NE	µg/kg	1	0	0%	65	n/a	0	n/a	n/a	0	n/a	n/a		

Notes:

[1] Contaminants of potential concern (COPCs) were established for the Marine Area based on a review of previous environmental studies. Previous sediment study results are summarized in Table F-1 (Appendix F).

[2] Proposed sediment cleanup levels (PCULs) for the protection of benthic organisms are the Sediment Cleanup Objective (SCO) / Apparent Effects Threshold (AET) values referenced from Table 2.

[3] The sediment data used for the Marine Area RI consist of samples obtained by GeoEngineers in general accordance with the RI/FS Work Plan (GeoEngineers 2014) as well as data collected during previous environmental studies (see Table 1). Sediment samples for the Marine Area RI are summarized in Table F-1 (Appendix F).

[4] Number of samples with analyte detected or non-detect at a concentration greater than PCUL / total number of samples analyzed for analyte.

[5] Maximum Exceedance Ratio = ratio of maximum detected or non-detect concentration to the PCUL.

[6] Contaminant of concern (COC) selection criteria is met if a COPC was detected at a concentration greater than the PCUL. Non-detect results were not considered in the selection of proposed COCs.

[7] Total LPAHs are the total of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene and anthracene; 2-methylnapthalene is not included in the sum of LPAHs.

[8] Total HPAHs are the total of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c-d)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene.

[9] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[10] Total chlordane represents the sum of concentrations of alpha-Chlordane (cis), gamma-Chlordane (trans), cis-nonachlor, trans-nonachlor and oxychlordane.

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

n/a = not applicable

NE = not established

OC = organic carbon normalized

PCUL = proposed cleanup level

Bold indicates the value (detect or non-detect) exceeds the PCUL.

Yellow shading indicates analyte is identified as a COC based on SCO/LAET PCUL exceedance.

Table 5

Proposed Cleanup Levels, Summary Statistics and Evaluation of Contaminants of Concern for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Contaminant of Potential Concern[1] (COPC)	CAS No.	Proposed Sediment Cleanup Level[2]: Intertidal Sediment (Above -3 ft MLLW)	Proposed Sediment Cleanup Level[2]: Subtidal Sediment (below -3 ft MLLW)	Units	Evaluation of RI Data Results[3]: Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Non-Detect Concentration	Maximum Detected Concentration	Non-Detect PCUL Exceedance Evaluation: Number of Non-detections > PCUL	Non-Detect PCUL Exceedance Evaluation: Frequency of PCUL Exceedance[4] (%)	Non-Detect PCUL Exceedance Evaluation: Maximum Exceedance Ratio[5] (ER)	SCO PCUL Exceedance Evaluation: Number of detections > PCUL	SCO PCUL Exceedance Evaluation: Frequency of PCUL Exceedance[4] (%)	SCO PCUL Exceedance Evaluation: Maximum Exceedance Ratio[5] (ER)	Contaminant of Concern[6] (COC) (Yes/No)	Comments
Metals																	
Arsenic	7440-38-2	12	12	mg/kg	160	143	89%	40	70.0	**5**	**29.4%**	**3.3**	**40**	**28.0%**	**5.8**	Yes	Retained as a COC
Cadmium	7440-43-9	0.80	0.80	mg/kg	160	129	81%	1.0	2.1	**3**	**9.7%**	**1.3**	**36**	**26.1%**	**2.6**	Yes	Retained as a COC
Chromium (as Chromium III)	16065-83-1	25,000	400,000	mg/kg	159	159	100%	n/a	60	0	n/a	n/a	0	n/a	<0.1	No	
Copper	7440-50-8	8,000	90,000	mg/kg	159	159	100%	n/a	1,040.0	0	n/a	n/a	0	n/a	<0.1	No	
Lead	7439-92-1	21	21	mg/kg	159	156	98%	20	176.000	0	n/a	1.0	**56**	**38.1%**	**8.4**	Yes	Retained as a COC
Mercury	7487-94-7	0.20	0.20	mg/kg	158	148	94%	0.06	39	0	n/a	0.3	**22**	**16.1%**	**192.5**	Yes	Retained as a COC
Silver	7440-22-4	200	4,000	mg/kg	159	66	42%	2	0	0	n/a	<0.1	0	n/a	<0.1	No	
Zinc	7440-66-6	60,000	700,000	mg/kg	159	159	100%	n/a	1,010	0	n/a	n/a	0	n/a	<0.1	No	
Organometallic Compounds																	
Tributyltin Ion (Bulk Sediment)	56-35-9	73	73	µg/kg	43	11	26%	33.6	9.19	0	n/a	0.5	0	n/a	0.1	No	
Tributyltin Ion (Interstitial Water)	56-35-9a	0.15	0.15	µg/L	14	0	0%	0.005	n/a	0	n/a	<0.1	0	n/a	<0.1	No	
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)																	
2-Methylnaphthalene	91-57-6	320	4,500	mg/kg	168	142	85%	0.02	13	0	n/a	<0.1	0	n/a	<0.1	No	
Acenaphthene	83-32-9	4,800	67,000	mg/kg	168	140	83%	0.02	22	0	n/a	<0.1	0	n/a	<0.1	No	
Acenaphthylene	208-96-8	4,800	67,300	mg/kg	168	133	79%	0.02	1.2	0	n/a	<0.1	0	n/a	<0.1	No	
Anthracene	120-12-7	24,000	340,000	mg/kg	168	143	85%	0.02	410	0	n/a	<0.1	0	n/a	<0.1	No	
Fluorene	86-73-7	3,200	40,000	mg/kg	168	139	83%	0.02	52	0	n/a	<0.1	0	n/a	<0.1	No	
Naphthalene	91-20-3	1,600	22,000	mg/kg	168	153	91%	0.02	43	0	n/a	<0.1	0	n/a	<0.1	No	
Phenanthrene	85-01-8	24,000	336,000	mg/kg	168	151	90%	0.02	90	0	n/a	<0.1	0	n/a	<0.1	No	
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)																	
Benzo(a)anthracene	56-55-3	See cPAH TEQ	See cPAH TEQ	mg/kg	188	162	86%	0.024	11	n/a	n/a	n/a	n/a	n/a	n/a	Yes	cPAH compounds are retained as COCs
Benzo(a)pyrene	50-32-8	See cPAH TEQ	See cPAH TEQ	mg/kg	188	154	82%	0.028	3.9	n/a	n/a	n/a	n/a	n/a	n/a	Yes	
Benzofluoranthenes[7] (Total)	n/a	See cPAH TEQ	See cPAH TEQ	mg/kg	189	158	84%	0.028	8.8	n/a	n/a	n/a	n/a	n/a	n/a	Yes	
Benzo(g,h,i)perylene	191-24-2	See cPAH TEQ	See cPAH TEQ	mg/kg	167	122	73%	0.028	1.4	n/a	n/a	n/a	n/a	n/a	n/a	Yes	
Chrysene	218-01-9	See cPAH TEQ	See cPAH TEQ	mg/kg	189	165	87%	0.024	17	n/a	n/a	n/a	n/a	n/a	n/a	Yes	
Dibenzo(a,h)anthracene	53-70-3	See cPAH TEQ	See cPAH TEQ	mg/kg	189	115	61%	0.028	0.39	n/a	n/a	n/a	n/a	n/a	n/a	Yes	
Fluoranthene	206-44-0	3,200	45,000	mg/kg	169	146	86%	0.02	76	0	n/a	<0.1	0	n/a	<0.1	No	
Indeno(1,2,3-c,d)pyrene	193-39-5	See cPAH TEQ	See cPAH TEQ	mg/kg	189	150	79%	0.028	1.5	n/a	n/a	n/a	n/a	n/a	n/a	Yes	
Pyrene	129-00-0	2,400	30,000	mg/kg	168	146	87%	0.02	36	0	n/a	<0.1	0	n/a	<0.1	No	
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)																	
Total cPAH TEQ[8] (ND=0 RL)	see Benzo(a)pyrene	0.056	0.056	mg/kg	189	166	88%	n/a	5.92	0	n/a	<0.1	**101**	**58.7%**	**105.6**	Yes	Retained as a COC
Total cPAH TEQ[8] (ND=0.5 RL)	see Benzo(a)pyrene	0.056	0.056	mg/kg	189	166	88%	n/a	5.92	0	n/a	<0.1	**101**	**58.7%**	**105.6**	Yes	
Chlorinated Hydrocarbons																	
1,2,4-Trichlorobenzene	120-82-1	38	88	mg/kg	161	17	11%	0.16	0.53	0	n/a	<0.1	0	n/a	<0.1	No	
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	21,000	230,000	mg/kg	161	33	20%	0.16	0.096	0	n/a	<0.1	0	n/a	<0.1	No	
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	200	474	mg/kg	161	40	25%	0.16	0.039	0	n/a	<0.1	0	n/a	<0.1	No	
Hexachlorobenzene	118-74-1	0.69	1.6	mg/kg	161	5	3%	0.16	0.242	0	n/a	0.2	0	n/a	0.2	No	
Phthalates																	
Bis(2-Ethylhexyl) Phthalate	117-81-7	24	60	mg/kg	160	68	43%	0.05	2.2	0	n/a	<0.1	0	n/a	<0.1	No	
Butyl Benzyl Phthalate	85-68-7	180	460	mg/kg	160	23	14%	0.02	0.65	0	n/a	<0.1	0	n/a	<0.1	No	
Dibutyl Phthalate	84-74-2	6,000	90,000	mg/kg	160	29	18%	0.02	0.52	0	n/a	<0.1	0	n/a	<0.1	No	
Diethyl Phthalate	84-66-2	49,000	700,000	mg/kg	160	34	21%	0.020	0.78	0	n/a	<0.1	0	n/a	<0.1	No	

Contaminant of Potential Concern[1] (COPC)	CAS No.	Proposed Sediment Cleanup Level[2]		Units	Evaluation of RI Data Results[3]											Contaminant of Concern[6] (COC) (Yes/No)	Comments
										Non-Detect PCUL Exceedance Evaluation			SCO PCUL Exceedance Evaluation				
		Intertidal Sediment (Above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)		Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Non-Detect Concentration	Maximum Detected Concentration	Number of Non-detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)	Number of detections > PCUL	Frequency of PCUL Exceedance[4] (%)	Maximum Exceedance Ratio[5] (ER)		
Dimethyl Phthalate	131-11-3	NE	NE	mg/kg	160	3	2%	0.020	0.066	n/a	n/a	n/a	n/a	n/a	n/a	No	
Di-N-Octyl Phthalate	117-84-0	600	9,000	mg/kg	160	5	3%	0.020	0.0573	0	n/a	<0.1	0	n/a	<0.1	No	
Phenols																	
2,4-Dimethylphenol	105-67-9	1,200	18,000	mg/kg	169	89	53%	0.028	1.8	0	n/a	<0.1	0	n/a	<0.1	No	
2-Methylphenol (o-Cresol)	95-48-7	3,000	44,000	mg/kg	169	47	28%	0.198	1.6	0	n/a	<0.1	0	n/a	<0.1	No	
4-Methylphenol (p-Cresol)	106-44-5	6,000	90,000	mg/kg	168	125	74%	0.02	51	0	n/a	<0.1	0	n/a	<0.1	No	
Pentachlorophenol	87-86-5	0.55	1.4	mg/kg	169	30	18%	3.300	0.33	**2**	**1%**	**6.0**	0	n/a	0.2	No	
Phenol	108-95-2	18,000	260,000	mg/kg	169	119	70%	0.031	2.3	0	n/a	<0.1	0	n/a	<0.1	No	
Miscellaneous Extractables																	
Dibenzofuran	132-64-9	170	2,000	mg/kg	169	136	80%	0.028	17	0	n/a	<0.1	0	n/a	<0.1	No	
Hexachlorobutadiene	87-68-3	14	33	mg/kg	168	7	4%	0.0910	0.214	0	n/a	<0.1	0	n/a	<0.1	No	
N-Nitrosodiphenylamine (as Diphenylamine)	86-30-6	70	180	mg/kg	166	3	2%	0.02	0.056	0	n/a	<0.1	0	n/a	<0.1	No	
Benzoic Acid	65-85-0	240,000	3,500,000	mg/kg	166	81	49%	0.20	7.1	0	n/a	<0.1	0	n/a	<0.1	No	
Benzyl Alcohol	100-51-6	6,000	90,000	mg/kg	168	38	23%	0.02	0.51	0	n/a	<0.1	0	n/a	<0.1	No	
Polychlorinated Biphenyls (PCBs)																	
Total PCBs (Aroclors or Congeners)	1336-36-3	0.19	0.49	mg/kg	27	14	52%	n/a	5.2	0	n/a	<0.1	**1**	**6.3%**	**10.6**	Yes	Retained as a COC
Total Dioxin-Like PCB Congeners TEQ[9] (ND=0 RL)	see Total Dioxins/Furans	0.38	0.38	ng/kg	105	92	88%	n/a	31.46	0	n/a	<0.1	**23**	**24%**	**82.8**	Yes	Retained as a COC
Total Dioxin-Like PCB Congeners TEQ[9] (ND=0.5 RL)	see Total Dioxins/Furans	0.38	0.38	ng/kg	105	92	88%	n/a	31.46	0	n/a	<0.1	**23**	**24%**	**82.8**	Yes	Retained as a COC
Dioxins and Furans																	
Total Dioxin/Furan TEQ[10] (ND=0 RL)	1746-01-6	5	5	ng/kg	106	101	95%	n/a	187	0	n/a	<0.1	**47**	**47%**	**37.4**	Yes	
Total Dioxin/Furan TEQ[10] (ND=0.5 RL)	1746-01-6	5	5	ng/kg	106	101	95%	n/a	187	0	n/a	<0.1	**47**	**47%**	**37.4**	Yes	

Notes:

[1] Contaminants of potential concern (COPCs) were established for the Marine Area based on a review of previous environmental studies. Previous sediment study results are summarized in Table F-2 (Appendix F).

[2] Proposed sediment cleanup levels for the protection of human health and higher trophic level ecological receptors are referenced from Table 3 and are based on the Sediment Cleanup Objective (SCO) except for arsenic, cPAHs and dioxin-like PCBs which are base on regional background which is the Cleanup Screening Level (CSL).

[3] The sediment data used for the Marine Area RI consist of samples obtained by GeoEngineers in general accordance with the RI/FS Work Plan (GeoEngineers 2014) and subsequent addenda, and data collected during previous environmental studies (see Table 1). Sediment samples for the Marine Area RI are summarized in Table F-2 (Appendix F).

[4] Number of samples with analyte detected or non-detect at a concentration greater than PCUL / total number of samples analyzed for analyte.

[5] Maximum Exceedance Ratio (ER) = ratio of maximum detected or non-detect concentration to the PCUL

[6] Contaminant of concern (COC) selection criteria is met if a COPC was detected at a concentration greater than the PCUL. Non-detect results were not considered in the selection of proposed COCs.

[7] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[8] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[9] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[10] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

μg/kg = micrograms per kilogram

μg/L = micrograms per liter

CSL = Cleanup Screening Level

mg/kg = milligrams per kilogram

n/a = not applicable

NE = not established

ng/kg = nanograms per kilogram

PCUL = proposed cleanup level

SCO = Sediment Cleanup Objective

Bold indicates the value (detect or non-detect) exceeds the PCUL.

Yellow shading indicates analyte is identified as a COC based on SCO PCUL exceedance.

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		ST-02	ST-03		ST-08	ST-11	ST-14		ST-20		ST-21	ST-24	Proposed Sediment Cleanup Level[2]
Sample Identification		13116000038	13116000004	13116000006	13116000029	13116000010	13116000021	13116000023	13116000014	13116000015	13116000027	13116000100	
Sample Date		05/14/07	05/07/07	05/07/07	05/11/07	05/07/07	05/08/07	05/08/07	05/07/07	05/07/07	05/11/07	05/15/07	
Sample Interval (dbm)		5 - 6 ft	3.5 - 6.2 ft	14 - 15.9 ft	7.3 - 10.5 ft	0 - 6.2 ft	3.4 - 4.6 ft	9.4 - 10.5 ft	9.9 - 11.2 ft	14 - 15.5 ft	9.1 - 11.2 ft	0-10 cm	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	90	85	80	100	85	90	90	90	90	70	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	6.11	46.9	9.21	24.1	18.9	44.0	14.4	30.8	25.1	17.1	1.45	NE
Metals													
Arsenic	mg/kg	--	--	--	--	--	--	--	--	--	--	7 U	57
Copper	mg/kg	--	--	--	--	--	--	--	--	--	--	23.1	390
Mercury	mg/kg	--	--	--	--	--	--	--	--	--	--	0.06 J	0.41
Zinc	mg/kg	--	--	--	--	--	--	--	--	--	--	56	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	210.9 J	5.0	413.5	22.3 J	795.2	7.9	24.3	6.3	10.9 J	17.2	13.3	370
2-Methylnaphthalene	mg/kg OC	18	0.3	32.6	1.3 J	68.8	0.5	2.3	0.4	0.8	1.2	1.4 U	38
Acenaphthene	mg/kg OC	39.3 J	0.3	58.6	1.2	116.4	0.3	2.4	0.5	1.04 J	2	1.4	16
Acenaphthylene	mg/kg OC	1.4	0.4	0.9	0.8	1.5	0.1	0.3	0.2	0.2	0.4	1.4 U	66
Anthracene	mg/kg OC	16.4	0.1	27.1	0.7	58.2	0.1	0.5	0.3	0.4	1.6	2.3	220
Fluorene	mg/kg OC	24.5	0.3	65.1	1.1	89.9	0.3	1.3	0.4	1.0	2.1	1.4 U	23
Naphthalene	mg/kg OC	57.3	3.0	44.5	14.1	227.5	6.1	15.3	3.6	5.6	5	2.0	99
Phenanthrene	mg/kg OC	54	0.7	184.6	3.2	232.8	0.6	2.2	1.0	1.8	5	7.6	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	12,888 J	2,349	38,079	5,380 J	150,290	3,496	3,494	1,955	2,736 J	2,947	193	5,200
2-Methylnaphthalene	µg/kg	1,100	150	3,000	320 J	13,000	200	330	130	210	210	20 U	670
Acenaphthene	µg/kg	2,400 J	130	5,400	280	22,000	150	350	150	260 J	340	20	500
Acenaphthylene	µg/kg	88	170	79	190	290	48	43	52	56	67	20 U	1,300
Anthracene	µg/kg	1,000	49	2,500	170	11,000	38	71	83	110	270	34	960
Fluorene	µg/kg	1,500	120	6,000	260	17,000	110	190	130	240	360	20 U	540
Naphthalene	µg/kg	3,500	1,400	4,100	3,400	43,000	2,700	2,200	1,100	1,400	850	29	2,100
Phenanthrene	µg/kg	3,300	330	17,000	760 J	44,000	250	310	310	460	850	110	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	143.9 J	1.4	158.3	5.9 J	477.2	1.4	4.6	2.8	4.7 J	26.2	67.4 J	960
Benzo(a)anthracene	mg/kg OC	14.2	0.05 U	8.4	0.2 J	45.5	0.03	0.4	0.3	0.5 J	2	5.3	110
Benzo(a)pyrene	mg/kg OC	9.2	0.05 U	2.8	0.1 U	20.6	0.03	0.3	0.2	0.5 J	2.2	4.5	99
Benzofluoranthenes[6] (Total)	mg/kg OC	19.1	0.05 U	7.1	0.1 U	46.6	0.1	0.6	0.4	1	3.8	9.7	230
Benzo(g,h,i)perylene	mg/kg OC	2.5 J	0.05 U	1.5	0.1 U	7.4	0.02 U	0.1	0.1	0.2	1.3	1.9	31
Chrysene	mg/kg OC	18	0.05 U	8.7	0.2 J	45.5	0.1	0.5	0.4	0.8 J	3.3	8.3	110
Dibenzo(a,h)anthracene	mg/kg OC	1	0.05 U	0.5	0.1 U	2.1	0.02 U	0.04 U	0.03	0.1 J	0.2	1.4 U	12
Fluoranthene	mg/kg OC	49.1	1.2	82.5	3.9	190.5	0.8	1.5	0.7	0.9	7	22.8 J	160

Sample Location[1]		ST-02	ST-03		ST-08	ST-11	ST-14		ST-20		ST-21	ST-24	Proposed Sediment Cleanup Level[2]
Sample Identification		13116000038	13116000004	13116000006	13116000029	13116000010	13116000021	13116000023	13116000014	13116000015	13116000027	13116000100	
Sample Date		05/14/07	05/07/07	05/07/07	05/11/07	05/07/07	05/08/07	05/08/07	05/07/07	05/07/07	05/11/07	05/15/07	
Sample Interval (dbm)		5 - 6 ft	3.5 - 6.2 ft	14 - 15.9 ft	7.3 - 10.5 ft	0 - 6.2 ft	3.4 - 4.6 ft	9.4 - 10.5 ft	9.9 - 11.2 ft	14 - 15.5 ft	9.1 - 11.2 ft	0-10 cm	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	2.9	0.05 U	1.3	0.1 U	7.9	0.02 U	0.2	0.1	0.2	1.2	**1.9**	34
Pyrene	mg/kg OC	27.8	0.1	45.6	1.8	111.1	0.4	1	0.6	0.6 J	5.1	**13.1**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	**8,792 J**	**648**	**14,583**	**1,445 J**	**90,190**	**599**	**665**	**870.8**	**1,191 J**	**4,481**	977 J	12,000
Benzo(a)anthracene	µg/kg	**870**	24 U	**770**	**37 J**	**8,600**	**14**	**51**	**77**	**120 J**	**350**	77	1,300
Benzo(a)pyrene	µg/kg	**560**	24 U	**260**	28 U	**3,900**	**11**	**38**	**64**	**120 J**	**370**	65	1,600
Benzofluoranthenes[6] (Total)	µg/kg	**1,170**	24 U	**650**	28 U	**8,800**	**40**	**89**	**130**	**250**	**650**	141	3,200
Benzo(g,h,i)perylene	µg/kg	**150 J**	24 U	**140**	28 U	**1,400**	9.6 U	**21**	**33**	**59**	**230**	27	670
Chrysene	µg/kg	**1,100**	24 U	**800**	**48 J**	**8,600**	**34**	**74**	**120**	**190 J**	**560**	120	1,400
Dibenzo(a,h)anthracene	µg/kg	**62**	24 U	**43**	28 U	**390**	9.6 U	6.2 U	**9.8**	**15 J**	**41**	20 U	230
Fluoranthene	µg/kg	**3,000**	**580**	**7,600**	**930**	**36,000**	**330**	**220**	**210**	**230**	**1,200**	330 J	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	**180**	24 U	**120**	28 U	**1,500**	9.6 U	**22**	**37**	**57**	**200**	27	600
Pyrene	µg/kg	**1,700**	**68**	**4,200**	**430**	**21,000**	**170**	**150**	**190**	**150 J**	**880**	190	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.1 U	0.05 U	0.07 U	0.12 U	**0.04 J**	0.02 U	0.04 U	0.02 U	0.03 U	0.04 U	1.4 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	0.1 U	0.05 U	0.07 U	0.12 U	0.03 U	0.02 U	0.04 U	0.02 U	0.03 U	0.04 U	1.4 U	2.3
Hexachlorobenzene	mg/kg OC	0.1 U	0.05 U	0.07 U	0.12 U	**0.07 J**	0.02 U	0.04 U	0.02 U	0.03 U	0.04 U	1.4 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	6.1 U	24 U	6.2 U	28 U	**7.4 J**	9.6 U	6.2 U	6.1 U	6.2 U	6.2 U	20 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	6.1 U	24 U	6.2 U	28 U	6.1 U	9.6 U	6.2 U	6.1 U	6.2 U	6.2 U	20 U	35
Hexachlorobenzene	µg/kg	6.1 U	24 U	6.2 U	28 U	**14 J**	9.6 U	6.2 U	6.1 U	6.2 U	6.2 U	20 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	0.2 U	0.08 J	0.1 U	0.2 J	0.2 J	0.05 U	0.1 U	0.08 U	0.05 U	0.2 U	**3.03 J**	47
Butyl Benzyl Phthalate	mg/kg OC	0.1 U	0.8	0.07 U	2.7	0.03	0.1 J	0.04 U	0.6	0.04 J	0.8	1.4 U	4.9
Diethyl Phthalate	mg/kg OC	0.1 U	0.05 U	0.07 U	0.1 U	0.06 U	0.02 U	0.06 U	0.06 U	0.03 U	0.04 U	1.4 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	10 U	**36 J**	9.9 U	**37 J**	**37 J**	22 U	18 U	26 U	12 U	30 U	44 J	1,300
Butyl Benzyl Phthalate	µg/kg	6.1 U	**390**	6.2 U	**650**	**6.1**	**58 J**	6.2 U	**180**	**9.9 J**	**140**	20 U	63
Diethyl Phthalate	µg/kg	6.7 U	24 U	6.2 U	28 U	12 U	9.6 U	8.6 U	17 U	7.4 U	6.2 U	20 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**170 J**	**34**	**42 J**	**110**	**800**	**250**	**240**	**95**	**87**	**48**	20 U	29
2-Methylphenol (o-Cresol)	µg/kg	**180**	**44**	**23**	**62**	**120**	**290**	**240**	**200**	**170**	**11**	20 U	63
4-Methylphenol (p-Cresol)	µg/kg	**470**	**2,600**	**300**	**3,700**	**480**	**2,600**	**830**	**1,100**	**1,200**	**550**	**24**	670
Phenol	µg/kg	15 U	**150 J**	31 U	**85 J**	**260 J**	**62 J**	**37 J**	**90 J**	**33 J**	**45 J**	20 U	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	18	0.4	52.1	0.99	68.8	0.93	1.7	0.97	0.99	1.4	1.4 U	15
Hexachlorobutadiene	mg/kg OC	0.1 U	0.05 U	0.07 U	0.1 U	0.05 J	0.02 U	0.04 U	0.02 U	0.03 U	0.04 U	1.4 U	3.9

Sample Location[1]		ST-02	ST-03		ST-08	ST-11	ST-14		ST-20		ST-21	ST-24	Proposed Sediment Cleanup Level[2]
Sample Identification		13116000038	13116000004	13116000006	13116000029	13116000010	13116000021	13116000023	13116000014	13116000015	13116000027	13116000100	
Sample Date		05/14/07	05/07/07	05/07/07	05/11/07	05/07/07	05/08/07	05/08/07	05/07/07	05/07/07	05/11/07	05/15/07	
Sample Interval (dbm)		5 - 6 ft	3.5 - 6.2 ft	14 - 15.9 ft	7.3 - 10.5 ft	0 - 6.2 ft	3.4 - 4.6 ft	9.4 - 10.5 ft	9.9 - 11.2 ft	14 - 15.5 ft	9.1 - 11.2 ft	0-10 cm	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**1,100**	**170**	**4,800**	**240**	**13,000**	**410**	**240**	**300**	**250**	**240**	20 U	540
Hexachlorobutadiene	µg/kg	6.1 U	24 U	6.2 U	28 U	**8.6 J**	9.6 U	6.2 U	6.1 U	6.2 U	6.2 U	20 U	11
Benzoic Acid	µg/kg	61 U	**600 J**	62 U	**530 J**	**680 J**	**110 J**	**69 J**	61 U	62 U	**64 J**	200 U	650
Benzyl Alcohol	µg/kg	30 U	120 U	**510 J**	140 U	**170 J**	**82 J**	31 U	**170 J**	**88 J**	**48 J**	20 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	--	--	--	--	--	--	--	--	--	--	1.10 U	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	--	--	--	--	--	--	--	--	--	--	16 U	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		ST-24	ST-29	ST-30	ST-32	ST-34		ST-37	ST-39		ST-42	ST-43	Proposed Sediment Cleanup Level[2]
Sample Identification		13116000101	13116000103	13116000102	13116000104	13116000105	13116000025	13116000106	13116000107	13116000033	13116000108	13116000031	
Sample Date		05/15/07	05/15/07	05/15/07	05/15/07	05/15/07	05/09/07	05/15/07	05/15/07	05/14/07	05/15/07	05/11/07	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2.8 ft	0-10 cm	0-10 cm	0 - 4 ft	0-10 cm	5.7 - 7.2 ft	
Sample Type		Surface	Surface	Surface	Surface	Surface	Subsurface	Surface	Surface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	35	95	35	15	15	15	10	5	<1	100	15
Conventionals													
Total Organic Carbon (TOC)	Percent	1.14	1.26	2.14	1.74	2.05	3.93	3.27	1.69	5.47	0.800	15.9	NE
Metals													
Arsenic	mg/kg	7 U	9 U	10	10	10	40 J	10 U	9 U	10	6 U	--	57
Copper	mg/kg	22.1	44.3	47.3	46.8	41.3	104	30.3	28.2	84.3	12.4	--	390
Mercury	mg/kg	0.05 U	0.09 J	0.1 J	0.15 J	0.14 J	--	0.08 J	0.11 J	--	0.05 U	--	0.41
Zinc	mg/kg	50	163	94	98	106	341 J	76	67	127	34	--	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	9.1	56.9	11.2	28.3	35.5	102.1 J	20.1	24.9	35	8.4	3710.1	370
2-Methylnaphthalene	mg/kg OC	1.8 U	2.8	0.9 U	1.3	2.1	7.4	1.1	1.4	2.9	2.5 U	54.7	38
Acenaphthene	mg/kg OC	1.8 U	5.8	1.2	3.3	4.9	14.5 J	2.3	2.6	3.3	2.5 U	94.3	16
Acenaphthylene	mg/kg OC	1.8 U	2.2	0.9 U	1.1	1	0.9	0.8	1.2 U	0.8	2.5 U	1.3	66
Anthracene	mg/kg OC	2.5	9.5	2	4.5	4.1	7.4	3.1	4.4	3.8	2.5 U	2578.6	220
Fluorene	mg/kg OC	1.8 U	5.8	1.1	2.8	4.0	12.7	1.9	2.6	4.4	2.5 U	327	23
Naphthalene	mg/kg OC	1.8 U	6.2	1.7	3.3	4.9	16	3.1	5	10.4	3.4	88.1	99
Phenanthrene	mg/kg OC	6.7	24.6	5.1	12.1	14.6	43.3	8	8.9	9.3	5	566	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	104	717	240	493	728	4,014 J	657	420	1,914	67	589,910	5,200
2-Methylnaphthalene	µg/kg	20 U	35	20 U	22	43	290	36	23	160	20 U	8,700	670
Acenaphthene	µg/kg	20 U	73	26	57	100	570 J	74	44	180	20 U	15,000	500
Acenaphthylene	µg/kg	20 U	28	20 U	20	20	34	26	20 U	44	20 U	210	1,300
Anthracene	µg/kg	28	120	43	78	84	290	100	75	210	20 U	410,000	960
Fluorene	µg/kg	20 U	73	24	48	81	500	61	44	240	20 U	52,000	540
Naphthalene	µg/kg	20 U	78	37	58	100	630	100	84	570	27	14,000	2,100
Phenanthrene	µg/kg	76	310	110	210	300	1,700	260	150	510	40	90,000	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	50.7 J	217.4 J	53.9 J	108.8 J	118.3 J	163.5 J	69.5 J	91.8 J	44.5	38.3 J	928.4	960
Benzo(a)anthracene	mg/kg OC	4.1 J	17.5 J	4.4	9.8 J	9.3 J	12.5	5.5 J	8.3 J	3.3	3.8 J	69.2	110
Benzo(a)pyrene	mg/kg OC	3.8	13.5 J	3.6	8	7.8	11.2	4.9	7.1	2.7	2.8	11.9	99
Benzofluoranthenes[6] (Total)	mg/kg OC	8.8	32.5	9.3	20.1	19.0	24.7	12.5	16.6	7.9	7.8	29.6	230
Benzo(g,h,i)perylene	mg/kg OC	1.8 U	7.2	1.1	4.8	4.4	3.3 J	2.8	4.2	0.6	2.5 U	2.3	31
Chrysene	mg/kg OC	7.7	28.6 J	7.5 J	16.1 J	16.1 J	18.8	10.4 J	14.2 J	5.9	5.4 J	106.9	110
Dibenzo(a,h)anthracene	mg/kg OC	1.8 U	1.6 U	0.9 U	1.1 U	1 U	0.7	0.6 U	1.2 U	0.3 U	2.5 U	1.1	12
Fluoranthene	mg/kg OC	14.9 J	66.7	15	29.3	39.5	61.1	21.1	26	15.4	13.8	478	160

Sample Location[1]		ST-24	ST-29	ST-30	ST-32	ST-34		ST-37	ST-39		ST-42	ST-43	Proposed Sediment Cleanup Level[2]
Sample Identification		13116000101	13116000103	13116000102	13116000104	13116000105	13116000025	13116000106	13116000107	13116000033	13116000108	13116000031	
Sample Date		05/15/07	05/15/07	05/15/07	05/15/07	05/15/07	05/09/07	05/15/07	05/15/07	05/14/07	05/15/07	05/11/07	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2.8 ft	0-10 cm	0-10 cm	0 - 4 ft	0-10 cm	5.7 - 7.2 ft	
Sample Type		Surface	Surface	Surface	Surface	Surface	Subsurface	Surface	Surface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	1.8 U	**6.2**	**1.4**	**4.5**	**3.6**	3.3	**2.5**	**1.8**	0.6	2.5 U	3.0	34
Pyrene	mg/kg OC	**11.4**	**45.2**	**11.7 J**	**16.1 J**	**18.5 J**	28 J	**9.8 J**	**13.6**	8.2	**8.8**	226.4	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	578 J	2,739 J	1,154 J	1,893	2,425 J	**6,427 J**	2,272	1,551 J	**2,432**	306 J	**147,610**	12,000
Benzo(a)anthracene	µg/kg	47 J	220 J	95	170 J	190 J	**490**	180 J	140 J	**180**	30 J	**11,000**	1,300
Benzo(a)pyrene	µg/kg	43	170 J	77	140	160	**440**	160	120	**150**	22	**1,900**	1,600
Benzofluoranthenes[6] (Total)	µg/kg	100	410	198	350	390	**970**	410	280	**430**	62	**4,700**	3,200
Benzo(g,h,i)perylene	µg/kg	20 U	91	23	84	91	**130 J**	91	71	**31**	20 U	**360**	670
Chrysene	µg/kg	88	360 J	160 J	280 J	330 J	**740**	340 J	240 J	**320**	43 J	**17,000**	1,400
Dibenzo(a,h)anthracene	µg/kg	20 U	20 U	20 U	20 U	20 U	**27**	20 U	20 U	20 U	20 U	**170**	230
Fluoranthene	µg/kg	170 J	840	320	510	810	**2,400**	690	440	**840**	110	**76,000**	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	20 U	78	31	79	74	**130**	81	30	**31**	20 U	**480**	600
Pyrene	µg/kg	130	570	250 J	280 J	380 J	**1,100 J**	320 J	230	**450**	70	**36,000**	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	1.8 U	1.6 U	0.9 U	1.2 U	1 U	0.5 U	0.6 U	1.2 U	0.4 U	2.5 U	0.04 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	1.8 U	1.6 U	0.9 U	1.2 U	1 U	0.5 U	0.6 U	1.2 U	0.4 U	2.5 U	0.6	2.3
Hexachlorobenzene	mg/kg OC	1.8 U	1.6 U	0.9 U	1.2 U	1 U	0.5 U	0.6 U	1.2 U	0.4 U	2.5 U	0.04 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	6.2 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**96**	35
Hexachlorobenzene	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	6.2 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	1.8 U	**3.8 J**	**1.4 J**	**2.1 J**	**1.9 J**	3.3	**1 J**	**2 J**	1.6	2.5 U	0.7 J	47
Butyl Benzyl Phthalate	mg/kg OC	1.8 U	1.6 U	0.9 U	1.2 U	1 U	0.5 U	0.6 U	1.2 U	0.4 U	2.5 U	1.8	4.9
Diethyl Phthalate	mg/kg OC	1.8 U	1.6 U	0.9 U	1.2 U	1 U	0.5 U	0.6 U	1.2 U	0.4 U	2.5 U	0.06 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	20 U	48 J	30 J	36 J	38 J	**130**	33 J	34 J	**88**	20 U	**110 J**	1,300
Butyl Benzyl Phthalate	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**290**	63
Diethyl Phthalate	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	9.9 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**20**	20 U	**410**	29
2-Methylphenol (o-Cresol)	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**120**	63
4-Methylphenol (p-Cresol)	µg/kg	20 U	**41**	20 U	**26**	**42**	**540**	**91**	**46**	**530**	20 U	**920**	670
Phenol	µg/kg	20 U	**22**	20 U	20 U	**23**	20 U	**25**	20 U	**25**	20 U	**37 J**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	1.8 U	**4.9**	**1.2**	**2.7**	**3.95**	11.7	**1.9**	**2.2**	3.3	2.5 U	106.9	15
Hexachlorobutadiene	mg/kg OC	1.8 U	1.6 U	0.9 U	1.2 U	0.98 U	0.5 U	0.6 U	1.2 U	0.4 U	2.5 U	0.4 U	3.9

Sample Location[1]		ST-24	ST-29	ST-30	ST-32	ST-34		ST-37	ST-39		ST-42	ST-43	Proposed Sediment Cleanup Level[2]
Sample Identification		13116000101	13116000103	13116000102	13116000104	13116000105	13116000025	13116000106	13116000107	13116000033	13116000108	13116000031	
Sample Date		05/15/07	05/15/07	05/15/07	05/15/07	05/15/07	05/09/07	05/15/07	05/15/07	05/14/07	05/15/07	05/11/07	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2.8 ft	0-10 cm	0-10 cm	0 - 4 ft	0-10 cm	5.7 - 7.2 ft	
Sample Type		Surface	Surface	Surface	Surface	Surface	Subsurface	Surface	Surface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	20 U	**62**	**25**	**47**	**81**	**460**	**62**	**37**	**180**	20 U	**17,000**	540
Hexachlorobutadiene	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	6.2 U	11
Benzoic Acid	µg/kg	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	**86 J**	650
Benzyl Alcohol	µg/kg	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**35 J**	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	**1.05**	**4.52**	1.54 U	0.98 U	**3.27**	**132.3**	**1.90**	0.95 U	**2.4**	2 U	--	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	**12**	**57**	33 U	17 U	**67**	**5,200**	**62**	16 U	**131**	16 U	--	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

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[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

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n/a = not applicable
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J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		SP-151		A1-15			A1-18			A1-23	A1-24		Proposed Sediment Cleanup Level[2]
Sample Identification		7234276	7234277	A1-15-S	A1-15-C1-3	A1-15-C3-5	A1-18-S	A1-18-C1-3	A1-18-C3-5	A1-23-S	A1-24-S	A1-24-C1-3	
Sample Date		06/12/2007	06/12/2007	08/01/08	08/13/08	08/13/08	09/04/08	08/14/08	08/14/08	08/04/08	09/04/08	09/04/08	
Sample Interval (dbm)		0 - 30 cm	0 - 30 cm	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	0-10 cm	1 - 3 ft	
Sample Type		Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Surface	Surface	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	Trace	<1	<1	**50**	<1	<1	**25**	**35**	**30**	15
Conventionals													
Total Organic Carbon (TOC)	Percent	**1.38**	**3.31**	**1.51**	**0.320**	**0.170**	**1.82**	**1.12**	**0.830**	**1.42**	**1.28**	**2.47**	NE
Metals													
Arsenic	mg/kg	**5.95**	**6.02**	7 U	6 U	7 U	8 U	**11**	**9**	9 U	**50**	**10**	57
Copper	mg/kg	**26.6**	**19.6**	**28.8**	**15.6**	**17.9**	**28.9**	**47**	**36.1**	**38.2**	**137**	**81.3**	390
Mercury	mg/kg	**0.05**	**0.079**	**0.1**	0.06 U	0.06 U	**0.09**	**0.12**	**0.09**	**0.08**	**0.1**	**0.3**	0.41
Zinc	mg/kg	**62.6**	**52.5**	**53 J**	**35**	**40**	**56 J**	**67**	**57**	**76 J**	**415 J**	**122**	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	**108**	**32.9 J**	**21.3 J**	5.9 U	11.8 U	**15.4 J**	**36.3 J**	**15.7 J**	**20.8 J**	**68.3**	**44.1**	370
2-Methylnaphthalene	mg/kg OC	**8.6**	**2**	**1.3 J**	5.9 U	11.8 U	**0.98 J**	**4.8**	**1.2**	**1.3 J**	**4.8**	**4.5**	38
Acenaphthene	mg/kg OC	**6**	**2.2**	**1.5**	5.9 U	11.8 U	**0.98 J**	**1.5 J**	2.3 U	**1.6**	**9.4**	**4.9**	16
Acenaphthylene	mg/kg OC	**5.7**	**2**	**1.4**	5.9 U	11.8 U	**0.9 J**	**2**	**1.9 J**	**1.0 J**	**2.2**	**0.8**	66
Anthracene	mg/kg OC	**8.6**	**3.1**	**2.8**	5.9 U	11.8 U	**1.7**	**2**	**1.9 J**	**2.5**	**8.6**	**4.9**	220
Fluorene	mg/kg OC	**6.6**	**2.6**	**1.9**	5.9 U	11.8 U	**1.3**	**1.8**	2.3 U	**1.9**	**7.3**	**6.1**	23
Naphthalene	mg/kg OC	**62**	**14.2 J**	**5.3**	5.9 U	11.8 U	**4.8**	**17.9**	**4.6**	**5.9**	**10.9**	**10.9**	99
Phenanthrene	mg/kg OC	**19.3**	**8.9**	**7.3**	5.9 U	11.8 U	**4.7**	**6.3**	**6**	**6.6**	**25**	**12.1**	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	1,491	1,090 J	322 J	19 U	20 U	281 J	406 J	129.9 J	295 J	874	1,090	5,200
2-Methylnaphthalene	µg/kg	118	66	19 J	19 U	20 U	18 J	54	9.9 J	18 J	62	110	670
Acenaphthene	µg/kg	80	73	22	19 U	20 U	18 J	17 J	19 U	23	120	120	500
Acenaphthylene	µg/kg	79	67	21	19 U	20 U	17 J	22	16 J	14 J	28	20	1,300
Anthracene	µg/kg	119	103	42	19 U	20 U	31	22	16 J	35	110	120	960
Fluorene	µg/kg	91	85	28	19 U	20 U	24	20	19 U	27	94	150	540
Naphthalene	µg/kg	855	469 J	80	19 U	20 U	88	200	38	84	140	270	2,100
Phenanthrene	µg/kg	267	293	110	19 U	20 U	85	71	50	94	320	300	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	**85**	**44.3**	**46**	12.8 J	11.8 U	**27.5 J**	**36.6**	**39.0 J**	**49.6 J**	**172**	**39.6 J**	960
Benzo(a)anthracene	mg/kg OC	**5.6**	**2.6**	**3.5**	5.9 U	11.8 U	**2.1**	**3.1**	**3.1**	**4.9**	**16.4**	**3.1**	110
Benzo(a)pyrene	mg/kg OC	**4.9**	**3**	**3.5**	5.9 U	11.8 U	**1.5**	**3.7**	**4**	**4.2**	**14.1**	**3.6**	99
Benzofluoranthenes[6] (Total)	mg/kg OC	**6.1**	**3.2**	**7.7**	5.9 U	11.8 U	**4**	**6.6**	**6.4**	**9.4**	**31.3**	**8.5**	230
Benzo(g,h,i)perylene	mg/kg OC	**3.2**	**2.4**	**1.8**	5.9 U	11.8 U	**1.5**	3.4 U	3.1 U	**2.7**	**7.4**	1.3 U	31
Chrysene	mg/kg OC	**8.2**	**6.7**	**4.8**	5.9 U	11.8 U	**2.9**	**3.8**	**4.5**	**7.7**	**24.2**	**6.5**	110
Dibenzo(a,h)anthracene	mg/kg OC	**0.7**	**0.5**	1.3 U	5.9 U	11.8 U	**0.7 J**	1.8 U	2.3 U	**0.9 J**	**3.4**	**0.4 J**	12
Fluoranthene	mg/kg OC	**25.1**	**11.1**	**11.3**	3.4 J	11.8 U	**7.1**	**7.5**	**8.7**	**9.2**	**35.2**	**10.9**	160

Sample Location[1]		SP-151		A1-15			A1-18			A1-23	A1-24		Proposed Sediment Cleanup Level[2]
Sample Identification		7234276	7234277	A1-15-S	A1-15-C1-3	A1-15-C3-5	A1-18-S	A1-18-C1-3	A1-18-C3-5	A1-23-S	A1-24-S	A1-24-C1-3	
Sample Date		06/12/2007	06/12/2007	08/01/08	08/13/08	08/13/08	09/04/08	08/14/08	08/14/08	08/04/08	09/04/08	09/04/08	
Sample Interval (dbm)		0 - 30 cm	0 - 30 cm	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	0-10 cm	1 - 3 ft	
Sample Type		Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Surface	Surface	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	**3.2**	**2.5**	**1.5**	5.9 U	11.8 U	**1.2**	**3**	**2.3 J**	**2.3**	**7.2**	**1.3**	34
Pyrene	mg/kg OC	**25.6**	**11**	**11.9**	9.4	11.8 U	**6.6**	**8.9**	**10.1**	**8.5**	**32.8**	**5.3**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	1,173	1,467	695	**41 J**	20 U	500 J	410	324 J	704 J	2,201	977 J	12,000
Benzo(a)anthracene	µg/kg	77	85	53	19 U	20 U	39	35	26	69	210	77	1,300
Benzo(a)pyrene	µg/kg	67	99	53	19 U	20 U	27	41	33	59	180	88	1,600
Benzofluoranthenes[6] (Total)	µg/kg	84	106	117	19 U	20 U	72	74	53	133	400	210	3,200
Benzo(g,h,i)perylene	µg/kg	44	78	27	19 U	20 U	27	38 U	26 U	38	95	32 U	670
Chrysene	µg/kg	113	223	72	19 U	20 U	52	42	37	110	310	160	1,400
Dibenzo(a,h)anthracene	µg/kg	9.6	16	20 U	19 U	20 U	12 J	20 U	19 U	12 J	44	10 J	230
Fluoranthene	µg/kg	347	368	170	**11 J**	20 U	130	84	72	130	450	270	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	44	82	23	19 U	20 U	21	34	19 J	33	92	32	600
Pyrene	µg/kg	353	365	180	**30**	20 U	120	100	84	120	420	130	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.6 U	0.3 U	1.3 U	5.9 U	11.8 U	1.04 U	1.8 U	2.3 U	1.4 U	1.6 U	0.8 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	0.6 U	0.3 U	1.3 U	5.9 U	11.8 U	1.04 U	1.8 U	2.3 U	1.4 U	1.6 U	0.8 U	2.3
Hexachlorobenzene	mg/kg OC	0.035 U	0.015 U	1.3 U	5.9 U	11.8 U	1.04 U	1.8 U	2.3 U	1.4 U	1.6 U	0.8 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	8.5 U	8.6 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	19 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	8.5 U	8.6 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	19 U	35
Hexachlorobenzene	µg/kg	0.48 U	0.5 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	19 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	1.3 U	0.69 U	**0.7 J**	5.9 U	11.8 U	**0.8 J**	**0.98 J**	2.3 U	**2.2**	**15.6 J**	**0.89**	47
Butyl Benzyl Phthalate	mg/kg OC	1.3 U	0.51 U	1.3 U	5.9 U	11.8 U	1 U	1.8 U	2.3 U	1.4 U	1.6 U	0.8 U	4.9
Diethyl Phthalate	mg/kg OC	1.3 U	1.0 U	1.3 U	5.9 U	11.8 U	1 U	1.8 U	2.3 U	1.4 U	1.6 U	0.8 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	17 U	23 U	11 J	19 U	20 U	14 J	11 J	19 U	31	200 J	22	1,300
Butyl Benzyl Phthalate	µg/kg	17 U	17 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	19 U	63
Diethyl Phthalate	µg/kg	17 U	34 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	19 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**34 J**	17 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	**23**	29
2-Methylphenol (o-Cresol)	µg/kg	8.5 U	8.6 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	**20**	63
4-Methylphenol (p-Cresol)	µg/kg	**133**	**115**	**68**	19 U	20 U	**50**	**31**	19 U	**45**	**87**	**870**	670
Phenol	µg/kg	76 U	65 U	**40**	19 U	20 U	**57**	**15 J**	19 U	**19 J**	**48**	**21**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	**10.3**	**4.02**	**1.6**	5.9 U	11.8 U	**1.1**	**1.2 J**	2.3 U	**1.8**	**7.5**	**4.5**	15
Hexachlorobutadiene	mg/kg OC	0.65 U	0.26 U	1.3 U	5.9 U	11.8 U	1 U	1.8 U	2.3 U	1.4 U	1.6 U	0.8 U	3.9

Sample Location[1]		SP-151		A1-15			A1-18			A1-23	A1-24		Proposed Sediment Cleanup Level[2]
Sample Identification		7234276	7234277	A1-15-S	A1-15-C1-3	A1-15-C3-5	A1-18-S	A1-18-C1-3	A1-18-C3-5	A1-23-S	A1-24-S	A1-24-C1-3	
Sample Date		06/12/2007	06/12/2007	08/01/08	08/13/08	08/13/08	09/04/08	08/14/08	08/14/08	08/04/08	09/04/08	09/04/08	
Sample Interval (dbm)		0 - 30 cm	0 - 30 cm	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	0-10 cm	1 - 3 ft	
Sample Type		Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Surface	Surface	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**142 J**	**133 J**	**24**	19 U	20 U	**20**	13 J	19 U	**26**	**96**	110	540
Hexachlorobutadiene	µg/kg	8.5 U	8.6 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	19 U	11
Benzoic Acid	µg/kg	262 U	**671 J**	200 U	190 U	200 U	190 U	200 U	190 U	200 U	200 U	190 U	650
Benzyl Alcohol	µg/kg	85 U	86 U	20 U	19 U	20 U	19 U	20 U	19 U	20 U	20 U	19 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	0.74 U	0.29 U	1.32 U	6.25 U	11.8 U	**1.48**	1.8 U	2.41 U	1.41 U	**5.94**	**1.34**	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	9.6 U	9.6 U	20 U	20 U	20 U	**27**	20 U	20 U	20 U	**76**	**33**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		A1-24	A1-31	A1-31B	EW-12-05	EW-12-06	EW-12-07	PG-62	PT-3	PT-5	PT-6	PT-8	Proposed Sediment Cleanup Level[2]
Sample Identification		A1-24-C3-5	A1-31-S	A1-31B-S	EPAX019F24	NAVHP85EDS404XX	BNWS008DBPS28	RB14-PG-62-S	PT-3-43.0-44.0	PT-5-43.0-44.0	PT-6-43.0-44.0	PT-8-43.0-44.0	
Sample Date		08/14/08	08/04/08	09/04/08	06/19/2012	06/19/2012	06/19/2012	04/22/2014	01/13/15	01/13/15	01/13/15	01/12/15	
Sample Interval (dbm)		3 - 5 ft	0-10 cm	0-10 cm	0 - 17 cm	0 - 17 cm	0 - 17 cm	0-10 cm	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	
Sample Type		Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	30	<1	<1	--	--	--	--	<1	<1	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	7.10	0.270	0.420	1.27	3.56	1.51	1.30 J	0.237	0.193	0.109	0.114	NE
Metals													
Arsenic	mg/kg	22	--	6 U	5.77	7.92	5.89	3.7	4.39 J	4.64 J	5.16 J	6	57
Copper	mg/kg	82	--	12	1,040	32.8	26	--	8.7	7.9	10.5	10.2	390
Mercury	mg/kg	0.28	--	0.05 U	0.0723	0.123	0.0875	0.040	0.0116 J	0.0107 J	0.0101 J	0.0079 J	0.41
Zinc	mg/kg	159	--	39	41	65.6	76.6	--	30	27	32	31	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	31.9	--	4.5 U	33.2 J	38.0	33.7	--	1 J	2.5 U	4.3 U	4.1 U	370
2-Methylnaphthalene	mg/kg OC	3.4	--	4.5 U	4.7	2.7	2.5	--	2 U	2.5 U	4.3 U	4.1 U	38
Acenaphthene	mg/kg OC	3.5	--	4.5 U	2.8	2.5	2.4	--	2 U	2.5 U	4.3 U	4.1 U	16
Acenaphthylene	mg/kg OC	0.5	--	4.5 U	2.1 J	1.9	1.8	--	2 U	2.5 U	4.3 U	4.1 U	66
Anthracene	mg/kg OC	3.5	--	4.5 U	3.5	4.2	3.2	--	2 U	2.5 U	4.3 U	4.1 U	220
Fluorene	mg/kg OC	5.1	--	4.5 U	2.9	3.1	2.5	--	2 U	2.5 U	4.3 U	4.1 U	23
Naphthalene	mg/kg OC	7.2	--	4.5 U	11.8	15.7	15.2	--	2 U	2.5 U	4.3 U	4.1 U	99
Phenanthrene	mg/kg OC	8.7	--	4.5 U	10.2	10.7	8.6	--	1 J	2.5 U	4.3 U	4.1 U	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	2,266	--	19 U	422	1,355	509	--	2.4 J	4.9 U	4.7 U	4.7 U	5,200
2-Methylnaphthalene	µg/kg	240	--	19 U	59	95	38	--	4.8 U	4.9 U	4.7 U	4.7 U	670
Acenaphthene	µg/kg	250	--	19 U	35	89	36	--	4.8 U	4.9 U	4.7 U	4.7 U	500
Acenaphthylene	µg/kg	36	--	19 U	26	66	27	--	4.8 U	4.9 U	4.7 U	4.7 U	1,300
Anthracene	µg/kg	250	--	19 U	44	150	49	--	4.8 U	4.9 U	4.7 U	4.7 U	960
Fluorene	µg/kg	360	--	19 U	37	110	37	--	4.8 U	4.9 U	4.7 U	4.7 U	540
Naphthalene	µg/kg	510	--	19 U	150	560	230	--	4.8 U	4.9 U	4.7 U	4.7 U	2,100
Phenanthrene	µg/kg	620	--	19 U	130	380	130	--	2.4 J	4.9 U	4.7 U	4.7 U	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	16.6	--	4.5 U	45.8 J	44.8 J	39.5 J	--	2 U	2.5 U	4.3 U	4.1 U	960
Benzo(a)anthracene	mg/kg OC	1.2	--	4.5 U	3.4	3.4	2.8	1.41	2 U	2.5 U	4.3 U	4.1 U	110
Benzo(a)pyrene	mg/kg OC	1.4	--	4.5 U	3.1	2.7	2.3	1.20	2 U	2.5 U	4.3 U	4.1 U	99
Benzofluoranthenes[6] (Total)	mg/kg OC	3.1	--	4.5 U	5.8	5.5	4.8	1.29	2 U	2.5 U	4.3 U	4.1 U	230
Benzo(g,h,i)perylene	mg/kg OC	0.6 U	--	4.5 U	1.34 J	1.01 J	1.06 J	--	2 U	2.5 U	4.3 U	4.1 U	31
Chrysene	mg/kg OC	2.3	--	4.5 U	5.1	4.5	3.8	1.88	2 U	2.5 U	4.3 U	4.1 U	110
Dibenzo(a,h)anthracene	mg/kg OC	0.3 U	--	4.5 U	0.9 UJ	0.28 J	0.9 UJ	0.166	2 U	2.5 U	4.3 U	4.1 U	12
Fluoranthene	mg/kg OC	5.5	--	4.5 U	11	12.4	10.6	--	2 U	2.5 U	4.3 U	4.1 U	160

Sample Location[1]		A1-24	A1-31	A1-31B	EW-12-05	EW-12-06	EW-12-07	PG-62	PT-3	PT-5	PT-6	PT-8	Proposed Sediment Cleanup Level[2]
Sample Identification		A1-24-C3-5	A1-31-S	A1-31B-S	EPAX019F24	NAVHP85EDS404XX	BNWS008DBPS28	RB14-PG-62-S	PT-3-43.0-44.0	PT-5-43.0-44.0	PT-6-43.0-44.0	PT-8-43.0-44.0	
Sample Date		08/14/08	08/04/08	09/04/08	06/19/2012	06/19/2012	06/19/2012	04/22/2014	01/13/15	01/13/15	01/13/15	01/12/15	
Sample Interval (dbm)		3 - 5 ft	0-10 cm	0-10 cm	0 - 17 cm	0 - 17 cm	0 - 17 cm	0-10 cm	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	
Sample Type		Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	0.5	--	4.5 U	**2**	1.4	**1.7**	**0.729**	2 U	2.5 U	4.3 U	4.1 U	34
Pyrene	mg/kg OC	2.8	--	4.5 U	**14.2**	13.8	**12.6**	--	2 U	2.5 U	4.3 U	4.1 U	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	**1,182**	--	19 U	582 J	**1,551 J**	597 J	--	4.8 U	4.9 U	4.7 U	4.7 U	12,000
Benzo(a)anthracene	µg/kg	**82**	--	19 U	43	**120**	42	18.1	4.8 U	4.9 U	4.7 U	4.7 U	1,300
Benzo(a)pyrene	µg/kg	**97**	--	19 U	39	**96**	34	15.3	4.8 U	4.9 U	4.7 U	4.7 U	1,600
Benzofluoranthenes[6] (Total)	µg/kg	**220**	--	19 U	73	**195**	72	16.5	4.8 U	4.9 U	4.7 U	4.7 U	3,200
Benzo(g,h,i)perylene	µg/kg	41 U	--	19 U	17 J	**36 J**	16 J	--	4.8 U	4.9 U	4.7 U	4.7 U	670
Chrysene	µg/kg	**160**	--	19 U	65	**160**	57	24.1	4.8 U	4.9 U	4.7 U	4.7 U	1,400
Dibenzo(a,h)anthracene	µg/kg	19 U	--	19 U	34 UJ	**9.8 J**	36 UJ	2.13	4.8 U	4.9 U	4.7 U	4.7 U	230
Fluoranthene	µg/kg	**390**	--	19 U	140	**440**	160	--	4.8 U	4.9 U	4.7 U	4.7 U	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	**33**	--	19 U	25	**50**	26	9.33	4.8 U	4.9 U	4.7 U	4.7 U	600
Pyrene	µg/kg	**200**	--	19 U	180	**490**	190	--	4.8 U	4.9 U	4.7 U	4.7 U	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.3 U	--	4.5 U	3 U	2 U	1 U	--	2 U	2.5 U	4.3 U	4.1 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	0.3 U	--	4.5 U	5 U	5 U	3 U	--	2 U	2.5 U	4.3 U	4.1 U	2.3
Hexachlorobenzene	mg/kg OC	0.3 U	--	4.5 U	1 U	1 U	0.6 U	--	0.41 U	0.51 U	0.87 U	0.84 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	19 U	--	19 U	34 U	46 U	36 U	--	4.8 U	4.9 U	4.7 U	4.7 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	19 U	--	19 U	67 U	91 U	73 U	--	4.8 U	4.9 U	4.7 U	4.7 U	35
Hexachlorobenzene	µg/kg	19 U	--	19 U	17 U	23 U	18 U	--	0.98 U	0.99 U	0.95 U	0.96 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	0.3 U	--	5.7	3 U	1 U	2 U	--	20 U	25 U	43 U	41 U	47
Butyl Benzyl Phthalate	mg/kg OC	0.3 U	--	4.5 U	3 U	1 U	**1 J**	--	2 U	2.5 U	4.3 U	4.1 U	4.9
Diethyl Phthalate	mg/kg OC	0.3 U	--	4.5 U	1 U	0.6 U	1 U	--	8 U	10 U	17 U	17 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	19 U	--	**24**	34 U	46 U	36 U	--	48 U	49 U	47 U	47 U	1,300
Butyl Benzyl Phthalate	µg/kg	19 U	--	19 U	34 U	46 U	16 J	--	4.8 U	4.9 U	4.7 U	4.7 U	63
Diethyl Phthalate	µg/kg	19 U	--	19 U	17 U	23 U	18 U	--	19 U	20 U	19 U	19 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**30**	--	19 U	170 U	230 U	180 U	--	24 U	24 U	24 U	24 U	29
2-Methylphenol (o-Cresol)	µg/kg	**34**	--	19 U	170 U	230 U	180 U	--	19 U	20 U	19 U	19 U	63
4-Methylphenol (p-Cresol)	µg/kg	**890**	--	19 U	**63 J**	**240**	**81 J**	--	19 U	20 U	19 U	19 U	670
Phenol	µg/kg	**24**	--	19 U	67 U	**43 J**	**73 NJ**	--	19 U	20 U	19 U	19 U	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	3.1	--	4.5 U	**2.52 J**	3	**2.0**	--	2 U	2.5 U	4.3 U	4.1 U	15
Hexachlorobutadiene	mg/kg OC	0.3 U	--	4.5 U	5 U	3 U	5 U	--	0.41 U	0.51 U	0.87 U	0.84 U	3.9

Sample Location[1]		A1-24	A1-31	A1-31B	EW-12-05	EW-12-06	EW-12-07	PG-62	PT-3	PT-5	PT-6	PT-8	Proposed Sediment Cleanup Level[2]
Sample Identification		A1-24-C3-5	A1-31-S	A1-31B-S	EPAX019F24	NAVHP85EDS404XX	BNWS008DBPS28	RB14-PG-62-S	PT-3-43.0-44.0	PT-5-43.0-44.0	PT-6-43.0-44.0	PT-8-43.0-44.0	
Sample Date		08/14/08	08/04/08	09/04/08	06/19/2012	06/19/2012	06/19/2012	04/22/2014	01/13/15	01/13/15	01/13/15	01/12/15	
Sample Interval (dbm)		3 - 5 ft	0-10 cm	0-10 cm	0 - 17 cm	0 - 17 cm	0 - 17 cm	0-10 cm	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	
Sample Type		Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	μg/kg	**220**	--	19 U	32 J	**120**	37	--	4.8 U	4.9 U	4.7 U	4.7 U	540
Hexachlorobutadiene	μg/kg	19 U	--	19 U	67 U	91 U	73 U	--	0.98 U	0.99 U	0.95 U	0.96 U	11
Benzoic Acid	μg/kg	190 U	--	190 U	--	--	--	--	190 U	200 U	190 U	190 U	650
Benzyl Alcohol	μg/kg	19 U	--	19 U	170 U	230 U	180 U	--	19 U	20 U	19 U	19 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	0.3	--	4.5 U	**0.37**	0.53	**0.99**	--	0.00068 J	0.0020 J	0.0051 J	0.0073 J	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	μg/kg	**21**	--	19 U	4.7	**19**	15	--	**0.0016 J**	**0.0038 J**	**0.0055 J**	**0.0048 J**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
μg/kg = microgram per kilogram
μg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		PT-10	PT-11	PT-12	PT-13	PT-14	ST-101		ST-102				Proposed Sediment Cleanup Level[2]
Sample Identification		PT-10-36.0-37.0	PT-11-36.0-37.0	PT-12-30.0-31.0	PT-13-29.0-30.0	PT-14-29.0-30.0	ST-101S_0-10	ST-101C_13.2-14.2	ST-102S_0-10	ST-102C_6.3-7.3	ST-102C_7.3-8.3	ST-102C_9.3-10.3	
Sample Date		01/14/15	01/15/15	01/15/15	01/15/15	01/15/15	10/24/18	10/23/18	10/24/18	10/23/18	10/23/18	10/23/18	
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0-10 cm	13.2-14.2 ft	0-10 cm	6.3-7.3 ft	7.3-8.3 ft	9.3-10.3 ft	
Sample Type		Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	Surface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	2.70	0.228	7.76	0.214	0.092	0.480	0.270	0.230	2.24	1.45	0.500	NE
Metals													
Arsenic	mg/kg	6.08 J	3.92 J	9	7	3.95 J	3.22	4.14	2.63	5.33	5.44	4.86	57
Copper	mg/kg	12.8	7.6	44.2	6.6	5.9	15	10.6	13.6	56	47.9	35	390
Mercury	mg/kg	0.08	0.0071 J	0.11	0.0072 J	0.0104 J	0.0195 J	0.0137 J	0.0158 J	0.102	0.0706 J	0.0443	0.41
Zinc	mg/kg	34	28	70	25	22	43.4	30.8	43.1	71.1	61.9	51.1	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	41.1	1.4 J	33.8	2	2.7 J	24.8 J	1.82 U	8.35 J	52.2 J	179 J	111	370
2-Methylnaphthalene	mg/kg OC	2.8	2.1 U	2.3	2.3 U	5.4 U	2.19	1.82 U	2.07 U	2.73	11.4	5.8	38
Acenaphthene	mg/kg OC	2.7	2.1 U	2.7	2.3 U	5.4 U	2.15 J	1.82 UJ	2.07 U J	2.98 J	11.1 J	6.72	16
Acenaphthylene	mg/kg OC	2	2.1 U	1	2.3 U	5.4 U	1.04 J	1.82 UJ	2.07 U J	3.13 J	12.5 J	6.38	66
Anthracene	mg/kg OC	4	2.1 U	2.1	2.3 U	5.4 U	4.67	1.82 U	1.57 J	2.82	7.5	6.6	220
Fluorene	mg/kg OC	3.3	2.1 U	3.1	2.3 U	5.4 U	2.69	1.82 U	2.07 U	3.59	12.2	7.78	23
Naphthalene	mg/kg OC	17	1.4 J	14	2.3	2.7 J	4.06 J	1.82 UJ	1.38 J	23.8 J	88.4 J	47.8	99
Phenanthrene	mg/kg OC	9.6	2.1 U	8.4	2.3 U	5.4 U	10.1	1.82 U	5.39	16	47.1	35.8	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	1,110	3.3 J	2,620	5	2.5 J	119 J	4.92 U	19.2 J	1,170 J	2,610 J	555	5,200
2-Methylnaphthalene	µg/kg	75	4.7 U	180	4.9 U	5.0 U	10.5	4.92 U	4.75 U	61.1	166	29	670
Acenaphthene	µg/kg	73	4.7 U	210	4.9 U	5.0 U	10.3 J	4.92 UJ	4.75 UJ	66.8 J	162 J	33.6	500
Acenaphthylene	µg/kg	53	4.7 U	80	4.9 U	5.0 U	5.01 J	4.92 UJ	4.75 UJ	70.1 J	182 J	31.9	1,300
Anthracene	µg/kg	100	4.7 U	160	4.9 U	5.0 U	22.4	4.92 U	3.62 J	63.2	110	33	960
Fluorene	µg/kg	89	4.7 U	240	4.9 U	5.0 U	12.9	4.92 U	4.75 U	80.5	178	38.9	540
Naphthalene	µg/kg	460	3.3 J	1,100	5	2.5 J	19.5 J	4.92 UJ	3.18 J	534 J	1,290 J	239	2,100
Phenanthrene	µg/kg	260	4.7 U	650	4.9 U	5.0 U	48.4	4.92 U	12.4	360	687	179	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	30.4	2.1 U	16.43	2.3 U	5.4 U	101 J	1.82 U	72.6 J	33 J	71.9 J	73.4	960
Benzo(a)anthracene	mg/kg OC	2.2	2.1 U	0.91	2.3 U	5.4 U	7.94	1.82 U	5.87	1.79	2.66	3.94	110
Benzo(a)pyrene	mg/kg OC	1.9	2.1 U	0.63	2.3 U	5.4 U	8.75 J	1.82 U	6.52 J	1.27 J	1.49 J	2.34	99
Benzofluoranthenes[6] (Total)	mg/kg OC	3.1	2.1 U	1.3	2.3 U	5.4 U	20.3	3.64 U	12.8	2.73	4.12	8.38	230
Benzo(g,h,i)perylene	mg/kg OC	1.4	2.1 U	0.57	2.3 U	5.4 U	4.5	1.82 U	5.26	1.1	1.31	2.5	31
Chrysene	mg/kg OC	2.3	2.1 U	1.3	2.3 U	5.4 U	9.33	1.82 U	9.39	2.5	4.38	5.62	110
Dibenzo(a,h)anthracene	mg/kg OC	0.89 U	2.1 U	0.31 U	2.3 U	5.4 U	2.54 J	1.82 U	3.5 J	0.408 J	0.512 J	0.32	12
Fluoranthene	mg/kg OC	9.6	2.1 U	5.9	2.3 U	5.4 U	21.7	1.82 U	13.4	12.7	31.9	26.6	160

Sample Location[1]		PT-10	PT-11	PT-12	PT-13	PT-14	ST-101		ST-102				Proposed Sediment Cleanup Level[2]
Sample Identification		PT-10-36.0-37.0	PT-11-36.0-37.0	PT-12-30.0-31.0	PT-13-29.0-30.0	PT-14-29.0-30.0	ST-101S_0-10	ST-101C_13.2-14.2	ST-102S_0-10	ST-102C_6.3-7.3	ST-102C_7.3-8.3	ST-102C_9.3-10.3	
Sample Date		01/14/15	01/15/15	01/15/15	01/15/15	01/15/15	10/24/18	10/23/18	10/24/18	10/23/18	10/23/18	10/23/18	
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0-10 cm	13.2-14.2 ft	0-10 cm	6.3-7.3 ft	7.3-8.3 ft	9.3-10.3 ft	
Sample Type		Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	Surface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	**1**	2.1 U	0.32	2.3 U	5.4 U	4.81	1.82 U	4.29	**0.866**	**0.681**	**1.55**	34
Pyrene	mg/kg OC	**8.9**	2.1 U	5.5	2.3 U	5.4 U	20.8	1.82 U	11.7	**9.64**	**25**	**22.2**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	821	4.7 U	**1,275**	4.9 U	5 U	**483 J**	9.84 U	**167 J**	739 J	1,050 J	367	12,000
Benzo(a)anthracene	µg/kg	59	4.7 U	**71**	4.9 U	5.0 U	**38.1**	4.92 U	**13.5**	40.1	38.8	19.7	1,300
Benzo(a)pyrene	µg/kg	51	4.7 U	**49**	4.9 U	5.0 U	**42.0 J**	4.92 UJ	**15.0 J**	28.5 J	21.7 J	11.7	1,600
Benzofluoranthenes[6] (Total)	µg/kg	84	4.7 U	**98**	4.9 U	5.0 U	**97.4**	9.84 U	**29.5**	61.2	60.1	41.9	3,200
Benzo(g,h,i)perylene	µg/kg	38	4.7 U	**44**	4.9 U	5.0 U	**21.6**	4.92 U	**12.1**	24.6	19.1	12.5	670
Chrysene	µg/kg	62	4.7 U	**98**	4.9 U	5.0 U	**44.8**	4.92 U	**21.6**	55.9	64	28.1	1,400
Dibenzo(a,h)anthracene	µg/kg	24 U	4.7 U	24 U	4.9 U	5.0 U	**12.2 J**	4.92 UJ	**8.06 J**	9.13 J	7.48 J	1.60 J	230
Fluoranthene	µg/kg	260	4.7 U	**460**	4.9 U	5.0 U	**104**	4.92 U	**30.9**	284	466	133	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	27	4.7 U	**25**	4.9 U	5.0 U	**23.1**	4.92 U	**9.86**	19.4	9.94	7.77	600
Pyrene	µg/kg	240	4.7 U	**430**	4.9 U	5.0 U	**99.6**	4.92 U	**26.9**	216	360	111	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.18 U	2.1 U	0.062 U	2.3 U	5.4 U	4.10 U	7.30 U	8.26 U	0.857 U	1.32 U	3.88 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	0.18 U	2.1 U	0.062 U	2.3 U	5.4 U	4.10 U	7.30 U	8.26 U	0.857 U	1.32 U	3.88 U	2.3
Hexachlorobenzene	mg/kg OC	0.036 U	0.42 U	0.012 U	0.46 U	1.1 U	0.100 U	0.190 U	0.210 U	0.0220 U	0.269 U	0.960 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	4.9 U	4.7 U	4.8 U	4.9 U	5.0 U	19.7 U	19.7 U	19.0 U	19.2 U	19.2 U	19.4 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	4.9 U	4.7 U	4.8 U	4.9 U	5.0 U	19.7 U	19.7 U	19.0 U	19.2 U	19.2 U	19.4 U	35
Hexachlorobenzene	µg/kg	0.97 U	0.95 U	0.96 U	0.98 U	1.0 U	0.48 U	0.50 U	0.48 U	0.50 U	3.93 U	4.8 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	1.8 U	21 U	0.62 U	23 U	50 U	10.3 U	18.3 U	20.7 U	**1.26**	3.28 U	9.68 U	47
Butyl Benzyl Phthalate	mg/kg OC	0.18 U	3.2	0.11	2.3 U	5.4 U	4.10 U	7.30 U	8.26 U	0.857 U	1.32 U	3.88 U	4.9
Diethyl Phthalate	mg/kg OC	0.7 U	8.3 U	0.44	9 U	20 U	4.10 U	8.04	8.26 U	0.835	**7.12**	3.88 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	49 U	47 U	48 U	49 U	50 U	49.3 U	49.3 U	47.6 U	28.2 J	47.9 U	48.4 U	1,300
Butyl Benzyl Phthalate	µg/kg	4.9 U	**7.4**	**8.8**	4.9 U	5.0 U	19.7 U	19.7 U	19.0 U	19.2 U	19.2 U	19.4 U	63
Diethyl Phthalate	µg/kg	20 U	19 U	**34**	20 U	20 U	19.7 U	21.7 U	19.0 U	18.7 U	104	19.4 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	24 U	23 U	**24 J**	25 U	25 U	24.7 U	24.7 U	23.8 U	**6.7 J**	**10.6 J**	**5.1 J**	29
2-Methylphenol (o-Cresol)	µg/kg	20 U	19 U	**36**	20 U	20 U	19.7 U	19.7 U	19.0 U	19.2 U	19.2 U	**10.6 J**	63
4-Methylphenol (p-Cresol)	µg/kg	20 U	**92**	**180**	20 U	20 U	19.7 U	19.7 U	19.0 U	**275**	**81.7**	**58.8**	670
Phenol	µg/kg	20 U	**38**	**59**	20 U	20 U	**23.2**	**21.2**	**14.5 J**	**20.9**	19.2 U	**14.6 J**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	**3.2**	2.1 U	3	2.3 U	5.4 U	4.79	7.30 U	8.26 U	**3.88**	**9.18**	**14.3**	15
Hexachlorobutadiene	mg/kg OC	0.036 U	0.42 U	0.012 U	0.46 U	1.1 U	4.10 U	7.30 U	8.26 U	0.857 U	1.32 U	3.88 U	3.9

Sample Location[1]		PT-10	PT-11	PT-12	PT-13	PT-14	ST-101		ST-102				Proposed Sediment Cleanup Level[2]
Sample Identification		PT-10-36.0-37.0	PT-11-36.0-37.0	PT-12-30.0-31.0	PT-13-29.0-30.0	PT-14-29.0-30.0	ST-101S_0-10	ST-101C_13.2-14.2	ST-102S_0-10	ST-102C_6.3-7.3	ST-102C_7.3-8.3	ST-102C_9.3-10.3	
Sample Date		01/14/15	01/15/15	01/15/15	01/15/15	01/15/15	10/24/18	10/23/18	10/24/18	10/23/18	10/23/18	10/23/18	
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0-10 cm	13.2-14.2 ft	0-10 cm	6.3-7.3 ft	7.3-8.3 ft	9.3-10.3 ft	
Sample Type		Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	Subsurface[8]	Surface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**86**	4.7 U	**200**	4.9 U	5.0 U	**23**	19.7 U	19.0 U	**86.8**	**134**	**71.7**	540
Hexachlorobutadiene	µg/kg	0.97 U	0.95 U	0.96 U	0.98 U	1.0 U	19.7 U	19.7 U	19.0 U	19.2 U	19.2 U	19.4 U	11
Benzoic Acid	µg/kg	200 U	**82 J**	**150 J**	200 U	200 U	71.8 U	64.0 U	31.8 U	**77.8 J**	**83.5 J**	**51.3 J**	650
Benzyl Alcohol	µg/kg	20 U	19 U	19 U	20 U	20 U	19.7 U	19.7 U	**19.0 J**	**19.2 J**	19.2 U	19.4 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	**0.0019 J**	**0.0018 J**	**0.0046 J**	**0.0017 J**	**0.0015 J**	**0.38 J**	0.008 U	**0.33 J**	**0.8 J**	**0.31 J**	**0.13 J**	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	**0.043 J**	**0.0041 J**	**0.24 J**	**0.0037 J**	**0.0014 J**	**1.81 J**	0.022 U	**0.75 J**	**18 J**	**4.59 J**	**0.64 J**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		ST-103	ST-104				ST-105		ST-106				Proposed Sediment Cleanup Level[2]
Sample Identification		ST-103S_0-10	ST-104S_0-10	ST-104C_7.3-8.3	ST-104C_8.3-9.3	ST-104C_10.3-11.3	ST-105S_0-10	ST-105C_11-12	ST-106S_0-10	ST-106C_3.1-4.1	ST-106C_4.1-5.1	ST-106C_6.1-7.1	
Sample Date		10/24/18	10/24/18	10/26/18	10/26/18	10/26/18	10/24/18	10/26/18	10/24/18	10/26/18	10/26/18	10/26/18	
Sample Interval (dbm)		0-10 cm	0-10 cm	7.3-8.3 ft	8.3-9.3 ft	10.3-11.3 ft	0-10 cm	11-12 ft	0-10 cm	3.1-4.1 ft	4.1-5.1 ft	6.1-7.1 ft	
Sample Type		Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	0.360	0.730	0.400	0.950	2.90	2.20	0.170	1.30	1.64	1.38	2.33	NE
Metals													
Arsenic	mg/kg	3.08	3.15	2.56	2.99	3.98	3.81	3.57	3.51	3.1	3.19	3.62	57
Copper	mg/kg	16.1	18.5	27.2	38.4	36.2	27.9	11.3	21.4	23.9	22.3	25.2	390
Mercury	mg/kg	0.0250 J	0.0189 J	0.0725	0.0843 J	0.142	0.0559	0.0126 J	0.0205 J	0.0331	0.0450 J	0.0563	0.41
Zinc	mg/kg	45.9	50.5	35.9	59.1	51.3	56.6	32.4	51.4	55.5	57	58.5	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	13.4 J	12.2 J	28 J	90.2 J	55	14.6 J	2.82 U	14.3 J	6.89 J	32.1 J	28.2	370
2-Methylnaphthalene	mg/kg OC	1.69	0.388 J	1.76	6.88	4.5	0.759	2.82 U	0.566	0.374	3.19	2.49	38
Acenaphthene	mg/kg OC	1.52 J	0.727 J	1.53 J	6.08 J	4.59	1.19 J	2.82 U	1.62 J	0.385 J	2.7 J	3.1	16
Acenaphthylene	mg/kg OC	1.35 UJ	1.37 J	0.808 J	2.94 J	1.91	0.559 J	2.82 U	0.403 J	0.238 J	1.16 J	0.747	66
Anthracene	mg/kg OC	1.81	2.45	4.9	9.13	3.3	2.5	2.82 U	1.92	1.5	4.44	4.11	220
Fluorene	mg/kg OC	1.26 J	0.93	2.12	8.07	4.69	1.44	2.82 U	1.37	0.574	3.09	3.44	23
Naphthalene	mg/kg OC	1.7 J	0.659 J	8.23 J	28.7 J	26	1.45 J	2.82 U	0.962 J	0.582 J	9.13 J	7.08	99
Phenanthrene	mg/kg OC	7.11	6.07	9.93	35.3	14.9	7.45	2.82 U	8	3.6	12	9.66	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	48.2 J	89.1 J	110 J	857 J	1,600	321 J	4.80 U	186 J	113 J	443 J	656	5,200
2-Methylnaphthalene	µg/kg	6.07	2.83 J	7.05	65.4	130	16.7	4.80 U	7.36	6.14	44	58.1	670
Acenaphthene	µg/kg	5.47 J	5.31 J	6.10 J	57.8 J	133	26.1 J	4.80 UJ	21.0 J	6.32 J	37.2 J	72.2	500
Acenaphthylene	µg/kg	4.85 UJ	10.0 J	3.23 J	27.9 J	55.3	12.3 J	4.80 UJ	5.24 J	3.90 J	16.0 J	17.4	1,300
Anthracene	µg/kg	6.51	17.9	19.6	86.7	95.8	55	4.80 U	25	24.6	61.3	95.8	960
Fluorene	µg/kg	4.52 J	6.79	8.46	76.7	136	31.6	4.80 U	17.8	9.41	42.7	80.1	540
Naphthalene	µg/kg	6.11 J	4.81 J	32.9 J	273 J	750	32.0 J	4.80 UJ	12.5 J	9.55 J	126 J	165	2,100
Phenanthrene	µg/kg	25.6	44.3	39.7	335	432	164	4.80 U	104	59	160	225	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	65 J	144 J	29.3 J	160 J	29	45.9 J	5.64 U	61.1 J	52.4	61.3	61.8	960
Benzo(a)anthracene	mg/kg OC	5.72	8.63	1.84	15.5	1.34	4.39	2.82 U	5.45	5.41	6.09	4.24	110
Benzo(a)pyrene	mg/kg OC	5.92 J	4.75 J	1.5 J	12.9 J	0.897	3.47 J	2.82 U	5.98 J	5.9 J	4.09 J	2.88	99
Benzofluoranthenes[6] (Total)	mg/kg OC	10.8	16	3.83	20.6	2.72	6.45	5.64 U	10.4	10.2	9.2	8.97	230
Benzo(g,h,i)perylene	mg/kg OC	4.33	2.29	1.24	7.2	0.893	2.15	2.82 U	4.42	3.5	2.42	1.79	31
Chrysene	mg/kg OC	5.97	15.6	2.21	17.4	2.16	5.5	2.82 U	6.21	6.22	8.77	7.85	110
Dibenzo(a,h)anthracene	mg/kg OC	2.81 J	1.47 J	1.78 J	2.75 J	0.455	0.777 J	2.82 U	1.48 J	1.18 J	1.1 J	0.717	12
Fluoranthene	mg/kg OC	14.1	57.9	8.8	39.1	11	11	2.82 U	12.2	7.99	11.2	13	160

Sample Location[1]		ST-103	ST-104				ST-105		ST-106				Proposed Sediment Cleanup Level[2]
Sample Identification		ST-103S_0-10	ST-104S_0-10	ST-104C_7.3-8.3	ST-104C_8.3-9.3	ST-104C_10.3-11.3	ST-105S_0-10	ST-105C_11-12	ST-106S_0-10	ST-106C_3.1-4.1	ST-106C_4.1-5.1	ST-106C_6.1-7.1	
Sample Date		10/24/18	10/24/18	10/26/18	10/26/18	10/26/18	10/24/18	10/26/18	10/24/18	10/26/18	10/26/18	10/26/18	
Sample Interval (dbm)		0-10 cm	0-10 cm	7.3-8.3 ft	8.3-9.3 ft	10.3-11.3 ft	0-10 cm	11-12 ft	0-10 cm	3.1-4.1 ft	4.1-5.1 ft	6.1-7.1 ft	
Sample Type		Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	4.11	**2.47**	1.1 J	**7.66**	**0.49**	**2.13**	2.82 U	**4.14**	**3.59**	**2.34**	**1.67**	34
Pyrene	mg/kg OC	11.2	**34.8**	7	**34.8**	**9**	**10.2**	2.82 U	**11**	**8.35**	**16.1**	**21**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	**234 J**	1,050 J	**117 J**	1,500 J	850	1,010 J	9.59 U	794 J	859	846	1440	12,000
Benzo(a)anthracene	µg/kg	**20.6**	63	**7.37**	147	38.9	96.5	4.80 U	70.9	88.8	84	98.9	1,300
Benzo(a)pyrene	µg/kg	**21.3 J**	34.7 J	**5.98 J**	123 J	26	76.3 J	4.80 UJ	77.7 J	96.7 J	56.4 J	67.2	1,600
Benzofluoranthenes[6] (Total)	µg/kg	**38.8**	120	**15.3**	196	79	142	9.59 U	135	168	127	209	3,200
Benzo(g,h,i)perylene	µg/kg	**15.6**	16.7	**4.95**	68.4	25.9	47.4	4.80 U	57.5	57.4	33.4	41.8	670
Chrysene	µg/kg	**21.5**	114	**8.82**	165	62.7	121	4.80 U	80.7	102	121	183	1,400
Dibenzo(a,h)anthracene	µg/kg	**10.1 J**	10.7 J	**7.10 J**	26.1 J	13.2	17.1 J	4.80 UJ	19.2 J	19.3 J	15.2 J	16.7	230
Fluoranthene	µg/kg	**50.6**	423	**35.2**	371	330	242	4.80 U	159	131	155	302	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	**14.8**	18	**4.40 J**	72.8	14.2	46.8	4.80 U	53.8	58.9	32.3	38.9	600
Pyrene	µg/kg	**40.3**	254	**28**	331	260	224	4.80 U	140	137	222	480	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	5.39 U	2.73 U	4.80 U	1.98 U	0.683 U	0.905 U	11.4 U	1.49 U	1.22 U	1.38 U	0.841 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	5.39 U	2.73 U	4.80 U	1.98 U	0.683 U	0.905 U	11.4 U	1.49 U	1.22 U	1.38 U	0.841 U	2.3
Hexachlorobenzene	mg/kg OC	0.140 U	0.0660 U	0.120 U	0.0520 U	0.170 U	0.0230 U	0.280 U	0.0380 U	0.0290 U	0.0360 U	0.210 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	19.4 U	19.9 U	19.2 U	18.8 U	19.8 U	19.9 U	19.3 U	19.4 U	20.0 U	19.0 U	19.6 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	19.4 U	19.9 U	19.2 U	18.8 U	19.8 U	19.9 U	19.3 U	19.4 U	20.0 U	19.0 U	19.6 U	35
Hexachlorobenzene	µg/kg	0.49 U	0.48 U	0.49 U	0.49 U	5.0 U	0.50 U	0.48 U	0.50 U	0.48 U	0.49 U	4.9 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	13.5 U	**7.47**	12.0 U	4.95 U	1.71 U	**2.54**	18.9	**35.6**	3.04 U	**10.0**	**51.1**	47
Butyl Benzyl Phthalate	mg/kg OC	5.39 U	2.73 U	4.80 U	1.46 J	0.683 U	0.905 U	11.4 U	1.49 U	1.22 U	1.38 U	**4.85**	4.9
Diethyl Phthalate	mg/kg OC	5.92	2.73 U	4.80 U	1.98 U	**0.752**	0.905 U	11.4 U	1.49 U	**1.9**	1.38 U	0.841 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	48.5 U	54.5	48.0 U	47.0 U	49.6 U	55.9	**32.1 J**	463	49.9 U	200	1190	1,300
Butyl Benzyl Phthalate	µg/kg	19.4 U	19.9 U	19.2 U	13.9 J	19.8 U	19.9 U	19.3 U	19.4 U	20.0 U	19.0 U	113	63
Diethyl Phthalate	µg/kg	**21.3**	19.9 U	19.2 U	18.8 U	21.8	19.9 U	19.3 U	19.4 U	30.3	19.0 U	19.6 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	24.2 U	24.9 U	24.0 U	**9.9 J**	**21.1**	24.9 U	24.1 U	24.2 U	25.0 U	**3.4 J**	**5.4 J**	29
2-Methylphenol (o-Cresol)	µg/kg	19.4 U	19.9 U	19.2 U	18.8 U	19.8 U	19.9 U	19.3 U	19.4 U	20.0 U	19.0 U	19.6 U	63
4-Methylphenol (p-Cresol)	µg/kg	19.4 U	19.9 U	**46.4**	**393**	**1,820**	**27.5**	19.3 U	19.4 U	20.0 U	**210**	**229**	670
Phenol	µg/kg	**13.8 J**	**11.1 J**	19.2 U	**52.2**	**62.8**	**29.1**	19.3 U	**13.4 J**	**10.3 J**	**71.2**	**57.3**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	5.39 U	**1.48 J**	4.80 U	**7.87**	**5.5**	**1.64**	11.4 U	**0.90**	**0.57 J**	**4.3**	**5.45**	15
Hexachlorobutadiene	mg/kg OC	5.39 U	2.73 U	4.80 U	1.98 U	0.683 U	0.905 U	11.4 U	1.49 U	1.22 U	1.38 U	0.841 U	3.9

Sample Location[1]		ST-103	ST-104				ST-105		ST-106				Proposed Sediment Cleanup Level[2]
Sample Identification		ST-103S_0-10	ST-104S_0-10	ST-104C_7.3-8.3	ST-104C_8.3-9.3	ST-104C_10.3-11.3	ST-105S_0-10	ST-105C_11-12	ST-106S_0-10	ST-106C_3.1-4.1	ST-106C_4.1-5.1	ST-106C_6.1-7.1	
Sample Date		10/24/18	10/24/18	10/26/18	10/26/18	10/26/18	10/24/18	10/26/18	10/24/18	10/26/18	10/26/18	10/26/18	
Sample Interval (dbm)		0-10 cm	0-10 cm	7.3-8.3 ft	8.3-9.3 ft	10.3-11.3 ft	0-10 cm	11-12 ft	0-10 cm	3.1-4.1 ft	4.1-5.1 ft	6.1-7.1 ft	
Sample Type		Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	19.4 U	10.8 J	19.2 U	74.8	160	36.1	19.3 U	11.7 J	9.4 J	59	127	540
Hexachlorobutadiene	µg/kg	19.4 U	19.9 U	19.2 U	18.8 U	19.8 U	19.9 U	19.3 U	19.4 U	20.0 U	19.0 U	19.6 U	11
Benzoic Acid	µg/kg	50.4 U	53.8 U	96.0 U	**186**	**388**	58.5 U	96.4 U	44.1 U	**32.3 J**	**288**	**197**	650
Benzyl Alcohol	µg/kg	**19.4 J**	19.9 U	19.2 U	**17.6 J**	19.8 U	19.9 U	19.3 U	19.4 U	20.0 U	**32.1**	19.6 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	0.39 J	**0.26 J**	1.8 J	4.13 J	**0.96 J**	**0.14 J**	0.023 J	**0.14 J**	**0.3 J**	**0.57 J**	**0.31 J**	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	**1.38 J**	1.88 J	**7.07 J**	**39.2 J**	27.8 J	3.04 J	**0.039 J**	1.78 J	4.99 J	7.85 J	7.14 J	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		ST-107			ST-108			ST-109			South DMMU Area		Proposed Sediment Cleanup Level[2]
Sample Identification		ST-107S_0-10	ST-107C_4.2-5.2	ST-107C_9.3-10.3	ST-108S_0-10	ST-108C_6.6-7.6	ST-108C_8.6-9.6	ST-109S_0-10	ST-109C_8.3-9.3	ST-109C_11.3-12.3	DMMU-1A-Comp	DMMU-1B-Comp	
Sample Date		10/24/18	10/25/18	10/25/18	10/24/18	10/25/18	10/25/18	10/24/18	10/25/18	10/25/18	10/23/18	10/23/18	
Sample Interval (dbm)		0-10 cm	4.2-5.2 ft	9.3-10.3 ft	0-10 cm	6.6-7.6 ft	8.6-9.6 ft	0-10 cm	8.3-9.3 ft	11.3-12.3 ft	2 - 3.7 ft	3.7 - 5.7 ft	
Sample Type		Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	<1	<1	<1	<1	5	30	<1	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	1.14	0.540	0.230	1.33	5.20	0.150	3.80	3.60	0.090	1.27	1.02	NE
Metals													
Arsenic	mg/kg	5.15	3.59	3.20	15	8.26	2.8	15.2	8.1	2.38	3.02	3.62	57
Copper	mg/kg	27	12.4	10.5	30.6	49.9	6.39	28.9	59.5	5.05	19.3	28.9	390
Mercury	mg/kg	0.0326 J	0.0261 J	0.0172 J	0.0293 J	0.176	0.0117 J	0.0399 J	0.295	0.00746 J	0.0393	0.0548	0.41
Zinc	mg/kg	62.4	31.2	30.4	131	904	26.9	150	99.1	22.1	47	52.5	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	54.3 J	11.9 J	2.16 U	190 J	70 J	103 J	99.2 J	221 J	201 J	27.1 J	67.8 J	370
2-Methylnaphthalene	mg/kg OC	4.25	1.04	2.16 U	12.2	4.83	7.6	9.45	9.36	102	2.96	6.06	38
Acenaphthene	mg/kg OC	7.12 J	1.1 J	2.16 U	24.2 J	8.73 J	11.7 J	15.4 J	35 J	77.9 J	2.91 J	5.76 J	16
Acenaphthylene	mg/kg OC	2 J	0.915 UJ	2.16 U	2.37 J	0.337 J	1.69 J	3.18 J	1.99 J	2.68 J	0.929 J	2.08 J	66
Anthracene	mg/kg OC	8.36	1.34	2.16 U	24	6.31	15.3	10.9	31.9	2.29 J	3.28	6.14	220
Fluorene	mg/kg OC	6.47	1.45	2.16 U	23	10.3	13.5	12.1	35	2.99 J	2.87	5.78	23
Naphthalene	mg/kg OC	10.4 J	2.81 J	2.16 U	39 J	9.29 J	16.1 J	35 J	39 J	109 J	7.23 J	28.5 J	99
Phenanthrene	mg/kg OC	20	5.17	2.16 U	80	35	44.3	22.7	78.1	6.8	9.84	19.5	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	619 J	64.1 J	4.96 U	2,500 J	3,640 J	154 J	3,770 J	7,950 J	181 J	344 J	692 J	5,200
2-Methylnaphthalene	µg/kg	48.5	5.63	4.96 U	162	251	11.4	359	337	91.7	37.6	61.8	670
Acenaphthene	µg/kg	81.2 J	5.95 J	4.96 UJ	322 J	454 J	17.6 J	587 J	1,260 J	70.1 J	37.0 J	58.8 J	500
Acenaphthylene	µg/kg	22.8 J	4.94 UJ	4.96 UJ	31.5 J	17.5 J	2.54 J	121 J	71.6 J	2.41 J	11.8 J	21.2 J	1,300
Anthracene	µg/kg	95.3	7.26	4.96 U	320	328	23	415	1,150	2.06 J	41.6	62.6	960
Fluorene	µg/kg	73.8	7.81	4.96 U	310	533	20.2	458	1,260	2.69 J	36.4	59	540
Naphthalene	µg/kg	118 J	15.2 J	4.96 UJ	520 J	483 J	24.1 J	1,330 J	1,400 J	97.8 J	91.8 J	291 J	2,100
Phenanthrene	µg/kg	228	27.9	4.96 U	1000	1820	66.4	861	2,810	6.12	125	199	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	200	9.76	--	570 J	64.2 J	117 J	274 J	235 J	17 J	62.4 J	90 J	960
Benzo(a)anthracene	mg/kg OC	15.4	0.607 J	2.16 U	39.8	4.3	8.4	26	19.7	1.28 J	4.51	7.55	110
Benzo(a)pyrene	mg/kg OC	11.1 J	0.469 J	2.16 U	23.6 J	1.75 J	3.54 J	16.9 J	5.44 J	1.11 J	2.78 J	4.55 J	99
Benzofluoranthenes[6] (Total)	mg/kg OC	25	1.2 J	4.32 U	61.0	4.0	8.4	43.7	12.3	10.7 U	7.23	9.52	230
Benzo(g,h,i)perylene	mg/kg OC	5.63	0.915 U	2.16 U	10.2	0.9	1.67 J	6.0	2.86	1.26 J	1.56	2.75	31
Chrysene	mg/kg OC	23.8	1.05	2.16 U	184	5.4	8.7	44.5	24.8	1.68 J	6.16	7.62	110
Dibenzo(a,h)anthracene	mg/kg OC	2.02 J	0.915 UJ	2.16 U	4.65 J	0.383 J	4.35 J	2.36 J	1.03 J	5.33 UJ	0.827 J	1.23 J	12
Fluoranthene	mg/kg OC	40	3.31	2.16 U	130	26.7	44.5	72.6	101	6.06	18	25.4	160

Sample Location[1]		ST-107			ST-108			ST-109			South DMMU Area		Proposed Sediment Cleanup Level[2]
Sample Identification		ST-107S_0-10	ST-107C_4.2-5.2	ST-107C_9.3-10.3	ST-108S_0-10	ST-108C_6.6-7.6	ST-108C_8.6-9.6	ST-109S_0-10	ST-109C_8.3-9.3	ST-109C_11.3-12.3	DMMU-1A-Comp	DMMU-1B-Comp	
Sample Date		10/24/18	10/25/18	10/25/18	10/24/18	10/25/18	10/25/18	10/24/18	10/25/18	10/25/18	10/23/18	10/23/18	
Sample Interval (dbm)		0-10 cm	4.2-5.2 ft	9.3-10.3 ft	0-10 cm	6.6-7.6 ft	8.6-9.6 ft	0-10 cm	8.3-9.3 ft	11.3-12.3 ft	2 - 3.7 ft	3.7 - 5.7 ft	
Sample Type		Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	**5.86**	0.915 U	2.16 U	**11.7**	0.9	1.65 J	7.2	2.71	5.33 U	**1.46**	**2.39**	34
Pyrene	mg/kg OC	**46.1**	**3.13**	2.16 U	**105**	19.8	35.1	54.2	65.6	5.58	**19.9**	**29**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	2000	52.7	9.93 U	7,580 J	**3,340 J**	**175 J**	**10,400 J**	**8,470 J**	**15.3 J**	792 J	918 J	12,000
Benzo(a)anthracene	µg/kg	176	3.28 J	4.96 U	529	**222**	**12.6**	**989**	**708**	**1.15 J**	57.3	77	1,300
Benzo(a)pyrene	µg/kg	127 J	2.53 J	4.96 UJ	314 J	**90.8 J**	**5.31 J**	**642 J**	**196 J**	**1.00 J**	35.3 J	46.4 J	1,600
Benzofluoranthenes[6] (Total)	µg/kg	290	6.48 J	9.93 U	810	**207**	**12.6**	**1,660**	**442**	9.60 U	91.8	97.1	3,200
Benzo(g,h,i)perylene	µg/kg	64.2	4.94 U	4.96 U	136	**48.4**	**2.50 J**	**229**	**103**	**1.13 J**	19.8	28	670
Chrysene	µg/kg	271	5.65	4.96 U	2,450	**282**	**13.1**	**1,690**	**892**	**1.51 J**	78.2	77.7	1,400
Dibenzo(a,h)anthracene	µg/kg	23.0 J	4.94 UJ	4.96 UJ	61.8 J	**19.9 J**	**6.52 J**	**89.6 J**	**37.0 J**	4.80 UJ	10.5 J	12.5 J	230
Fluoranthene	µg/kg	460	17.9	4.96 U	1,730	**1,390**	**66.8**	**2,760**	**3,630**	**5.45**	228	259	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	66.8	4.94 U	4.96 U	155	**47**	**2.47 J**	**272**	**97.5**	4.80 U	18.6	24.4	600
Pyrene	µg/kg	526	16.9	4.96 U	1,390	**1,030**	**52.7**	**2,060**	**2,360**	**5.02**	253	296	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	1.75 U	3.65 U	8.65 U	1.50 U	3.81 U	13.3 U	0.526 U	0.556 U	21.2 U	1.51 U	1.94 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	1.75 U	3.65 U	8.65 U	1.50 U	3.81 U	13.3 U	0.526 U	0.556 U	21.2 U	1.51 U	1.94 U	2.3
Hexachlorobenzene	mg/kg OC	0.0440 U	0.0930 U	0.150 U	0.0360 U	0.0100 U	0.310 U	0.0130 U	0.0230 U	0.530 U	0.0390 U	0.0470 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	20.0 U	19.7 U	19.9 U	20.0 U	198 U	19.9 U	20.0 U	20.0 U	19.1 U	19.2 U	19.8 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	20.0 U	19.7 U	19.9 U	20.0 U	198 U	19.9 U	20.0 U	20.0 U	19.1 U	19.2 U	19.8 U	35
Hexachlorobenzene	µg/kg	0.50 U	0.50 U	0.35 U	0.48 U	0.52 U	0.47 U	0.49 U	0.81 U	0.48 U	0.49 U	0.48 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	4.38 U	9.15 U	21.7 U	**19.5**	9.52 U	19.8	6.1	1.39 U	53.0 U	3.78 U	4.85 U	47
Butyl Benzyl Phthalate	mg/kg OC	1.75 U	3.65 U	8.65 U	1.50 U	3.81 U	13.3 U	0.526 U	0.556 U	21.2 U	1.51 U	1.94 U	4.9
Diethyl Phthalate	mg/kg OC	**1.7**	3.65 U	8.65 U	1.6	3.81 U	13.3 U	0.526 U	0.556 U	21.2 U	1.51 U	1.94 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	49.9 U	49.4 U	49.8 U	259	495 U	**29.7 J**	**231**	50.0 U	47.7 U	48.0 U	49.5 U	1,300
Butyl Benzyl Phthalate	µg/kg	20.0 U	19.7 U	19.9 U	20.0 U	198 U	19.9 U	20.0 U	20.0 U	19.1 U	19.2 U	19.8 U	63
Diethyl Phthalate	µg/kg	19.5	19.7 U	19.9 U	21.2	198 U	19.9 U	20.0 U	20.0 U	19.1 U	19.2 U	19.8 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	24.9 U	24.7 U	24.9 U	**15.1 J**	**69.5 J**	24.9 U	24.9 U	**119**	**12.1 J**	**2.5 J**	**6.9 J**	29
2-Methylphenol (o-Cresol)	µg/kg	20.0 U	19.7 U	19.9 U	20.0 U	198 U	19.9 U	20.0 U	20.0 U	19.1 U	19.2 U	19.8 U	63
4-Methylphenol (p-Cresol)	µg/kg	74.3	19.7 U	19.9 U	**629**	**14,900**	**113**	**786**	215	19.1 U	**94.9**	**681**	670
Phenol	µg/kg	**78.7**	19.7 U	19.9 U	**170**	**200**	19.9 U	**141**	**45.7**	19.1 U	**54**	**65.2**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	**6.8**	3.65 U	8.65 U	**96.2**	31.3	20.5	34.5	30.8	21.2 U	**3.65**	**6.44**	15
Hexachlorobutadiene	mg/kg OC	1.75 U	3.65 U	8.65 U	1.50 U	3.81 U	13.3 U	0.526 U	0.556 U	21.2 U	1.51 U	1.94 U	3.9

Sample Location[1]		ST-107			ST-108			ST-109			South DMMU Area		Proposed Sediment Cleanup Level[2]
Sample Identification		ST-107S_0-10	ST-107C_4.2-5.2	ST-107C_9.3-10.3	ST-108S_0-10	ST-108C_6.6-7.6	ST-108C_8.6-9.6	ST-109S_0-10	ST-109C_8.3-9.3	ST-109C_11.3-12.3	DMMU-1A-Comp	DMMU-1B-Comp	
Sample Date		10/24/18	10/25/18	10/25/18	10/24/18	10/25/18	10/25/18	10/24/18	10/25/18	10/25/18	10/23/18	10/23/18	
Sample Interval (dbm)		0-10 cm	4.2-5.2 ft	9.3-10.3 ft	0-10 cm	6.6-7.6 ft	8.6-9.6 ft	0-10 cm	8.3-9.3 ft	11.3-12.3 ft	2 - 3.7 ft	3.7 - 5.7 ft	
Sample Type		Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**77**	19.7 U	19.9 U	**1,280**	**1,630**	**30.7**	**1,310**	**1,110**	19.1 U	**46.3**	**65.7**	540
Hexachlorobutadiene	µg/kg	20.0 U	19.7 U	19.9 U	20.0 U	198 U	19.9 U	20.0 U	20.0 U	19.1 U	19.2 U	19.8 U	11
Benzoic Acid	µg/kg	**61.2 J**	98.7 U	99.6 U	**77.8 J**	989 U	**18.8 J**	**126**	99.9 U	95.4 U	203 U	233 U	650
Benzyl Alcohol	µg/kg	20.0 U	19.7 U	19.9 U	20.0 U	198 U	19.9 U	20.0 U	20.0 U	**14.6 J**	19.2 U	19.8 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	**0.64 J**	**0.3 J**	**0.016 J**	**0.44 J**	**0.93 J**	**0.88 J**	**2 J**	**0.0087 J**	**0.012 J**	**0.04 J**	**2.6 J**	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	**7.28 J**	**1.63 J**	**0.037 J**	**5.8 J**	**48.4 J**	**1.32 J**	**74.2 J**	**0.31 J**	**0.011 J**	**0.51 J**	**26.1 J**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
µg/kg = microgram per kilogram
µg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		South DMMU Area					North DMMU Area	MAF-01					Proposed Sediment Cleanup Level[2]
Sample Identification		DMMU-1C-Comp	DMMU-1D-Comp	DMMU-1E-Comp	DMMU-1F-Comp	DMMU-1 Keyway	DMMU-2D-Comp	MAF-SS-01_0-10	MAF-SS-DUP-01	MAF-SC-01_0-2	MAF-SC-DUP-01	MAF-SC-01_2-4	
Sample Date		10/23/18	10/23/18	10/23/18	10/23/18	10/23/18	10/25/18	10/20/15	10/20/15	11/11/15	11/11/15	11/11/15	
Sample Interval (dbm)		5.7 -7.7 ft	7.7 - 9.7 ft	9.7 - 11.7 ft	11.7 - 13.7 ft	6.8 - 10.8 ft	6.2 - 9.3 ft	0-10 cm	0-10 cm	0 - 2 ft	0 - 2 ft	2 - 4 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	<1	<1	<1	<1	<5	<5	**100**	**100**	**100**	15
Conventionals													
Total Organic Carbon (TOC)	Percent	**1.47**	**2.86**	**3.34**	**1.53**	**0.810**	**5.68**	**1.22**	**1.11**	**14.1 J**	**4.32 J**	--	NE
Metals													
Arsenic	mg/kg	**3.32**	**3.67**	**4.76**	**4.46**	**3.43**	**9.68**	**23**	**19**	**20 J**	**33 J**	--	57
Copper	mg/kg	**28.9**	**35.7**	**59.3**	**54.5**	**16.1**	**77.2**	**34.1**	**30.4**	**51.2 J**	**154 J**	--	390
Mercury	mg/kg	**0.0749**	**0.0906**	**0.209 J**	**0.129**	**0.0250 J**	**0.515**	**0.09**	**0.11**	**0.21**	**0.23**	--	0.41
Zinc	mg/kg	**52.6**	**58.3**	**74.2**	**67.4**	**39.5**	**404**	**84**	**81**	**80**	**114**	--	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	**52.2 J**	**31 J**	**62 J**	**87.6**	**24.9 J**	521 J	**327 J**	**296 J**	32.8 J	186 J	--	370
2-Methylnaphthalene	mg/kg OC	**4.48**	**2.36**	**4.46**	**4.8**	**2.2**	47.4	**30**	**30**	2.7 J	17 J	--	38
Acenaphthene	mg/kg OC	**4.46 J**	**2.79 J**	**4.37 J**	**4.24**	**2.52 J**	86.6 J	**51**	**46**	5.2 J	32 J	--	16
Acenaphthylene	mg/kg OC	**2.01 J**	**0.846 J**	**3.08 J**	**5.78**	**0.651 J**	4.79 J	**6.7 J**	**5 J**	0.6 J	3.2 J	--	66
Anthracene	mg/kg OC	**5.67**	**3.28**	**2.88**	**4.61**	**2.1**	35.9	**20**	**21**	3	9	--	220
Fluorene	mg/kg OC	**5.41**	**3.3**	**4.8**	**5.1**	**2.5**	76.0	**39**	**40**	4	23	--	23
Naphthalene	mg/kg OC	**17.8 J**	**10.1 J**	**31.4 J**	**39.5**	**9.72 J**	160 J	**130**	**120**	11 J	72 J	--	99
Phenanthrene	mg/kg OC	**16.9**	**10.6**	**15.5**	**28.2**	**7.4**	159.0	**80**	**71**	8.5	50	--	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	768 J	886 J	2,070 J	1,340	202 J	**29,600 J**	3,992 J	3,285 J	**4,627 J**	**8,030 J**	--	5,200
2-Methylnaphthalene	µg/kg	65.9	67.4	149	73.4	17.6	**2,690**	360	330	**380 J**	**720 J**	--	670
Acenaphthene	µg/kg	65.6 J	79.9 J	146 J	64.9	20.4 J	**4,920 J**	620	510	**740 J**	**1,400 J**	--	500
Acenaphthylene	µg/kg	29.5 J	24.2 J	103 J	88.5	5.27 J	**272 J**	82 J	55 J	**87 J**	**140 J**	--	1,300
Anthracene	µg/kg	83.4	93.9	96.2	70.6	17.3	**2,040**	250	230	**400**	**400**	--	960
Fluorene	µg/kg	79.6	94.5	160	78.1	20.6	**4,300**	470	400	**600**	**990**	--	540
Naphthalene	µg/kg	261 J	289 J	1,050 J	605	78.7 J	**9,070 J**	1,600	1,300	**1,600 J**	**3,100 J**	--	2,100
Phenanthrene	µg/kg	249	304	518	431	59.6	**9,020**	970	790	**1,200**	**2,000**	--	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	**60 J**	**31.4 J**	**27.5 J**	**51.7**	**19.1 J**	239 J	**190.8 J**	**146 J**	28.6	95.8 J	--	960
Benzo(a)anthracene	mg/kg OC	**4.2**	**1.98**	**1.54**	**2.16**	**1.2**	13.3	**13 J**	**9**	2.3	5.8	--	110
Benzo(a)pyrene	mg/kg OC	**3.11 J**	**1.24 J**	**1.11 J**	**1.42**	**0.6**	3.38 J	**9.8 J**	**5.3 J**	1.3	3.7	--	99
Benzofluoranthenes[6] (Total)	mg/kg OC	**6.28**	**3.01**	**2.48**	**4.63**	**1.6**	9.2	**21 J**	**13 J**	2.3	8.1	--	230
Benzo(g,h,i)perylene	mg/kg OC	**2.63**	**1**	**1.12**	**1.35**	**0.574 J**	1.5	**5.9 J**	**3.1 J**	0.54	2	--	31
Chrysene	mg/kg OC	**5.43**	**2.99**	**2.1**	**3.76**	**1.3**	20.0	**20**	**13**	2.3	7.9	--	110
Dibenzo(a,h)anthracene	mg/kg OC	**0.891 J**	**0.43 J**	**0.308 J**	**0.454**	**0.9**	0.377 J	4 U	1.3 U	0.19	1.3 U	--	12
Fluoranthene	mg/kg OC	**20.3**	**11.2**	**10.4**	**20.6**	**7.3**	118.0	**67**	**59**	8.5	32	--	160

Sample Location[1]		South DMMU Area					North DMMU Area	MAF-01					Proposed Sediment Cleanup Level[2]
Sample Identification		DMMU-1C-Comp	DMMU-1D-Comp	DMMU-1E-Comp	DMMU-1F-Comp	DMMU-1 Keyway	DMMU-2D-Comp	MAF-SS-01_0-10	MAF-SS-DUP-01	MAF-SC-01_0-2	MAF-SC-DUP-01	MAF-SC-01_2-4	
Sample Date		10/23/18	10/23/18	10/23/18	10/23/18	10/23/18	10/25/18	10/20/15	10/20/15	11/11/15	11/11/15	11/11/15	
Sample Interval (dbm)		5.7 -7.7 ft	7.7 - 9.7 ft	9.7 - 11.7 ft	11.7 - 13.7 ft	6.8 - 10.8 ft	6.2 - 9.3 ft	0-10 cm	0-10 cm	0 - 2 ft	0 - 2 ft	2 - 4 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	**2.14**	**0.906**	**0.749**	**0.837**	**0.436 J**	1.4	**4.6 J**	**2.4 J**	0.5	1.2 J	–	34
Pyrene	mg/kg OC	**16.3**	**8.57**	**7.66**	**16.5**	**5.4**	76.9	**52**	**41**	11	35	–	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	900 J	897 J	919 J	791	155 J	**13,600 J**	2,328 J	1,620 J	**4,033**	**4,139 J**	–	12,000
Benzo(a)anthracene	µg/kg	61.7	56.7	51.3	33.1	9.93	**753**	160	100	**330**	**250**	–	1,300
Benzo(a)pyrene	µg/kg	45.7 J	35.5 J	37.0 J	21.8	4.48 J	**192 J**	120 J	59 J	**190**	**160**	–	1,600
Benzofluoranthenes[6] (Total)	µg/kg	92.3	86	82.7	70.8	13.2	**525**	260 J	140 J	**320**	**350**	–	3,200
Benzo(g,h,i)perylene	µg/kg	38.7	28.7	37.5	20.7	4.65 J	**87.6**	72 J	34 J	**76**	**86**	–	670
Chrysene	µg/kg	79.8	85.5	70	57.5	10.1	**900**	200	140	**320**	**340**	–	1,400
Dibenzo(a,h)anthracene	µg/kg	13.1 J	12.3 J	10.3 J	6.94	6.9	**21.4 J**	49 U	14 U	**27**	54 U	–	230
Fluoranthene	µg/kg	298	321	349	315	58.9	**6,690**	820	660	**1,200**	**1,400**	–	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	31.4	25.9	25	12.8	3.53 J	**76.5**	56 J	27 J	**70**	**53 J**	–	600
Pyrene	µg/kg	239	245	256	252	43.5	**4,370**	640	460	**1,500**	**1,500**	–	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	1.35 U	0.692 U	0.587 U	0.320 U	2.40 U	1.70 U	0.4 U	0.43 U	0.11 J	0.56	–	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	1.35 U	0.692 U	0.587 U	0.320 U	2.40 U	1.70 U	0.4 U	**0.13 J**	0.16 U	0.25 U	–	2.3
Hexachlorobenzene	mg/kg OC	0.0330 U	0.0170 U	0.0140 U	0.320 U	0.0600 U	0.0856 U	0.4 U	0.43 U	0.16 U	0.44	–	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	19.8 U	19.8 U	19.6 U	4.9 U	19.4 U	96.3 U	4.9 U	4.8 U	**16 J**	**24**	–	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	19.8 U	19.8 U	19.6 U	4.9 U	19.4 U	96.3 U	4.9 U	**1.4 J**	22 U	11 U	–	35
Hexachlorobenzene	µg/kg	0.49 U	0.48 U	0.48 U	4.9 U	0.49 U	4.86 U	4.9 U	4.8 U	22 U	**19**	–	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	**2.37 J**	1.73 U	1.46 U	**6.33**	**3.83 J**	4.24 U	**2.3 J**	**3.4 J**	3.3 J	7.4 J	–	47
Butyl Benzyl Phthalate	mg/kg OC	1.35 U	0.692 U	**1.78**	0.320 U	2.40 U	1.70 U	**0.25 J**	0.43 U	0.16 U	0.25 U	–	4.9
Diethyl Phthalate	mg/kg OC	1.35 U	0.692 U	0.587 U	**1.54**	2.40 U	1.70 U	2 U	1.7 U	0.6 J	1.2	–	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	34.8 J	49.6 U	48.9 U	96.9	31.0 J	241 U	28 J	38 J	**470 J**	**320 J**	–	1,300
Butyl Benzyl Phthalate	µg/kg	19.8 U	19.8 U	59.3	4.9 U	19.4 U	96.3 U	3.1 J	4.8 U	22 U	11 U	–	63
Diethyl Phthalate	µg/kg	19.8 U	19.8 U	19.6 U	23.6	19.4 U	96.3 U	20 UJ	19 UJ	**80 J**	**52**	–	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**10.8 J**	**8.2 J**	**24.6 J**	**17.0 J**	**3.5 J**	**438**	**10 J**	**15 J**	**56 J**	**110**	–	29
2-Methylphenol (o-Cresol)	µg/kg	19.8 U	19.8 U	19.6 U	4.9 U	19.4 U	96.3 U	**8.8 J**	**11 J**	88 U	**46**	–	63
4-Methylphenol (p-Cresol)	µg/kg	**765**	**730**	**1,920**	**1,590**	**109**	**5,130**	**330**	**390**	**3,200**	**2,500**	–	670
Phenol	µg/kg	**86.1**	**51.5**	**59**	**54.8**	**13.2 J**	**403**	**73**	**69**	**170 J**	**120 J**	–	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	**6.69**	**2.9**	**5.81**	**11.6**	**2.3 J**	53	**42**	**39**	4.4 J	28 J	–	15
Hexachlorobutadiene	mg/kg OC	1.35 U	0.692 U	**6.41**	0.320 U	0.6 U	0.4 U	0.4 U	0.43 U	0.09 J	1.4 J	–	3.9

Sample Location[1]		South DMMU Area					North DMMU Area	MAF-01					Proposed Sediment Cleanup Level[2]
Sample Identification		DMMU-1C-Comp	DMMU-1D-Comp	DMMU-1E-Comp	DMMU-1F-Comp	DMMU-1 Keyway	DMMU-2D-Comp	MAF-SS-01_0-10	MAF-SS-DUP-01	MAF-SC-01_0-2	MAF-SC-DUP-01	MAF-SC-01_2-4	
Sample Date		10/23/18	10/23/18	10/23/18	10/23/18	10/23/18	10/25/18	10/20/15	10/20/15	11/11/15	11/11/15	11/11/15	
Sample Interval (dbm)		5.7 -7.7 ft	7.7 - 9.7 ft	9.7 - 11.7 ft	11.7 - 13.7 ft	6.8 - 10.8 ft	6.2 - 9.3 ft	0-10 cm	0-10 cm	0 - 2 ft	0 - 2 ft	2 - 4 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Surface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	μg/kg	98.4	83	194	177	18.8 J	**3,010**	510	430	**620 J**	**1,200 J**	--	540
Hexachlorobutadiene	μg/kg	19.8 U	19.8 U	214	4.9 U	4.9 U	24.1 U	4.9 U	4.8 U	**12 J**	**62 J**	--	11
Benzoic Acid	μg/kg	221 U	141 U	**409**	**216**	**68.3 J**	540 U	**80 J**	**120 J**	**340 J**	**380 J**	--	650
Benzyl Alcohol	μg/kg	19.8 U	19.8 U	**27.2**	19.7 U	**16.1 J**	71.7 U	20 U	**16 J**	88 U	44 U	--	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	**1.3 J**	**1.1 J**	**1.01 J**	**0.86 J**	**0.56 J**	0.26	**30.2**	--	11.6	--	--	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	μg/kg	19.7 J	32.8 J	33.6 J	13.1 J	4.52 J	14.5	368	--	**1,630**	--	--	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

μg/kg = microgram per kilogram

μg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-01			MAF-02						MAF-03		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-01_4-6	MAF-SC-01_20-22	MAF-SC-DUP-02	MAF-SS-02_0-10	MAF-SC-02_0-2	MAF-SC-02_2-4	MAF-SC-02_4-6	MAF-SC-02_20-22	MAF-SC-DUP-10	MAF-SS-03_0-10	MAF-SC-03_0-2	
Sample Date		11/11/15	11/11/15	11/11/15	10/20/15	11/10/15	11/10/15	11/10/15	11/10/15	11/10/15	10/20/15	11/11/15	
Sample Interval (dbm)		4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	0 - 2 ft	2 - 4 ft	4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	0 - 2 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	100	<1	<1	10	100	100	100	<1	<1	50	100	15
Conventionals													
Total Organic Carbon (TOC)	Percent	12.4 J	0.210 J	0.27 J	2.85	28.8	--	13.8	0.350 J	0.35 J	9.68	13.4 J	NE
Metals													
Arsenic	mg/kg	22.9 J	7	8	18	20	--	14.5 J	10	20	60	11.8 J	57
Copper	mg/kg	64	8.1	8.3	31.1	90.8	--	123	7.1 J	9 J	42.9	63.3	390
Mercury	mg/kg	0.23	0.0074 J	0.008 J	0.2	0.0396 J	--	0.22	0.0101 J	0.0055 J	0.22	0.3	0.41
Zinc	mg/kg	102	27	30	97	833 J	--	1,010 J	25 J	32 J	98	464 J	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	68.7	13.7 J	3.5 J	154	30.7	--	114	89.6 J	270 J	132	346 J	370
2-Methylnaphthalene	mg/kg OC	6	1.6 J	0.9 J	12	2.2	--	8.7	6.6 J	11 J	9.4	47.0 J	38
Acenaphthene	mg/kg OC	9.7	1.8 J	1.8 U	30	3	--	9.4	17 J	31 J	28	40	16
Acenaphthylene	mg/kg OC	2.9	2.3 U	1.8 U	3.1	1.1	--	2.7	1.1 J	2.1	1.2	7	66
Anthracene	mg/kg OC	2	2.3 U	1.8 U	11	0.3	--	0.2	9 J	19 J	18	7	220
Fluorene	mg/kg OC	6.1	1.5 J	1.8 U	19	1.5	--	3.7	9.5 J	18 J	17	57 J	23
Naphthalene	mg/kg OC	39	6.7 J	2.4 J	56	22	--	94	40 J	180 J	44	160	99
Phenanthrene	mg/kg OC	9.7	3.7	1.0 J	40	3	--	3.3	13 J	24 J	25	72	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	8,520	28.5 J	9.3 J	4,390	8,840	--	15,700	312.8 J	960 J	12,820	46,400 J	5,200
2-Methylnaphthalene	µg/kg	700	3.4 J	2.4 J	350	620	--	1,200	23 J	39 J	910	6,300 J	670
Acenaphthene	µg/kg	1,200	3.8 J	4.8 U	850	850	--	1,300	59 J	110 J	2,700	6,000	500
Acenaphthylene	µg/kg	360	4.8 U	4.8 U	89	310	--	370	3.8 J	7.4	120	1,000	1,300
Anthracene	µg/kg	200	4.8 U	4.8 U	320	100	--	26	30 J	66 J	1,700	1,000	960
Fluorene	µg/kg	760	3.1 J	4.8 U	530	420	--	510	33 J	62 J	1,600	7,700 J	540
Naphthalene	µg/kg	4,800	14 J	6.5 J	1,600	6,300	--	13,000	140 J	630 J	4,300	21,000	2,100
Phenanthrene	µg/kg	1,200	7.6	2.8 J	1,000	860	--	450	47 J	85 J	2,400	9,700	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	13.1 J	5.0 J	1.8 U	67.0 J	2.4 J	--	1.3	101 J	145.4 J	165.9	30.9 J	960
Benzo(a)anthracene	mg/kg OC	0.44 J	2.3 U	1.8 U	4.0	0.1	--	0.1 U	9	10	12	1 J	110
Benzo(a)pyrene	mg/kg OC	0.69 U	2.3 U	1.8 U	3.0	0.1	--	0.1 U	5.2	5.1	4.3	2.1 U	99
Benzofluoranthenes[6] (Total)	mg/kg OC	0.48 J	2.3 U	1.8 U	7.0	0.2	--	0.1 U	9.7	9.3	9.4	2.1 U	230
Benzo(g,h,i)perylene	mg/kg OC	0.69 U	2.3 U	1.8 U	1.8	0.05	--	0.1 U	3	3	2	2.1 U	31
Chrysene	mg/kg OC	0.6 J	2.3 U	1.8 U	4.9	0.2	--	0.1 U	12	13	11	1 J	110
Dibenzo(a,h)anthracene	mg/kg OC	0.69 U	2.3 U	1.8 U	0.4 J	0.01 J	--	0.1 U	1.3 U	0.9 J	0.7	2.1 U	12
Fluoranthene	mg/kg OC	6.5	2.8	1.8 U	25.0	1.2	--	0.7	34.0 J	59 J	74	17	160

Sample Location[1]		MAF-01			MAF-02						MAF-03		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-01_4-6	MAF-SC-01_20-22	MAF-SC-DUP-02	MAF-SS-02_0-10	MAF-SC-02_0-2	MAF-SC-02_2-4	MAF-SC-02_4-6	MAF-SC-02_20-22	MAF-SC-DUP-10	MAF-SS-03_0-10	MAF-SC-03_0-2	
Sample Date		11/11/15	11/11/15	11/11/15	10/20/15	11/10/15	11/10/15	11/10/15	11/10/15	11/10/15	10/20/15	11/11/15	
Sample Interval (dbm)		4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	0 - 2 ft	2 - 4 ft	4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	0 - 2 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	0.69 U	2.3 U	1.8 U	**1.4**	**0.0**	--	0.1 U	**1.9**	**2.2**	**1.8**	2.1 U	34
Pyrene	mg/kg OC	**5**	**2.2 J**	1.8 U	**20.0**	**0.7**	--	**0.6**	**26**	**42**	**50**	**11**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	μg/kg	**1,624 J**	**10.4 J**	4.8 U	**1,910 J**	**704.1 J**	--	**176**	**352.6 J**	**514.8 J**	**16,060**	**4,140 J**	12,000
Benzo(a)anthracene	μg/kg	**55 J**	4.8 U	4.8 U	**100**	**28**	--	16 U	**30**	**37**	**1,200**	**140 J**	1,300
Benzo(a)pyrene	μg/kg	86 U	4.8 U	4.8 U	**85**	**18**	--	16 U	**18**	**18**	**420**	280 U	1,600
Benzofluoranthenes[6] (Total)	μg/kg	**59 J**	4.8 U	4.8 U	**200**	**45**	--	16 U	**34**	**33**	**910**	280 U	3,200
Benzo(g,h,i)perylene	μg/kg	86 U	4.8 U	4.8 U	**52**	**13**	--	16 U	**10**	**10**	**190**	280 U	670
Chrysene	μg/kg	**80 J**	4.8 U	4.8 U	**140**	**48**	--	16 U	**43**	**46**	**1,100**	**200 J**	1,400
Dibenzo(a,h)anthracene	μg/kg	86 U	4.8 U	4.8 U	**12 J**	**3.8 J**	--	16 U	4.7 U	**3.1 J**	**65**	280 U	230
Fluoranthene	μg/kg	**810**	**5.8**	4.8 U	**720**	**340**	--	**100**	**120 J**	**210 J**	**7,200**	**2,300**	1,700
Indeno(1,2,3-c,d)pyrene	μg/kg	86 U	4.8 U	4.8 U	**41**	**8.3**	--	16 U	**6.6**	**7.7**	**170**	280 U	600
Pyrene	μg/kg	**620**	**4.6 J**	4.8 U	**560**	**200**	--	**76**	**91**	**150**	**4,800**	**1,500**	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.14 U	2.3 U	1.8 U	0.16 U	0.017 U	--	0.12 U	1.3 U	1.4 U	**0.065**	1.2 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	0.14 U	2.3 U	1.8 U	0.16 U	**0.011 J**	--	0.12 U	1.3 U	1.4 U	**0.024 J**	1.2 U	2.3
Hexachlorobenzene	mg/kg OC	0.14 U	2.3 U	1.8 U	0.16 U	0.017 U	--	**0.43**	1.3 U	1.4 U	0.05 U	1.2 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	μg/kg	17 U	4.8 U	4.8 U	4.7 U	4.9 U	--	16 U	4.7 U	4.9 U	**6.3**	160 UJ	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	μg/kg	17 U	4.8 U	4.8 U	4.7 U	**3.2 J**	--	16 U	4.7 U	4.9 U	**2.3 J**	160 UJ	35
Hexachlorobenzene	μg/kg	17 U	4.8 U	4.8 U	4.7 U	4.9 U	--	**59**	4.7 U	4.9 U	4.8 U	160 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	2.8 U	**15**	18 U	**1 J**	**2.9**	--	**5.5**	**13 J**	14 U	0.5 U	**16 J**	47
Butyl Benzyl Phthalate	mg/kg OC	0.14 U	2.3 U	1.8 U	0.16 U	0.017 U	--	**0.28**	1.3 U	1.4 U	0.05 U	1.2 U	4.9
Diethyl Phthalate	mg/kg OC	1.1 U	**10**	7.1 U	0.67 U	**0.07**	--	1.4 U	**6**	5.4 U	0.2 U	**5.8 J**	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	μg/kg	350 U	**31 J**	48 U	**30 J**	**840**	--	**760**	**44 J**	49 U	48 U	**2,200 J**	1,300
Butyl Benzyl Phthalate	μg/kg	17 U	4.8 U	4.8 U	4.7 U	4.9 U	--	**39**	4.7 U	4.9 U	4.8 U	160 U	63
Diethyl Phthalate	μg/kg	140 U	**20**	19 U	19 UJ	**20**	--	190 U	**20**	19 U	19 UJ	**780 J**	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	μg/kg	**380**	24 U	24 U	**11 J**	**130**	--	**1,000**	**13 J**	**15 J**	**320**	**1,800 J**	29
2-Methylphenol (o-Cresol)	μg/kg	**83 J**	19 U	19 U	**10 J**	**290**	--	**930**	19 U	19 U	**63**	**620 J**	63
4-Methylphenol (p-Cresol)	μg/kg	**8,500**	**19**	19 U	**150**	**1,800**	--	**16,000**	**22**	**15 J**	**2,400**	**51,000 J**	670
Phenol	μg/kg	**130 J**	19 U	19 U	**71**	**430**	--	**420**	19 U	19 U	**120**	**2,300 J**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	**6.9**	**2.2 J**	1.8 U	**24**	**1.6**	--	**3.3**	**9.7**	**15**	**32**	**46 J**	15
Hexachlorobutadiene	mg/kg OC	0.14 U	2.3 U	1.8 U	0.16 U	0.017 U	--	**1.2**	1.3 U	1.4 U	**0.02 J**	1.2 U	3.9

Sample Location[1]		MAF-01			MAF-02						MAF-03		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-01_4-6	MAF-SC-01_20-22	MAF-SC-DUP-02	MAF-SS-02_0-10	MAF-SC-02_0-2	MAF-SC-02_2-4	MAF-SC-02_4-6	MAF-SC-02_20-22	MAF-SC-DUP-10	MAF-SS-03_0-10	MAF-SC-03_0-2	
Sample Date		11/11/15	11/11/15	11/11/15	10/20/15	11/10/15	11/10/15	11/10/15	11/10/15	11/10/15	10/20/15	11/11/15	
Sample Interval (dbm)		4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	0 - 2 ft	2 - 4 ft	4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	0 - 2 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**860**	**4.6 J**	4.8 U	680	**470**	--	**450**	**34**	**52**	**3,100**	**6,200 J**	540
Hexachlorobutadiene	µg/kg	17 U	4.8 U	4.8 U	4.7 U	4.9 U	--	**170**	4.7 U	4.9 U	**1.6 J**	160 U	11
Benzoic Acid	µg/kg	**890 J**	190 U	190 U	**64 J**	**200**	--	1,900 U	190 UJ	190 U	190 U	**7,100 J**	650
Benzyl Alcohol	µg/kg	140 U	19 U	19 U	19 U	**73**	--	190 U	19 U	19 UJ	19 U	650 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	--	--	--	--	--	--	--	--	--	**2.87 J**	**22.2 J**	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	--	--	--	--	--	--	--	--	--	**278 J**	**2,980 J**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
µg/kg = microgram per kilogram
µg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-03					MAF-04						Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-DUP-03	MAF-SC-03_2-4	MAF-SC-03_4-6	MAF-SC-03_8-10	MAF-SC-03_21-23	MAF-SS-04_0-10	MAF-SC-04_0-2[9]	MAF-SC-DUP-05	MAF-SC-04_2-4[10]	MAF-SC-04_4-6	MAF-SC-04_8-10	
Sample Date		11/11/15	11/11/15	11/11/15	11/11/15	11/11/2015	10/20/15	10/26/15	10/26/15	10/26/15	10/26/15	10/26/15	
Sample Interval (dbm)		0 - 2 ft	2 - 4 ft	4 - 6 ft	8 - 10 ft	21 - 23 ft	0-10 cm	0 - 2 ft	0 - 2 ft	2 - 4 ft	4 - 6 ft	8 - 10 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	100	100	100	100	<1	75	75	75	75	85	25	15
Conventionals													
Total Organic Carbon (TOC)	Percent	28.2 J	--	34.1	41.5	0.270	20.2	41.0 J	37.6 J	47.8 J	52.5	5.00 J	NE
Metals													
Arsenic	mg/kg	9 J	--	10.8 J	8.8 J	2.9	20	20 U	20 U	20 U	20 U	20	57
Copper	mg/kg	56.3	--	56.6	44.5	5.17	39.7	68.3	69	45	67.7	71.4	390
Mercury	mg/kg	0.4	--	0.25	0.15	0.0264	0.09	0.28 J	0.37 J	0.16 J	0.24 J	0.20 J	0.41
Zinc	mg/kg	146 J	--	742	995	20.5	113	67	51	41	228	104	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	124 J	--	79.8	64.8	210 J	57.4	64.6	49.5	54.1	63.1	887	370
2-Methylnaphthalene	mg/kg OC	9.6 J	--	5.3	5.1	11.2	4.2	6.3	5.1	5.2	6.3	100	38
Acenaphthene	mg/kg OC	10	--	8.5	5.5	9.2	12	8.8	6.9	7.3	8.4	160	16
Acenaphthylene	mg/kg OC	4.3	--	3	1.8	1.1 J	0.9	2	1.5	1.7	1.7	20	66
Anthracene	mg/kg OC	2.7	--	2	0.9	9.7	2.4	0.2	0.2	0.3	0.6	20	220
Fluorene	mg/kg OC	12 J	--	7	4.1	11.8	6.4	4.6	3.7	3.8	5	110	23
Naphthalene	mg/kg OC	64	--	44	46	137	26	46	35	38	42	420	99
Phenanthrene	mg/kg OC	27	--	15	6.7	39.3	9.4	2.7	3	3.3	5.5	160	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	34,850 J	--	27,200	26,910	560 J	11,600	26,504	18,600	25,860	33,110	44,600	5,200
2-Methylnaphthalene	µg/kg	2,700 J	--	1,800	2,100	30.2	850	2,600	1,900	2,500	3,300	5,200	670
Acenaphthene	µg/kg	4,000	--	2,900	2,300	24.9	2,400	3,600	2,600	3,500	4,400	7,800	500
Acenaphthylene	µg/kg	1,200	--	900	740	2.88 J	190	840	570	830	910	1,000	1,300
Anthracene	µg/kg	750	--	800	370	26.2	480	64	68	130	300	1,000	960
Fluorene	µg/kg	3,400 J	--	2,400	1,700	31.8	1,300	1,900	1,400	1,800	2,600	5,600	540
Naphthalene	µg/kg	18,000	--	15,000	19,000	369	5,300	19,000	13,000	18,000	22,000	21,000	2,100
Phenanthrene	µg/kg	7,500	--	5,200	2,800	106	1,900	1,100	1,000	1,600	2,900	8,200	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	17.1 J	--	8.6 J	3.4 J	--	16.4	0.9 J	1.1 J	1.4 J	2.9 J	93.9 J	960
Benzo(a)anthracene	mg/kg OC	1.2 U	--	0.2	0.05 J	--	1	0.05 U	0.051 U	0.04 U	0.04	3	110
Benzo(a)pyrene	mg/kg OC	1.2 U	--	0.1 J	0.089 U	--	0.9	0.05 U	0.051 U	0.04 U	0.036 U	0.9	99
Benzofluoranthenes[6] (Total)	mg/kg OC	1.2 U	--	0.3	0.089 U	--	2.1	0.05 U	0.051 U	0.04 U	0.04	2.2	230
Benzo(g,h,i)perylene	mg/kg OC	1.2 U	--	0.15 U	0.089 U	--	0.4	0.03 J	0.051 U	0.04 U	0.036 U	0.5	31
Chrysene	mg/kg OC	0.78 J	--	0.3	0.08 J	--	1	0.03 J	0.03 J	0.04	0.08	4.2	110
Dibenzo(a,h)anthracene	mg/kg OC	1.2 U	--	0.15 U	0.089 U	--	0.24 U	0.01 J	0.008 J	0.03 J	0.02 J	1.3 J	12
Fluoranthene	mg/kg OC	9.6	--	5.0	2	--	5.9	0.5	0.6	0.8	1.7	50	160

Sample Location[1]		MAF-03					MAF-04						Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-DUP-03	MAF-SC-03_2-4	MAF-SC-03_4-6	MAF-SC-03_8-10	MAF-SC-03_21-23	MAF-SS-04_0-10	MAF-SC-04_0-2[9]	MAF-SC-DUP-05	MAF-SC-04_2-4[10]	MAF-SC-04_4-6	MAF-SC-04_8-10	
Sample Date		11/11/15	11/11/15	11/11/15	11/11/15	11/11/2015	10/20/15	10/26/15	10/26/15	10/26/15	10/26/15	10/26/15	
Sample Interval (dbm)		0 - 2 ft	2 - 4 ft	4 - 6 ft	8 - 10 ft	21 - 23 ft	0-10 cm	0 - 2 ft	0 - 2 ft	2 - 4 ft	4 - 6 ft	8 - 10 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	1.2 U	--	0.15 U	0.089 U	--	**0.4**	0.05 U	0.051 U	0.04 U	0.036 U	**0.4**	34
Pyrene	mg/kg OC	**6.7**	--	**2.7**	**1.3**	--	**4.2**	**0.3**	**0.4**	**0.5**	**1**	**32**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	**4,820 J**	--	**2,934 J**	**1,423 J**	--	**3,316**	**377 J**	**395.1 J**	**653 J**	**1,528 J**	**4,726 J**	12,000
Benzo(a)anthracene	µg/kg	340 U	--	**70**	**22 J**	--	**200**	20 U	19 U	19 U	**23**	**150**	1,300
Benzo(a)pyrene	µg/kg	340 U	--	**34 J**	37 U	--	**180**	20 U	19 U	19 U	19 U	**43**	1,600
Benzofluoranthenes[6] (Total)	µg/kg	340 U	--	**110**	37 U	--	**430**	20 U	19 U	19 U	**20**	**110**	3,200
Benzo(g,h,i)perylene	µg/kg	340 U	--	52 U	37 U	--	**89**	**11 J**	19 U	19 U	19 U	**27**	670
Chrysene	µg/kg	**220 J**	--	**100**	**31 J**	--	**300**	**11 J**	**12 J**	**21**	**43**	**210**	1,400
Dibenzo(a,h)anthracene	µg/kg	340 U	--	52 U	37 U	--	49 U	**5.0 J**	**3.1 J**	**12 J**	**12 J**	**67 J**	230
Fluoranthene	µg/kg	**2,700**	--	**1700**	**850**	--	**1,200**	**220**	**240**	**400**	**880**	**2,500**	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	340 U	--	52 U	37 U	--	**77**	20 U	19 U	19 U	19 U	**19**	600
Pyrene	µg/kg	**1,900**	--	**920**	**520**	--	**840**	**130**	**140**	**220**	**550**	**1,600**	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	**1.9 J**	--	0.15 U	**0.094**	1.80 U	0.024 U	**0.0059 J**	**0.011 J**	**0.0044 J**	**0.0042 J**	**0.04 J**	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	**0.078 J**	--	0.15 U	0.089 U	1.80 U	**0.0084 J**	**0.011 J**	**0.017 J**	**0.0077 J**	**0.008 J**	**0.074 J**	2.3
Hexachlorobenzene	mg/kg OC	0.24 U	--	0.15 U	0.089 U	1.80 U	0.024 U	0.012 U	0.013 U	0.01 U	0.0093 U	0.097 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	**530 J**	--	52 U	**39**	4.8 U	4.9 U	**2.4 J**	**4.2 J**	**2.1 J**	**2.2 J**	**2.0 J**	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	**22 J**	--	52 U	37 U	4.8 U	**1.7 J**	**4.5 J**	**6.4**	**3.7 J**	**4.2 J**	**3.7 J**	35
Hexachlorobenzene	µg/kg	68 U	--	52 U	37 U	4.8 U	4.9 U	5.0 U	5.0 U	5.0 U	4.9 U	4.9 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	**1 J**	--	**2.8 J**	0.89 U	17.8 U	0.24 U	0.1 U	0.1 U	0.1 U	0.093 U	0.97 U	47
Butyl Benzyl Phthalate	mg/kg OC	0.24 U	--	0.15 U	0.089 U	1.80 U	0.024 U	0.012 U	0.013 U	0.01 U	0.0093 U	0.097 U	4.9
Diethyl Phthalate	mg/kg OC	0.96 U	--	1.2 U	**0.43**	7.11 U	0.1 UJ	0.05 UJ	0.05 UJ	0.04 UJ	**0.07 J**	**1.1 J**	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	**400 J**	--	**940 J**	370 U	48.1 U	49 U	50 U	50 U	50 U	49 U	49 U	1,300
Butyl Benzyl Phthalate	µg/kg	68 U	--	52 U	37 U	4.8 U	4.9 U	5.0 U	5.0 U	5.0 U	4.9 U	4.9 U	63
Diethyl Phthalate	µg/kg	270 UJ	--	420 U	**180**	19.2 U	20 UJ	20 UJ	20 UJ	20 UJ	**37 J**	**55 J**	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**540 J**	--	**640**	**1,600**	**16.0 J**	**170**	**820**	**900**	**660**	**820**	**1,500 J**	29
2-Methylphenol (o-Cresol)	µg/kg	**300 J**	--	**330 J**	**660**	19.2 U	**140**	**1,500**	**1,600**	**1,300**	**1,400**	**1,600**	63
4-Methylphenol (p-Cresol)	µg/kg	**22,000 J**	--	**23,000**	**31,000**	**47.5**	**1,000**	**22,000**	**25,000**	**17,000**	**19,000**	**8,600**	670
Phenol	µg/kg	**380 J**	--	**330 J**	**390**	19.2 U	**340**	**450**	**480**	**370**	**420**	**290**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	**10 J**	--	**6 J**	**4.1**	**11.3**	**7.4**	**3.4**	**3.0**	**3.3**	**4.0**	**72**	15
Hexachlorobutadiene	mg/kg OC	0.24 U	--	0.15 U	0.089 U	1.80 U	0.024 U	0.012 U	0.013 U	0.01 U	0.0093 U	0.097 U	3.9

Sample Location[1]		MAF-03					MAF-04						Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-DUP-03	MAF-SC-03_2-4	MAF-SC-03_4-6	MAF-SC-03_8-10	MAF-SC-03_21-23	MAF-SS-04_0-10	MAF-SC-04_0-2[9]	MAF-SC-DUP-05	MAF-SC-04_2-4[10]	MAF-SC-04_4-6	MAF-SC-04_8-10	
Sample Date		11/11/15	11/11/15	11/11/15	11/11/15	11/11/2015	10/20/15	10/26/15	10/26/15	10/26/15	10/26/15	10/26/15	
Sample Interval (dbm)		0 - 2 ft	2 - 4 ft	4 - 6 ft	8 - 10 ft	21 - 23 ft	0-10 cm	0 - 2 ft	0 - 2 ft	2 - 4 ft	4 - 6 ft	8 - 10 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**3,000 J**	--	**2,000**	**1,700**	**30.4**	**1,500**	**1,400**	**1,000**	**1,600**	**2,000**	**3,600**	540
Hexachlorobutadiene	µg/kg	68 U	--	52 U	37 U	4.8 U	4.9 U	5.0 U	5.0 U	5.0 U	4.9 U	4.9 U	11
Benzoic Acid	µg/kg	**2,200 J**	--	**1,600 J**	**2,000**	192 U	**88 J**	200 U	200 U	200 U	200 U	200 U	650
Benzyl Alcohol	µg/kg	270 U	--	420 U	150 U	19.2 U	**69**	**110 J**	**87 J**	**61**	**80**	**63**	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	9.4 J	--	--	--	2.62 J	0.55 J	0.014 J	--	0.013 J	--	--	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	**2,650 J**	--	--	--	**7.07 J**	**111 J**	**34 J**	--	**6.32 J**	--	--	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-04	MAF-05				MAF-07	MAF-08		MAF-09	MAF-10		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-04_16-18	MAF-SS-05_0-10	MAF-SC-05_0-2	MAF-SC-05_4-6	MAF-SC-05_12-14	MAF-SS-07_0-10	MAF-SS-08_0-10	MAF-SS-DUP-02	MAF-SS-09_0-10	MAF-SS-10_0-10	MAF-SC-10_0-2	
Sample Date		11/10/2015	10/20/15	11/11/15	11/11/15	11/11/2015	10/19/15	10/19/15	10/19/15	10/19/15	10/20/15	10/29/15	
Sample Interval (dbm)		16 - 18 ft	0-10 cm	0 - 2 ft	4 - 6 ft	12 - 14 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2 ft	
Sample Type		Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface	
Stratigraphic Unit		Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	100	100	<1	5	<1	<1	25	<5	<5	15
Conventionals													
Total Organic Carbon (TOC)	Percent	0.170	7.38	13.9 J	19.2 J	0.280	1.35	0.0800 J	0.077 J	2.15	4.17	5.26	NE
Metals													
Arsenic	mg/kg	--	16	20	14.4 J	--	10	8	8	11	20	20	57
Copper	mg/kg	--	24.7	70.7	31.5	--	12.1	6.3 J	11.0 J	8.9	43.1	52.9	390
Mercury	mg/kg	--	0.06	0.12	0.0752 J	--	0.05	0.03 U	0.03 U	0.05	0.11	0.16	0.41
Zinc	mg/kg	--	59	120	72	--	34	24 J	35 J	34	102	101	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	320 J	131	43.8	42.9	69.6 J	83	7.7 J	4.5 J	90.1	143	132	370
2-Methylnaphthalene	mg/kg OC	2.1 J	10	3	3.7	4.6	7	3.5 J	6.2 U	9.8	15	11	38
Acenaphthene	mg/kg OC	3.2	19	7	7.3	9.8	9.6	5.8 U	6.2 U	10	20	21	16
Acenaphthylene	mg/kg OC	2.7 U	3.3	0.7	0.8	1.7 J	2	5.8 U	6.2 U	3.6	4.3	2.3	66
Anthracene	mg/kg OC	2.7 U	6.4	3	2.2	7.4	7.2	5.8 U	6.2 U	7.9	9.4	14	220
Fluorene	mg/kg OC	1.6 J	12	5.5	5.1	9.3	10	5.8 U	6.2 U	11	18	21	23
Naphthalene	mg/kg OC	23.1	64	18	19	22.3	31	7.7	4.5 J	36	55	40	99
Phenanthrene	mg/kg OC	4.4	30	9.4	8.9	19.1	20	5.7 U	5.7 U	21	36	34	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	55 J	9,670	6,090	8,240	195 J	1,120	6.2 J	3.5 J	1,937	5,970	6,940	5,200
2-Methylnaphthalene	µg/kg	3.64 J	900	400	710	12.9	94	2.8 J	4.8 U	210	630	580	670
Acenaphthene	µg/kg	5.47	1,400	1,000	1,400	27.3	130	4.7 U	4.8 U	220	850	1,100	500
Acenaphthylene	µg/kg	4.6 U	240	100	150	4.85 J	30	4.7 U	4.8 U	77	180	120	1,300
Anthracene	µg/kg	4.6 U	470	420	420	20.6	97	4.7 U	4.8 U	170	390	720	960
Fluorene	µg/kg	2.73 J	860	770	970	26	140	4.7 U	4.8 U	230	750	1,100	540
Naphthalene	µg/kg	39.3	4,700	2,500	3,600	62.5	420	6.2	3.5 J	780	2,300	2,100	2,100
Phenanthrene	µg/kg	7.47	2,000	1,300	1,700	53.5	300	4.6 U	4.4 U	460	1,500	1,800	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	2.6 J	54.4	27.9	18.19	--	55.8 J	13.5	15.3	59.3	71.3	84 J	960
Benzo(a)anthracene	mg/kg OC	2.7 U	2.8	1.8	0.78	--	3.5	5.8 U	6.2 U	3.5	5	6	110
Benzo(a)pyrene	mg/kg OC	2.7 U	1.8	1.7	0.39	--	2.1	5.8 U	6.2 U	3	3.6	4.2 J	99
Benzofluoranthenes[6] (Total)	mg/kg OC	5.5 U	5	3	1.2	--	4.9	5.8 U	6.2 U	6.5	8.6	8.9	230
Benzo(g,h,i)perylene	mg/kg OC	2.7 U	1.1	0.9	0.29	--	1.1	5.8 U	6.2 U	1.5	2	2.3 J	31
Chrysene	mg/kg OC	2.7 U	4.3	3.1	1.1	--	4.5	5.8 U	6.2 U	4.6	6.2	9.1	110
Dibenzo(a,h)anthracene	mg/kg OC	2.7 U	0.7 U	0.2	0.1	--	0.3 J	5.8 U	6.2 U	0.4	0.5	0.6 J	12
Fluoranthene	mg/kg OC	2.6 J	22	8.6	8.9	--	21	5.9	7.4	20	20	30	160

Sample Location[1]		MAF-04	MAF-05				MAF-07	MAF-08		MAF-09	MAF-10		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-04_16-18	MAF-SS-05_0-10	MAF-SC-05_0-2	MAF-SC-05_4-6	MAF-SC-05_12-14	MAF-SS-07_0-10	MAF-SS-08_0-10	MAF-SS-DUP-02	MAF-SS-09_0-10	MAF-SS-10_0-10	MAF-SC-10_0-2	
Sample Date		11/10/2015	10/20/15	11/11/15	11/11/15	11/11/2015	10/19/15	10/19/15	10/19/15	10/19/15	10/20/15	10/29/15	
Sample Interval (dbm)		16 - 18 ft	0-10 cm	0 - 2 ft	4 - 6 ft	12 - 14 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2 ft	
Sample Type		Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface	
Stratigraphic Unit		Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	2.7 U	0.9	0.7	0.28	--	**0.89**	5.8 U	6.2 U	**1**	2	1.8 J	34
Pyrene	mg/kg OC	2.7 U	16	7.9	5	--	**18**	7.5	7.9	**19**	20	21	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	**4.4 J**	**4,012**	**3,874**	**3,493**	--	752.6 J	**10.9**	**11.8**	1,275	**2,974**	**4,418 J**	12,000
Benzo(a)anthracene	µg/kg	4.6 U	**210**	**250**	**150**	--	47	4.7 U	4.8 U	75	**210**	**300**	1,300
Benzo(a)pyrene	µg/kg	4.6 U	**130**	**230**	**75**	--	28	4.7 U	4.8 U	60	**150**	**220 J**	1,600
Benzofluoranthenes[6] (Total)	µg/kg	9.3 U	**400**	**420**	**230**	--	66	4.7 U	4.8 U	140	**360**	**470**	3,200
Benzo(g,h,i)perylene	µg/kg	4.6 U	**84**	**120**	**55**	--	15	4.7 U	4.8 U	32	**82**	**120 J**	670
Chrysene	µg/kg	4.6 U	**320**	**430**	**210**	--	61	4.7 U	4.8 U	98	**260**	**480**	1,400
Dibenzo(a,h)anthracene	µg/kg	4.6 U	48 U	**30**	**20**	--	3.6 J	4.7 U	4.8 U	9.5	**22**	**31 J**	230
Fluoranthene	µg/kg	**4.4 J**	**1,600**	**1,200**	**1,700**	--	280	**4.8**	**5.7**	420	**1,000**	**1,600**	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	4.6 U	**68**	**94**	**53**	--	12	4.7 U	4.8 U	30	**70**	**97 J**	600
Pyrene	µg/kg	4.6 U	**1,200**	**1,100**	**1,000**	--	240	**6.1**	**6.1**	410	**820**	**1,100**	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	--	0.031 J	0.035 U	0.026 U	--	0.35 U	6 U	6.2 U	**0.079 J**	0.055 J	0.093 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	--	0.051 J	0.035 U	0.02 J	--	**0.16 J**	6 U	6.2 U	**0.56**	0.12	0.18	2.3
Hexachlorobenzene	mg/kg OC	--	0.065 U	0.035 U	0.026 U	--	0.35 U	6 U	6.2 U	**0.12 J**	0.12 U	0.093 UJ	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	--	**2.3 J**	4.9 U	4.9 U	--	4.7 U	4.9 U	4.8 U	1.7 J	**2.3 J**	4.9 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	--	**3.8 J**	4.9 U	**4 J**	--	2.1 J	4.9 U	4.8 U	12	**4.9**	**9.5**	35
Hexachlorobenzene	µg/kg	--	4.8 U	4.9 U	4.9 U	--	4.7 U	4.9 U	4.8 U	2.6 J	4.8 U	4.9 UJ	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	--	0.38 J	1.1	1.3	--	3.5 U	60 U	62 U	2.2 U	1.2 J	2.3 J	47
Butyl Benzyl Phthalate	mg/kg OC	--	0.092	0.25	0.026 U	--	**0.81**	6 U	6.2 U	0.22 U	0.12 U	0.093 U	4.9
Diethyl Phthalate	mg/kg OC	--	0.43 J	0.53	0.63	--	**1.3 J**	20 U	31 J	**1.2 J**	0.46 U	0.7	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	--	**28 J**	**150**	**250**	--	47 U	49 U	48 U	48 U	**52 J**	**120 J**	1,300
Butyl Benzyl Phthalate	µg/kg	--	**6.8**	**35**	4.9 U	--	11	4.9 U	4.8 U	4.8 U	4.8 U	4.9 U	63
Diethyl Phthalate	µg/kg	--	**32 J**	**74**	**120**	--	17 J	20 UJ	**24 J**	26 J	19 UJ	**37**	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**14.4 J**	**37**	**56**	**86**	24.4 U	24 U	25 U	24 U	**18 J**	**43**	**39 J**	29
2-Methylphenol (o-Cresol)	µg/kg	18.7 U	**33**	**31**	**64**	19.5 U	19 U	20 U	19 U	**12 J**	**37**	20 U	63
4-Methylphenol (p-Cresol)	µg/kg	18.7 U	**620**	**710**	**1,100**	19.5 U	**160**	20 U	19 U	**350**	**980 J**	**1,900**	670
Phenol	µg/kg	18.7 U	**250**	**150**	**390**	19.5 U	**53**	**17 J**	19 U	**460**	**270 J**	**210 J**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	11.0 U	18	6.0	5.7	5.04 J	**10**	3.1 J	3.5 J	**11**	20	17	15
Hexachlorobutadiene	mg/kg OC	2.80 U	0.065 U	0.035 U	0.026 U	1.8 U	0.35 U	6 U	6.2 U	0.22 U	0.12 U	0.093 U	3.9

Sample Location[1]		MAF-04	MAF-05				MAF-07	MAF-08		MAF-09	MAF-10		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-04_16-18	MAF-SS-05_0-10	MAF-SC-05_0-2	MAF-SC-05_4-6	MAF-SC-05_12-14	MAF-SS-07_0-10	MAF-SS-08_0-10	MAF-SS-DUP-02	MAF-SS-09_0-10	MAF-SS-10_0-10	MAF-SC-10_0-2	
Sample Date		11/10/2015	10/20/15	11/11/15	11/11/15	11/11/2015	10/19/15	10/19/15	10/19/15	10/19/15	10/20/15	10/29/15	
Sample Interval (dbm)		16 - 18 ft	0-10 cm	0 - 2 ft	4 - 6 ft	12 - 14 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2 ft	
Sample Type		Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface	
Stratigraphic Unit		Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	18.7 U	**1,300**	**840**	**1,100**	**14.1 J**	140	**2.5 J**	**2.7 J**	230	**800**	**920**	540
Hexachlorobutadiene	µg/kg	4.7 U	4.8 U	4.9 U	4.9 U	4.9 U	4.7 U	4.9 U	4.8 U	4.8 U	4.8 U	4.9 U	11
Benzoic Acid	µg/kg	187 U	**230**	**220**	**510**	195 U	**100 J**	200 U	190 U	**410**	**550**	**260 J**	650
Benzyl Alcohol	µg/kg	18.7 U	**56**	20 U	20 U	19.5 U	19 U	20 U	19 U	**34**	**51**	**43**	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	0.001 J	1.46 J	0.084 J	--	0.01 J	**0.39 J**	--	--	**0.24 J**	0.40 J	0.2 J	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	0.0017 U	**108 J**	**11.6 J**	--	**0.0281 J**	5.3 J	--	--	5.1 J	**16.6 J**	**10.5 J**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	Pass	Pass	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	Pass	Pass	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	Pass	**Fail**	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
µg/kg = microgram per kilogram
µg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-10		MAF-11				MAF-12			MAF-13	MAF-14	Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-DUP-07	MAF-SC-10_6-7.6	MAF-SS-11_0-10	MAF-SC-11_0-2	MAF-SC-11_2-4	MAF-SC-11_6-8	MAF-SS-12_0-10	MAF-SC-12_0-2	MAF-SC-12_2-4	MAF-SS-13_0-10	MAF-SS-14_0-10	
Sample Date		10/29/15	10/29/2015	10/20/15	10/28/15	10/28/15	10/28/2015	10/20/15	10/28/15	10/28/15	10/20/15	10/21/15	
Sample Interval (dbm)		0 - 2 ft	6 - 7.6 ft	0-10 cm	0 - 2 ft	2 - 4 ft	6 - 8 ft	0-10 cm	0 - 2 ft	2 - 4 ft	0-10 cm	0-10 cm	
Sample Type		Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	
Field Screening													
Visual Wood Content[3]	%	<5	<1	**75**	**25**	**50**	<1	**15**	**10**	<5	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	**4.66**	**2.82**	**7.32**	**4.11**	**6.51**	**3.69**	**0.99**	**3.95**	**2.10**	**0.380**	**0.455**	NE
Metals													
Arsenic	mg/kg	**20**	--	**30**	**70**	**40**	**9.1**	**20**	**19**	**14**	**11**	**10**	57
Copper	mg/kg	**70.4**	--	**45.3**	**236**	**118**	**132**	**44.1**	**62.7**	**37.2**	**18.6**	**20**	390
Mercury	mg/kg	**0.18**	--	**0.1**	**0.14**	**0.22**	**0.3**	**0.12**	**0.14**	**0.09**	**0.0202 J**	**0.0182 J**	0.41
Zinc	mg/kg	**123**	--	**98**	**559**	**269**	**65.6**	**119**	**128 J**	**55 J**	**51**	**47**	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	177	**91.1**	42.8	131	127	91.6	**120**	75.4	**111**	123	24.6 J	370
2-Methylnaphthalene	mg/kg OC	15	**6.0**	4	7.8	12	7.7	**21**	5	**7.6**	8.9	1.3	38
Acenaphthene	mg/kg OC	28	**6.8**	6.4	22	22	10	**14**	7.1	**10**	16	1.6	16
Acenaphthylene	mg/kg OC	2.6	**5.1**	1	2.3	2.2	3.6	**5.1**	3.3	**7.1**	3.7	0.7 J	66
Anthracene	mg/kg OC	17	**4.6**	3.3	10	6	1.7	**13**	6.3	**4.5**	13	3.7	220
Fluorene	mg/kg OC	30	**6.3**	4.5	19	20	7.5	**13**	8.9	**10**	15	2	23
Naphthalene	mg/kg OC	56	**47.9**	18	27	43	56.6	**44**	28	**52**	32	3.5	99
Phenanthrene	mg/kg OC	40	**20.4**	9.7	51	34	12.1	**30**	22	**27**	45	13	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	**8,230**	2,570	**3,130**	**5,390**	**8,240**	**3,380**	1,191	**2,980**	2,340	**467**	**112 J**	5,200
2-Methylnaphthalene	µg/kg	**690**	168	**290**	**320**	**790**	**284**	210	**200**	160	**34**	**5.7**	670
Acenaphthene	µg/kg	**1,300**	193	**470**	**910**	**1,400**	**370**	140	**280**	210	**59**	**7.3**	500
Acenaphthylene	µg/kg	**120**	145	**80**	**94**	**140**	**131**	51	**130**	150	**14**	**3.2 J**	1,300
Anthracene	µg/kg	**810**	129	**240**	**420**	**400**	**61.5**	130	**250**	94	**48**	**17**	960
Fluorene	µg/kg	**1,400**	177	**330**	**770**	**1,300**	**277**	130	**350**	220	**56**	**10**	540
Naphthalene	µg/kg	**2,600**	1350	**1,300**	**1,100**	**2,800**	**2,090**	440	**1,100**	1,100	**120**	**16**	2,100
Phenanthrene	µg/kg	**2,000**	576	**710**	**2,100**	**2,200**	**447**	300	**870**	570	**170**	**58**	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	88.1 J	**38.3**	44.8	195.2	55.67	12 J	**110**	85.44	**31.43**	157 J	65.4 J	960
Benzo(a)anthracene	mg/kg OC	5.6	**2.0**	3.6	18	2.9	0.4	**8.8**	6.3	**1.2**	8.4	5.7	110
Benzo(a)pyrene	mg/kg OC	2.8 J	**1.6**	3	10	2	0.2	**6.1**	3	**0.67**	7.1	5.1	99
Benzofluoranthenes[6] (Total)	mg/kg OC	7.3	**3.2**	6.4	20	4.5	0.5	**14**	6.8	**1.6**	18	9.9	230
Benzo(g,h,i)perylene	mg/kg OC	1.3 J	**1.4**	1	7	1	0.2	**3.3**	2	**0.62**	4.2	3.3	31
Chrysene	mg/kg OC	7.5	**2.8**	5.9	20	3.7	0.6	**10**	6.1	**1.8**	12	6.2	110
Dibenzo(a,h)anthracene	mg/kg OC	0.3 J	**0.2**	0.4	2	0.28	0.135 U	**0.92**	0.33	0.22 U	1.1 J	0.8 J	12
Fluoranthene	mg/kg OC	39	**15.5**	11	54	23	6.3	**30**	33	**10**	50	18	160

Sample Location[1]		MAF-10		MAF-11				MAF-12			MAF-13	MAF-14	Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-DUP-07	MAF-SC-10_6-7.6	MAF-SS-11_0-10	MAF-SC-11_0-2	MAF-SC-11_2-4	MAF-SC-11_6-8	MAF-SS-12_0-10	MAF-SC-12_0-2	MAF-SC-12_2-4	MAF-SS-13_0-10	MAF-SS-14_0-10	
Sample Date		10/29/15	10/29/2015	10/20/15	10/28/15	10/28/15	10/28/2015	10/20/15	10/28/15	10/28/15	10/20/15	10/21/15	
Sample Interval (dbm)		0 - 2 ft	6 - 7.6 ft	0-10 cm	0 - 2 ft	2 - 4 ft	6 - 8 ft	0-10 cm	0 - 2 ft	2 - 4 ft	0-10 cm	0-10 cm	
Sample Type		Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	1.1 J	0.9	1.3	6.6	1	0.09 J	3	1.1	0.29	3.7	3.1	34
Pyrene	mg/kg OC	24	11	12	50	17	4	33	28	11	50	13	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	4,106 J	1,080	3,282	8,022	3,624	450 J	1,090	3,375	660.1	598 J	297.7 J	12,000
Benzo(a)anthracene	µg/kg	260	55.1	260	730	190	13	87	250	26	32	26	1,300
Benzo(a)pyrene	µg/kg	130 J	44.3	200	600	130	7.5	61	100	14	27	23	1,600
Benzofluoranthenes[6] (Total)	µg/kg	340	91.5	470	1,000	290	17.4	140	270	33	68	45	3,200
Benzo(g,h,i)perylene	µg/kg	61 J	38.7	100	300	90	7.7	33	60	13	16	15	670
Chrysene	µg/kg	350	78.2	430	840	240	20.9	100	240	38	47	28	1,400
Dibenzo(a,h)anthracene	µg/kg	16 J	5.73	29	82	18	5 U	9.1	13	4.7 U	4.0 J	3.7 J	230
Fluoranthene	µg/kg	1,800	436	840	2,200	1,500	234	300	1,300	300	200	82	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	49 J	24.2	93	270	66	3.5 J	30	42	6.1	14	14	600
Pyrene	µg/kg	1,100	309	860	2,000	1,100	146	330	1,100	230	190	61	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.11 U	--	0.067 U	0.12 U	0.077 U	--	0.5 U	0.12 U	0.22 U	1.3 U	1.1 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	0.28	--	0.027 J	0.088 J	0.23	--	0.5 U	0.063 J	0.062 J	1.3 U	1.1 U	2.3
Hexachlorobenzene	mg/kg OC	0.11 UJ	--	0.067 U	0.12 UJ	0.077 UJ	--	0.5 U	0.12 UJ	0.22 UJ	1.3 U	1.1 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	4.9 U	--	4.9 U	4.9 U	5.0 U	--	5.0 U	4.9 U	4.7 U	4.9 U	4.8 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	13	--	2.0 J	3.6 J	15	--	5.0 U	2.5 J	1.3 J	4.9 U	4.8 U	35
Hexachlorobenzene	µg/kg	4.9 UJ	--	4.9 U	4.9 UJ	5.0 UJ	--	5.0 U	4.9 UJ	4.7 UJ	4.9 U	4.8 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	1.5 J	--	0.89	10	2 J	--	14	1.2 U	2.2 U	13 U	11 U	47
Butyl Benzyl Phthalate	mg/kg OC	0.11 UJ	--	0.082	0.12 U	0.077 U	--	0.5 U	0.12 U	0.22 U	1.3 U	1.1 U	4.9
Diethyl Phthalate	mg/kg OC	1	--	0.3 UJ	0.8	0.91 U	--	2 UJ	0.46 J	1.6	5 UJ	4.2 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	69 J	--	65	500	130 J	--	140	49 U	47 U	49 U	48 U	1,300
Butyl Benzyl Phthalate	µg/kg	4.9 UJ	--	6.0	4.9 U	5.0 U	--	5.0 U	4.9 U	4.7 U	4.9 U	4.8 U	63
Diethyl Phthalate	µg/kg	47	--	20 UJ	33	59 U	--	20 UJ	18 J	34	20 UJ	19 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	68 J	21.9 J	21 J	24 J	81	80	25 U	16 J	21 J	24 U	24 U	29
2-Methylphenol (o-Cresol)	µg/kg	39 U	27	20	20 U	59 U	20.0 U	20 U	20 U	49	20 U	19 U	63
4-Methylphenol (p-Cresol)	µg/kg	3,000	249	720	1,300	4,300	1,260	150	680 J	560	40	19 U	670
Phenol	µg/kg	650 J	42.7	440	240 J	140	54.2	200	140 J	66 J	24	19 U	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	24	6.1	4.9	18	20	7.0	16	8.1	10	15	2.2	15
Hexachlorobutadiene	mg/kg OC	0.11 U	0.17 U	0.067 U	0.12 U	0.054 J	0.14 U	0.5 U	0.12 U	0.22 U	1.3 U	1.1 U	3.9

Sample Location[1]		MAF-10		MAF-11				MAF-12			MAF-13	MAF-14	Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-DUP-07	MAF-SC-10_6-7.6	MAF-SS-11_0-10	MAF-SC-11_0-2	MAF-SC-11_2-4	MAF-SC-11_6-8	MAF-SS-12_0-10	MAF-SC-12_0-2	MAF-SC-12_2-4	MAF-SS-13_0-10	MAF-SS-14_0-10	
Sample Date		10/29/15	10/29/2015	10/20/15	10/28/15	10/28/15	10/28/2015	10/20/15	10/28/15	10/28/15	10/20/15	10/21/15	
Sample Interval (dbm)		0 - 2 ft	6 - 7.6 ft	0-10 cm	0 - 2 ft	2 - 4 ft	6 - 8 ft	0-10 cm	0 - 2 ft	2 - 4 ft	0-10 cm	0-10 cm	
Sample Type		Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**1,100**	171	**360**	**740**	**1,000**	**259**	160	**320**	220	**58**	**9.9**	540
Hexachlorobutadiene	µg/kg	4.9 U	4.8 U	4.9 U	4.9 U	**3.5 J**	5.0 U	5.0 U	4.9 U	4.7 U	4.9 U	4.8 U	11
Benzoic Acid	µg/kg	**650 J**	**145 J**	**200**	**340**	**280 J**	**137 J**	**100 J**	**140 J**	**130 J**	200 U	190 U	650
Benzyl Alcohol	µg/kg	**59 J**	19.3 U	**52**	**37 J**	59 UJ	20.0 U	**33**	20 U	**25 J**	20 U	19 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	1.42 J	--	0.029 J	0.68 J	10.1 J	0.12 J	**19.6 J**	--	**0.15 J**	0.63 J	0.22 J	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	**66.4 J**	--	**2.14 J**	**27.8 J**	**657 J**	**4.58 J**	195 J	--	3.11 J	**2.39 J**	**0.988 J**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	Pass	--	--	--	Pass	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	Pass	--	--	--	Pass	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	Pass	--	--	--	**Fail**	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
µg/kg = microgram per kilogram
µg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-15			MAF-16	MAF-17	MAF-18	MAF-19	MAF-20		MAF-21		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-15_0-10	MAF-SC-15_0-2	MAF-SC-DUP-08	MAF-SS-16_0-10	MAF-SS-17_0-10	MAF-SS-18_0-10	MAF-SS-19_0-10	MAF-SS-20_0-10	MAF-SC-20_1-2	MAF-SS-21_0-10	MAF-SS-DUP-04	
Sample Date		10/21/15	10/28/15	10/28/15	10/21/15	10/21/15	10/21/15	10/20/15	10/20/15	10/29/2015	10/21/15	10/21/15	
Sample Interval (dbm)		0-10 cm	0 - 2 ft	0 - 2 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	1 - 2 ft	0-10 cm	0-10 cm	
Sample Type		Surface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<5	<5	<1	<1	<1	**10**	<5	<1	**10**	**10**	15
Conventionals													
Total Organic Carbon (TOC)	Percent	**0.124**	**0.415**	**0.499**	**0.291**	**0.257**	**0.766**	**3.70**	**3.83**	**0.940**	**5.30 J**	**1.8**	NE
Metals													
Arsenic	mg/kg	**11**	**13**	**12**	**9**	**9**	**11**	**19**	**23**	--	**20**	**20**	57
Copper	mg/kg	**13.7**	**32.3**	**25.4**	**13.2**	**12.7**	**15.1**	**162**	**58**	--	**50.2**	**46.9**	390
Mercury	mg/kg	**0.0127 J**	**0.04**	**0.05**	**0.0094 J**	**0.0138 J**	**0.05**	**0.11**	**0.15**	--	**0.13**	**0.15**	0.41
Zinc	mg/kg	**42**	**51**	**47**	**39**	**30**	**41**	**100**	**118**	--	**85**	**82**	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	9 J	67.2 J	39.9 J	0.9 J	3.6 J	**33**	48.9	66.6	**83.1**	64.2	**147**	370
2-Methylnaphthalene	mg/kg OC	2.6 J	2.7	2.2	1.6 U	1.8 U	**2.3**	3.2	5	**5.8**	5	**10**	38
Acenaphthene	mg/kg OC	4 U	3.9	2.6	1.6 U	1.8 U	**4.4**	4.3	6.8	**4.5**	6.7	**14**	16
Acenaphthylene	mg/kg OC	4 U	5.3 J	2.8 J	1.6 U	1.8 U	**1**	2	3	**6.3**	2.4	**5**	66
Anthracene	mg/kg OC	4 U	8.7	4.8	1.6 U	1.8 U	**5.1**	4.3	5.5	**6.8**	5.9	**14**	220
Fluorene	mg/kg OC	4 U	6.3 J	3.6 J	1.6 U	1.8 U	**3.8**	4.9	7.3	**5.5**	7.2	**20**	23
Naphthalene	mg/kg OC	3 J	17	11	1.6 U	1.1 J	**8.1**	21	30	**38.1**	24	**60**	99
Phenanthrene	mg/kg OC	6	27	15	0.9 J	2.5	**9.9**	12	20	**21.9**	18	**40**	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	**11.1 J**	**279 J**	**199 J**	**2.5 J**	**9.3 J**	250	**1,810**	**2,550**	781	**3,460**	2,710	5,200
2-Methylnaphthalene	µg/kg	**3.2 J**	**11**	**11**	4.6 U	4.7 U	18	**120**	**190**	54.8	**270**	200	670
Acenaphthene	µg/kg	4.9 U	**16**	**13**	4.6 U	4.7 U	34	**160**	**260**	42.7	**360**	250	500
Acenaphthylene	µg/kg	4.9 U	**22 J**	**14 J**	4.6 U	4.7 U	10	**90**	**100**	59	**130**	100	1,300
Anthracene	µg/kg	4.9 U	**36**	**24**	4.6 U	4.7 U	39	**160**	**210**	64.2	**320**	260	960
Fluorene	µg/kg	4.9 U	**26 J**	**18 J**	4.6 U	4.7 U	29	**180**	**280**	51.3	**390**	300	540
Naphthalene	µg/kg	**3.7 J**	**69**	**55**	4.6 U	**2.9 J**	62	**770**	**1,000**	358	**1,300**	1,100	2,100
Phenanthrene	µg/kg	**7.4**	**110**	**75**	**2.5 J**	**6.4**	76	**450**	**700**	206	**960**	700	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	26.8 J	156.1 J	80.4 J	8.5 J	37.2 J	**50.6 J**	36	42.8	**61 J**	45.7 J	**111.3 J**	960
Benzo(a)anthracene	mg/kg OC	2.3 J	13 J	5.4 J	1.6 U	3	**4.2**	2.6	3	**4.2**	2.8	**7.6**	110
Benzo(a)pyrene	mg/kg OC	2.7 J	14 J	6 J	1.6 U	5.1	**3**	1.8	2.1	**4**	1.7	**5**	99
Benzofluoranthenes[6] (Total)	mg/kg OC	5.6	27 J	10 J	1.9	5.8	**6.1**	4.3	4.7	**7.1**	4.3	**12**	230
Benzo(g,h,i)perylene	mg/kg OC	4 U	8.7 J	4.6 J	1.6 U	1.7 J	**1.7**	1	1.4	**3.8**	1	**3**	31
Chrysene	mg/kg OC	3.7 J	18 J	7.4 J	1.5 J	4	**5**	3.2	3.1	**5.4**	3.3	**9.8**	110
Dibenzo(a,h)anthracene	mg/kg OC	4 U	2.3	1.1	1.6 U	1.8 U	**0.3 J**	0.2	0.3	**0.4 J**	0.2 J	**0.6 J**	12
Fluoranthene	mg/kg OC	6.8	39	22	2.9	6.6	**14**	11	15	**19.8**	16	**37**	160

Sample Location[1]		MAF-15			MAF-16	MAF-17	MAF-18	MAF-19	MAF-20		MAF-21		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-15_0-10	MAF-SC-15_0-2	MAF-SC-DUP-08	MAF-SS-16_0-10	MAF-SS-17_0-10	MAF-SS-18_0-10	MAF-SS-19_0-10	MAF-SS-20_0-10	MAF-SC-20_1-2	MAF-SS-21_0-10	MAF-SS-DUP-04	
Sample Date		10/21/15	10/28/15	10/28/15	10/21/15	10/21/15	10/21/15	10/20/15	10/20/15	10/29/2015	10/21/15	10/21/15	
Sample Interval (dbm)		0-10 cm	0 - 2 ft	0 - 2 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	1 - 2 ft	0-10 cm	0-10 cm	
Sample Type		Surface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	4 U	7 J	3.6 J	1.6 U	1.4 J	**1**	0.9	1.1	**2.4**	0.85	**2**	34
Pyrene	mg/kg OC	5.6	29	18	2.3	9.7	**14**	11	13	**13.5**	15	**35**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	**33.2 J**	**647.7 J**	**401.3 J**	**24.8 J**	**95.5 J**	387.6 J	**1,333**	**1,639**	570 J	**2,461 J**	2,047 J	12,000
Benzo(a)anthracene	µg/kg	**2.9 J**	**52 J**	**27 J**	4.6 U	**7.6**	32	**97**	**100**	39.7	**150**	140	1,300
Benzo(a)pyrene	µg/kg	**3.3 J**	**57 J**	**30 J**	4.6 U	**13**	23	**66**	**82**	37.9	**94**	90	1,600
Benzofluoranthenes[6] (Total)	µg/kg	**7**	**110 J**	**60 J**	**5.5**	**15**	47	**160**	**180**	66.5	**230**	220	3,200
Benzo(g,h,i)perylene	µg/kg	4.9 U	**36 J**	**23 J**	4.6 U	**4.4 J**	13	**40**	**54**	35.5	**60**	50	670
Chrysene	µg/kg	**4.6 J**	**73 J**	**37 J**	**4.3 J**	**10**	40	**120**	**120**	50.9	**180**	180	1,400
Dibenzo(a,h)anthracene	µg/kg	4.9 U	**9.7**	**5.3**	4.6 U	4.7 U	2.6 J	**8.4**	**12**	4.03 J	**11 J**	11 J	230
Fluoranthene	µg/kg	**8.4**	**160**	**110**	**8.4**	**17**	110	**420**	**570**	186	**880**	680	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	4.9 U	**30 J**	**18 J**	4.6 U	**3.5 J**	10	**32**	**41**	22.5	**46**	36	600
Pyrene	µg/kg	**7**	**120**	**91**	**6.6**	**25**	110	**390**	**480**	127	**810**	640	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	4 U	1.1 U	0.94 U	1.6 U	1.8 U	0.64 U	0.13 U	0.13 U	--	0.046 J	0.27 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	4 U	1.1 U	0.94 U	1.6 U	1.8 U	0.64 U	0.11 J	0.11 J	--	0.063 J	**0.17 J**	2.3
Hexachlorobenzene	mg/kg OC	4 U	1.1 UJ	0.94 UJ	1.6 U	1.8 U	0.64 U	0.13 U	0.13 U	--	0.093 U	0.27 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	4.9 U	4.7 U	4.7 U	4.6 U	4.7 U	4.9 U	4.7 U	4.8 U	--	**2.5 J**	4.9 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	4.9 U	4.7 U	4.7 U	4.6 U	4.7 U	4.9 U	**4.0 J**	**4.4 J**	--	**3.4 J**	3.2 J	35
Hexachlorobenzene	µg/kg	4.9 U	4.7 UJ	4.7 UJ	4.6 U	4.7 U	4.9 U	4.7 U	4.8 U	--	5.0 U	4.9 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	40 U	11 U	9.4 U	16 U	18 U	6.4 U	1.4	1.3 U	--	0.91 J	**1.8 J**	47
Butyl Benzyl Phthalate	mg/kg OC	12	1.1 U	0.94 U	1.6 U	1.8 U	0.64 U	0.13 U	0.13 U	--	0.093 U	0.27 U	4.9
Diethyl Phthalate	mg/kg OC	20 U	4.6 U	3.8 U	6.2 U	7.4 U	3 U	0.51 UJ	0.5 UJ	--	0.4 U	1 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	49 U	47 U	47 U	46 U	47 U	49 U	**51**	48 U	--	**49 J**	34 J	1,300
Butyl Benzyl Phthalate	µg/kg	**15**	4.7 U	4.7 U	4.6 U	4.7 U	4.9 U	4.7 U	4.8 U	--	5.0 U	4.9 U	63
Diethyl Phthalate	µg/kg	20 U	19 U	19 U	18 U	19 U	20 U	19 UJ	19 UJ	--	20 U	20 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	25 U	24 U	23 U	23 U	24 U	24 U	24 U	**22 J**	24.3 U	**22 J**	**17 J**	29
2-Methylphenol (o-Cresol)	µg/kg	20 U	19 U	19 U	18 U	19 U	20 U	**7.5 J**	**17 J**	19.4 U	20 U	20 U	63
4-Methylphenol (p-Cresol)	µg/kg	20 U	**42 J**	**95 J**	18 U	19 U	20	**250**	**740**	**75.5**	**1,400**	**1,200**	670
Phenol	µg/kg	20 U	**18 J**	**25 J**	18 U	15 U	22 U	**110**	**370**	**16.8 J**	**820 J**	**300 J**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	2.3 J	5.5 J	3.4 J	1.6 U	1.8 U	**4.4**	5.0	7.3	**5.9**	8.2	**17**	15
Hexachlorobutadiene	mg/kg OC	4 U	1.1 U	0.94 U	1.6 U	1.8 U	0.64 U	0.13 U	0.13 U	0.52 U	0.093 U	0.27 U	3.9

Sample Location[1]		MAF-15			MAF-16	MAF-17	MAF-18	MAF-19	MAF-20		MAF-21		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-15_0-10	MAF-SC-15_0-2	MAF-SC-DUP-08	MAF-SS-16_0-10	MAF-SS-17_0-10	MAF-SS-18_0-10	MAF-SS-19_0-10	MAF-SS-20_0-10	MAF-SC-20_1-2	MAF-SS-21_0-10	MAF-SS-DUP-04	
Sample Date		10/21/15	10/28/15	10/28/15	10/21/15	10/21/15	10/21/15	10/20/15	10/20/15	10/29/2015	10/21/15	10/21/15	
Sample Interval (dbm)		0-10 cm	0 - 2 ft	0 - 2 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	1 - 2 ft	0-10 cm	0-10 cm	
Sample Type		Surface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**2.8 J**	**23 J**	**17 J**	4.6 U	4.7 U	34	**200**	**280**	55.7	**440**	310	540
Hexachlorobutadiene	µg/kg	4.9 U	4.7 U	4.7 U	4.6 U	4.7 U	4.9 U	4.7 U	4.8 U	4.9 U	5.0 U	4.9 U	11
Benzoic Acid	µg/kg	200 U	190 U	190 U	180 U	190 U	200 U	**160 J**	**250**	194 U	**450**	**530**	650
Benzyl Alcohol	µg/kg	20 UJ	19 U	19 U	18 U	19 U	20 U	**17 J**	**42**	19.4 U	20 U	20 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	2.56 J	--	--	0.13 J	--	--	0.043 J	0.19 J	**0.15 J**	1.29 J	**0.40 J**	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	**3.17 J**	--	--	**0.38 J**	--	--	**1.6 J**	**7.11 J**	1.44 J	**69.3 J**	7.27 J	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	Pass	--	Pass	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	Pass	--	Pass	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	Pass	--	Pass	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
µg/kg = microgram per kilogram
µg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-21			MAF-22	MAF-23	MAF-24	MAF-25	MAF-26	MAF-27	MAF-28		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-21_0-1	MAF-SC-DUP-09	MAF-SC-21_2-4	MAF-SS-22_0-10	MAF-SS-23_0-10	MAF-SS-24_0-10	MAF-SS-25_0-10	MAF-SS-26_0-10	MAF-SS-27_0-10	MAF-SS-28_0-10	MAF-SS-DUP-05	
Sample Date		10/29/15	10/29/15	10/29/2015	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	2 - 4 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	
Field Screening													
Visual Wood Content[3]	%	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	**5.30**	**4.34**	**1.14**	**6.30 J**	**0.161**	**0.084**	**0.139**	**0.138**	**0.579**	**0.178**	**0.142**	NE
Metals													
Arsenic	mg/kg	**20**	**20**	–	–	–	**9**	**9**	**8**	**9**	–	–	57
Copper	mg/kg	**79.6**	**86.8**	–	–	–	**11.4**	**11.7**	**11.8**	**13.9**	–	–	390
Mercury	mg/kg	**0.24**	**0.26**	–	–	–	**0.0123 J**	**0.0084 J**	**0.0110 J**	**0.0154 J**	–	–	0.41
Zinc	mg/kg	**109**	**109**	–	–	–	**35**	**38**	**35**	**41**	–	–	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	55.5 J	101 J	**68**	27.4	–	5.6 U	4.0 U	9.3	**2.7 J**	–	–	370
2-Methylnaphthalene	mg/kg OC	4.2 J	9.0 J	**4.4**	2.7	–	5.6 U	4.0 U	3.6 U	0.81 U	–	–	38
Acenaphthene	mg/kg OC	5.1	8.3	**4.5**	3.3	–	5.6 U	4.0 U	3.6 U	0.81 U	–	–	16
Acenaphthylene	mg/kg OC	2.3	3.5	**5.2**	1.1	–	5.6 U	4.0 U	3.6 U	0.81 U	–	–	66
Anthracene	mg/kg OC	4	7	**6.5**	2.1	–	5.6 U	4.0 U	2.5 J	**0.5 J**	–	–	220
Fluorene	mg/kg OC	6.2 J	13.0 J	**5.4**	3	–	5.6 U	4.0 U	3.6 U	0.81 U	–	–	23
Naphthalene	mg/kg OC	23	41	**26.7**	14.1	–	5.6 U	4.0 U	3.6 U	**0.6 J**	–	–	99
Phenanthrene	mg/kg OC	15	28	**19**	6.6	–	5.6 U	4.0 U	6.8	**1.7**	–	–	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	**2,940**	**4,390 J**	770	**1,740**	–	4.7 U	5.6 U	**12.8 J**	15.8 J	–	–	5,200
2-Methylnaphthalene	µg/kg	**220 J**	**400 J**	50.4	**171**	–	4.7 U	5.6 U	5.0 U	4.7 U	–	–	670
Acenaphthene	µg/kg	**270**	**360**	50.9	**210**	–	4.7 U	5.6 U	5.0 U	4.7 U	–	–	500
Acenaphthylene	µg/kg	**120**	**150**	58.7	**67**	–	4.7 U	5.6 U	5.0 U	4.7 U	–	–	1,300
Anthracene	µg/kg	**200**	**300**	74	**127**	–	4.7 U	5.6 U	**3.4 J**	2.6 J	–	–	960
Fluorene	µg/kg	**330 J**	**580 J**	61.9	**184**	–	4.7 U	5.6 U	5.0 U	4.7 U	–	–	540
Naphthalene	µg/kg	**1,200**	**1,800**	304	**787**	–	4.7 U	5.6 U	5.0 U	3.5 J	–	–	2,100
Phenanthrene	µg/kg	**820**	**1,200**	220	**368**	–	4.7 U	5.6 U	**9.4**	9.7	–	–	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	38.3	64	–	17	–	5.6 U	4 U	39.4 J	**9.8 J**	–	–	960
Benzo(a)anthracene	mg/kg OC	2.1	3.7	–	1	–	5.6 U	4 U	3.8	**0.8 J**	–	–	110
Benzo(a)pyrene	mg/kg OC	1.2	2.2	–	0.7	–	5.6 U	4 U	3.9	**1.1**	–	–	99
Benzofluoranthenes[6] (Total)	mg/kg OC	3	5.5	–	1.7	–	5.6 U	4 U	6.2	**2**	–	–	230
Benzo(g,h,i)perylene	mg/kg OC	0.9	2	–	0.5	–	5.6 U	4 U	2.7 J	**0.9**	–	–	31
Chrysene	mg/kg OC	2.3	4.4	–	1.4	–	5.6 U	4 U	4.4	**1**	–	–	110
Dibenzo(a,h)anthracene	mg/kg OC	0.1	0.3	–	0.1	–	5.6 U	4 U	3.6 U	0.8 U	–	–	12
Fluoranthene	mg/kg OC	16	25	–	6.5	–	5.6 U	4 U	7	**1.9**	–	–	160

Sample Location[1]		MAF-21			MAF-22	MAF-23	MAF-24	MAF-25	MAF-26	MAF-27	MAF-28		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-21_0-1	MAF-SC-DUP-09	MAF-SC-21_2-4	MAF-SS-22_0-10	MAF-SS-23_0-10	MAF-SS-24_0-10	MAF-SS-25_0-10	MAF-SS-26_0-10	MAF-SS-27_0-10	MAF-SS-28_0-10	MAF-SS-DUP-05	
Sample Date		10/29/15	10/29/15	10/29/2015	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	2 - 4 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	**0.6**	**1**	–	**0.4**	–	5.6 U	4 U	**2.5 J**	**0.7 J**	–	–	34
Pyrene	mg/kg OC	**12**	**20**	–	**4.9**	–	5.6 U	4 U	**8.7**	**1.6**	–	–	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	**2,029**	**2,779**	–	**1,080**	–	4.7 U	5.6 U	**54.4 J**	**56.6 J**	–	–	12,000
Benzo(a)anthracene	µg/kg	**110**	**160**	–	**62.2**	–	4.7 U	5.6 U	**5.2**	**4.6 J**	–	–	1,300
Benzo(a)pyrene	µg/kg	**64**	**96**	–	**43**	–	4.7 U	5.6 U	**5.4**	**6.3**	–	–	1,600
Benzofluoranthenes[6] (Total)	µg/kg	**160**	**240**	–	**108**	–	4.7 U	5.6 U	**8.5**	**10**	–	–	3,200
Benzo(g,h,i)perylene	µg/kg	**48**	**70**	–	**29.5**	–	4.7 U	5.6 U	**3.7 J**	**5.2**	–	–	670
Chrysene	µg/kg	**120**	**190**	–	**86.2**	–	4.7 U	5.6 U	**6.1**	**5.9**	–	–	1,400
Dibenzo(a,h)anthracene	µg/kg	**7.2**	**11**	–	**6.42**	–	4.7 U	5.6 U	5.0 U	4.7 U	–	–	230
Fluoranthene	µg/kg	**850**	**1,100**	–	**364**	–	4.7 U	5.6 U	**10**	**11**	–	–	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	**30**	**42**	–	**22.6**	–	4.7 U	5.6 U	**3.5 J**	**4.2 J**	–	–	600
Pyrene	µg/kg	**640**	**870**	–	**283**	–	4.7 U	5.6 U	**12**	**9.4**	–	–	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.092 U	0.11 U	–	–	–	5.6 U	3.4 U	3.6 U	0.81 U	–	–	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	**0.085 J**	**0.069 J**	–	–	–	5.6 U	3.4 U	3.6 U	0.81 U	–	–	2.3
Hexachlorobenzene	mg/kg OC	0.092 UJ	0.11 UJ	–	–	–	5.6 U	3.4 U	3.6 U	0.81 U	–	–	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	4.9 U	4.8 U	–	–	–	4.7 U	4.7 U	5.0 U	4.7 U	–	–	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	**4.5 J**	**3.0 J**	–	–	–	4.7 U	4.7 U	5.0 U	4.7 U	–	–	35
Hexachlorobenzene	µg/kg	4.9 UJ	4.8 UJ	–	–	–	4.7 U	4.7 U	5.0 U	4.7 U	–	–	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	**1.8 J**	2.2 U	–	–	–	60 U	34 U	33 U	8.1 U	–	–	47
Butyl Benzyl Phthalate	mg/kg OC	0.092 U	0.11 U	–	–	–	5.6 U	3.4 U	3.6 U	0.81 U	–	–	4.9
Diethyl Phthalate	mg/kg OC	0.74 U	0.9 U	–	–	–	20 U	14 U	13 U	3.3 U	–	–	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	**94 J**	97 U	–	–	–	50 U	47 U	46 U	47 U	–	–	1,300
Butyl Benzyl Phthalate	µg/kg	4.9 U	4.8 U	–	–	–	4.7 U	4.7 U	5.0 U	4.7 U	–	–	63
Diethyl Phthalate	µg/kg	39 U	39 U	–	–	–	20 U	19 U	18 U	19 U	–	–	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**25**	**20 J**	24.2 U	**12.1 J**	–	23 U	24 U	25 U	24 U	–	–	29
2-Methylphenol (o-Cresol)	µg/kg	39 U	39 U	19.3 U	19.9 U	–	20 U	19 U	18 U	19 U	–	–	63
4-Methylphenol (p-Cresol)	µg/kg	**3,100**	**2,200**	31	**825**	–	20 U	19 U	18 U	19 U	–	–	670
Phenol	µg/kg	**160**	**130**	16.1 J	**242**	–	20 U	12 U	18 U	11 U	–	–	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	**6.0**	**10**	–	**3.3**	11.7 U	5.6 U	4 U	3.6 U	0.81 U	–	–	15
Hexachlorobutadiene	mg/kg OC	0.092 U	0.11 U	–	0.079 U	2.9 U	5.6 U	3.4 U	3.6 U	0.81 U	–	–	3.9

Sample Location[1]		MAF-21			MAF-22	MAF-23	MAF-24	MAF-25	MAF-26	MAF-27	MAF-28		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SC-21_0-1	MAF-SC-DUP-09	MAF-SC-21_2-4	MAF-SS-22_0-10	MAF-SS-23_0-10	MAF-SS-24_0-10	MAF-SS-25_0-10	MAF-SS-26_0-10	MAF-SS-27_0-10	MAF-SS-28_0-10	MAF-SS-DUP-05	
Sample Date		10/29/15	10/29/15	10/29/2015	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	10/21/15	
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	2 - 4 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	**300**	**440**	--	**206**	18.9 U	4.7 U	5.6 U	5.0 U	4.7 U	--	--	540
Hexachlorobutadiene	µg/kg	4.9 U	4.8 U	--	5.0 U	4.7 U	4.7 U	4.7 U	5.0 U	4.7 U	--	--	11
Benzoic Acid	µg/kg	**450**	**240 J**	--	**583**	189 U	200 U	190 U	180 U	190 U	--	--	650
Benzyl Alcohol	µg/kg	39 UJ	39 UJ	--	**38.9**	18.9 U	20 U	19 U	18 U	19 U	--	--	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	--	--	**0.003 J**	0.034 J	--	--	0.16 J	--	**0.076 J**	--	--	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	--	--	0.035 J	**2.14 J**	--	--	**0.23 J**	--	0.44 J	--	--	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	Pass	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	Pass	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	**Fail**	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-29	MAF-30		MAF-31	MAF-32	MAF-33		MAF-34	MAF-35	MAF-36	MAF-37	Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-29_0-10	MAF-SS-30_0-10	MAF-SS-DUP-03	MAF-SS-31_0-10	MAF-SS-32_0-10	MAF-SS-33_0-10	MAF-SS-DUP-06	MAF-SS-34_0-10	MAF-SS-35_0-10	MAF-SS-36_0-10	MAF-SS-37_0-10	
Sample Date		10/21/15	10/21/15	10/21/15	10/19/15	10/19/15	10/19/15	10/19/15	10/20/15	10/19/15	10/19/15	09/13/2016	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	
Sample Type		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	<1	**10**	**40**	<1	<1	<1	**10**	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	**0.108**	**0.125**	**0.131**	**4.76**	**1.25**	**1.47**	**1.88**	**1.66**	**5.45**	**2.12**	**1.59**	NE
Metals													
Arsenic	mg/kg	--	--	--	**10**	**13**	**14**	**13**	**20**	--	**40 U**	--	57
Copper	mg/kg	--	--	--	**35.7**	**16.3**	**19.3**	**18.9**	**24.5**	--	**13**	--	390
Mercury	mg/kg	--	--	--	**0.11**	0.04 U	0.03 U	0.04 U	**0.07**	--	**0.03**	--	0.41
Zinc	mg/kg	--	--	--	**79**	**37**	**45**	**45**	**66**	--	**32**	--	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	--	--	--	78	**98.2**	**139**	**97.6**	**155**	57.2	**85.8**	--	370
2-Methylnaphthalene	mg/kg OC	--	--	--	7.8	**8.8**	**12**	**8.5**	**15**	7.2	**6.6**	--	38
Acenaphthene	mg/kg OC	--	--	--	7.8	**14**	**17**	**12**	**23**	6.2	**11**	--	16
Acenaphthylene	mg/kg OC	--	--	--	3.2	**3**	**3.9**	**2.9**	**3.5**	2.6	**2**	--	66
Anthracene	mg/kg OC	--	--	--	5	**20**	**10**	**9.6**	**13**	4.8	**13**	--	220
Fluorene	mg/kg OC	--	--	--	8.6	**12**	**17**	**12**	**19**	7.7	**12**	--	23
Naphthalene	mg/kg OC	--	--	--	36	**34**	**54**	**40**	**56**	22	**15**	--	99
Phenanthrene	mg/kg OC	--	--	--	17	**20**	**33**	**20**	**41**	14	**33**	--	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	--	--	--	**3,700**	1,228	2,040	1,834	2,568	**3,120**	1,820	--	5,200
2-Methylnaphthalene	µg/kg	--	--	--	**370**	110	180	160	250	**390**	140	--	670
Acenaphthene	µg/kg	--	--	--	**370**	170	250	230	380	**340**	240	--	500
Acenaphthylene	µg/kg	--	--	--	**150**	38	58	54	58	**140**	40	--	1,300
Anthracene	µg/kg	--	--	--	**240**	200	200	180	210	**260**	280	--	960
Fluorene	µg/kg	--	--	--	**410**	150	250	220	310	**420**	250	--	540
Naphthalene	µg/kg	--	--	--	**1,700**	420	790	750	930	**1,200**	320	--	2,100
Phenanthrene	µg/kg	--	--	--	**830**	250	490	400	680	**760**	690	--	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	--	--	--	33.8	**133.7**	**105.5 J**	**71.4 J**	**101.1**	41.1	**111.3 J**	--	960
Benzo(a)anthracene	mg/kg OC	--	--	--	2.3	**13**	**9.5**	**5.9**	**8.4**	2.6	**9**	--	110
Benzo(a)pyrene	mg/kg OC	--	--	--	1.5	**6.2**	**4.8**	**3.1**	**5.1**	2	**4.6**	--	99
Benzofluoranthenes[6] (Total)	mg/kg OC	--	--	--	3.8	**14**	**12**	**7.4**	**10**	4.8	**11**	--	230
Benzo(g,h,i)perylene	mg/kg OC	--	--	--	0.8	**2.2**	**2.2 J**	**1.2 J**	**2**	0.9	**1.7**	--	31
Chrysene	mg/kg OC	--	--	--	4	**14**	**16 J**	**7.4 J**	**10**	3.3	**14**	--	110
Dibenzo(a,h)anthracene	mg/kg OC	--	--	--	0.23	**0.7**	**0.56**	**0.36**	**0.6**	0.22	**0.5 J**	--	12
Fluoranthene	mg/kg OC	--	--	--	11	**44**	**31**	**24**	**33**	12	**35**	--	160

Sample Location[1]		MAF-29	MAF-30		MAF-31	MAF-32	MAF-33		MAF-34	MAF-35	MAF-36	MAF-37	Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-29_0-10	MAF-SS-30_0-10	MAF-SS-DUP-03	MAF-SS-31_0-10	MAF-SS-32_0-10	MAF-SS-33_0-10	MAF-SS-DUP-06	MAF-SS-34_0-10	MAF-SS-35_0-10	MAF-SS-36_0-10	MAF-SS-37_0-10	
Sample Date		10/21/15	10/21/15	10/21/15	10/19/15	10/19/15	10/19/15	10/19/15	10/20/15	10/19/15	10/19/15	09/13/2016	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	
Sample Type		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	--	--	--	0.71	**2.2**	**1.9 J**	**1.2 J**	**1.9**	0.72	**1.7**	--	34
Pyrene	mg/kg OC	--	--	--	8.8	**37**	**28**	**20**	**26**	10	**34**	--	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	--	--	--	**1,607**	1,671	1550 J	1,342	1,679	**2,240**	2,359 J	--	12,000
Benzo(a)anthracene	µg/kg	--	--	--	**110**	160	140	110	140	**140**	200	--	1,300
Benzo(a)pyrene	µg/kg	--	--	--	**72**	78	71	59	84	**110**	98	--	1,600
Benzofluoranthenes[6] (Total)	µg/kg	--	--	--	**180**	180	170	140	200	**260**	230	--	3,200
Benzo(g,h,i)perylene	µg/kg	--	--	--	**40**	27	33 J	23 J	34	**49**	35	--	670
Chrysene	µg/kg	--	--	--	**200**	180	240 J	140 J	200	**180**	290	--	1,400
Dibenzo(a,h)anthracene	µg/kg	--	--	--	**11**	9.1	8.2	6.7	10	**12**	11 J	--	230
Fluoranthene	µg/kg	--	--	--	**540**	550	450	460	550	**650**	740	--	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	--	--	--	**34**	27	28 J	23 J	31	**39**	35	--	600
Pyrene	µg/kg	--	--	--	**420**	460	410	380	430	**800**	720	--	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	--	--	--	0.055 J	0.38 U	0.33 U	0.26 U	0.28 U	--	0.22 U	--	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	--	--	--	0.34	**0.14 J**	**0.27 J**	**0.11 J**	0.28 U	--	0.22 U	--	2.3
Hexachlorobenzene	mg/kg OC	--	--	--	0.1 U	0.38 U	0.33 U	0.26 U	0.28 U	--	0.22 U	--	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	--	--	--	**2.6 J**	4.8 U	4.9 U	4.9 U	4.7 U	--	4.7 U	--	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	--	--	--	**16**	1.7 J	3.9 J	2.1 J	4.7 U	--	4.7 U	--	35
Hexachlorobenzene	µg/kg	--	--	--	4.8 U	4.8 U	4.9 U	4.9 U	4.7 U	--	4.7 U	--	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	--	--	--	1 U	**2.7**	3.3 U	**1.9 J**	**2 J**	--	2.2 U	--	47
Butyl Benzyl Phthalate	mg/kg OC	--	--	--	0.1 U	0.38 U	0.33 U	**0.43**	**0.34**	--	0.22 U	--	4.9
Diethyl Phthalate	mg/kg OC	--	--	--	0.4 UJ	1.5 UJ	1 UJ	1 UJ	**1.6 J**	--	0.9 UJ	--	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	--	--	--	48 U	34 J	49 U	36 J	33 J	--	47 U	--	1,300
Butyl Benzyl Phthalate	µg/kg	--	--	--	4.8 U	4.8 U	4.9 U	8	5.6	--	4.7 U	--	63
Diethyl Phthalate	µg/kg	--	--	--	19 UJ	19 UJ	20 UJ	20 UJ	26 J	--	19 UJ	--	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	--	--	--	**61**	**9.9 J**	24 U	24 U	24 U	--	**20 J**	26.3 U	29
2-Methylphenol (o-Cresol)	µg/kg	--	--	--	**36**	19 U	**8.8 J**	20 U	19 U	--	**19 U**	19.9 U	63
4-Methylphenol (p-Cresol)	µg/kg	--	--	--	**1,300**	**250**	**230**	**240**	**120**	--	**130**	**241**	670
Phenol	µg/kg	--	--	--	**290**	**93**	**130 J**	**68 J**	**81**	--	**90**	**104**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	--	--	--	7.8	**13**	**17**	**12**	**23**	6.8	**10**	--	15
Hexachlorobutadiene	mg/kg OC	--	--	--	0.1 U	0.38 U	0.33 U	0.26 U	0.28 U	0.09 U	0.22 U	--	3.9

Sample Location[1]		MAF-29	MAF-30		MAF-31	MAF-32	MAF-33		MAF-34	MAF-35	MAF-36	MAF-37	Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-29_0-10	MAF-SS-30_0-10	MAF-SS-DUP-03	MAF-SS-31_0-10	MAF-SS-32_0-10	MAF-SS-33_0-10	MAF-SS-DUP-06	MAF-SS-34_0-10	MAF-SS-35_0-10	MAF-SS-36_0-10	MAF-SS-37_0-10	
Sample Date		10/21/15	10/21/15	10/21/15	10/19/15	10/19/15	10/19/15	10/19/15	10/20/15	10/19/15	10/19/15	09/13/2016	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	
Sample Type		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	--	--	--	**370**	160	250	220	380	**384**	220	--	540
Hexachlorobutadiene	µg/kg	--	--	--	4.8 U	4.8 U	4.9 U	4.9 U	4.7 U	4.9 U	4.7 U	--	11
Benzoic Acid	µg/kg	--	--	--	**730**	**120 J**	**210**	**150 J**	190 U	**502**	**75 J**	--	650
Benzyl Alcohol	µg/kg	--	--	--	**31**	**17 J**	**18 J**	**15 J**	19 U	**53.4**	**14 J**	--	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	--	--	--	--	**0.29 J**	--	**0.35 J**	**13 J**	2.26 J	**0.32 J**	--	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	--	--	--	--	3.65 J	--	6.64 J	216 J	**123 J**	6.68 J	--	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	Pass	--	--	--	--	Pass	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	Pass	--	--	--	--	Pass	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	Pass	--	--	--	--	Pass	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-38		MAF-56				MAF-57			MAF-58		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-38_0-10	MAF-DUP-07	MAF-SS-56_0-10	MAF-SC-56_0-2	MAF-SC-DUP-07	MAF-SC-56_2-4	MAF-SS-57_0-10	MAF-SC-57_0-2	MAF-SC-57_2-4	MAF-SS-58_0-10	MAF-SC-58_2-4	
Sample Date		09/13/2016	09/13/2016	11/13/18	11/12/18	11/12/18	11/12/18	11/14/18	11/13/18	11/13/18	11/14/18	11/13/18	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-2 ft	0-2 ft	2-4 ft	0-10 cm	0-2 ft	2-4 ft	0-10 cm	2-4 ft	
Sample Type		Surface	Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Field Screening													
Visual Wood Content[3]	%	<1	<1	<1	<5	<5	<1	<1	15	<1	5	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	2.68	1.60	0.570	0.560	0.490 J	0.0700	1.78	1.75	0.300	4.94	0.900	NE
Metals													
Arsenic	mg/kg	--	--	3.52	4.63	4.72	4.4	5.77	5.18	3.89	9.6	5.67	57
Copper	mg/kg	--	--	10.1	10.1	10.5 J	6.62	32	17.4	9.74	42.5	17.8 J	390
Mercury	mg/kg	--	--	0.0261 J	0.0321	0.0745	0.00636 J	0.0551	0.0270 J	0.0107 J	0.105	0.0676	0.41
Zinc	mg/kg	--	--	30.2	30	32.6	26	58.4	45	28.6	85.2	36.7	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	--	--	55.6	48	54.1 J	4.13 J	56.7 J	37.1	18.4 J	43.1	50.6 J	370
2-Methylnaphthalene	mg/kg OC	--	--	5.25	3.46	3.29	7.14 U	6.12	3.43	1.42 J	4.13	3.62	38
Acenaphthene	mg/kg OC	--	--	6.05	3.73	3.43	7.14 U	9.1	4.8	2.16	5.95	3.87	16
Acenaphthylene	mg/kg OC	--	--	2.32	2.36	3.06	7.14 U	2.37 J	1.16	0.717 J	1.16	2.84	66
Anthracene	mg/kg OC	--	--	5.68	3.61	4.37	7.14 U	7.75	3.53	2.06	4.31	4.09	220
Fluorene	mg/kg OC	--	--	5.61	4.09	4.39	7.14 U	7.81	4.55	2.19	6.01	4.12	23
Naphthalene	mg/kg OC	--	--	18.9	20	22.2	4.13 J	12.2	13.5	5.47	10.6	20.1	99
Phenanthrene	mg/kg OC	--	--	16.9	14.8	16.6 J	3.79 U	17.5	9.49	5.83	15	16 J	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	--	--	317.0	270	265 J	2.89 J	1,010 J	649	55.3 J	2,130	455 J	5,200
2-Methylnaphthalene	µg/kg	--	--	29.9	19.4	16.1	5.00 U	109	60.1	4.27 J	204	32.6	670
Acenaphthene	µg/kg	--	--	34.5	20.9	16.8	5.00 U	162	84	6.49	294	34.8	500
Acenaphthylene	µg/kg	--	--	13.2	13.2	15	5.00 U	42.2 J	20.3	2.15 J	57.2	25.6	1,300
Anthracene	µg/kg	--	--	32.4	20.2	21.4	5.00 U	138	61.8	6.17	213	36.8	960
Fluorene	µg/kg	--	--	32	22.9	21.5	5.00 U	139	79.7	6.57	297	37.1	540
Naphthalene	µg/kg	--	--	108	110	109	2.89 J	218	237	16.4	523	181	2,100
Phenanthrene	µg/kg	--	--	96.5	82.7	81.3 J	2.65 U	311	166	17.5	742	140 J	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	--	--	59.1	43.9	44.5 J	3.38 J	111 J	33.7	21.2 J	50.8	50.1	960
Benzo(a)anthracene	mg/kg OC	2.58	9.50	3.75	2.8	2.73	1.79 J	8.54	2.3	1.51 J	3.79	3.11	110
Benzo(a)pyrene	mg/kg OC	2.21	7.44	2.54	2.16	2.27	1.83 U	5.15	2.31	1.05 U	2.87	2.88	99
Benzofluoranthenes[6] (Total)	mg/kg OC	4.70	17.0	5.63	4.5	5	14.3 U	13.1	5.39	3.3 J	6.8	5.83	230
Benzo(g,h,i)perylene	mg/kg OC	--	--	1.74	1.7	1.89	7.14 U	2.45 J	1.31	0.907 U	1.78	2.48	31
Chrysene	mg/kg OC	3.73	14.19	3.98	3.23	3.02	7.14 U	10.8	2.86	1.79	5.04	3.93	110
Dibenzo(a,h)anthracene	mg/kg OC	0.29	1.15	1.47 U	1.44 U	1.51 U	9.44 U	4.33	1.42 U	2.23 U	1.08	2.46	12
Fluoranthene	mg/kg OC	--	--	21.4	14.4	15 J	4.93 U	25.2	7.66	6.03	14	14	160

Sample Location[1]		MAF-38		MAF-56				MAF-57			MAF-58		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-38_0-10	MAF-DUP-07	MAF-SS-56_0-10	MAF-SC-56_0-2	MAF-SC-DUP-07	MAF-SC-56_2-4	MAF-SS-57_0-10	MAF-SC-57_0-2	MAF-SC-57_2-4	MAF-SS-58_0-10	MAF-SC-58_2-4	
Sample Date		09/13/2016	09/13/2016	11/13/18	11/12/18	11/12/18	11/12/18	11/14/18	11/13/18	11/13/18	11/14/18	11/13/18	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-2 ft	0-2 ft	2-4 ft	0-10 cm	0-2 ft	2-4 ft	0-10 cm	2-4 ft	
Sample Type		Surface	Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	**1.13**	**3.41**	**1.44**	**1.39**	1.21	1.59 j	**2.81**	**1.12**	0.743 J	1.63	**2.01**	34
Pyrene	mg/kg OC	--	--	**18.6**	**13.7**	13.4 J	4.84 U	**38.5**	**10.7**	7.8	13.9	**13.4**	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	--	--	337	255	**218 J**	**2.36 J**	1,974 J	590	**63.5 J**	**2,510**	451 J	12,000
Benzo(a)anthracene	µg/kg	69.1	152	21.4	15.7	**13.4**	**1.25 J**	152	40.2	**4.53 J**	**187**	28	1,300
Benzo(a)pyrene	µg/kg	59.3	119	14.5	12.1	**11.1**	1.28 U	91.7	40.5	3.16 U	**142**	25.9	1,600
Benzofluoranthenes[6] (Total)	µg/kg	126	272	32.1	25.2	**24.5**	10.0 U	234	94.4	**9.89 J**	**336**	52.5	3,200
Benzo(g,h,i)perylene	µg/kg	--	--	9.93	9.54	**9.26**	5.00 U	43.6 J	23	2.72 U	**87.7**	22.3	670
Chrysene	µg/kg	100	227	22.7	18.1	**14.8**	5.00 U	192	50	**5.36**	**249**	35.4	1,400
Dibenzo(a,h)anthracene	µg/kg	7.64	18.4	8.38 U	8.06 U	7.38 U	6.61 U	77	24.8 U	6.70 U	**53.2**	22.1	230
Fluoranthene	µg/kg	--	--	122	80.9	**73.3 J**	3.45 U	448	134	**18.1**	**690**	126 J	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	30.2	54.5	8.23	7.81	**5.93**	**1.11 J**	50.1	19.6	**2.23 J**	**80.7**	18.1	600
Pyrene	µg/kg	--	--	106	76.5	**65.7 J**	3.39 U	686	188	**23.4**	**688**	121 J	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	--	--	3.46 U	3.55 U	4.02 U	28.4 U	1.09 U	1.10 U	6.60 U	0.391 U	2.14 U	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	--	--	3.46 U	3.55 U	4.02 U	28.4 U	1.09 U	1.10 U	6.60 U	0.391 U	2.14 U	2.3
Hexachlorobenzene	mg/kg OC	--	--	0.860 U	0.890 U	1.00 U	7.10 U	0.280 U	0.270 U	1.70 U	0.0970 U	0.530 U	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	--	--	19.7 UJ	19.9 U	19.7 UJ	19.9 U	19.4 U	19.3 U	19.8 U	19.3 U	19.3 U	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	--	--	19.7 UJ	19.9 U	19.7 UJ	19.9 U	19.4 UJ	19.3 U	19.8 U	19.3 U	19.3 U	35
Hexachlorobenzene	µg/kg	--	--	4.9 U	5.0 U	4.9 U	5.0 U	4.9 U	4.8 U	5.0 U	4.8 U	4.8 U	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	--	--	**5.00**	8.91 U	10.1 U	71.3 U	2.73 U	2.75 U	16.5 U	1.08	5.37 U	47
Butyl Benzyl Phthalate	mg/kg OC	--	--	3.46 U	3.55 U	4.02 U	28.4 U	1.09 U	1.10 U	6.60 U	0.391 U	2.14 U	4.9
Diethyl Phthalate	mg/kg OC	--	--	3.46 U	**5.39**	4.02 U	26.4	1.09 U	**2.74**	6.60 U	0.391 U	2.14 U	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	--	--	28.5 J	49.9 U	49.3 U	49.9 U	48.6 U	48.2 U	49.6 U	**53.4**	48.3 U	1,300
Butyl Benzyl Phthalate	µg/kg	--	--	19.7 U	19.9 U	19.7 U	19.9 U	19.4 U	19.3 U	19.8 U	19.3 U	19.3 U	63
Diethyl Phthalate	µg/kg	--	--	19.7 U	30.2	19.7 U	18.5 J	19.4 U	48	19.8 U	19.3 U	19.3 U	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	**13.8 J**	25.7 U	24.6 U	24.9 U	24.7 U	24.9 U	24.3 U	24.1 U	24.8 U	**7.6 J**	**2.8 J**	29
2-Methylphenol (o-Cresol)	µg/kg	19.5 U	19.6 U	19.7 UJ	19.9 U	19.7 UJ	19.9 U	19.4 UJ	19.3 U	19.8 U	19.3 U	19.3 U	63
4-Methylphenol (p-Cresol)	µg/kg	**351**	**172**	19.7 UJ	**18.3 J**	19.7 UJ	19.9 U	130 J	**98**	19.8 U	**132**	**43**	670
Phenol	µg/kg	**127**	**38.8**	**19.8 J**	**16.3 J**	**11.2 UJ**	**12.8 J**	**58.6 J**	**21.1**	19.8 U	**146 J**	**12.5 J**	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	--	--	**6.2**	**4.3**	4.71	28.4 U	**8.3**	**3.4**	3.3	2.29	**4.7**	15
Hexachlorobutadiene	mg/kg OC	--	--	3.46 U	3.55 U	4.02 U	28.4 U	1.09 U	1.10 U	6.60 U	0.391 U	2.14 U	3.9

Sample Location[1]		MAF-38		MAF-56				MAF-57			MAF-58		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-38_0-10	MAF-DUP-07	MAF-SS-56_0-10	MAF-SC-56_0-2	MAF-SC-DUP-07	MAF-SC-56_2-4	MAF-SS-57_0-10	MAF-SC-57_0-2	MAF-SC-57_2-4	MAF-SS-58_0-10	MAF-SC-58_2-4	
Sample Date		09/13/2016	09/13/2016	11/13/18	11/12/18	11/12/18	11/12/18	11/14/18	11/13/18	11/13/18	11/14/18	11/13/18	
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-2 ft	0-2 ft	2-4 ft	0-10 cm	0-2 ft	2-4 ft	0-10 cm	2-4 ft	
Sample Type		Surface	Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Native Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	µg/kg	--	--	**35.4**	**23.9**	**23.1**	19.9 U	**148**	**59.9**	**9.9 J**	**113**	**42.2**	540
Hexachlorobutadiene	µg/kg	--	--	19.7 UJ	19.9 U	19.7 UJ	19.9 U	19.4 U	19.3 U	19.8 U	19.3 U	19.3 U	11
Benzoic Acid	µg/kg	--	--	**32.3 J**	**23.3 J**	**19.3 J**	**14.3 J**	**76.8 J**	**19.7 J**	99.2 U	**64.3 J**	**22.5 J**	650
Benzyl Alcohol	µg/kg	--	--	19.7 UJ	19.9 U	19.7 UJ	19.9 U	19.4 UJ	19.3 U	19.8 U	19.3 U	19.3 U	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	--	--	**0.29 J**	**0.30 J**	**1.35 J**	**19.4 J**	**0.029 J**	**0.030 J**	**1.06 J**	**0.0037 J**	**0.063 J**	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	µg/kg	--	--	**8.12 J**	**1.63 J**	**6.64 J**	**0.25 J**	**3.18 J**	**9.34 J**	**1.03 J**	**14.2 J**	**0.57 J**	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed

µg/kg = microgram per kilogram

µg/L = microgram per liter

cm = centimeter

dbm = depth below mudline

ft = feet

mg/L = milligram per liter

mg-N/kg = milligrams of nitrogen per kilogram

mg-N/L = milligrams of nitrogen per liter

n/a = not applicable

NE = not established

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

mg/kg = milligram per kilogram

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

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the PCUL.

Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.

Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-59				MAF-60			EDP62		EDP63		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-59_0-10	MAF-SC-59_2-4	MAF-SC-59_6-8	MAF-SC-59_10-12	MAF-SS-60_0-10	MAF-SC-60_4-6	MAF-SC-60_8-10	EDP62_0.0-1.0	EDP62_2.0-3.0	EDP63_0.0-1.0	EDP63_2.0-3.0	
Sample Date		11/14/18	11/12/18	11/12/18	11/12/18	11/14/18	11/12/18	11/12/18	04/27/21	04/27/21	04/27/21	04/27/21	
Sample Interval (dbm)		0-10 cm	2-4 ft	6-8 ft	10-12 ft	0-10 cm	4-6 ft	8-10 ft	0-1 ft	2-3 ft	0-1 ft	2-3 ft	
Sample Type		Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Intertidal	Intertidal	Intertidal	
Field Screening													
Visual Wood Content[3]	%	**20**	<5	<1	<1	<1	**10**	<1	<1	<1	<1	<1	15
Conventionals													
Total Organic Carbon (TOC)	Percent	**2.83**	**3.71**	**1.33**	--	**1.48**	**1.33**	**0.210**	--	--	--	--	NE
Metals													
Arsenic	mg/kg	**9.15**	**7.06**	**4.9**	**2.92**	**5.89**	**3.5**	**3.24**	**1.51 J**	**2.53 J**	**2.95 J**	**3.50 J**	57
Copper	mg/kg	**41.1**	**39.2**	**24.7**	**7.33**	**30.5**	**20**	**5.62**	**11.8**	**11**	**11.8**	**12.6**	390
Mercury	mg/kg	**0.119**	**0.223**	**38.5**	**0.00839 J**	**0.0808**	**0.0485**	**0.0156 J**	**0.00586 J**	**0.00782 J**	**0.0403**	**0.0337**	0.41
Zinc	mg/kg	**80.1**	**65.4**	**50.5**	**25.2**	**62.4**	**59.9**	**20.3**	**34.9**	**41.5**	**37.6**	**39.1**	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)													
Sum of LPAHs[4]	mg/kg OC	**59**	79.8	**127.8 J**	--	**170**	**177**	20.9 J	--	--	--	--	370
2-Methylnaphthalene	mg/kg OC	**5.62**	8.81	**10 J**	--	**18.6**	**16.7**	2.48	--	--	--	--	38
Acenaphthene	mg/kg OC	**6.75**	8.38	**11.1 J**	--	**26.2**	**28**	3.27	--	--	--	--	16
Acenaphthylene	mg/kg OC	**2.2**	2.35	**7.01 J**	--	**6.06**	**4.41**	2.24 U	--	--	--	--	66
Anthracene	mg/kg OC	**6.18**	5.7	**7.5 J**	--	**23.9**	**24.6**	1.58 J	--	--	--	--	220
Fluorene	mg/kg OC	**6.22**	9.68	**12.3 J**	--	**23.1**	**22.3**	2.88	--	--	--	--	23
Naphthalene	mg/kg OC	**21.2**	32.6	**55.3 J**	--	**44.8**	**38.7**	7.67	--	--	--	--	99
Phenanthrene	mg/kg OC	**16.3**	21.1	**34.5 J**	--	**46.6**	**58.7**	5.48	--	--	--	--	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)													
Sum of LPAHs[4]	µg/kg	1,670	**2,960**	1,700.2 J	--	2,520	2,350	**43.8 J**	--	--	--	--	5,200
2-Methylnaphthalene	µg/kg	159	**327**	133 J	--	275	222	**5.21**	--	--	--	--	670
Acenaphthene	µg/kg	191	**311**	148 J	--	388	373	**6.87**	--	--	--	--	500
Acenaphthylene	µg/kg	62.3	**87.3**	93.2 J	--	89.7	58.6	4.70 U	--	--	--	--	1,300
Anthracene	µg/kg	175	**210**	100 J	--	353	327	**3.32 J**	--	--	--	--	960
Fluorene	µg/kg	176	**359**	164 J	--	342	296	**6.04**	--	--	--	--	540
Naphthalene	µg/kg	601	**1,210**	736 J	--	663	515	**16.1**	--	--	--	--	2,100
Phenanthrene	µg/kg	461	**781**	459 J	--	689	781	**11.5**	--	--	--	--	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)													
Sum of HPAHs[5]	mg/kg OC	**75.6**	89	**67.7 J**	--	**259**	**281**	15.8 J	--	--	--	--	960
Benzo(a)anthracene	mg/kg OC	**5.69**	7.74	**3.7**	--	**20.7**	**22**	1.18 J	--	--	--	--	110
Benzo(a)pyrene	mg/kg OC	**4.1**	6.55	**2.5**	--	**11**	**14.7**	0.795 U	--	--	--	--	99
Benzofluoranthenes[6] (Total)	mg/kg OC	**10.8**	11.7	**5.4**	--	**29.6**	**39.2**	1.94 J	--	--	--	--	230
Benzo(g,h,i)perylene	mg/kg OC	**2.56**	5.23	**2.4**	--	**5.11**	**5.48**	2.24 U	--	--	--	--	31
Chrysene	mg/kg OC	**9.68**	7.76	**4.7**	--	**27.8**	**33.5**	1.61 J	--	--	--	--	110
Dibenzo(a,h)anthracene	mg/kg OC	**1.88**	2.36	**1.6 J**	--	**4.04**	**2.77**	2.24 U	--	--	--	--	12
Fluoranthene	mg/kg OC	**20**	22	**24.5**	--	**68.2**	**93.2**	4.95	--	--	--	--	160

Sample Location[1]		MAF-59				MAF-60			EDP62		EDP63		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-59_0-10	MAF-SC-59_2-4	MAF-SC-59_6-8	MAF-SC-59_10-12	MAF-SS-60_0-10	MAF-SC-60_4-6	MAF-SC-60_8-10	EDP62_0.0-1.0	EDP62_2.0-3.0	EDP63_0.0-1.0	EDP63_2.0-3.0	
Sample Date		11/14/18	11/12/18	11/12/18	11/12/18	11/14/18	11/12/18	11/12/18	04/27/21	04/27/21	04/27/21	04/27/21	
Sample Interval (dbm)		0-10 cm	2-4 ft	6-8 ft	10-12 ft	0-10 cm	4-6 ft	8-10 ft	0-1 ft	2-3 ft	0-1 ft	2-3 ft	
Sample Type		Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Intertidal	Intertidal	Intertidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	2.3	3.8	1.4	--	4.69	5.59	0.505 J	--	--	--	--	34
Pyrene	mg/kg OC	18.7	21.4	21.7	--	88	65	5.62	--	--	--	--	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)													
Sum of HPAHs[5]	µg/kg	2,140	3,300	900.7 J	--	3,840	3,740	33.2 J	--	--	--	--	12,000
Benzo(a)anthracene	µg/kg	161	287	49.5	--	306	292	2.48 J	--	--	--	--	1,300
Benzo(a)pyrene	µg/kg	116	243	32.9	--	170	195	1.67 U	--	--	--	--	1,600
Benzofluoranthenes[6] (Total)	µg/kg	307	435	71.2	--	438	522	4.08 J	--	--	--	--	3,200
Benzo(g,h,i)perylene	µg/kg	72.5	194	31.8	--	75.7	72.9	4.70 U	--	--	--	--	670
Chrysene	µg/kg	274	288	61.9	--	412	445	3.39 J	--	--	--	--	1,400
Dibenzo(a,h)anthracene	µg/kg	53.2	87.6	21.2 J	--	59.8	36.9	4.70 U	--	--	--	--	230
Fluoranthene	µg/kg	566	830	326	--	1,010	1,240	10.4	--	--	--	--	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	65.1	141	18.2	--	69.4	74.3	1.06 J	--	--	--	--	600
Pyrene	µg/kg	529	794	288	--	1,300	860	11.8	--	--	--	--	2,600
Chlorinated Hydrocarbons (OC Normalized)													
1,2,4-Trichlorobenzene	mg/kg OC	0.686 U	0.523 U	0.40 U	--	1.30 U	1.48 U	9.05 U	--	--	--	--	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	0.686 U	0.523 U	0.30 U	--	1.30 U	1.48 U	9.05 U	--	--	--	--	2.3
Hexachlorobenzene	mg/kg OC	0.170 U	0.130 U	0.10 U	--	0.320 U	0.370 U	2.20 U	--	--	--	--	0.38
Chlorinated Hydrocarbons (Dry Weight)													
1,2,4-Trichlorobenzene	µg/kg	19.4 U	19.4 U	19.4 U	--	19.3 U	19.7 U	19.0 U	--	--	--	--	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	19.4 U	19.4 U	19.4 U	--	19.3 U	19.7 U	19.0 U	--	--	--	--	35
Hexachlorobenzene	µg/kg	4.9 U	4.9 U	4.9 U	--	4.8 U	4.9 U	4.7 U	--	--	--	--	22
Phthalates (OC Normalized)													
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	3.82	0.803	2.10 U	--	10.0	5.29	22.6 U	--	--	--	--	47
Butyl Benzyl Phthalate	mg/kg OC	0.686 U	0.523 U	0.60 U	--	1.30 U	1.48 U	9.05 U	--	--	--	--	4.9
Diethyl Phthalate	mg/kg OC	0.686 U	0.523 U	2.40	--	1.30 U	1.48 U	9.05 U	--	--	--	--	61
Phthalates (Dry Weight)													
Bis(2-Ethylhexyl) Phthalate	µg/kg	108	29.8 J	27.6 U	--	200	70.4	47.4 U	--	--	--	--	1,300
Butyl Benzyl Phthalate	µg/kg	19.4 U	19.4 U	19.4 U	--	19.3 U	19.7 U	19.0 U	--	--	--	--	63
Diethyl Phthalate	µg/kg	19.4 U	19.4 U	31.9	--	19.3 U	19.7 U	19.0 U	--	--	--	--	200
Phenols (Dry Weight)													
2,4-Dimethylphenol	µg/kg	10.0 J	44	11.9 J	--	5.4 J	7.2 J	23.7 U	--	--	--	--	29
2-Methylphenol (o-Cresol)	µg/kg	19.4 U	56.3	12 J	--	19.3 U	19.7 U	19.0 U	--	--	--	--	63
4-Methylphenol (p-Cresol)	µg/kg	141	1,170	270	--	146	55.3	19.0 U	--	--	--	--	670
Phenol	µg/kg	82.4 J	60.1	27.9	--	46.6 J	33.1	19.0 U	--	--	--	--	420
Miscellaneous Extractables (OC Normalized)													
Dibenzofuran	mg/kg OC	8.6	10.9	11.6	--	18.5	21	4.76	--	--	--	--	15
Hexachlorobutadiene	mg/kg OC	0.2 U	0.1 U	0.4 U	--	1.30 U	1.48 U	9.05 U	--	--	--	--	3.9

Sample Location[1]		MAF-59				MAF-60			EDP62		EDP63		Proposed Sediment Cleanup Level[2]
Sample Identification		MAF-SS-59_0-10	MAF-SC-59_2-4	MAF-SC-59_6-8	MAF-SC-59_10-12	MAF-SS-60_0-10	MAF-SC-60_4-6	MAF-SC-60_8-10	EDP62_0.0-1.0	EDP62_2.0-3.0	EDP63_0.0-1.0	EDP63_2.0-3.0	
Sample Date		11/14/18	11/12/18	11/12/18	11/12/18	11/14/18	11/12/18	11/12/18	04/27/21	04/27/21	04/27/21	04/27/21	
Sample Interval (dbm)		0-10 cm	2-4 ft	6-8 ft	10-12 ft	0-10 cm	4-6 ft	8-10 ft	0-1 ft	2-3 ft	0-1 ft	2-3 ft	
Sample Type		Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Intertidal	Intertidal	Intertidal	
Miscellaneous Extractables (Dry Weight)													
Dibenzofuran	μg/kg	244	**406**	154	--	274	279	**10.0 J**	--	--	--	--	540
Hexachlorobutadiene	μg/kg	19.4 U	19.4 U	19.4 U	--	19.3 U	19.7 U	19.0 U	--	--	--	--	11
Benzoic Acid	μg/kg	**70.4 J**	**121 J**	**59 J**	--	**65.5 J**	**55.0 J**	94.8 U	--	--	--	--	650
Benzyl Alcohol	μg/kg	19.4 U	19.4 U	19.4 U	--	19.3 U	19.7 U	19.0 U	--	--	--	--	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)													
Total PCBs (Aroclors or Congeners)	mg/kg OC	**0.36 J**	0.56 J	**0.052 J**	--	**0.47 J**	**1.05 J**	0.069 J	--	--	--	--	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)													
Total PCBs (Aroclors or Congeners)	μg/kg	10.3 J	20.9 J	**12.8 J**	--	7.02 J	13.9 J	**0.14 J**	--	--	--	--	130
Bioassay Tests[7]													
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	--	--	--	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
μg/kg = microgram per kilogram
μg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 6

Summary of Sediment Analytical Results for the Protection of Benthic Organisms

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		EDP64		EDP65		Proposed Sediment Cleanup Level[2]
Sample Identification		EDP64_0.0-1.0	EDP64_2.0-3.0	EDP65_0.0-1.0	EDP65_2.0-3.0	
Sample Date		04/27/21	04/27/21	04/27/21	04/27/21	
Sample Interval (dbm)		0-1 ft	2-3 ft	0-1 ft	2-3 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	
Field Screening						
Visual Wood Content[3]	%	<1	<1	<1	<1	15
Conventionals						
Total Organic Carbon (TOC)	Percent	--	--	--	--	NE
Metals						
Arsenic	mg/kg	**4.44 J**	**5.28 J**	**3.43 J**	**5.43 J**	57
Copper	mg/kg	**13.4**	**14.7**	**11.9**	**11.1**	390
Mercury	mg/kg	**0.00621 J**	**0.0164 J**	**0.00838 J**	**0.0105 J**	0.41
Zinc	mg/kg	**43.2**	**43.5**	**39.1**	**29.5**	410
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (OC Normalized)						
Sum of LPAHs[4]	mg/kg OC	--	--	--	--	370
2-Methylnaphthalene	mg/kg OC	--	--	--	--	38
Acenaphthene	mg/kg OC	--	--	--	--	16
Acenaphthylene	mg/kg OC	--	--	--	--	66
Anthracene	mg/kg OC	--	--	--	--	220
Fluorene	mg/kg OC	--	--	--	--	23
Naphthalene	mg/kg OC	--	--	--	--	99
Phenanthrene	mg/kg OC	--	--	--	--	100
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (Dry Weight)						
Sum of LPAHs[4]	µg/kg	--	--	--	--	5,200
2-Methylnaphthalene	µg/kg	--	--	--	--	670
Acenaphthene	µg/kg	--	--	--	--	500
Acenaphthylene	µg/kg	--	--	--	--	1,300
Anthracene	µg/kg	--	--	--	--	960
Fluorene	µg/kg	--	--	--	--	540
Naphthalene	µg/kg	--	--	--	--	2,100
Phenanthrene	µg/kg	--	--	--	--	1,500
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (OC Normalized)						
Sum of HPAHs[5]	mg/kg OC	--	--	--	--	960
Benzo(a)anthracene	mg/kg OC	--	--	--	--	110
Benzo(a)pyrene	mg/kg OC	--	--	--	--	99
Benzofluoranthenes[6] (Total)	mg/kg OC	--	--	--	--	230
Benzo(g,h,i)perylene	mg/kg OC	--	--	--	--	31
Chrysene	mg/kg OC	--	--	--	--	110
Dibenzo(a,h)anthracene	mg/kg OC	--	--	--	--	12
Fluoranthene	mg/kg OC	--	--	--	--	160

Sample Location[1]		EDP64		EDP65		Proposed Sediment Cleanup Level[2]
Sample Identification		EDP64_0.0-1.0	EDP64_2.0-3.0	EDP65_0.0-1.0	EDP65_2.0-3.0	
Sample Date		04/27/21	04/27/21	04/27/21	04/27/21	
Sample Interval (dbm)		0-1 ft	2-3 ft	0-1 ft	2-3 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	
Indeno(1,2,3-c,d)pyrene	mg/kg OC	--	--	--	--	34
Pyrene	mg/kg OC	--	--	--	--	1,000
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (Dry Weight)						
Sum of HPAHs[5]	µg/kg	--	--	--	--	12,000
Benzo(a)anthracene	µg/kg	--	--	--	--	1,300
Benzo(a)pyrene	µg/kg	--	--	--	--	1,600
Benzofluoranthenes[6] (Total)	µg/kg	--	--	--	--	3,200
Benzo(g,h,i)perylene	µg/kg	--	--	--	--	670
Chrysene	µg/kg	--	--	--	--	1,400
Dibenzo(a,h)anthracene	µg/kg	--	--	--	--	230
Fluoranthene	µg/kg	--	--	--	--	1,700
Indeno(1,2,3-c,d)pyrene	µg/kg	--	--	--	--	600
Pyrene	µg/kg	--	--	--	--	2,600
Chlorinated Hydrocarbons (OC Normalized)						
1,2,4-Trichlorobenzene	mg/kg OC	--	--	--	--	0.81
1,2-Dichlorobenzene (o-Dichlorobenzene)	mg/kg OC	--	--	--	--	2.3
Hexachlorobenzene	mg/kg OC	--	--	--	--	0.38
Chlorinated Hydrocarbons (Dry Weight)						
1,2,4-Trichlorobenzene	µg/kg	--	--	--	--	31
1,2-Dichlorobenzene (o-Dichlorobenzene)	µg/kg	--	--	--	--	35
Hexachlorobenzene	µg/kg	--	--	--	--	22
Phthalates (OC Normalized)						
Bis(2-Ethylhexyl) Phthalate	mg/kg OC	--	--	--	--	47
Butyl Benzyl Phthalate	mg/kg OC	--	--	--	--	4.9
Diethyl Phthalate	mg/kg OC	--	--	--	--	61
Phthalates (Dry Weight)						
Bis(2-Ethylhexyl) Phthalate	µg/kg	--	--	--	--	1,300
Butyl Benzyl Phthalate	µg/kg	--	--	--	--	63
Diethyl Phthalate	µg/kg	--	--	--	--	200
Phenols (Dry Weight)						
2,4-Dimethylphenol	µg/kg	--	--	--	--	29
2-Methylphenol (o-Cresol)	µg/kg	--	--	--	--	63
4-Methylphenol (p-Cresol)	µg/kg	--	--	--	--	670
Phenol	µg/kg	--	--	--	--	420
Miscellaneous Extractables (OC Normalized)						
Dibenzofuran	mg/kg OC	--	--	--	--	15
Hexachlorobutadiene	mg/kg OC	--	--	--	--	3.9

Sample Location[1]		EDP64		EDP65		Proposed Sediment Cleanup Level[2]
Sample Identification		EDP64_0.0-1.0	EDP64_2.0-3.0	EDP65_0.0-1.0	EDP65_2.0-3.0	
Sample Date		04/27/21	04/27/21	04/27/21	04/27/21	
Sample Interval (dbm)		0-1 ft	2-3 ft	0-1 ft	2-3 ft	
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	
Miscellaneous Extractables (Dry Weight)						
Dibenzofuran	µg/kg	--	--	--	--	540
Hexachlorobutadiene	µg/kg	--	--	--	--	11
Benzoic Acid	µg/kg	--	--	--	--	650
Benzyl Alcohol	µg/kg	--	--	--	--	57
Polychlorinated Biphenyls (PCBs) (OC Normalized)						
Total PCBs (Aroclors or Congeners)	mg/kg OC	--	--	--	--	12
Polychlorinated Biphenyls (PCBs) (Dry Weight)						
Total PCBs (Aroclors or Congeners)	µg/kg	--	--	--	--	130
Bioassay Tests[7]						
10-Day Amphipod Mortality Test (acute toxicity)	n/a	--	--	--	--	NE
20-Day Juvenile Infaunal Growth Test (chronic toxicity)	n/a	--	--	--	--	NE
Larval Development Test (acute toxicity)	n/a	--	--	--	--	NE

Notes:

[1] Sample locations shown in Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) area presented in Table 4. The organic carbon normalized screening levels are applicable to sediment with a total organic carbon (TOC) concentration ranging from 0.5 to 3.5 percent. Results for sediment samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the dry weight screening levels (EPA 1988).

[3] Visual wood content values of <1 indicate that wood debris was not identified in the sample.

[4] Total LPAH represents the sum of the detected concentrations of the following LPAH compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported. The result for 2-Methylnaphthalene is not included in the LPAH sum.

[5] Total HPAH represents the sum of the detected 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. When all compounds are undetected, only the single highest individual chemical quantitation limit is reported.

[6] Total benzofluoranthenes represents the sum of concentrations of the b, j, and k isomers.

[7] See Table H-3 through H-5 for a summary of bioassay test results.

[8] Sediment sample collected from the Z-Layer during the 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016) and is representative of current surface sediment conditions following completion of the 2016/2017 Interim Action.

[9] The polychlorinated phenols (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[10] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

-- = not analyzed
µg/kg = microgram per kilogram
µg/L = microgram per liter
cm = centimeter
dbm = depth below mudline
ft = feet
mg/L = milligram per liter
mg-N/kg = milligrams of nitrogen per kilogram
mg-N/L = milligrams of nitrogen per liter
n/a = not applicable
NE = not established
U = The analyte was not detected at a concentration greater than the value identified.
J = The analyte was detected and the detected concentration is considered an estimate.
mg/kg = milligram per kilogram
mg/kg OC = milligram per kilogram normalized to organic carbon
Bold font type indicates the analyte was detected at the reported concentration.
Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.
Blue shading indicates that the practical quantitation limit (PQL) or the organic carbon normalized value calculated from the PQL exceeds the preliminary cleanup level.
Grey text indicates that the shaded value is not compared to the preliminary cleanup level because the preliminary cleanup level is not appropriate based on the TOC concentration in the sample (see Note 2).

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		ST-02	ST-03		ST-5C	ST-08	ST-9C	ST-11	ST-14		ST-15C	ST-17C	Proposed Sediment Cleanup Level[2]	
Sample Identification		13116000038	13116000004	13116000006	13116000007	13116000029	13116000019	13116000010	13116000021	13116000023	13116000013	13116000037		
Sample Date		5/14/2007	5/7/2007	5/7/2007	5/7/2007	5/11/2007	5/8/2007	5/7/2007	5/8/2007	5/8/2007	5/7/2007	5/14/2007		
Sample Interval (dbm)		5 - 6 ft	3.5 - 6.2 ft	14 - 15.9 ft	0.9 - 2.5 ft	7.3 - 10.5 ft	10.1 - 12.0 ft	0 - 6.2 ft	3.4 - 4.6 ft	9.4 - 10.5 ft	0.8 - 2.2 ft	5.9 - 7.1 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	--	--	--	--	--	--	--	--	--	--	--	12	12
Cadmium	mg/kg	--	--	--	--	--	--	--	--	--	--	--	0.80	0.80
Lead	mg/kg	--	--	--	--	--	--	--	--	--	--	--	21	21
Mercury	mg/kg	--	--	--	--	--	--	--	--	--	--	--	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.87**	0.024 U	**0.77**	--	**0.037 J**	--	**8.6**	**0.014**	**0.051**	--	--	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.56**	0.024 U	**0.26**	--	0.028 U	--	**3.9**	**0.011**	**0.038**	--	--	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**1.17**	0.024 U	**0.65**	--	0.028 U	--	**8.8**	**0.04**	**0.089**	--	--	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.15 J**	0.024 U	**0.14**	--	0.028 U	--	**1.4**	0.0096 U	**0.021**	--	--	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**1.1**	0.024 U	**0.8**	--	**0.048 J**	--	**8.6**	**0.034**	**0.074**	--	--	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.062**	0.024 U	**0.043**	--	0.028 U	--	**0.39**	0.0096 U	0.0062 U	--	--	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.18**	0.024 U	**0.12**	--	0.028 U	--	**1.5**	0.0096 U	**0.022**	--	--	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.799**	0 U	**0.426**	--	**0.0042**	--	**5.915**	**0.0167**	**0.0549**	--	--	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.799**	0.018 U	**0.426**	--	**0.0238**	--	**5.915**	**0.0177**	**0.0553**	--	--	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	**17.9 J**	--	**35.2 J**	--	--	--	**36.1**	**120**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	**17.9 J**	--	**35.2 J**	--	--	--	**36.1**	**120**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

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[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

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-- = not analyzed

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Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		ST-20		ST-21	ST-24		ST-29	ST-30	ST-32	ST-34	ST-34	ST-37	Proposed Sediment Cleanup Level[2]	
Sample Identification		13116000014	13116000015	13116000027	13116000100	13116000101	13116000103	13116000102	13116000104	13116000105	13116000025	13116000106		
Sample Date		5/7/2007	5/7/2007	5/11/2007	5/15/2007	5/15/2007	5/15/2007	5/15/2007	5/15/2007	5/15/2007	5/9/2007	5/15/2007		
Sample Interval (dbm)		9.9 - 11.2 ft	14 - 15.5 ft	9.1 - 11.2 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2.8 ft	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Subsurface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	--	--	--	7 U	7 U	9 U	**10**	**10**	**10**	**40 J**	10 U	12	12
Cadmium	mg/kg	--	--	--	0.3 U	0.3 U	**0.7**	**0.7**	**0.8**	**0.8**	**1.5**	**0.6**	0.80	0.80
Lead	mg/kg	--	--	--	**9.0**	**9.0**	**21**	**16**	**17**	**19**	**55**	**13**	21	21
Mercury	mg/kg	--	--	--	**0.06 J**	0.05 U	**0.09 J**	**0.1 J**	**0.15 J**	**0.14 J**	--	**0.08 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.077**	**0.12 J**	**0.35**	**0.077**	**0.047 J**	**0.22 J**	**0.095**	**0.17 J**	**0.19 J**	**0.49**	**0.18 J**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.064**	**0.12 J**	**0.37**	**0.065**	**0.043**	**0.17 J**	**0.077**	**0.14**	**0.16**	**0.44**	**0.16**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.13**	**0.25**	**0.65**	**0.1**	**0.141**	**0.41**	**0.198**	**0.35**	**0.39**	**0.97**	**0.41**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.033**	**0.059**	**0.23**	**0.027**	0.02 U	**0.091**	**0.023**	**0.084**	**0.091**	**0.13 J**	**0.091**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.12**	**0.19 J**	**0.56**	**0.12**	**0.088**	**0.36 J**	**0.16 J**	**0.28 J**	**0.33 J**	**0.74**	**0.34 J**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.0098**	**0.015 J**	**0.041**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	**0.027**	0.02 U	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.037**	**0.057**	**0.2**	**0.027**	0.02 U	**0.078**	**0.031**	**0.079**	**0.074**	**0.13**	**0.081**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.091**	**0.166**	**0.500**	**0.091**	**0.059**	**0.244**	**0.111**	**0.203**	**0.229**	**0.609**	**0.231**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.091**	**0.166**	**0.500**	**0.092**	**0.061**	**0.245**	**0.112**	**0.204**	**0.230**	**0.609**	**0.232**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	--	--	--	0.016 U	**0.012**	**0.057**	0.033 U	0.017 U	**0.067**	**5.2**	**0.062**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	5.00	5.00

Notes:

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		ST-39	ST-39	ST-42	ST-43	SP-151	SP-151	A1-15	A1-15		A1-18	A1-18	Proposed Sediment Cleanup Level[2]	
Sample Identification		13116000107	13116000033	13116000108	13116000031	7234276	7234277	A1-15-S	A1-15-C1-3	A1-15-C3-5	A1-18-S	A1-18-C1-3		
Sample Date		5/15/2007	5/14/2007	5/15/2007	5/11/2007	06/12/2007	06/12/2007	8/1/2008	8/13/2008	8/13/2008	9/4/2008	8/14/2008		
Sample Interval (dbm)		0-10 cm	0 - 4 ft	0-10 cm	5.7 - 7.2 ft	0 - 30 cm	0 - 30 cm	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	1 - 3 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Surface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	9 U	**10**	6 U	--	**5.95**	**6.02**	7 U	6 U	7 U	8 U	**11**	12	12
Cadmium	mg/kg	**0.6**	**2.1**	0.2 U	--	**0.34**	**0.3**	**0.4**	0.2 U	0.3 U	**0.6**	**0.5**	0.80	0.80
Lead	mg/kg	**13**	**55**	**3.0**	--	**9.99**	**8.95**	**10**	2 U	3 U	**11**	**11**	21	21
Mercury	mg/kg	**0.11 J**	--	0.05 U	--	**0.05**	**0.079**	**0.1**	0.06 U	0.06 U	**0.09**	**0.12**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.14 J**	**0.18**	**0.03 J**	**11**	**0.077**	**0.085**	**0.053**	0.019 U	0.02 U	**0.039**	**0.035**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.12**	**0.15**	**0.022**	**1.9**	**0.067**	**0.099**	**0.053**	0.019 U	0.02 U	**0.027**	**0.041**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.28**	**0.43**	**0.062**	**4.7**	**0.084**	**0.106**	0.02 U	**0.117**	0.019 U	**0.053**	**0.072**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.071**	**0.031**	0.02 U	**0.36**	**0.044**	**0.078**	**0.027**	0.019 U	0.02 U	**0.027**	0.038 U	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.24 J**	**0.32**	**0.043 J**	**17**	**0.113**	**0.223**	**0.072**	0.019 U	0.02 U	**0.052**	**0.042**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.02 U	0.02 U	0.02 U	**0.17**	**0.0096**	**0.016**	0.02 U	0.019 U	0.02 U	**0.012 J**	0.02 U	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.03**	**0.031**	0.02 U	**0.48**	**0.044**	**0.082**	**0.023**	0.019 U	0.02 U	**0.021**	**0.034**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.167**	**0.217**	**0.029**	**3.705**	**0.093**	**0.135**	**0.073**	0 U	0 U	**0.042**	**0.056**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.168**	**0.218**	**0.032**	**3.705**	**0.093**	**0.135**	**0.074**	0.014 U	0.015 U	**0.042**	**0.057**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	0.016 U	**0.131**	0.016 U	--	0.0096 U	0.0099 U	0.02 U	0.02 U	0.02 U	**0.027**	0.02 U	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	**4.45 J**	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	**4.45 J**	--	5.00	5.00

Notes:

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Table 7

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Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		A1-18	A1-23	A1-24	A1-24		A1-31B	EW-12-05	EW-12-06	EW-12-07	PG-62	PT-3	Proposed Sediment Cleanup Level[2]	
Sample Identification		A1-18-C3-5	A1-23-S	A1-24-S	A1-24-C1-3	A1-24-C3-5	A1-31B-S	EPAX019F24	BNWS008DBPS28	NAVHP85EDS404XX	RB14-PG-62-S	PT-3-43.0-44.0		
Sample Date		8/14/2008	8/4/2008	9/4/2008	9/4/2008	8/14/2008	9/4/2008	06/19/2012	06/19/2012	06/19/2012	04/22/2014	1/13/2015		
Sample Interval (dbm)		3 - 5 ft	0-10 cm	0-10 cm	1 - 3 ft	3 - 5 ft	0-10 cm	0 - 17 cm	0 - 17 cm	0 - 17 cm	0-10 cm	0 - 1 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Surface	Surface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface[6]		
Stratigraphic Unit		Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**9.0**	9 U	**50**	**10**	**22**	6 U	**5.77**	**7.92**	**5.89**	**3.7**	**4.39 J**	12	12
Cadmium	mg/kg	**0.3**	**0.8**	**1.5**	**2.0**	**1.8**	0.3 U	**0.281**	**0.681**	**0.281**	**0.20**	**0.3**	0.80	0.80
Lead	mg/kg	**8.0**	**15**	**47**	**55**	**50**	**4.0**	**27**	**14.4**	**10.9**	--	**2.15 J**	21	21
Mercury	mg/kg	**0.09**	**0.08**	**0.1**	**0.3**	**0.28**	0.05 U	**0.0723**	**0.123**	**0.0875**	**0.040**	**0.0116 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.026**	**0.069**	**0.21**	**0.077**	**0.082**	0.019 U	**0.043**	**0.042**	**0.12**	**0.0181**	0.0048 U	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.033**	**0.059**	**0.18**	**0.088**	**0.097**	0.019 U	**0.039**	**0.034**	**0.096**	**0.0153**	0.0048 U	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.074**	**0.133**	**0.22**	**0.4**	**0.21**	0.019 U	**0.051**	**0.051**	**0.14**	**0.0165**	0.0048 U	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	0.026 U	**0.038**	**0.095**	0.032 U	0.041 U	0.019 U	**0.017 J**	**0.016 J**	**0.036 J**	--	0.0048 U	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.037**	**0.11**	**0.31**	**0.16**	**0.16**	0.019 U	**0.065**	**0.057**	**0.16**	**0.0241**	0.0048 U	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.019 U	**0.012 J**	**0.044**	**0.01 J**	0.019 U	0.019 U	0.034 UJ	0.036 UJ	**0.0098 J**	**0.00213**	0.0048 U	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.019 J**	**0.033**	**0.092**	**0.032**	**0.033**	0.019 U	**0.025**	**0.026**	**0.05**	**0.00933**	0.0048 U	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.043**	**0.085**	**0.258**	**0.123**	**0.132**	0 U	**0.054**	**0.049**	**0.135**	**0.0208**	0 U	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.044**	**0.085**	**0.258**	**0.123**	**0.133**	0.014 U	**0.055**	**0.050**	**0.135**	**0.0208**	0.003 U	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	0.02 U	0.02 U	**0.076**	**0.033**	**0.021**	0.019 U	**0.0047**	**0.015**	**0.019**	--	**0.00000158 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	0 U	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	0.07 U	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	**16.6 J**	**50.5 J**	--	**0.044 J**	**0.929 J**	**0.549 J**	**1.39 J**	**1.26 J**	**0.009 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	**16.6 J**	**50.5 J**	--	**0.18 J**	**1.43 J**	**1.28 J**	**2.06 J**	**1.52 J**	**0.093 J**	5.00	5.00

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Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		PT-5	PT-6	PT-8	PT-10	PT-11	PT-12	PT-13	PT-14	ST-101		ST-102	Proposed Sediment Cleanup Level[2]	
Sample Identification		PT-5-43.0-44.0	PT-6-43.0-44.0	PT-8-43.0-44.0	PT-10-36.0-37.0	PT-11-36.0-37.0	PT-12-30.0-31.0	PT-13-29.0-30.0	PT-14-29.0-30.0	ST-101S_0-10	ST-101C_13.2-14.2	ST-102S_0-10		
Sample Date		1/13/2015	1/13/2015	1/12/2015	1/14/2015	1/15/2015	1/15/2015	1/15/2015	1/15/2015	10/24/18	10/23/18	10/24/18		
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0-10 cm	13.2-14.2 ft	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface[6]	Subsurface[6]	Subsurface[6]	Subsurface[6]	Subsurface[6]	Subsurface[6]	Subsurface[6]	Subsurface[6]	Surface	Subsurface	Surface		
Stratigraphic Unit		Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Native Deposit	Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Native Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**4.64 J**	**5.16 J**	**6.0**	**6.08 J**	**3.92 J**	**9.0**	**7.0**	**3.95 J**	**3.22**	**4.14**	**2.63**	12	12
Cadmium	mg/kg	**0.3**	**0.3**	**0.220 J**	**0.4**	**0.211 J**	**1.1**	**0.2**	**0.165 J**	**0.16**	**0.12**	**0.05 J**	0.80	0.80
Lead	mg/kg	**1.55 J**	**2.20 J**	**2.04 J**	**10**	**1.48 J**	**26**	**1.25 J**	**1.12 J**	**5.98**	**1.79**	**6.06**	21	21
Mercury	mg/kg	**0.0107 J**	**0.0101 J**	**0.0079 J**	**0.08**	**0.0071 J**	**0.11**	**0.0072 J**	**0.0104 J**	**0.0195 J**	**0.0137 J**	**0.0158 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	0.0049 U	0.0047 U	0.0047 U	**0.059**	0.0047 U	**0.071**	0.0049 U	0.005 U	**0.0381**	0.00492 U	**0.0135**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	0.0049 U	0.0047 U	0.0047 U	**0.051**	0.0047 U	**0.049**	0.0049 U	0.005 U	**0.0420 J**	0.00492 UJ	**0.015**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	0.0049 U	0.0047 U	0.0047 U	**0.84**	0.0047 U	**0.098**	0.0049 U	0.005 U	**0.0974**	0.00984 U	**0.0295**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	0.0049 U	0.0047 U	0.0047 U	**0.038**	0.0047 U	**0.044**	0.0049 U	0.005 U	**0.0216**	0.00492 U	**0.0121**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	0.0049 U	0.0047 U	0.0047 U	**0.062**	0.0047 U	**0.098**	0.0049 U	0.005 U	**0.0448**	0.00492 U	**0.0216**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.0049 U	0.0047 U	0.0047 U	0.024 U	0.0047 U	0.024 U	0.0049 U	0.005 U	**0.0122 J**	0.00492 UJ	**0.00806**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	0.0049 U	0.0047 U	0.0047 U	**0.027**	0.0047 U	**0.025**	0.0049 U	0.005 U	**0.0231**	0.00492 U	**0.00986**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	0 U	0 U	0 U	**0.069**	0 U	**0.069**	0 U	0 U	**0.0595**	0 U	**0.0213**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	0.003 U	0.003 U	0.003 U	**0.070**	0.003 U	**0.071**	0.003 U	0.004 U	**0.0595**	0.00371 U	**0.0213**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**0.00000377 J**	**0.00000554 J**	**0.00000479 J**	**0.0000427 J**	**0.00000411 J**	**0.00024 J**	**0.00000371 J**	**0.00000136 J**	**0.00181 J**	**0.0000215 J**	**0.000753 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	0 U	0 U	0 U	0 U	0 U	**0.00045 J**	0 U	0 U	**0.0035 J**	0 U	**0.0013 J**	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	0.07 U	0.08 U	0.08 U	0.06 U	0.06 U	**0.048 J**	0.06 U	0.06 U	**0.040 J**	0.066 U	**0.035 J**	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	**0.019 J**	0 U	**0.17 J**	**0.23 J**	**0.018 J**	**6.8**	**0.027 J**	**0.004 J**	**4.44 J**	**0.0063 J**	**0.21 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	**0.176 J**	0.1 U	**0.51 J**	**0.63 J**	**0.085 J**	**7.14 J**	**0.102 J**	**0.124 J**	**4.44 J**	**0.295 J**	**0.59 J**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

[7] The polychlorinated biphenyl (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[8] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not analyzed

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeter

ft = feet

RL = Reporting limit

dbm = depth below mudline

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		ST-102			ST-103	ST-104				ST-105		ST-106	Proposed Sediment Cleanup Level[2]	
Sample Identification		ST-102C_6.3-7.3	ST-102C_7.3-8.3	ST-102C_9.3-10.3	ST-103S_0-10	ST-104S_0-10	ST-104C_7.3-8.3	ST-104C_8.3-9.3	ST-104C_10.3-11.3	ST-105S_0-10	ST-105C_11-12	ST-106S_0-10		
Sample Date		10/23/18	10/23/18	10/23/18	10/24/18	10/24/18	10/26/18	10/26/18	10/26/18	10/24/18	10/26/18	10/24/18		
Sample Interval (dbm)		6.3-7.3 ft	7.3-8.3 ft	9.3-10.3 ft	0-10 cm	0-10 cm	7.3-8.3 ft	8.3-9.3 ft	10.3-11.3 ft	0-10 cm	11-12 ft	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Surface/Recent	Native Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**5.33**	**5.44**	**4.86**	**3.08**	**3.15**	**2.56**	**2.99**	**3.98**	**3.81**	**3.57**	**3.51**	12	12
Cadmium	mg/kg	**0.42**	**0.31**	**0.13**	**0.08 J**	**0.05 J**	**0.10 J**	**0.2**	**0.21**	**0.19**	**0.05 J**	**0.11 J**	0.80	0.80
Lead	mg/kg	**29.7**	**10.8**	**5.83**	**7.28**	**8.84**	**21.3**	**64.8 J**	**52.8**	**9.65**	**1.87**	**9.05**	21	21
Mercury	mg/kg	**0.102**	**0.0706**	**0.0443**	**0.0250 J**	**0.0189 J**	**0.0725**	**0.0843 J**	**0.142**	**0.0559**	**0.0126 J**	**0.0205 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.0401**	**0.0388**	**0.0197**	**0.0206**	**0.063**	**0.00737**	**0.147**	**0.0389**	**0.0965**	0.00480 U	**0.0709**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.0285**	**0.0217**	**0.0117**	**0.0213**	**0.0347 J**	**0.00598 J**	**0.123 J**	**0.026**	**0.0763 J**	0.00480 UJ	**0.0777 J**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.0612**	**0.0601**	**0.0419**	**0.0388**	**0.12**	**0.0153**	**0.196**	**0.079**	**0.142**	0.00959 U	**0.135**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.0246**	**0.0191**	**0.0125**	**0.0156**	**0.0167**	**0.00495**	**0.0684**	**0.0259**	**0.0474**	0.00480 U	**0.0575**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.0559**	**0.064**	**0.0281**	**0.0215**	**0.114**	**0.00882**	**0.165**	**0.0627**	**0.121**	0.00480 U	**0.0807**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.00913**	**0.00748**	**0.00160 J**	**0.0101**	**0.0107 J**	**0.00710 J**	**0.0261 J**	**0.0132**	**0.0171 J**	0.00480 UJ	**0.0192 J**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.0194**	**0.00994**	**0.00777**	**0.0148**	**0.018**	**0.00440 J**	**0.0728**	**0.0142**	**0.0468**	0.00480 U	**0.0538**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.0420**	**0.0340**	**0.0191**	**0.0299**	**0.0570 J**	**0.00949 J**	**0.169 J**	**0.0416**	**0.108 J**	0 U	**0.106**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.0420**	**0.0340**	**0.0191**	**0.0299**	**0.0570 J**	**0.00949 J**	**0.169 J**	**0.0416**	**0.108 J**	0.00362 U	**0.106**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**0.0175 J**	**0.00459 J**	**0.000644 J**	**0.0014 J**	**0.00188**	**0.00707**	**0.0392 J**	**0.0278 J**	**0.00304 J**	**0.0000387 J**	**0.00178 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	**0.29 J**	**0.158 J**	**0.00142**	**0.07 J**	**0.0037 J**	**0.124 J**	**0.879**	**0.563**	**0.17 J**	**0.0001**	**0.0036 J**	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	**0.31 J**	**0.169 J**	**0.0759**	**0.074 J**	**0.05 J**	**0.137 J**	**0.907**	**0.584**	**0.18 J**	**0.063**	**0.034 J**	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	**11.39 J**	**9.84 J**	**3.19 J**	**1.75 J**	**1.12 J**	**1.97 J**	**32.7**	**5.86 J**	**2.61 J**	**0.0051 J**	**1.74 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	**11.39 J**	**9.84 J**	**3.29 J**	**2.06 J**	**1.26 J**	**2.03 J**	**32.7**	**5.86 J**	**2.73 J**	**0.32 J**	**1.92 J**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

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-- = not analyzed

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J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeter

ft = feet

RL = Reporting limit

dbm = depth below mudline

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		ST-106			ST-107			ST-108			ST-109		Proposed Sediment Cleanup Level[2]	
Sample Identification		ST-106C_3.1-4.1	ST-106C_4.1-5.1	ST-106C_6.1-7.1	ST-107S_0-10	ST-107C_4.2-5.2	ST-107C_9.3-10.3	ST-108S_0-10	ST-108C_6.6-7.6	ST-108C_8.6-9.6	ST-109S_0-10	ST-109C_8.3-9.3		
Sample Date		10/26/18	10/26/18	10/26/18	10/24/18	10/25/18	10/25/18	10/24/18	10/25/18	10/25/18	10/24/18	10/25/18		
Sample Interval (dbm)		3.1-4.1 ft	4.1-5.1 ft	6.1-7.1 ft	0-10 cm	4.2-5.2 ft	9.3-10.3 ft	0-10 cm	6.6-7.6 ft	8.6-9.6 ft	0-10 cm	8.3-9.3 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Subsurface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	3.1	3.19	3.62	5.15	3.59	3.20	15	8.26	2.8	15.2	8.10	12	12
Cadmium	mg/kg	0.16	0.18	0.24	0.43	0.16	0.10 J	0.74	1.74	0.05 J	1.14	0.570	0.80	0.80
Lead	mg/kg	14	17.9 J	14.7	9.75	4.38	1.99	21.9	94.7	3.84 J	22	67.3	21	21
Mercury	mg/kg	0.0331	0.0450 J	0.0563	0.0326 J	0.0261 J	0.0172 J	0.0293 J	0.176	0.0117 J	0.0399 J	0.295	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	0.0888	0.084	0.0989	0.176	0.00328 J	0.00496 U	0.529	0.222	0.0126	0.989	0.708	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	0.0967 J	0.0564 J	0.0672	0.127 J	0.00253 J	0.00496 UJ	0.314 J	0.0908 J	0.00531 J	0.642 J	0.196 J	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	0.168	0.127	0.209	0.29	0.00648 J	0.00993 U	0.810	0.207	0.0126	1.66	0.442	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	0.0574	0.0334	0.0418	0.0642	0.00494 U	0.00496 U	0.136	0.0484	0.00250 J	0.229	0.103	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	0.102	0.121	0.183	0.271	0.00565	0.00496 U	2.45	0.282	0.0131	1.69	0.892	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.0193 J	0.0152 J	0.0167	0.0230 J	0.00494 UJ	0.00496 UJ	0.0618 J	0.0199 J	0.00652 J	0.0896 J	0.0370 J	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	0.0589	0.0323	0.0389	0.0668	0.00494 U	0.00496 U	0.155	0.047	0.00247 J	0.272	0.0975	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	0.131 J	0.0835 J	0.105	0.185 J	0.00356 J	0 U	0.494 J	0.143 J	0.00886 J	0.971 J	0.333 J	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	0.131 J	0.0835 J	0.105	0.185 J	0.00406 J	0.00375 UJ	0.494 J	0.143 J	0.00886 J	0.971 J	0.333 J	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	0.005 J	0.00785 J	0.00714 J	0.00728 J	0.00163 J	0.0000374 J	0.0058 J	0.0484 J	0.00132 J	0.0742 J	0.000312 J	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	0.19 J	0.267 J	0.321 J	0.34 J	0.0041 J	0.0001 J	0.12 J	1.07	0.0038 J	0.95	0.0004 J	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	0.2 J	0.293 J	0.344 J	0.35 J	0.058 J	0.0345 J	0.13 J	1.09	0.0474 J	0.95	0.067 J	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	1.81 J	5.79 J	7.83 J	3.51 J	0.58 J	0.0091 J	10.7 J	187 J	1.39	25.4 J	5.15 J	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	1.9 J	5.79 J	7.83 J	3.51 J	0.84 J	0.339 J	10.7 J	187 J	1.65	25.5 J	5.17 J	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

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[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

[7] The polychlorinated biphenyl (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[8] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not analyzed

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeter

ft = feet

RL = Reporting limit

dbm = depth below mudline

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		ST-109	South DMMU Area			South DMMU Area				North DMMU Area	MAF-01		Proposed Sediment Cleanup Level[2]	
Sample Identification		ST-109C_11.3-12.3	DMMU-1A-Comp	DMMU-1B-Comp	DMMU-1C-Comp	DMMU-1D-Comp	DMMU-1E-Comp	DMMU-1F-Comp	DMMU-1 Keyway	DMMU-2D-Comp	MAF-SS-01_0-10	MAF-SS-DUP-01		
Sample Date		10/25/18	10/23/18	10/23/18	10/23/18	10/23/18	10/23/18	10/23/18	10/23/18	10/25/18	10/20/2015	10/20/2015		
Sample Interval (dbm)		11.3-12.3 ft	2 - 3.7 ft	3.7 - 5.7 ft	5.7 -7.7 ft	7.7 - 9.7 ft	9.7 - 11.7 ft	11.7 - 13.7 ft	6.8 - 10.8 ft	6.2 - 9.3 ft	0-10 cm	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Surface		
Stratigraphic Unit		Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**2.38**	**3.02**	**3.62**	**3.32**	**3.67**	**4.76**	**4.46**	**3.43**	**9.68**	**23**	**19**	12	12
Cadmium	mg/kg	**0.05 J**	**0.180**	**0.32**	**0.26**	**0.23**	**0.42**	**0.34**	**0.150**	**1.44**	**0.9**	**0.9**	0.80	0.80
Lead	mg/kg	**2.20 J**	**10.6**	**25.7**	**23**	**39.6**	**70.7 J**	**46.4**	**9.62 J**	**149**	**65**	**103**	21	21
Mercury	mg/kg	**0.00746 J**	**0.0393**	**0.0548**	**0.0749**	**0.0906**	**0.209 J**	**0.129**	**0.025 J**	**0.515**	**0.09**	**0.11**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.00115 J**	**0.0573**	**0.077**	**0.0617**	**0.0567**	**0.0513**	**0.0331**	**0.00993**	**0.753**	**0.16**	**0.1**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.00100 J**	**0.0353 J**	**0.0464 J**	**0.0457 J**	**0.0355 J**	**0.0370 J**	**0.0218**	**0.00448 J**	**0.192 J**	**0.12 J**	**0.059 J**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	0.00960 U	**0.0918**	**0.0971**	**0.0923**	**0.086**	**0.0827**	**0.0708**	**0.0132**	**0.525**	**0.26 J**	**0.14 J**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.00113 J**	**0.0198**	**0.028**	**0.0387**	**0.0287**	**0.0375**	**0.0207**	**0.00465 J**	**0.0876**	**0.072 J**	**0.034 J**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.00151 J**	**0.0782**	**0.0777**	**0.0798**	**0.0855**	**0.0700**	**0.0575**	**0.0101**	**0.900**	**0.2**	**0.14**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.00480 UJ	**0.0105 J**	**0.0125 J**	**0.0131 J**	**0.0123 J**	**0.0103 J**	**0.00694**	**0.0069**	**0.0214 J**	0.049 U	0.014 U	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	0.00480 U	**0.0186**	**0.0244**	**0.0314**	**0.0259**	**0.025**	**0.0128**	**0.00353 J**	**0.0765**	**0.056 J**	**0.027 J**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.00113 J**	**0.0539 J**	**0.0683 J**	**0.0664 J**	**0.0545 J**	**0.0582 J**	**0.0339**	**0.00794 J**	**0.339 J**	**0.17 J**	**0.087 J**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.00137 J**	**0.0539 J**	**0.0683 J**	**0.0664 J**	**0.0545 J**	**0.0582 J**	**0.0339**	**0.00794 J**	**0.339 J**	**0.172 J**	**0.088 J**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**0.000011 J**	**0.00509 J**	**0.0261 J**	**0.0197 J**	**0.0328 J**	**0.0336 J**	**0.0131 J**	**0.00452 J**	**0.0145**	**0.368**	--	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	0.000 U	**0.2 J**	**0.83**	**0.36 J**	**0.71**	**0.323 J**	**0.0187**	**0.0112 J**	**0.036**	**7.13**	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	0.0611 U	**0.21 J**	**0.84**	**0.37 J**	**0.72**	**0.343 J**	**0.143**	**0.0753 J**	**0.16**	**7.15**	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	**0.0068 J**	**3.91 J**	**10.9 J**	**11.3 J**	**13.5 J**	**23.1 J**	**7.6 J**	**36.3 J**	**29.4 J**	--	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	**0.254 J**	**3.91 J**	**19.9 J**	**11.3 J**	**13.5 J**	**23.1 J**	**7.6 J**	**36.4 J**	**29.4 J**	--	--	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

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[8] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not analyzed

U = The analyte was not detected at a concentration greater than the value identified.

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Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-01					MAF-02					MAF-03	Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SC-01_0-2	MAF-SC-DUP-01	MAF-SC-01_4-6	MAF-SC-01_20-22	MAF-SC-DUP-02	MAF-SS-02_0-10	MAF-SC-02_0-2	MAF-SC-02_4-6	MAF-SC-02_20-22	MAF-SC-DUP-10	MAF-SS-03_0-10		
Sample Date		11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	10/20/2015	11/10/2015	11/10/2015	11/10/2015	11/10/2015	10/20/2015		
Sample Interval (dbm)		0 - 2 ft	0 - 2 ft	4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	0 - 2 ft	4 - 6 ft	20 - 22 ft	20 - 22 ft	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**20 J**	**33 J**	**22.9 J**	**7.0**	**8.0**	**18**	**20**	**14.5 J**	**10**	**20**	**60**	12	12
Cadmium	mg/kg	**0.7 J**	**1.3 J**	**1.0**	**0.05 J**	**0.092 J**	**0.9**	**0.7**	**0.535 J**	0.6 U	0.7 U	**1.8**	0.80	0.80
Lead	mg/kg	**130**	**176**	**80**	**4.0**	**4.0**	**27**	**45**	**37**	**3.17 J**	**4.45 J**	**115**	21	21
Mercury	mg/kg	**0.21**	**0.23**	**0.23**	**0.0074 J**	**0.008 J**	**0.2**	**0.0396 J**	**0.22**	**0.0101 J**	**0.0055 J**	**0.22**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.33**	**0.25**	**0.055 J**	0.0048 U	0.0048 U	**0.1**	**0.028**	0.016 U	**0.03**	**0.037**	**1.2**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.19**	**0.16**	0.086 U	0.0048 U	0.0048 U	**0.085**	**0.018**	0.016 U	**0.018**	**0.018**	**0.42**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.32**	**0.35**	**0.059 J**	0.0048 U	0.0048 U	**0.2**	**0.045**	0.016 U	**0.034**	**0.033**	**0.91**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.076**	**0.086**	0.086 U	0.0048 U	0.0048 U	**0.052**	**0.013**	0.016 U	**0.01**	**0.01**	**0.19**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.32**	**0.34**	**0.08 J**	0.0048 U	0.0048 U	**0.14**	**0.048**	0.016 U	**0.043**	**0.046**	**1.1**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.027**	0.054 U	0.086 U	0.0048 U	0.0048 U	**0.012 J**	**0.0038 J**	0.016 U	0.0047 U	**0.0031 J**	**0.065**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.07**	**0.053 J**	0.086 U	0.0048 U	0.0048 U	**0.041**	**0.0083**	0.016 U	**0.0066**	**0.0077**	**0.17**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.268 J**	**0.229 J**	**0.012 J**	0 U	0 U	**0.122 J**	**0.027 J**	0 U	**0.026 J**	**0.027 J**	**0.666 J**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.268 J**	**0.231 J**	**0.064 J**	0.003 U	0.003 U	**0.122 J**	**0.027 J**	0.011 U	**0.026 J**	**0.027 J**	**0.666 J**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**1.63**	--	--	--	--	--	--	--	--	--	**0.278 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	**21.31**	--	--	--	--	--	--	--	--	--	**7.40**	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	**21.33**	--	--	--	--	--	--	--	--	--	**7.41**	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	--	--	**16.1 J**	--	--	--	--	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	--	--	**16.1 J**	--	--	--	--	--	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

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U = The analyte was not detected at a concentration greater than the value identified.

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Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-03					MAF-04						Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SC-03_0-2	MAF-SC-DUP-03	MAF-SC-03_4-6	MAF-SC-03_8-10	MAF-SC-03_21-23	MAF-SS-04_0-10	MAF-SC-04_0-2[7]	MAF-SC-DUP-05	MAF-SC-04_2-4[8]	MAF-SC-04_4-6	MAF-SC-04_8-10		
Sample Date		11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	10/20/2015	10/26/2015	10/26/2015	10/26/2015	10/26/2015	10/26/2015		
Sample Interval (dbm)		0 - 2 ft	0 - 2 ft	4 - 6 ft	8 - 10 ft	21 - 23 ft	0-10 cm	0 - 2 ft	0 - 2 ft	2 - 4 ft	4 - 6 ft	8 - 10 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**11.8 J**	**9 J**	**10.8 J**	**8.8 J**	**2.9**	**20**	20 U	20 U	20 U	20 U	**20**	12	12
Cadmium	mg/kg	**0.791 J**	**1.0**	**0.725 J**	**0.449 J**	**0.1**	**1.1**	**1.0**	1 U	1 U	0.9 U	**1.0**	0.80	0.80
Lead	mg/kg	**122**	**169**	**112**	**62**	**2.1**	**31**	**60 J**	**50 J**	**30 J**	**42 J**	**54 J**	21	21
Mercury	mg/kg	**0.3**	**0.4**	**0.25**	**0.15**	**0.0264**	**0.09**	**0.28 J**	**0.37 J**	**0.16 J**	**0.24 J**	**0.20 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.14 J**	0.34 U	**0.07**	**0.022 J**	--	**0.2**	0.02 U	0.019 U	0.019	**0.023**	**0.15**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	0.28 U	0.34 U	**0.034 J**	0.037 U	--	**0.18**	0.02 U	0.019 U	0.019	0.019 U	**0.043**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	0.28 U	0.34 U	**0.11**	0.037 U	--	**0.43**	0.02 U	0.019 U	0.019	**0.02**	**0.11**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	0.28 U	0.34 U	0.052 U	0.037 U	--	**0.089**	**0.011 J**	0.019 U	0.019	0.019 U	**0.027**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.2 J**	**0.22 J**	**0.1**	**0.031 J**	--	**0.3**	**0.011 J**	**0.012 J**	**0.021**	**0.043**	**0.21**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.28 U	0.34 U	0.052 U	0.037 U	--	0.049 U	**0.0050 J**	**0.0031 J**	**0.012**	**0.012 J**	**0.067 J**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	0.28 U	0.34 U	0.052 U	0.037 U	--	**0.077**	0.02 U	0.019 U	0.019	0.019 U	**0.019**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.016 J**	**0.002 J**	**0.053 J**	**0.003 J**	--	**0.254 J**	**0.001 J**	**0.0004 J**	**0.001 J**	**0.006 J**	**0.08 J**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.198 J**	**0.24 J**	**0.058 J**	**0.027 J**	--	**0.256 J**	**0.014 J**	**0.013 J**	**0.014 J**	**0.016 J**	**0.08 J**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**2.98 J**	**2.65 J**	--	--	**0.00707 J**	**0.111 J**	**0.0339 J**	--	**0.00632 J**	--	--	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	**31.46 J**	**21.32 J**	--	--	**0.01 J**	**1.19**	**1.09**	--	**0.018 J**	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	**31.61 J**	**21.38 J**	--	--	**0.068 J**	**1.20**	**1.10**	--	**0.101 J**	--	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	--	--	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

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[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

[7] The polychlorinated biphenyl (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[8] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not analyzed

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeter

ft = feet

RL = Reporting limit

dbm = depth below mudline

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-04	MAF-05				MAF-07	MAF-08		MAF-09	MAF-10		Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SC-04_16-18	MAF-SS-05_0-10	MAF-SC-05_0-2	MAF-SC-05_4-6	MAF-SC-05_12-14	MAF-SS-07_0-10	MAF-SS-08_0-10	MAF-SS-DUP-02	MAF-SS-09_0-10	MAF-SS-10_0-10	MAF-SC-10_0-2		
Sample Date		11/10/2015	10/20/2015	11/11/2015	11/11/2015	11/11/2015	10/19/2015	10/19/2015	10/19/2015	10/19/2015	10/20/2015	10/29/2015		
Sample Interval (dbm)		16 - 18 ft	0-10 cm	0 - 2 ft	4 - 6 ft	12 - 14 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0 - 2 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface		
Stratigraphic Unit		Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Native Deposit	Native Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	--	16	20	14.4 J	--	10	8.0	8.0	11	20	20	12	12
Cadmium	mg/kg	--	0.6	1.2	0.9	--	0.256 J	0.044 U	0.047 U	0.114 U	0.9	1.4 J	0.80	0.80
Lead	mg/kg	--	28	34	21	--	5.0	2 J	6 J	6.0	19	68	21	21
Mercury	mg/kg	--	0.06	0.12	0.0752 J	--	0.05	0.03 U	0.03 U	0.05	0.11	0.16	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	0.00464 U	0.21	0.25	0.15	--	0.047	0.0047 U	0.0048 U	0.075	0.21	0.3	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	0.00464 U	0.13	0.23	0.075	--	0.028	0.0047 U	0.0048 U	0.06	0.15	0.22 J	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	0.00929 U	0.4	0.42	0.23	--	0.066	0.0047 U	0.0048 U	0.14	0.36	0.47	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	0.00464 U	0.084	0.12	0.055	--	0.015	0.0047 U	0.0048 U	0.032	0.082	0.12 J	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	0.00464 U	0.32	0.43	0.21	--	0.061	0.0047 U	0.0048 U	0.098	0.26	0.48	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.00464 U	0.048 U	0.03	0.02	--	0.0036 J	0.0047 U	0.0048 U	0.0095	0.022	0.031 J	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	0.00464 U	0.068	0.094	0.053	--	0.012	0.0047 U	0.0048 U	0.03	0.07	0.097 J	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	0 U	0.201 J	0.314 J	0.122 J	--	0.042 J	0 U	0 U	0.086 J	0.219 J	0.315 J	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	0.0035 U	0.203 J	0.314 J	0.122 J	--	0.042 J	0.003 U	0.003 U	0.086 J	0.219 J	0.315 J	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	0.0000017 U	0.108 J	0.0116 J	--	0.0000281 J	0.0053 J	--	--	0.0051 J	0.0166	0.0105 J	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	0 U	1.77	0.31 J	--	0 U	0.015 J	--	--	0.007 J	0.50	0.343 J	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	0.081 U	1.783	0.32 J	--	0.081 U	0.079 J	--	--	0.095 J	0.50	0.36 J	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	--	--	18.0 J	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	--	--	18.0 J	--	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

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ng/kg = nanogram per kilogram

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Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-10		MAF-11		MAF-11		MAF-12			MAF-13	MAF-14	Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SC-DUP-07	MAF-SC-10_6-7.6	MAF-SS-11_0-10	MAF-SC-11_0-2	MAF-SC-11_2-4	MAF-SC-11_6-8	MAF-SS-12_0-10	MAF-SC-12_0-2	MAF-SC-12_2-4	MAF-SS-13_0-10	MAF-SS-14_0-10		
Sample Date		10/29/2015	10/29/2015	10/20/2015	10/28/2015	10/28/2015	10/28/2015	10/20/2015	10/28/2015	10/28/2015	10/20/2015	10/21/2015		
Sample Interval (dbm)		0 - 2 ft	6 - 7.6 ft	0-10 cm	0 - 2 ft	2 - 4 ft	6 - 8 ft	0-10 cm	0 - 2 ft	2 - 4 ft	0-10 cm	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal		
Metals														
Arsenic	mg/kg	**20**	--	**30**	**70**	**40**	**9.1**	**20**	**19**	**14**	**11**	**10**	12	12
Cadmium	mg/kg	**2.0 J**	--	**0.9**	**1.2**	**1.6**	**0.73**	**0.9**	**1.0**	**0.4**	**0.179 J**	0.131 U	0.80	0.80
Lead	mg/kg	**45**	--	**21**	**93**	**65**	**32.7**	**21**	**50 J**	**15 J**	**8.0**	**10**	21	21
Mercury	mg/kg	**0.18**	--	**0.1**	**0.14**	**0.22**	**0.2649**	**0.12**	**0.14**	**0.09**	**0.0202 J**	**0.0182 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.26**	**0.0551**	**0.26**	**0.73**	**0.19**	**0.013**	**0.087**	**0.25**	**0.026**	**0.032**	**0.026**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.13 J**	**0.0443**	**0.2**	**0.6**	**0.13**	**0.0075**	**0.061**	**0.1**	**0.014**	**0.027**	**0.023**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.34**	**0.0915**	**0.47**	**1.0**	**0.29**	**0.0174**	**0.14**	**0.27**	**0.033**	**0.068**	**0.045**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.061 J**	**0.0387**	**0.1**	**0.3**	**0.09**	**0.00771**	**0.033**	**0.06**	**0.013**	**0.016**	**0.015**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.35**	**0.0782**	**0.43**	**0.84**	**0.24**	**0.0209**	**0.1**	**0.24**	**0.038**	**0.047**	**0.028**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.016 J**	**0.00573**	**0.029**	**0.082**	**0.018**	0.00497 U	**0.0091**	**0.013**	0.0047 U	**0.0040 J**	**0.0037 J**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.049 J**	**0.0242**	**0.093**	**0.27**	**0.066**	**0.00345 J**	**0.03**	**0.042**	**0.0061**	**0.014**	**0.014**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.2 J**	**0.063**	**0.29 J**	**0.817 J**	**0.189 J**	**0.011**	**0.089 J**	**0.16 J**	**0.0209 J**	**0.039 J**	**0.032 J**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.2 J**	**0.063**	**0.29 J**	**0.817 J**	**0.189 J**	**0.011**	**0.089 J**	**0.16 J**	**0.0211 J**	**0.039 J**	**0.032 J**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**0.0664 J**	--	**0.00214 J**	--	**0.657 J**	**0.00458 J**	**0.195 J**	--	**0.00311 J**	**0.00239 J**	**0.000988 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	**1.82 J**	--	**0.005 J**	--	**0.93**	**0.013 J**	**1.72**	--	**0.021 J**	**0.006 J**	**0.0014 J**	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	**1.87 J**	--	**0.077 J**	--	**0.94**	**0.068 J**	**1.72**	--	**0.021 J**	**0.078 J**	**0.035 J**	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	--	--	--	**21.7 J**	--	--	**1.76 J**	**0.95 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	**21.7 J**	--	--	**1.77 J**	**1.22 J**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

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mg/kg = milligram per kilogram

-- = not analyzed

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-15			MAF-16	MAF-17	MAF-18	MAF-19	MAF-20		MAF-21		Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SS-15_0-10	MAF-SC-15_0-2	MAF-SC-DUP-08	MAF-SS-16_0-10	MAF-SS-17_0-10	MAF-SS-18_0-10	MAF-SS-19_0-10	MAF-SS-20-0-10	MAF-SC-20_1-2	MAF-SS-21_0-10	MAF-SS-DUP-04		
Sample Date		10/21/2015	10/28/2015	10/28/2015	10/21/2015	10/21/2015	10/21/2015	10/20/2015	10/20/2015	10/29/2015	10/21/2015	10/21/2015		
Sample Interval (dbm)		0-10 cm	0 - 2 ft	0 - 2 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	1 - 2 ft	0-10 cm	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Surface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Subsurface	Surface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**11**	**13**	**12**	**9.0**	**9.0**	**11**	**19**	**23**	--	**20**	**20**	12	12
Cadmium	mg/kg	0.2 U	**0.135 J**	**0.096 J**	0.068 U	**0.3**	**0.250 J**	**0.7**	**1.4**	--	**1.0**	**1.1**	0.80	0.80
Lead	mg/kg	**11**	**11**	**11**	**8.0**	**8.0**	**7.0**	**19**	**30**	--	**25**	**26**	21	21
Mercury	mg/kg	**0.0127 J**	**0.04**	**0.05**	**0.0094 J**	**0.0138 J**	**0.05**	**0.11**	**0.15**	--	**0.13**	**0.15**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.0029 J**	**0.052 J**	**0.027 J**	0.0046 U	**0.0076**	**0.032**	**0.097**	**0.1**	**0.0397**	**0.15**	**0.14**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.0033 J**	**0.057 J**	**0.03 J**	0.0046 U	**0.013**	**0.023**	**0.066**	**0.082**	**0.0379**	**0.094**	**0.09**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.007**	**0.11 J**	**0.06 J**	**0.0055**	**0.015**	**0.047**	**0.16**	**0.18**	**0.0665**	**0.23**	**0.22**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	0.0049 U	**0.036 J**	**0.023 J**	0.0046 U	**0.0044 J**	**0.013**	**0.04**	**0.054**	**0.0355**	**0.06**	**0.05**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.0046 J**	**0.073 J**	**0.037 J**	**0.0043 J**	**0.01**	**0.04**	**0.12**	**0.12**	**0.0509**	**0.18**	**0.18**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	0.0049 U	**0.0097**	**0.0053**	0.0046 U	0.0047 U	**0.0026 J**	**0.0084**	**0.012**	**0.00403 J**	**0.011 J**	**0.011 J**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	0.0049 U	**0.03 J**	**0.018 J**	0.0046 U	**0.0035 J**	**0.01**	**0.032**	**0.041**	**0.0225**	**0.046**	**0.036**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.0043 J**	**0.078 J**	**0.041 J**	**0.0006 J**	**0.016 J**	**0.0326 J**	**0.097 J**	**0.117 J**	**0.052**	**0.14 J**	**0.13 J**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.0048 J**	**0.078 J**	**0.041 J**	**0.0036 J**	**0.016 J**	**0.0326 J**	**0.097 J**	**0.117 J**	**0.052**	**0.14 J**	**0.13 J**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**0.00317 J**	--	--	**0.000378 J**	--	--	**0.0016 J**	**0.00711 J**	**0.00144 J**	**0.0693 J**	**0.00727 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	**0.002**	--	--	**0.0006 J**	--	--	**0.005 J**	**0.27 J**	**0.0025 J**	**1.28 J**	**0.24 J**	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	**0.035**	--	--	**0.034 J**	--	--	**0.059 J**	**0.29 J**	**0.086 J**	**1.29 J**	**0.24 J**	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	**23.9 J**	--	--	**0.058 J**	--	--	**13.7 J**	**20.2 J**	--	**16.2 J**	**17.0 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	**23.9 J**	--	--	**0.43 J**	--	--	**13.7 J**	**20.2 J**	--	**16.2 J**	**17.0 J**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

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[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

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[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

[7] The polychlorinated biphenyl (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[8] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not analyzed

U = The analyte was not detected at a concentration greater than the value identified.

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cm = centimeter

ft = feet

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Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-21			MAF-22	MAF-23	MAF-24	MAF-25	MAF-26	MAF-27	MAF-31	MAF-32	Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SC-21_0-1	MAF-SC-DUP-09	MAF-SC-21_2-4	MAF-SS-22_0-10	MAF-SS-23_0-10	MAF-SS-24_0-10	MAF-SS-25_0-10	MAF-SS-26_0-10	MAF-SS-27_0-10	MAF-SS-31_0-10	MAF-SS-32_0-10		
Sample Date		10/29/2015	10/29/2015	10/29/2015	10/21/2015	10/21/2015	10/21/2015	10/21/2015	10/21/2015	10/21/2015	10/19/2015	10/19/2015		
Sample Interval (dbm)		0 - 1 ft	0 - 1 ft	2 - 4 ft	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**20**	**20**	--	--	--	**9.0**	**9.0**	**8.0**	**9.0**	**10**	**13**	12	12
Cadmium	mg/kg	**2.0**	**1.9**	--	--	--	0.033 U	0.054 U	0.053 U	0.074 U	**1.1**	**0.291 J**	0.80	0.80
Lead	mg/kg	**44**	**46**	--	--	--	**5.0**	**7.0**	**4.0**	**8.0**	**22**	**6.0**	21	21
Mercury	mg/kg	**0.24**	**0.26**	--	--	--	**0.0123 J**	**0.0084 J**	**0.0110 J**	**0.0154 J**	**0.11**	0.04 U	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.11**	**0.16**	--	**0.0621**	--	0.0047 U	0.0056 U	**0.0052**	**0.0046 J**	**0.11**	**0.16**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.064**	**0.096**	--	**0.0463**	--	0.0047 U	0.0056 U	**0.0054**	**0.0063**	**0.072**	**0.078**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.16**	**0.24**	--	**0.108**	--	0.0047 U	0.0056 U	**0.0085**	**0.01**	**0.18**	**0.18**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.048**	**0.07**	--	**0.031**	--	0.0047 U	0.0056 U	**0.0037 J**	**0.0052**	**0.04**	**0.027**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.12**	**0.19**	--	**0.0881**	--	0.0047 U	0.0056 U	**0.0061**	**0.0059**	**0.2**	**0.18**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.0072**	**0.011**	--	**0.00793 J**	--	0.0047 U	0.0056 U	0.0050 U	0.0047 U	**0.011**	**0.0091**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.03**	**0.042**	--	**0.0257**	--	0.0047 U	0.0056 U	**0.0035 J**	**0.0042 J**	**0.034**	**0.027**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.096 J**	**0.14 J**	--	**0.068**	--	0 U	0 U	**0.007 J**	**0.008 J**	**0.108 J**	**0.117 J**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.096 J**	**0.14 J**	--	**0.068**	--	0.003 U	0.004 U	**0.007 J**	**0.008 J**	**0.108 J**	**0.117 J**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	--	--	**0.000035 J**	**0.00214 J**	--	--	**0.000226 J**	--	**0.000442 J**	--	**0.00365 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	0 U	**0.006 J**	--	--	**0.00028 J**	--	**0.00058 J**	**0.19 J**	**0.0099 J**	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	0.057 U	**0.07 J**	--	--	**0.033 J**	--	**0.034 J**	**0.20 J**	**0.043 J**	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	**6.99 J**	--	--	**0.036 J**	--	**0.054 J**	**16.3 J**	**1.46 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	**6.99 J**	--	--	**0.56 J**	--	**0.39 J**	**16.3 J**	**1.79 J**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

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ng/kg = nanogram per kilogram

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U = The analyte was not detected at a concentration greater than the value identified.

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-33		MAF-34	MAF-35	MAF-36	MAF-37	MAF-38	MAF-39		MAF-40	MAF-41	Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SS-33_0-10	MAF-SS-DUP-06	MAF-SS-34_0-10	MAF-SS-35_0-10	MAF-SS-36_0-10	MAF-SS-37_0-10	MAF-SS-38_0-10	MAF-SS-39_0-10	MAF-DUP-08	MAF-SS-40_0-10	MAF-SS-41_0-10		
Sample Date		10/19/2015	10/19/2015	10/20/2015	10/19/2015	10/19/2015	09/13/2016	09/13/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016		
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	**14**	**13**	**20**	--	40 U	--	--	--	--	--	--	12	12
Cadmium	mg/kg	**0.3**	**0.4**	**0.356 J**	--	**0.50 J**	--	--	--	--	--	--	0.80	0.80
Lead	mg/kg	**9.0**	**7.0**	**11**	--	20 U	--	--	--	--	--	--	21	21
Mercury	mg/kg	0.03 U	0.04 U	**0.07**	--	**0.03**	--	--	--	--	--	--	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.14**	**0.11**	**0.14**	**0.14**	**0.2**	**0.085**	**0.152**	**0.0374**	**0.167**	**0.0385**	**0.0747**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.071**	**0.059**	**0.084**	**0.11**	**0.098**	**0.0746**	**0.119**	**0.0311**	**0.111**	**0.0316**	**0.0522**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.17**	**0.14**	**0.2**	**0.26**	**0.23**	**0.153**	**0.272**	**0.0655**	**0.247**	**0.0669**	**0.115**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.033 J**	**0.023 J**	**0.034**	**0.049**	**0.035**	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.24 J**	**0.14 J**	**0.2**	**0.18**	**0.29**	**0.119**	**0.227**	**0.0577**	**0.233**	**0.0415**	**0.123**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.0082**	**0.0067**	**0.01**	**0.012**	**0.011 J**	**0.0124**	**0.0184**	**0.00412**	**0.015**	**0.00486**	**0.00705**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.028 J**	**0.023 J**	**0.031**	**0.039**	**0.035**	**0.042**	**0.0545**	**0.0161**	**0.0459**	**0.0158**	**0.0235**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.108 J**	**0.088 J**	**0.124 J**	**0.157 J**	**0.149 J**	**0.105**	**0.171**	**0.044**	**0.16082**	**0.045**	**0.075**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.108 J**	**0.088 J**	**0.124 J**	**0.157 J**	**0.149 J**	**0.105**	**0.171**	**0.044**	**0.16082**	**0.045**	**0.075**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	--	**0.00664 J**	**0.216 J**	**0.123 J**	**0.00668 J**	--	--	--	--	--	--	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	**0.014 J**	**6.25**	**2.75**	**0.53 J**	**0.002 J**	**0.12 J**	--	--	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	**0.047 J**	**6.25**	**2.77**	**0.54 J**	**0.047 J**	**0.13 J**	--	--	--	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	**4.35 J**	**7.73 J**	**27.9 J**	**7.49 J**	**11.7 J**	**10.3 J**	--	--	**3.36 J**	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	**4.36 J**	**8.28 J**	**27.9 J**	**7.60 J**	**11.7 J**	**10.3 J**	--	--	**3.38 J**	--	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		MAF-42	MAF-43	MAF-44	MAF-45	MAF-46	MAF-47	MAF-48	MAF-49	MAF-50	MAF-51	MAF-52	Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SS-42_0-10	MAF-SS-43_0-10	MAF-SS-44_0-10	MAF-SS-45_0-10	MAF-SS-46_0-10	MAF-SS-47_0-10	MAF-SS-48_0-10	MAF-SS-49_0-10	MAF-SS-50_0-10	MAF-SS-51_0-10	MAF-SS-52_0-10		
Sample Date		09/14/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016	09/14/2016		
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	--	--	--	--	--	--	--	--	--	--	--	12	12
Cadmium	mg/kg	--	--	--	--	--	--	--	--	--	--	--	0.80	0.80
Lead	mg/kg	--	--	--	--	--	--	--	--	--	--	--	21	21
Mercury	mg/kg	--	--	--	--	--	--	--	--	--	--	--	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.0715**	**0.0498**	**0.0875**	**0.233**	**0.111**	**0.0353**	**0.0217**	**0.0387**	**0.131**	**0.0708**	**0.212**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.0503**	**0.0376**	**0.112**	**0.271**	**0.129**	**0.0296**	**0.025**	**0.0351**	**0.092**	**0.0646**	**0.227**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.11**	**0.0957**	**0.223**	**0.464**	**0.316**	**0.0653**	**0.05**	**0.0669**	**0.225**	**0.149**	**0.551**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	--	--	--	--	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.102**	**0.0676**	**0.176**	**0.255**	**0.164**	**0.0437**	**0.0332**	**0.0484**	**0.18**	**0.107**	**0.354**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.00865**	**0.00513**	**0.017**	**0.0283**	**0.021**	**0.00419**	**0.00476**	**0.00638**	**0.0129**	**0.00918**	**0.0401**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.0271**	**0.0188**	**0.0517**	**0.131**	**0.0609**	**0.0131**	**0.0147**	**0.0182**	**0.0395**	**0.0323**	**0.127**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.073**	**0.055**	**0.152**	**0.359**	**0.182**	**0.042**	**0.034**	**0.049**	**0.135**	**0.092**	**0.324**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.073**	**0.055**	**0.152**	**0.359**	**0.182**	**0.042**	**0.034**	**0.049**	**0.135**	**0.092**	**0.324**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	--	--	**0.14 J**	--	--	**0.12 J**	--	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	--	--	**0.15 J**	--	--	**0.12 J**	--	--	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	**2.10 J**	--	--	--	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	**2.12 J**	--	--	--	5.00	5.00

Notes:

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[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

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Table 7

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Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-53	MAF-54	MAF-55	MAF-56				MAF-57			MAF-58	Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SS-53_0-10	MAF-SS-54_0-10	MAF-SS-55-0-10	MAF-SS-56_0-10	MAF-SC-56_0-2	MAF-SC-DUP-07	MAF-SC-56_2-4	MAF-SS-57_0-10	MAF-SC-57_0-2	MAF-SC-57_2-4	MAF-SS-58_0-10		
Sample Date		09/14/2016	09/14/2016	11/13/18	11/13/18	11/12/18	11/12/18	11/12/18	11/14/18	11/13/18	11/13/18	11/14/18		
Sample Interval (dbm)		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-2 ft	0-2 ft	2-4 ft	0-10 cm	0-2 ft	2-4 ft	0-10 cm	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Surface	Surface	Surface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal		
Metals														
Arsenic	mg/kg	--	--	--	**3.52**	**4.63**	**4.72**	**4.4**	**5.77**	**5.18**	**3.89**	**9.6**	12	12
Cadmium	mg/kg	--	--	--	**0.08 J**	**0.10 J**	**0.11 J**	0.12 U	**0.47**	**0.22**	**0.15**	**0.85**	0.80	0.80
Lead	mg/kg	--	--	--	**4.57**	**5.07**	**4.85 J**	**2.99**	**10.3**	**9.18**	**3.89**	**20.3**	21	21
Mercury	mg/kg	--	--	--	**0.0261 J**	**0.0321**	**0.0745**	**0.00636 J**	**0.0551**	**0.0270 J**	**0.0107 J**	**0.105**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.118**	**0.546**	**0.0206**	**0.0214**	**0.0157**	**0.0134**	**0.00125 J**	**0.152**	**0.0402**	**0.00453 J**	**0.187**	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.1**	**0.352**	**0.0166**	**0.0145**	**0.0121**	**0.0111**	0.00128 U	**0.0917**	**0.0405**	0.00316 U	**0.142**	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.261**	**0.851**	**0.0234**	**0.0321**	**0.0252**	**0.0245**	0.0100 U	**0.234**	**0.0944**	**0.00989 J**	**0.336**	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	--	--	--	**0.00993**	**0.00954**	**0.00926**	0.00500 U	**0.0436 J**	**0.023**	0.00272 U	**0.0877**	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.203**	**0.751**	**0.0215**	**0.0227**	**0.0181**	**0.0148**	0.00500 U	**0.192**	**0.05**	**0.00536**	**0.249**	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.017**	**0.0451**	0.00924 U	0.00838 U	0.00806 U	0.00738 U	0.00661 U	**0.077**	0.0248 U	0.00670 U	**0.0532**	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.0499**	**0.151**	**0.00888**	**0.00823**	**0.00781**	**0.00593**	**0.00111 J**	**0.0501**	**0.0196**	**0.00223 J**	**0.0807**	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.147**	**0.519**	**0.0221 J**	**0.0209 J**	**0.0180 J**	**0.0164 J**	**0.000236 J**	**0.145 J**	**0.0564 J**	**0.00488 J**	**0.210 J**	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.147**	**0.519**	**0.0226 J**	**0.0213 J**	**0.0180 J**	**0.0164 J**	**0.00359 J**	**0.145 J**	**0.0577 J**	**0.00521 J**	**0.210 J**	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	--	--	--	**0.00812 J**	**0.00163 J**	**0.0664 J**	**0.000245 J**	**0.00318 J**	**0.00934 J**	**0.00103 J**	**0.0142 J**	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	--	**0.20 J**	**0.0037 J**	**0.0021 J**	**0.0005 J**	**0.14 J**	**0.26 J**	**0.0026 J**	**0.37 J**	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	--	**0.21 J**	**0.040 J**	**0.064 J**	**0.050 J**	**0.15 J**	**0.27 J**	**0.029 J**	**0.38 J**	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	--	--	**0.34 J**	**3.36 J**	**2.33 J**	**1.42 J**	**0.20 J**	**5.45 J**	**5.51 J**	**1.17 J**	**15.0 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	--	--	**0.65 J**	**3.37 J**	**2.33 J**	**1.54 J**	**0.42 J**	**5.45 J**	**5.51 J**	**1.26 J**	**15.0 J**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

[7] The polychlorinated biphenyl (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[8] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not analyzed

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeter

ft = feet

RL = Reporting limit

dbm = depth below mudline

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former

Everett, Washington

Sample Location[1]		MAF-58	MAF-59				MAF-60			MAF-61		EDP62	Proposed Sediment Cleanup Level[2]	
Sample Identification		MAF-SC-58_2-4	MAF-SS-59_0-10	MAF-SC-59_2-4	MAF-SC-59_6-8	MAF-SC-59_10-12	MAF-SS-60_0-10	MAF-SC-60_4-6	MAF-SC-60_8-10	MAF-SS-61_0-10	MAF-SS-DUP-11	EDP62_0.0-1.0		
Sample Date		11/13/18	11/14/18	11/12/18	11/12/18	11/12/18	11/14/18	11/12/18	11/12/18	11/14/18	11/14/18	04/27/21		
Sample Interval (dbm)		2-4 ft	0-10 cm	2-4 ft	6-8 ft	10-12 ft	0-10 cm	4-6 ft	8-10 ft	0-10 cm	0-10 cm	0-1 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Surface	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface	Surface	Surface	Subsurface		
Stratigraphic Unit		Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Native Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Subtidal	Intertidal		
Metals														
Arsenic	mg/kg	**5.67**	**9.15**	**7.06**	**4.9**	**2.92**	**5.89**	**3.5**	**3.24**	--	--	**1.51 J**	12	12
Cadmium	mg/kg	**0.21**	**0.54**	**0.65**	**0.28**	**0.07 J**	**0.61**	**0.22**	0.12 U	--	--	0.236 U	0.80	0.80
Lead	mg/kg	**8.44 J**	**14.4**	**35.9**	**23.2**	**2.21**	**10.4**	**7.47**	**2.39**	--	--	**3.31**	21	21
Mercury	mg/kg	**0.0676**	**0.119**	**0.223**	**38.5**	**0.00839 J**	**0.0808**	**0.0485**	**0.0156 J**	--	--	**0.00586 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)														
Benzo(a)anthracene	mg/kg	**0.028**	**0.161**	**0.287**	**0.0495**	--	**0.306**	**0.292**	**0.00248 J**	**0.0566 J**	**0.0338 J**	--	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	**0.0259**	**0.116**	**0.243**	**0.0329**	--	**0.17**	**0.195**	0.00167 U	**0.0521 J**	**0.0264 J**	--	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	**0.0525**	**0.307**	**0.435**	**0.0712**	--	**0.438**	**0.522**	**0.00408 J**	**0.0760 J**	**0.0413 J**	--	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	**0.0223**	**0.0725**	**0.194**	**0.0318**	--	**0.0757**	**0.0729**	0.00470 U	--	--	--	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	**0.0354**	**0.274**	**0.288**	**0.0619**	--	**0.412**	**0.445**	**0.00339 J**	**0.0669 J**	**0.0400 J**	--	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	**0.0221**	**0.0532**	**0.0876**	**0.0212 J**	--	**0.0598**	**0.0369**	0.00470 U	0.0245 U	0.0221 U	--	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	**0.0181**	**0.0651**	**0.141**	**0.0182**	--	**0.0694**	**0.0743**	**0.00106 J**	**0.0249 J**	**0.0134 J**	--	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)														
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	**0.0361 J**	**0.177**	**0.341**	**0.0495 J**	--	**0.261**	**0.292**	**0.00247 J**	**0.0685 J**	**0.0379 J**	--	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	**0.0372 J**	**0.177**	**0.341**	**0.0495 J**	--	**0.261**	**0.292**	**0.00251 J**	**0.0697 J**	**0.0379 J**	--	0.056	0.056
Polychlorinated Biphenyls (PCBs)														
Total PCBs (Aroclors or Congeners)	mg/kg	**0.000565 J**	**0.0103 J**	**0.0209 J**	**0.0128 J**	--	**0.00702 J**	**0.0139 J**	**0.000144 J**	--	--	--	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	**0.001 J**	**0.27 J**	**0.424 J**	**0.015 J**	--	**0.16 J**	**0.47**	**0.0002 J**	--	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	**0.029 J**	**0.28 J**	**0.434 J**	**0.084 J**	--	**0.17 J**	**0.48**	**0.041 J**	--	--	--	0.38	0.38
Dioxins and Furans														
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	**2.74 J**	**12.9 J**	**29.7 J**	**8.62 J**	**0.024 J**	**6.48 J**	**9.79 J**	**0.14 J**	**3.64 J**	**3.22 J**	**0.036 J**	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	**2.74 J**	**12.9 J**	**29.7 J**	**8.62 J**	**0.27 J**	**6.48 J**	**9.79 J**	**0.47 J**	**3.64 J**	**3.23 J**	**0.406 J**	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

[3] Total cPAH Toxicity Equivalency Quotients (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) from MTCA Table 708-2 (WAC 173-340-900).

[4] Total PCB congener TEQs were calculated using the 2005 World Health Organization (WHO) TEF values for humans and mammals (Van den Berg et al., 2006).

[5] Total dioxin/furan TEQs were calculated using United States Environmental Protection Agency (USEPA) TEF values for human health (EPA, 2003).

[6] Sediment sample collected from the Z-Layer during the 2016 Interim Action Dredged Material Characterization Study and is representative of surface sediment conditions following completion of the 2016/2017 Interim Action.

[7] The polychlorinated biphenyl (PCB) results are from sample MAF-SC-04-0-2(B) which was collected from an additional core advanced at this location to collect an adequate volume of sediment sample.

[8] The reported results are from sample MAF-SC-DUP-06 which is a duplicate sample for MAF-SC-04_2-4 advanced at this location.

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not analyzed

U = The analyte was not detected at a concentration greater than the value identified.

J = The analyte was detected and the detected concentration is considered an estimate.

cm = centimeter

ft = feet

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dbm = depth below mudline

Bold font type indicates the analyte was detected at the reported concentration.

Yellow shading indicates exceedance of the wood debris screening level and/or Benthic PCUL.

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Table 7

Summary of Sediment Analytical Results for the Protection of Human Health and Higher Trophic Level Ecological Receptors

Weyerhaeuser Mill A Former
Everett, Washington

Sample Location[1]		EDP62	EDP63		EDP64		EDP65		Proposed Sediment Cleanup Level[2]	
Sample Identification		EDP62_2.0-3.0	EDP63_0.0-1.0	EDP63_2.0-3.0	EDP64_0.0-1.0	EDP64_2.0-3.0	EDP65_0.0-1.0	EDP65_2.0-3.0		
Sample Date		04/27/21	04/27/21	04/27/21	04/27/21	04/27/21	04/27/21	04/27/21		
Sample Interval (dbm)		2-3 ft	0-1 ft	2-3 ft	0-1 ft	2-3 ft	0-1 ft	2-3 ft	Intertidal Sediment (above -3 ft MLLW)	Subtidal Sediment (below -3 ft MLLW)
Sample Type		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface		
Stratigraphic Unit		Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit	Recent Deposit		
Tidal Zone		Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal	Intertidal		
Metals										
Arsenic	mg/kg	**2.53 J**	**2.95 J**	**3.50 J**	**4.44 J**	**5.28 J**	**3.43 J**	**5.43 J**	12	12
Cadmium	mg/kg	0.239 U	0.269 U	0.246 U	0.257 U	0.248 U	0.245 U	0.238 U	0.80	0.80
Lead	mg/kg	**8.8**	**3.75**	**4.45**	**7.27**	**7.36**	**5.52**	**3.58**	21	21
Mercury	mg/kg	**0.00782 J**	**0.0403**	**0.0337**	**0.00621 J**	**0.0164 J**	**0.00838 J**	**0.0105 J**	0.20	0.20
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)										
Benzo(a)anthracene	mg/kg	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Benzo(a)pyrene	mg/kg	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Benzofluoranthenes (Total)	mg/kg	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Benzo(g,h,i)perylene	mg/kg	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Chrysene	mg/kg	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Dibenzo(a,h)anthracene	mg/kg	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Indeno(1,2,3-c,d)pyrene	mg/kg	--	--	--	--	--	--	--	See cPAH TEQ	See cPAH TEQ
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)										
Total cPAH TEQ[3] (ND=0 RL)	mg/kg	--	--	--	--	--	--	--	0.056	0.056
Total cPAH TEQ[3] (ND=0.5 RL)	mg/kg	--	--	--	--	--	--	--	0.056	0.056
Polychlorinated Biphenyls (PCBs)										
Total PCBs (Aroclors or Congeners)	mg/kg	--	--	--	--	--	--	--	0.23	0.58
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0 RL)	ng/kg	--	--	--	--	--	--	--	0.38	0.38
Total Dioxin-Like PCB Congeners TEQ[4] (ND=0.5 RL)	ng/kg	--	--	--	--	--	--	--	0.38	0.38
Dioxins and Furans										
Total Dioxin/Furan TEQ[5] (ND=0 RL)	ng/kg	0.00 U	0.00 UJ	**0.022 J**	**0.015 J**	**0.327 J**	0.00 UJ	0.00 UJ	5.00	5.00
Total Dioxin/Furan TEQ[5] (ND=0.5 RL)	ng/kg	0.465 U	0.328 UJ	**0.292 J**	**0.368 J**	**0.551 J**	0.356 UJ	0.309 UJ	5.00	5.00

Notes:

[1] Sample locations shown on Figures 10 through 12.

[2] Proposed cleanup levels (PCULs) are presented in Table 3. Screening levels are based on the exposure pathways specific to intertidal sediment (i.e., beach play, clamming and net fishing) and subtidal sediment (i.e., net fishing) and is the risk-based value adjusted for regional background and PQL, whichever is higher.

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Blue shading indicates that the practical quantitation limit (PQL) exceeds the proposed sediment cleanup level.

Table 8

Estimation of Contamination Depth in the Marine Area

Weyerhaeuser Mill A Former

Everett, Washington

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
Sediment Management Area 1a													
1a	ST-41	May-2007	-55.67	0.6 ft	0 - 0.6 ft	<1	Not Observed	No Data	No Data	n/a	n/a	n/a	**Rationale 1:** No chemical analytical data is available at this location. Either sub-surface investigation was not completed or sub-surface data is not available and therefore, native contact could not be identified at this location. Due to insufficient information, the depth of contamination could not be estimated at this location.
1a	A1-17	Aug-2008	-60.99	11 cm	0 - 11 cm	25	Unspecified	No Data	No Data	n/a	n/a	n/a	See Rationale 1. As discussed in the RI/FS, wood debris observed at this location are not associated with Mill A Site.
1a	EW-12-07	Jun-2012	-115.1	17 cm	0 - 17 cm	<1	Not Observed	No Exceedance	Total cPAH TEQ	n/a	0.5 ft	-115.6	**Rationale 2:** A sample collected from surface sediment at this location identified exceedances of the PCUL. Either sub-surface investigation was not completed or sub-surface data is not available and therefore, native contact could not be identified at this location. This location is in the outermost portions of the Marine Area is at a distance away from source areas and therefore, the depth of contamination at this location is expected to be surficial. The depth of contamination is assumed to be 0.5 feet bml (i.e. the approximate depth of the surface sample interval rounded to nearest half foot) for the purposes of the FS.
1a	MAF-19	Oct-2015	-82.3	10 ft	0 - 10 cm	10	Lumber	No Exceedance	Arsenic, Total cPAH TEQ Total Dioxin/Furan TEQ	2 ft	2 ft	-84.3	**Rationale 3:** Sample(s) collected from sediment above the native contact at this location identified exceedances of the PCUL. Sample representative of native sediment was either not collected or analyzed at this location. This location is situated in an area that is not subject to vessel scour and reworking of the sediment and therefore, the observed native contact is expected to be undisturbed and representative of a depth below which contamination is not expected to be present. Therefore, the depth of contamination at this location is assumed to be at the native contact for the purposes of the FS.
					0 - 1 ft	<1	Bark	No Data	No Data				
					1 - 10 ft	<1	n/a	No Data	No Data				
1a	MAF-20	Oct-2015	-78.35	4.5 ft	0 - 10 cm	<5	Lumber	No Exceedance (Based on Bioassay)	Arsenic, Cadmium, Lead Total cPAH TEQ Total Dioxin/Furan TEQ	2 ft	2 ft	-80.35	**Rationale 4:** A sample collected from surface sediment at this location identified exceedances of the PCUL. Sample(s) collected from sub-surface sediment above the native contact at this location did not identify any PCUL exceedances; however, not all Marine Area COCs were tested. Sample representative of native sediment was either not collected or analyzed at this location. This location is situated in an area that is not subject to vessel scour and reworking of the sediment and therefore, the observed native contact is expected to be undisturbed and representative of a depth below which contamination is not expected to be present. Therefore, the depth of contamination at this location is assumed to be at the native contact for the purposes of the FS.
					0 - 1 ft	<1	Chips	No Data	No Data				
					1 - 2 ft	<1	Chips	No Exceedance	No Exceedance				
					2 - 4.5 ft	<1	Not Observed	No Data	No Data				
1a	MAF-22	Oct-2015	-61.6	10 cm	0 - 10 cm	<1	Bark	4-Methylphenol (p-Cresol) Larval Development Test Failure	Total cPAH TEQ Total Dioxin/Furan TEQ	n/a	0.5 ft	-62.1	See Rationale 2.
1a	MAF-37	Sep-2016	-94.9	10 cm	0 - 10 cm	<1	Not Observed	No Exceedance	Total cPAH TEQ Total Dioxin/Furan TEQ	n/a	0.5 ft	-95.4	See Rationale 2.
1a	MAF-41	Sep-2016	-102.6	10 cm	0 - 10 cm	<1	Not Observed	No Data	Total cPAH TEQ	n/a	0.5 ft	-103.1	See Rationale 2.
1a	MAF-42	Sep-2016	-181.8	10 cm	0 - 10 cm	<1	Not Observed	No Data	Total cPAH TEQ	n/a	0.5 ft	-182.3	See Rationale 2.
1a	MAF-44	Sep-2016	-81.5	10 cm	0 - 10 cm	50	Bark	No Data	Total cPAH TEQ	n/a	0.5 ft	-82.0	See Rationale 2. As discussed in the RI/FS, wood debris observed at this location are not associated with Mill A Site.
1a	MAF-45	Sep-2016	-63.3	10 cm	0 - 10 cm	<1	Not Observed	No Data	Total cPAH TEQ	n/a	0.5 ft	-63.8	See Rationale 2.

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
Sediment Management Area 1b													
1b	MAF-21	Oct-2015	-71.4	6 ft	0 - 10 cm	10	Bark and Lumber	No Exceedance (Based on Bioassay)	Arsenic, Cadmium Lead, Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	2 ft	2 ft	-73.4	**Rationale 5:** Sample(s) collected from sediment above the native contact at this location identified exceedances of the PCUL. Sample(s) collected at and/or below the native contact did not identify the exceedances of PCUL for tested COCs. Therefore, the depth of contamination at this location is assumed to be at the native contact for the purposes of the FS.
					0 - 1 ft	10	Bark, Sawdust, and Chips	4-Methylphenol (p-Cresol) Fluorene	Arsenic, Cadmium, Lead Mercury, Total cPAH TEQ				
					1 - 2 ft	5	Bark, Sawdust, and Chips	No Data	No Data				
					2 - 4 ft	<1	Not Observed	No Exceedance	No Exceedance				
					4 - 6 ft	<1	Not Observed	No Data	No Data				
1b	MAF-38	Sep-2016	-82.1	10 cm	0 - 10 cm	<1	n/a	No Exceedance	Total cPAH TEQ Total Dioxin/Furan TEQ	n/a	0.5 ft	-82.6	See Rationale 2.
1b	ST-33	May-2007	-61.2	0.7 ft	0 - 0.7 ft	<5	Unspecified	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
Sediment Management Area 1c													
1c	MAF-39	Sep-2016	-67.5	10 cm	0 - 10 cm	35	Chips and Sawdust	No Data	Total cPAH TEQ	n/a	0.5 ft	-68.0	See Rationale 2.
Sediment Management Area 1d													
1d	MAF-10	Oct-2015	-55.1	9 ft	0 - 10 cm	<5	Bark and Sawdust	Sum of LPAHs, Acenaphthene Fluorene, Naphthalene 2,4-DiMethylphenol 4-Methylphenol (p-Cresol) Dibenzofuran Larval Development Test Failure	Arsenic, Cadmium Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	7.5 ft	7.5 ft	-62.6	See Rationale 3.
					0 - 2 ft	<5 - 15	Chips and Sawdust	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Fluorene Naphthalene, Phenanthrene Fluoranthene 2,4-DiMethylphenol 4-Methylphenol (p-Cresol) Phenol, Dibenzofuran Benzyl Alcohol	Arsenic, Cadmium, Lead Total cPAH TEQ Total Dioxin-Like PCB TEQ				
					2 - 5.5 ft	10 - 15	Sawdust	No Data	No Data				
					5.5 - 5.7 ft	100	Lumber	No Data	No Data				
					5.7 - 6 ft	<1	Bark	No Data	No Data				
					6 - 7.6 ft	<1	Bark	No Exceedance	Total cPAH TEQ				
					7.6 - 9 ft	<1	Not Observed	No Data	No Data				
1d	MAF-12	Oct-2015	-56.9	12 ft	0 - 10 cm	15	Lumber	Dibenzofuran, Total PCBs Larval Development Test Failure	Arsenic, Cadmium Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	4 ft	4 ft	-60.9	See Rationale 3.
					0 - 2 ft	10	Chips	4-Methylphenol (p-Cresol)	Arsenic, Cadmium, Lead Total cPAH TEQ				
					2 - 4 ft	<5	Chips	No Exceedance	Arsenic				
					4 - 12 ft	<1	Not Observed	No Data	No Data				
1d	ST-28	May-2007	-61.7	n/a	n/a	25	Bark	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
1d	ST-30	May-2007	-67.9	0.7 ft	0 - 10 cm	95	Unspecified	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	**Rationale 6:** A sample collected from surface sediment at this location identified exceedances of the PCUL. Other investigation(s) completed in the vicinity of this location identified the presence of contamination in sediment above native contact. Either sub-surface investigation was not completed or sub-surface data is not available and therefore, native contact could not be identified at this location. Due to insufficient information, the depth of contamination could not be estimated at this location.
					10 - 21 cm	95	Unspecified	No Data	No Data				
1d	ST-31	May-2007	-55.7	n/a	n/a	20	Bark	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
1d	ST-36	May-2007	-57.0	0.6 ft	n/a	<1	Not Observed	No Data	No Data	n/a	n/a	n/a	See Rationale 1.

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition		Chemical Analytical Condition		Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
						Visual Wood Content (%)	Observed Wood Type	Benthic PCUL Exceedance[3]	Human Health PCUL Exceedance[4]				
Sediment Management Area 2a													
2a	A1-24	Aug-2008	-53.0	13 ft	0 - 10 cm	20	Unspecified	Zinc	Arsenic, Cadmium, Lead, Total cPAH TEQ Total Dioxin/Furan TEQ	n/a	n/a	n/a	**Rationale 7:** Sample(s) at this location identified exceedances of the PCUL. The chemical analytical data at this location did not identify the base of contamination. The native contact was either not identified or could not be confirmed because 1) the location does not have chemical analytical data representative of native sediment that meets the PCUL for Marine Area COCs to support the confirmation of the native contact, and/or 2) the location is subject to scour and therefore, relying on aged data that may not be representative of current conditions increases the uncertainty in estimating the depth of contamination as a result of high potential of reworking. Therefore, the depth of contamination could not be estimated at this location.
					0 - 1 ft	20	Unspecified	No Data	No Data				
					1 - 3 ft	25 - 30	Unspecified	4-Methylphenol (p-Cresol)	Cadmium, Lead, Mercury, Total cPAH TEQ Total Dioxin/Furan TEQ				
					3 - 5 ft	25 - 30	Unspecified	2,4-Dimethylphenol, 4-Methylphenol (p-Cresol)	Arsenic, Cadmium Lead, Mercury Total cPAH TEQ				
					5 - 13 ft	<1	Not Observed	No Data	No Data				
2a	MAF-11	Oct-2015	-54.8	11 ft	0 - 10 cm	75	Chips	4-Methylphenol (p-Cresol), Phenol	Arsenic, Cadmium, Total cPAH TEQ	8 ft	8 ft	-62.8	**Rationale 8:** Sample(s) collected from sediment above the native contact at this location identified exceedances of the PCUL. Sample representative of native sediment was either not collected or analyzed at this location. For the purposes of the FS, the depth of contamination at this location is assumed to be at the native contact, which is estimated to be located below the deepest sample interval identifying the exceedances of the PCUL.
					0 - 2 ft	25	Chips	Arsenic, Zinc, Sum of LPAHs, Acenaphthene Fluorene, Phenanthrene Fluoranthene 4-Methylphenol (p-Cresol) Dibenzofuran	Arsenic, Cadmium, Lead, Benzo(a)pyrene Total cPAH TEQ				
					2 - 4 ft	50	Sawdust and Twigs	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Fluorene Naphthalene, Phenanthrene 2,4-Dimethylphenol 4-Methylphenol (p-Cresol) Dibenzofuran, Total PCBs	Arsenic, Cadmium, Lead Benzo(a)pyrene, Total cPAH TEQ, Total PCBs, Total Dioxin-Like PCB TEQ				
					4 - 6 ft	75	Sawdust and Twigs	No Data	No Data				
					6 - 8 ft	<1	Not Observed	2,4-DiMethylphenol 4-Methylphenol (p-Cresol)	Lead, Mercury				
					8 - 11 ft	<1	Not Observed	No Data	No Data				
2a	MAF-58	Nov-2018	-54.7	10 ft	0 - 10 cm	5	Chips and Bark	No Exceedance	Cadmium, Total cPAH TEQ Total Dioxin/Furan TEQ	2 ft	2 ft	-56.7	See Rationale 5.
					0 - 2 ft	35	Chips and Bark	No Data	No Data				
					2 - 4 ft	<1	Not Observed	No Exceedance	No Exceedance				
					4 - 10 ft	<1	Not Observed	No Data	No Data				
2a	MAF-59	Nov-2018	-51.9	12 ft	0 - 10 cm	20	Bark and Chips	No Exceedance	Total cPAH TEQ Total Dioxin/Furan TEQ	10 ft	10 ft	-61.9	See Rationale 5.
					0 - 2 ft	50	Fibers and Chips	No Data	No Data				
					2 - 4 ft	<5	Fibers	2,4-Dimethylphenol 4-Methylphenol (p-Cresol)	Lead, Mercury, Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ				
					4 - 6 ft	<5	Fibers	No Data	No Data				
					6 - 8 ft	<1	Not Observed	Mercury	Lead, Mercury Total Dioxin/Furan TEQ				
					8 - 10 ft	<1	Not Observed	No Data	No Data				
					10 - 12 ft	<1	Not Observed	No Exceedance	No Exceedance				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
2a	ST-32	May-2007	-54.5	10 ft	0 - 10 cm	10	Bark	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 6.
					0 - 7.2 ft	10	Bark	No Data	No Data				
					7.2 - 10 ft	<1	Not Observed	No Data	No Data				
Sediment Management Area 2b													
2b	A1-15	Aug-2008	-51.5	12 ft	0 - 10 cm	10	Unspecified	No Exceedance	Total cPAH TEQ	1 ft	n/a	n/a	**Rationale 9:** A sample collected from surface sediment at this location identified exceedances of the PCUL. Sample(s) collected from sub-surface sediment at this location did not identify any PCUL exceedances; however, not all Marine Area COCs were tested. The native contact was either not identified or could not be confirmed because 1) the location does not have chemical analytical data representative of native sediment that meets the PCUL for Marine Area COCs to support the confirmation of the native contact, and/or 2) the location is subject to scour and therefore relying on aged data that may not be representative of current conditions increases the uncertainty in estimating the depth of contamination as a result of high potential of reworking. Therefore, the depth of contamination could not be estimated at this location.
					0 - 1 ft	<1	Not Observed	No Data	No Data				
					1 - 3 ft	<1	Not Observed	No Exceedance	No Exceedance				
					3 - 5 ft	<1	Not Observed	No Exceedance	No Exceedance				
					5 - 12 ft	<1	Not Observed	No Data	No Data				
2b	A1-20	Aug-2008	-44.8	13 cm	0 - 13 cm	10	Unspecified	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
2b	MAF-09	Oct-2015	-46.0	10 cm	0 - 10 cm	<25	Bark, Twigs, and Sawdust	Phenol	Total cPAH TEQ	n/a	0.5 ft	-46.5	See Rationale 2.
2b	MAF-35	Oct-2015	-54.6	10 cm	0 - 10 cm	10	Bark and Twigs	No Exceedance	Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	n/a	n/a	n/a	See Rationale 2.
2b	MAF-36	Oct-2015	-45.8	10 cm	0 - 10 cm	<1	Bark	No Exceedance	Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	n/a	n/a	n/a	See Rationale 2.
2b	MAF-46	Sep-2016	-53.9	10 cm	0 - 10 cm	<1	Not Observed	No Data	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 2.
2b	SP-151	Jun-2007	-51.6	30 cm	0 - 30 cm	<1	Not Observed	2,4-Dimethylphenol, Benzoic Acid	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 7.
Sediment Management Area 3a													
3a	MAF-31	Oct-2015	-43.1	10 cm	0 - 10 cm	10	Bark	2,4-Dimethylphenol, 4-Methylphenol (p-Cresol), Benzoic Acid	Cadmium, Lead Total cPAH TEQ Total Dioxin/Furan TEQ	n/a	0.5 ft	-43.6	See Rationale 2.
3a	ST-42	May-2007	-42.0	12 ft	0 - 10 cm	5	Chips	No Exceedance	No Exceedance	n/a	n/a	n/a	**Rationale 10:** A sample collected from surface sediment at this location did not identify exceedances of the PCUL; however, the sample was not tested for all of the Marine Area COCs. The native contact was either not identified or could not be confirmed because 1) the location does not have chemical analytical data representative of native sediment that meets the PCUL for Marine Area COCs to support the confirmation of the native contact, and/or 2) the location is subject to scour and therefore relying on aged data that may not be representative of current conditions increases the uncertainty in estimating the depth of contamination as a result of high potential of reworking. Therefore, the depth of contamination could not be estimated at this location.
					0 - 12 ft	5	Chips and Chunks	No Data	No Data				
Sediment Management Area 3b													
3b	MAF-33	Oct-2015	-39.7	10 cm	0 - 10 cm	<1	Bark	Acenaphthene, Dibenzofuran	Arsenic, Total cPAH TEQ	n/a	0.5 ft	-40.2	See Rationale 2.
Sediment Management Area 3c													
3c	MAF-32	Oct-2015	-23.4	10 cm	0 - 10 cm	40	Bark	No Exceedance	Arsenic, Total cPAH TEQ	n/a	0.5 ft	-23.9	See Rationale 2.
Sediment Management Area 4													
4	PT3[6]	Jan-2015	-42.48	5 ft	0 - 1 ft	<1	Not Observed	No Exceedance	No Exceedance	0 ft	0 ft	n/a	**Rationale 11:** At this location, contaminated material were completely removed as part the 2016 Pacific Terminal Interim Action. For the purposes of the FS, contamination is assumed to be not present at this location.
					1 - 5 ft	<1	Not Observed	No Data	No Data				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition		Chemical Analytical Condition		Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
						Visual Wood Content (%)	Observed Wood Type	Benthic PCUL Exceedance[3]	Human Health PCUL Exceedance[4]				
4	PT5[6]	Jan-2015	-43.9	5 ft	0 - 1 ft	<1	Not Observed	No Exceedance	No Exceedance	0 ft	0 ft	n/a	See Rationale 11.
					1 - 5 ft	<1	Not Observed	No Data	No Data				
4	PT6[6]	Jan-2015	-42.09	2 ft	0 - 1 ft	<1	Not Observed	No Exceedance	No Exceedance	0 ft	0 ft	n/a	See Rationale 11.
					1 - 2 ft	<1	Not Observed	No Data	No Data				
4	PT8[6]	Jan-2015	-42.61	3 ft	0 - 1 ft	<1	Not Observed	No Exceedance	No Exceedance	0 ft	0 ft	n/a	See Rationale 11.
					1 - 3 ft	<1	Not Observed	No Data	No Data				
Sediment Management Area 5													
5	MAF-01	Oct/ Nov-2015	-4.7	23.5 ft	0 - 10 cm	<5	Bark	Acenaphthene, Fluorene, Naphthalene, Dibenzofuran Total PCBs	Arsenic, Cadmium, Lead Total cPAH TEQ Total Dioxin-Like PCB TEQ	20 ft	20 ft	-24.7	See Rationale 5.
					0 - 4 ft	100	Sawdust and Chips	No Data	No Data				
					4 - 6 ft	90	Chips	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Fluorene Naphthalene 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Dibenzofuran, Benzoic Acid	Arsenic, Cadmium Lead, Mercury Total cPAH TEQ				
					6 - 11 ft	50 - 100	Sawdust and Chips	No Data	No Data				
					11 - 20 ft	<1	Lumber	No Data	No Data				
					20 - 22 ft	<1	Not Observed	No Exceedance	No Exceedance				
5	MAF-02	Oct/ Nov-2015	-5.0	23.5 ft	0 - 10 cm	10	Lumber	Acenaphthene Dibenzofuran	Arsenic, Cadmium, Lead Total cPAH TEQ Total Dioxin/Furan TEQ	18 ft	18 ft	-23.0	See Rationale 5.
					0 6 ft	100	Sawdust	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Naphthalene Hexachlorobenzene 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Hexachlorobutadiene Dibenzofuran	Arsenic Lead Mercury				
					6 - 18 ft	25 - 100	Sawdust, Fibers and Lumber	No Data	No Data				
					18 - 20 ft	<1	Not Observed	No Data	No Data				
					20 - 22 ft	<1	Not Observed	No Exceedance	No Exceedance				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
5	MAF-03	Oct/ Nov-2015	-21.2	23.5 ft	0 - 10 cm	50	Sawdust	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Anthracene Fluorene, Naphthalene Phenanthrene, Sum of HPAHs Fluoranthene, Pyrene 2,4-Dimethylphenol 4-Methylphenol (p-Cresol) Dibenzofuran, Total PCBs	Arsenic, Cadmium, Lead Mercury, Total cPAH TEQ Total Dioxin-Like PCB TEQ	20 ft	20 ft	-41.2	See Rationale 5.
					0 - 10 ft	100	Sawdust and Chips	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Anthracene Fluorene, Naphthalene Phenanthrene, Fluoranthene 1,2,4-Trichlorobenzene Bis(2-Ethylhexyl) Phthalate Diethyl Phthalate 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Phenol, Dibenzofuran Benzoic Acid	Arsenic, Cadmium, Lead Mercury, Total cPAH TEQ Total PCBs Total Dioxin-Like PCB TEQ				
					10 - 20 ft	80 - 100	Sawdust, Fibers and Chips	No Data	No Data				
					20 - 21 ft	<1	Not Observed	No Data	No Data				
					21 - 23 ft	<1	Not Observed	No Exceedance	No Exceedance				
5	MAF-04	Oct/ Nov-2015	-15.7	20 ft	0 - 10 cm	75	Sawdust	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Fluorene Naphthalene, Phenanthrene 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Dibenzofuran, Benzyl Alcohol	Arsenic, Cadmium, Lead Total cPAH TEQ Total Dioxin-Like PCB TEQ	15 ft	15 ft	-30.7	See Rationale 5.
					0 - 16 ft	25 - 85	Sawdust and Chips	Sum of LPAHs, 2-Methylnaphthalene, Acenaphthene, Anthracene, Fluorene, Naphthalene, Phenanthrene, Fluoranthene, 2,4-Dimethylphenol, 2-Methylphenol (o-Cresol), 4-Methylphenol (p-Cresol), Phenol, Dibenzofuran, Benzyl Alcohol	Arsenic, Cadmium, Lead, Mercury, Total cPAH TEQ Total Dioxin-Like PCB TEQ				
					10 - 15 ft	25	Sawdust, Chips, and Fibers	No Data	No Data				
					15 - 16 ft	<1	Not Observed	No Data	No Data				
					16 - 18 ft	<1	Not Observed	No Exceedance	No Exceedance				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition		Chemical Analytical Condition		Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
						Visual Wood Content (%)	Observed Wood Type	Benthic PCUL Exceedance[3]	Human Health PCUL Exceedance[4]				
5	MAF-05	Oct/Nov-2015	-5.1	15 ft	0 - 10 cm	<1	Not Observed	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Fluorene Naphthalene, Phenanthrene 2,4-Dimethylphenol Dibenzofuran	Arsenic, Lead Total cPAH TEQ Total Dioxin-Like PCB TEQ	10.5 ft	10.5 ft	-15.6	See Rationale 5.
					0 - 6 ft	100	Chips and Sawdust	Sum of LPAHs, 2-Methylnaphthalene Acenaphthene, Fluorene Naphthalene, Phenanthrene 2,4-Dimethylphenol 4-Methylphenol (p-Cresol) Dibenzofuran	Arsenic, Cadmium, Lead Total cPAH TEQ				
					6 - 10.5 ft	100	Chips and Sawdust	No Data	No Data				
					10.5 - 12 ft	<1	Not Observed	No Data	No Data				
					12 - 14 ft	<1	Not Observed	No Exceedance	No Exceedance				
5	MAF-34	Oct-2015	-10.0	10 cm	0 - 10 cm	<1	Not Observed	Acenaphthene, Dibenzofuran, Total PCBs	Arsenic, Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	n/a	n/a	n/a	See Rationale 6.
5	PT11[6]	Jan-2015	-27.0	13 ft	0 - 3.5 ft	n/a	n/a	n/a (Bedding/Rock Armor Layer)	n/a (Bedding/Rock Armor Layer)	4 ft	4 ft	-31.0	**<u>Rationale 12:</u>** At this location, a portion of the contaminated material was removed as part of the 2016 Pacific Terminal Interim Action. Following dredging, approximately 3.5 feet layer of bedding and armor rock was placed on the dredged surface to cover the exposed contamination. The estimated depth of contamination below mudline presented in this table is referenced to the existing mudline and includes the layer of rock. Rationale that that the volume of contaminated material calculated for the purposes of the FS does not include the armor rock volume.
					3.5 - 4 ft	<5	Chips	No Data	No Data				
					4 - 9 ft	<1	Not Observed	No Data	No Data				
					9 - 10 ft	<1	Not Observed	No Exceedance	No Exceedance				
					10 - 13 ft	<1	Not Observed	No Data	No Data				
5	PT12[6]	Jan-2015	-26.5	12.5 ft	0 - 3.5 ft	n/a	n/a	n/a (Bedding/Rock Armor Layer)	n/a (Bedding/Rock Armor Layer)	7.5 ft	7.5 ft	-34.0	See Rationale 12.
					3.5 - 4.5 ft	10	Unspecified	No Exceedance	Cadmium, Lead Total cPAH TEQ, Total Dioxin/Furan TEQ				
					4.5 - 7.5 ft	10	Unspecified	No Data	No Data				
					7.5 - 12.5 ft	<1	Not Observed	No Data	No Data				
5	PT13[6]	Jan-2015	-24.3	11.5 ft	0 - 3.5 ft	n/a	n/a	n/a (Bedding/Rock Armor Layer)	n/a (Bedding/Rock Armor Layer)	3.5 ft	3.5 ft	-27.8	See Rationale 11.
					3.5 - 4.5 ft	<1	Not Observed	No Data	No Data				
					4.5 - 5.5 ft	<1	Not Observed	No Exceedance	No Exceedance				
					5.5 - 11.5 ft	<1	Not Observed	No Data	No Data				
5	PT14[6]	Jan-2015	-25.4	12.5 ft	0 - 3.5 ft	n/a	n/a	n/a (Bedding/Rock Armor Layer)	n/a (Bedding/Rock Armor Layer)	3.5 ft	3.5 ft	-28.9	See Rationale 11.
					3.5 - 12.5	<1	Not Observed	No Exceedance	No Exceedance				
					4.5 - 12.5 ft	<1	Not Observed	No Data	No Data				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
5	ST109	Oct-2018	-28.8	18 ft	0 - 10 cm	25	Sawdust and Chips	Acenaphthene, Chrysene Fluoranthene, 4-Methylphenol (p-Cresol), Dibenzofuran	Arsenic, Cadmium, Lead Benzo(a)pyrene, Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	9.5 ft	9.5 ft	-38.3	See Rationale 5.
					0 - 8.3 ft	50 - 75	Sawdust and Chips	No Data	No Data				
					8.3 - 9.3 ft	30 - 50	Unspecified	Sum of LPAHs, Acenaphthene Anthracene, Fluorene Phenanthrene, Fluoranthene 2,4-DiMethylphenol Dibenzofuran	Lead, Mercury Total cPAH TEQ Total Dioxin/Furan TEQ				
					9.3 - 11.3 ft	<1	Not Observed	No Data	No Data				
					11.3 - 12.3 ft	<1	Not Observed	No Exceedance	No Exceedance				
					12.3 - 18 ft	< 1	Not Observed	No Data	No Data				
5	ST-1	May-2007	-1.8	8 ft	0 - 8 ft	0 - 5	Twigs and Chips	No Data	No Data	n/a	n/a	n/a	**Rationale 13:** Chemical analytical data is not available at this location. The native contact was either not identified or could not be confirmed because 1) the location does not have chemical analytical data representative of native sediment that meets the PCUL for Marine Area COCs to support the confirmation of the native contact, and/or 2) the location is subject to scour and therefore relying on aged data that may not be representative of current conditions increases the uncertainty in estimating the depth of contamination as a result of high potential of reworking. Due to insufficient information, the depth of contamination could not be estimated at this location.
5	ST-2	May-2007	-32.3	14 ft	0 - 5 ft	10 - 90	Sawdust, Chips and Bark	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					5 - 6 ft	90	Sawdust and Bark	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Anthracene Fluorene, Naphthalene Phenanthrene, Fluoranthene 2,4-DiMethylphenol 2-Methylphenol (o-Cresol) Dibenzofuran	Total cPAH TEQ				
					6 - 6.8 ft	90	Sawdust and Bark	No Data	No Data				
					6.8 - 14 ft	<1	Not Observed	No Data	No Data				
5	ST-3	May-2007	-6.7	18 ft	0 - 3.5 ft	25	Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					3.5 - 6.2 ft	85	Sawdust	Butyl benzyl Phthalate, 2,4-Dimethylphenol, 4-Methylphenol (p-Cresol)	No Exceedance				
					6.2 - 14 ft	85	Sawdust	No Data	No Data				
					14 - 15.9 ft	80	Chips	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Anthracene Fluorene, Naphthalene Phenanthrene, Sum of HPAHs Fluoranthene, Pyrene 2,4-Dimethylphenol Dibenzofuran, Benzyl Alcohol	Total cPAH TEQ				
					15.9 - 18 ft	0 - 10	Chips	No Data	No Data				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition		Chemical Analytical Condition		Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
						Visual Wood Content (%)	Observed Wood Type	Benthic PCUL Exceedance[3]	Human Health PCUL Exceedance[4]				
5	ST-5	May-2007	-15.7	20 ft	0 - 0.9 ft	90	Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					0.9 - 2.5 ft	90	Chips	No Exceedance	Total Dioxin/Furan TEQ				
					2.5 - 5 ft	50	Chips, Twigs, and Bark	No Data	No Data				
					5 - 19 ft	100	Sawdust and Chips	No Data	No Data				
					19 - 20 ft	5	Chips	No Data	No Data				
5	ST-6	May-2007	-5.2	12 ft	0 - 2 ft	30	Fibers and Bark	No Data	No Data	n/a	n/a	n/a	See Rationale 13.
					2 - 12 ft	100	Sawdust and Chips	No Data	No Data				
5	ST-8	May-2007	-16.7	20 ft	0 - 4.4 ft	60	Bark and Fibers	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					4.4 - 7.3 ft	100	Sawdust and Chips	No Data	No Data				
					7.3 - 10.5 ft	100	Sawdust and Chips	Sum of LPAHs, Naphthalene, Butyl benzyl Phthalate, 2,4-Dimethylphenol, 4-Methylphenol (p-Cresol)	No Exceedance				
					10.5 - 18 ft	100	Sawdust and Chips	No Data	No Data				
					18 - 20 ft	<1	Not Observed	No Data	No Data				
5	ST-9	May-2007	-6.6	20 ft	0 - 1.3 ft	10	Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					1.3 - 10.1 ft	100	Sawdust and Chips	No Data	No Data				
					10.1 - 12 ft	100	Sawdust and Chips	No Data	Total Dioxin/Furan TEQ				
					12 - 14.7 ft	80	Bark	No Data	No Data				
					14.7 - 17 ft	20	Bark	No Data	No Data				
					17 - 20 ft	<1	Not Observed	No Data	No Data				
5	ST-11	May-2007	-23.9	20 ft	0 - 6.2 ft	85	Sawdust	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Anthracene Fluorene, Naphthalene Phenanthrene, Sum of HPAHs Benzo(a)anthracene Benzo(a)pyrene Benzofluoranthenes Benzo(g,h,i)perylene Chrysene Dibenzo(a,h)anthracene Fluoranthene Indeno(1,2,3-c,d)pyrene Pyrene, 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) Dibenzofuran, Benzoic Acid Benzyl Alcohol	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 7.
					6.2 - 10.2 ft	85	Sawdust	No Data	No Data				
					10.2 - 20 ft	<1	Not Observed	No Data	No Data				
5	ST-12	May-2007	-7.2	11 ft	0 - 11 ft	100	Sawdust and Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 13.

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
5	ST-14	May-2007	-9.1	20 ft	0 - 3.4 ft	30	Sawdust	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					3.4 - 4.6 ft	90	Sawdust	Naphthalene 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Benzyl Alcohol	No Exceedance				
					4.6 - 9.4 ft	90	Sawdust	No Data	No Data				
					9.4 - 10.5 ft	90	Sawdust	Naphthalene 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol)	No Exceedance				
					10.5 - 12.2 ft	30	Chunks	No Data	No Data				
					12.2 - 20 ft	<1	Not Observed	No Data	No Data				
5	ST-15	May-2007	-23.5	20 ft	0 - 0.8 ft	90	Sawdust and Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					0.8 - 2.2 ft	90	Sawdust and Chips	No Data	Total Dioxin/Furan TEQ				
					2.2 - 7 ft	90	Sawdust and Chips	No Data	No Data				
					7 - 20 ft	<1	n/a	No Data	No Data				
5	ST-17	May-2007	-12.1	18 ft	0 - 5.9 ft	100	Sawdust and Twigs	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					5.9 - 7.1 ft	100	Sawdust and Twigs	No Data	Total Dioxin/Furan TEQ				
					7.1 - 8 ft	100	Sawdust and Twigs	No Data	No Data				
					8 - 14.8 ft	<1	n/a	No Data	No Data				
					14.8 - 18 ft	<5	Unspecified	No Data	No Data				
5	ST-19	May-2007	-11.2	4.25 ft	0 - 4.25 ft	95	Sawdust and Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 13.
5	ST-20	May-2007	-20.9	20 ft	0 - 9.9 ft	50 - 90	Fibers, Sawdust and Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					9.9 - 11.2 ft	90	Sawdust and Chips	Butyl benzyl Phthalate 2,4-DiMethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Benzyl Alcohol	Total cPAH TEQ				
					11.2 - 14 ft	90	Sawdust and Chips	No Data	No Data				
					14 - 15.5 ft	90	Sawdust and Chips	2,4-DiMethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Benzyl Alcohol	Total cPAH TEQ				
					15.5 - 17.5 ft	90	Sawdust and Chips	No Data	No Data				
					17.5 - 20 ft	<1	n/a	No Data	No Data				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
5	ST-21	May-2007	-12.6	20 ft	0 - 9.1 ft	5 - 70	Bark, Fibers and Chips	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					9.1 - 11.2 ft	70	Bark and Fibers	Butyl benzyl Phthalate, 2,4-Dimethylphenol	Total cPAH TEQ				
					11.2 - 12.3 ft	70	Bark and Fibers	No Data	No Data				
					12.3 - 20 ft	<1	n/a	No Data	No Data				
Sediment Management Area 6													
6	MAF-13	Oct-2015	-43.2	6 ft	0 - 10 cm	<1	n/a	No Exceedance	No Exceedance	1 ft	1 ft	-44.2	**Rationale 14:** A sample collected from surface sediment at this location did not identify exceedances of the PCUL. Sample(s) from sub-surface sediment were either not collected or analyzed at this location. The native contact was identified at this location. The depth of contamination at this location is assumed to be at the native contact for the purposes of the FS because of one or more of the following reasons: 1) the presence of contamination was identified in the RI at investigation locations adjacent to this location indicating that there is a potential for contamination to be present in this area above native contact and the location could not be reasonably eliminated from the SMA. 2) The area of this location is subject to scour as evidenced by the scour features in the bathymetric survey confirming uncertainty in the distribution of recent deposits containing contamination in this area. Because of the scour, the shallow subsurface condition is variable and dynamic. 3) sub-surface sediment chemical analytical data is not available at the location. Review of chemical analytical data of adjacent core locations identify that recent deposits (above the native contact) have contamination exceeding the PCULs. Recent deposit material observed at this location is similar to that observed at adjacent core locations and therefore, because of the lack of chemical analytical data, sediment above native contact is considered to be contaminated.
					0 - 1 ft	5	Chips	No Data	No Data				
					1 - 6 ft	<1	n/a	No Data	No Data				
6	MAF-14	Oct-2015	-0.5	4.5 ft	0 - 10 cm	<1	Not Observed	No Exceedance	No Exceedance	4 ft	4 ft	-4.5	See Rationale 14.
					0 - 4.5 ft	<1	Not Observed	No Data	No Data				
6	MAF-18	Oct-2015	-33.4	8 ft	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	6.5 ft	6.5 ft	-39.9	See Rationale 14.
					0 - 8 ft	<1 - 5	Chips and Twigs	No Data	No Data				
6	MAF-55	Nov-2018	-44.0	10 ft	0 - 10 cm	<1	Not Observed	No Exceedance	No Exceedance	0 ft	Surficial	Surficial	**Rationale 15:** A sample collected from surface sediment at this location did not identify exceedances of the PCULs. Sample(s) of sub-surface sediment were either not collected or analyzed at this location. The native contact was identified at the surface at this location. However, there is a potential for contamination to be present because sediments in the area of this location are dynamic and can be redistributed by scour as evidenced by the scour features in the bathymetric survey. Therefore, surficial contamination is assumed to be present at this location for the purposes of the FS.
					0 - 10 ft	<1	Not Observed	No Data	No Data				
6	MAF-56	Nov-2018	-45.3	10 ft	0 - 10 cm	<1	Not Observed	No Exceedance	No Exceedance	0 ft	Surficial	Surficial	See Rationale 15.
					0 - 4 ft	<5	Unspecified	No Exceedance	No Exceedance				
					0 - 10 ft	<1	Unspecified	No Data	No Data				
6	MAF-57	Nov-2018	-38.9	10 ft	0 - 10 cm	<1	Twigs	No Exceedance	Total cPAH TEQ Total Dioxin/Furan TEQ	2 ft	2 ft	-40.9	See Rationale 5.
					0 - 2 ft	15	Twigs	No Exceedance	Total cPAH TEQ Total Dioxin/Furan TEQ				
					2 - 4 ft	< 1	Not Observed	No Exceedance	No Exceedance				
					4 - 10 ft	<1	Not Observed	No Data	No Data				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
6	MAF-60	Nov-2018	-38.7	14.5 ft	0 - 10 cm	<1	Twigs	Acenaphthene, Fluorene Dibenzofuran	Total cPAH TEQ Total Dioxin/Furan TEQ	6.5 ft	6.5 ft	-45.2	See Rationale 5.
					0 - 4 ft	10 - 15	Fibers	No Data	No Data				
					4 - 6 ft	10	Fibers	Acenaphthene Dibenzofuran	Total cPAH TEQ, Total Dioxin-Like PCB TEQ, Total Dioxin/Furan TEQ				
					6 - 8 ft	<1	Not Observed	No Data	No Data				
					8 - 10 ft	<1	Not Observed	No Exceedance	No Exceedance				
					10 - 14.5 ft	<1	Not Observed	No Data	No Data				
6	MAF61	Nov-2018	-44.0	10 ft	0 - 10 cm	<5	Bark and Chips	No Data	Total cPAH TEQ	0.5 ft	0.5 ft	-44.5	See Rationale 8.
					0 - 2 ft	<5	Bark	No Data	No Data				
					2 - 10 ft	<1	Not Observed	No Data	No Data				
6	PT10[6]	Jan-2015	-29.2	15 ft	0-3.5 ft	n/a	Not Observed	Bedding/Rock Armor Layer	Bedding/Rock Armor Layer	7.5 ft	7.5 ft	-36.7	See Rationale 12.
					3.5-6.5 ft	20 - 50	Sawdust, Chips and Lumber	No Data	No Data				
					6.5-7.5 ft	20	Chips and Lumber	No Exceedance	Total cPAH TEQ				
					7.5-15 ft	<1	Not Observed	No Data	No Data				
6	ST101	Oct-2018	-33.7	18 ft	0 - 10 cm	<1	Not Observed	No Exceedance	Total cPAH TEQ	13.5 ft	13.5 ft	-47.2	See Rationale 5.
					0 - 13.2 ft	0 - 10	Unspecified	No Data	No Data				
					13.2 - 14.2 ft	<1	Not Observed	No Exceedance	No Exceedance				
					14.2 - 18 ft	<1	Not Observed	No Data	No Data				
6	ST102	Oct-2018	-15.8	10.5 ft	0 - 10 cm	<1	Not Observed	No Exceedance	No Exceedance	9 ft	9 ft	-24.8	See Rationale 5.
					0 - 6.3 ft	0 - 10	Twigs, Fibers and Chips	No Data	No Data				
					6.3 - 7.3 ft	<1	Not Observed	No Exceedance	Lead Total Dioxin/Furan TEQ				
					7.3 - 8.3 ft	<1	Not Observed	No Exceedance	Total Dioxin/Furan TEQ				
					8.3 - 9.3 ft	<1	Not Observed	No Data	No Data				
					9.3 - 10.3 ft	<1	Not Observed	No Exceedance	No Exceedance				
					10.3 - 10.5 ft	<1	Not Observed	No Data	No Data				
6	ST103	Oct-2018	-12.9	18 ft	0 - 10 cm	<1	Not Observed	No Exceedance	No Exceedance	15.5 ft	15.5 ft	-28.4	See Rationale 14.
					0 - 15.5 ft	0 - 10	Twigs, Bark and Chips	No Data	No Data				
					15.5 - 17.7 ft	<1	Not Observed	No Data	No Data				
6	ST104	Oct-2018	-17.1	19 ft	0 - 10 cm	<1	Not Observed	No Exceedance	Total cPAH TEQ	12 ft	12 ft	-29.1	See Rationale 8.
					0 - 7.3 ft	<1	Not Observed	No Data	No Data				
					7.3 - 8.3 ft	10	Twigs and Chips	No Exceedance	Lead				
					8.3 - 9.3 ft	10	Twigs and Chips	No Exceedance	Lead, Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ				
					9.3 - 11.3 ft	5 - 10	Twigs and Chips	4-Methylphenol (p-Cresol)	Lead, Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ				
					11.3 - 19 ft	<1	Not Observed	No Data	No Data				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
6	ST105	Oct-2018	-34.2	19 ft	0 - 10 cm	<1	Not Observed	No Exceedance	Total cPAH TEQ	11 ft	11 ft	-45.2	See Rationale 5.
					0 - 11 ft	<1 - 5	Unspecified	No Data	No Data				
					11 - 12 ft	<1	Not Observed	No Exceedance	No Exceedance				
					12 - 19 ft	<1	Not Observed	No Data	No Data				
6	ST106	Oct-2018	-20.0	16 ft	0 - 10 cm	<1	Not Observed	No Exceedance	Total cPAH TEQ	7.5 ft	7.5 ft	-27.5	See Rationale 8.
					0 - 3.1 ft	<1	Not Observed	No Data	No Data				
					3.1 - 4.1 ft	<1	Not Observed	No Exceedance	Total cPAH TEQ				
					4.1 - 5.1 ft	<1	Not Observed	No Exceedance	Total cPAH TEQ, Total Dioxin/Furan TEQ				
					6.1 - 7.1 ft	<1	Not Observed	Bis(2-Ethylhexyl) Phthalate	Total cPAH TEQ, Total Dioxin/Furan TEQ				
					7.5 - 16 ft	<1	Not Observed	No Data	No Data				
6	ST107	Oct-2018	-36.7	14.5 ft	0 - 10 cm	<1	Not Observed	No Exceedance	Total cPAH TEQ	4 ft	4 ft	-40.7	See Rationale 5.
					0 - 4.2 ft	<1	Not Observed	No Data	No Data				
					4.2 - 5.2 ft	<1	Not Observed	No Exceedance	No Exceedance				
					5.2 - 9.3 ft	<1	Not Observed	No Data	No Data				
					9.3 - 10.3 ft	<1	Not Observed	No Exceedance	No Exceedance				
					10.3 - 14.5 ft	<1	Not Observed	No Data	No Data				
6	ST108	Oct-2018	-37.0	16 ft	0 - 10 cm	<1	Not Observed	Acenaphthene, Chrysene Dibenzofuran	Arsenic, Lead, Total cPAH TEQ Total Dioxin/Furan TEQ	8 ft	8 ft	-45.0	See Rationale 5.
					0 - 6.6 ft	30 - 50	Unspecified	No Data	No Data				
					6.6 - 7.6 ft	<1	Not Observed	Zinc, Phenanthrene, 2,4-Dimethylphenol, 4-Methylphenol (p-Cresol) Dibenzofuran	Cadmium, Lead, Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ				
					7.6 - 8.6 ft	<1	Not Observed	No Data	No Data				
					8.6 - 9.6 ft	<1	Not Observed	No Exceedance	No Exceedance				
					9.6 - 16 ft	<1	Not Observed	No Data	No Data				
6	ST-23	May-2007	-3.1	20 cm	0 - 20 cm	<1	Not Observed	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
6	ST-24	May-2007	-41.8	0.8 ft	0 - 0.8 ft	<1	Not Observed	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 6.
6	ST-25	May-2007	-30.7	20 cm	0 - 20 cm	<1	Not Observed	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
6	ST-26	May-2007	-47.5	n/a	n/a	<1	Not Observed	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
6	ST-27	May-2007	-40.5	20 cm	0 - 20 cm	10	Twigs	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
6	ST-29	May-2007	-44.8	9.5 ft	0 - 10 cm	5	Twigs	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 7.
					10 cm - 4 ft	5	Twigs	No Data	No Data				
					4 - 9.5 ft	<1	n/a	No Data	No Data				
6	ST-34	May-2007	-51.7	10 ft	0 - 10 cm	15	Chips	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 7.
					0 - 2.8 ft	15	Chips	Acenaphthene Phenanthrene Fluoranthene	Arsenic, Cadmium, Lead Total cPAH TEQ Total PCBs				
					2.8 - 4.5 ft	15	Chips	No Data	No Data				
					4.5 - 10 ft	<1	n/a	No Data	No Data				
6	ST-35	May-2007	-32.9	0.6 ft	0 - 0.6 ft	100	Unspecified	No Data	No Data	n/a	n/a	n/a	See Rationale 1.

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
6	ST-37	May-2007	-36.9	10 cm	0 - 10 cm	30	Chips	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 7.
				10 ft	0 - 2.8 ft	30	Chips	No Data	No Data				
					2.8 - 6.8 ft	15	Fibers	No Data	No Data				
					6.8 - 10 ft	<1	Not Observed	No Data	No Data				
6	ST-39	May-2007	-50.6	10 ft	0 - 10 cm	5	Twigs, Fibers and Chunks	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 7.
					0 - 4 ft	5	Twigs, Fibers and Chunks	Total PCBs	Cadmium, Lead Total cPAH TEQ				
					4 - 5.9 ft	5	Twigs, Fibers and Chunks	No Data	No Data				
					5.9 - 10 ft	<1	Not Observed	No Data	No Data				
6	ST-43	May-2007	-39.0	14 ft	0 - 3.1 ft	30	Fibers	No Data	No Data	n/a	n/a	n/a	See Rationale 7.
					3.1 -4.4 ft	5	Fibers	No Data	No Data				
					4.4 - 5.7 ft	100	Sawdust and Chunks	No Data	No Data				
					5.7 - 7.2 ft	100	Sawdust and Chunks	Mercury, Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Anthracene Fluorene, Naphthalene Phenanthrene, Sum of HPAHs Benzo(a)anthracene Benzo(a)pyrene Benzofluoranthenes Chrysene, Fluoranthene Pyrene, 1,2-Dichlorobenzene Butyl benzyl Phthalate 2,4-DiMethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Dibenzofuran	Total cPAH TEQ				
					7.2 - 8.1 ft	100	Sawdust and Chunks	No Data	No Data				
					8.1 - 14 ft	<1	Not Observed	No Data	No Data				
6	ST-44	May-2007	-27.0	19 ft	0 - 2.4 ft	<1	Not Observed	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
					2.4 - 7.8 ft	25-30	Bark and Twigs	No Data	No Data				
					7.8 - 12.7 ft	90	Bark and Chunks	No Data	No Data				
					12.7 - 19 ft	<1	Not Observed	No Data	No Data				
6	North DMMU Area (ST-108 and ST-109)	Oct-2018	Varies	Varies	6.2 - 9.3 ft	<1	Not Observed	Sum of LPAHs 2-Methylnaphthalene Acenaphthene, Anthracene Fluorene, Naphthalene Phenanthrene, Sum of HPAHs Fluoranthene, Pyrene 2,4-Dimethylphenol 4-Methylphenol (p-Cresol) Dibenzofuran	Cadmium, Lead, Mercury Total cPAH TEQ Total Dioxin/Furan TEQ	Varies	See investigation locations ST-108 and ST-109	See investigation locations ST-108 and ST-109	**Rationale 16:** North DMMU Area sample is a composite sample collected from investigation locations ST-108 and ST-109. See Rationales for investigation locations ST-108 and ST-109.

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition		Chemical Analytical Condition		Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
						Visual Wood Content (%)	Observed Wood Type	Benthic PCUL Exceedance[3]	Human Health PCUL Exceedance[4]				
6	South DMMU Area (ST-101 through ST-107)	Oct-2018	Varies	Varies	2 - 3.7 ft	<1	Not Observed	No Exceedance	No Exceedance	Varies	See investigation locations ST-101 and ST-107	See investigation locations ST-101 and ST-107	**Rationale 17:** South DMMU Area sample(s) are composite of sample(s) collected from investigation locations ST-101 through ST-107. See Rationales for investigation locations ST-101 through ST-107.
					3.7 - 13.7 ft	<1	Not Observed	4-Methylphenol (p-Cresol) Hexachlorobutadiene	Lead, Mercury, Total cPAH TEQ, Total Dioxin-Like PCB Congeners TEQ, Total Dioxin/Furan TEQ				
					6.8 - 10.8 ft	<1	n/a	No Exceedance	Total Dioxin/Furan TEQ				
Sediment Management Area 7													
7	MAF-15	Oct-2015	7.3	10 cm	0 - 10 cm	<1	Bark	No Exceedance	Total Dioxin/Furan TEQ	4 ft	4 ft	3.3	See Rationale 3.
				7.5 ft	0 - 2 ft	<5	Bark and Chips	No Exceedance	Arsenic Total cPAH TEQ				
					2 - 4 ft	<1	n/a	No Data	No Data				
					4 - 7.5 ft	<1	Chips	No Data	No Data				
Sediment Investigation Locations Outside Sediment Management Areas													
Outside SMA	MAF-50	Sep-2016	-66.8	10 cm	0 - 10 cm	<1	Unspecified	No Data	Total cPAH TEQ	n/a	n/a	n/a	**Rationale 18:** This investigation location is situated outside of the Marine Area SMA. Contamination observed at this location is not considered associated with Mill A Site as identified in the RI. Environmental data at this location is not applicable for contamination depth estimation at the Marine Area.
Outside SMA	MAF-51	Sep-2016	-42.9	10 cm	0 - 10 cm	25	Chips and Bark	No Data	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 18.
Outside SMA	MAF-52	Sep-2016	-102.2	10 cm	0 - 10 cm	35	Bark	No Data	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 18.
Outside SMA	MAF-53	Sep-2016	-38.6	10 cm	0 - 10 cm	65	Chips and Bark	No Data	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 18.
Outside SMA	MAF-54	Sep-2016	-45.7	10 cm	0 - 10 cm	<1	Unspecified	No Data	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 18.
Outside SMA	A1-18	Aug-2008	-98.0	11.5 ft	0 - 10 cm	5	Fibers	No Exceedance	No Exceedance	n/a	n/a	n/a	See Rationale 18.
					0 - 1 ft	5	Fibers	No Data	No Data				
					1 - 3 ft	<1	n/a	No Exceedance	Total cPAH TEQ				
					3 - 5 ft	3	Fibers	No Exceedance	No Exceedance				
					5 - 11.5 ft	<5	Twigs, Fibers, Chunks	No Data	No Data				
Outside SMA	A1-23	Aug-2008	-233.0	15 cm	0 - 10 cm	<1	n/a	No Exceedance	Total cPAH TEQ	n/a	n/a	n/a	See Rationale 18.
					10 - 15 cm	<1	n/a	No Data	No Data				
Outside SMA	A1-31	Aug-2008	-8.6	12 cm	0 - 10 cm	<1	n/a	No Exceedance	No Exceedance	n/a	0 ft	n/a	**Rationale 19:** This investigation location is situated outside of the Marine Area SMA. The surface sample at this location did not identified exceedance of the PCULs for the COCs analyzed. Based on the available data, contamination exceeding the PCULs is assumed to be not present at this location, for the purposes of the FS.
					10 - 12 cm	<1	n/a	No Data	No Data				
Outside SMA	EW-12-05	Jun-2012	-48.5	17 cm	0 - 17 cm	<1	n/a	Copper	Lead	n/a	n/a	n/a	See Rationale 18.
Outside SMA	EW-12-06	Jun-2012	-57.1	17 cm	0 - 17 cm	<1	n/a	No Exceedance	No Exceedance	0 ft	0 ft	n/a	See Rationale 19.
Outside SMA	MAF-07	Oct-2015	-41.2	5 ft	0 - 10 cm	5	Chips	No Exceedance	No Exceedance	1.5 ft	0 ft	n/a	See Rationale 19.
					0 - 1.5 ft	10	Chips	No Data	No Data				
					1.5 - 5 ft	<1	n/a	No Data	No Data				
Outside SMA	MAF-08	Oct-2015	-44.6	10 cm	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	n/a	0 ft	n/a	See Rationale 19.

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition		Chemical Analytical Condition		Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
						Visual Wood Content (%)	Observed Wood Type	Benthic PCUL Exceedance[3]	Human Health PCUL Exceedance[4]				
Outside SMA	MAF-16	Oct-2015	10.1	4 ft	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	2 ft	0 ft	n/a	See Rationale 19.
					0 - 4 ft	<1	n/a	No Data	No Data				
Outside SMA	MAF-17	Oct-2015	0.5	9 ft	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	3 ft	0 ft	n/a	See Rationale 19.
					0 - 2 ft	<5	Unspecified	No Data	No Data				
					2 - 9 ft	<1	n/a	No Data	No Data				
Outside SMA	MAF-23	Oct-2015	-2.1	10 ft	0 - 10 cm	<1	Bark	No Exceedance	No Data	9 ft	0 ft	n/a	See Rationale 19.
					0 - 2 ft	<5	Chips	No Data	No Data				
					2 - 10 ft	<1	Chips, Bark and Twigs	No Data	No Data				
Outside SMA	MAF-24	Oct-2015	4.9	5 ft	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	2 ft	0 ft	n/a	See Rationale 19.
					0 - 5 ft	<1	n/a	No Data	No Data				
Outside SMA	MAF-25	Oct-2015	4.0	4 ft	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	2 ft	0 ft	n/a	See Rationale 19.
					0 - 4 ft	<1	Bark	No Data	No Data				
Outside SMA	MAF-26	Oct-2015	9.7	3 ft	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	3 ft	0 ft	n/a	See Rationale 19.
					0 - 3 ft	<1	Twigs	No Data	No Data				
Outside SMA	MAF-27	Oct-2015	9.4	3.5 ft	0 - 10 cm	<1	Bark	No Exceedance	No Exceedance	2 ft	0 ft	n/a	See Rationale 19.
					0 - 3.5 ft	<1	n/a	No Data	No Data				
Outside SMA	MAF-28	Oct-2015	8.7	8 ft	0 - 10 cm	<1	Bark	No Exceedance	No Data	4 ft	0 ft	n/a	See Rationale 19.
					0 -8 ft	<1	Bark	No Data	No Data				
Outside SMA	MAF-29	Oct-2015	4.0	8 ft	0 - 10 cm	<1	Bark	No Exceedance	No Data	2 ft	0 ft	n/a	See Rationale 19.
					0 - 8 ft	<1	n/a	No Data	No Data				
Outside SMA	MAF-30	Oct-2015	2.0	10 ft	0 - 10 cm	<1	Bark	No Exceedance	No Data	7 ft	0 ft	n/a	See Rationale 19.
					0 - 10 ft	<1	Chips and Fibers	No Data	No Data				
Outside SMA	MAF-40	Sep-2016	-165.3	16 cm	0 - 10 cm	<1	Unspecified	No Data	No Exceedance	n/a	0 ft	n/a	See Rationale 19.
					10 - 16 cm	<1	Unspecified	No Data	No Data				
Outside SMA	MAF-43	Sep-2016	-138.7	25 cm	0 - 10 cm	<1	Unspecified	No Data	No Exceedance	n/a	0 ft	n/a	See Rationale 19.
					10 - 25 cm	<1	Unspecified	No Data	No Data				
Outside SMA	MAF-47	Sep-2016	-49.5	25 cm	0 - 10 cm	<1	Unspecified	No Data	No Exceedance	n/a	0 ft	n/a	See Rationale 19.
					10 - 25 cm	<1	Unspecified	No Data	No Data				
Outside SMA	MAF-48	Sep-2016	-110.0	26 cm	0 - 10 cm	<1	Unspecified	No Data	No Exceedance	n/a	0 ft	n/a	See Rationale 19.
					10 - 26 cm	<1	Unspecified	No Data	No Data				
Outside SMA	MAF-49	Sep-2016	-55.8	25 cm	0 - 10 cm	<1	Unspecified	No Data	No Exceedance	n/a	0 ft	n/a	See Rationale 19.
					10 - 25 cm	<1	Unspecified	No Data	No Data				
Outside SMA	PG-62	Apr-2014	-302.2	10 cm	0 - 10 cm	<1	n/a	No Exceedance	No Exceedance	n/a	0 ft	n/a	See Rationale 19.
Outside SMA	ST-22	May-2007	0.9	n/a	n/a	<1	n/a	No Data	No Data	n/a	n/a	n/a	See Rationale 1.
Upland Area Investigation Locations Adjacent to the Marine Area													
Uplands	EDP36	Jun-2016	19.3	25 ft	0 - 23 ft	n/a	Chips, Chunks, Sawdust, Lumber and Bark	n/a	n/a	23 ft	n/a	n/a	**Rationale 20:** Upland boring locations located adjacent to the Marine Area were used to estimate the depth of contamination based on the elevation of the native contact.
					23 - 25 ft	n/a	Not Observed	n/a	n/a				

SMA	Investigation Location[1]	Investigation Date	Mudline Elevation[2] (ft MLLW)	Investigation Depth (dbm)	Sample/ Depth Interval (dbm)	Observed Wood Condition: Visual Wood Content (%)	Observed Wood Condition: Observed Wood Type	Chemical Analytical Condition: Benthic PCUL Exceedance[3]	Chemical Analytical Condition: Human Health PCUL Exceedance[4]	Native Sediment Contact[5] (dbm)	Estimated Depth of Contamination (dbm)	Estimated Base of Contamination (ft MLLW)	Rationale
Uplands	EDP44	Jun-2016	18.4	30 ft	0 - 24 ft	n/a	Chips and Lumber	n/a	n/a	24 ft	n/a	n/a	See Rationale 20.
					24 - 30 ft	n/a	Not Observed	n/a	n/a				
Uplands	EST09	Jan-2010	17.9	25 ft	0 - 22.5 ft	n/a	Bark	n/a	n/a	22.5 ft	n/a	n/a	See Rationale 20.
					22.5 - 25 ft	n/a	Unspecified	n/a	n/a				
Uplands	EST10	Jan-2010	17.7	26.5 ft	0 - 25 ft	n/a	Lumber	n/a	n/a	25 ft	n/a	n/a	See Rationale 20.
					25 - 26.5 ft	n/a	Unspecified	n/a	n/a				
Uplands	EST10D	Aug-2016	18.3	35 ft	0 - 25.5 ft	n/a	Logs, Lumber, Fibers and Chips	n/a	n/a	25.5 ft	n/a	n/a	See Rationale 20.
					25.5 - 30 ft	n/a	Not Observed	n/a	n/a				
Uplands	EST11	Jan-2010	17.5	66.25 ft	0 - 29 ft	n/a	Sawdust, Fibers, Bark and Chunks	n/a	n/a	29 ft	n/a	n/a	See Rationale 20.
					29 - 66.25 ft	n/a	Not Observed	n/a	n/a				
Uplands	EST11D	Aug-2016	17.6	40 ft	0 - 28 ft	n/a	Sawdust, Fibers, Logs, Lumber and Chunks	n/a	n/a	28 ft	n/a	n/a	See Rationale 20.
					28 - 40 ft	n/a	Not Observed	n/a	n/a				
Uplands	EST12	Jan-2010	18.0	75.5 ft	0 - 27 ft	n/a	Lumber and Chunks	n/a	n/a	27 ft	n/a	n/a	See Rationale 20.
					27 - 75.5 ft	n/a	Chunk to Not Observed	n/a	n/a				
Uplands	EST13	Jan-2010	17.5	24.5 ft	0 - 21.5 ft	n/a	Unspecified	n/a	n/a	21.5 ft	n/a	n/a	See Rationale 20.
					21.5 - 24.5 ft	n/a	Not Observed	n/a	n/a				

Notes:

[1] Sample locations shown in Figure 71.

[2] Mudline elevation based on bathymetric surveys completed by Pacific Geomatic Services Inc. in December 2014 incorporating the Tetra Tech February 2017 bathymetric survey following completion of the 2016/2017 Pacific Terminal Interim Action dredging.

[3] Contaminant exceedances for the protection of benthic organisms (Benthic PCUL) referenced from Table 6.

[4] Contaminant exceedances for the protection of human health and higher level trophic ecological receptors (Human Health PCUL) referenced from Table 7.

[5] Native sediment contact was determined based on sediment stratigraphy observed in the core log and chemical analytical results of samples collected at the investigation location. Additionally, stratigraphy and chemical analytical information from neighboring locations were also considered if the information at an investigation location was insufficient in interpreting the native contact.

[6] Contaminated sediment and observed wood debris were dredged at this location in conjunction with the 2016/2017 Pacific Terminal Interim Action. Mudline elevations referenced by the sediment core log no longer represent current conditions. The approximate investigation depth indicated is based on the existing post-interim action mudline elevation.

bml = below mudline

cm = centimeter

cPAH = carcinogenic polycyclic aromatic hydrocarbon

FS = Feasibility Study

ft = feet

MLLW = Mean Lower Low Water

n/a = not applicable

PCB = polychlorinated biphenyl

PCUL = Proposed Cleanup Level

SMA = Sediment Management Areas

TEQ = toxic equivalent quotient

Table 9

Applicable or Relevant and Appropriate Requirements

Weyerhaeuser Mill A Former
Everett, Washington

Authorizing Statute and Implementing Regulation	Citation	Description, Procedural/Substantive Requirements	Applicability
Federal ARARs			
Clean Air Act (CAA)	42 United States Code (USC) 7401 et seq. 40 Code of Federal Regulations (CFR) 50	Provides air quality standards for six criteria pollutants, including particulate matter, to protect public health and welfare. The requirements of the Clean Air Act are administered by a local agency - Northwest Clean Air Agency.	Air emission permits are required at MTCA cleanup sites if air emissions are sufficient enough to trigger the need for Title V air operating permits (7661A), prevention of significant deterioration permits (7475), or nonattainment new source review permits (7502(c)(5)). These permits are mandated by the Federal Clean Air Act (42 U.S.C.) and are required because an exemption would result in the state's loss of federal authorization to implement these permitting requirements in Washington.
Clean Water Act (CWA)	Section 401 - Water Quality Certification	Section 401 requires that any activity which may result in a discharge into the navigable waters shall obtain a certification from the Washington State Department of Ecology that the water quality standards will be met.	These requirements are applicable to proposed remedial alternatives that consist of in-water dredging, filling, capping and/or enhanced natural recovery (ENR) actions. The requirements will be identified by preparing Joint Aquatic Resource Permit Application (JARPA) for Washington State Department of Ecology's review to obtain 401 Water Quality Certification.
	Section 404 - Dredge and Fill Regulations	Section 404 requires a permit for the discharge of dredge or fill material into waters of the United States, including filling or construction activities in navigable waters and wetlands.	These requirements are applicable to proposed remedial alternatives that include in-water dredging, filling, capping and/or enhanced natural recovery (ENR) actions. The requirements will be identified by preparing JARPA for U.S Army Corps of Engineers (USACE) review to obtain coverage under an USACE Nationwide Permit (NWP) 38. NWP 38 applies to the "Cleanup of Hazardous and Toxic Waste" or standalone permit.
Endangered Species Act (ESA)	16 USC. 1531 – 1544 50 CFR Parts 17, 402	Provides for the protection of species of fish, wildlife, and plants that are listed as threatened or endangered with extinction. It also protects designated critical habitat for listed species. The Act outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species, including consultation with resource agencies.	Applicable to the site for listed and proposed to be listed threatened or endangered species and their habitat areas which will, or could, be impacted by cleanup action. The requirements include consultation with United States Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) Fisheries, and Ecology to evaluate whether threatened or endangered species will be impacted. This consultation will be coordinated by USACE as part of coverage under the CWA Section 404 Nationwide Permit 38. Based on consultation, development of a biological assessment (BA) or biological opinion (BO) may be needed to demonstrate compliance.
Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)	16 USC 1801 et. seq., 50 CFR Part 600	The MSFCMA was adopted to conserve and manage the fishery resources found off the coasts of the United States and the anadromous species and Continental Shelf fishery resources of the United States by protecting essential fish habitat.	Applicable to alternatives that have potential to impact habitat covered under MSFCMA. The requirements include consultation with USFWS, NOAA Fisheries, and Ecology to evaluate MSFCMA requirements. This consultation will be coordinated with the Endangered Species Act consultation by USACE as part of coverage under the CWA Section 404 Nationwide Permit 38. Based on consultation, development of a BA or BO may be needed to demonstrate compliance.
Federal Coastal Zone Management Act (CZMA)	16 USC 1451-1464 15 CFR 923-930	The CZMA requires that federal agency action that is reasonably likely to affect use of shorelines be consistent with the approved coastal zone management plan to the maximum extent practicable, subject to limitations set forth in the CZMA.	Applicable if construction is completed within 200 feet of the shoreline. These requirements are applicable to proposed remedial alternatives that include in-water dredging, filling, capping and/or ENR actions. The requirements will be met by preparing a CMZA form for Washington State Department of Ecology's review. Ecology reviews the proposed project for consistency with state environmental requirements, including shoreline permitting requirements.
Fish and Wildlife Conservation Act (FWCA)	16 USC. 661 et seq 50 CFA 83	Requires that adequate provision must be made for the conservation, maintenance, and management of wildlife resources and habitat and requires consultation with the USFWS and appropriate state agencies.	Applicable to the site if listed threatened or endangered species habitat areas will, or could, be impacted by cleanup action. Requirements of the FWCA will be evaluated in conjunction with the ESA consultation with USFWS and NOAA Fisheries.
Occupational Safety and Health Act (OSHA)	29 CFR 1904 29 CFR 1910 29 CFR 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations, including training and construction safety requirements.	Applicable to construction phases of a cleanup. Construction activities will be conducted in accordance with the requirements of OSHA.
Identification and Management of Hazardous Wastes	40 CFR 261 et seq.	Specifies how to determine whether a solid waste is considered hazardous (whether listed or based on characteristic) and how to manage hazardous wastes.	Applicable to remedial alternatives that involve dredging of contaminated sediment and wood debris. Dredged sediment will be evaluated in accordance with the requirement of Resource Conservation and Recovery Act (RCRA) to determine hazardous waste designation of the material for the purposes of appropriate management, transport and disposal of dredged material.

Authorizing Statute and Implementing Regulation	Citation	Description, Procedural/Substantive Requirements	Applicability
State ARARs			
Model Toxics Control Act (MTCA) Cleanup Regulation	Revised Code of Washington (RCW) 70.105D Chapter 173-340 Washington Administrative Code (WAC)	MTCA is the primary regulation governing cleanup actions.	Cleanup actions conducted by Ecology under MTCA are exempt from the procedural requirements of most state and local laws/permits; however, must meet substantive requirements of the laws/permits.
Sediment Management Standards (SMS)	Chapter 70.105D RCW Chapter 90.48 RCW Chapter 173-204 WAC	SMS is the primary regulation governing sediment cleanup actions.	MTCA is one of the authorities defining the SMS; thus, waivers of state and local laws/permits also apply to sediment cleanups.
State Environmental Policy Act (SEPA)	Chapter 43.21C RCW Chapter 173-802 WAC Chapter 197-11 WAC	SEPA (Chapter 43.21C RCW; WAC 197-11) and the SEPA procedures (WAC 173-802) are intended to ensure that state and local government officials consider environmental values when making decisions. Prior to taking any action on a proposal, including initiating a remedial construction activity, agencies must follow specific procedures to ensure that appropriate consideration has been given to the environment. This includes issuing an environmental determination and holding a public comment period. If there is a probable significant adverse environmental impact associated with the project, then a Determination of Significance is issued, and an Environmental Impact Statement (EIS) is required. If there is no probable significant adverse environmental impact associated with the project, then a Determination of Non-Significance is issued.	Applicable. A SEPA checklist and determination is required prior remedial construction activities.
Archeological Sites and Resources, Archeological Excavation and Removal Permit	Chapter 27.53 RCW Chapter 25-46 WAC Chapter 25-48 WAC	Prohibits the unauthorized disturbance of cultural and archaeological resources without a permit, and any archaeological investigations and monitoring at a site must be conducted by a professional archeologist. Agencies are required to notify the Department of Archaeology and Historic Preservation (DAHP), the Governor's Office of Indian Affairs (GOIA), and concerned tribes and provide them an opportunity to review and provide comments about potential project impacts.	Potentially applicable to a site where response actions involve disturbance or alteration of the ground and/or site terrain. Appropriate measures will be taken to evaluate the presence of cultural and archeological resources. If a potential for an existence of cultural or archeological resources exists, then appropriate measures will be taken during excavation/dredging activities and appropriate tribal members will be contacted if an artifact is encountered.
Construction Stormwater General Permit (CSWGP), Water Pollution Control Act	Chapter 90.48 RCW	Coverage under the CSWGP is generally required for any clearing, grading, or excavating if the project site discharges a) Stormwater from the site into surface waters of the State, or b) Stormwater into storm drainage systems that discharge to surface waters of the State. And c) Disturbs one or more acres of land area (including off Site disturbance acreage), or d) Disturb less than one acre of land area, if the project or activity is part of a larger common plan of development or sale, if the common plan of development or sale will ultimately disturb one or more acres.	Applicable if the cleanup action meets the identified criteria under Description, Procedural/Substantive Requirements. If required, the project will obtain coverage under the CSWGP. In addition, a stormwater pollution prevention plan (SWPPP) will be prepared before start of land disturbing activities, which will describe the best management practices (BMPs) that will be implemented to protect surface water quality.
Washington Hydraulic Project Approval (HPA)	Chapter 77.55.061 RCW Chapter 220-110 WAC	HPA and associated requirements for construction projects in state waters have been established for the protection of fish and shellfish. Any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state requires an HPA.	Substantive requirements of HPA are applicable. These requirements are applicable to proposed remedial alternatives that consist of in-water dredging, filling, capping and/or include ENR actions. The requirements will be identified by preparing JARPA for the Washington Department of Fish and Wildlife (WDFW) review. The substantive requirements of an HPA include restrictions on dates of in-water work (in-water windows) to protect fish species at critical life history stages (e.g., spawning season for salmonids). For cleanup action alternatives in marine waters, the in-water work windows will be utilized during performance of the cleanup action.
Shoreline Management Act	Chapter 90.58 RCW Chapter 173-27-060 WAC	The Shoreline Management Act and its implementing regulations establish requirements for substantial developments occurring within waters of the state or within 200 feet of the shoreline. Local shoreline management programs are adopted under state regulations, creating an enforceable state law.	Applicable to remedial alternatives that include activities within 200 feet of the shoreline. Cleanup actions under MTCA are exempt from shoreline management act permitting set forth for Shorelands under RCW 90.58; however, will need to meet substantive requirements. The City of Everett has set forth requirements based on local considerations such as shoreline use, economic development, public access, circulation, recreation, conservation, and historical and cultural features. The Port and Potentially Liable Parties (PLPs) must work with the City of Everett to meet the substantive requirements set forth in their Shoreline Master Program prior to initiating the cleanup action. The Shoreline Master Program must be consistent with the policies and requirements of the Shoreline Management Act and the State Shoreline Master Program Guidelines.

Authorizing Statute and Implementing Regulation	Citation	Description, Procedural/Substantive Requirements	Applicability
Solid Waste Management, Dangerous Waste Regulations	Chapter 70A.205 RCW Chapter 70.105 RCW Chapter 173-303 WAC	Governs solid and dangerous waste handling and management, including identification, accumulation, storage, transport, treatment, and disposal.	The project is exempt from the procedural requirements for state-only designated dangerous waste set forth in RCW 70.105 but must meet the substantive requirements for designating state-only dangerous waste. The project is exempt from the procedural requirements for solid waste set forth in RCW 70A.205. The project must follow the substantive requirements for waste designation, handling, and disposal of solid waste set forth by the receiving facility. The receiving facility must provide permission to dispose of waste at the facility prior to delivering waste to the intended destination. The Port and PLP is required to designate waste and if dangerous waste is present, manage and dispose of the dangerous waste based on generator status and the requirements set forth by your chosen permitted disposal facility.
Washington Industrial Safety and Health Act (WISHA)	Chapter 49.17 RCW Chapter 296-62 WAC Chapter 296-843 WAC	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations, including training and construction safety requirements.	Applicable to construction phases of a cleanup. Construction activities will be conducted in accordance with the requirements of WISHA.
Local ARARs			
City of Everett Noise Control	Chapter 20.08 Everett Municipal Code (EMC)	Establishes noise levels and standards.	Cleanup actions conducted by Ecology under MTCA are exempt from the procedural requirements of most state and local laws/permits; however, must meet substantive requirements of the laws/permits. Substantive requirements are applicable to construction noise generated due to a cleanup action. Construction activities associated with the remedial alternatives will comply with City of Everett noise control requirements.
City of Everett Publicly Owned Treatment Water (POTW) discharge authorization	Chapter 14.40 EMC	Establishes the requirements and limitations for discharges to the POTW.	Cleanup actions conducted by Ecology under MTCA are exempt from the procedural requirements of most state and local laws/permits; however, must meet substantive requirements of the laws/permits. Substantive requirements are potentially applicable if dredged material is processed upland of the Site to permitted landfill disposal. The cleanup action would be permit exempt; however, substantive requirements would apply.
City of Everett stormwater management program	Chapter 14.28 EMC	Provides the necessary measures to control the quantity and quality of stormwater produced by new development and redevelopment such that they comply with water quality standards and contribute to the protection of beneficial uses of the receiving waters.	Cleanup actions conducted by Ecology under MTCA are exempt from the procedural requirements of most state and local laws/permits; however, must meet substantive requirements of the laws/permits. Substantive requirements are potentially applicable if dredged material is processed upland of the Site prior to permitted landfill disposal.
City of Everett Building and Construction Code	Chapter 16 EMC	The purpose of the Building and Construction Code is to protect public health, safety, and general welfare as they relate to the construction and occupancy of buildings and structures.	Cleanup actions conducted by Ecology under MTCA are exempt from the procedural requirements of most state and local laws/permits; however, must meet substantive requirements of the laws/permits. Substantive requirements are applicable for remedial alternatives that involve construction of structures.
City of Everett Traffic Code	Chapter 46 EMC	Establishes the requirements for traffic control.	Cleanup actions conducted by Ecology under MTCA are exempt from the procedural requirements of most state and local laws/permits; however, must meet substantive requirements of the laws/permits. Substantive requirements are applicable to construction traffic associated with a cleanup action. Construction activities such as haul truck operations may require appropriate traffic control including signage or flaggers as per the requirements of the City of Everett Traffic Code.

Table 10

Remedial Technology Screening

Weyerhaeuser Mill A Former
Everett, Washington

Remedial Technology Identification			Description	Implementability	Effectiveness	Relative Cost		Applicability	Technology Retained (Yes/No)
Category	Type	Option				Capital	O&M		
No Action	No Action	None	No institutional controls or treatment.	Technically implementable at the Site, however, does not meet MTCA threshold criteria and will not meet remedial action objectives.	Not effective for protecting human health and environment.	None	None	No action is retained as it is applicable to SMA-4, which is the location of 2016 Pacific Terminal Interim Action (IA). As discussed in Section 7.5, contamination was completely removed from SMA-4. Additional remedial action is therefore not needed in this area. No action is not considered appliable to other SMAs.	Yes
Institutional Controls (IC)	Proprietary and Governmental Controls, Informational Devices and Access Restrictions	Proprietary Controls include restrictive convent/deed restrictions. Governmental Controls include notices in local zoning or building department records describing land use restrictions, commercial and recreational fishing bans/limits. Informational Devices include warning signage and health advisories. Access Restrictions include fencing.	Proprietary Controls are agreements between Ecology and a landowner that are filed with the county register of deeds along with property deeds/covenants and may be used to prohibit activities on a property that may adversely impact cleanup activities that have been completed. Governmental Controls impose restrictions on land or resource use using the authority of a government entity. Warning signage are physically installed to inform the public regarding health risks. Health advisories are issued to the public that residual contamination remains on site. Fencing is physically installed to prevent public access to contamination.	Technically implementable at the Site except for access restrictions (fencing). The upland portion of the Site is a Port terminal facility, which is already fenced and has a gated entry. Fencing is not applicable in the marine intertidal and subtidal environment.	Not effective for remediating contaminants but can be effective at reducing risks and maintaining the integrity of remedies that are implemented on site.	Low	Low	The SMS (WAC 173-204-570(3)(h)) does not allow cleanup actions at the Site to rely exclusively on institutional controls and monitoring. Institutional controls with the exception of access restrictions (fencing) are retained as a component of cleanup action alternatives and are most likely to be identified following the completion of the cleanup action, based on the built condition of the remedy.	Yes
Natural Recovery	Sedimentation /Deposition	Monitored Natural Recovery (MNR)	Reduction of toxicity and bioavailability of contaminants through natural deposition of clean sediment, physical and biological mixing, and biodegradation. Monitoring in the form of periodic sediment sampling is performed to verify natural recovery is occurring within a reasonable restoration timeframe.	Technically implementable at the Site. Monitoring is required to confirm the natural recovery rate overtime.	In general, the effectiveness of Natural Recovery is limited to areas with lower contaminant concentrations that are net depositional. Not effective in areas where sediment and wood debris may be subject to erosive forces such as tidal forces, wave-induced currents, vessel scour or disturbances due to other physical means or where natural sedimentation rates are low. The scour study completed as part of the RI identified scour potential from vessel operations within and adjacent to the navigable areas of the Site where mudline elevations are shallower than -55 feet MLLW and therefore, MNR is not effective within these areas. Based on the sedimentation rate calculated for the Marine Area outside of the potential scour area as part of the RI, long-term risk reduction within the biologically active zone (i.e., 10 cm) is expected to occur within a 10-year period due to natural sedimentation.	Low	Moderate	MNR is retained given that the calculated sedimentation rates for the Marine Area are anticipated to deposit new sediment at a thickness that is equivalent to, or greater than the thickness of the compliance interval within a 10-year period and the technology can be reliably implemented outside of the identified scour areas at the Site. MNR is applicable to SMA-1 because this area is expected to be net depositional due to it being outside of the identified scour areas at the Site (deeper than -55 feet MLLW). MNR is also applicable to SMA-7 because this area is located at a distance away from scour influence and is part of the depositional delta feature emanating from Pigeon Creek. MNR is not applicable to other SMAs because they are located within areas of the Site that are subject to scour.	Yes

Remedial Technology Identification			Description	Implementability	Effectiveness	Relative Cost		Applicability	Technology Retained (Yes/No)
Category	Type	Option				Capital	O&M		
Natural Recovery	Sedimentation /Deposition	Enhanced Natural Recovery (ENR)	Natural sedimentation is enhanced by placement of clean sand over the recovery area. The sand is typically placed on a mass per area basis since the material is intended to mix with the in-place sediments rather than to isolate the contamination. As a result, ENR does not require highly precise placement techniques such as are used for the construction of caps. Technology relies on natural mixing processes (e.g., bioturbation) to reduce contaminant levels over time. Similar to MNR, monitoring is performed to confirm performance and rate of recovery within a reasonable restoration timeframe.	Technically implementable at the Site. The ability to place the clean sand materials precisely decreases with water depth. However, the clean materials placement does not require the same level of precision as placement of cap materials so the technology can effectively be implemented in deeper water. Monitoring is required to confirm the materials placement and natural recovery rate over-time.	In general, the effectiveness of ENR is limited to areas with lower contaminant concentrations that are net depositional. ENR sand is intended to mix with the surface sediments to lower concentrations and speed up natural recovery. ENR is not effective in areas where sediment and wood debris may be subject to erosive forces such as tidal forces, wave-induced currents, vessel scour or disturbances due to other physical means. Similar to MNR, ENR is not effective in areas within/adjacent to the navigable areas of the Site with mudline elevations shallower than -55 feet MLLW due to disturbances from vessel scour. ENR includes placement of a mass of clean sand over the surface of contaminated sediments to ultimately redistribute over the area and mix with the existing sediments to reduce the risks and enhance natural recovery processes. For the Site, the placement of a six-inch equivalent layer of sand is assumed and the movement and mixing of the placed sand are expected over-time to achieve the long-term reduction in surface sediment concentrations. Natural recovery will continue on the surface to provide further risk reduction. Long-term risk reduction timeframe for ENR can be shorter than MNR due to the placement of the clean sand.	Moderate	Moderate	ENR is retained given that the calculated sedimentation rates for the Marine Area are anticipated to deposit new sediment at a thickness that is equivalent to, or greater than the thickness of the compliance interval within a 10-year period and the technology can be reliably implemented outside of the identified scour areas at the Site. ENR is applicable to SMA-1 because this area is expected to be net depositional due to it being outside of the identified scour areas at the Site (deeper than -55 feet MLLW). ENR is also applicable to SMA-7 because this area is located at a distance away from scour influence and is part of the depositional delta feature emanating from Pigeon Creek. ENR is not applicable to other SMAs because they are located within areas of the Site that are subject to scour.	Yes
Capping	Conventional Cap	Conventional Sand Cap	Conventional sand capping includes covering contaminated sediment and/or wood debris with a thick layer of clean sand. A three-foot sand layer is assumed For the Site. Capping requires precision placement of materials to ensure that the engineered elements of the cap are properly constructed. A sand cap provides physical isolation of contaminated sediment and reduces direct-contact exposure risk and decreases the ability of burrowing organisms to move buried contaminants to the surface (i.e., bioturbation). Sand caps are designed to be of sufficient thickness to meet this purpose and should have an allowance for consolidation so that a minimum cap thickness is maintained following placement. Fine fraction and organic carbon content typically found in naturally occurring sands can also provide chemical isolation from contaminated sediment by treating/ sequestering dissolved contaminants migrating through the cap. Sand caps without an armoring layer typically do not provide for erosion protection.	Technically implementable except for in the deeper areas of the Site where increases in the depth of water significantly decreases the ability to accurately and precisely place the cap material to the required thickness. Increased water depth also limits the ability to readily maintain caps over-time, due to the reduced ability to precisely place cap materials in deeper water. Sand caps have been successfully constructed in multiple Puget Sound locations. In general, capping (without dredging) increases bottom elevations, which can reduce the water depth required for navigation and alter pre-existing habitat. Capping, when implemented in navigation areas, must account for a factor of safety to protect the surface of the cap from potential damage from the navigation activities and maintenance dredging. The capping material must provide protection from erosive forces in areas subject to scour. If changes in bottom elevations are expected to degrade aquatic habitat, mitigation may be required by regulatory agencies.	A conventional sand cap is effective at providing stable physical isolation and chemical isolation from contamination. Sand caps (without armoring) are not effective in areas that are subject to erosive forces such as tidal forces, wave-induced currents, vessel scour, etc. Due to the requirement for precision placement of cap material, the effectiveness of capping will decrease with water depth due to the inability to adequately construct and maintain the technology.	Moderate to High	Low to Moderate	Significant portions of SMA-1 are located in the deepest parts of the Site and as a result conventional sand capping within these SMAs is not applicable due to the significant challenges to precision construction and maintenance requirements of conventional sand caps. Capping without armoring is not applicable within SMAs-2, 3 and 6 because these areas are subject to vessel scour. Capping is not applicable in SMA-4 as this SMA does not require further remedial actions. Capping is not applicable in SMA-5 as this area is identified as a future cargo handling area and capping contaminated sediment and wood debris in this area will pose limitations or restrictions to the potential future site uses in this area of the Site. Capping is not applicable in SMA-7 because it will raise the grade in this shallow, intertidal area and impact the existing critical habitat elevations. A dredge and cap approach are not applicable in SMA-7 because dredging to accommodate the required cap thickness will result in complete removal of contamination.	No

Remedial Technology Identification			Description	Implementability	Effectiveness	Relative Cost		Applicability	Technology Retained (Yes/No)
Category	Type	Option				Capital	O&M		
Capping	Conventional Cap	Conventional Armored Sand Cap	An armored sand cap includes a layer of armoring on top of a sand layer to provide erosion protection component. Armoring layer is designed to withstand erosive forces such as tidal forces, wave-induced currents, vessel scour, etc. The armored sand cap includes covering contaminated sediment and/or wood debris with a thick layer of clean sand. Capping requires precision placement of materials to ensure that the engineered elements of the cap are properly constructed. For the Site, a three-foot sand layer covered by a three-foot armor layer is assumed. An armored sand cap provides physical isolation of contaminated sediment, reduces direct-contact exposure risk and decreases the ability of burrowing organisms to move buried contaminants to the surface (i.e., bioturbation). Armored sand caps are designed to be of sufficient thickness to meet this purpose and should have an allowance for consolidation so that a minimum cap thickness is maintained following placement. Fine fraction and organic carbon content typically found in naturally occurring sands can also provide chemical isolation from contaminated sediment by treating/ sequestering dissolved contaminants migrating through the cap.	Technically implementable except for in the deeper areas of the Site where increases in the depth of water significantly decreases the ability to place the cap material accurately and precisely to the required thickness. Increased water depth also limits the ability to readily maintain caps over-time, due to the reduced ability to precisely place cap materials in deeper water. Armored sand caps have been successfully constructed in multiple Puget Sound locations. In general, capping (without dredging) increases bottom elevations, which can reduce the water depth required for navigation and alter pre-existing habitat. Capping, when implemented in navigation areas, must account for a factor of safety to protect the surface of the cap from the navigation activities and maintenance dredging activities. The capping material must provide protection from erosive forces in areas subject to scour. If changes in bottom elevations are expected to degrade aquatic habitat, mitigation may be required by regulatory agencies.	An armored sand cap is effective at providing physical isolation from contamination, provides protection from erosive forces, and chemical isolation from contamination. Due to the requirement for precision placement of cap material, the effectiveness of capping may decrease with water depth due to the inability to adequately construct the technology.	Moderate to High	Low to Moderate	Armored cap is not applicable in SMA-1 since this SMA is not subject to erosive forces such as vessel scour. Armored caps are not applicable within SMAs-2, 3 and 6 because placement of caps in these areas of the Site will decrease navigation elevations and prevent future dredging which is inconsistent with the current and anticipated future uses of the Site. A dredge and cap approach to place an armored cap is not considered applicable within SMAs-2, 3 and 6 because dredging to accommodate the cap thickness will either result in complete removal of contamination to meet armored cap thickness requirements or result in leaving only a small volume of contamination in-place that would be more expensive to cap than to completely remove. Armored cap is not applicable in SMA-4, 5 and 7 for similar reasons as described above under sand cap.	No
	Amended/ Reactive Cap	Amended/ Reactive Sand Cap	An amended/reactive sand cap includes use of specialized material (i.e., amendments) to enhance the chemical isolation capacity (i.e., ability of the cap to treat/sequester dissolved contaminants migrating through the cap) or otherwise decrease the thickness of caps compared to sand cap. Specialized material are mixed with sand or placed in layers. Capping requires precision placement of materials to ensure that the engineered elements of the cap are properly constructed. Specialized material could include one or more of the following - activated carbon (AC), granular organoclay or metal hydroxides such as zero-valent iron and alumina material. AC can absorb a wide range of Site contaminants including organics and certain metals, granular organoclay can absorb organic Site contaminants including dissolved polycyclic aromatic hydrocarbons (PAHs) and semi-volatile organic compounds (SVOCs) and metal hydroxides are capable of binding metals. Amended/reactive sand caps without an armoring layer typically do not provide for erosion protection.	Technically implementable except for in the deeper areas of the Site where increases in the depth of water significantly decreases the ability to precisely place the cap material to the required thickness. Increased water depth also limits the ability to readily maintain caps over-time, due to the reduced ability to precisely place cap materials in deeper water. Water depth also limits the ability to readily maintain caps over-time, due to the reduced ability to precisely place cap materials in deeper water. In general, capping (without dredging) increases bottom elevations, which can reduce the water depth required for navigation and alter pre-existing habitat. Capping, when implemented in navigation areas, must account for a factor of safety to protect the surface of the cap from the navigation activities and maintenance dredging activities. The capping material must provide protection from erosive forces in areas subject to scour. If changes in bottom elevations are expected to degrade aquatic habitat, mitigation may be required by regulatory agencies.	An amended/reactive sand cap is effective at providing physical and chemical isolation from contamination. Amended/reactive sand caps (without armoring) are not effective in areas that are subject to erosive forces such as tidal forces, wave-induced currents, vessel scour, etc. Due to the requirement for precision placement of cap material, the effectiveness of capping may decrease with water depth due to the inability to adequately construct the technology.	Moderate to High	Moderate	Significant portions of SMAs-1 are located in the deepest parts of the Site and as a result, amended/reactive sand capping within these SMAs is not applicable due to the significant challenges to precision construction and maintenance requirements of amended/reactive sand caps. Capping without armoring is not applicable within SMAs-2, 3 and 6 because these areas are subject to vessel scour. Capping is not applicable in SMA-4 as this SMA does not require further remedial actions. Capping is not applicable in SMA-5 as this area is identified as a future cargo handling area and capping contaminated sediment and wood debris in this area will pose limitations or restrictions to the potential future site uses in this area of the Site. Capping is not applicable in SMA-7 because it will raise the grade in this shallow, intertidal area and impact the existing critical habitat elevations. A dredge and cap approach are not applicable in SMA-7 because dredging to accommodate the required cap thickness will result in complete removal of contamination.	No

Remedial Technology Identification			Description	Implementability	Effectiveness	Relative Cost		Applicability	Technology Retained (Yes/No)
Category	Type	Option				Capital	O&M		
Capping	Amended/ Reactive Cap	Amended/ Reactive Sand Cap with Armoring	The remedy includes a layer of armoring on top of the amended/reactive cap to provide erosion protection component. Armoring layers are designed to withstand erosive forces such as tidal forces, wave-induced currents, vessel scour, etc. Capping requires precision placement of materials to ensure that the engineered elements of the cap are properly constructed. An amended/reactive sand cap includes use of specialized material (i.e., amendments) to enhance the chemical isolation capacity (i.e., ability of the cap to treat/sequester dissolved contaminants migrating through the cap) or otherwise decrease the thickness of caps compared to sand cap. Specialized material are mixed with sand or placed in layers. Specialized material could include one or more of the following - AC, granular organoclay or metal hydroxides such as zero-valent iron and alumina material. AC can absorb a wide range of Site contaminants including organics and certain metals, granular organoclay can absorb organic Site contaminants including dissolved PAHs and SVOCs and metal hydroxides are capable of binding metals.	Technically implementable except for in the deeper areas of the Site where increases in the depth of water significantly decreases the ability to precisely place the cap material to the required thickness. Increased water depth also limits the ability to readily maintain caps over-time, due to the reduced ability to precisely place cap materials in deeper water. Water depth also limits the ability to readily maintain caps over-time, due to the reduced ability to precisely place cap materials in deeper water. In general, capping (without dredging) increases bottom elevations, which can reduce the water depth required for navigation and alter pre-existing habitat. Capping, when implemented in navigation areas, must account for a factor of safety to protect the surface of the cap from the navigation activities and maintenance dredging activities. The capping material must provide protection from erosive forces in areas subject to scour. If changes in bottom elevations are expected to degrade aquatic habitat, mitigation may be required by regulatory agencies.	An amended/reactive sand cap with armoring is effective in providing physical and chemical isolation and provides protection from erosive forces. Due to the requirement for precision placement of cap material, the effectiveness of capping may decrease with water depth due to the inability to adequately construct the technology.	Moderate to High	Moderate	An amended/reactive sand cap with armoring is not applicable in SMA-1 since this SMA is not subject to erosive forces such as vessel scour. Armored caps are not applicable within SMAs-2, 3 and 6 because placement of caps in these areas of the Site will decrease navigation elevations and prevent future dredging which is inconsistent with the current and anticipated future uses of the Site. A dredge and cap approach to place an armored cap is not considered applicable within SMAs-2, 3 and 6 because dredging to accommodate the cap thickness will either result in complete removal of contamination to meet armored cap thickness requirements or result in leaving only a small volume of contamination in-place that would be more expensive to cap than to completely remove. Armored cap is not applicable in SMA-4, 5 and 7 for similar reasons as described above under amended/reactive sand cap.	No
Capping	Dynamic Cap	Dynamic Sand Cap	Dynamic sand capping includes placement of clean imported sand on top of the existing sediment surface on a mass per area basis with individual materials placements overlapping each other to achieve cap thickness that is equivalent to or greater than the thickness of the compliance zone (i.e., 10 cm) at the time of construction. The thickness of dynamic sand cap is not expected to be even following the placement of materials during construction. However, the dynamic sand cap materials are expected to be distributed over time by current action to achieve a more even thickness. The distribution of the placed dynamic sand cap materials across the placement area is expected reach equilibrium within a reasonable restoration timeframe. The purpose of the dynamic sand cap is to prevent exposure to contamination and to prevent resuspension and transport of contaminants to other areas of the Site. For the purposes of this FS, a three-foot thickness equivalent mass of sand over the area of placement is assumed. Since dynamic sand caps are placed on a mass per area basis, they do not require precise placement techniques such as are used for the construction of conventional or amended/reactive sand caps. Fine fraction and organic carbon content typically found in naturally occurring sands can treat/sequester dissolved contaminants migrating through the cap. To allow the dynamic sand caps to distribute within the placement area, they are not armored and therefore, do not provide erosion protection. The performance of dynamic sand caps is evaluated by sampling and analysis of surface sediment in the placement area over a reasonable restoration timeframe.	Technically implementable at the Site. In general, the ability to place a sediment cap precisely decreases with water depth. However, dynamic sand cap placement does not require the same level of precision as the placement of conventional or amended/reactive cap materials, so the technology is expected to be reasonably implemented in moderately deep water. Monitoring the dynamic sand cap is required to evaluate effectiveness over time. In general, capping (without dredging) increases bottom elevations, which can reduce the water depth required for navigation and alter pre-existing habitat. Capping, when implemented in navigation areas, must account for a factor of safety to protect the surface of the cap from potential damage from the navigation activities and interference with maintenance dredging. If changes in bottom elevations are expected to degrade aquatic habitat, mitigation may be required by regulatory agencies.	Dynamic sand caps do not require the precise placement techniques as the conventional sand cap and therefore, can effectively be implemented in moderately deep water. To allow the dynamic sand caps to distribute within the placement area, they are not armored and therefore, are not effective in areas of the Site that are subject to vessel scour (i.e., areas with mudline elevations shallower than -55 feet MLLW). Vessel scour is expected to disrupt the distribution of sand and prevent the isolation of underlying contamination.	Moderate to High	Moderate	Dynamic sand cap placement does not require the same level of precision as the placement of conventional or amended/reactive cap materials so the technology is expected to be reasonably implemented in moderately deep mudline (up to -75 feet MLLW) of SMA-1d. Significant portions of SMAs 1a, 1b and 1c are in the deepest part of the Site (up to 215 feet, 90 feet and 115 feet MLLW, respectively) and as a result, dynamic sand capping is expected to become challenging to implement and therefore not considered applicable in these SMAs. Dynamic sand caps cannot be armored and therefore not applicable within SMAs-2, 3 and 6 because these areas are subject to vessel scour and cap without armoring would not be effective. Placement in SMA-1d will require partial dredging to ensure that the cap material is located below the scour depth. Capping is not applicable in SMA-4 as this SMA does not require further remedial actions. Capping is not applicable in SMA-5 as this area is identified as a future cargo handling area and capping contaminated sediment and wood debris in this area will pose limitations or restrictions to the potential future site uses in this area of the Site. Capping is not applicable in SMA-7 because it will raise the grade in this shallow, intertidal area and impact the existing critical habitat elevations. A dredge and cap approach is not applicable in SMA-7 because dredging to accommodate the required cap thickness will result in complete removal of contamination.	Yes

Remedial Technology Identification			Description	Implementability	Effectiveness	Relative Cost		Applicability	Technology Retained (Yes/No)
Category	Type	Option				Capital	O&M		
Containment	Low-Permeability Physical Barriers	Containment structure using sheet piles, berms or similar	Placement of a low-permeability containment structure to isolate and prevent potential lateral movement of contaminated source area sediment and wood debris. A containment structure (sheet pile, berm or similar) is installed to provide containment of in-place contaminated sediment and wood debris. The containment structure can be extended vertically upwards to create space for disposal of dredged material - see CDF remedial technology description below.	Technically implementable at the Site. The containment structure would be designed by a structural engineer for site conditions for structural stability. Buried debris or subsurface obstructions such as utilities may interfere and would require removal as part of the barrier installation.	Effective for long-term containment and environmental protection. Engineered containment structure will be designed for seismic stability and other conditions to achieve a high degree of protectiveness and permanence.	High	High	In-place containment is retained for SMA-5 as a compatible element of the CDF technology. In-place containment is not considered applicable to other SMAs.	Yes
Removal	Dredging/Excavation of Sediment and Wood Debris	Mechanical Dredging/ Excavation	Dredging/excavation of contaminated sediment and wood debris using land-based and/or water-based equipment outfitted with a clamshell or equivalent dredging bucket. Removal requires precision placement of the dredging bucket at the sediment surface to ensure that complete removal of the contamination, both horizontally and vertically, is achieved. Land-based removal would include use of land-based excavation equipment and transport vehicles (ex. dump trucks) operated from the shoreline during low tides when the work area is exposed. Water-based removal would include use of a barge-mounted dredge and a material barge for dredged material transport.	Technically implementable at the Site except for in the deeper areas of the Site where increases in the depth of water significantly decreases the ability to precisely remove contaminated material to the required depth. Dredging is commonly used in the marine environment to remove contaminated sediment and/or wood debris. Implementation is less effective in deeper areas of the Site where increases in the depth of water significantly lowers the ability to precisely place the dredging bucket which could result in incomplete removal or residuals that may result in additional dredging passes and/or placement of clean sand on the dredged surface. Dredging cycle times increase significantly with depth thus elongating the construction duration. Dredging action must rely on stable side cuts and/or shoring systems, as applicable, to protect the upland areas of the Site and existing structures including pile supported wharfs, piers, and slope armor. For the Site, a toe wall is assumed to be required to complete dredging in front of the South Terminal in SMA-6 to protect the structure as the depth of contamination exceeds the design dredge depth at the structure. Structural support to the existing aged wooden bulkhead wall between the South and Pacific Terminals in SMA-5 is also assumed to be required to provide structural stability during removal of contaminated material. The dredging action must consider debris management, given the presence of wood debris in the contaminated sediment.	Effective where complete contaminant removal is achieved. Effectiveness decreases with water depth due to the decrease in dredging accuracy and an increase in potential for incomplete dredging or residuals. In areas of incomplete dredging or where contaminant residuals cannot be eliminated a sand cover may be required to compensate for the reduced effectiveness and manage chemical concentrations on the exposed surface. In areas where only a thin layer of contamination is present, over-dredging allowances that are required to achieve complete removal will lower effectiveness by substantially increasing disposal volumes.	Moderate to High	Low	Significant portions of SMAs-1a, 1b and 1c are located in the deepest areas of the Site (up to -215 feet, -90 feet and -115 feet MLLW, respectively) and contain relatively large areas where the thickness of contamination and wood debris to be removed is on the order of thickness of the over dredge allowance. The water depth and removal thickness conditions in SMAs-1a, 1b and 1c make removal technically challenging, ineffective and costly and as a result, removal in not applicable in these SMAs. Water depths within SMA-1d are less deep than in SMAs-1a, 1b and 1c, although range up to -75 feet MLLW. As a result, removal is assumed to be applicable to SMA-1d, although difficult to implement due to water depths and may result in reduced effectiveness. Removal is applicable in SMAs-2, 3, 5, 6 and 7 as the mudline in these SMAs is relatively shallow which increases the ability to deploy and control the dredge bucket with precision and increases the overall effectiveness of removal. Within SMA-7, removal is followed by backfilling to restore elevations and mitigate impacts to critical habitat elevations.	Yes

Remedial Technology Identification			Description	Implementability	Effectiveness	Relative Cost		Applicability	Technology Retained (Yes/No)
Category	Type	Option				Capital	O&M		
Management of Removed Sediment/ Dredged Materials	Upland Disposal	Landfill	Disposal of contaminated sediment and wood debris at an off-site, permitted landfill.	Technically implementable. Offloading, dewatering and processing are required prior to transport. Waste characterization is required for disposal approval at the landfill facility. Given the large volume of dredged material at the Site, dredging production rates may be limited by limits in offsite transportation (e.g., availability of trucks, containers and train cars) and disposal throughput (e.g., daily disposal volumes given by the landfill facility).	Proven technology effective for the long-term management of contaminated sediments and wood debris. Common disposal option for dredged sediments and wood debris.	High	Low	Applicable. Commonly used method to dispose contaminated dredged/excavated material.	Yes
	Confined Disposal Facility (CDF)	Upland, Nearshore, or In-Water Facility	Engineered containment structure to contain dredged sediment and wood debris. A CDF can be located upland, partially in water (nearshore facility), or completely in water. In addition to lateral confinement provided by uplands and shoring walls, a CDF relies on capping technology to provide for surface confinement.	Technically implementable at the Site. A CDF structure has been previously constructed at the Pacific Terminal and has been shown to be successful at containing contaminated dredged material. A containment structure must be designed to minimize/prevent contaminant migration. A CDF must be designed by a structural engineer for site conditions and to provide long-term structural stability. Buried debris or subsurface obstructions such as utilities may interfere with the wall installation. Dredged material placed in the CDF must be capped at the surface to contain the material and prevent exposure and infiltration of stormwater. A CDF may have capacity limitations and require offsite upland disposal where the volume of dredged material exceeds the disposal volume of the CDF.	A CDF is effective for the permanent and long-term containment of dredged material. CDF structures have been effectively used at the Mill A Site and at other sediment cleanups in the Puget Sound. A CDF can reduce schedule delays, project costs and carbon emissions by reducing offsite transportation and disposal of dredged material.	High	High	Applicable within SMA-5 where CDF structure can be constructed and remain compatible with the current and future uses.	Yes
	Contained Aquatic Disposal (CAD)	In-Water Disposal and Containment	Removed impacted sediment and wood debris is placed in a natural or artificial in-water depression in the water body and contained with cap material.	Not implementable at the Site due to the lack of a location for the facility.	Effective for long-term containment and environmental protection if a suitable site is available.	High	High	Not applicable for the current project due to absence of suitable location. Unlikely to provide additional benefit over other technologies.	No
	Aquatic Open-Water Disposal	Open-Water Disposal at Designated Site	Sediment that meets the Dredged Material Management Program (DMMP) criteria are allowed to be disposed at one of the Department of Natural Resources (DNR) open-water disposal sites in Puget Sound. The Port Gardner open-water disposal site is the closest open water disposal location to the Site. Sediment targeted for open-water disposal would require a formal Dredged Material Suitability Determination from the DMMP. Larger wood debris are not allowed to be disposed at the open water disposal site.	Uncertain implementability due to the known levels of contamination at the Site. Technically implementable using available equipment and methods. Subject to DMMP screening criteria and suitability determination.	Effective for removal and disposal of sediment with contaminant concentrations that meet the open water disposal criteria and contain limited or no debris. Approval for open-water disposal is expected to be difficult for contaminated sediment containing wood waste originating from a known cleanup project.	Low	Low	Not applicable. Dredge material containing contamination and wood waste makes open-water disposal approval unlikely.	No
	Beneficial Reuse	Placement in Other Upland or Aquatic Environment	Reuse for engineering purposes, habitat enhancement or other beneficial needs. Dredged material would require a beneficial use determination.	Uncertain implementability due to the known levels of contamination at the Site. A suitable reuse for the dredged material has not been identified.	The general fine-grained nature and presence of wood waste and contaminants limit the potential for reuse of the Site dredged material.	Moderate to High	Low	Dredge material containing contamination and wood waste makes beneficial use approval unlikely.	No

Remedial Technology Identification			Description	Implementability	Effectiveness	Relative Cost		Applicability	Technology Retained (Yes/No)
Category	Type	Option				Capital	O&M		
Ex-Situ Sediment Treatment	Bioremediation	Landfarming, Slurry Bioreactor or Biopiles	Biodegradation of contaminants in removed dredged material is enhanced through modification of material conditions and provision of substrate necessary for microbial growth. Treatment is conducted in landfarm arrangement, above ground reactor, or in treatment cells (biopiles).	Difficult to implement. Landfarming option may require use of a large amount of space depending on the quantity of excavated/dredged material. Slurry and biopile treatment require reactor or treatment cell construction. Leachate and off-gassing require collection and treatment. Addition of additives may increase total bulk volume of treated sediment.	Likely ineffective for PCBs and dioxin/furans.	Moderate to High	Moderate to High	Likely not effective and difficult to implement.	No
	Incineration	Rotary Kiln	Material is heated above approximately 1,600 degrees Fahrenheit to volatilize and combust organic contaminants. Incinerator off-gas is treated in an air pollution control system.	Potentially difficult to implement. Limited space for on-site treatment system and staging. Specific feed size and material handling requirements may impact implement ability. Suitable off-site facility not currently identified. Emissions are likely problematic.	Proven effective treatment, although afterburner likely needed to combust dioxins/furans.	High	High	High-cost relative to other ex situ treatment technologies. Even if feasible, may not provide added incremental benefit.	No
	Sediment Washing	Water and Surfactants	Removal of leachable contaminants from sediment using water and surfactants in an aboveground reactor with subsequent treatment of residual fluids.	Difficult to implement. Residuals that are difficult to extract from the sediment matrix may require additional treatment. Could generate state designated Dangerous Waste. Limited space on site for treatment system siting and staging due active terminal operations. Debris screening may be required. Suitable off-site facility has not been identified.	Likely ineffective due to the presence of wood waste and PCBs, and dioxins and furans which have a strong affinity for sorption to solids and organics.	High	High	Difficult to implement. High cost.	No
	Solidification/ Stabilization	Cement or Lime based Processes/ Microencapsulation	Reagents are introduced to physically bind or enclose contaminants, or to induce chemical reactions between the stabilizing agent and contaminants to reduce their mobility. Resultant materials are typically disposed of.	Difficult to implement. Limited space on site for treatment system siting and staging due active terminal operations. Wood waste and debris screening may be required. Can result in significant increase in volume of reacted material. Post-treatment disposal will be required.	May be ineffective for treatment due to presence to wood waste and organic compounds.	Moderate to High	Low	Likely inadequate effectiveness and reliability for organics. Potentially difficult to implement with high wood waste content.	No
In-Situ Sediment Treatment	Chemical Treatment	Amendment/ Stabilization	This technology involves immobilizing contaminants by physically binding or enclosing the sediment within a stabilized mass, or chemically treating the contaminants. Additives are mixed with the sediment in-situ to encapsulate the sediment and/or reduce the solubility, mobility, and toxicity of the contaminants.	Technically implementable. May be effective for addressing contaminants but may have negative affects to habitat in the marine environment. There are relatively few case studies to establish the potential effectiveness of this technology for treatment of contaminated sediment. Post-treatment disposal may be required.	Effective in sequestering organic contaminants through a combination of adsorption, ion exchange and precipitation. However, this is an emerging technology with limited full-scale applications. Likely not effective to wood debris present on site.	Moderate to High	Moderate	Not effective in treating wood debris. Additionally, this is an emerging technology with only bench- or pilot-scale studies.	No

Table 11

Summary and Evaluation of Alternatives — Minimum Requirements for Sediment Cleanup Actions

Weyerhaeuser Mill A Former
Everett, Washington

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Alternative Summary	• Monitored Natural Recovery (MNR) in SMAs 1 (1a through 1d) and 7 measuring approximately 43 acres. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 424,520 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 424,520 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b through 1d, and 7 measuring approximately 16.2 acres. Approximately 20,900 tons of sand is estimated to be placed in these SMAs. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 424,520 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 424,520 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand is estimated to be placed in this SMA. • Placement of dynamic sand cap in SMA 1d measuring approximately 4.5 acres. Approximately 35,720 tons of sand cap material is estimated to be placed in SMA 1d. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Dredge in SMA-1d to provide stable transition slopes to allow full removal in adjacent SMA-2a and to remove contaminated sediment in SMA-1d above elevation -60 feet MLLW which will ensure that the dynamic sand cap placed in SMA-1d is not above the maximum scour elevation (i.e., -55 feet MLLW). Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 438,070 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 438,070 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand are estimated to be placed in these SMAs. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 484,010 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 484,010 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Enhanced Natural Recovery (ENR) in SMAs 1a, 1b, and 1c measuring approximately 35.7 acres. Approximately 46,140 tons of sand is estimated to be placed in these SMAs. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c), 5, 6 and 7. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 519,310 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 519,310 tons of dredged material at an off-site permitted landfill. • Backfilling in SMA-7 with sand to restore existing critical habitat elevations. Approximately 43,440 tons of sand backfill is estimated to be placed in this SMA. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Minimum Requirements for Sediment Cleanup Actions (WAC 173-204-570[3])					
Protection of Human Health and the Environment	**Yes**, this alternative protects human health and the environment using a combination of MNR, full removal of contaminated media and institutional controls. • In SMAs where MNR is implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). Monitoring will be performed to ensure natural recovery process are effective in protecting human health and the environment. • In SMAs where full removal is implemented, protection of human health and environment is achieved following the completion of cleanup construction.	**Yes**, this alternative protects human health and the environment using a combination of MNR, ENR, sediment capping, full removal of contaminated media and institutional controls. • In SMAs where MNR or ENR are implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentration immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where full removal is implemented, protection of human health and environment is achieved following the completion of cleanup construction.	**Yes**, this alternative protects human health and the environment using a combination of MNR, ENR, sediment capping, full removal of contaminated media and institutional controls. • In SMAs where MNR or ENR are implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentration immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where dynamic sand capping or full removal are implemented, protection of human health and environment is achieved following the completion of cleanup construction. • The dynamic sand cap will be monitored to ensure that the remedy is effective in protecting human health and the environment.	**Yes**, this alternative protects human health and the environment using a combination of MNR, ENR, full removal of contaminated media and institutional controls. • In SMAs where MNR or ENR are implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentration immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where full removal is implemented, protection of human health and environment is achieved following the completion of cleanup construction.	**Yes**, this alternative protects human health and the environment using a combination of ENR, full removal of contaminated media and institutional controls. • In SMAs where ENR is implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentrations immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where full removal is implemented, protection of human health and environment is achieved following the completion of cleanup construction.
Compliance with Cleanup Standards	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs and SOC exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs and dioxin/furans with SWAC ER of 1.51 and 1.32, respectively in SMA-1 (1a through 1d) and 7. • PCB, LPAHs, Phenols and miscellaneous extractables with ER of up to 1.6, 1.7, 1.5, and 1.5, respectively, in SMA-1 (1a, 1b and 1d). • Wood debris in excess of 15% in SMA-1c and 1d.	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs with SWAC ER of 1.22 in SMA-1 (1a through 1d) and 7. • 4-methylphenol with ER of up to 1.2 in SMA-1a.	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs with SWAC ER of 1.12 in SMAs-1a through 1c and 7. • 4-methylphenol with ER of up to 1.2 in SMA-1a.	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs with SWAC ER of 1.13 in SMA-1a through 1c and 7. • 4-methylphenol with ER of up to 1.2 in SMA-1a.	**Yes**, this alternative is expected to comply with cleanup standards following the completion of construction.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Compliance with Applicable State and Federal Laws	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.
Use permanent solutions to the maximum extent practicable	**Yes**, these alternative uses permanent solutions to the maximum extent practicable as determined through a Disproportionate Cost Analysis (DCA; WAC 173-340-360(3)(e)). The DCA is presented in Section 10 of the RI/FS Report.				
Provide for a reasonable restoration timeframe	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative is expected to achieve cleanup standards immediately following completion of construction.
Source Control Measures	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the primary source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.
Sediment Recovery Zone	Alternative does not require a sediment recovery zone.	Alternative does not require a sediment recovery zone.	Alternative does not require a sediment recovery zone.	Alternative does not require a sediment recovery zone.	Alternative does not require a sediment recovery zone.
Institutional Controls	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.
Provide for public and affected landowner review and comment	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Provision for Compliance Monitoring	**Yes**, this alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the MNR areas.	**Yes**, this alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR and MNR areas.	**Yes**, this alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the capped, ENR and MNR areas.	**Yes**, this alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR and MNR areas.	**Yes**, this alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR areas.
Provide for Periodic Review	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.

Notes:

CDF = confined disposal facility

COCs = contaminants of concern

cPAHs = carcinogenic polycyclic aromatic hydrocarbons. Includes benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d).

CY = cubic yard

DCA = Disproportionate Cost Analysis

ENR = enhanced natural recovery

ER = Exceedance Ratio

LPAHs = low molecular weight polycyclic aromatic hydrocarbons. Includes 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene and phenanthrene.

Miscellaneous Extractables = Includes dibenzofuran, hexachlorobutadiene, benzoic acid and benzyl alcohol.

MNR = monitored natural recovery

MTCA = Model Toxics Control Act

NPDES = National Pollution Discharge Elimination System

PCB = polychlorinated biphenyl

PCUL = proposed cleanup level

SMA = Sediment Management Area

SWAC = surface weighted average concentration

RI/FS = Remedial Investigation/Feasibility Study

Table 11

Summary and Evaluation of Alternatives — Minimum Requirements for Sediment Cleanup Actions

Weyerhaeuser Mill A Former
Everett, Washington

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Alternative Summary	• Monitored Natural Recovery (MNR) in SMAs 1 (1a through 1d) and 7 measuring approximately 43 acres. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c) and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 227,970 tons of dredged material are estimated to be removed from these SMAs. • Construction of confined disposal facility (CDF) within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 1,770 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b through 1d, and 7 measuring approximately 16.2 acres. Approximately 20,900 tons of sand is estimated to be placed in these SMAs. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c) and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 227,970 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 1,770 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand is estimated to be placed in this SMA. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Placement of dynamic sand cap in SMA 1d measuring approximately 4.5 acres. Approximately 35,720 tons of sand cap material is estimated to be placed in SMA 1d. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c) and 6. Dredge in SMA-1d to provide stable transition slopes to allow full removal in adjacent SMA-2a and to remove contaminated sediment in SMA-1d above elevation -60 feet MLLW which will ensure that the dynamic sand cap placed in SMA-1d is not above the maximum scour elevation (i.e., -55 feet MLLW). Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 241,520 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 15,320 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand is estimated to be placed in these SMAs. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c) and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 287,460 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 61,260 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Enhanced Natural Recovery (ENR) in SMAs 1a, 1b, and 1c measuring approximately 35.7 acres. Approximately 46,140 tons of sand is estimated to be placed in these SMAs. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c) 6 and 7. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 322,760 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 96,560 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • Backfilling in SMA-7 with sand to restore existing critical habitat elevations. Approximately 43,440 tons of sand backfill is estimated to be placed in this SMA. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Minimum Requirements for Sediment Cleanup Actions (WAC 173-204-570[3])					
Protection of Human Health and the Environment	**Yes**, this alternative protects human health and the environment using a combination of MNR, containment/CDF, full removal of contaminated media and institutional controls. • In SMAs where MNR is implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where containment/CDF and/or full removal are implemented, protection of human health and environment is achieved following the completion of cleanup construction. • The containment/CDF will be monitored to ensure that the contaminants remain confined and that the remedy is effective in protecting human health and the environment.	**Yes**, this alternative protects human health and the environment using a combination of MNR, ENR, containment/CDF, full removal of contaminated media and institutional controls. • In SMAs where MNR or ENR are implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentration immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where containment/CDF and/or full removal are implemented, protection of human health and environment is achieved following the completion of cleanup construction. • The containment/CDF will be monitored to ensure that the contaminants remain confined and that the remedy is effective in protecting human health and the environment.	**Yes**, this alternative protects human health and the environment using a combination of MNR, ENR, sediment capping, containment/CDF, full removal of contaminated media and institutional controls. • In SMAs where MNR or ENR are implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentration immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where dynamic sand capping, containment/CDF or full removal are implemented, protection of human health and environment is achieved following the completion of cleanup construction. • The dynamic sand cap and containment/CDF will be monitored to ensure that the remedy is effective in protecting human health and the environment.	**Yes**, this alternative protects human health and the environment using a combination of MNR, ENR, containment/CDF, full removal of contaminated media and institutional controls. • In SMAs where MNR or ENR are implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentration immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where containment/CDF and/or full removal are implemented, protection of human health and environment is achieved following the completion of cleanup construction. • The containment/CDF will be monitored to ensure that the contaminants remain confined and that the remedy is effective in protecting human health and the environment.	**Yes**, this alternative protects human health and the environment using a combination of ENR, containment/CDF, full removal of contaminated media and institutional controls. • In SMAs where ENR is implemented, protection of human health and environment is achieved over a reasonable restoration timeframe (≤ 10 years). ENR will reduce contaminant concentration immediately following the placement of thin-layer sand and will reduce the restoration timeframe as compared to MNR. Monitoring will be performed to ensure natural recovery processes are effective in protecting human health and the environment. • In SMAs where containment/CDF and/or full removal are implemented, protection of human health and environment is achieved following the completion of cleanup construction. • The containment/CDF will be monitored to ensure that the contaminants remain confined and that the remedy is effective in protecting human health and the environment.
Compliance with Cleanup Standards	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs and SOC exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs and dioxin/furans with SWAC ER of 1.51 and 1.32, respectively in SMA-1 (1a through 1d) and 7. • PCB, LPAHs, Phenols and miscellaneous extractables with ER of up to 1.6, 1.7, 1.5, and 1.5, respectively, in SMA-1 (1a, 1b and 1d). • Wood debris in excess of 15% in SMA-1c and 1d.	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs with SWAC ER of 1.22 in SMA-1 (1a through 1d) and 7. • 4-methylphenol with ER of up to 1.2 in SMA-1a.	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs with SWAC ER of 1.12 in SMAs-1a through 1c and 7. • 4-methylphenol with ER of up to 1.2 in SMA-1a.	**Yes**, this alternative is expected to comply with cleanup standards within a reasonable restoration timeframe (≤ 10 years). The COCs exceeding the cleanup standards remaining at the completion of construction will be subject to reduction in concentration over time through natural recovery and include: • cPAHs with SWAC ER of 1.13 in SMA-1a through 1c and 7. • 4-methylphenol with ER of up to 1.2 in SMA-1a.	**Yes**, this alternative is expected to comply with cleanup standards following the completion of construction.
Compliance with Applicable State and Federal Laws	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.	**Yes**, this alternative will be planned, designed and constructed in a manner that complies with applicable state and federal laws. Applicable permits will be obtained, and the permit/ substantive requirements will be met as part of construction and monitoring.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Use permanent solutions to the maximum extent practicable	**Yes**, this alternative uses permanent solutions to the maximum extent practicable as determined through a Disproportionate Cost Analysis (DCA; WAC 173-340-360(3)(e)). The DCA is presented in Section 10 of the RI/FS Report.				
Provide for a reasonable restoration timeframe	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) based on the sedimentation rate calculated for the Marine Area. Further evaluation will be completed as part of the design phase of the project.	**Yes**, this alternative will achieve cleanup standards immediately following completion of construction.
Source Control Measures	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.	**Yes**, this alternative provides source control measures. The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. Existing stormwater outfalls at the Site are being regulated and managed by the Port under NPDES permit(s) with the applicable regulatory agencies.
Sediment Recovery Zone	Alternative does not include a sediment recovery zone	Alternative does not include a sediment recovery zone	Alternative does not include a sediment recovery zone	Alternative does not include a sediment recovery zone	Alternative does not include a sediment recovery zone
Institutional Controls	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.	**Yes**, this alternative leaves contamination in the Marine Area and therefore, institutional controls may be required. Institutional controls will be defined during future steps in the cleanup process.
Provide for public and affected landowner review and comment	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.	**Yes**, the RI/FS and the alternatives presented in the document are subject to public review as part of the MTCA cleanup process.
Provision for Compliance Monitoring	**Yes**, Alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR, MNR and containment/CDF areas.	**Yes**, Alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR, MNR and containment/CDF areas.	**Yes**, Alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR, MNR, capping and containment/CDF areas.	**Yes**, Alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR, MNR and containment/CDF areas.	**Yes**, Alternative includes provisions for compliance monitoring. Monitoring requirements and contingency plans will be included as administrative controls in the cleanup action to ensure the protectiveness of the ENR and containment/CDF areas.
Provide for Periodic Review	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.	**Yes**, this alternative provides for period review. Ecology is expected to conduct review every five years following the completion of construction to assure that human health and the environment continue to be protected.

Notes:

CDF = confined disposal facility

COCs = contaminants of concern

cPAHs = carcinogenic polycyclic aromatic hydrocarbons. Includes benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d).

CY = cubic yard

DCA = Disproportionate Cost Analysis

ENR = enhanced natural recovery

ER = Exceedance Ratio

LPAHs = low molecular weight polycyclic aromatic hydrocarbons. Includes 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene and phenanthrene.

Miscellaneous Extractables = Includes dibenzofuran, hexachlorobutadiene, benzoic acid and benzyl alcohol.

MNR = monitored natural recovery

MTCA = Model Toxics Control Act

NPDES = National Pollution Discharge Elimination System

PCB = polychlorinated biphenyl

PCUL = proposed cleanup level

SMA = Sediment Management Area

SWAC = surface weighted average concentration

RI/FS = Remedial Investigation/Feasibility Study

Table 12

Summary and Evaluation of Alternatives — Disproportionate Cost Analysis Criteria

Weyerhaeuser Mill A Former
Everett, Washington

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Alternative Summary	• Monitored Natural Recovery (MNR) in SMAs 1 (1a through 1d) and 7 measuring approximately 43 acres. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 424,520 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 424,520 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b through 1d, and 7 measuring approximately 16.2 acres. Approximately 20,900 tons of sand is estimated to be placed in these SMAs. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 424,520 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 424,520 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand is estimated to be placed in this SMA. • Placement of dynamic sand cap in SMA 1d measuring approximately 4.5 acres. Approximately 35,720 tons of sand cap material is estimated to be placed in SMA 1d. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Dredge in SMA-1d to provide stable transition slopes to allow full removal in adjacent SMA-2a and to remove contaminated sediment in SMA-1d above elevation -60 feet MLLW which will ensure that the dynamic sand cap placed in SMA-1d is not above the maximum scour elevation (i.e., -55 feet MLLW). Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 438,070 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 438,070 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand is estimated to be placed in these SMAs. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c), 5 and 6. Approximately 484,010 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 484,010 tons of dredged material at an off-site permitted landfill. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Enhanced Natural Recovery (ENR) in SMAs 1a, 1b, and 1c measuring approximately 35.7 acres. Approximately 46,140 tons of sand is estimated to be placed in these SMAs. • Removal and replacement of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall and upland retaining wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c), 5, 6 and 7. Approximately 519,310 tons of dredged material are estimated to be removed from these SMAs. • Upland transload, transport and disposal of approximately 519,310 tons of dredged material at an off-site permitted landfill. • Backfilling in SMA-7 with sand to restore existing critical habitat elevations. Approximately 43,440 tons of sand backfill is estimated to be placed in this SMA. • No further action in SMA 4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Disproportionate Cost Analysis Criteria [173-340-360(3)(f) and SMS 173-204-570(4)] and Ecology Publication No. 17-09-052 – Relative Benefit Evaluation (Scored from 1 = Low to 10 = High)					
Protectiveness	Score = 7	Score = 7.5	Score = 8	Score = 8	Score = 9
"Overall protectiveness of human health and the environment, including the degree to which existing risks are reduced, time required to reduce risk at the facility and attain cleanup standards, on-site and offsite risks resulting from implementing the alternative, and improvement of the overall environmental quality. This also includes evaluating potential risks to the integrity of the remedy from climate change impacts."	• Achieves a moderate-high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. Full removal reduces risk to a high degree as contaminants are permanently removed from the Site and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10 under the requirement of "Compliance with Cleanup Standards." Areas subject to full removal will meet cleanup standards on completion of the remedy construction. • The primary risk associated with implementing this alternative is the potential for the MNR area to not meet cleanup standards within the reasonable restoration timeframe (≤ 10 years). • Under this alternative, a significant amount (approximately 68% by volume) of the Marine Area contamination is addressed through full removal, which meets cleanup standards and improves environmental quality at the Marine Area immediately following construction. A substantial amount of the remaining contamination (approximately 32% by volume) is addressed using MNR, which relies on a restoration timeframe to improve environmental quality. The offsite transport of dredged material will contribute to significant carbon emissions in addition to the carbon emissions from the onsite construction activities. This alternative will result in an improvement of overall environmental quality at a moderate-high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) is MNR, which is implemented in SMA-1 and 7. SMA-1 is subtidal and therefore, the effects of climate change are not anticipated. Portions of SMA-7 are intertidal and climate change has the potential of impacting MNR in this SMA if conditions for natural sedimentation are diminished. Full removal of contaminated media in SMAs-2, 3, 5 and 6, and no action in SMA-4 are not expected to be impacted by climate change. • This alternative will result in a loss of aquatic habitat at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Full removal of contaminated sediment and wood debris in SMAs 3c, 5 and 6 will result in the loss of critical habitat	• Achieves a moderate-high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the time frame for meeting cleanup standards. Full removal reduces risk to a high degree as contaminants are permanently removed from the Site and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10 under the requirement of "Compliance with Cleanup Standards." Areas subject to full removal will meet cleanup standards on completion of the remedy construction. • The primary risks associated with implementing this alternative is the potential for the MNR and ENR areas to not meet cleanup standards within the reasonable restoration timeframe (≤ 10 years). • Under this alternative, a significant amount (approximately 68% by volume) of the Marine Area contamination is addressed through full removal, which meets cleanup standards and improves environmental quality at the Marine Area immediately following construction. A substantial amount of contamination (approximately 32% by volume) is addressed using MNR and ENR, both of which rely on restoration timeframe to improve environmental quality. ENR reduces restoration timeframe through placement of a thin layer of sand and thus provides for a better environmental quality as compared to MNR. The offsite transport of dredged material will contribute to significant carbon emissions in addition to the carbon emissions from the onsite construction activities. This alternative will result in an improvement of overall environmental quality at a moderate-high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) include MNR and ENR, which are implemented in SMA-1 and/or 7. SMA-1 is subtidal and therefore effects of climate change are not anticipated. Portions of SMA-7 are intertidal and climate change has a potential of impacting ENR in this SMA if conditions for natural sedimentation are diminished. Full removal of	• Achieves a high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the time frame for meeting cleanup standards. Dynamic sand cap reduces risk to a moderate-high degree by isolating the contaminated media from surrounding aquatic environment. Full removal reduces risk to a high degree as contaminants are permanently removed from the Site and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10 under the requirement of "Compliance with Cleanup Standards." Areas subject to full removal will meet cleanup standards on completion of the remedy construction. • The primary risks with implementing this alternative include the potential for the MNR and ENR areas to not meet the cleanup standards within the reasonable restoration timeframe (≤ 10 years). • Under this alternative, a significant amount (approximately 78% by volume) of the Marine Area contamination is addressed through full removal and dynamic sand capping, all of which meet cleanup standards and improves environmental quality at the Marine Area immediately following construction. A considerable amount (approximately 22% by volume) of contamination is addressed using MNR and ENR, which relies on restoration timeframe to improve environmental quality. The offsite transport of dredged material will contribute to significant carbon emissions in addition to the carbon emissions from the onsite construction activities. This alternative will result in an improvement of overall environmental quality at a high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) rise include MNR, ENR and dynamic sand capping, which are implemented in SMA-1 and/or 7. SMA-1 is subtidal and therefore effects of climate change is not anticipated. Portions of SMA-7 are intertidal and climate change has a potential of impacting ENR in this SMA if conditions for natural sedimentation are	• Achieves a high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the time frame for meeting cleanup standards. Full removal reduces risk to a high degree as contaminants are permanently removed from the Site and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10 under the requirement of "Compliance with Cleanup Standards." Areas subject to full removal will meet cleanup standards on completion of the remedy construction. • The primary risks with implementing this alternative include ineffective removal in the deeper water areas and the potential for the MNR and ENR areas to not meet cleanup standards within the reasonable restoration timeframe (≤ 10 years). Dredging in the deeper areas of the Site presents significant challenges to place dredge buckets accurately and precisely, potentially resulting in incomplete dredging and contaminated dredging residuals. Deeper water increases the potential for contaminant losses to the water column as the dredged material is raised to the surface. • Under this alternative, a significant amount (approximately 78% by volume) of the Marine Area contamination is addressed through full removal, which meet cleanup standards and improves environmental quality at the Marine Area immediately following construction. A considerable amount (approximately 22% by volume) of contamination is addressed using MNR and ENR, which relies on restoration timeframe to improve environmental quality. The offsite transport of dredged material will contribute to significant carbon emissions in addition to the carbon emissions from the onsite construction activities. This alternative will result in an improvement of overall environmental quality at a high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) include MNR and ENR, which are implemented in SMA-1a, 1b, 1c and/or 7. SMAs-1a, 1b and 1c are subtidal and therefore effects	• Achieves a high degree of protectiveness. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the timeframe for meeting cleanup standards. Full removal reduces risk to a high degree as contaminants are permanently removed from the Site and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards following the completion of construction as described in Table 10 under the requirement of "Compliance with Cleanup Standards." • Cleanup standards are expected to be met at the completion of construction; however, the primary risks with implementing this alternative include ineffective removal in the deeper water areas and the potential for the ENR area to not maintain the cleanup standards. Dredging in the deeper areas of the Site presents significant challenges to place dredge buckets accurately and precisely, potentially resulting in incomplete dredging and contaminated dredging residuals. Deeper water increases the potential for contaminant losses to the water column as the dredged material is raised to the surface. • Under this alternative, a significant amount (approximately 83% by volume) of the Marine Area contamination is addressed through full removal, which meets cleanup standards and improves environmental quality at the Marine Area immediately following construction. A considerable amount (approximately 17% by volume) is addressed using ENR, which relies on restoration timeframe to improve environmental quality. The offsite transport of dredged material will contribute to significant carbon emissions in addition to the carbon emissions from the onsite construction activities. This alternative will result in an improvement of overall environmental quality at a high level. The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) is ENR, which is implemented in SMAs-1a, 1b and 1c, which are subtidal. Full removal of contaminated media in SMAs-1d, 2, 3, 5 and 6, full removal and backfill in SMA-7, and no action in SMA-4 are not expected to be impacted by climate change. Therefore, remedies implemented as part of this alternative are not expected to be impacted by climate change. • This alternative will result in a loss of aquatic

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
(Protectiveness Continued)	elevations. MNR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	contaminated media in SMAs-2, 3, 5 and 6, and no action in SMA-4 are not expected to be impacted by climate change. • This alternative will result in a loss of aquatic habitat at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Full removal of contaminated sediment and wood debris in SMAs 3c, 5 and 6 will result in the loss of critical habitat elevations. ENR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	diminished. Full removal of contaminated media in SMAs-2, 3, 5 and 6, and no action in SMA-4 are not expected to be impacted by climate change. • This alternative will result in a loss of aquatic habitat at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Full removal of contaminated sediment and wood debris in SMAs 3c, 5 and 6 will result in the loss of critical habitat elevations. ENR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	of climate change are not anticipated. Portions of SMA-7 are intertidal and climate change has a potential of impacting ENR in this SMA if conditions for natural sedimentation are diminished. Full removal of contaminated media in SMAs-1d, 2, 3, 5 and 6, and no action in SMA-4 are not expected to be impacted by climate change. • This alternative will result in a loss of aquatic habitat at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Full removal of contaminated sediment and wood debris in SMAs 3c, 5 and 6 will result in the loss of critical habitat elevations. ENR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	habitat at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Full removal of contaminated sediment and wood debris in SMAs 3c, 5 and 6 will result in the loss of critical habitat elevations. Full removal and backfill to restore existing elevations in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Permanence	Score = 6.5	Score = 7	Score = 7.5	Score = 8	Score = 8.5
"The degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated."	• Achieves a moderate degree of permanence because approximately 32% by volume of contaminated media is addressed using MNR and approximately 68% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility and volume over time. Full removal immediately reduces toxicity, mobility and volume of hazardous substance from the Marine Area following construction. • Contamination addressed using MNR will naturally degrade and attenuate over time. Contamination addressed by full removal is not destroyed but will be disposed of at an off-site permitted landfill where it will be permanently isolated and contained from the environment. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a moderate-high degree of permanence because approximately 32% by volume of contaminated media is addressed using MNR and ENR and approximately 68% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility, and volume over time. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Full removal immediately reduces toxicity, mobility, and volume of hazardous substances from the Marine Area following construction. • Contamination addressed using MNR and ENR will naturally degrade and attenuate over time. Contamination addressed by full removal is not destroyed but will be disposed of at an off-site permitted landfill where it will be permanently isolated and contained from the environment. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a moderate-high degree of permanence because approximately 22% by volume of contaminated media is addressed using MNR and ENR, 10% is addressed using dynamic sand capping and 68% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility, and volume. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Dynamic sand capping reduces the mobility of hazardous substances through placement and distribution of 3-feet equivalent mass of sand to isolate the underlying contamination. Dynamic sand capping does not immediately reduce toxicity and volume of hazardous substances but prevents exposure through isolation. Full removal immediately reduces toxicity, mobility and volume of hazardous substance from the Marine Area following construction. • Contamination addressed using MNR, ENR and dynamic sand cap will naturally degrade and attenuate over time. Contamination addressed using capping is not destroyed but isolated from the aquatic environment to prevent exposure. Contamination addressed using full removal is not destroyed but disposed at an off-site permitted landfill where it will be permanently isolated and contained from the environment. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a high degree of permanence because approximately 22% by volume of contaminated media is addressed using MNR and ENR and approximately 78% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility, and volume. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Full removal immediately reduces toxicity, mobility, and volume of hazardous substances from the Marine Area following construction. Dredging in deeper water areas poses a risk for incomplete removal or residuals which would act to lower the degree of permanence. • Contamination addressed using MNR and ENR will naturally degrade and attenuate over time. Contamination addressed by full removal is not destroyed but will be disposed of at an off-site permitted landfill where it will be permanently isolated and contained from the environment. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a high degree of permanence because approximately 17% by volume of contaminated media is addressed using ENR and approximately 83% is addressed using full removal. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Full removal immediately reduces toxicity, mobility, and volume of hazardous substances from the Marine Area following construction. Dredging in deeper water areas poses a risk for incomplete removal or residuals which would act to lower the degree of permanence. • Contamination addressed using ENR will naturally degrade and attenuate over time. Contamination addressed by full removal is not destroyed but will be disposed of at an off-site permitted landfill where it will be permanently isolated and contained from the environment. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Long-Term Effectiveness	**Score = 7**	**Score = 7**	**Score = 7.5**	**Score = 8**	**Score = 8.5**
"Long-term effectiveness includes the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-site at concentrations that exceed cleanup levels, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes."	• Achieves a moderate degree of long-term effectiveness due to its reliance on MNR to address contaminated media (approximately 32% by volume) located outside of the full removal areas at the Site. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal element of this alternative. Until the cleanup standards are achieved through MNR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced through time, until recovery is achieved over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR is implemented. This contamination may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a moderate degree of long-term effectiveness due to its reliance on MNR and ENR to address contaminated media (approximately 32% by volume) located outside of the full removal areas at the Site. MNR and ENR are expected to achieve a similar degree of long-term effectiveness since both technologies rely on natural attenuation processes and both are expected to achieve cleanup standards within a reasonable restoration timeframe. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal element of this alternative. Until the cleanup standards are achieved through MNR and ENR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced over time, until recovery is achieved over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR and ENR are implemented. This contamination may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a moderate-high degree of long-term effectiveness due to its reliance on MNR, ENR and dynamic sand capping to address contaminated media (approximately 32% by volume) located outside of the full removal areas at the Site. Dynamic sand capping is expected to achieve a higher degree to long-term effectiveness as compared to MNR and ENR since capping will result in isolation of contaminated media while MNR and ENR rely on natural attenuation processes to reduce contaminant concentrations. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal and dynamic sand capping elements of this alternative. Until the cleanup standards are achieved through MNR and ENR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced through time, until recovery is achieved/cleanup standards are met over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR, ENR and dynamic sand capping are implemented. This contamination may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a high degree of long-term effectiveness due to its reliance on both MNR and ENR to address contaminated media (approximately 22% by volume) located outside of the full removal areas of the Site. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal element of this alternative. Long-term risks associated with dredging the deeper areas at the Site include potential for incomplete removal and contaminated dredging residuals due to increased implementation challenges. Until the cleanup standards are achieved through MNR and ENR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced over time, until recovery is achieved over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR and ENR are implemented. This contamination may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a high degree of long-term effectiveness due to reliance on ENR to address contaminated media (approximately 17% by volume) located outside of the full removal areas of the Site. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal element of this alternative. Long-term risks associated with dredging the deeper areas at the Site include potential for incomplete removal and contaminated dredging residuals due to increased implementation challenges. Cleanup standards are expected to be met at the completion of construction; however, long-term risks with implementing this alternative include a potential for the ENR area to not maintain the cleanup standards. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where ENR is implemented. This contamination may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Management of Short-Term Risks	**Score = 7.5**	**Score = 7**	**Score = 6.5**	**Score = 6**	**Score = 5.5**
"The risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks."	• Manages short-term risks to a moderate-high degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary best management practices (BMPs) and compliance monitoring. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • The dredged material removed from the Site will be disposed at an off-site landfill, posing potential risk of accidental spills/releases during transportation. This risk will be managed through rapid response to address potential spills. • Capacity limitations on transportation and landfill disposal may limit throughput for the large volume of dredged material. Capacity limitations would prolong the construction schedule and exposure period of contaminated media to human health and the environment. Multiple offsite disposal options may be required to meet the project throughput requirements.	• Manages short-term risks to a moderate degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • The dredged material removed from the Site will be disposed at an off-site landfill, posing potential risk of accidental spills/releases during transportation. This risk will be managed through rapid response to address potential spills. • Capacity limitations on transportation and landfill disposal may limit throughput for the large volume of dredged material. Capacity limitations would prolong the construction schedule and exposure period of contaminated media to human health and the environment. Multiple offsite disposal options may be required to meet the project throughput requirements. • The import of sand/fill material for ENR may result in short-term risks related to both the transport and placement of material.	• Manages short-term risks to a moderate degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. • Short-term risks associated with dynamic sand cap placement include disturbance and resuspension of contaminated sediment or porewater on impact with the bottom and smothering of benthic communities and aquatic vegetation. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • The dredged material removed from the Site will be disposed at an off-site landfill, posing potential risk of accidental spills/releases during transportation. This risk will be managed through rapid response to address potential spills. • Capacity limitations on transportation and landfill disposal may limit throughput for the large volume of dredged material. Capacity limitations would prolong the construction schedule and exposure period of contaminated media to human health and the environment. Multiple offsite disposal options may be required to meet the project throughput requirements. • The import of sand/fill material for capping and ENR may result in short-term risks related to both the transport and placement of material.	• Manages short-term risks to a moderate degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. This alternative involves dredging in one of the deep SMAs at the Site which has an increased risk for incomplete removal and residuals due to lower precision performance of the dredging equipment. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • The dredged material removed from the Site will be disposed at an off-site landfill, posing potential risk of accidental spills/releases during transportation. This risk will be managed through rapid response to address potential spills. • Capacity limitations on transportation and landfill disposal may limit throughput for the large volume of dredged material. Capacity limitations would prolong the construction schedule and exposure period of contaminated media to human health and the environment. Multiple offsite disposal options may be required to meet the project throughput requirements. • The import of sand/fill material for ENR may result in short-term risks related to both the transport and placement of material.	• Manages short-term risks to a moderate degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. This alternative involves dredging in one of the deep SMAs at the Site which has an increased risk for incomplete removal and residuals due to lower precision performance of the dredging equipment. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • The dredged material removed from the Site will be disposed at an off-site landfill, posing potential risk of accidental spills/releases during transportation. This risk will be managed through rapid response to address potential spills. • Capacity limitations on transportation and landfill disposal may limit throughput for the large volume of dredged material. Capacity limitations would prolong the construction schedule and exposure period of contaminated media to human health and the environment. Multiple offsite disposal options may be required to meet the project throughput requirements. • The import of sand/fill material for ENR may result in short-term risks related to both the transport and placement of material.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Technical and Administrative Implementability	**Score = 8.5**	**Score = 8**	**Score = 7.5**	**Score = 6.5**	**Score = 6**
"Ability to be implemented including consideration of whether the alternative is technically possible, availability of necessary offsite facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions."	• Achieves a high level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and upland retaining wall. A significant area of the Site requires only monitoring under this alternative. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. This alternative will not prohibit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities, including construction of the South Terminal toe wall and upland retaining wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 424,520 tons of contaminated material. Capacity limitations on transportation and landfill disposal may require the construction to be phased over multiple years. Depending on the rate of dredging, use of multiple transportation and landfill alternatives may be necessary. • The use of MNR reduces the overall dredged material volume and need for precision materials placement or dredging in the deeper areas of the Site. • Monitoring will be required to confirm the effectiveness of MNR to achieve the cleanup standards within the restoration timeframe.	• Achieves a high level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and upland retaining wall. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. This alternative will not prohibit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities, including construction of the South Terminal toe wall and upland retaining wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 424,520 tons of contaminated material. Capacity limitations on transportation and landfill disposal may require the construction to be phased over multiple years. Depending on the rate of dredging, use of multiple transportation and landfill alternatives may be necessary. • The use of MNR and ENR reduces the overall dredged material volume and the need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water column is not expected to pose significant technical challenges since sand placed for ENR purposes does not require the precision that is necessary for capping and can effectively be implemented in deeper water areas. • Monitoring will be required to confirm the effectiveness of MNR and ENR to achieve the cleanup standards within the restoration timeframe.	• Achieves a moderate level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and upland retaining wall. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. This alternative will not prohibit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities, including construction of the South Terminal toe wall and upland retaining wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 438,070 tons of contaminated material. Capacity limitations on transportation and landfill disposal may require the construction to be phased over multiple years. Depending on the rate of dredging, use of multiple transportation and landfill alternatives may be necessary. • The use of MNR, ENR and dynamic sand cap reduces the overall dredged material volume and need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water and dynamic sand cap material in moderately deep water is not expected to pose significant technical challenges since the sand placement techniques to implement these technologies do not require the precision that is necessary for conventional or amended/reactive capping. • Monitoring will be required to confirm the effectiveness of MNR and ENR to achieve the cleanup standards within the restoration timeframe and to confirm the effectiveness of the dynamic sand caps.	• Achieves a moderate level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and upland retaining wall. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. This alternative will not prohibit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities, including construction of the South Terminal toe wall and upland retaining wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance /monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 484,010 tons of contaminated material. Capacity limitations on transportation and landfill disposal may require the construction to be phased over multiple years. Depending on the rate of dredging, use of multiple transportation and landfill alternatives may be necessary. • The use of MNR and ENR reduces the overall dredged material volume and the need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water column is not expected to pose significant technical challenges since sand placed for ENR purposes does not require the precision that is necessary for capping and can effectively be implemented in deeper water areas. • Dredging is proposed in SMA-1d with mudline up to -75 feet MLLW. Significant inherent technical challenges are associated with the precision dredging in deep water and risk potential schedule delays, incomplete dredging, residuals, releases to the water column and increased cost due to over-dredging. • Monitoring will be required to confirm the effectiveness of MNR and ENR to achieve the cleanup standards within the restoration timeframe.	• Achieves a moderate level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and upland retaining wall. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. This alternative will not prohibit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities, including construction of the South Terminal toe wall and upland retaining wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance /monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 519,310 tons of contaminated material. Capacity limitations on transportation and landfill disposal may require the construction to be phased over multiple years. Depending on the rate of dredging, use of multiple transportation and landfill alternatives may be necessary. • The use of ENR reduces the overall dredged material volume and need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water column is not expected to pose significant technical challenges since sand placed for ENR purposes does not require the precision that is necessary for capping and can effectively be implemented in deeper water areas. • Dredging is proposed in SMA-1d with mudline up to -75 feet MLLW. Significant inherent technical challenges are associated with the precision dredging in deep water and risk potential schedule delays, incomplete dredging, residuals, releases to the water column and increased cost due to over-dredging. • Monitoring will be required to confirm the effectiveness of ENR to achieve the cleanup standards within the restoration timeframe.

Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Consideration of Public Concerns	**Score = 6.5**	**Score = 7**	**Score = 7.5**	**Score = 7.5**	**Score = 8.5**
"Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site."	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. • All of the contaminated dredged material generated from this alternative will be transported off-site by trucks on public streets and/or highways since this alternative solely relies on the use of off-site landfill facilities for the disposal of contaminated dredged material. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. • All of the contaminated dredged material generated from this alternative will be transported off-site by trucks on public streets and/or highways since this alternative solely relies on the use of off-site landfill facilities for the disposal of contaminated dredged material. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. • All of the contaminated dredged material generated from this alternative will be transported off-site by trucks on public streets and/or highways since this alternative solely relies on the use of off-site landfill facilities for the disposal of contaminated dredged material. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. • All of the contaminated dredged material generated from this alternative will be transported off-site by trucks on public streets and/or highways since this alternative solely relies on the use of off-site landfill facilities for the disposal of contaminated dredged material. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. • All of the contaminated dredged material generated from this alternative will be transported off-site by trucks on public streets and/or highways since this alternative solely relies on the use of off-site landfill facilities for the disposal of contaminated dredged material. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.

Notes:

BMPs = best management practices
CDF = confined disposal facility
COCs = contaminants of concern
DCA = Disproportionate Cost Analysis
Ecology = Washington State Department of Ecology
ENR = enhanced natural recovery
MNR = monitored natural recovery
MTCA = Model Toxics Control Act
RI/FS = Remedial Investigation/Feasibility Study
SMA = sediment management area

Table 12

Summary and Evaluation of Alternatives — Disproportionate Cost Analysis Criteria

Weyerhaeuser Mill A Former
Everett, Washington

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Alternative Summary	• Monitored Natural Recovery (MNR) in SMAs 1 (1a through 1d) and 7 measuring approximately 43 acres. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c) and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 227,970 tons of dredged material are estimated to be removed from these SMAs. • Construction of confined disposal facility (CDF) within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 1,770 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b through 1d, and 7 measuring approximately 16.2 acres. Approximately 20,900 tons of sand is estimated to be placed in these SMAs. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c) and 6. Dredge stable side slopes at 3H:1V in SMA-1d to allow for full removal to be completed in adjacent SMA-2a. Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 227,970 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 1,770 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand is estimated to be placed in this SMA. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Placement of dynamic sand cap in SMA 1d measuring approximately 4.5 acres. Approximately 35,720 tons of sand cap material is estimated to be placed in SMA 1d. • Full removal of contaminated sediment and wood debris from SMAs 2 (2a and 2b), 3 (3a through 3c) and 6. Dredge in SMA-1d to provide stable transition slopes to allow full removal in adjacent SMA-2a and to remove contaminated sediment in SMA-1d above elevation -60 feet MLLW which will ensure that the dynamic sand cap placed in SMA-1d is not above the maximum scour elevation (i.e., -55 feet MLLW). Side slope dredging in SMA-1a, 1b and 1c is not assumed for the purposes of the FS since the full removal depths in the adjacent portions of SMA-2a/2b are shallow. Approximately 241,520 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 15,320 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Monitored Natural Recovery (MNR) in SMA 1a measuring approximately 26.8 acres. • Enhanced Natural Recovery (ENR) in SMAs 1b, 1c and 7 measuring approximately 11.7 acres. Approximately 15,140 tons of sand is estimated to be placed in these SMAs. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c) and 6. Approximately 287,460 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 61,260 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.	• Enhanced Natural Recovery (ENR) in SMAs 1a, 1b, and 1c measuring approximately 35.7 acres. Approximately 46,140 tons of sand is estimated to be placed in these SMAs. • Removal of the existing South Terminal pile-supported roll-on/roll-off berth to provide access to dredging areas and installation of South Terminal toe wall to support existing structures and achieve complete contaminant removal through dredging. • Full removal of contaminated sediment and wood debris from SMAs 1d, 2 (2a and 2b), 3 (3a through 3c) 6 and 7. Approximately 322,760 tons of dredged material are estimated to be removed from these SMAs. • Construction of CDF within SMA-5. Approximately 196,550 tons of contaminated sediment and wood debris located in SMA-5 will be contained and covered by the CDF. The CDF will provide space for the disposal of approximately 226,200 tons of dredged material. • Dispose approximately 226,200 tons of dredged material into the on-site CDF. • Upland transload, transport and disposal of approximately 96,560 tons of dredged material that cannot be disposed into the on-site CDF at an off-site permitted landfill. • Backfilling in SMA-7 with sand to restore existing critical habitat elevations. Approximately 43,440 tons of sand backfill is estimated to be placed in this SMA. • No further action in SMA-4 due to the completeness of the 2016 interim action. • Institutional controls, as necessary.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Disproportionate Cost Analysis Criteria [173-340-360(3)(f) and SMS 173-204-570(4)] and Ecology Publication No. 17-09-052 – Relative Benefit Evaluation (Scored from 1 = Low to 10 = High)					
Protectiveness	Score = 7.5	Score = 8	Score = 8.5	Score = 8.5	Score = 9.5
"Overall protectiveness of human health and the environment, including the degree to which existing risks are reduced, time required to reduce risk at the facility and attain cleanup standards, on-site and offsite risks resulting from implementing the alternative, and improvement of the overall environmental quality. This also includes evaluating potential risks to the integrity of the remedy from climate change impacts."	• Achieves a moderate-high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. Containment/CDF reduces risk to a high degree as it contains and isolates contaminated media in an engineered structure and eliminates the need to perform remedial action such as removal to address the in-place contamination located within the CDF footprint. Full removal reduces risk to a high degree as contaminants are permanently removed from exposure pathways and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10-1 under the requirement of "Compliance with Cleanup Standards." Areas subject to containment/CDF and full removal will meet cleanup standards on completion of the remedy construction. • The primary risk associated with implementing this alternative is the potential for the MNR area to not meet cleanup standards within the reasonable restoration timeframe (≤ 10 years). • Under this alternative, a significant amount (approximately 68% by volume) of the Marine Area contamination is addressed through containment/CDF and full removal, which meet cleanup standards and improves environmental quality at the Marine Area immediately following construction. A substantial amount of the remaining contamination (approximately 32% by volume) is addressed using MNR, which relies on restoration timeframe to improve environmental quality. Under this alternative, approximately 99% of the dredged material are estimated to be disposed of in the on-site CDF while the remaining approximately 1% will require off-site transport and landfill disposal. As a result, carbon emissions resulting from this alternative are reduced significantly relative to offsite disposal due to the reduced off-site transportation activities. This alternative will result in an improvement of overall environmental quality at a moderate-high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) is MNR, which is implemented in SMA-1 and 7. SMA-1 is subtidal and therefore, the effects of climate change is not anticipated. Portions of SMA-7 are intertidal and climate change has the potential of impacting MNR in this SMA if conditions for natural sedimentation are diminished. Full removal of contaminated media	• Achieves a high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the time frame for meeting cleanup standards. Containment/CDF reduces risk to a high degree as it contains and isolates contaminated media in an engineered structure and eliminates the need to perform remedial action such as removal to address the in-place contamination located within the CDF footprint. Full removal reduces risk to a high degree as contaminants are permanently removed from exposure pathways and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10 under the requirement of "Compliance with Cleanup Standards." Areas subject to containment/CDF and full removal will meet cleanup standards on completion of the remedy construction. • The primary risks associated with implementing this alternative is the potential for the MNR and ENR areas to not meet cleanup standards within the reasonable restoration timeframe (≤ 10 years). Under this alternative, a significant amount (approximately 68% by volume) of the Marine Area contamination is addressed through containment/CDF and full removal, which meet cleanup standards and improves environmental quality at the Marine Area immediately following construction. A substantial amount of contamination (approximately 32% by volume) is addressed using MNR and ENR, both of which rely on restoration timeframe to improve environmental quality. ENR reduces restoration timeframe through placement of a thin layer of sand and thus provides for a better environmental quality as compared to MNR. Under this alternative, approximately 99% of the dredged material are estimated to be disposed of in the on-site CDF while the remaining approximately 1% will require off-site transport and landfill disposal. As a result, carbon emissions resulting from this alternative are reduced significantly relative to offsite disposal due to the reduced off-site transportation activities. This alternative will result in an improvement of overall environmental quality at a high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea	• Achieves a high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the time frame for meeting cleanup standards. Dynamic sand cap reduces risk to a moderate-high degree by isolating the contaminated media from surrounding aquatic environment. Containment/CDF reduces risk to a high degree as it contains and isolates contaminated media in an engineered structure and eliminates the need to perform remedial action such as removal to address the in-place contamination located within the CDF footprint. Full removal reduces risk to a high degree as contaminants are permanently removed from exposure pathways and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10 under the requirement of "Compliance with Cleanup Standards." Areas subject to containment/CDF and full removal will meet cleanup standards on completion of the remedy construction. • The primary risks with implementing this alternative include the potential for the MNR and ENR areas to not meet cleanup standards within a reasonable restoration timeframe (≤ 10 years). • Under this alternative, a significant amount (approximately 78% by volume) of the Marine Area contamination is addressed through containment/CDF, full removal and dynamic sand capping, which meet cleanup standards and improves environmental quality at the Marine Area immediately following construction. A considerable amount (approximately 22% by volume) of contamination is addressed using MNR and ENR, which relies on restoration timeframe to improve environmental quality. Under this alternative, approximately 99% of the dredged material are estimated to be disposed in the on-site CDF while the remaining approximately 1% will require off-site transport and landfill disposal. As a result, carbon emissions resulting from this alternative are reduced significantly relative to offsite disposal due to the reduced off-site transportation activities. This alternative will result in an improvement of overall environmental quality at a high level. The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) include MNR, ENR and dynamic sand capping, which are	• Achieves a high degree of protectiveness. MNR reduces risk to a lower degree as compared to other remedies as it relies on natural attenuation and a restoration timeframe to meet cleanup standards. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the time frame for meeting cleanup standards. Containment/CDF reduces risk to a high degree as it contains and isolates contaminated media in an engineered structure and eliminates the need to perform remedial action such as removal to address the in-place contamination located within the CDF footprint. Full removal reduces risk to a high degree as contaminants are permanently removed from exposure pathways and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards within a reasonable restoration timeframe (≤ 10 years) as described in Table 10 under the requirement of "Compliance with Cleanup Standards." Areas subject to containment/CDF and full removal will meet cleanup standards on completion of the remedy construction. • The primary risks with implementing this alternative include ineffective removal in the deeper water areas and the potential for the MNR and ENR areas to not meet cleanup standards within the reasonable restoration timeframe (≤ 10 years). Dredging in deeper areas of the Site presents significant challenges to place dredge bucket accurately and precisely, potentially resulting in incomplete dredging and contaminated dredging residuals. Deeper water increases the potential for contaminant losses to the water column as the dredged material is raised to the surface. Under this alternative, a significant amount (approximately 78% by volume) of the Marine Area contamination is addressed through containment/CDF and full removal, which meet cleanup standards and improves environmental quality at the Marine Area immediately following construction. A considerable amount (approximately 22% by volume) of contamination is addressed using MNR and ENR, which relies on restoration timeframe to improve environmental quality. Under this alternative, approximately 79% of the dredged material are estimated to be disposed of in the on-site CDF while the remaining approximately 21% will require off-site transport and landfill disposal. As a result, carbon emissions resulting from this alternative are reduced relative to offsite disposal due to the partially reduced off-	• Achieves a high degree of protectiveness. ENR reduces risks to a moderate degree due to the placement of sand to reduce contaminant concentrations and the time frame for meeting cleanup standards. Containment/CDF reduces risk to a high degree as it contains and isolates contaminated media in an engineered structure and eliminates the need to perform remedial action such as removal to address the in-place contamination located within the CDF footprint. Full removal reduces risk to a high degree as contaminants are permanently removed from exposure pathways and cleanup standards are met following implementation of the remedy. • This alternative is expected to attain cleanup standards following the completion of construction as described in Table 10 under the requirement of "Compliance with Cleanup Standards." • Cleanup standards are expected to be met at the completion of construction; however, the primary risks with implementing this alternative include ineffective removal in the deeper water areas and the potential of not maintaining cleanup standards in the ENR area. Dredging in deeper areas of the Site presents significant challenges to place dredge bucket accurately and precisely, potentially resulting in incomplete dredging and contaminated dredging residuals. Deeper water increases the potential for contaminant losses to the water column as the dredged material is raised to the surface. • Under this alternative, a significant amount (approximately 83% by volume) of the Marine Area contamination is addressed through containment/CDF and full removal, which meets cleanup standards and improves environmental quality at the Marine Area immediately following construction. A considerable amount (approximately 17% by volume) is addressed using ENR, which relies on restoration timeframe to improve environmental quality. Under this alternative, approximately 570% of the dredged material are estimated to be disposed in the on-site CDF while the remaining approximately 30% will require off-site transport and landfill disposal. As a result, carbon emissions resulting from this alternative are reduced relative to offsite disposal due to the partially reduced off-site transportation activities. This alternative will result in an improvement of overall environmental quality at a high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) is ENR, which is implemented in SMA-1a, 1b and 1c, which are subtidal. Full removal of contaminated media in SMAs-1d, 2, 3 and 6,

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
(Protectiveness Continued)	in SMAs-2, 3 and 6, containment/CDF in SMA-5 and no action in SMA-4 are not expected to be impacted by climate change. The top of CDF wall will be constructed at an elevation that is at or above the adjacent upland areas where Port terminal facilities are located, and therefore, climate change such as sea level rise is not expected to impact CDF. Port terminal facilities are well above sea level and are not expected to be impacted by sea level rise in the foreseeable future. This alternative will result in a loss of aquatic habitat and waters of the State at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Construction of CDF in SMA-5 will result in loss of aquatic habitat and waters of the State. Full removal of contaminated sediment and wood debris in 3c and 6 will result in the loss of critical habitat elevations. MNR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat and waters of the State resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	level rise) include MNR and ENR, which are implemented in SMA-1 and/or 7. SMA-1 is subtidal and therefore effects of climate change are not anticipated. Portions of SMA-7 are intertidal and climate change has a potential of impacting ENR in this SMA if conditions for natural sedimentation are diminished. Full removal of contaminated media in SMAs-2, 3 and 6, containment/CDF in SMA-5 and no action in SMA-4 are not expected to be impacted by climate change. The top of CDF wall will be constructed at an elevation that is at or above the adjacent upland areas where Port terminal facilities are located, and therefore, climate change such as sea level rise is not expected to impact CDF. Port terminal facilities are well above sea level and are not expected to be impacted by sea level rise in the foreseeable future. • This alternative will result in a loss of aquatic habitat and waters of the State at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Construction of CDF in SMA-5 will result in loss of aquatic habitat and waters of the State. Full removal of contaminated sediment and wood debris in 3c and 6 will result in the loss of critical habitat elevations. ENR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat and waters of the State resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	implemented in SMA-1 and/or 7. SMA-1 is subtidal and therefore effects of climate change are not anticipated. Portions of SMA-7 are intertidal and climate change has a potential of impacting ENR in this SMA if conditions for natural sedimentation are diminished. Full removal of contaminated media in SMAs-2, 3 and 6, containment/CDF in SMA-5 and no action in SMA-4 are not expected to be impacted by climate change. The top of CDF wall will be constructed at an elevation that is at or above the adjacent upland areas where Port terminal facilities are located, and therefore, climate change such as sea level rise is not expected to impact CDF. Port terminal facilities are well above sea level and are not expected to be impacted by sea level rise in the foreseeable future. • This alternative will result in a loss of aquatic habitat and waters of the State at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Construction of CDF in SMA-5 will result in loss of aquatic habitat and waters of the State. Full removal of contaminated sediment and wood debris in 3c and 6 will result in the loss of critical habitat elevations. ENR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat and waters of the State resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	site transportation activities. This alternative will result in an improvement of overall environmental quality at a high level. • The remedy element of this alternative that could be most impacted by climate change (e.g., sea level rise) include MNR and ENR, which are implemented in SMA-1a, 1b, 1c and/or 7. SMAs-1a, 1b and 1c are subtidal and therefore effects of climate change are not anticipated. Portions of SMA-7 are intertidal and climate change has a potential of impacting ENR in this SMA if conditions for natural sedimentation are diminished. Full removal of contaminated media in SMAs-1d, 2, 3 and 6, containment/CDF in SMA-5 and no action in SMA-4 are not expected to be impacted by climate change. The top of CDF wall will be constructed at an elevation that is at or above the adjacent upland areas where Port terminal facilities are located, and therefore, climate change such as sea level rise is not expected to impact CDF. Port terminal facilities are well above sea level and are not expected to be impacted by sea level rise in the foreseeable future. • This alternative will result in a loss of aquatic habitat and waters of the State at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Construction of CDF in SMA-5 will result in loss of aquatic habitat and waters of the State. Full removal of contaminated sediment and wood debris in 3c and 6 will result in the loss of critical habitat elevations. ENR in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat and waters of the State resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.	containment/CDF in SMA-5, full removal and backfill in SMA-7, and no action in SMA-4 are not expected to be impacted by climate change. The top of CDF wall will be constructed at an elevation that is at or above the adjacent upland areas where Port terminal facilities are located, and therefore, climate change such as sea level rise is not expected to impact CDF. Port terminal facilities are well above sea level and are not expected to be impacted by sea level rise in the foreseeable future. Therefore, remedies implemented as part of this alternative are not expected to be impacted by climate change. • This alternative will result in a loss of aquatic habitat and waters of the State at the Site. SMAs 3c, 5, 6 and 7 contain critical aquatic habitat elevations. Construction of CDF in SMA-5 will result in loss of aquatic habitat and waters of the State. Full removal of contaminated sediment and wood debris in 3c and 6 will result in the loss of critical habitat elevations. Full removal and backfill to restore existing elevations in SMA-7 does not affect habitat elevations and therefore, will not result in the loss of critical aquatic habitat. A habitat mitigation plan will be developed as part of the project permitting process in consultation with regulatory agencies and will be implemented to offset the loss of aquatic habitat and waters of the State resulting from this alternative. The Port anticipates use of the advanced habitat mitigation at the Blue Heron Slough Conservation and Mitigation Bank as part of the offset to habitat impacts resulting from the remedial action.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Permanence	Score = 6	Score = 6.5	Score = 7	Score = 7.5	Score = 8
"The degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated."	• Achieves a moderate degree of permanence because approximately 32% by volume of contaminated media is addressed using MNR, approximately 37% is addressed using containment/CDF and approximately 31% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility, and volume. Containment/CDF reduces the mobility of hazardous substances following implementation. Containment/CDF does not immediately reduce toxicity and volume of hazardous substances but prevents exposure through isolation. Full removal immediately reduces toxicity, mobility, and volume of hazardous substance from the Marine Area following construction. • Contamination addressed using MNR will naturally degrade and attenuate over time. • Contamination addressed by full removal is not destroyed but will be contained/disposed in an on-site CDF or at off-site permitted landfill where it will be permanently isolated from the environment. The containment of contaminated media in the CDF is permanent, however, due to the location, does not result in reduction of volume at the Site. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a moderate degree of permanence because approximately 32% by volume of contaminated media is addressed using MNR and ENR, approximately 37% is addressed using containment/CDF and approximately 31% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility, and volume. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Containment/CDF reduces the mobility of hazardous substances following implementation. Containment/CDF does not immediately reduce toxicity and volume of hazardous substances but prevents exposure through isolation. Full removal immediately reduces toxicity, mobility, and volume of hazardous substances from the Marine Area following construction. • Contamination addressed using MNR and ENR will naturally degrade and attenuate over time. • Contamination addressed by full removal is not destroyed but will be contained/disposed in an on-site CDF or at off-site permitted landfill where it will be permanently isolated from the environment. The containment of contaminated media in the CDF is permanent, however, due to the location, does not result in reduction of volume at the Site. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a moderate degree of permanence because approximately 22% by volume of contaminated media is addressed using MNR and ENR, approximately 10% is addressed using dynamic sand capping, approximately 37% is addressed using containment/CDF and approximately 31% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility, and volume. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Dynamic sand capping reduces the mobility of hazardous substances through placement and distribution of 3-feet equivalent mass of sand to isolate the underlying contamination. The CDF reduces the mobility of hazardous substances following completion of construction. Dynamic sand capping and containment/CDF do not immediately reduce toxicity and volume of hazardous substances but prevents exposure through isolation. Full removal immediately reduces toxicity, mobility, and volume of hazardous substances from the Marine Area following construction. • Contamination addressed using MNR, ENR and dynamic sand cap will naturally degrade and attenuate over time. • Contamination addressed using dynamic sand capping is not destroyed but isolated from the aquatic environment to prevent exposure. Contamination addressed by full removal is not destroyed but will be contained/disposed in an on-site CDF or at off-site permitted landfill where it will be permanently isolated from the environment. The containment of contaminated media in the CDF is permanent, however, due to the location, does not result in reduction of volume at the Site. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a moderate-high degree of permanence because approximately 22% by volume of contaminated media is addressed using MNR and ENR, approximately 37% is addressed using containment/CDF and approximately 41% is addressed using full removal. MNR relies on natural attenuation processes to reduce toxicity, mobility, and volume. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Containment/CDF reduces the mobility of hazardous substances following implementation. Containment/CDF does not immediately reduce toxicity and volume of hazardous substances but prevents exposure through isolation. Full removal immediately reduces toxicity, mobility, and volume of hazardous substances from the Marine Area following construction. Dredging in deeper water areas poses a risk for incomplete removal or residuals which would act to lower the degree of permanence. • Contamination addressed using MNR and ENR will naturally degrade and attenuate over time. • Contamination addressed by full removal is not destroyed but will be contained/disposed in an on-site CDF or at off-site permitted landfill where it will be permanently isolated from the environment. The containment of contaminated media in the CDF is permanent, however, due to the location, does not result in reduction of volume at the Site. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.	• Achieves a high degree of permanence because approximately 17% by volume of contaminated media is addressed using ENR, approximately 37% is addressed using containment/CDF and approximately 46% is addressed using full removal. ENR involves placement of a thin layer of sand to reduce contaminant concentrations and the timeframe in which natural attenuation processes work to reduce toxicity, mobility, and volume. Containment/CDF reduces the mobility of hazardous substances following implementation. Containment/CDF does not immediately reduce toxicity and volume of hazardous substances but prevents exposure through isolation. Full removal immediately reduces toxicity, mobility, and volume of hazardous substances from the Marine Area following construction. Dredging in deeper water areas poses a risk for incomplete removal or residuals which would act to lower the degree of permanence. • Contamination addressed using ENR will naturally degrade and attenuate over time. • Contamination addressed by full removal is not destroyed but will be contained/disposed in an on-site CDF or at off-site permitted landfill where it will be permanently isolated from the environment. The containment of contaminated media in the CDF is permanent, however, due to the location, does not result in reduction of volume at the Site. • The historic processes generating hazardous substances at the Marine Area are no longer in operation. A passive ongoing source of contamination to the surface sediment of Marine Area can be attributed to erosion and dispersal of the historical contamination. This alternative will result in complete removal or containment of contamination from the source areas that are subjected to scour (SMAs-2, 3, 5 and 6) and thus will eliminate this source. • Treatment proposed under this alternative is through natural degradation and attenuation processes, which are irreversible and will not generate treatment residuals.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Long-Term Effectiveness	**Score = 6.5**	**Score = 6.5**	**Score = 7**	**Score = 7.5**	**Score = 8.0**
"Long-term effectiveness includes the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-site at concentrations that exceed cleanup levels, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes."	• Achieves a moderate degree of long-term effectiveness due to its reliance on MNR to address contaminated media (approximately 32% by volume) located outside of the containment/CDF and full removal areas at the Site. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal and containment/CDF elements of this alternative. Until the cleanup standards are achieved through MNR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced through time, until recovery is achieved over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR is implemented and within the containment/CDF. The contamination within SMAs with MNR may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. Potential for failure of containment/CDF structure will be managed by engineering the structure to perform its function, long-term monitoring, and performing maintenance on the structure over-time. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a moderate degree of long-term effectiveness due to its reliance on MNR and ENR to address contaminated media (approximately 32% by volume) located outside of the containment/CDF and full removal areas at the Site. MNR and ENR are expected to achieve a similar degree of long-term effectiveness since both technologies rely on natural attenuation processes and both are expected to achieve cleanup standards within a reasonable restoration timeframe. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal and containment/CDF elements of this alternative. Until the cleanup standards are achieved through MNR and ENR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced over time, until recovery is achieved over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR and ENR is implemented and within the containment/CDF. The contamination within SMAs with MNR and ENR may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. Potential for failure of containment/CDF structure will be managed by engineering the structure to perform its function, long-term monitoring, and performing maintenance on the structure over-time. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a moderate degree of long-term effectiveness due to its reliance on MNR, ENR and dynamic sand capping to address contaminated media (approximately 32% by volume) located outside of the containment/CDF and full removal areas at the Site. Dynamic sand capping is expected to achieve a higher degree to long-term effectiveness as compared to MNR and ENR since capping will result in isolation of contaminated media while MNR and ENR rely on natural attenuation processes to reduce contaminant concentrations. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal, containment/CDF and dynamic sand capping elements of this alternative. Until the cleanup standards are achieved through MNR and ENR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced through time, until recovery is achieved/cleanup standards are met over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR, ENR and dynamic sand capping are implemented and within the containment/CDF. The contamination within SMAs with MNR, ENR and dynamic sand capping may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. Potential for failure of containment/CDF structure will be managed by engineering the structure to perform its function, long-term monitoring, and performing maintenance on the structure over-time. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a moderate-high degree of long-term effectiveness due to its reliance on both MNR and ENR to address contaminated media (approximately 22% by volume) located outside of the containment/CDF and full removal areas of the Site. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal and containment/CDF elements of this alternative. Long-term risks associated with dredging the deeper areas at the Site include potential for incomplete removal and contaminated dredging residuals due to increased implementation challenges. Until the cleanup standards are achieved through MNR and ENR in the remaining parts of the Site, risks of exposure to hazardous substances will remain, although reduced over time, until recovery is achieved over the restoration timeframe. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where MNR and ENR are implemented and within the containment/CDF. The contamination in SMAs with MNR and ENR may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors Potential for failure of containment/CDF structure will be managed by engineering the structure to perform its function, long-term monitoring, and performing maintenance on the structure over-time. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.	• Achieves a moderate-high degree of long-term effectiveness due to reliance on ENR to address contaminated media (approximately 17% by volume) located outside of the containment/CDF and full removal areas of the Site. • Given that the technologies used in this alternative are well established and proven, this alternative is considered reliable. • Risks are immediately reduced through the full removal and containment/CDF elements of this alternative. Long-term risks associated with dredging the deep areas at the Site include potential for incomplete removal and presence of contaminated dredging residuals due to increased implementation challenges. Cleanup standards are expected to be met at the completion of construction; however, long-term risks with implementing this alternative include a potential for the ENR area to not maintain the cleanup standards. • Under this alternative, subsurface contamination below the point of compliance will remain in the SMAs where ENR is implemented and within the containment/CDF. The contamination within SMAs with ENR may be disturbed due to unanticipated natural or man-made forces and potentially pose a risk if exposed to receptors. Potential for failure of containment/CDF structure will be managed by engineering the structure to perform its function, long-term monitoring, and performing maintenance on the structure over-time. • Institutional controls may be required to ensure the long-term effectiveness of the alternative. Institutional controls are effective if followed.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Management of Short-Term Risks	**Score = 9.5**	**Score = 9**	**Score = 8.5**	**Score = 8**	**Score = 7.5**
"The risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks."	• Manages short-term risks to a high degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • Approximately 99% of the dredged material are estimated to be disposed of in the on-site CDF while the remaining approximately 1% will require off-site transport and landfill disposal. As a result, the potential risk of accidental spills/releases during transportation is significantly reduced. This risk will be managed through rapid response to address potential spills. Due to the negligible quantity of dredged material requiring landfill disposal, the potential for short-term risks associated with production delays due to offsite disposal are significantly reduced. The import of sand/fill material to cover contamination in the CDF may result in short-term risks related to both the transport and placement of material.	• Manages short-term risks to a high degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • Approximately 99% of the dredged material are estimated to be disposed of in the on-site CDF while the remaining approximately 1% will require off-site transport and landfill disposal. As a result, the potential risk of accidental spills/releases during transportation is significantly reduced. This risk will be managed through rapid response to address potential spills. Due to the negligible quantity of dredged material requiring landfill disposal, the potential for short-term risks associated with production delays due to offsite disposal are significantly reduced. • The import of sand/fill material for ENR and to cover contamination in the CDF may result in short-term risks related to both the transport and placement of material.	• Manages short-term risks to a high degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. • Short-term risks associated with dynamic sand cap placement include disturbance and resuspension of contaminated sediment or porewater on impact with the bottom and smothering of benthic communities and aquatic vegetation. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • Approximately 94% of the dredged material are estimated to be disposed of in the on-site CDF while the remaining approximately 6% will require off-site transport and landfill disposal. As a result, the potential risk of accidental spills/releases during transportation is significantly reduced. This risk will be managed through rapid response to address potential spills. Due to the negligible quantity of dredged material requiring landfill disposal, the potential for short-term risks associated with production delays due to offsite disposal are significantly reduced. • The import of sand/fill material for dynamic sand capping, ENR and to cover contamination in the CDF may result in short-term risks related to both the transport and placement of material.	• Manages short-term risks to a high degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. This alternative involves dredging in one of the deep SMAs at the Site which has an increased risk for incomplete removal and residuals due to lower precision performance of the dredging equipment. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • Approximately 79% of the dredged material is estimated to be disposed in the on-site CDF while the remaining approximately 21% will require off-site transport and landfill disposal. As a result, the potential risk of accidental spills/releases during transportation is reduced to a certain degree. This risk will be managed through rapid response to address potential spills. Due to the relatively low quantity of dredged material requiring landfill disposal, potential for short-term risks associated with production delays due to offsite disposal are significantly reduced. • The import of sand/fill material for ENR and to cover contamination in the CDF may result in short-term risks related to both the transport and placement of material. •	• Manages short-term risks to a moderate-high degree through use of common construction methods for sediment remediation. • Marine construction activities pose potential health and safety risks to construction workers and temporary impacts to water quality and marine life during construction. Moderate risks can be mitigated by isolating the work zone, notifying the public including commercial and recreational boat traffic, water quality management, street route planning for transportation of materials, and spill response preparedness. These measures are typical for marine remediation projects and are proven effective in minimizing the risks. • There is a potential for dredging residual, but it will be managed during construction by implementing necessary BMPs and compliance monitoring. This alternative involves dredging in one of the deep SMAs at the Site which has an increased risk for incomplete removal and residuals due to lower precision performance of the dredging equipment. • Dredging to achieve full removal in the vicinity of existing structures present significant risk to the integrity of the structures. This risk will be mitigated by installation of structural elements to protect the existing infrastructure during construction. The structural elements will be designed to meet the requirements of the construction conditions. • Approximately 70% of the dredged material are estimated to be disposed of in the on-site CDF while the remaining approximately 30% will require off-site transport and landfill disposal. As a result, the potential risk of accidental spills/releases during transportation is reduced to a certain degree. This risk will be managed through rapid response to address potential spills. Due to the relatively low quantity of dredged material requiring landfill disposal, potential for short-term risks associated with production delays due to offsite disposal are significantly reduced. • The import of sand/fill material for ENR and to cover contamination in the CDF may result in short-term risks related to both the transport and placement of material.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Technical and Administrative Implementability	Score = 9.5	Score = 9	Score = 8.5	Score = 7.5	Score = 7
"Ability to be implemented including consideration of whether the alternative is technically possible, availability of necessary offsite facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions."	• Achieves a high level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and Containment/CDF. A significant area of the Site requires only monitoring under this alternative. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. • This alternative requires the Containment/CDF to be located within SMA-5 to not limit the identified current or future Site uses. Other elements of this alternative do not limit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities, and construction of the South Terminal toe wall and containment/CDF wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 1,770 tons of contaminated material. Capacity limitations on transportation and landfill disposal are not expected to pose management and schedule challenges for this alternative. • The use of MNR reduces the overall dredged material volume and need for precision materials placement or dredging in the deeper areas of the Site. • Monitoring will be required to confirm the effectiveness of MNR to achieve the cleanup standards within the restoration timeframe.	• Achieves a high level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and Containment/CDF. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. • This alternative requires the Containment/CDF to be located within SMA-5 to not limit the identified current or future Site uses. Other elements of this alternative do not limit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities and construction of the South Terminal toe wall and containment/CDF wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 1,770 tons of contaminated material. Capacity limitations on transportation and landfill disposal are not expected to pose management and schedule challenges for this alternative. • The use of MNR and ENR reduces the overall dredged material volume and the need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water column is not expected to pose significant technical challenges since sand placed for ENR purposes does not require the precision that is necessary for capping and can effectively be implemented in deeper water areas. • Monitoring will be required to confirm the effectiveness of MNR and ENR to achieve the cleanup standards within the restoration timeframe.	• Achieves a moderate-high level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and Containment/CDF. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. • This alternative requires the Containment/CDF to be located within SMA-5 to not limit the identified current or future Site uses. Other elements of this alternative do not limit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities and construction of the South Terminal toe wall and containment/CDF wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 15.320 tons of contaminated material. Capacity limitations on transportation and landfill disposal are not expected to pose management and schedule challenges for this alternative. • The use of MNR, ENR and dynamic sand capping reduces the overall dredged material volume and need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water and dynamic sand cap material in moderately deep water is not expected to pose significant technical challenges since the sand placement techniques to implement these technologies do not require the precision that is necessary for conventional or amended/reactive capping. • Monitoring will be required to confirm the effectiveness of MNR and ENR to achieve the cleanup standards within the restoration timeframe and to confirm the effectiveness of the dynamic sand caps.	• Achieves a moderate-high level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the South Terminal toe wall and Containment/CDF. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. • This alternative requires the Containment/CDF to be located within SMA-5 to not limit the identified current or future Site uses. Other elements of this alternative do not limit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities and construction of the South Terminal toe wall and containment/CDF wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 61,260 tons of contaminated material. Capacity limitations on transportation and landfill disposal are not expected to pose significant management and schedule challenges for this alternative. • The use of MNR and ENR reduces the overall dredged material volume and the need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water column is not expected to pose significant technical challenges since sand placed for ENR purposes does not require the precision that is necessary for capping and can effectively be implemented in deeper water areas. • Dredging is proposed in SMA-1d with mudline up to -75 feet MLLW. Significant inherent technical challenges are associated with the precision dredging in deep water and risk potential schedule delays, incomplete dredging, residuals, releases to the water column and increased cost due to over-dredging. • Monitoring will be required to confirm the effectiveness of MNR and ENR to achieve the cleanup standards within the restoration timeframe.	• Achieves a moderate-high level of technical implementability through the use of common marine construction methods to complete the remedial action including the construction of the toe South Terminal wall and Containment/CDF. • Administrative implementability will be addressed by meeting the cleanup objectives and other regulatory and permitting requirements for the project. • This alternative requires the Containment/CDF to be located within SMA-5 to not limit the identified current or future Site uses. Other elements of this alternative do not limit the identified current or future Site uses. • Due to the magnitude and complexity, multiple in-water work seasons will be required to complete construction on this alternative. • Dredging activities and construction of the South Terminal toe wall and containment/CDF wall will require coordination with Port's operations to minimize impact on vessel operations at Port's terminals. Outside of the Port's navigational areas access for construction activities, and future maintenance/monitoring will not be limited by site operations. • Offsite landfill facilities will be required for the disposal of 96,560 tons of contaminated material. Capacity limitations on transportation and landfill disposal are not expected to pose significant management and schedule challenges for this alternative. • The use ENR reduces the overall dredged material volume and need for precision materials placement or dredging in the deeper areas of the Site. • Placing ENR sand in deep water column is not expected to pose significant technical challenges since sand placed for ENR purposes does not require the precision that is necessary for capping and can effectively be implemented in deeper water areas. • Dredging is proposed in SMA-1d with mudline up to -75 feet MLLW. Significant inherent technical challenges are associated with the precision dredging in deep water and risk potential schedule delays, incomplete dredging, residuals, releases to the water column and increased cost due to over-dredging. • Monitoring will be required to confirm the effectiveness of ENR to achieve the cleanup standards within the restoration timeframe.

Alternative	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Consideration of Public Concerns	**Score = 7.5**	**Score = 8**	**Score = 8.5**	**Score = 8.5**	**Score = 9.5**
"Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site."	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score for protectiveness. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. This alternative has reduced traffic, noise, and potential contaminant exposure as a result of the use of CDF technology and therefore, the relative benefit score based on protectiveness is not modified. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score for protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. This alternative has reduced traffic, noise, and potential contaminant exposure as a result of the use of CDF technology and therefore, the relative benefit score based on protectiveness is not modified. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score for protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. This alternative has reduced traffic, noise, and potential contaminant exposure as a result of the use of CDF technology and therefore, the relative benefit score based on protectiveness is not modified. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score for protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. This alternative has reduced traffic, noise, and potential contaminant exposure as a result of the use of CDF technology and therefore, the relative benefit score based on protectiveness is not modified. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.	• Public concerns are not yet known. • It is assumed that protectiveness is the greatest public concern and therefore, the score for this criterion considers the relative benefit score for protectiveness as modified by the considerations described below. • It is also anticipated that the public will be concerned about traffic and noise disturbances and potential exposure to contaminated material resulting from accidental release during transportation of contaminated dredged material on public streets and/or highway. This alternative has reduced traffic, noise, and potential contaminant exposure as a result of the use of CDF technology and therefore, the relative benefit score based on protectiveness is not modified. • The relative benefit score for this criterion will be reviewed and revised as necessary after receiving public comments on the RI/FS.

Notes:

BMPs = best management practices
CDF = confined disposal facility
COCs = contaminants of concern
DCA = Disproportionate Cost Analysis
Ecology = Washington State Department of Ecology
ENR = enhanced natural recovery
MNR = monitored natural recovery
MTCA = Model Toxics Control Act
RI/FS = Remedial Investigation/Feasibility Study
SMA = sediment management area

Table 13

Summary of Relative Benefit Ranking, Cost and Relative Benefit/Cost Ratios for Alternatives

Weyerhaeuser Mill A Former
Everett, Washington

Remedial Alternatives	1	2	3	4	5	6	7	8	9	10
Relative Benefits Ranking for DCA Criteria[1]										
Protectiveness	7.00	7.50	8.00	8.00	9.00	7.50	8.00	8.50	8.50	9.50
Permanence	6.50	7.00	7.50	8.00	8.50	6.00	6.50	7.00	7.50	8.00
Long-Term Effectiveness	7.00	7.00	7.50	8.00	8.50	6.50	6.50	7.00	7.50	8.00
Management of Short-Term Risk	7.50	7.00	6.50	6.00	5.50	9.50	9.00	8.50	8.00	7.50
Technical and Administrative Implementability	8.50	8.00	7.50	6.50	6.00	9.50	9.00	8.50	7.50	7.00
Consideration of Public Concerns	6.50	7.00	7.50	7.50	8.50	7.50	8.00	8.50	8.50	9.50
Weighted[2] Relative Benefits Ranking for DCA Criteria[1]										
Protectiveness (weighted as 30%)	2.10	2.25	2.40	2.40	2.70	2.25	2.40	2.55	2.55	2.85
Permanence (weighted as 20%)	1.30	1.40	1.50	1.60	1.70	1.20	1.30	1.40	1.50	1.60
Long-Term Effectiveness (weighted as 20%)	1.40	1.40	1.50	1.60	1.70	1.30	1.30	1.40	1.50	1.60
Management of Short-Term Risks (weighted as 10%)	0.75	0.70	0.65	0.60	0.55	0.95	0.90	0.85	0.80	0.75
Technical and Administrative Implementability (weighted as 10%)	0.85	0.80	0.75	0.65	0.60	0.95	0.90	0.85	0.75	0.70
Consideration of Public Concerns (weighted as 10%)	0.65	0.70	0.75	0.75	0.85	0.75	0.80	0.85	0.85	0.95
Total Weighted Relative Benefit Score	**7.1**	**7.3**	**7.6**	**7.6**	**8.1**	**7.4**	**7.6**	**7.9**	**8.0**	**8.5**
Cost										
Total Estimated Cleanup Cost (Accuracy +50%/-30%)	**$ 230.9 M**	**$ 233.1 M**	**$ 238.8 M**	**$ 243.7 M**	**$ 258.0 M**	**$ 201.9 M**	**$ 204.0 M**	**$ 209.8 M**	**$ 214.7 M**	**$ 229.0 M**
Disproportionate Cost Analysis										
Relative Benefit to Cost Ratio[2]	**6.16**	**6.28**	**6.38**	**6.30**	**6.34**	**7.40**	**7.52**	**7.60**	**7.48**	**7.45**
Overall Alternative Ranking										
Overall Alternative Ranking	**10**	**9**	**6**	**8**	**7**	**5**	**2**	**1**	**3**	**4**

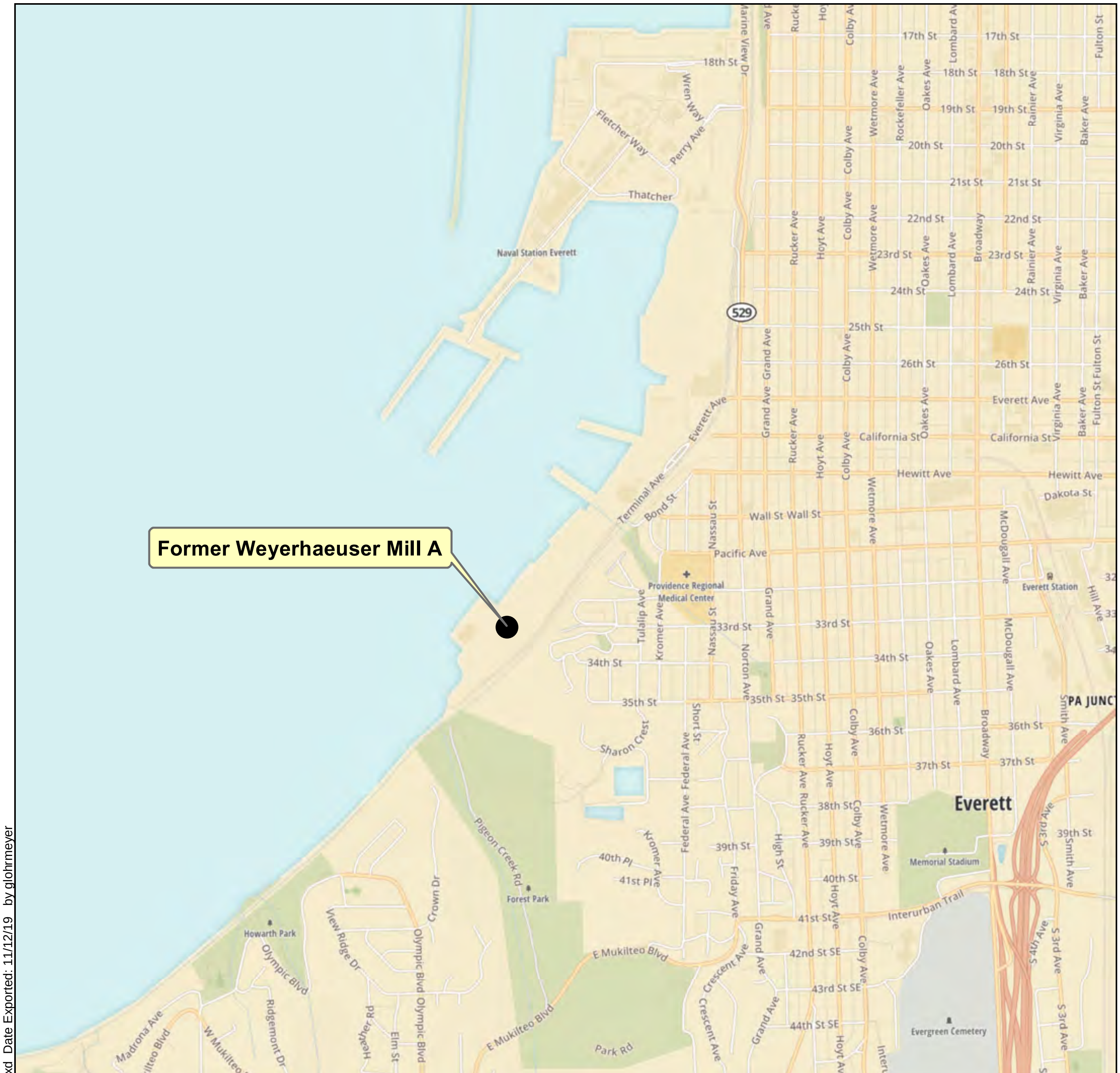
Notes:

[1] Refer to Table 12 for detailed evaluation of Disproportionate Cost Analysis criteria.

[2] Weightings were established by Ecology as referenced in Opinion Letter dated December 28, 2009.

[3] The relative benefit to cost ratio is calculated by dividing total weighted relative benefit ranking by total cleanup cost. Total cleanup cost for each alternative is normalized by the cost of the alternative with lowest cost, which is Alternative 6, to avoid relative benefit to cost ratios with millionth decimal place. For example, relative benefit to cost ratio of Alternative 1 is calculated as follows: Total Weighted Relative Benefit Score of Alternative 1/(Cost of Alternative 1/Cost of Alternative 6) = 7.1 / (230.9 M/201.9M) = 6.16.

FIGURES



N
W E
S

2,000 0 2,000

Feet

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 Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Weyerhaeuser Mill A Former Site
Everett, Washington

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Figure 1

Notes:
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Data Source: Aerial photo from Port of Everett, 2009.

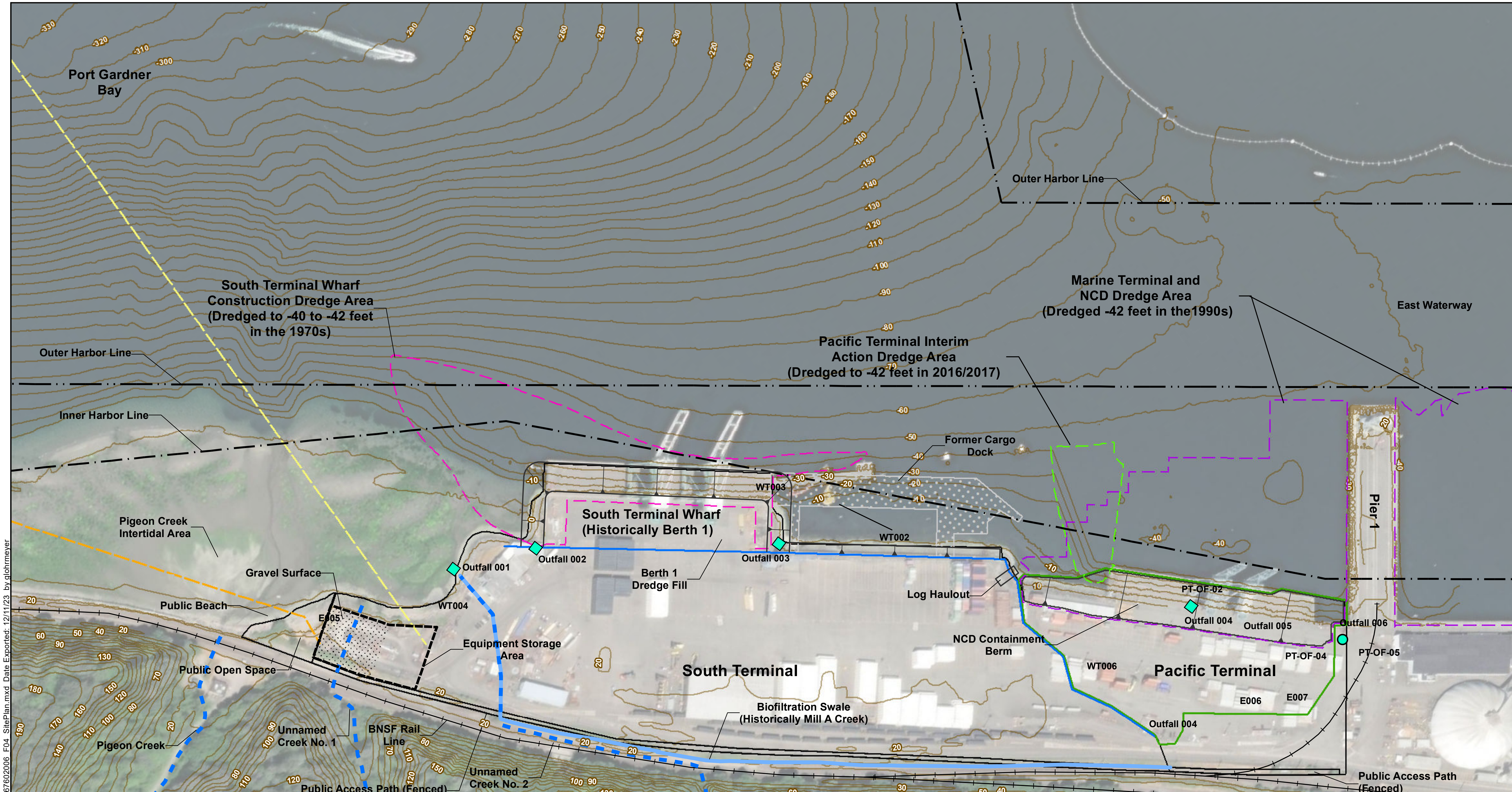
Path: P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F02_Overview.mxd Map Revised: 13 January 2020 glohrmeyer

Overview

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 2



Notes:
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Data Source: Base aerial from ESRI, 2022

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Construction Berm
- Historical Piling Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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

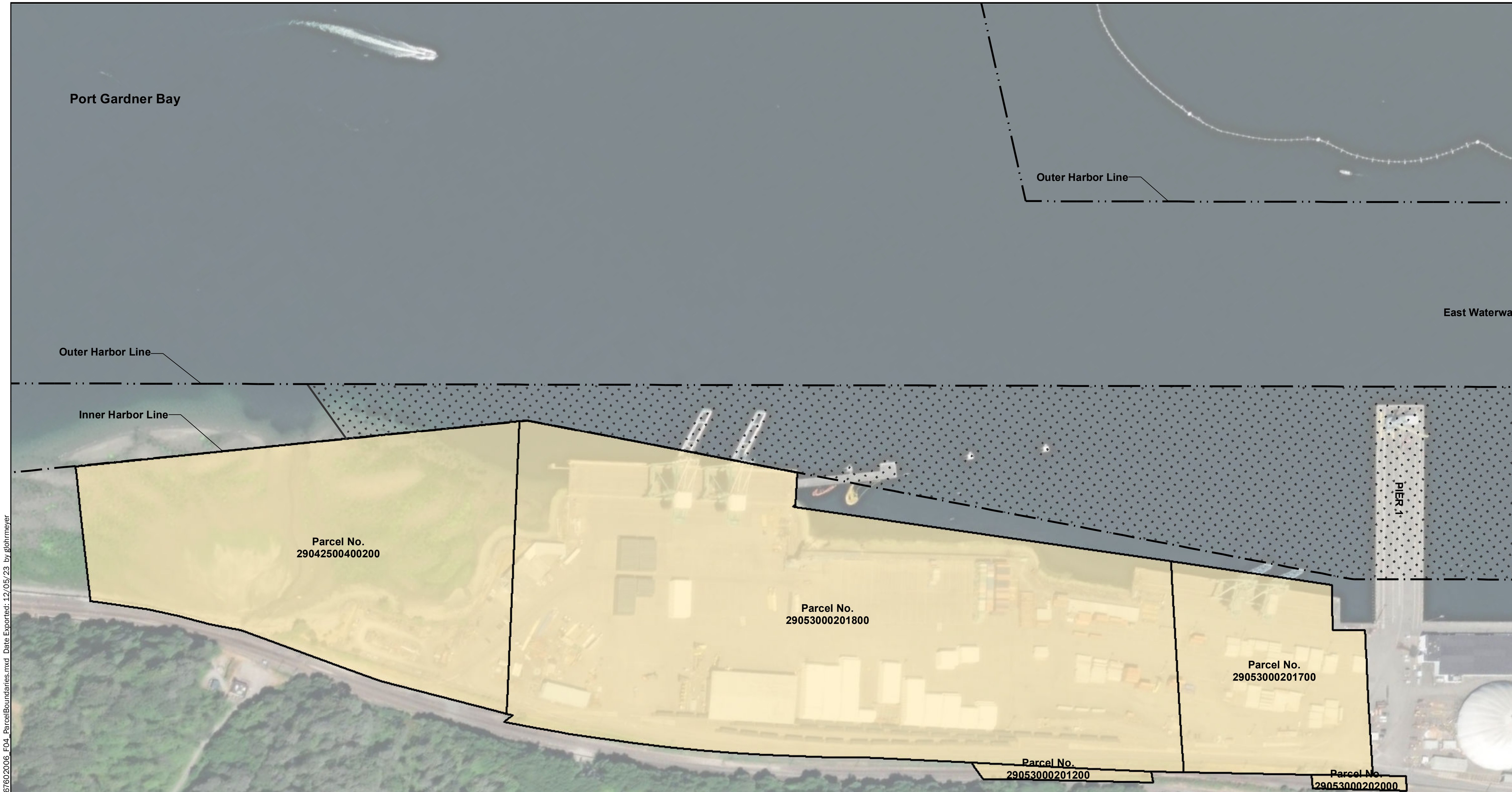
Site Plan

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 3

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F04_SitePlan.mxd Date Exported: 12/11/23 by glohrmeyer



Notes:
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Data Source: Base aerial from ESRI, 2022

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Parcel Boundary

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

300 0 300
Feet

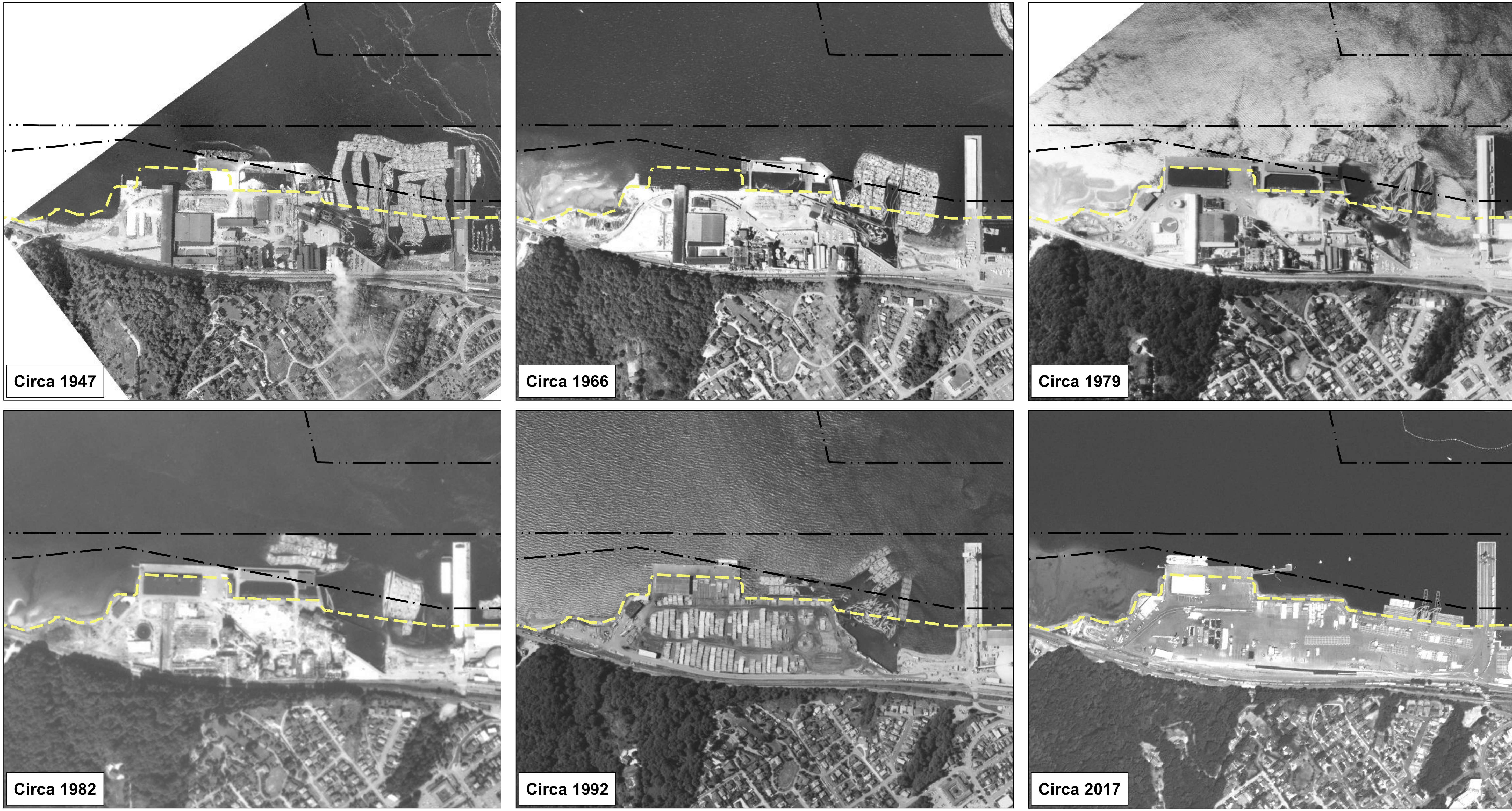
Property Boundaries

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 4

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F04_ParcelBoundaries.mxd Date Exported: 12/05/23 by glohrmeyer



Notes:
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Data Source: Historical aerial photos from Port of Everett. (Image dates: 1947, 1966, 1979, 1982, 1992).
2009 aerial from Aerials Express Seattle.
Shoreline from Walker & Associates Survey, 2006.

Legend

- Current Shoreline
- Inner Harbor Line
- Outer Harbor Line

800 0 800
Feet

Property Development 1947 through 2017

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 5

Path: P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F05_PropertyDevelopment.mxd Map Revised: 05 December 2023 glohrmeyer

Notes:
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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 Source: Base aerial from ESRI, 2022.
Historical mill layout from Port of Everett. Site features based on Everett Sulphite Mill Plot Plan dated January 5, 1965.

W N S E

200 0 200
Feet

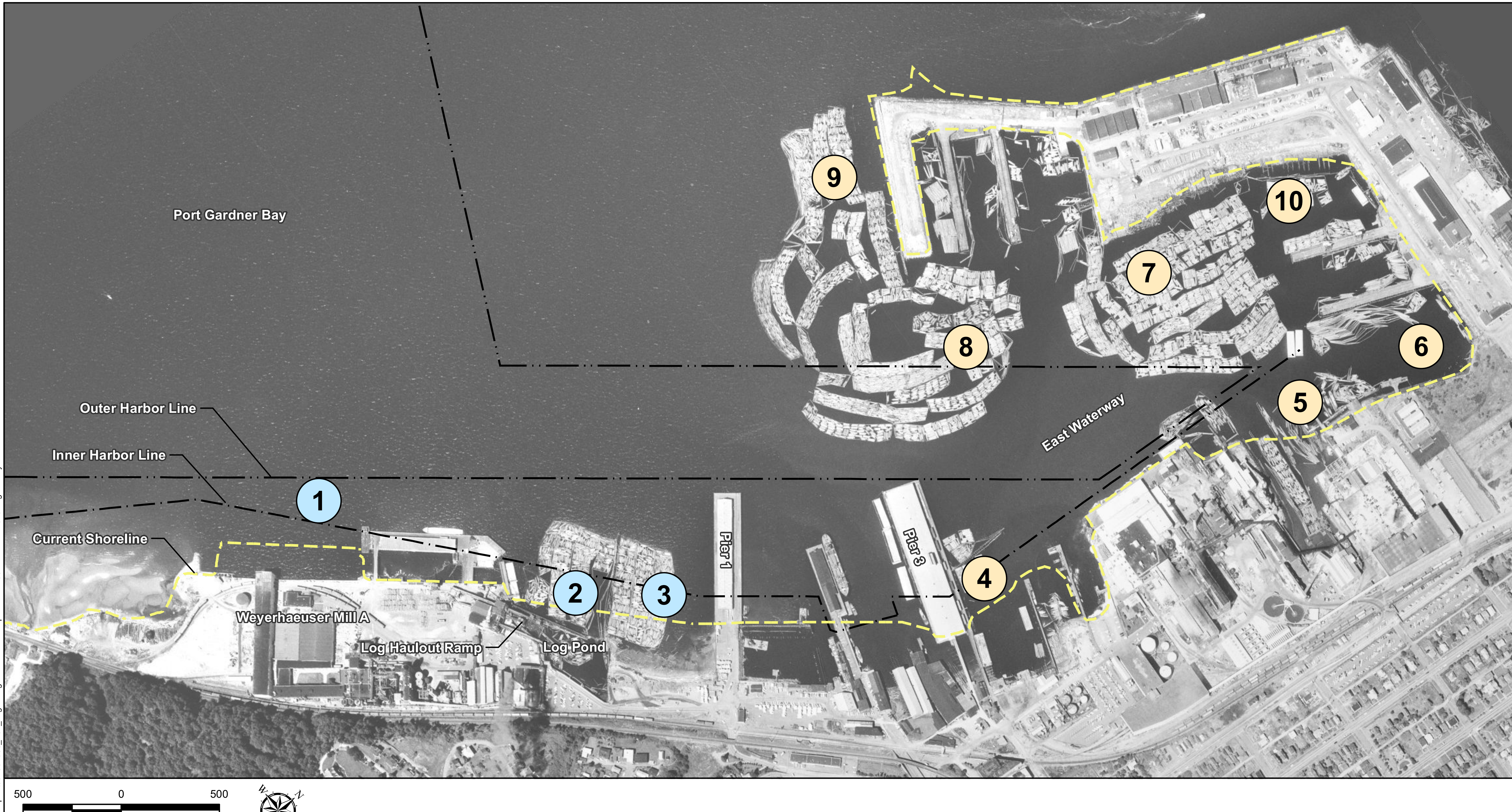
1965 Weyerhaeuser Mill A Layout

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 6

Path: P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_F06_MillA_Historical_Layout.mxd Map Revised: 05 December 2023 glohrmeyer



Path: P:\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F07_LogStorageArea.mxd Map Revised: 05 December 2023 glohrmeyer

Notes:
1. The locations of all features shown are approximate.
2. Log storage areas and capacities obtained from Port of Everett memo, "Log Storage and the Port of Everett" January 2, 1987.
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: Aerial image from Port of Everett, 1966.
Shoreline from Walker & Associates Survey, 2006.

Log Storage Areas Associated with Historical Mill A Operations

1. Mill A Dock (11 acres)
2. Mill A Pocket (3.4 acres)
3. Mill A Storage (3.4 acres)

Other Historical East Waterway Log Storage Areas

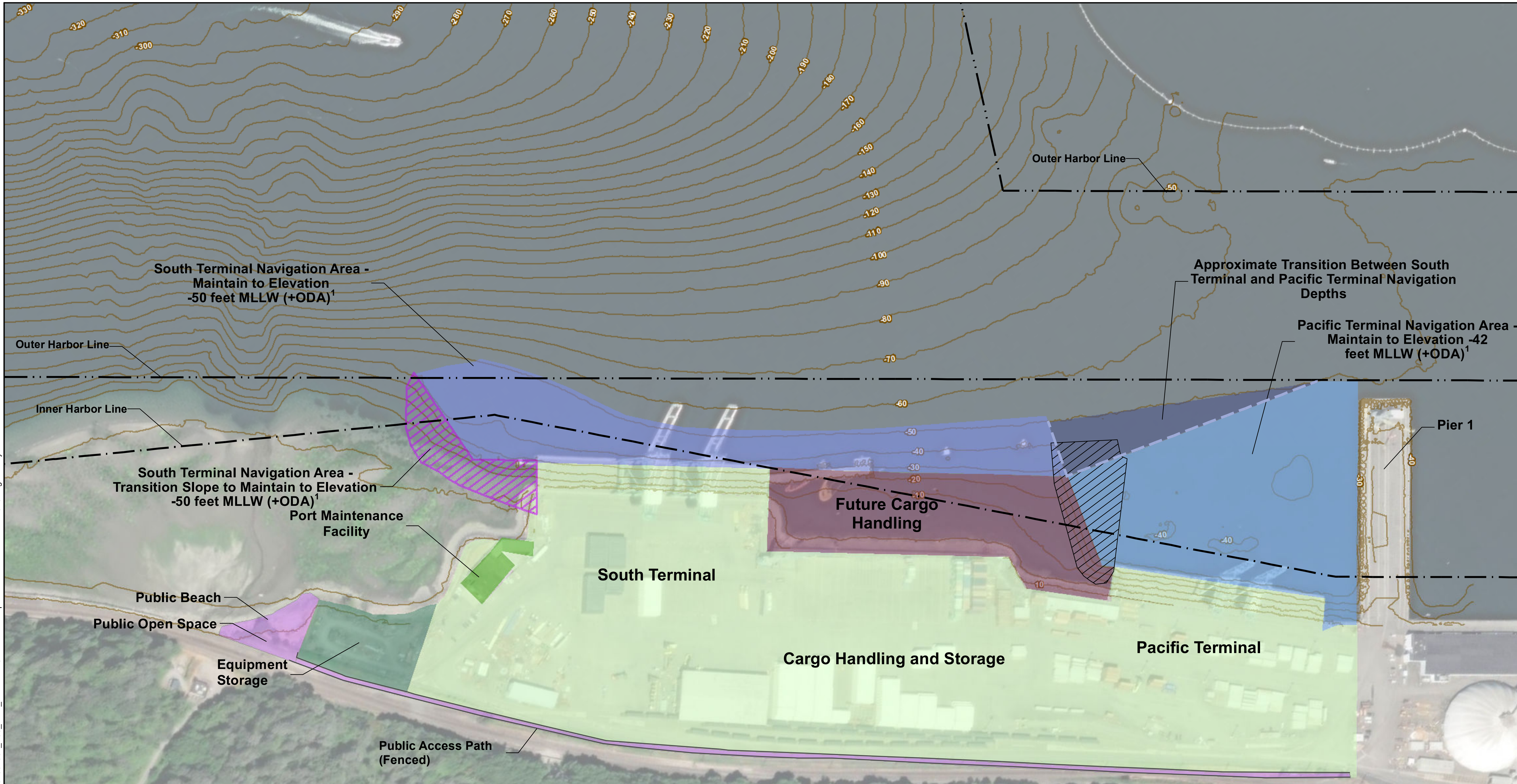
4. 3 North (2.75 acres)
5. Scott's Rework (2.75 acres)
6. Naval Reserve Dock (2.75 acres)
7. Craneways (8.25 acres)
8. Cove (9.6 acres)
9. Face of the Fill (10.3 acres)
10. Eastside Log Dump (3.4 acres)

Historical Log Storage Areas

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 7



Notes:
1. Navigation Area does not include transition slopes for maintained berth depth.
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: Base aerial from ESRI, 2022.

Legend

Bathymetry Contour (Feet MLLW)

Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MLLW - Mean Lower Low Water
ODA - Over-Dredge Allowance

300 0 300
Feet

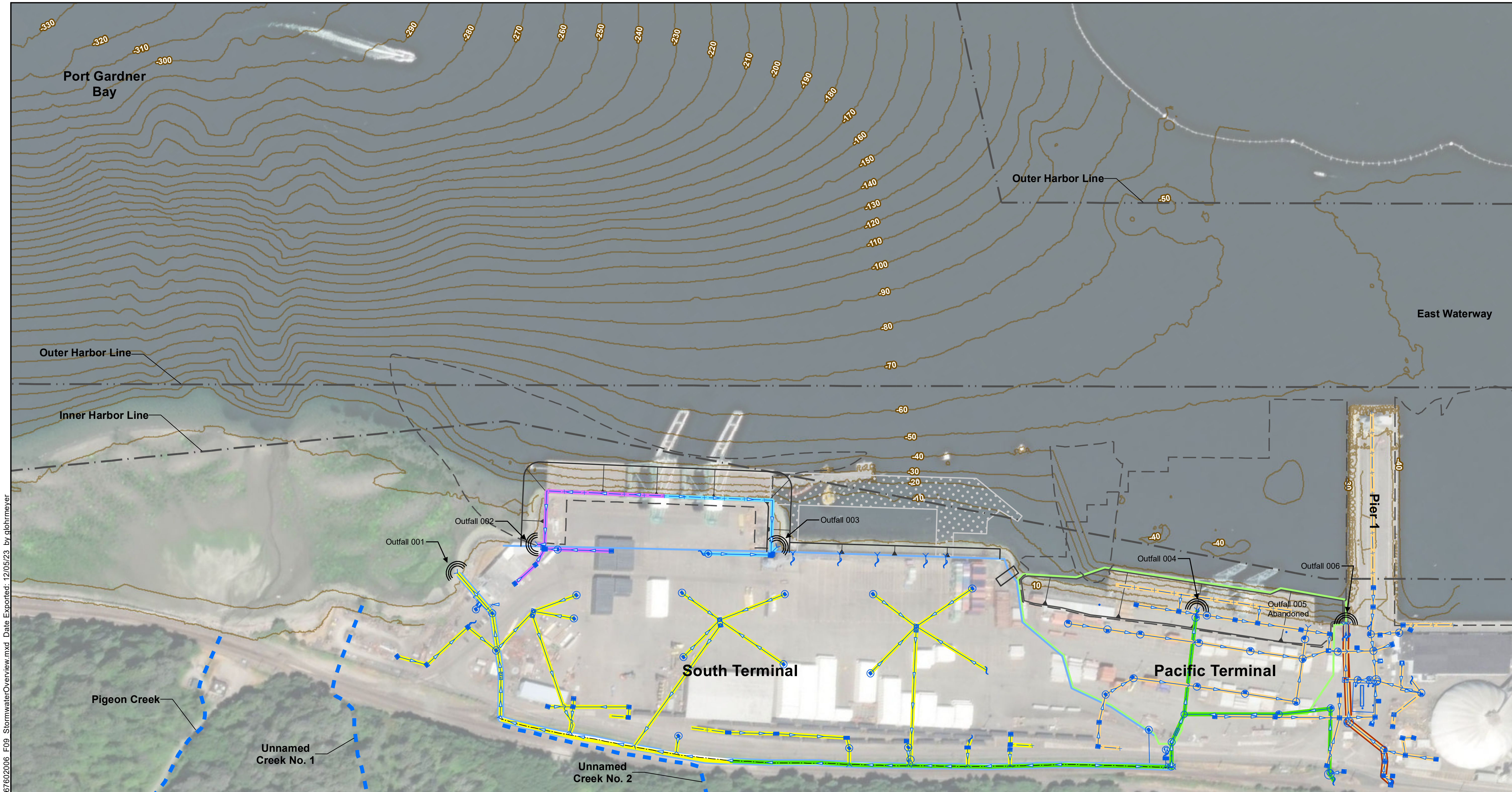
Current and Future Property Use Assumptions

Weyerhaeuser Mill A Former Site
Everett, Washington

GeoEngineers

Figure 8

Path: P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602007_F05_DNR_FutureSiteUse.mxd Map Revised: 11 December 2023 glohrmeyer



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Data Source: Base aerial from ESRI, 2022

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Bulkhead
- Topography/Bathymetry Contour
- Outfall 001 Stormwater Drain Network
- Outfall 002 Stormwater Drain Network
- Outfall 003 Stormwater Drain Network
- Outfall 004 Stormwater Drain Network
- Outfall 006 Stormwater Drain Network
- City of Everett Combined Sewer Overflow (CSO)
- Biofiltration Swale
- Storm Drain (Inferred)
- Swale
- Trench Drain
- Culvert End
- End of Pipe is Unknown
- Flow Direction

300 0 300
Feet

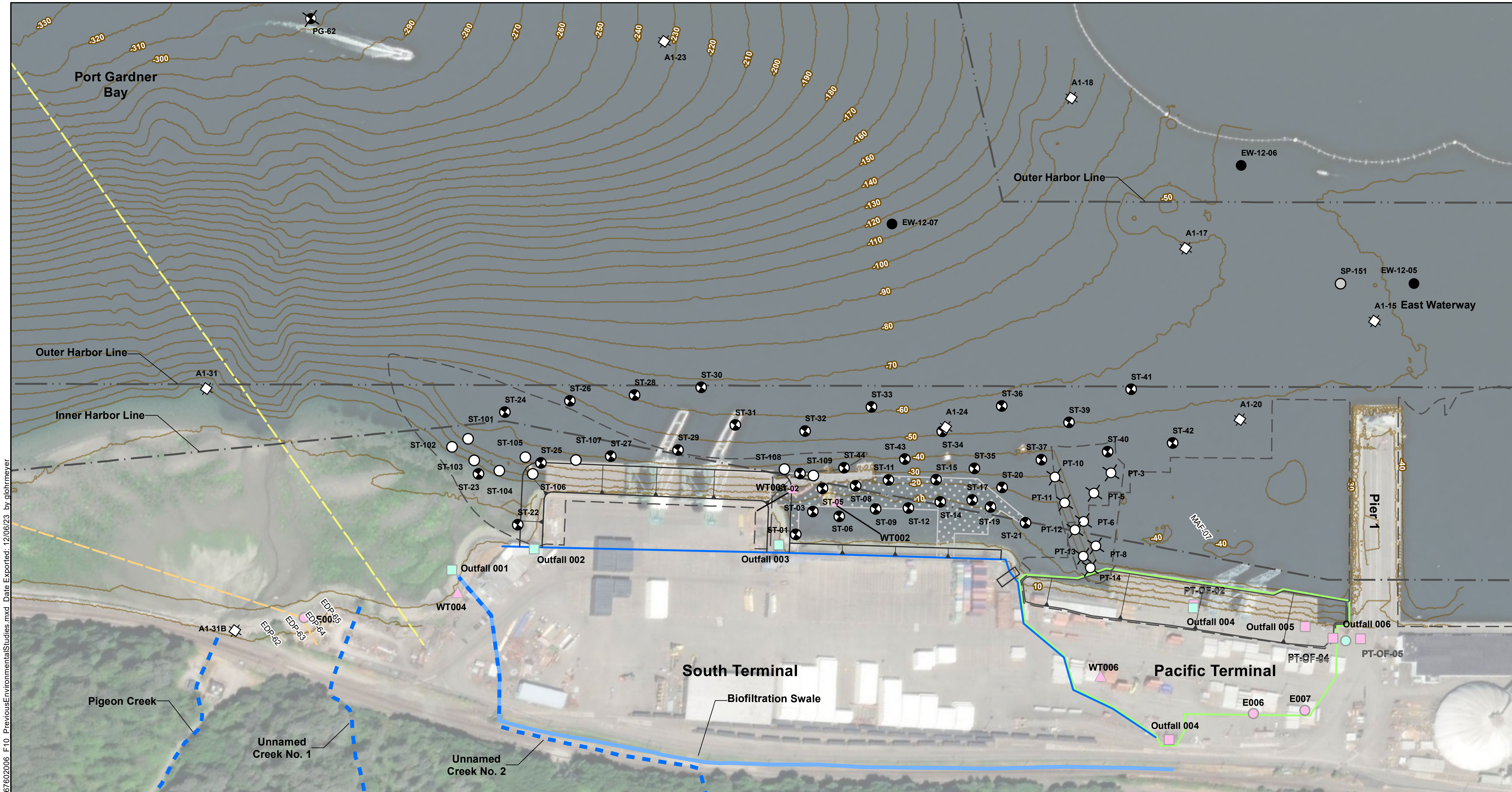
Stormwater System Drainage Overview

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 9

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_F09_StormwaterOverview.mxd Date Exported: 12/05/23 by glohrmeyer



Legend

- 2007 Former Mill A Sediment Investigation (Geomatrix, 2007)
- 2007 Whidbey Basin Sediment Investigation (Ecology, 2013a)
- 2008 Port Gardner and Lower Snohomish Estuary Sediment Investigation (SAIC, 2009)
- 2012 Port Gardner and East Waterway Sediment Investigation (Ecology, 2013b)
- 2014 Port Gardner Bay Regional Backround Sediment Investigation (Ecology, 2014)
- 2015 Pacific Terminal Dredged Material Characterization (GeoEngineers, 2016)
- 2018 South Terminal Dredged Material Characterization (GeoEngineers, 2018)
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (approximate)
- Bulkhead
- Topography/Bathymetry Contour
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

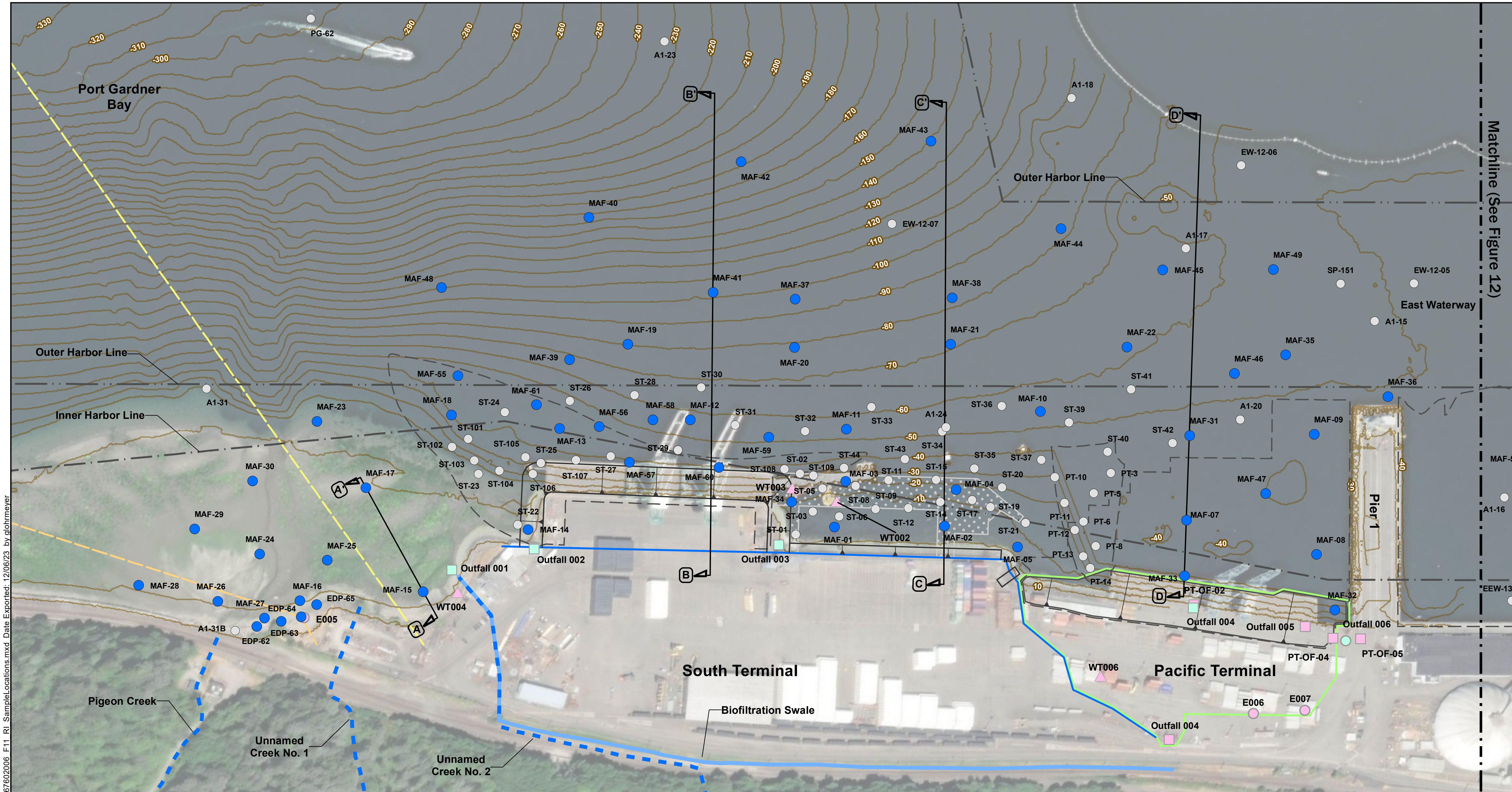
Previous Environmental Study Sediment Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 10

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F10_PreviousEnvironmentalStudies.mxd Date Exported: 12/06/23 by globrmeyer



Legend

- Marine Area Remedial Investigation Sampling Location
- Previous Environmental Study/Dredged Material Characterization Study Sampling Location
- Cross Section Location (A – A')
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/City of Marysville Outfall 100 (approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (approximate)
- Bulkhead
- Topography/Bathymetry Contour
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

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 Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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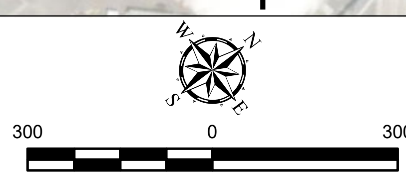
Marine Area Remedial Investigation Sediment Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 11



Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Marine Area Remedial Investigation Sampling Location
- Previous Environmental Study Sampling Location

East Waterway
Sediment Sampling Locations

Weyerhaeuser Mill A Former
Everett, Washington

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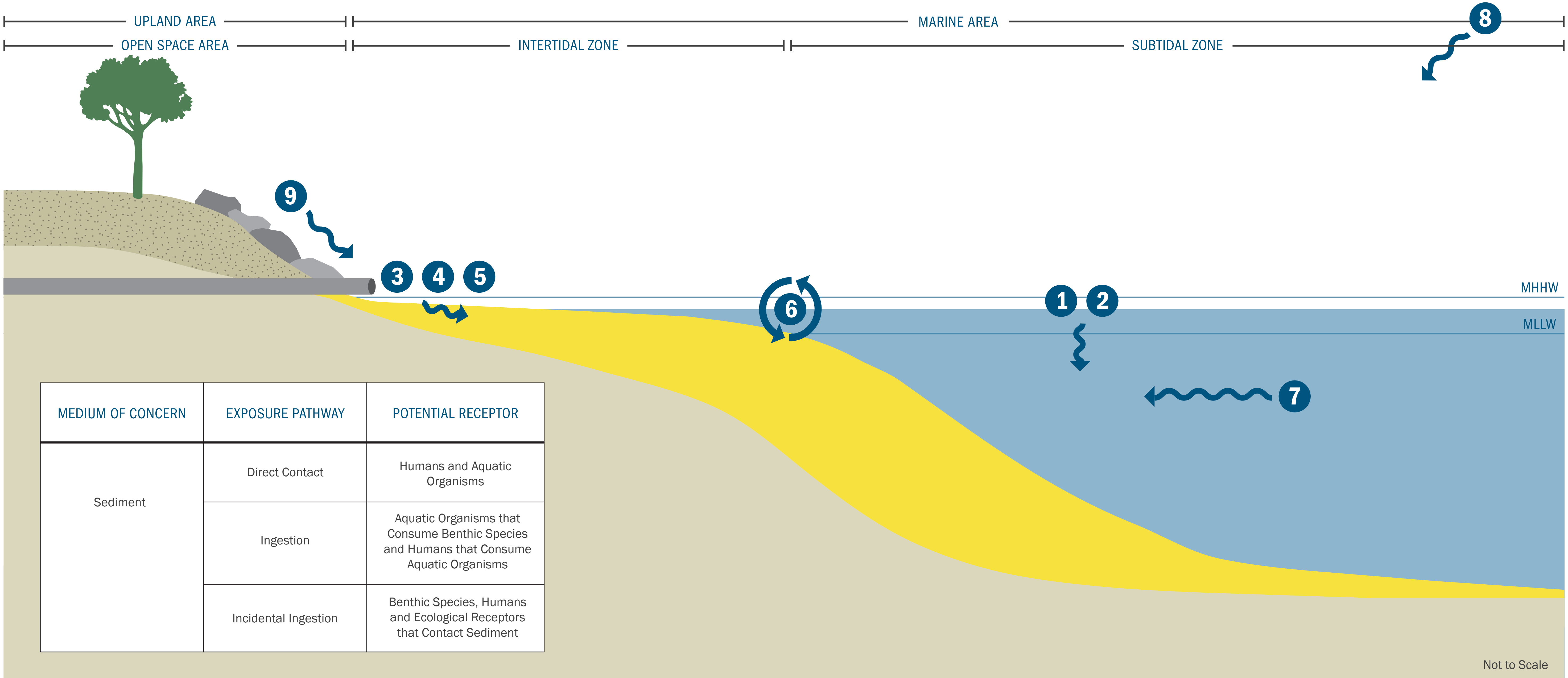
Figure 12

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F12_EastWaterway_SampleLocations.mxd Date Exported: 12/06/23 by glohrmeyer



MEDIUM OF CONCERN	EXPOSURE PATHWAY	POTENTIAL RECEPTOR
Sediment	Direct Contact	Humans and Aquatic Organisms
	Ingestion	Aquatic Organisms that Consume Benthic Species and Humans that Consume Aquatic Organisms
	Incidental Ingestion	Benthic Species, Humans and Ecological Receptors that Contact Sediment

Legend

Potential Contaminant Transport Pathway

MHHW Mean Higher High Water

MLLW Mean Lower Low Water

Stratigraphy

Upland Fill Soil

Pigeon Creek/Mixed/Unconsolidated Sand and Silt

Snohomish Basin Alluvium

Release And Transport Pathway

1. Direct deposition of wood debris to the sediment from historical wood milling operations and pulp production from the late 1800s to 1980 and rafted logs, prior to being pulled ashore, sorted and stacked in the Upland Area pending transport by vessels between 1983 and the mid-2000s.
2. Direct deposition from current and historical vessel traffic and berthing in the Marine Area through drips, spills and incidental releases.
3. Direct deposition from industrial wastewater discharges from washing, bleaching, and drying processes, and stormwater generated during Mill A operations into the Marine Area through historical shoreline outfalls.
4. Direct deposition from combined sewer overflow discharges by the City of Everett onto the Marine Area through historical shoreline outfalls.
5. Direct deposition from stormwater discharges by the Port into the Marine Area through current shoreline outfalls.
6. Resuspension of sediment and wood debris through bioturbation or disturbance (i.e., wave and current action, propeller scour and vessel anchors, maintenance dredging, etc.).
7. Transport of hazardous substances sorbed to particulates entrained in the water column from off-site sources.
8. Atmospheric deposition of particulates from current and historical combustion (vehicle and marine vessel emissions, hog fuel burner, etc.) and/or industrial operations.
9. Direct deposition of upland contamination to sediments from shoreline bank erosion.

Marine Area Conceptual Site Model
South Terminal Open Space/Pigeon Creek Area

Weyerhaeuser Mill A Former Site
Everett, Washington

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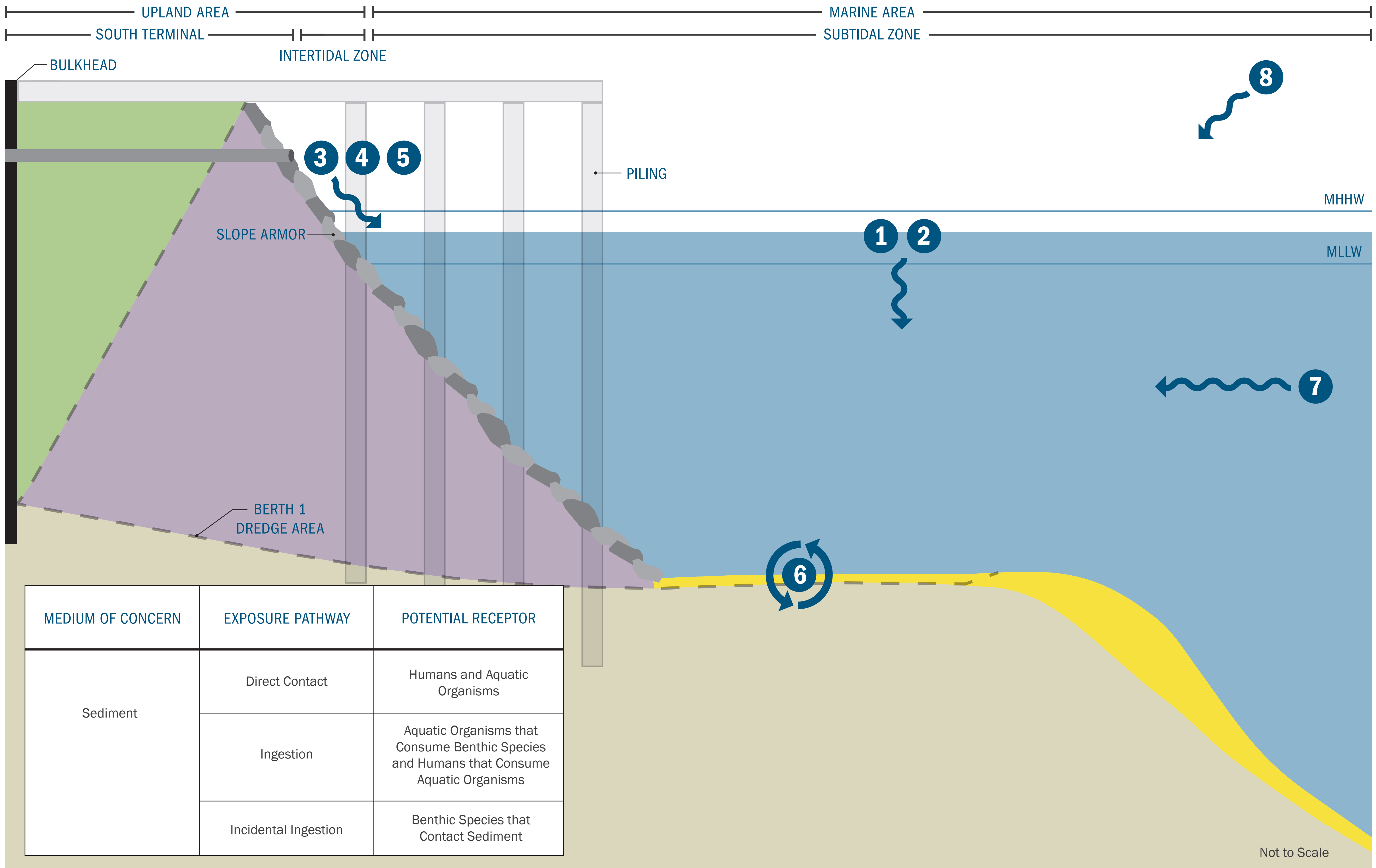
Figure 13

P:\0676020\Graphics_Misc\067602006 Marine Area CSM South Terminal Open Space Pigeon Creek.ai Date Exported: 7/23/20 by spride



MEDIUM OF CONCERN	EXPOSURE PATHWAY	POTENTIAL RECEPTOR
Sediment	Direct Contact	Humans and Aquatic Organisms
	Ingestion	Aquatic Organisms that Consume Benthic Species and Humans that Consume Aquatic Organisms
	Incidental Ingestion	Benthic Species that Contact Sediment

Legend

- ➡ Potential Contaminant Transport Pathway
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Stratigraphy

- South Terminal Wharf (Berth 1) Fill Berm
- South Terminal Wharf (Berth 1) Dredge Fill
- Mixed/Unconsolidated Sand and Silt
- Snohomish Basin Alluvium

Release And Transport Pathway

1. Direct deposition of wood debris to the sediment from historical wood milling operations and pulp production from the late 1800s to 1980 and rafted logs, prior to being pulled ashore, sorted and stacked in the Upland Area pending transport by vessels between 1983 and the mid-2000s.
2. Direct deposition from current and historical vessel traffic and berthing in the Marine Area through drips, spills and incidental releases.
3. Direct deposition from industrial wastewater discharges from washing, bleaching, and drying processes, and stormwater generated during Mill A operations into the Marine Area through historical shoreline outfalls.
4. Direct deposition from combined sewer overflow discharges by the City of Everett onto the Marine Area through historical shoreline outfalls.
5. Direct deposition from stormwater discharges by the Port into the Marine Area through current shoreline outfalls.
6. Resuspension of sediment and wood debris through bioturbation or disturbance (i.e., wave and current action, propeller scour and vessel anchors, maintenance dredging, etc.).
7. Transport of hazardous substances sorbed to particulates entrained in the water column from off-site sources.
8. Atmospheric deposition of particulates from current and historical combustion (vehicle and marine vessel emissions, hog fuel burner, etc.) and/or industrial operations.

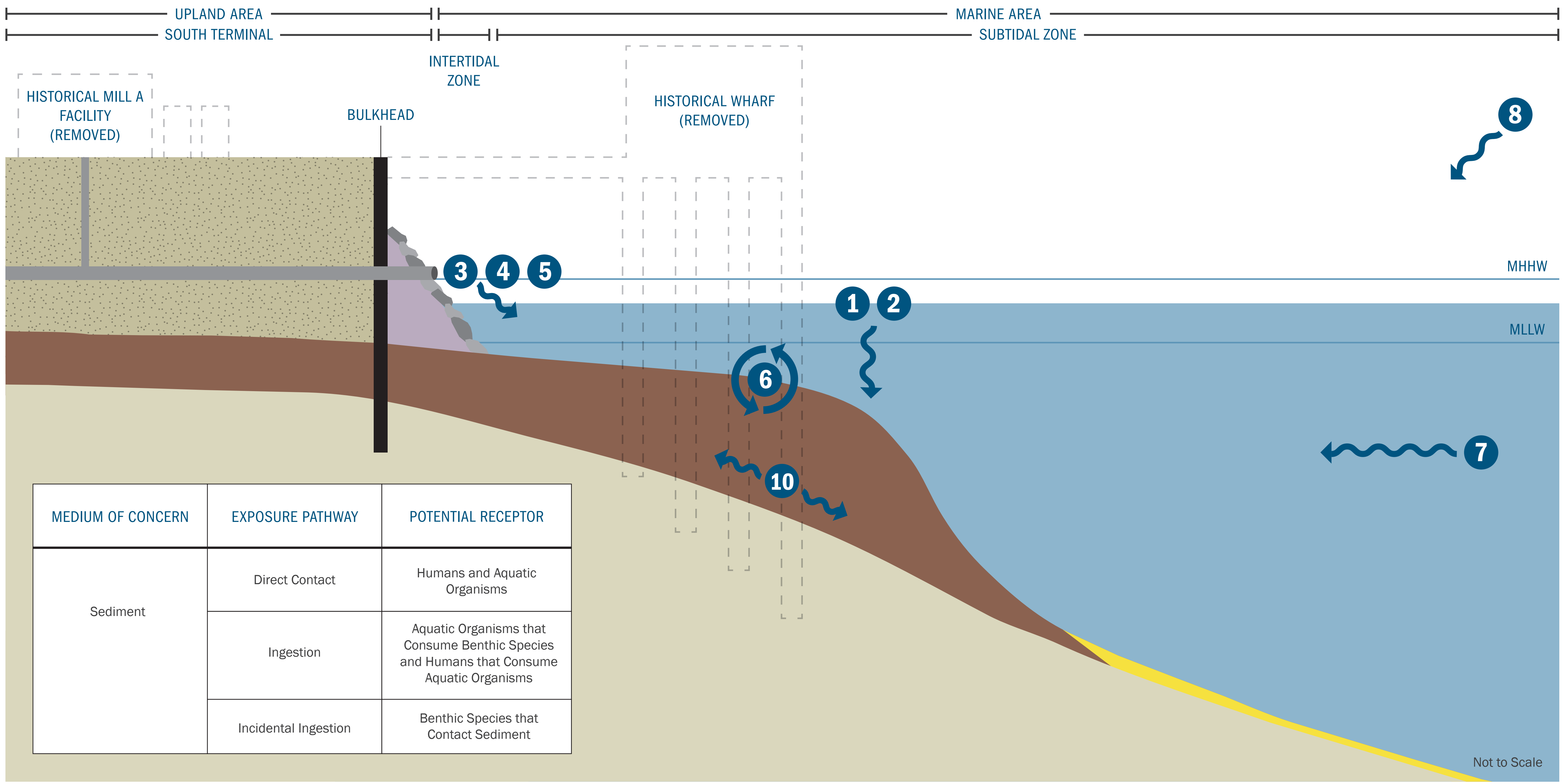
Marine Area Conceptual Site Model
South Terminal Wharf Area

Weyerhaeuser Mill A Former Site
Everett, Washington

GEOENGINEERS

Figure 14

P:\0\0676020\Graphics_Misc\067602006 Marine Area CSM South Terminal Wharf Area.ai Date Exported: 7/23/20 by spride



MEDIUM OF CONCERN	EXPOSURE PATHWAY	POTENTIAL RECEPTOR
Sediment	Direct Contact	Humans and Aquatic Organisms
	Ingestion	Aquatic Organisms that Consume Benthic Species and Humans that Consume Aquatic Organisms
	Incidental Ingestion	Benthic Species that Contact Sediment

Legend

- Potential Contaminant Transport Pathway
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Stratigraphy

- Upland Fill Soil
- South Terminal Wharf Fill Berm
- Wood Debris/Mixed Sand and Silt
- Mixed/Unconsolidated Sand and Silt
- Snohomish Basin Alluvium

Release And Transport Pathway

1. Direct deposition of wood debris to the sediment from historical wood milling operations and pulp production from the late 1800s to 1980 and rafted logs, prior to being pulled ashore, sorted and stacked in the Upland Area pending transport by vessels between 1983 and the mid-2000s.
2. Direct deposition from current and historical vessel traffic and berthing in the Marine Area through drips, spills and incidental releases.
3. Direct deposition from industrial wastewater discharges from washing, bleaching, and drying processes, and stormwater generated during Mill A operations into the Marine Area through historical shoreline outfalls.
4. Direct deposition from combined sewer overflow discharges by the City of Everett onto the Marine Area through historical shoreline outfalls.
5. Direct deposition from stormwater discharges by the Port into the Marine Area through current shoreline outfalls.
6. Resuspension of sediment and wood debris through bioturbation or disturbance (i.e., wave and current action, propeller scour and vessel anchors, maintenance dredging, etc.).
7. Transport of hazardous substances sorbed to particulates entrained in the water column from off-site sources.
8. Atmospheric deposition of particulates from current and historical combustion (vehicle and marine vessel emissions, hog fuel burner, etc.) and/or industrial operations.
10. Degradation of wood debris

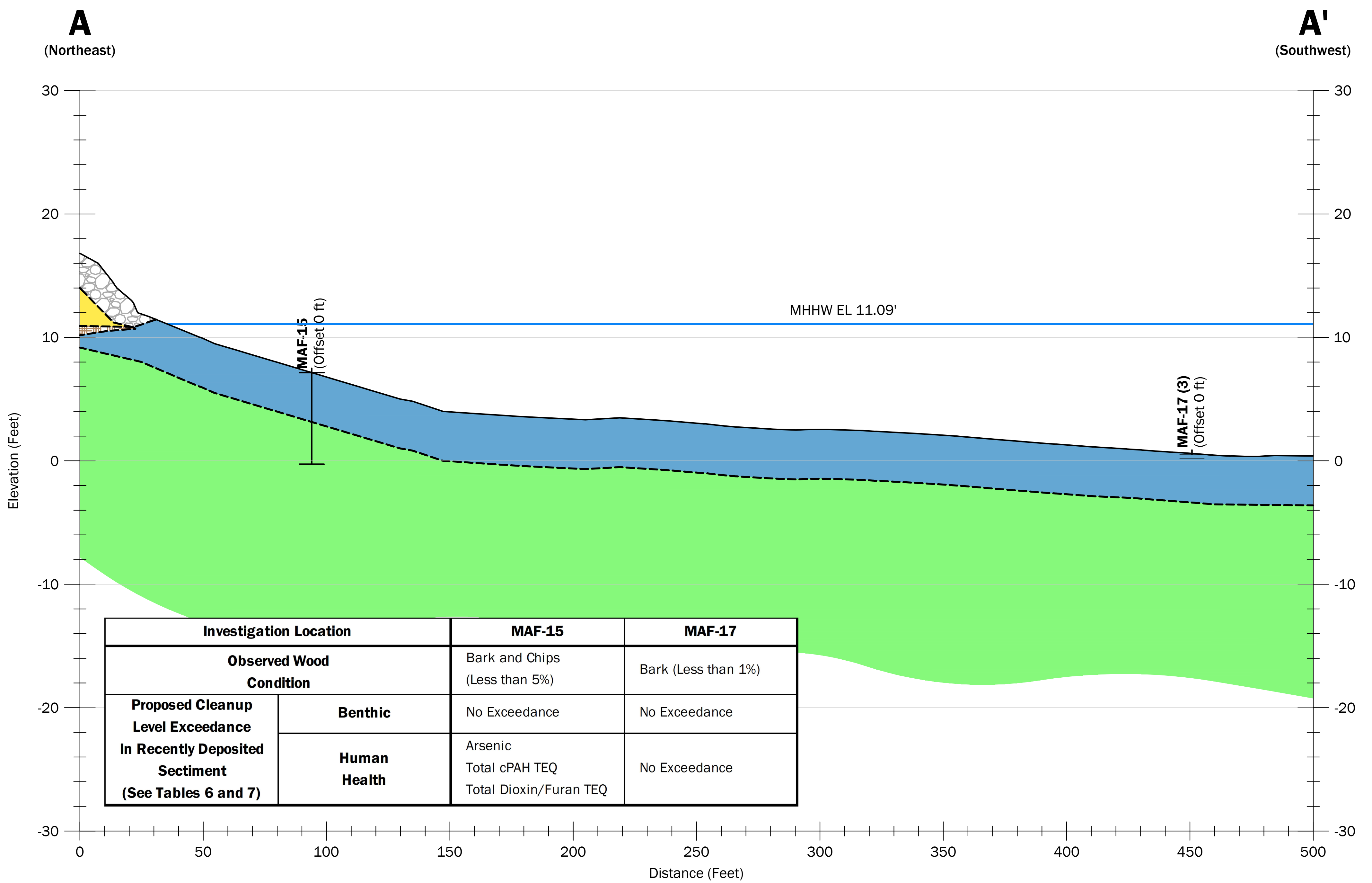
Marine Area Conceptual Site Model Northeast of South Terminal Wharf

Weyerhaeuser Mill A Former Site
Everett, Washington

GeoEngineers

Figure 15

P:\0\0676020\Graphics_Misc\067602006 Marine Area CSM Northeast of South Terminal Wharf.ai Date Exported: 2/20/24 by spride



Investigation Location		MAF-15	MAF-17
Observed Wood Condition		Bark and Chips (Less than 5%)	Bark (Less than 1%)
Proposed Cleanup Level Exceedance In Recently Deposited Sectiment (See Tables 6 and 7)	Benthic	No Exceedance	No Exceedance
	Human Health	Arsenic Total cPAH TEQ Total Dioxin/Furan TEQ	No Exceedance

Legend

- Existing Mudline
- Inferred Sediment Contact
- Sediment Core

Recently Deposited Sediment

- Wood Debris (>50% Wood Debris)
- Pigeon Creek Sediment

Native Sediment

- Snohomish Basin Alluvium

Other Materials

- Approximate Shoreline Slope Armor (Rip-Rap)
- Upland Fill Soil

EL Elevation
MLLW Mean Lower Low Water
cPAH Carseniginic Polycyclic Aromatic Hydrocarbon
TEQ Toxic Equivalent Quotient

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

50 0 50
Horizontal Scale in Feet
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

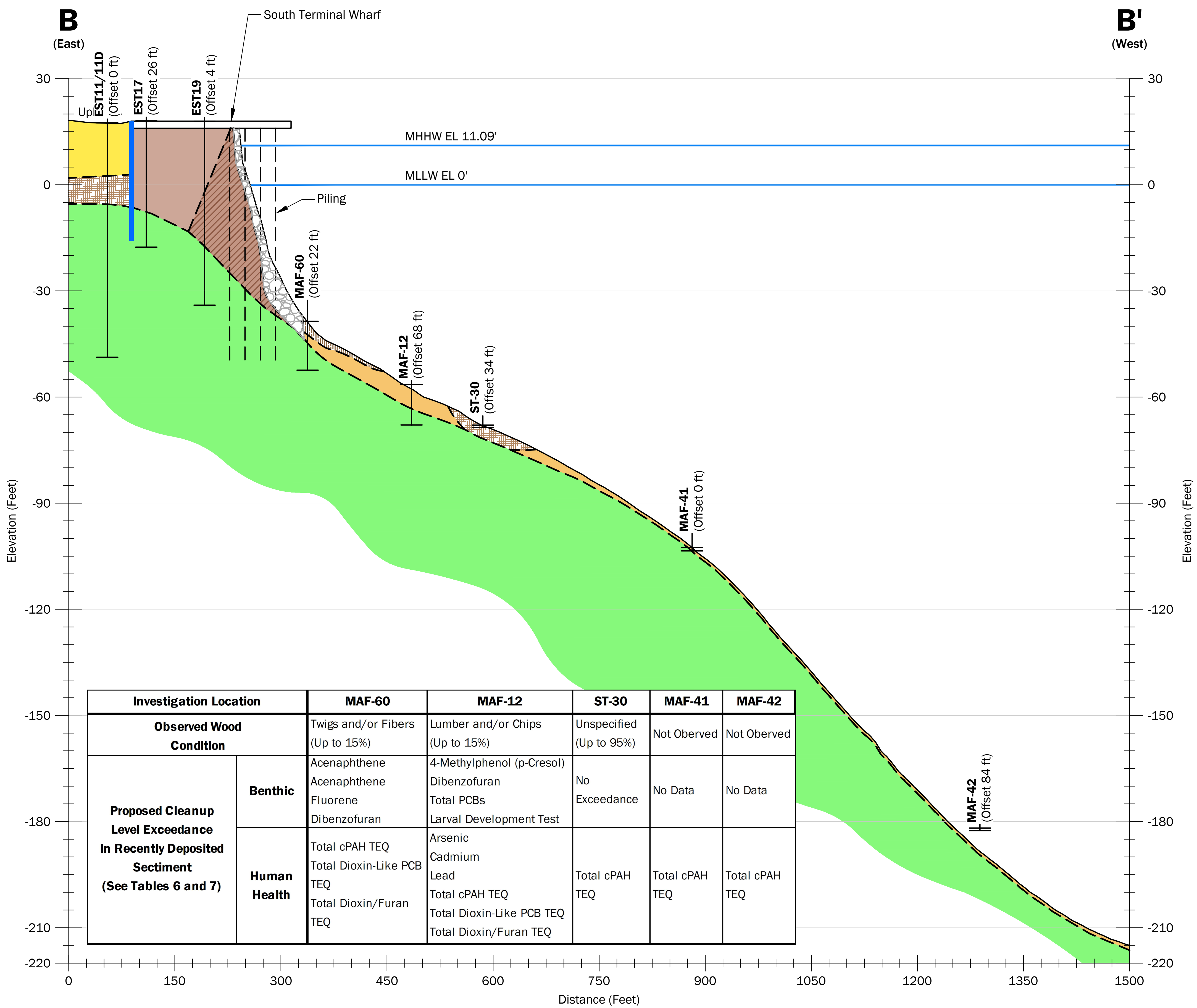
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 16

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F016_Cross Section A - A'.dwg F13 Date Exported:12/12/2023 12:53 PM - by Chad Stickel



Investigation Location		MAF-60	MAF-12	ST-30	MAF-41	MAF-42
Observed Wood Condition		Twigs and/or Fibers (Up to 15%)	Lumber and/or Chips (Up to 15%)	Unspecified (Up to 95%)	Not Oberved	Not Oberved
Proposed Cleanup Level Exceedance In Recently Deposited Sectiment (See Tables 6 and 7)	Benthic	Acenaphthene Acenaphthene Fluorene Dibenzofuran	4-Methylphenol (p-Cresol) Dibenzofuran Total PCBs Larval Development Test	No Exceedance	No Data	No Data
	Human Health	Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	Arsenic Cadmium Lead Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	Total cPAH TEQ	Total cPAH TEQ	Total cPAH TEQ

Legend

- Existing Mudline
- Inferred Sediment Contact
- Sediment Core
- Bulkhead (Depth Unknown)

Recently Deposited Sediment

- Wood Debris (>50% Wood Debris)
- Mixed Sand and Silt (10% - 50% Wood Debris)
- Unconsolidated Sand and Silt (<10% Wood Debris)

Native Sediment

- Snohomish Basin Alluvium

Other Materials

- Approximate Shoreline Slope Armor (Rip-Rap)
- Upland Fill Soil
- South Terminal Wharf (Berth 1) Dredged Fill
- South Terminal Wharf (Berth 1) Fill Berm

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water
cPAH Carseniginic Polycyclic Aromatic Hydrocarbon
PCB Polychlorinated Biphenyl
TEQ Toxic Equivalent Quotient

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

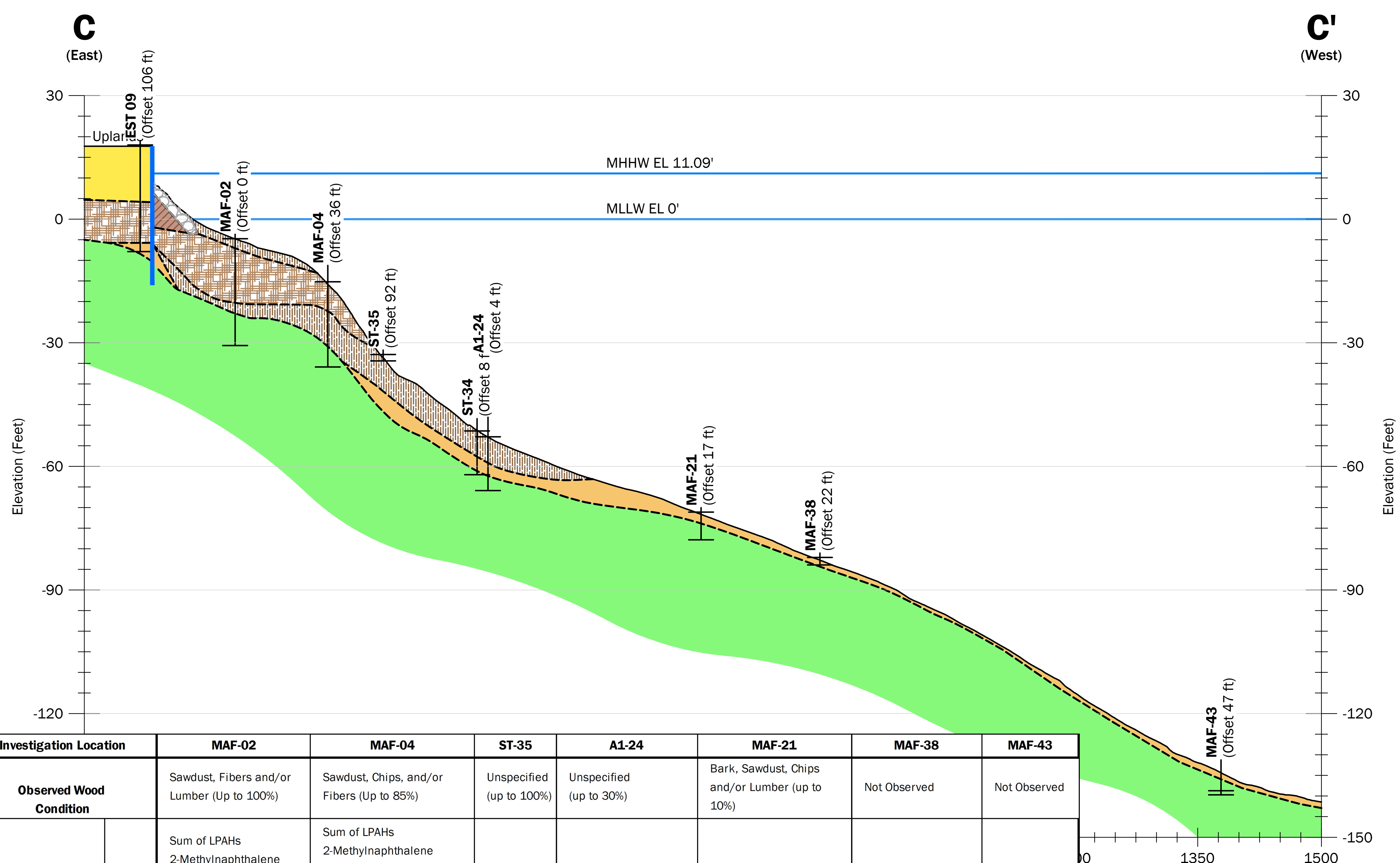
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 17

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F017_Cross Section B - B'.dwg F14 Date Exported:12/12/2023 12:53 PM - by Chad Stickel



Investigation Location		MAF-02	MAF-04	ST-35	A1-24	MAF-21	MAF-38	MAF-43
Observed Wood Condition		Sawdust, Fibers and/or Lumber (Up to 100%)	Sawdust, Chips, and/or Fibers (Up to 85%)	Unspecified (up to 100%)	Unspecified (up to 30%)	Bark, Sawdust, Chips and/or Lumber (up to 10%)	Not Observed	Not Observed
Proposed Cleanup Level Exceedance In Recently Deposited Sectiment (See Tables 6 and 7)	Benthic	Sum of LPAHs 2-Methylnaphthalene Acenaphthene Naphthalene Hexachlorobenzene 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Hexachlorobutadiene Dibenzofuran	Sum of LPAHs 2-Methylnaphthalene Acenaphthene Fluorene Naphthalene Phenanthrene 2,4-Dimethylphenol 2-Methylphenol (o-Cresol) 4-Methylphenol (p-Cresol) Phenol Dibenzofuran Benzyl Alcohol	No Data	Zinc 4-Methylphenol (p-Cresol) 2,4-Dimethylphenol	Fluorene 4-Methylphenol (p-Cresol)	No Exceedance	No Data
	Human Health	Arsenic Cadmium Lead Mercury Total cPAH TEQ Total Dioxin/Furan TEQ	Arsenic Cadmium, Lead Mercury Total cPAH TEQ Total Dioxin-Like PCB TEQ	No Data	Arsenic Cadmium Lead Mercury Total cPAH TEQ Total Dioxin/Furan TEQ	Arsenic Cadmium Lead Mercury Total cPAH TEQ Total Dioxin-Like PCB TEQ Total Dioxin/Furan TEQ	Total cPAH TEQ Total Dioxin/Furan TEQ	No Exceedance

Legend

- Existing Mudline
- Inferred Sediment Contact
- Sediment Core
- Bulkhead (Depth Unknown)

Recently Deposited Sediment

- Wood Debris (>50% Wood Debris)
- Mixed Sand and Silt (10% - 50% Wood Debris)
- Unconsolidated Sand and Silt (<10% Wood Debris)

Native Sediment

- Snohomish Basin Alluvium

Other Materials

- Approximate Shoreline Slope Armor (Rip-Rap)
- Upland Fill Soil
- South Terminal Wharf (Berth 1) Dredged Fill
- South Terminal Wharf (Berth 1) Fill Berm

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water
cPAH Carseniginic Polycyclic Aromatic Hydrocarbon
HPAH High Molecular Weight Polycyclic Aromatic Hydrocarbon
LPAH Low Molecular Weight Polycyclic Aromatic Hydrocarbon
PCB Polychlorinated Biphenyl
TEQ Toxic Equivalent Quotient
N/A Not Available

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

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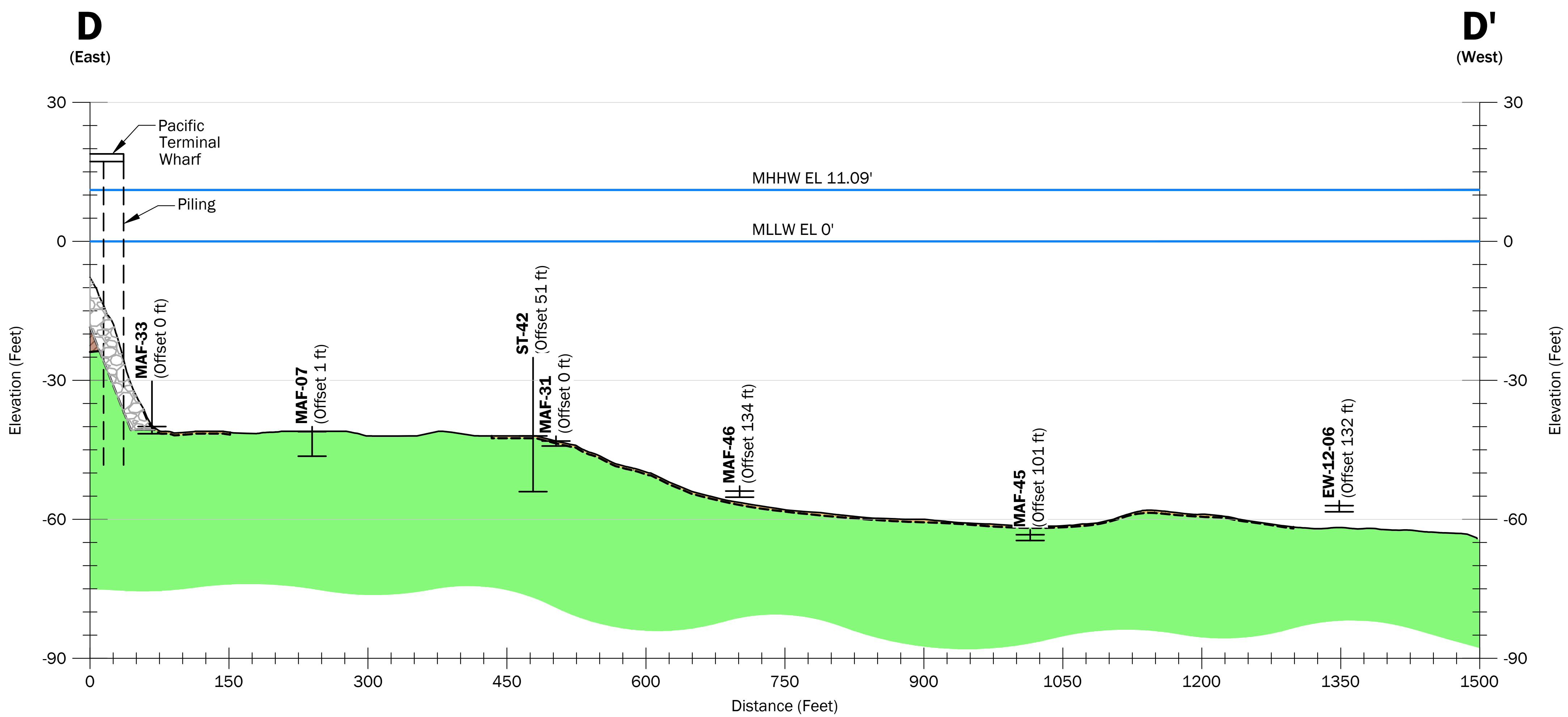
Figure 18

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F018_Cross Section C - C.dwg F15 Date Exported:12/12/2023 12:53 PM - by Chad Stickel



Legend

Existing Mudline

Inferred Sediment Contact

Sediment Core

Recently Deposited Sediment

Unconsolidated Sand and Silt (<10% Wood Debris)

Native Sediment

Snohomish Basin Alluvium

Other Materials

Approximate Shoreline Slope Armor (Rip-Rap)

South Terminal Wharf (Berth 1) Fill Berm

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water
cPAH Carseniginic Polycyclic Aromatic Hydrocarbon
PCB Polychlorinated Biphenyl
TEQ Toxic Equivalent Quotient
N/A Not Available

Investigation Location		MAF-33	MAF-07	ST-42	MAF-31	MAF-46	MAF-45	EW-12-06
Observed Wood Condition		Bark (Less than 1%)	Chips (Up to 10%)	Chips and/or Cunks (Up to 5%)	Bark (Up to 10%)	No Observed	No Observed	N/A
Proposed Cleanup Level Exceedance In Recently Deposited Sectiment (See Tables 6 and 7)	Benthic	Acenaphthene Dibenzofuran	No Exceedance	No Data	2,4-Dimethylphenol 4-Methylphenol (p-Cresol), Benzoic Acid	No Data	No Data	No Exceedance
	Human Health	Arsenic Total cPAH TEQ	No Exceedance	No Data	Cadmium, Lead Total cPAH TEQ Total Dioxin/Furan TEQ	Total cPAH TEQ	Total cPAH TEQ	No Exceedance

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

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.

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

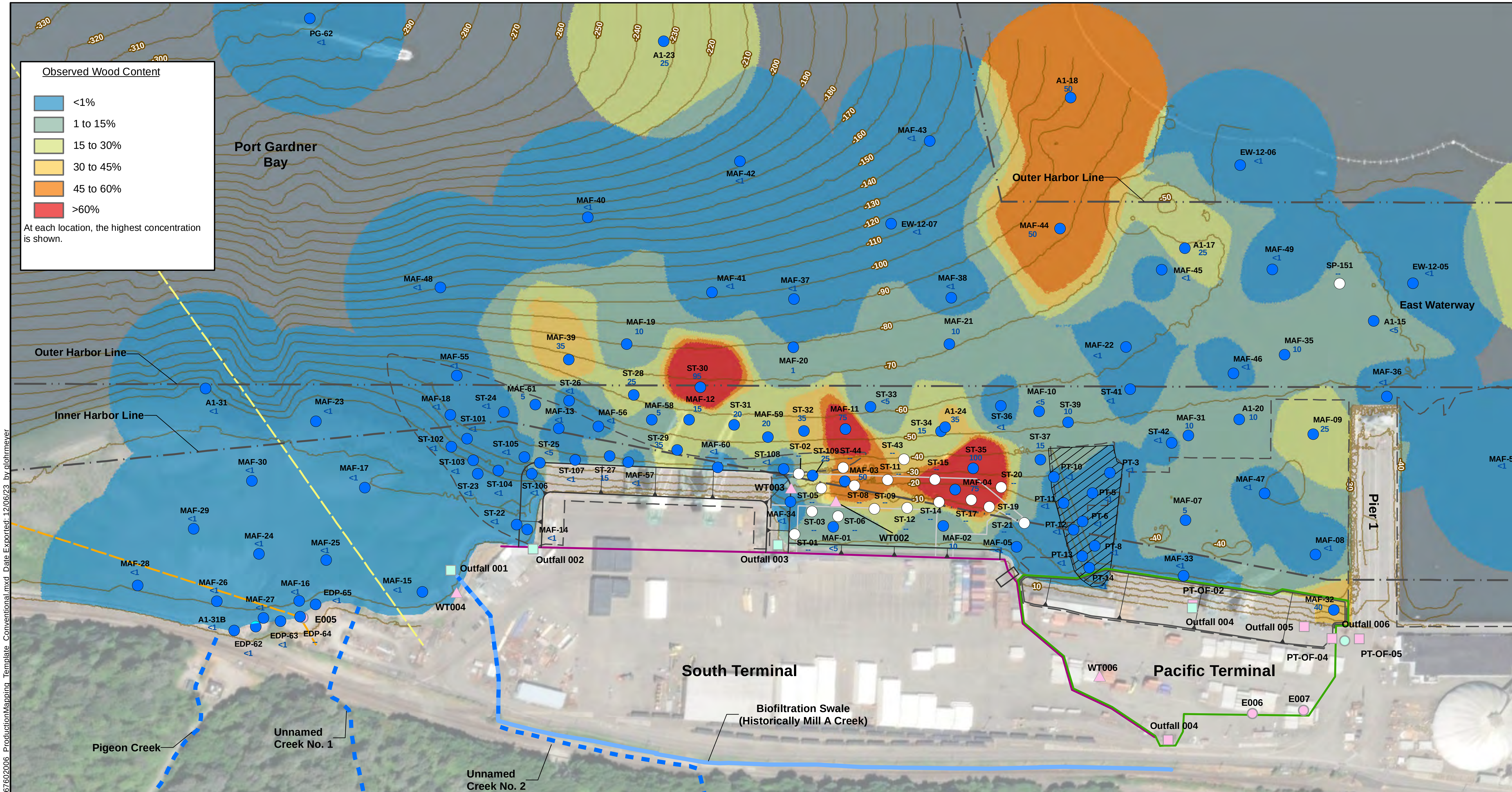
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 19

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F019_Cross Section D - D'.dwg F16 Date Exported:12/12/2023 12:54 PM - by Chad Stickel



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300

Feet

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.
3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.

Data Source: Base aerial from ESRI, 2022

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Observed Wood Content Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 20

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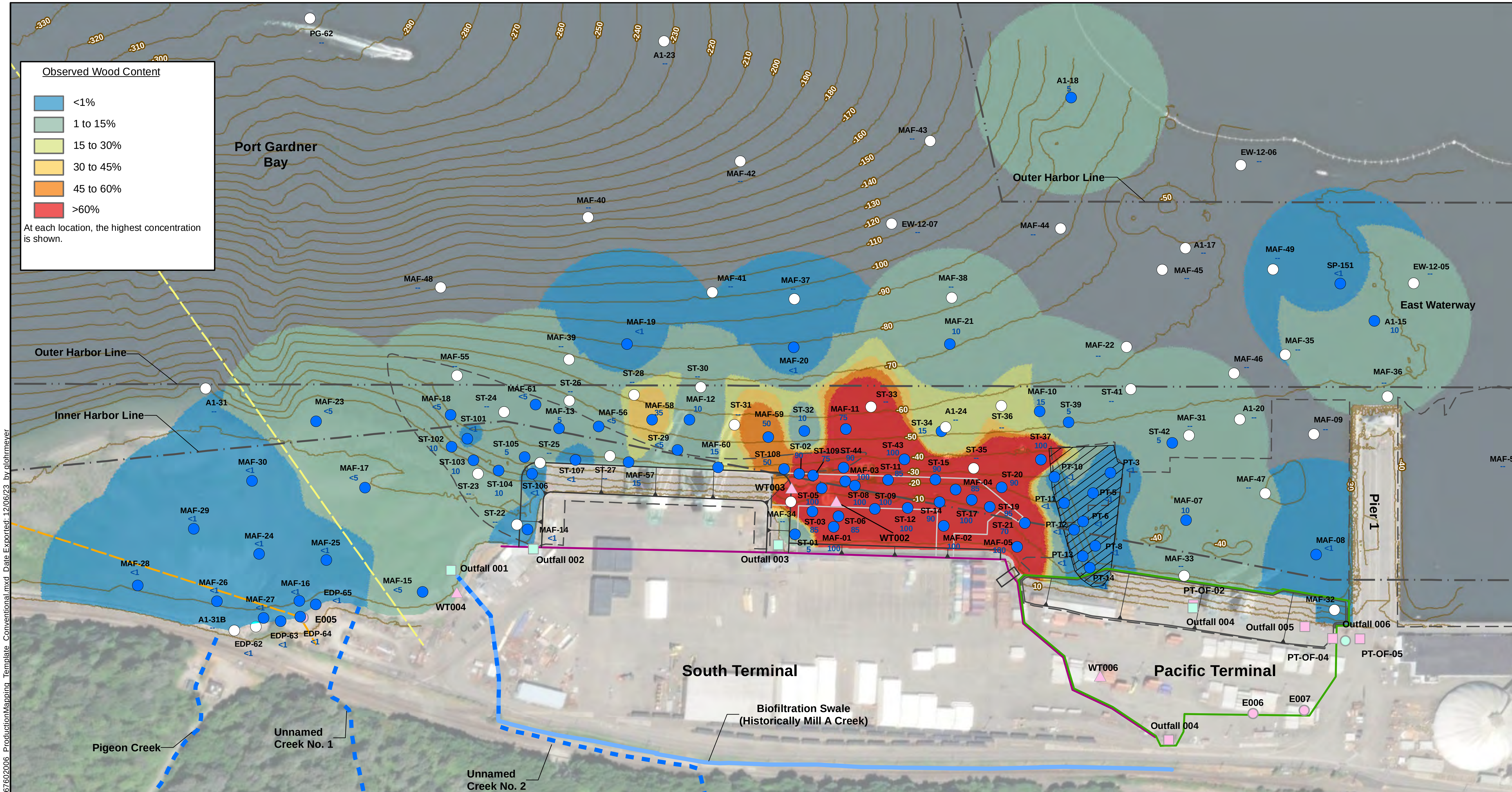

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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.
3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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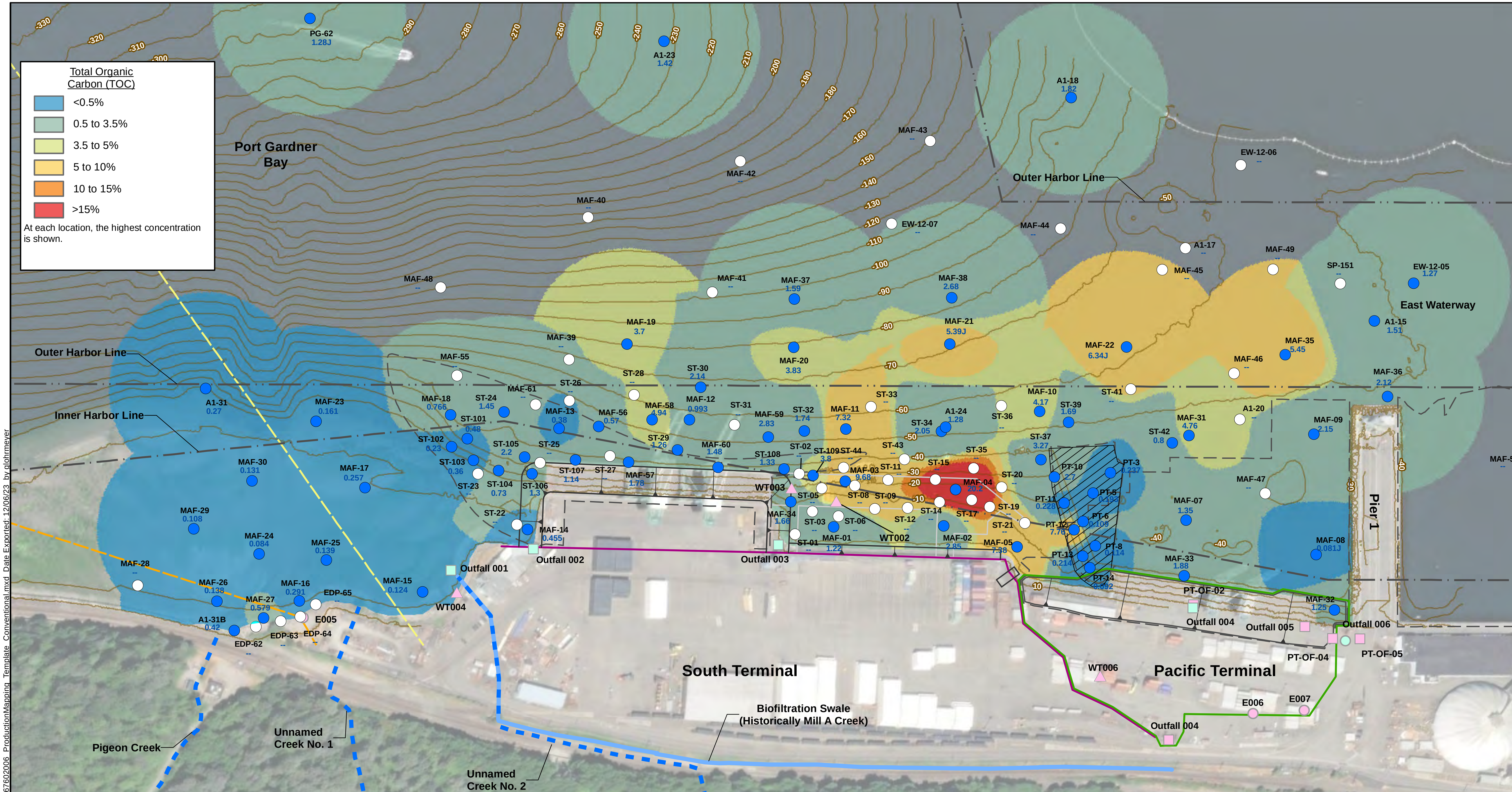
Observed Wood Content Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 21



300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Total Organic Carbon (TOC) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 22

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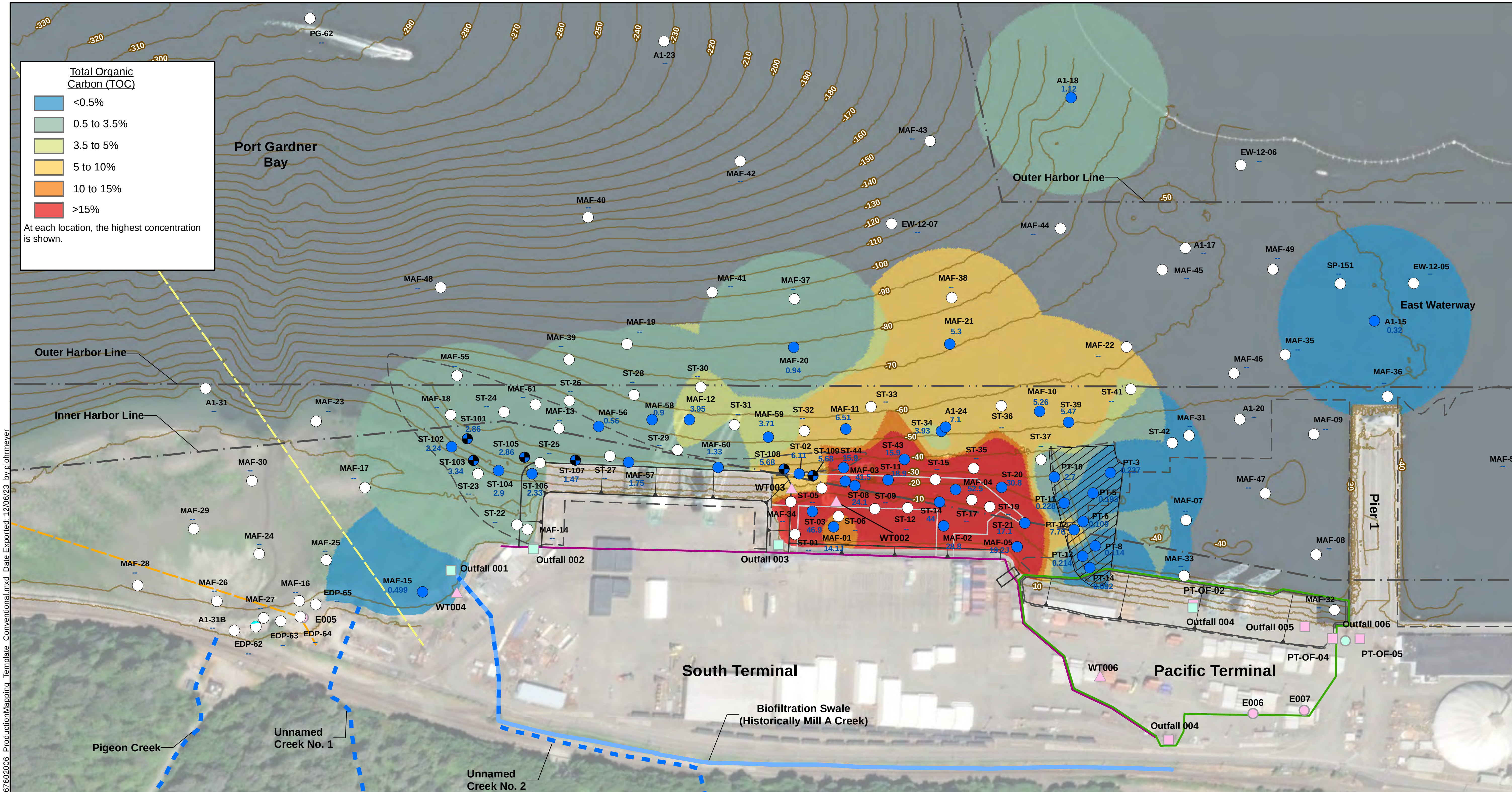

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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.
3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total Organic Carbon (TOC) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 23

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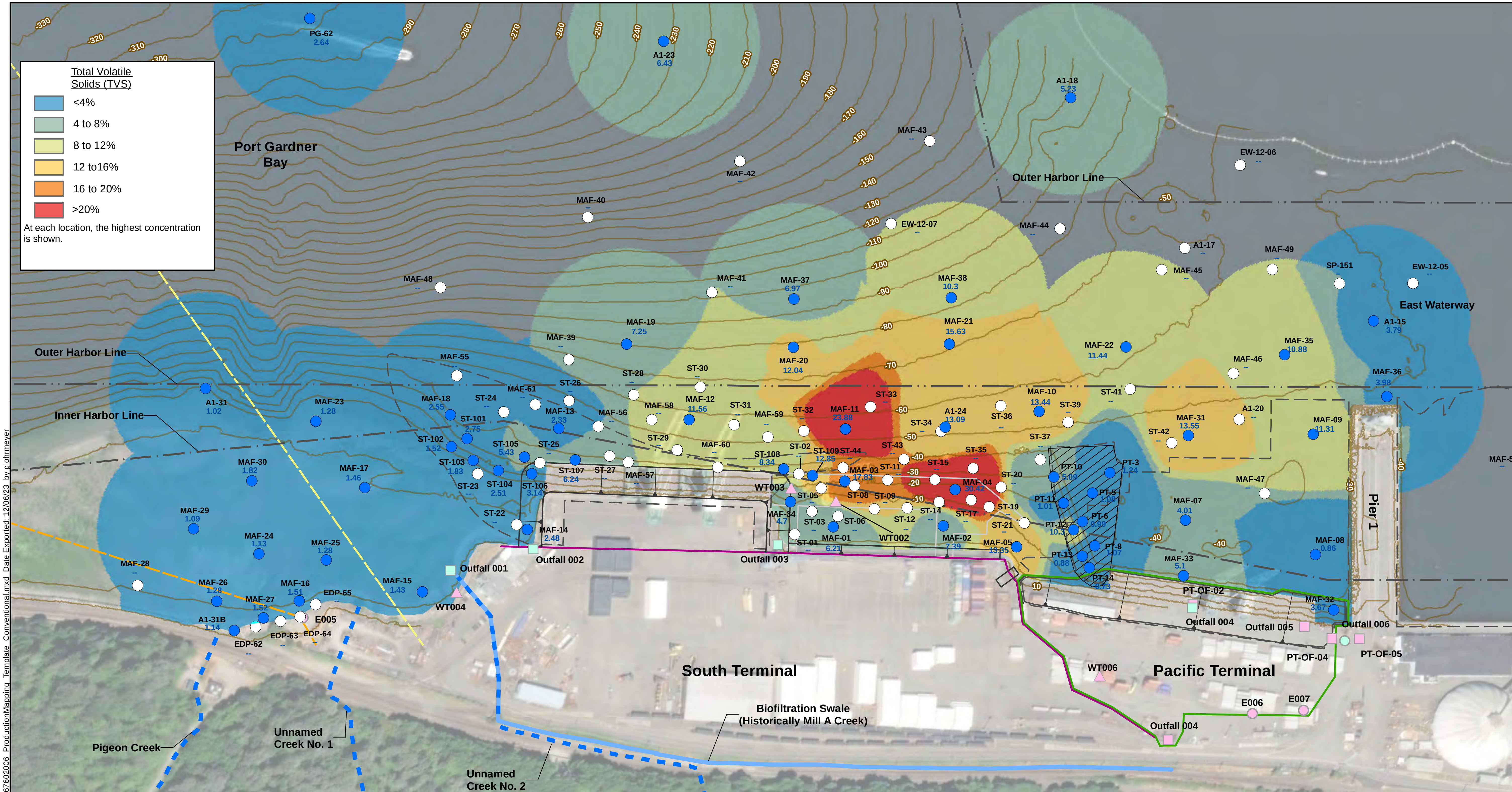

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
1. The locations of all features shown are approximate.
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total Volatile Solids (TVS) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

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Figure 24

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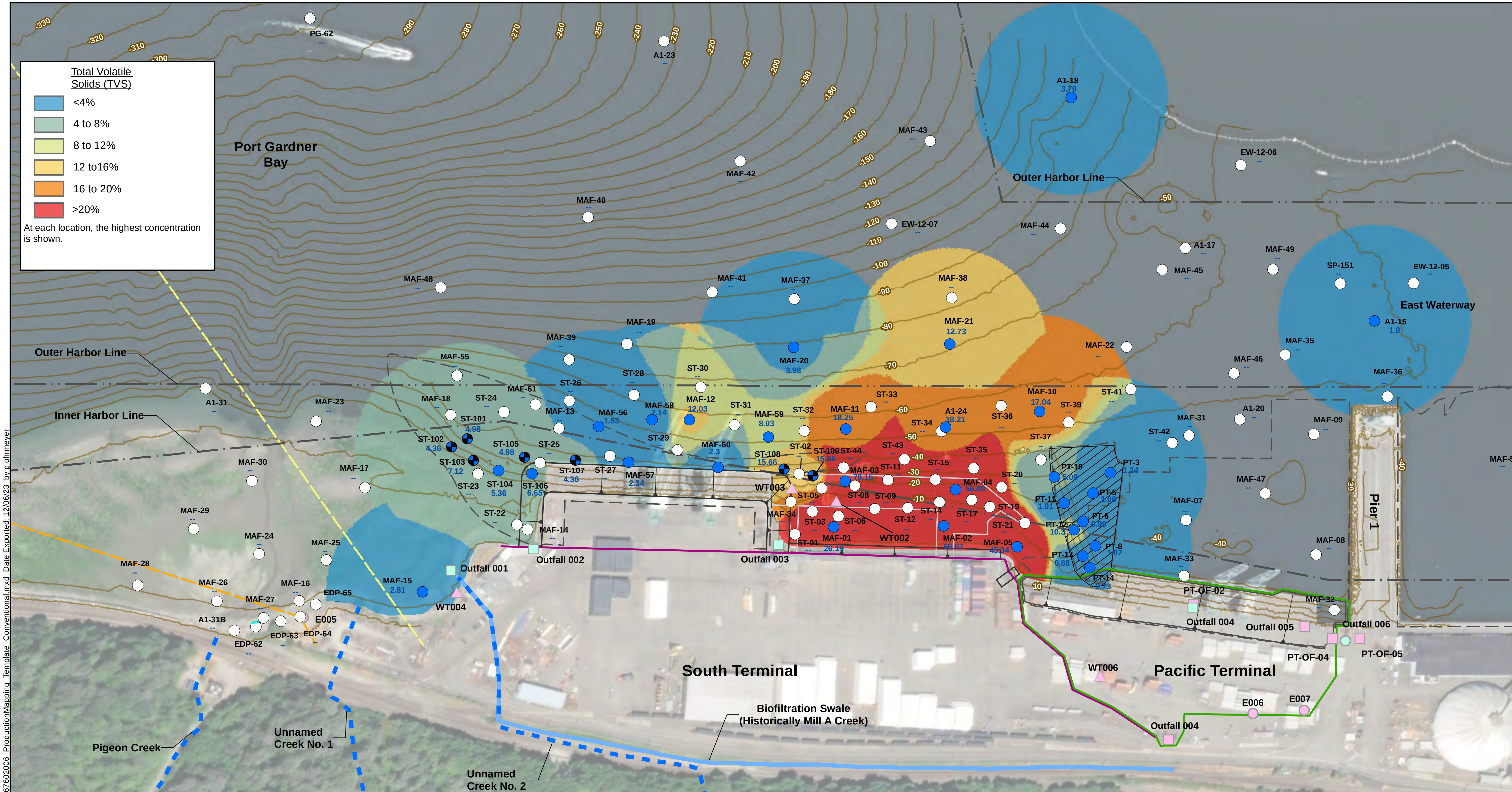

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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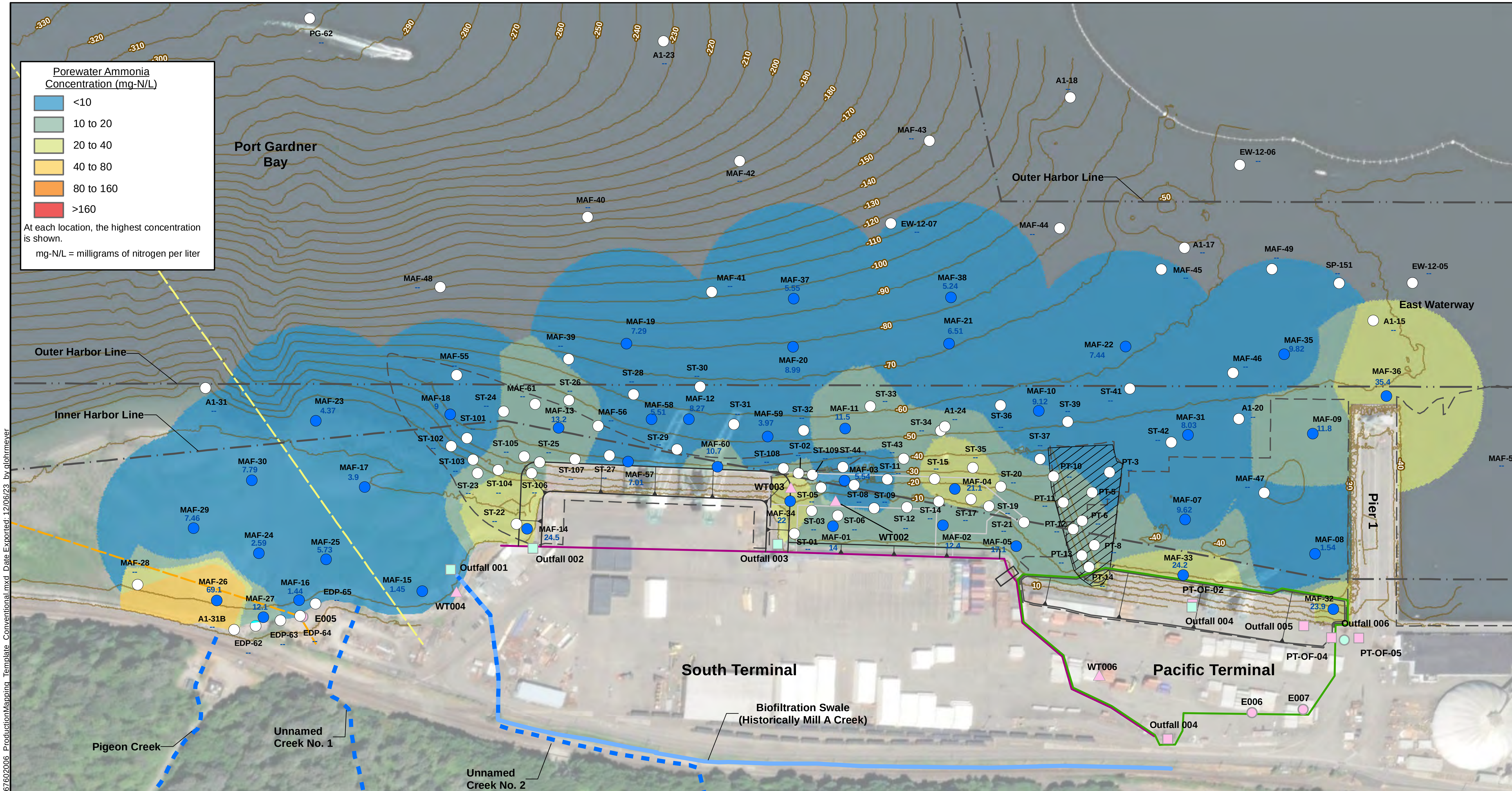
Total Volatile Solids (TVS) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 25



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 Sample Location Identification
1.22 Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
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- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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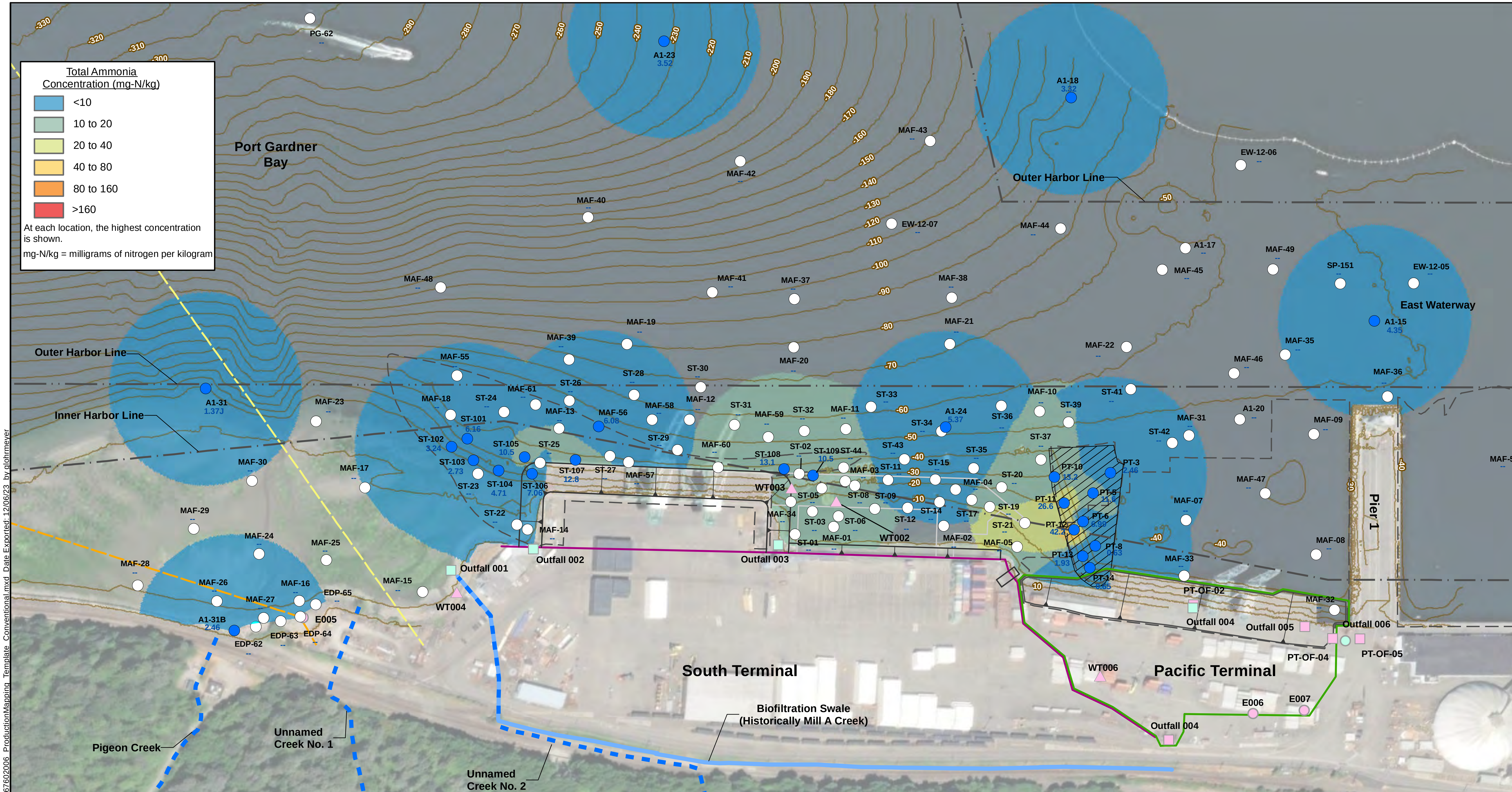
Porewater Ammonia Concentration Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 26



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 Sample Location Identification
1.22 Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
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- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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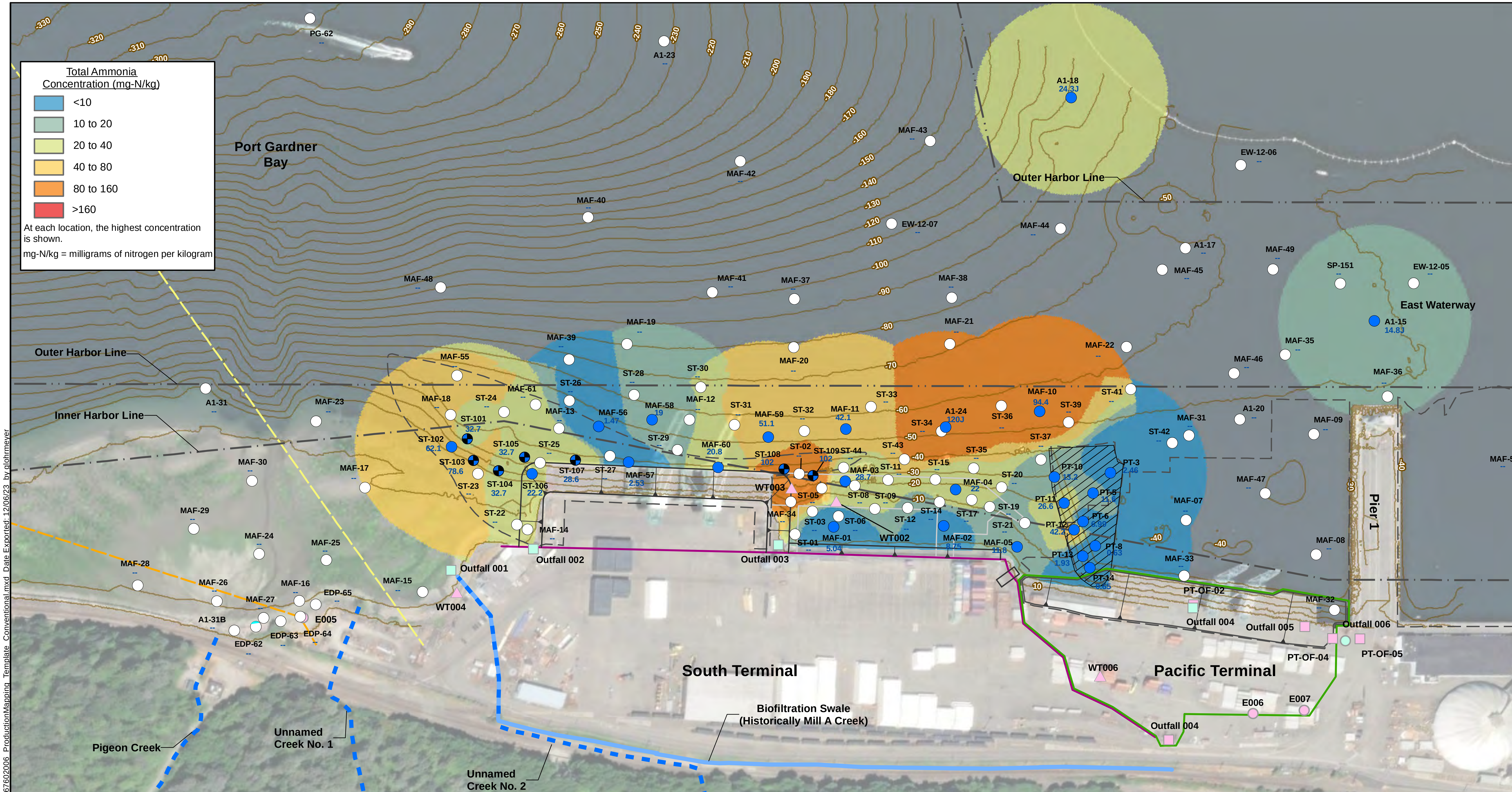
3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total Ammonia Concentration Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 27



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
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- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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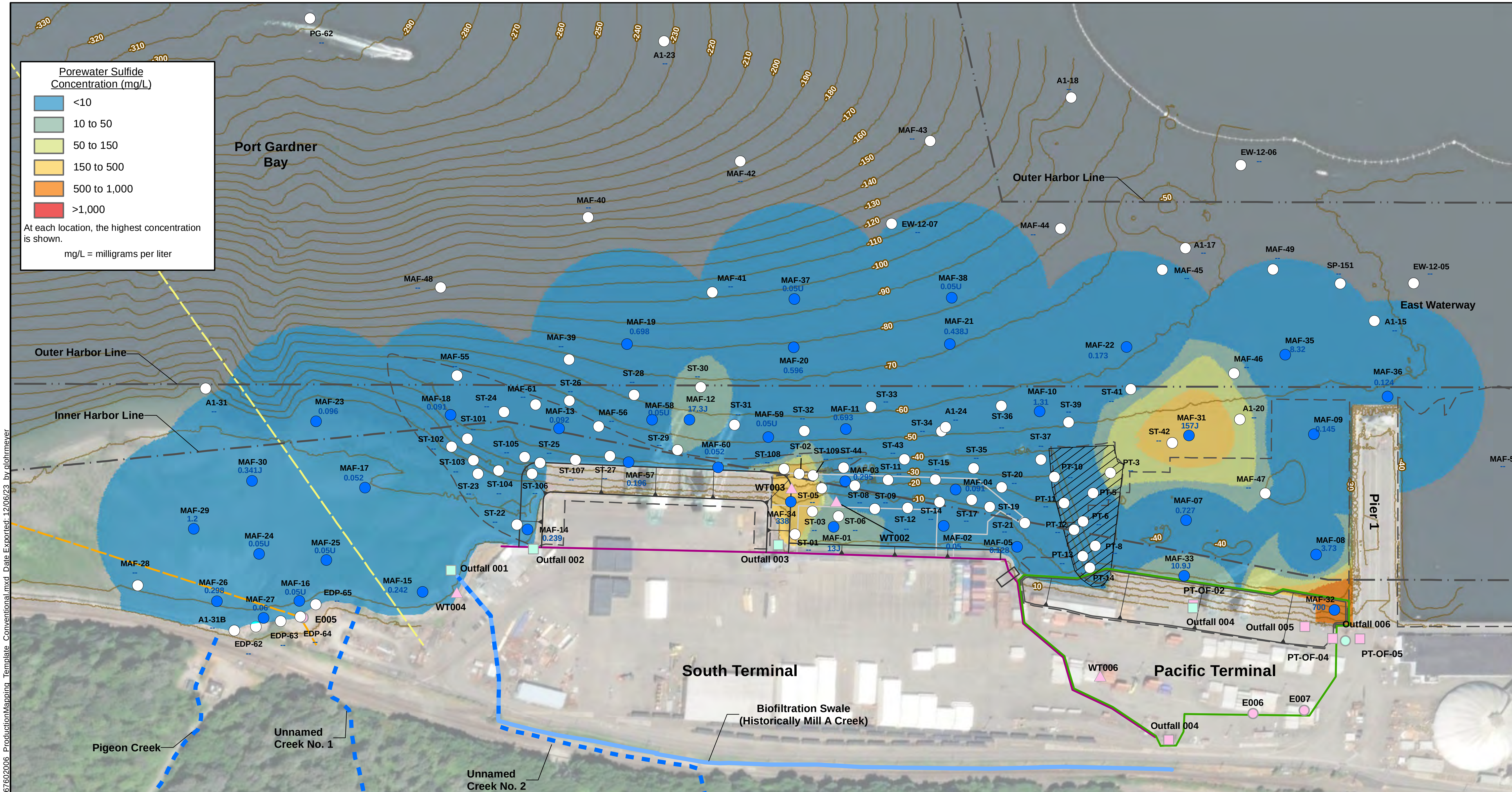
Total Ammonia Concentration Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 28



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result

Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
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- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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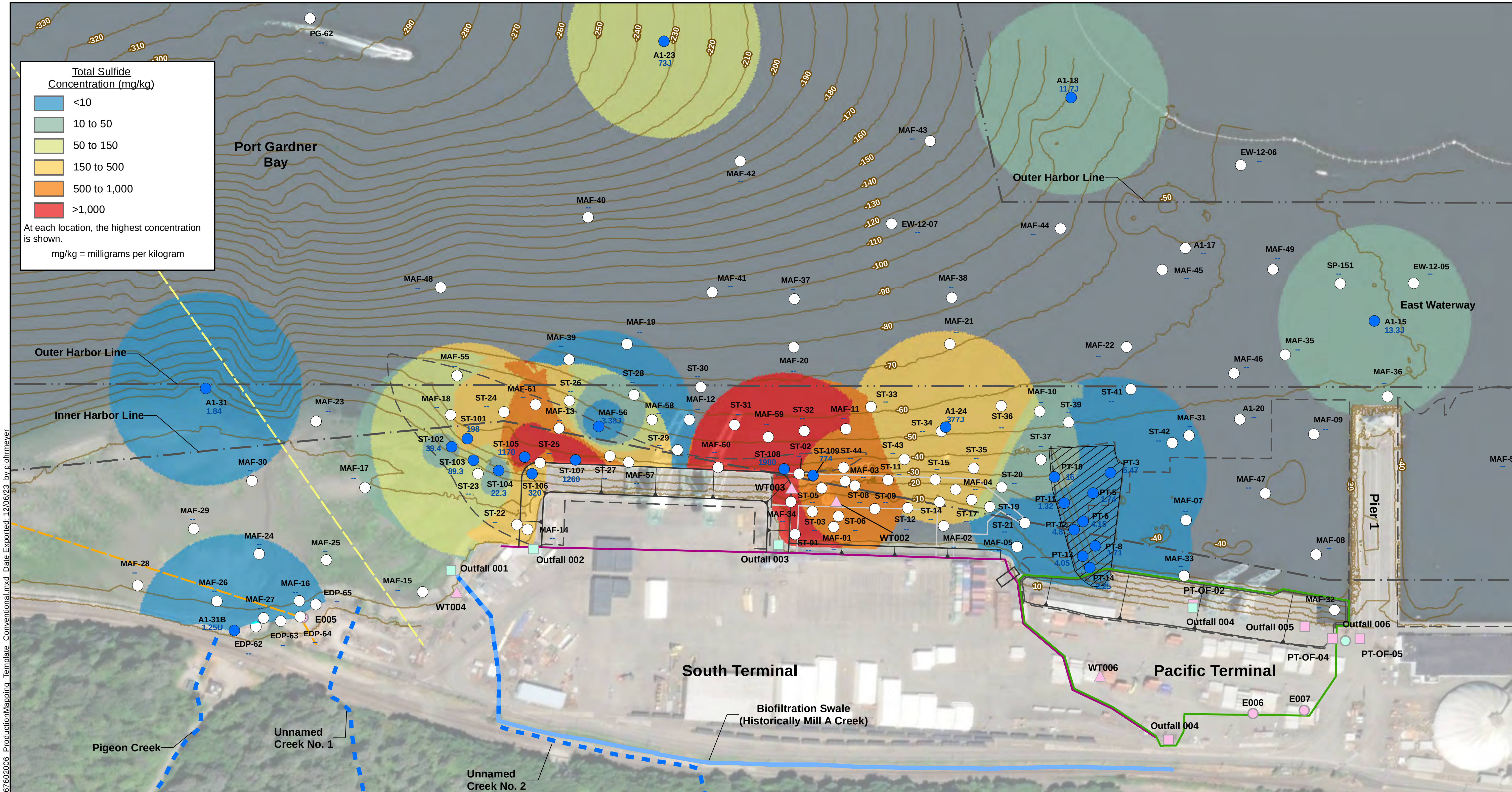
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Porewater Sulfide Concentration Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 29



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
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- Bulkhead
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- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total Sulfide Concentration Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 30

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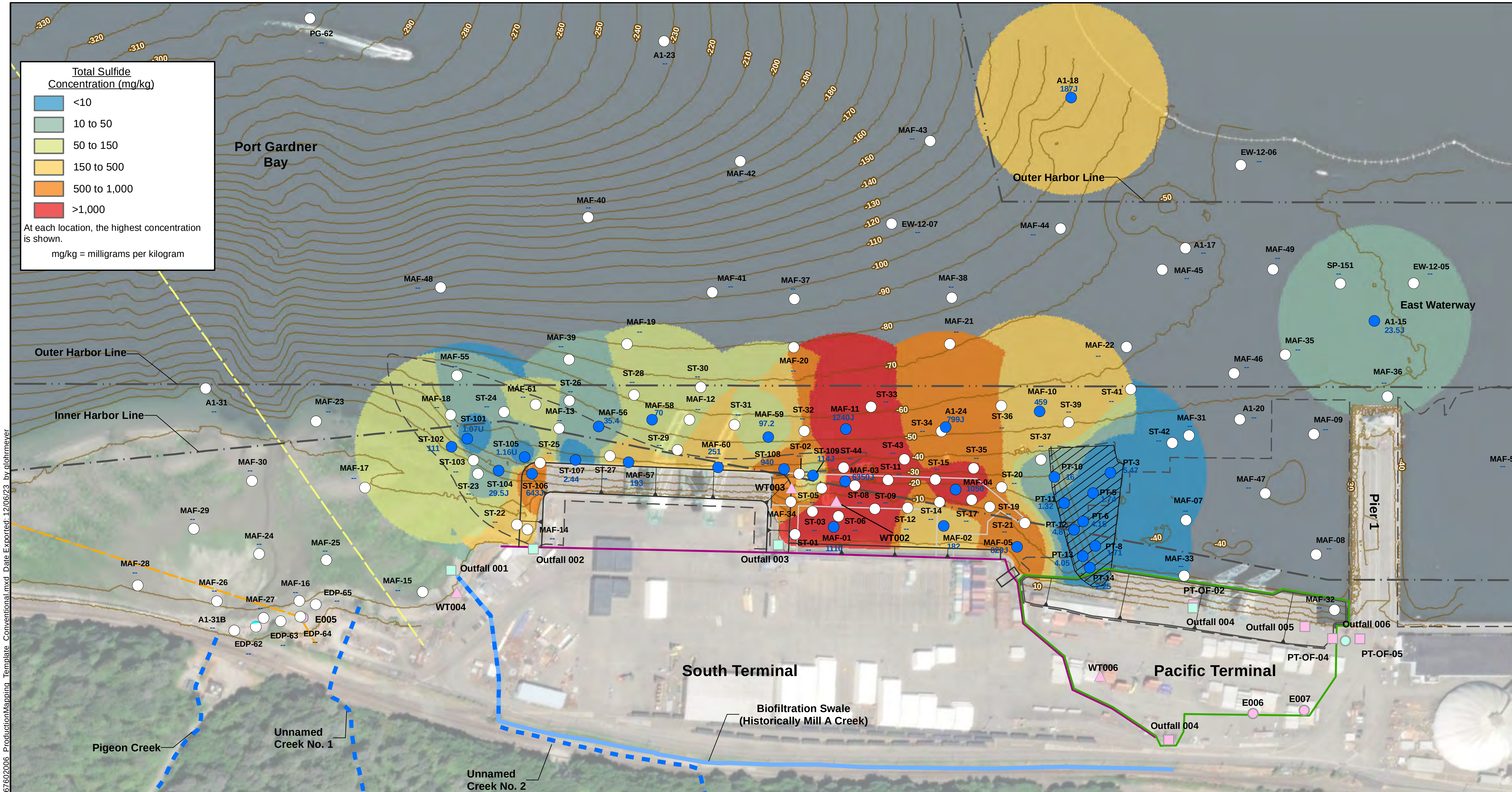

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
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- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total Sulfide Concentration Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

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Figure 31

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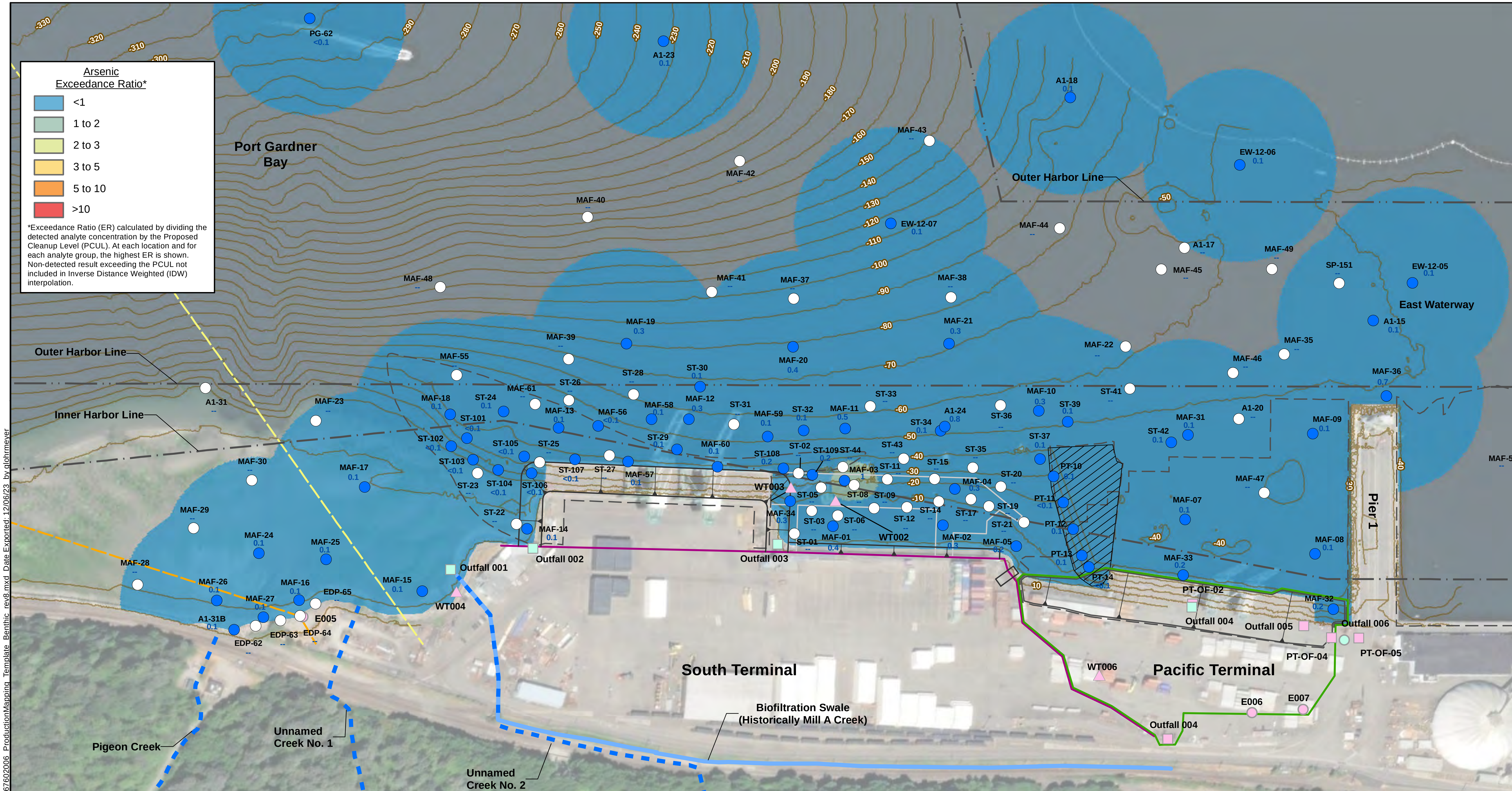

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300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
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- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
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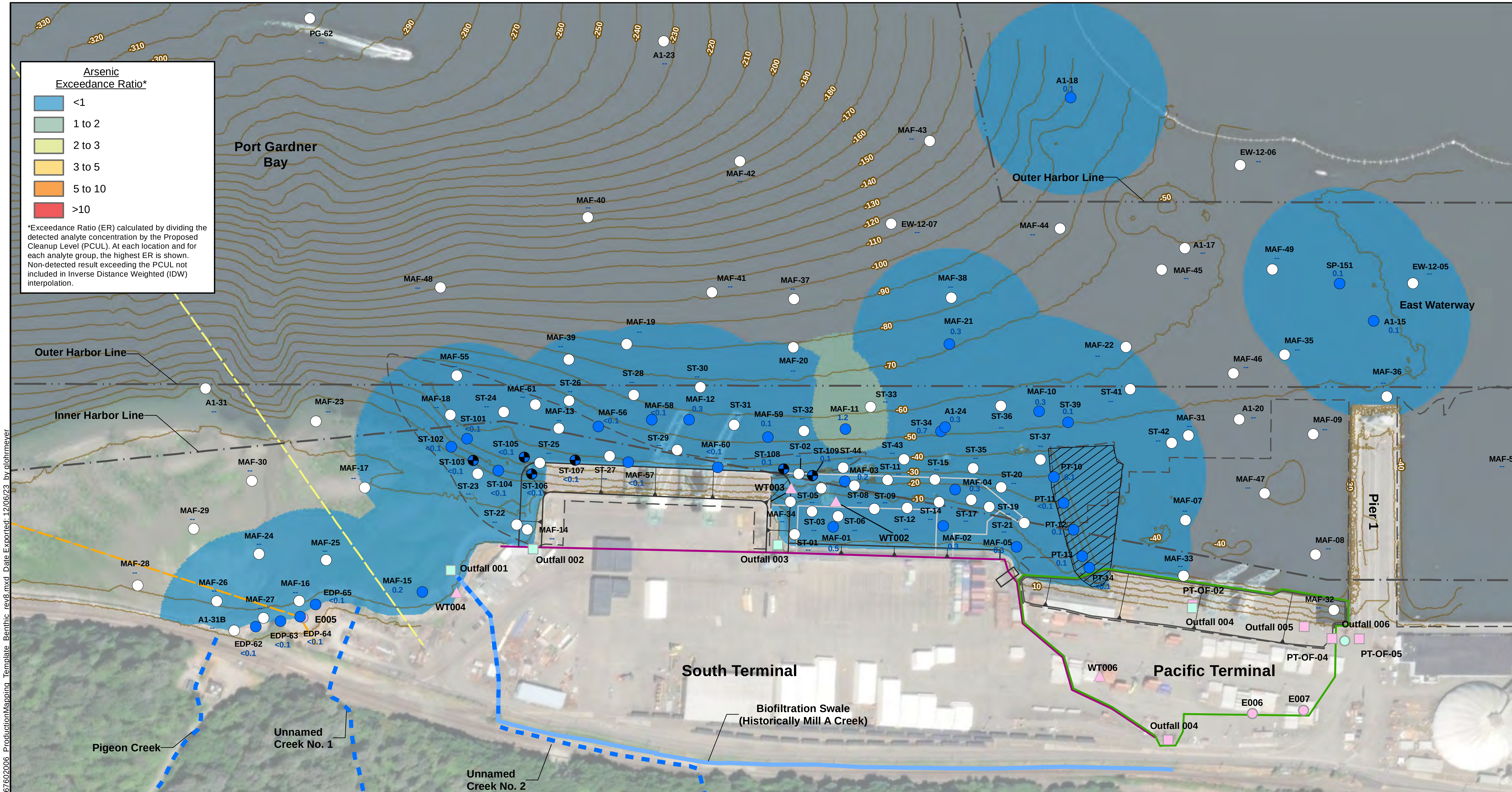
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Arsenic Results (Benthic)
Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 32



300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
- Historical Piling Area
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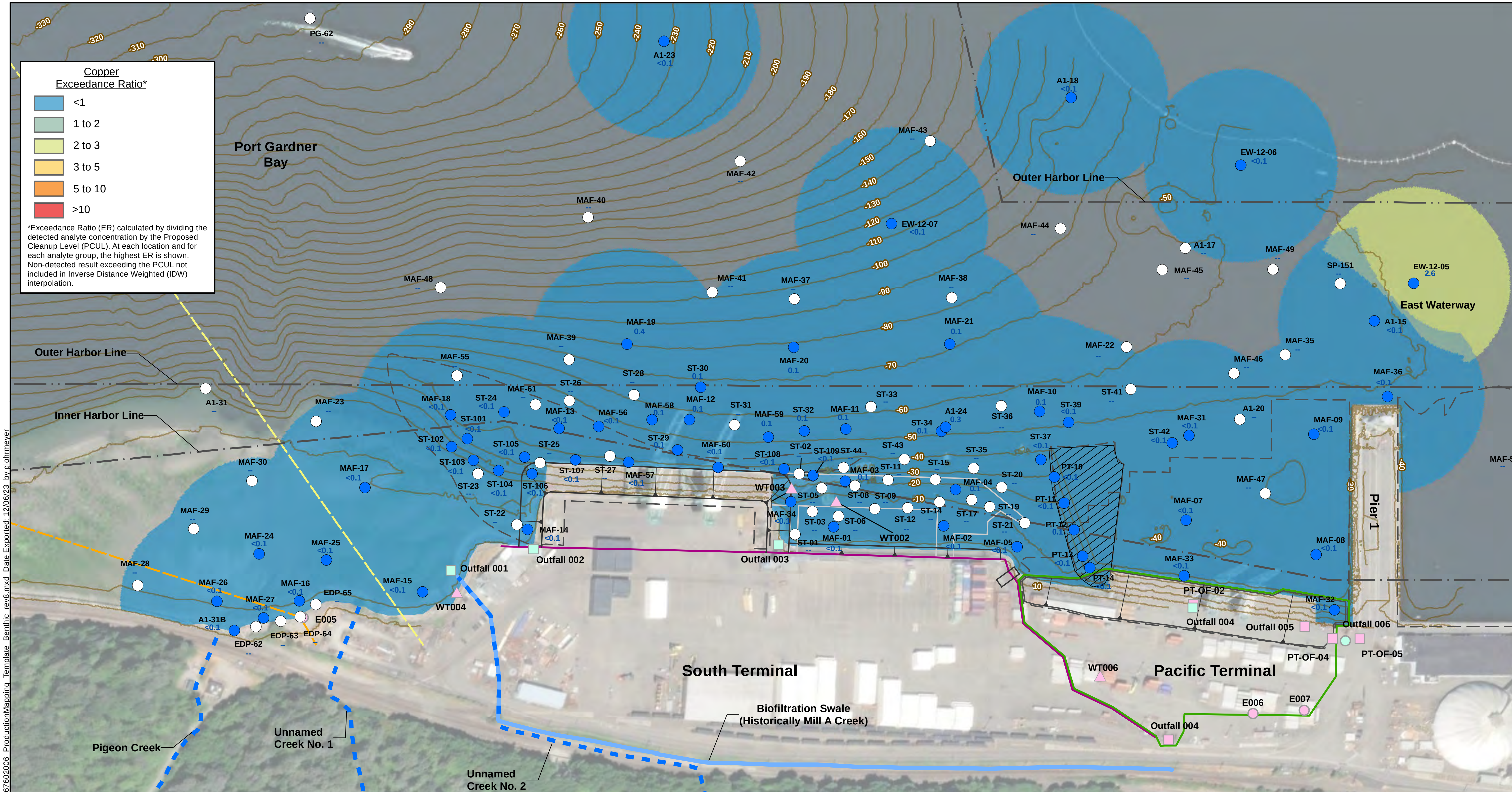
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Arsenic Results (Benthic) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 33



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 Sample Location Identification
1.22 Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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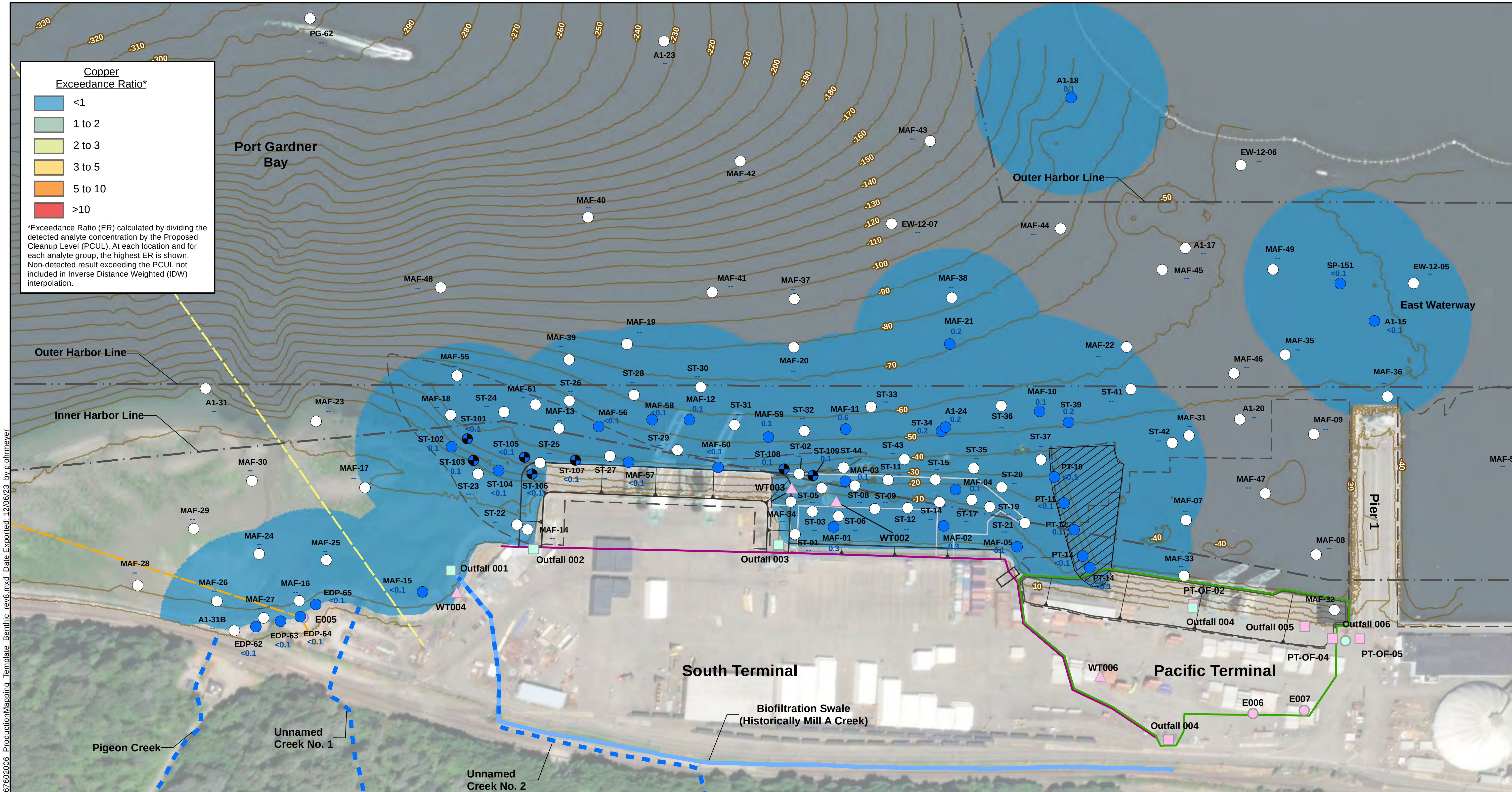
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Copper Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 34



Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
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- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Copper Results (Benthic)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

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Figure 35

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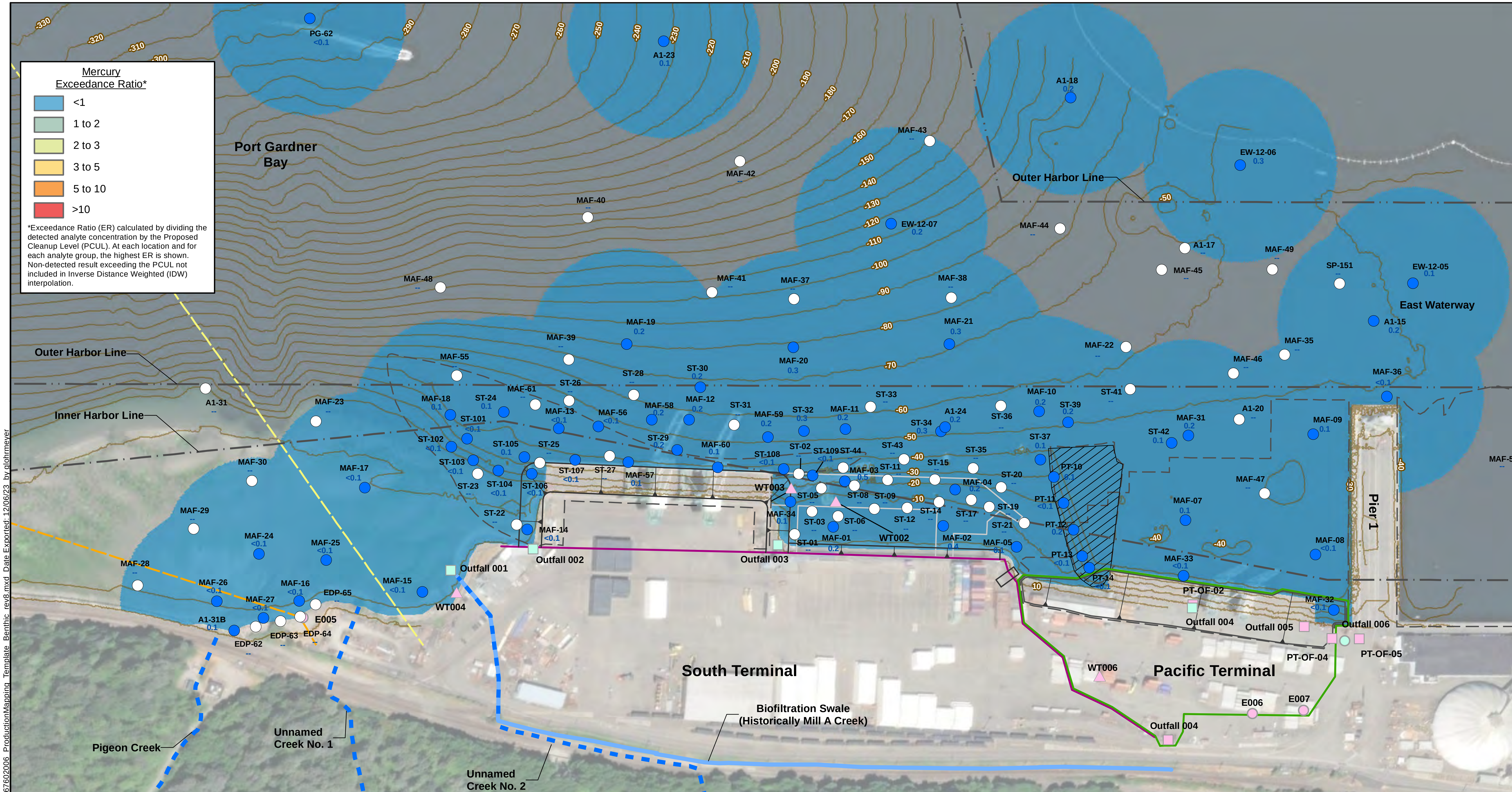

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300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)

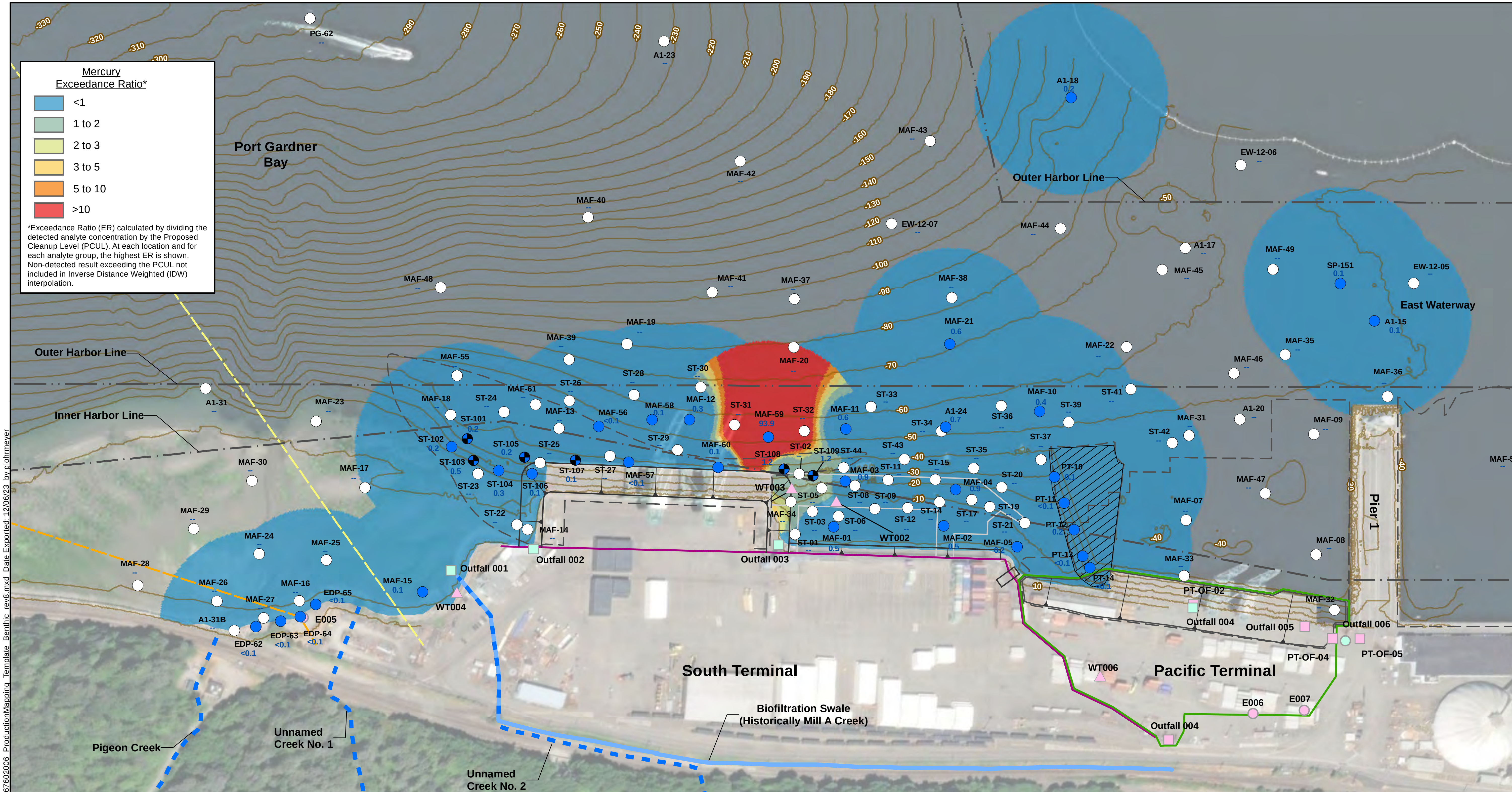
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Mercury Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 36



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 Sample Location Identification
1.22 Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
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- Bulkhead
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- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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Mercury Results (Benthic)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

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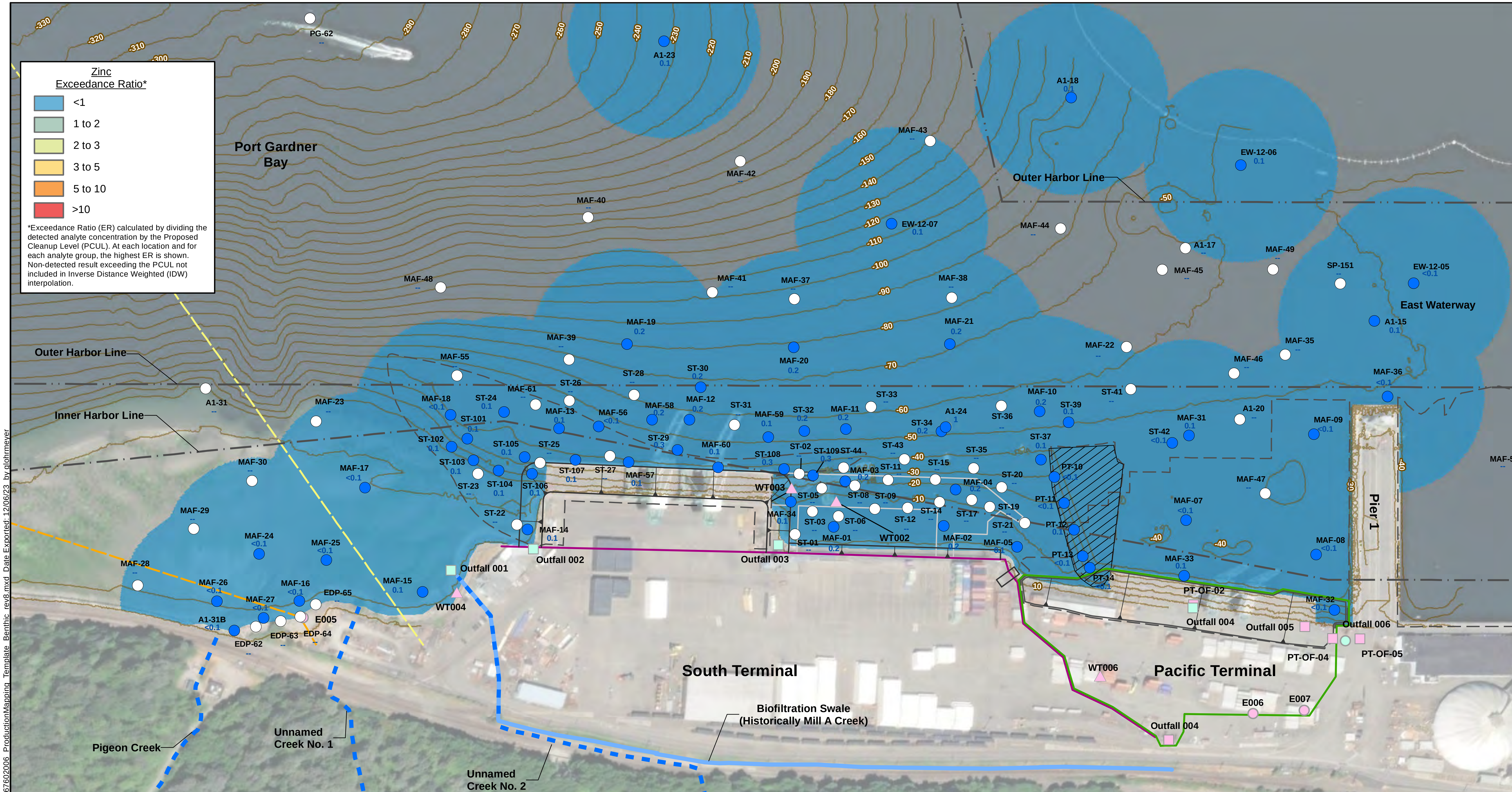
Figure 37



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Zinc Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

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Figure 38

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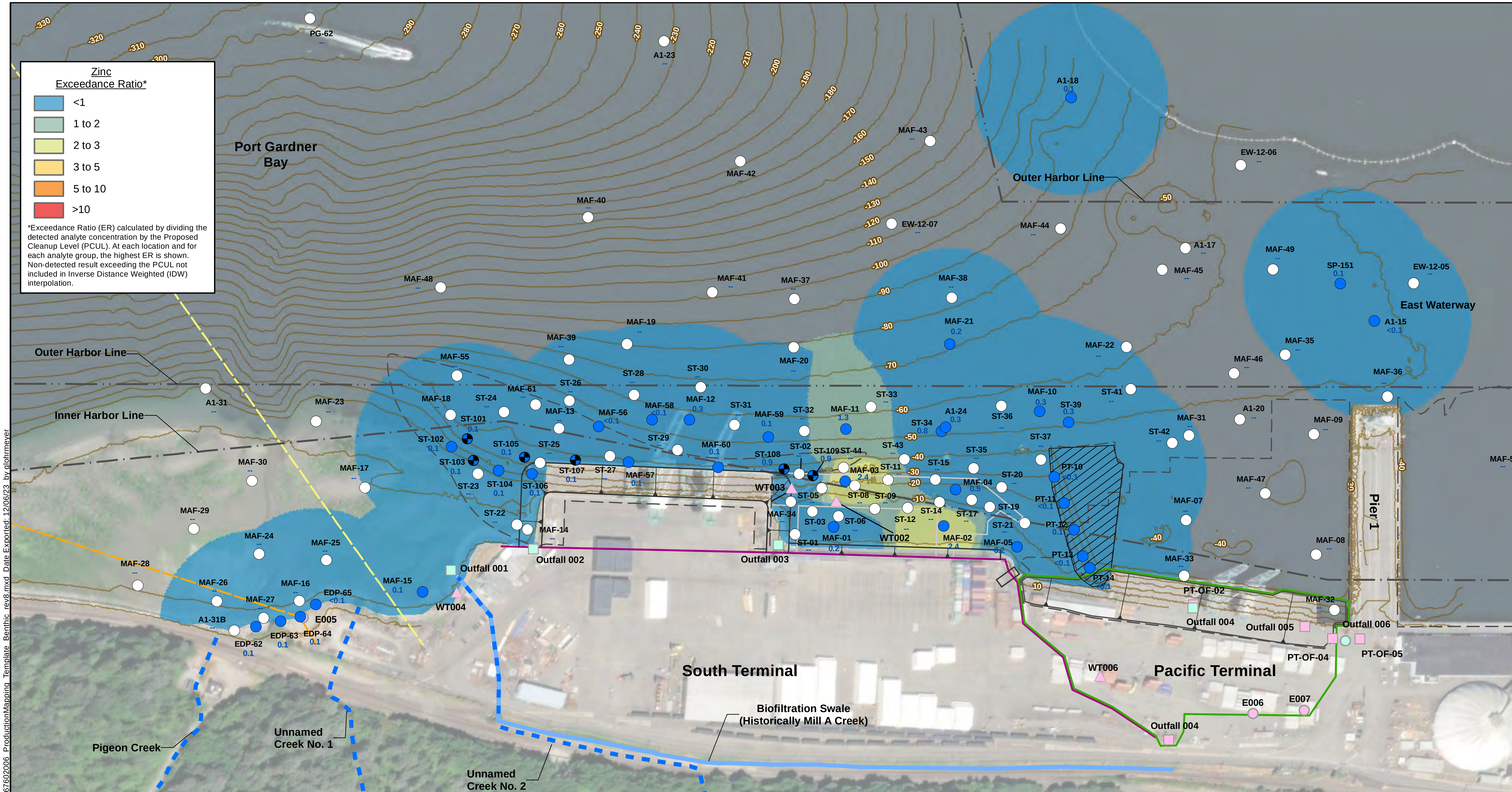

300 0 300
Feet

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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)

- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

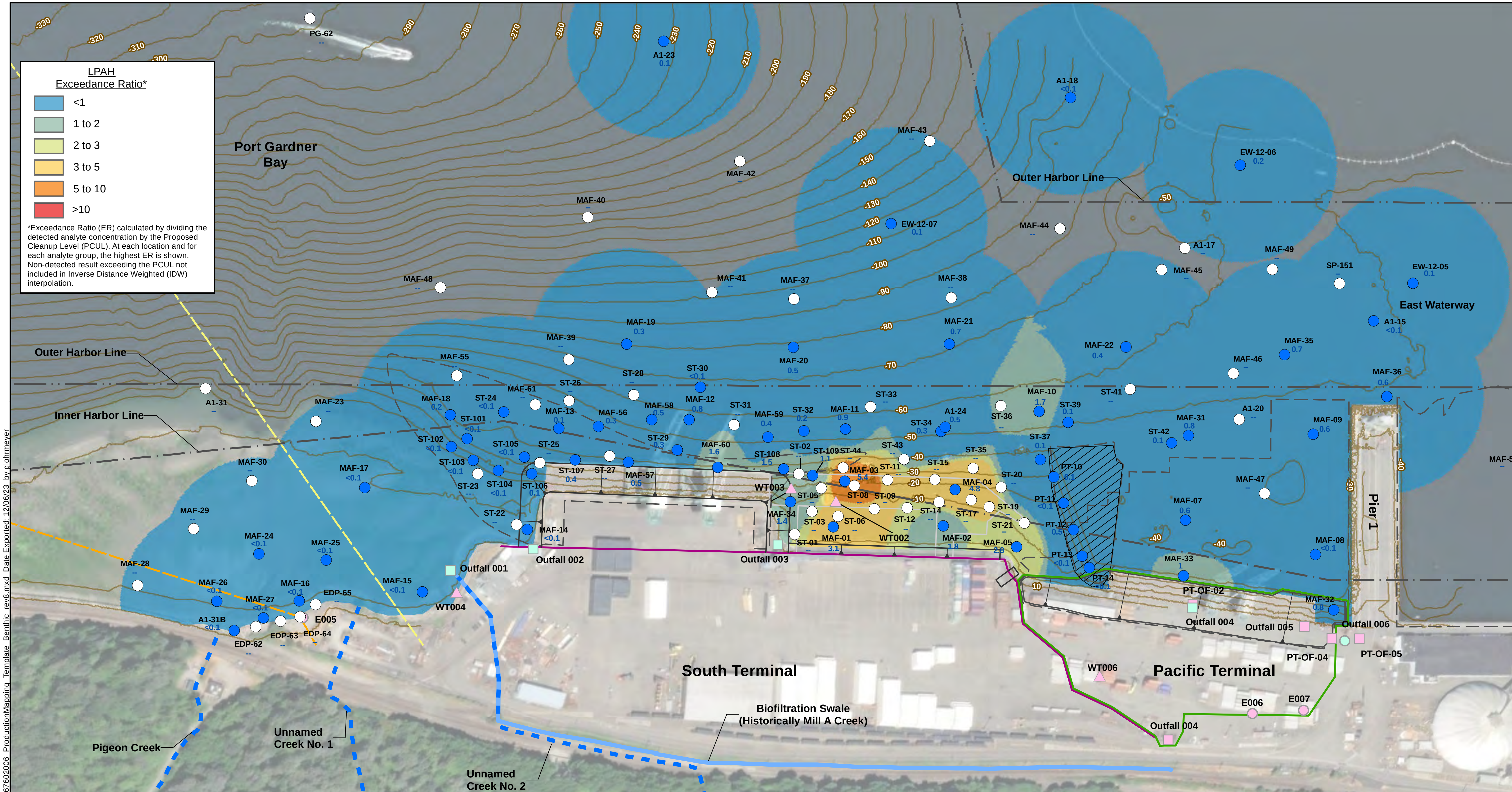
Zinc Results (Benthic)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 39

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_ProductionMapping_Template_Benthic_rev8.mxd Date Exported: 12/06/23 by glohrmeyer



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
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- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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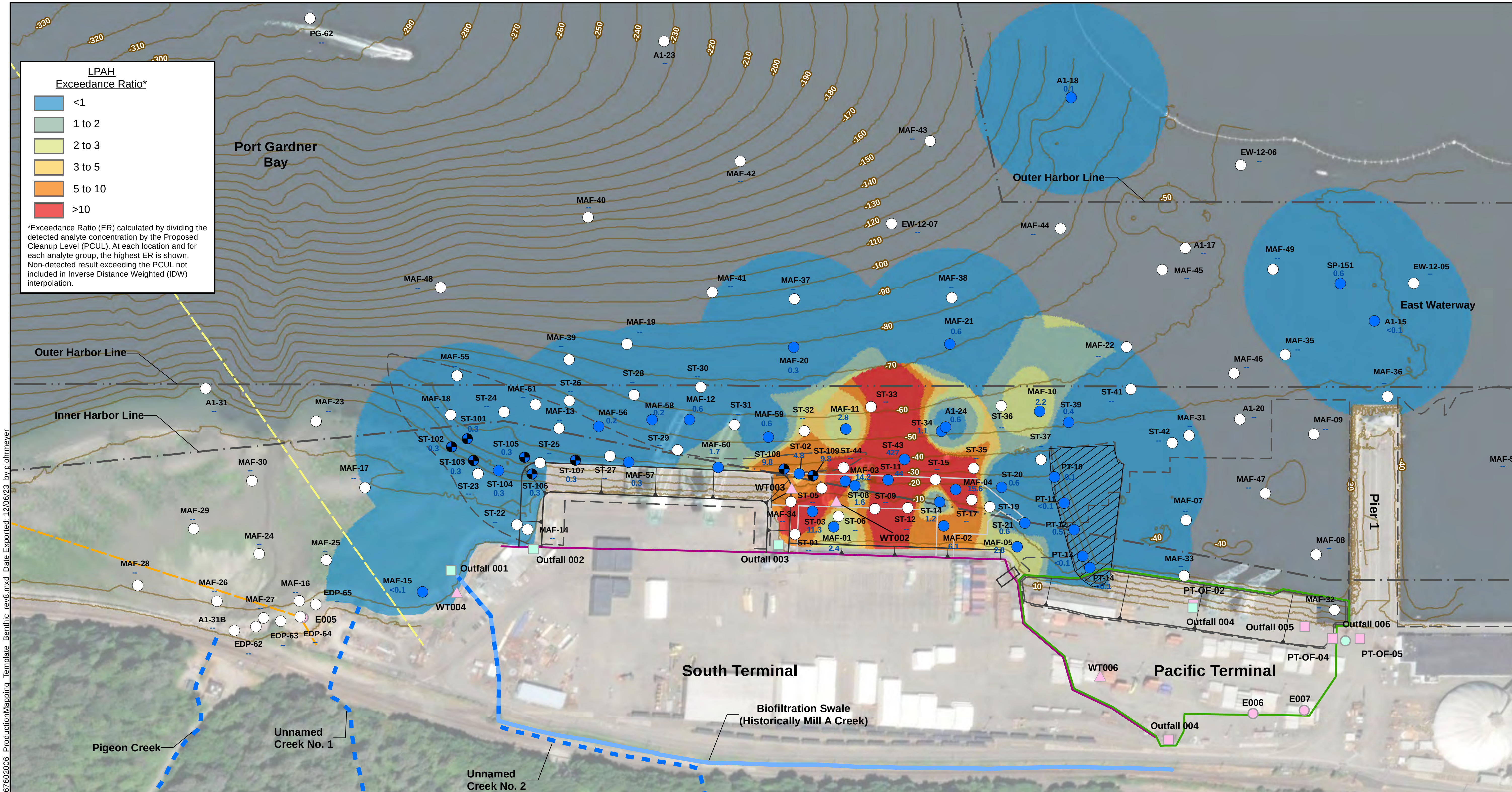
LPAH Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 40



300 0 300

Feet

Notes:
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Data Source: Base aerial from ESRI, 2018

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)

- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

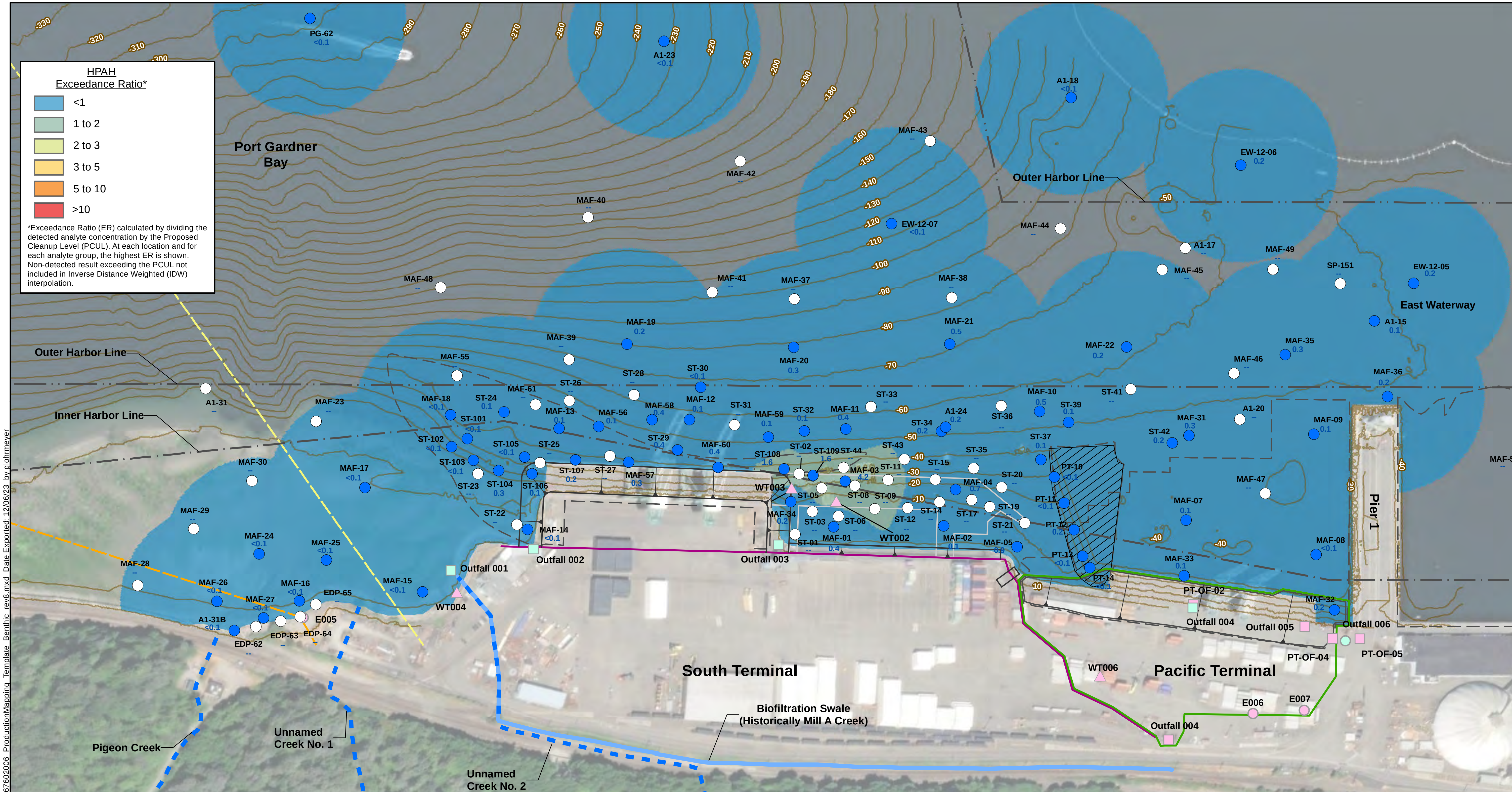
LPAH Results (Benthic) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 41

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_ProductionMapping_Template_Benthic_rev8.mxd Date Exported: 12/06/23 by glohrmeyer



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

HPAH Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 42

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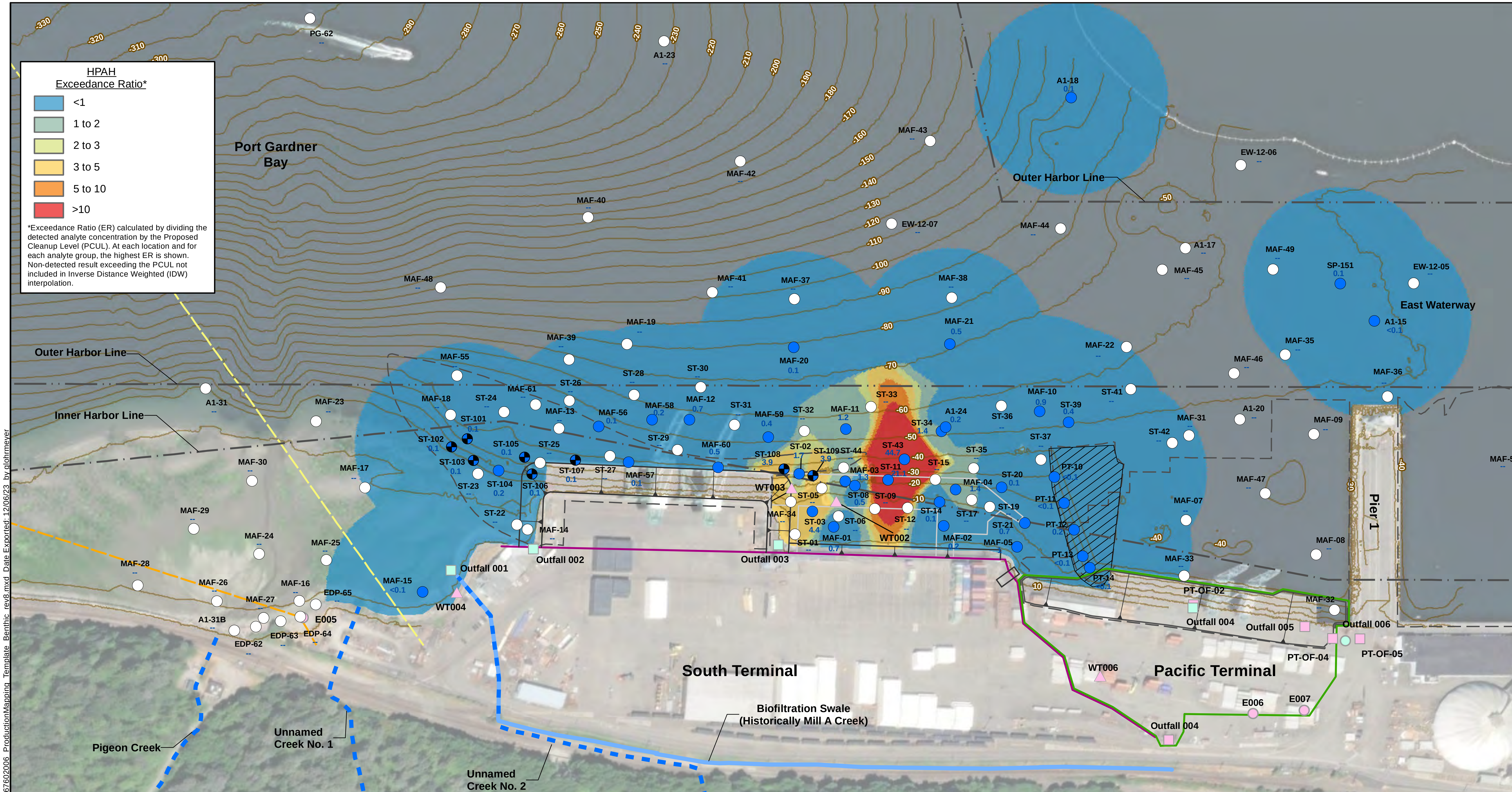

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300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
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- Bulkhead
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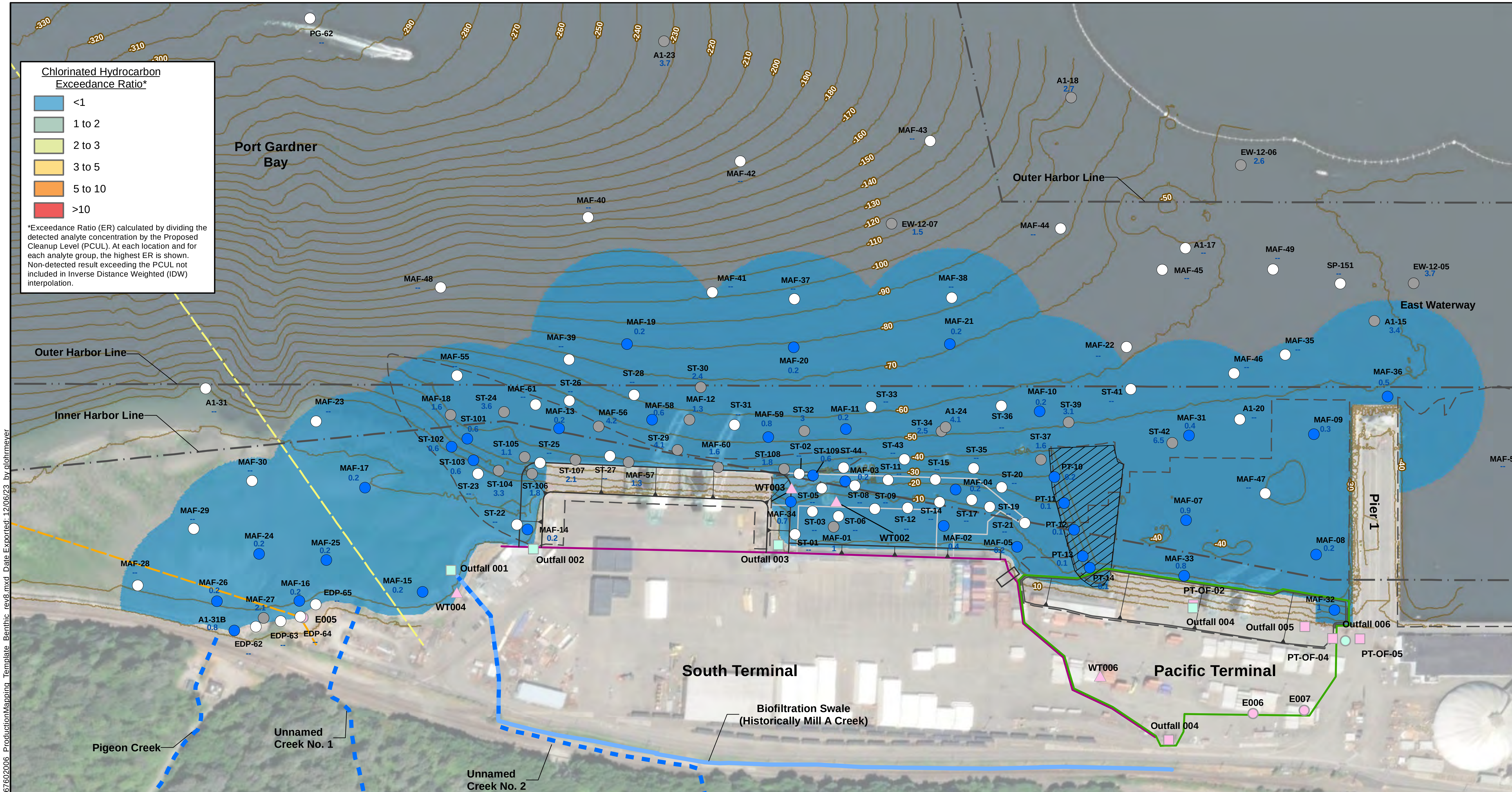
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

HPAH Results (Benthic)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 43



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300 0 300

Feet

Notes:
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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
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- Dredged Area
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- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
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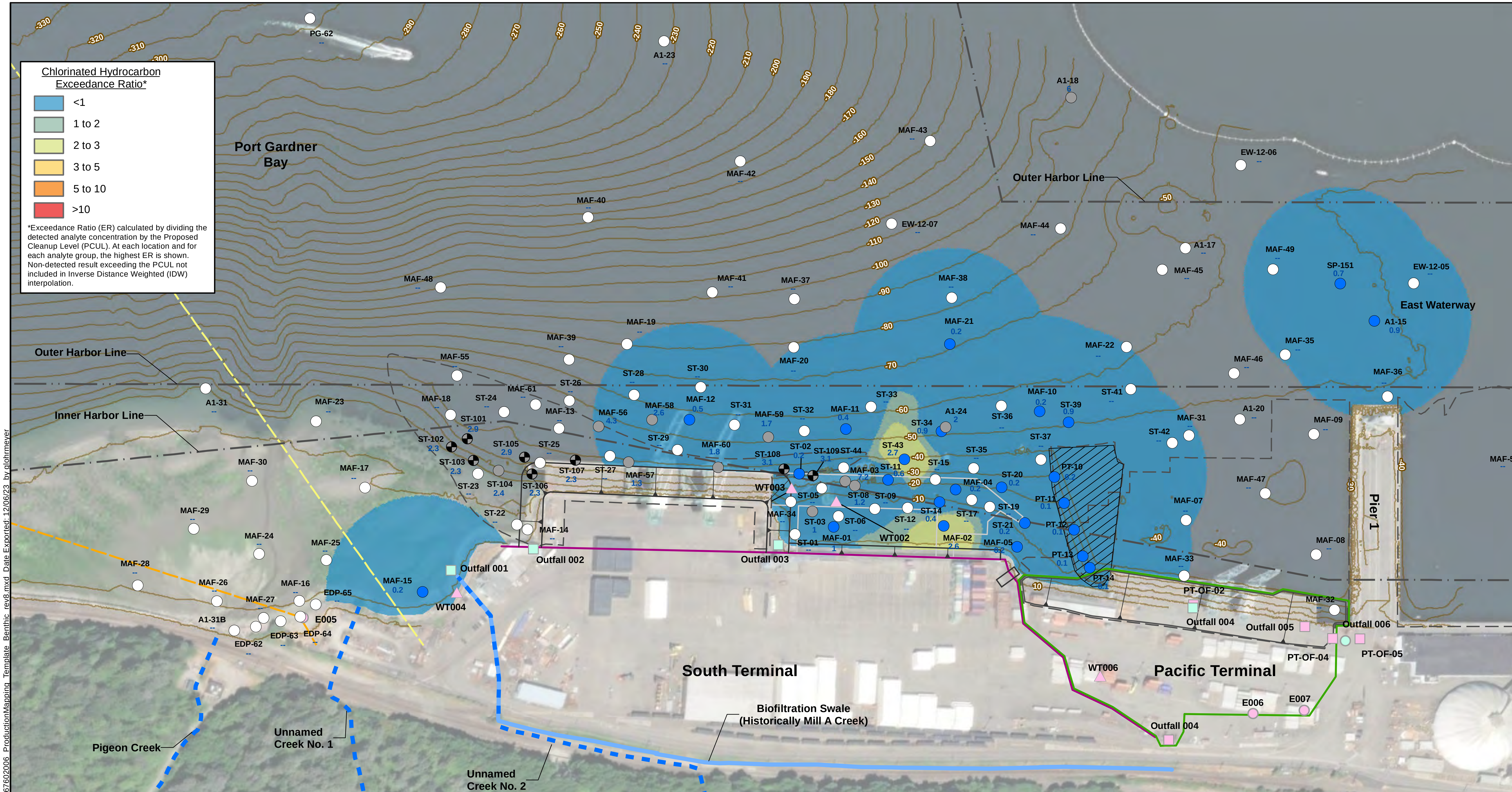
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Chlorinated Hydrocarbon Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 44



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

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- Dredged Area
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- Bulkhead
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- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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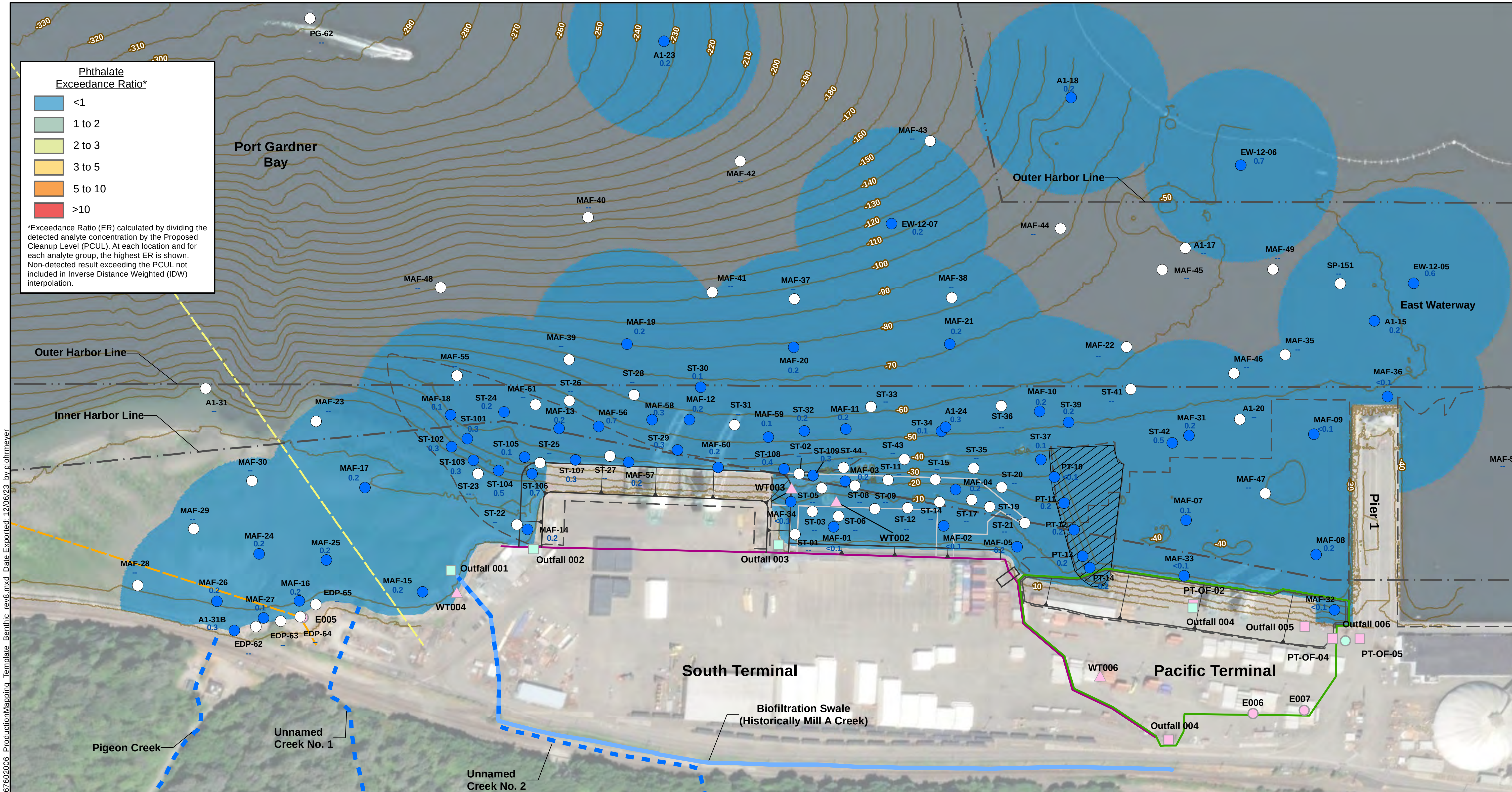
Chlorinated Hydrocarbon Results (Benthic) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 45



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
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- Former Stormwater Outfall (Abandoned)
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300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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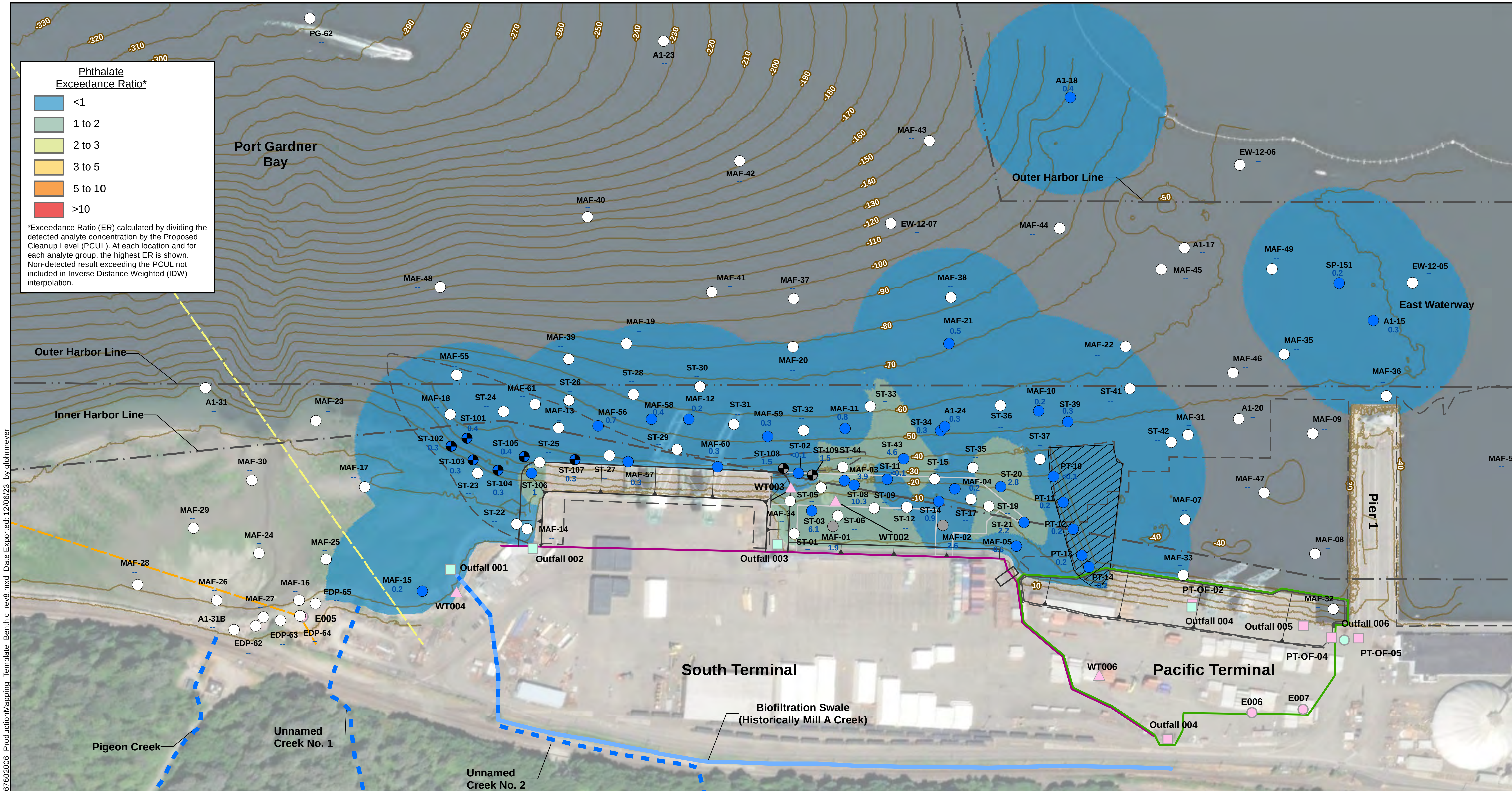
Phthalate Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 46



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
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- Former Stormwater Outfall (Abandoned)
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- Current Stormwater Outfall

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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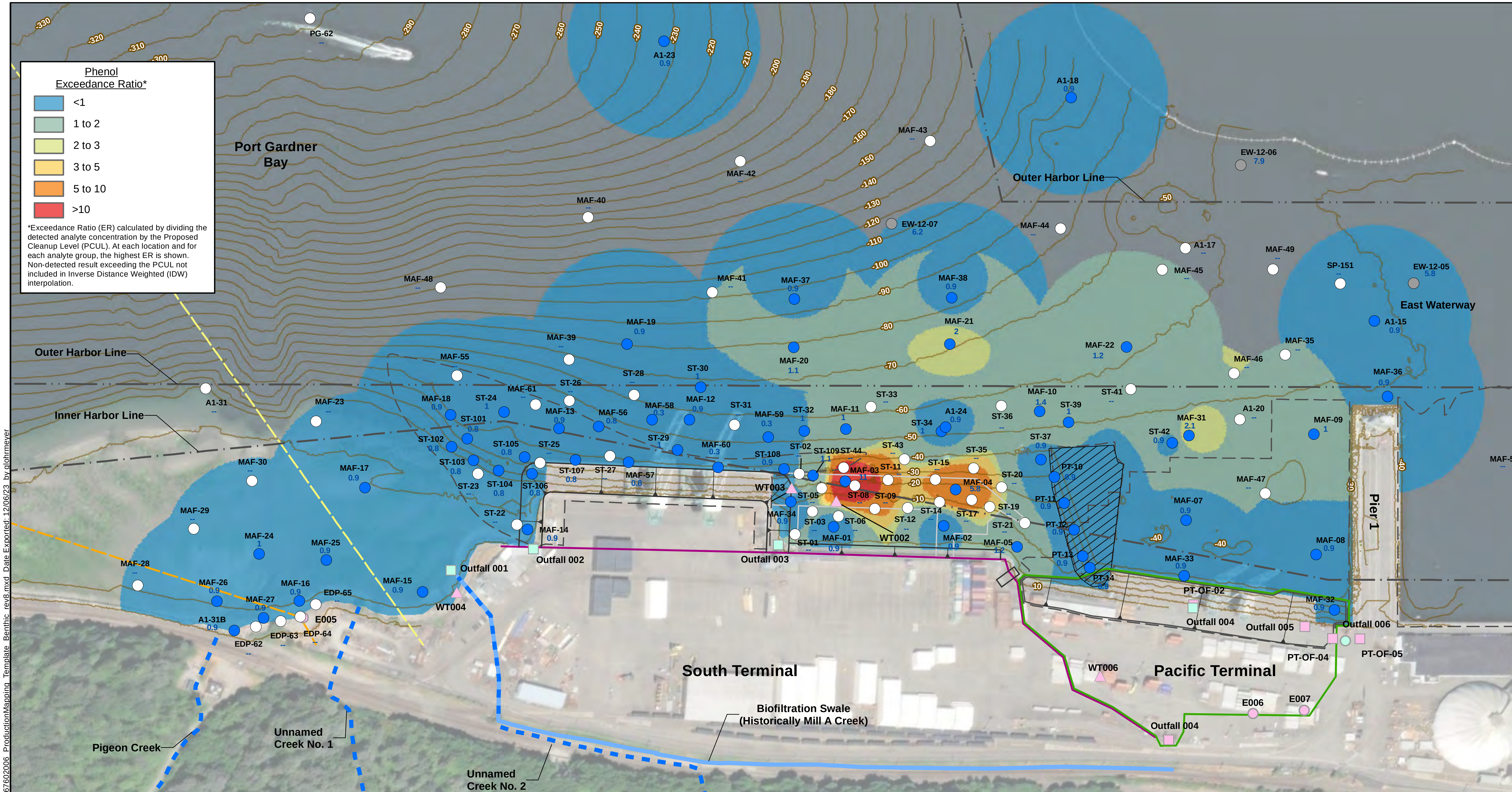
Phthalate Results (Benthic) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 47



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
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- Former Stormwater Outfall (Abandoned)
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- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Phenol Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 48

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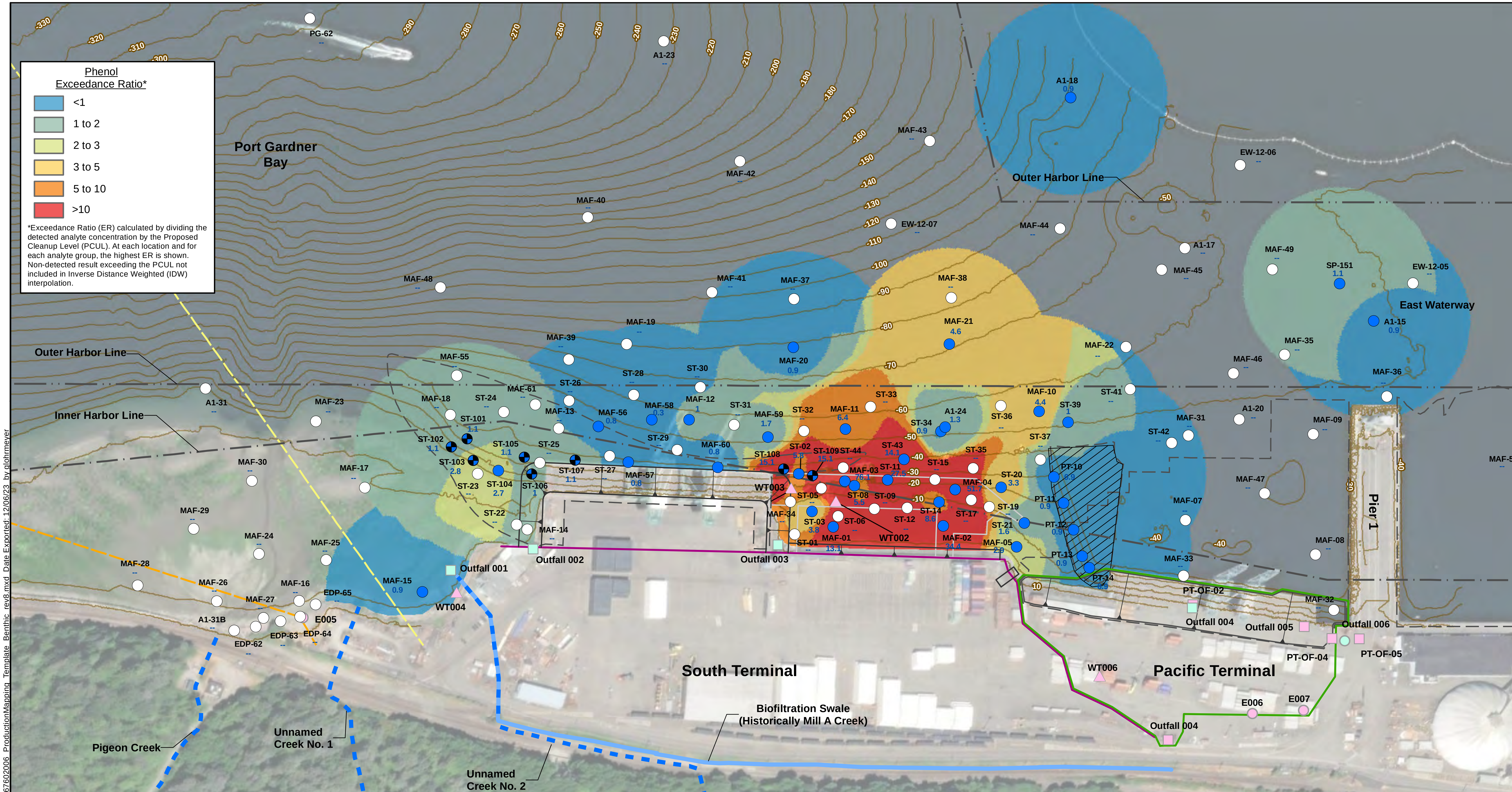

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
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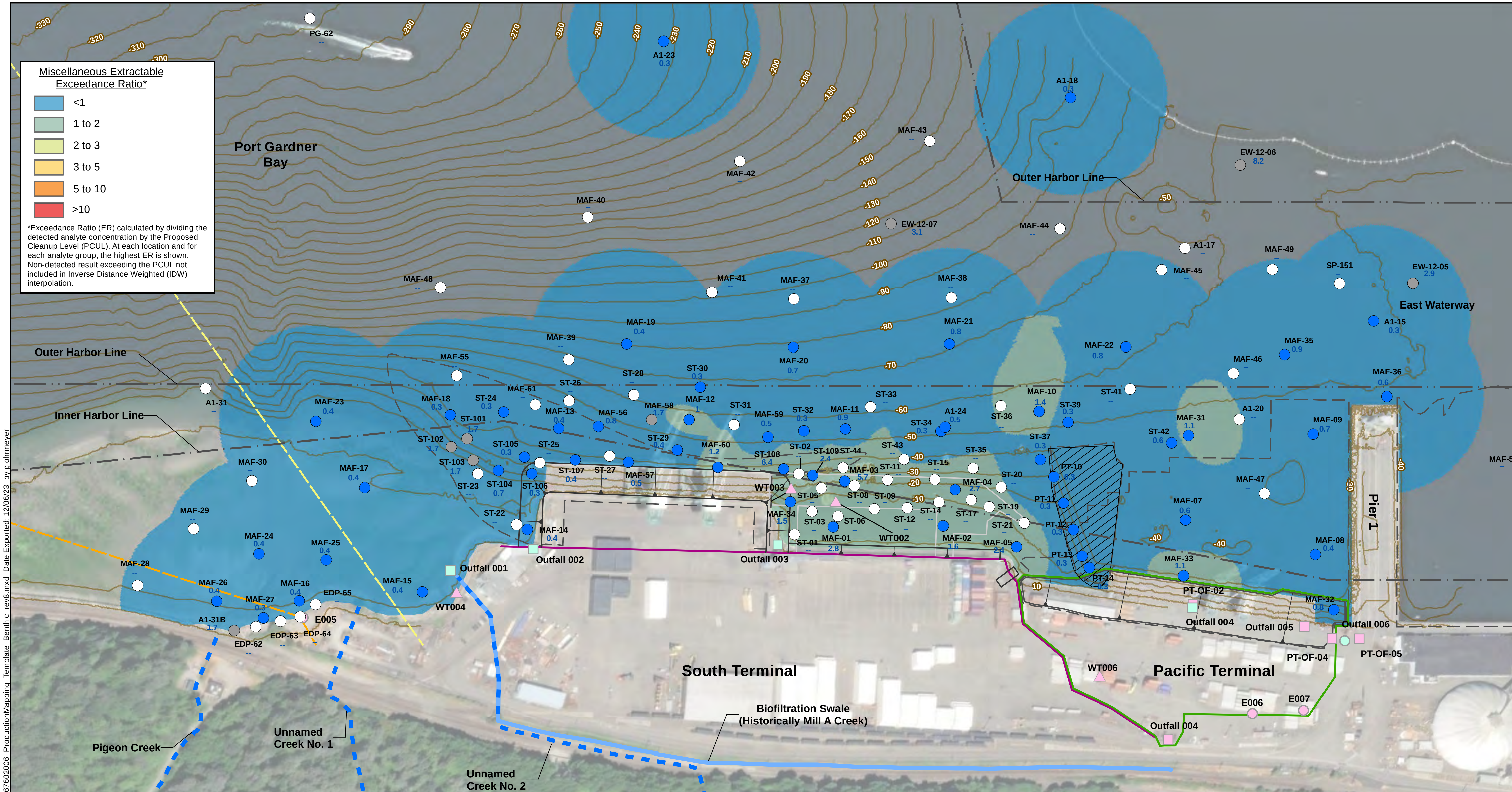
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Phenol Results (Benthic)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 49



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 Sample Location Identification Result

- Construction Berm
- Historical Piling Area
- Dredged Area
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- 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])
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- Current Stormwater Outfall

300 0 300
Feet

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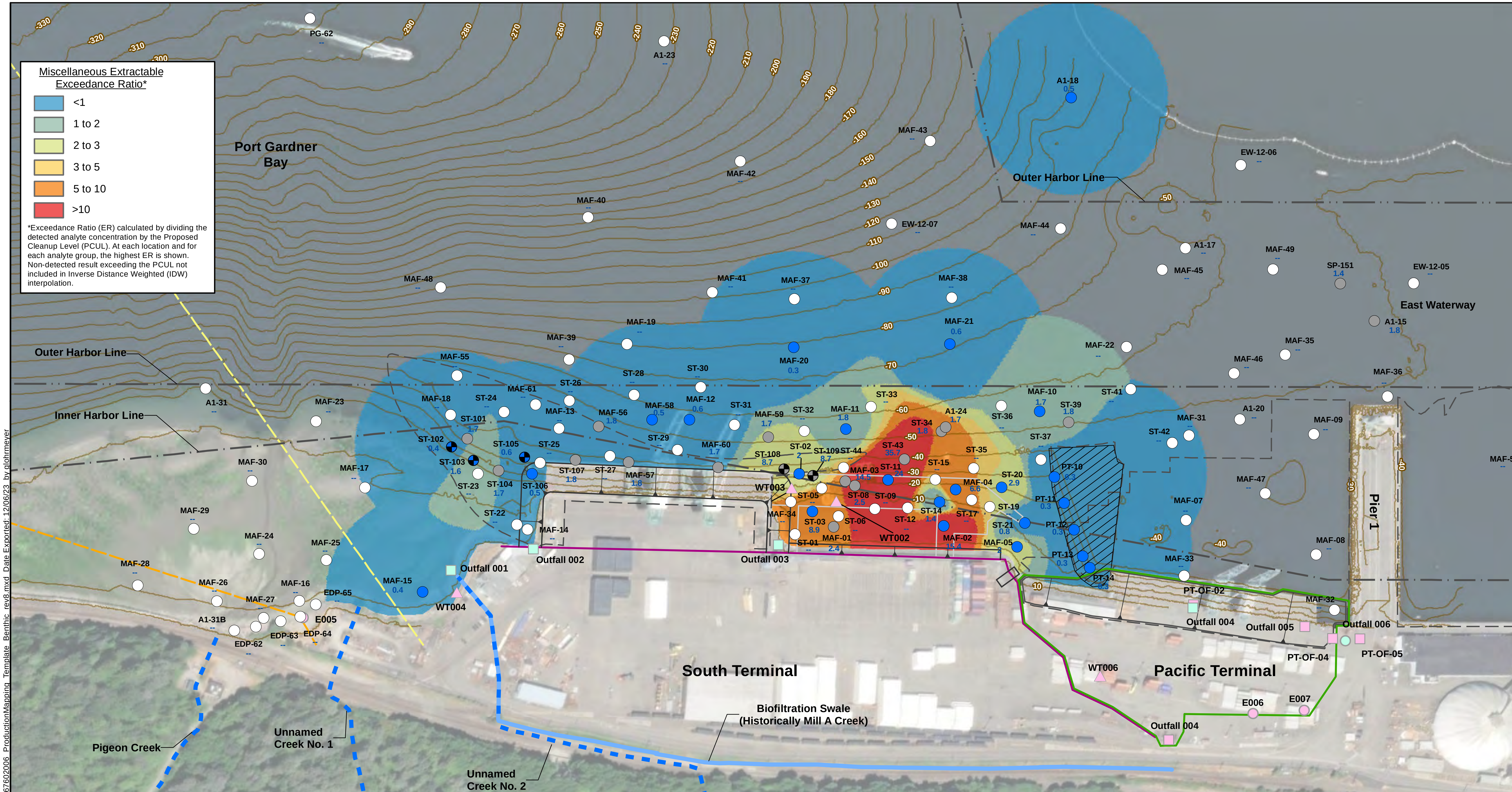
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Miscellaneous Extractable Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 50



300 0 300
Feet

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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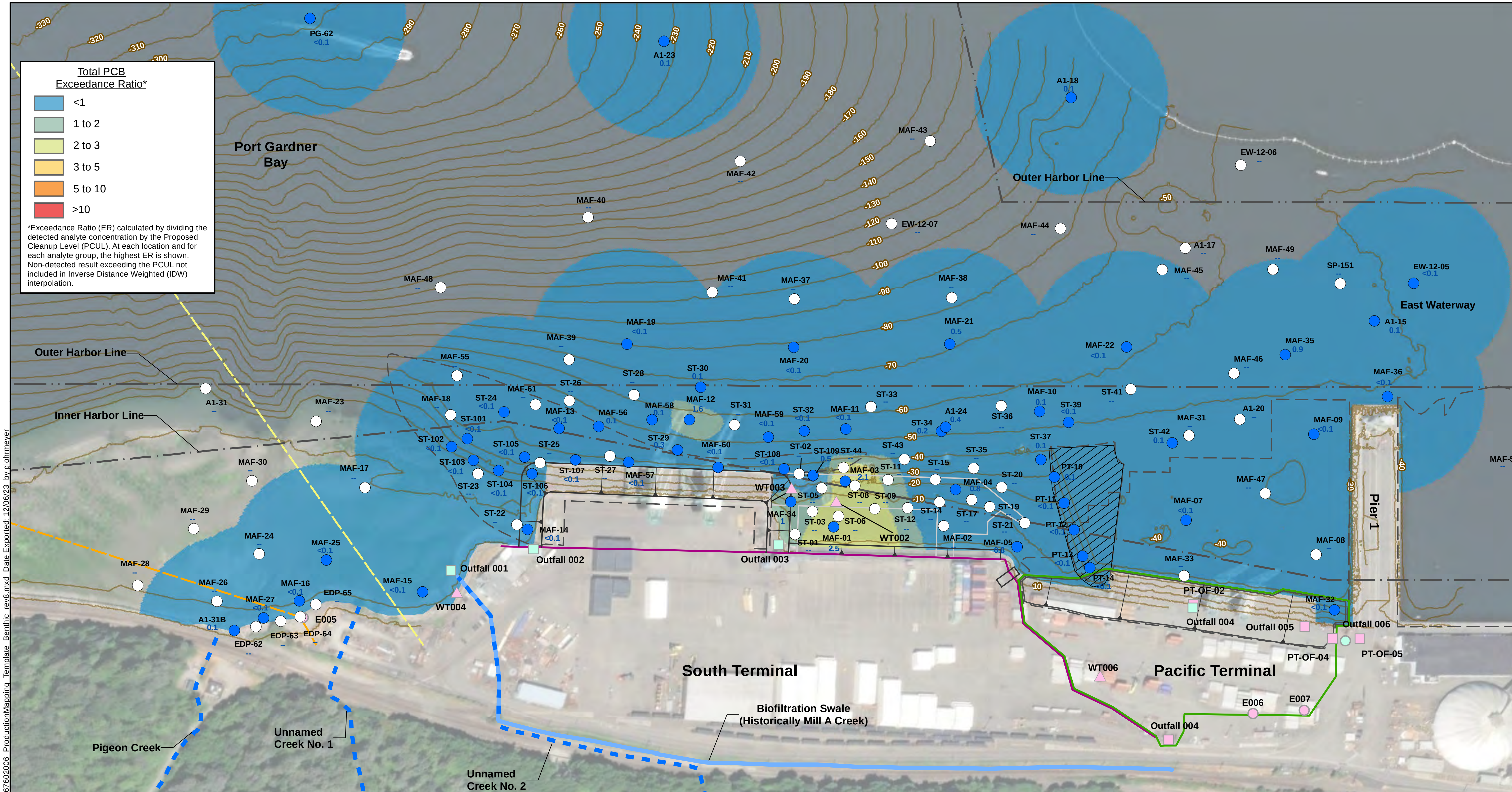
Miscellaneous Extractable Results (Benthic) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 51



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300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)

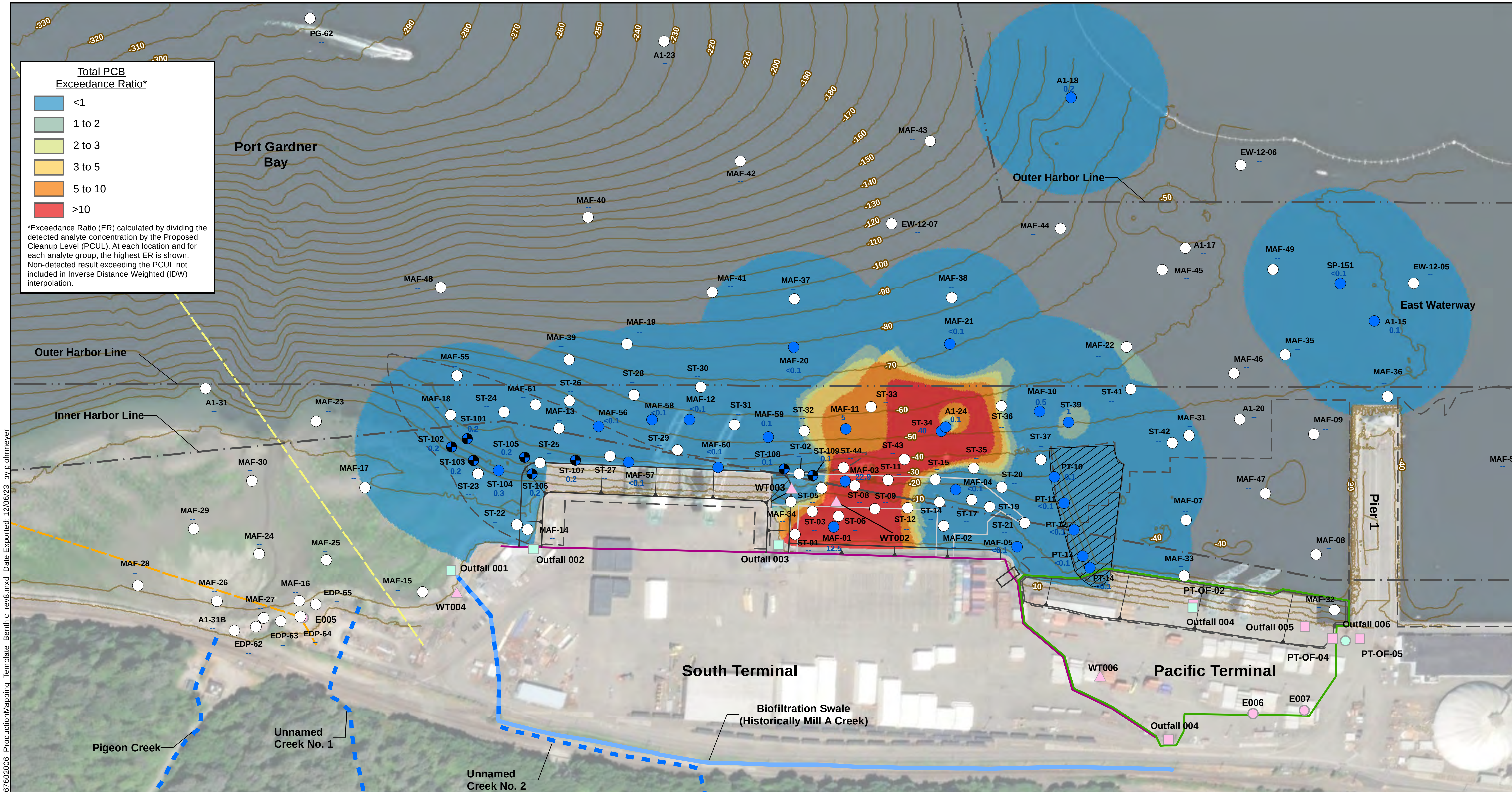
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Total PCB Results (Benthic) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 52



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification, Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total PCB Results (Benthic) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 53

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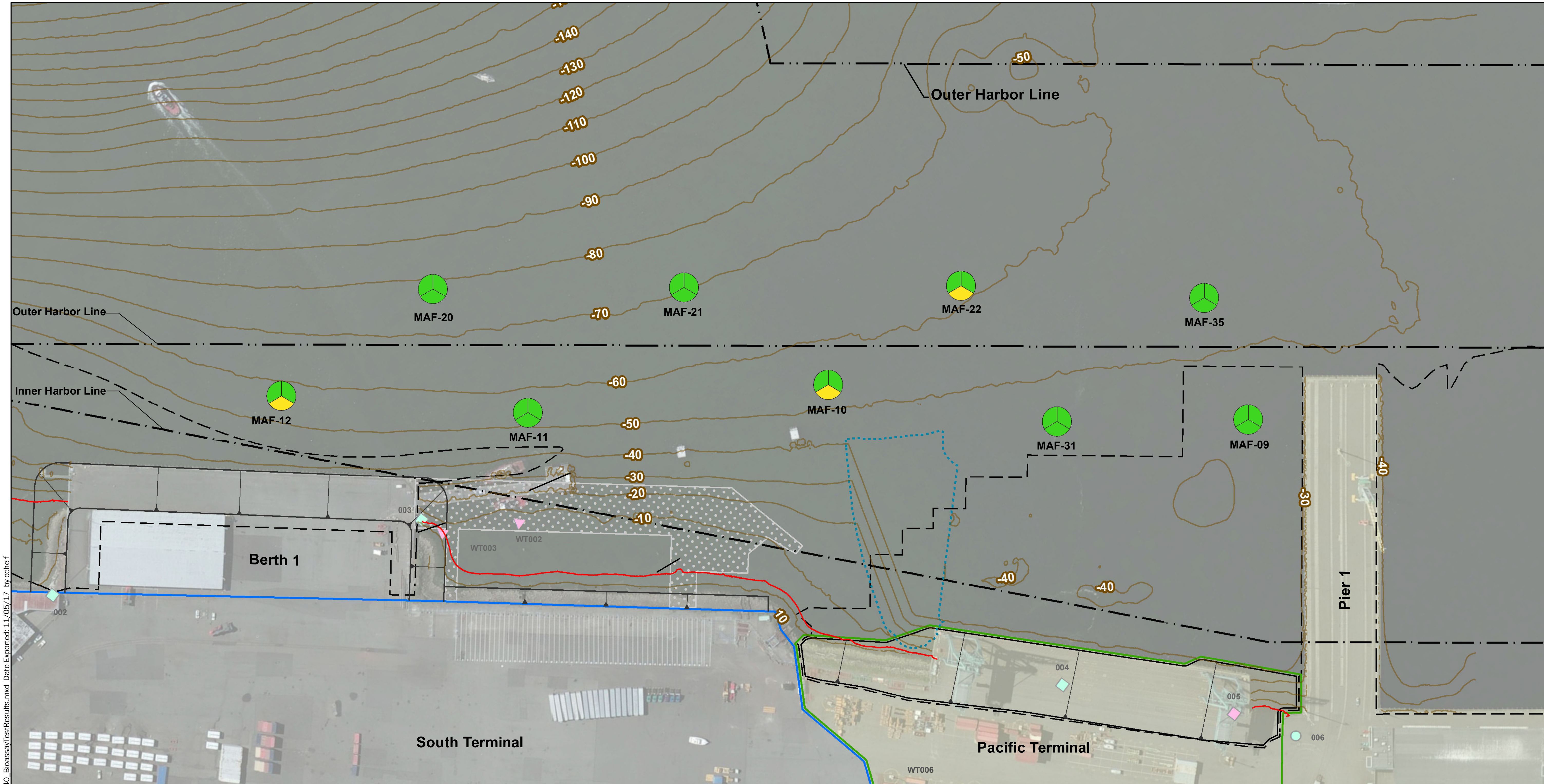

200 0 200

Feet

10-day Amphipod Bioassay

20-day Juvenile Polychaete Bioassay

Larval Development Bioassay

Green color indicates test passed SCO and CSL biological criteria.
Yellow color indicates test failed SCO biological criteria.
Red color indicates test failed SCO and CSL biological criteria.

SCO = Sediment Cleanup Objective
CSL = Cleanup Screening Level

Legend

- Construction Berm Fill
- Historical Pier
- Interim Action Dredge Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility
- -3 Feet Mean Low Low Water (MLLW) Elevation Contour Line
- Bulkhead
- Historical Industrial Outfall
- Former Combined Sewer Outfall (CSO)
- Former Stormwater Outfall
- Current CSO
- Current Stormwater Outfall

Notes:
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Data Source: Base aerial from Bing Maps, 2011.

Projection: NAD 1983 State Plane Washington North FIPS 4601 Feet

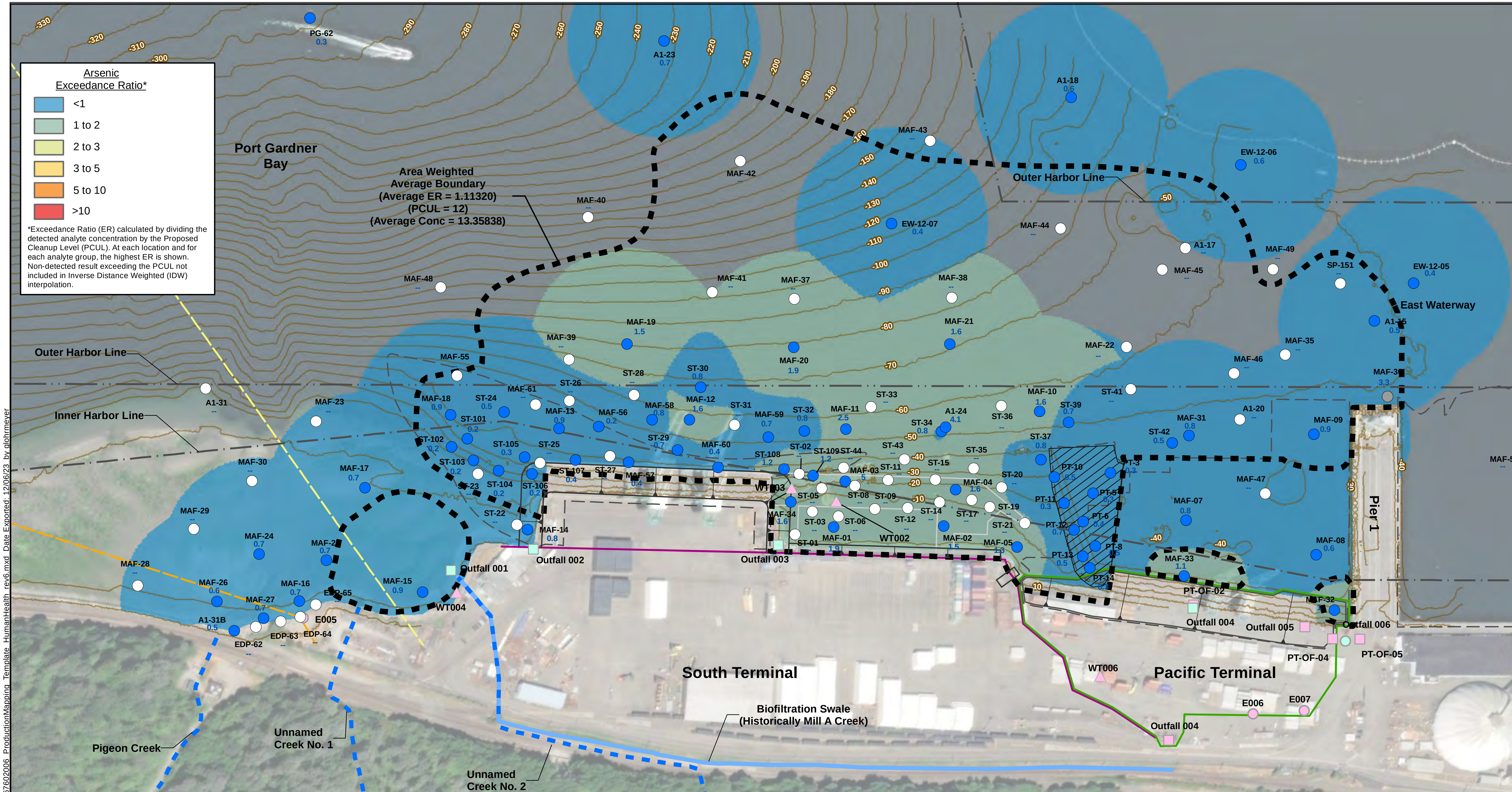
Bioassay Test Results

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 54

P:\0\0676020\GIS\MXD\RI_Data_Report\0676020005_F40_BioassayTestResults.mxd Date Exported: 11/05/17 by cchelf



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300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)

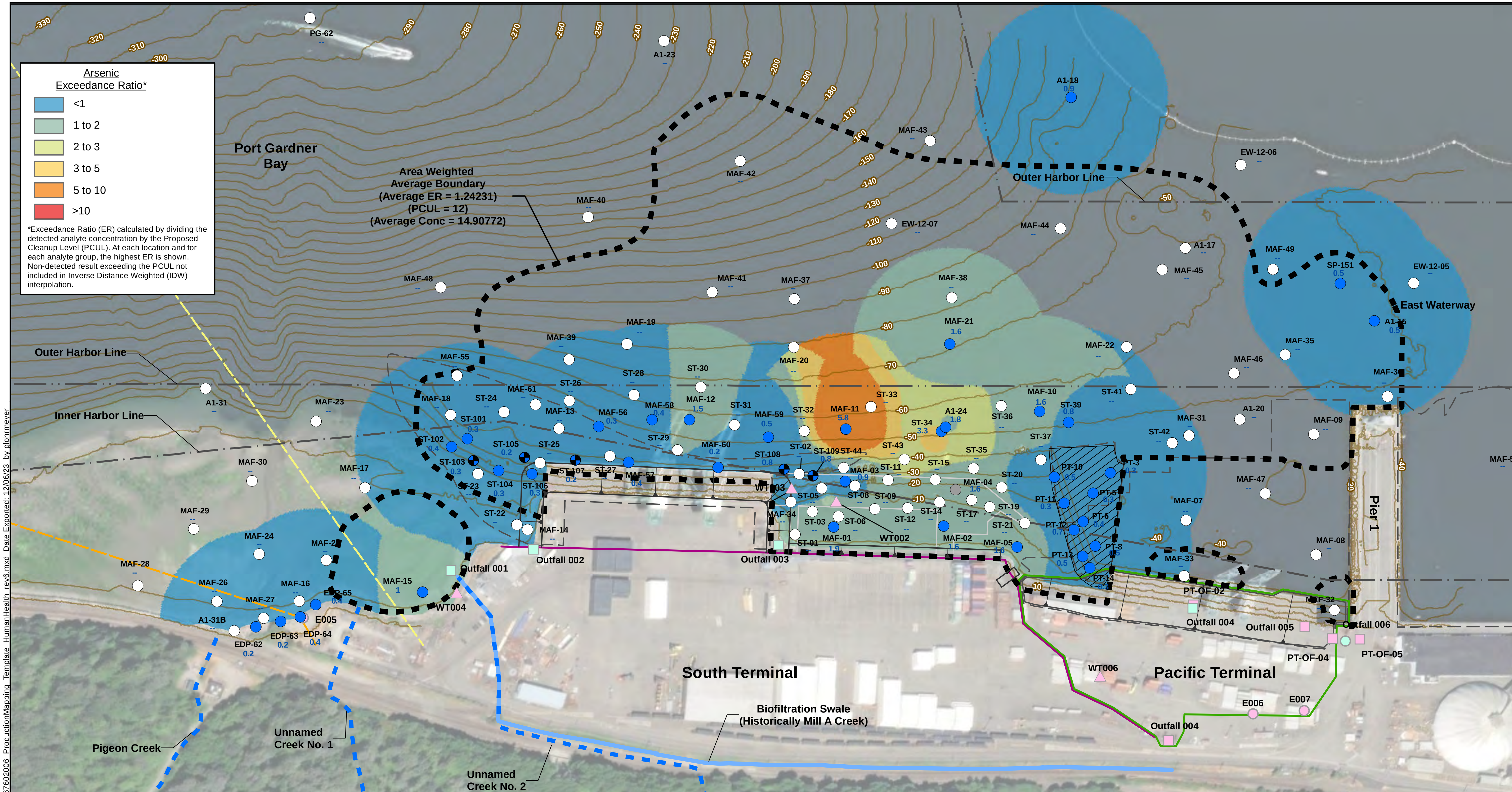
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

**Arsenic Results (Human Health)
Surface Sediment (0-10 cm)**

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 55



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
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- Dredged Area
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- Bulkhead
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- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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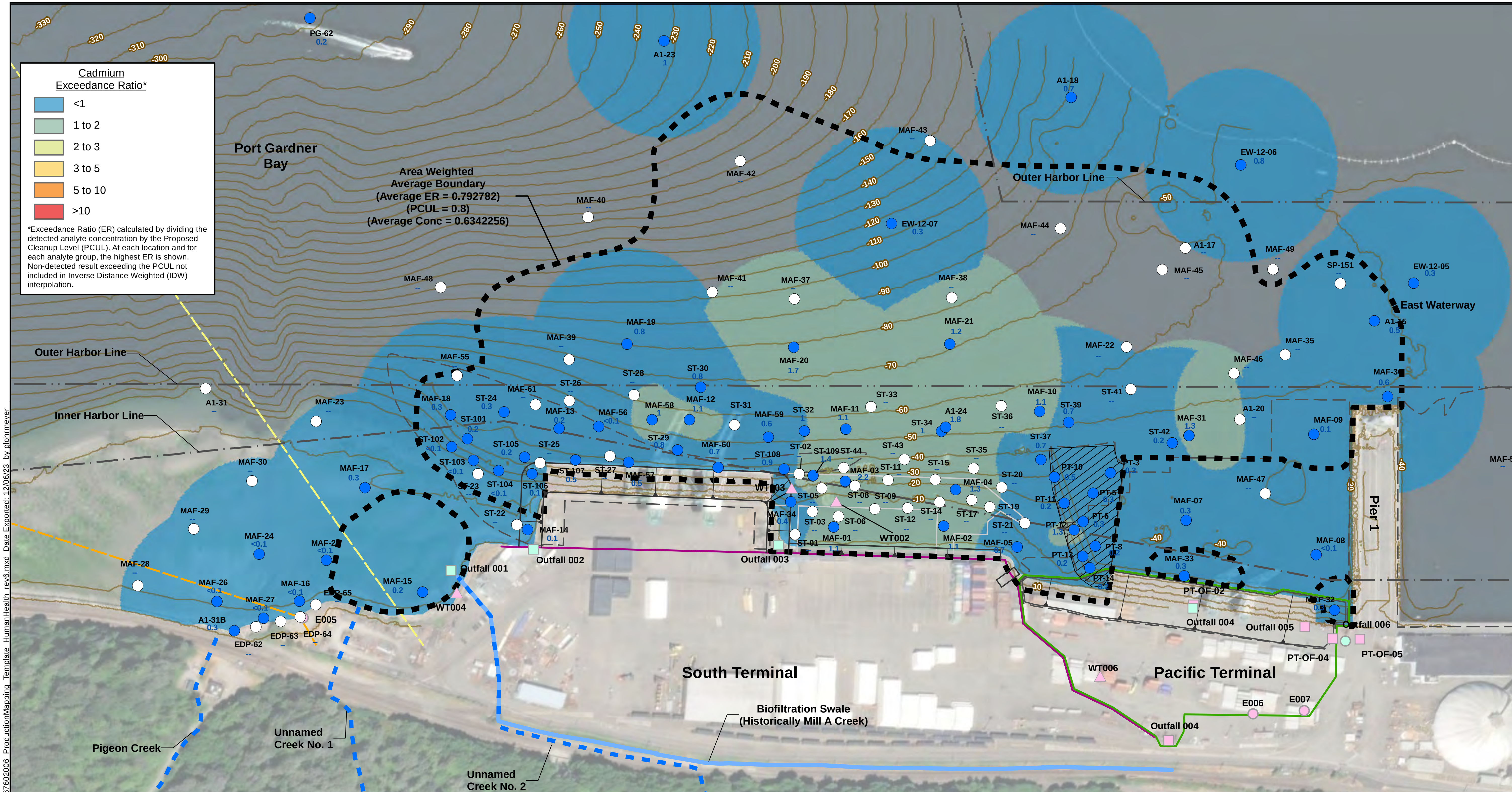
Arsenic Results (Human Health) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 56



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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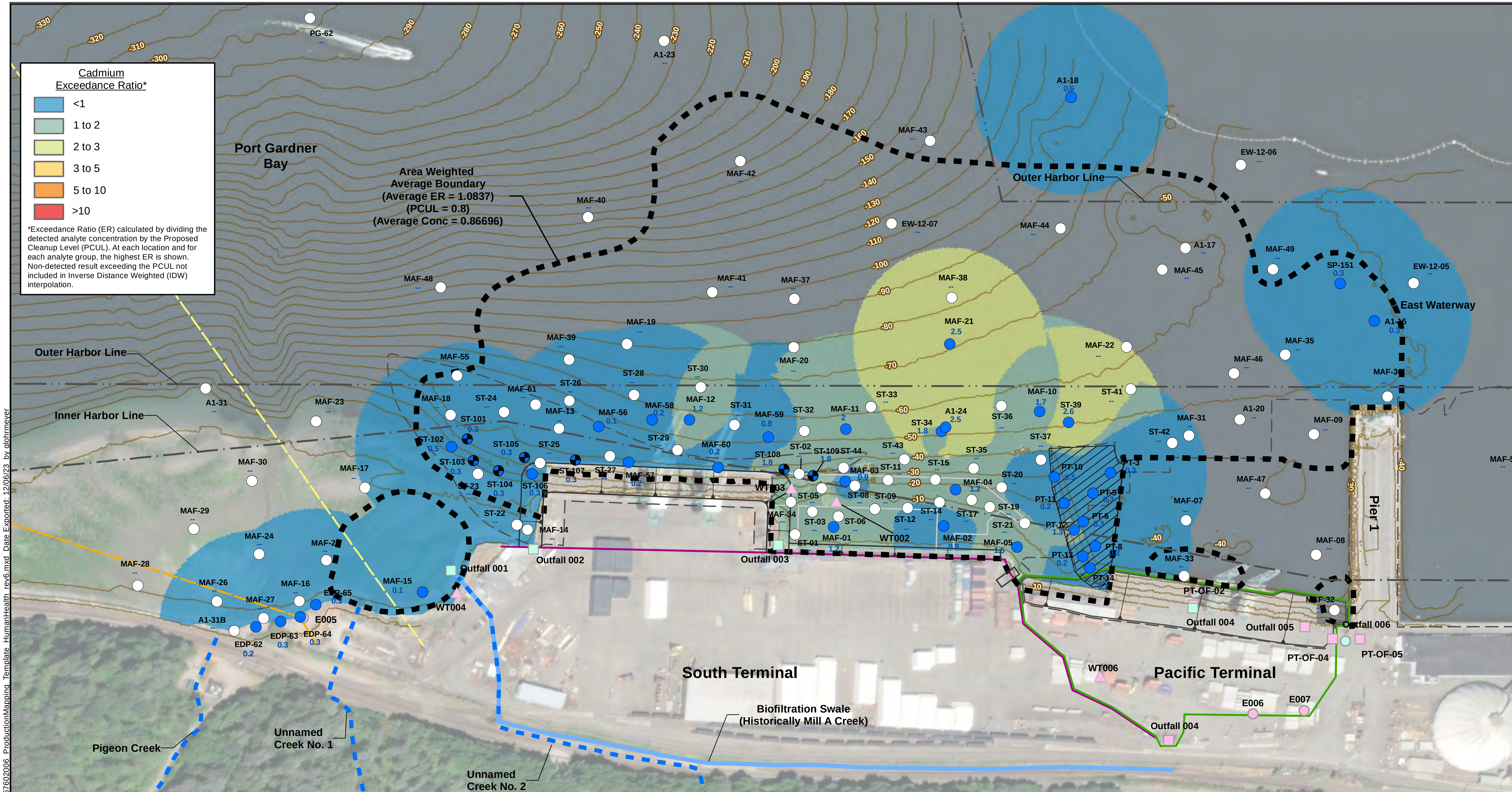
Cadmium Results (Human Health)
Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 57



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 Sample Location Identification
1.22 Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
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- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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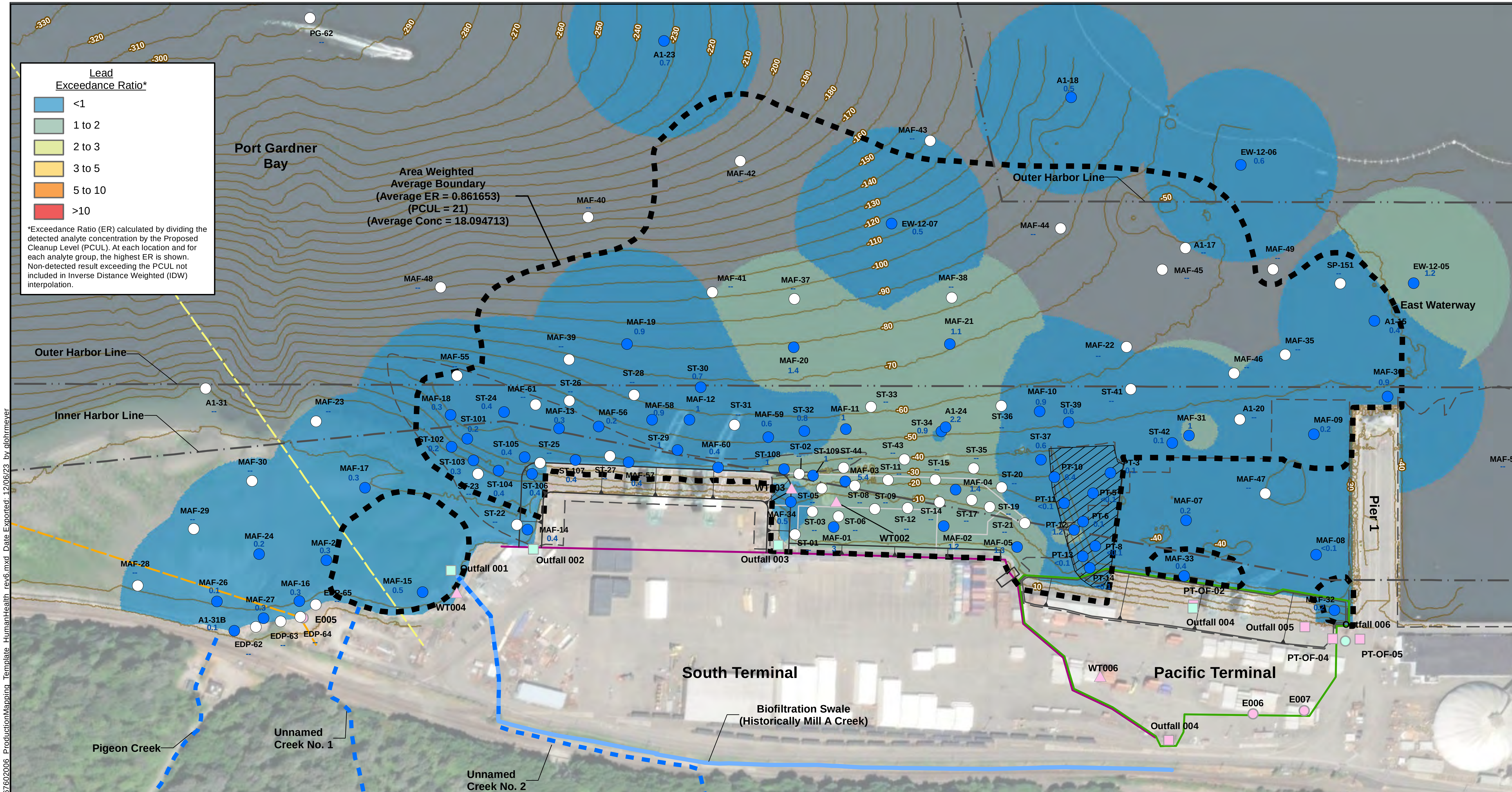
Cadmium Results (Human Health)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 58



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
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- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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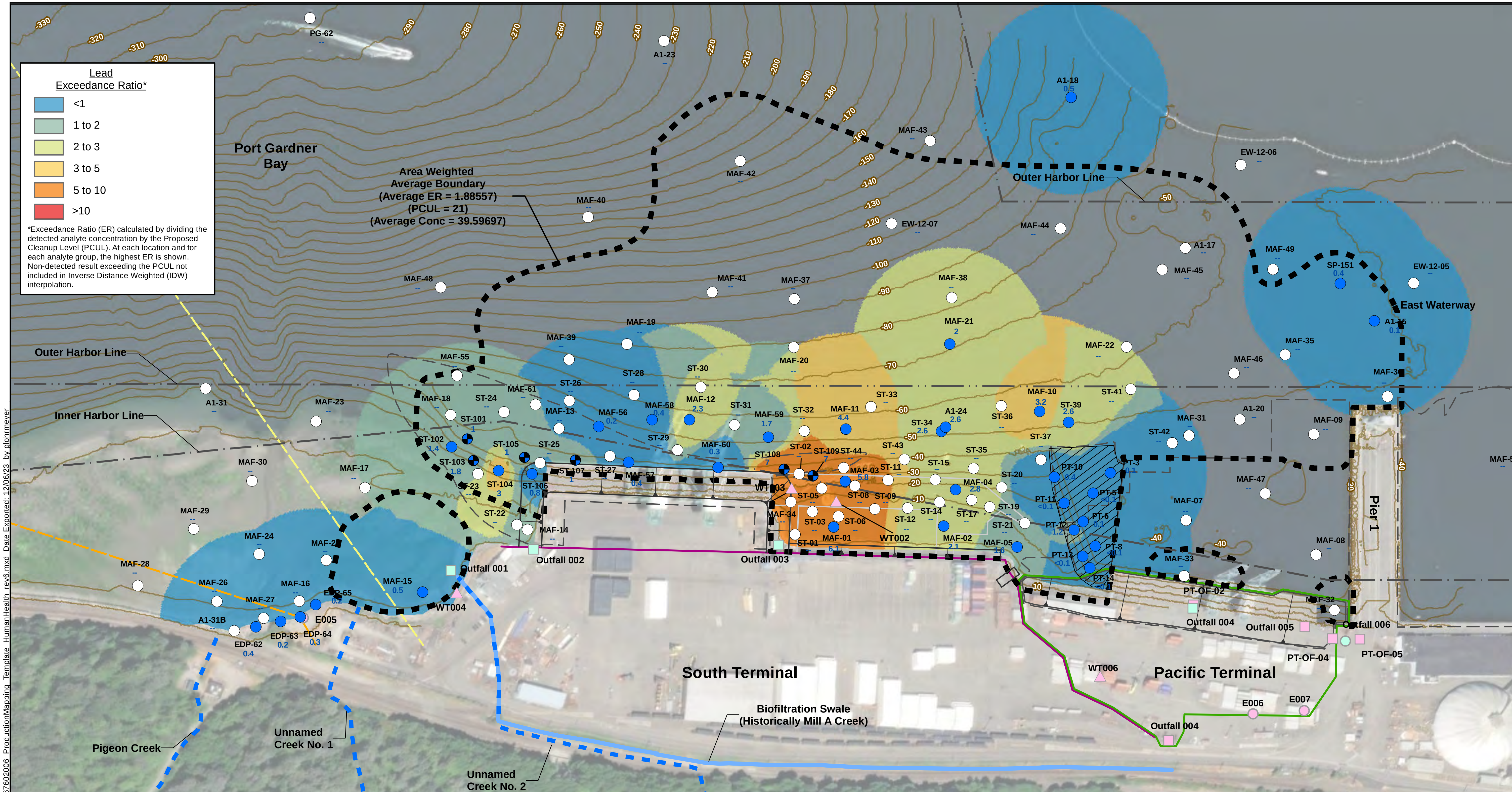
Lead Results (Human Health)
Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 59



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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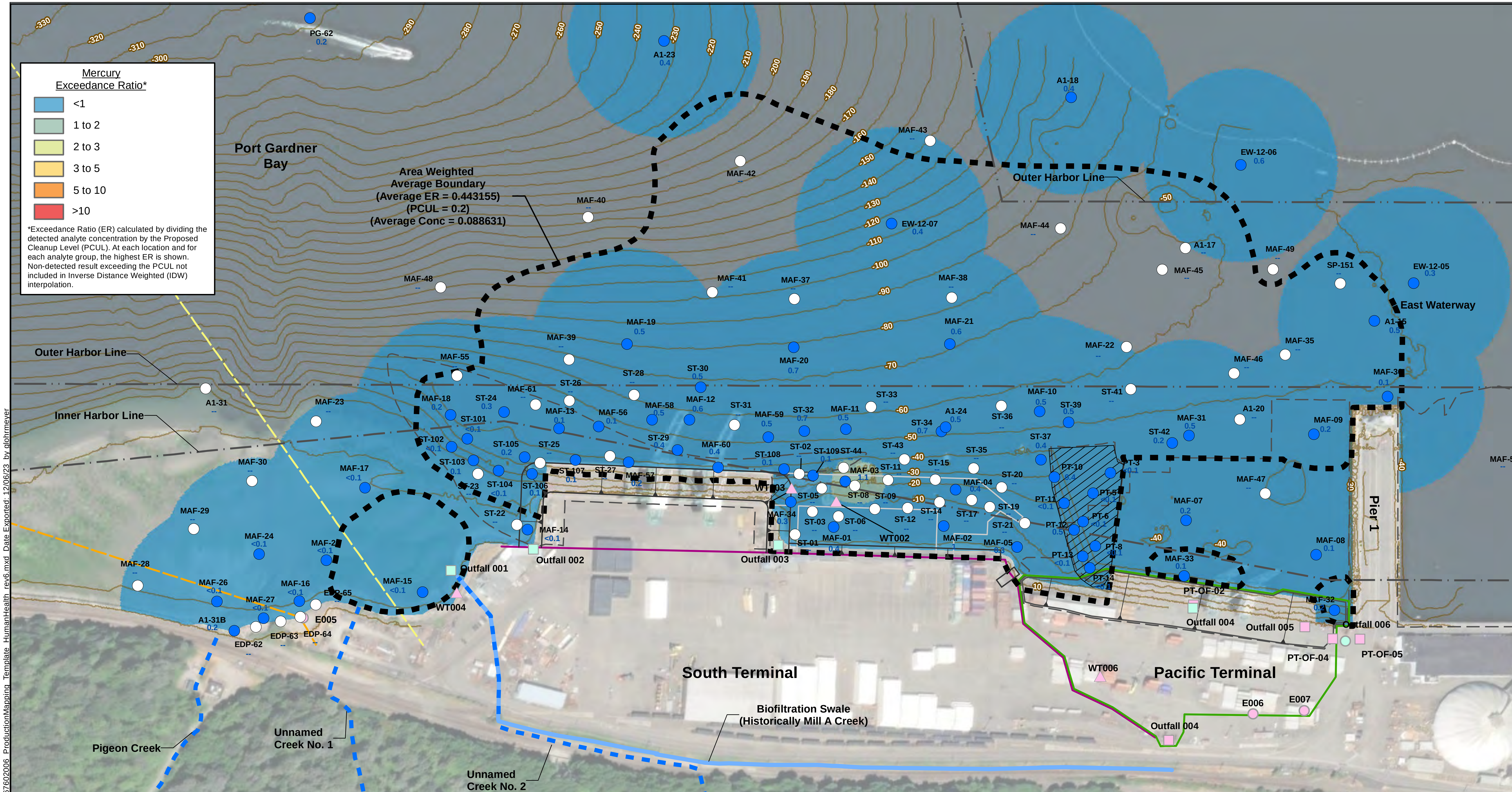
Lead Results (Human Health) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 60



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 Sample Location Identification
1.22 Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Mercury Results (Human Health)
Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 61

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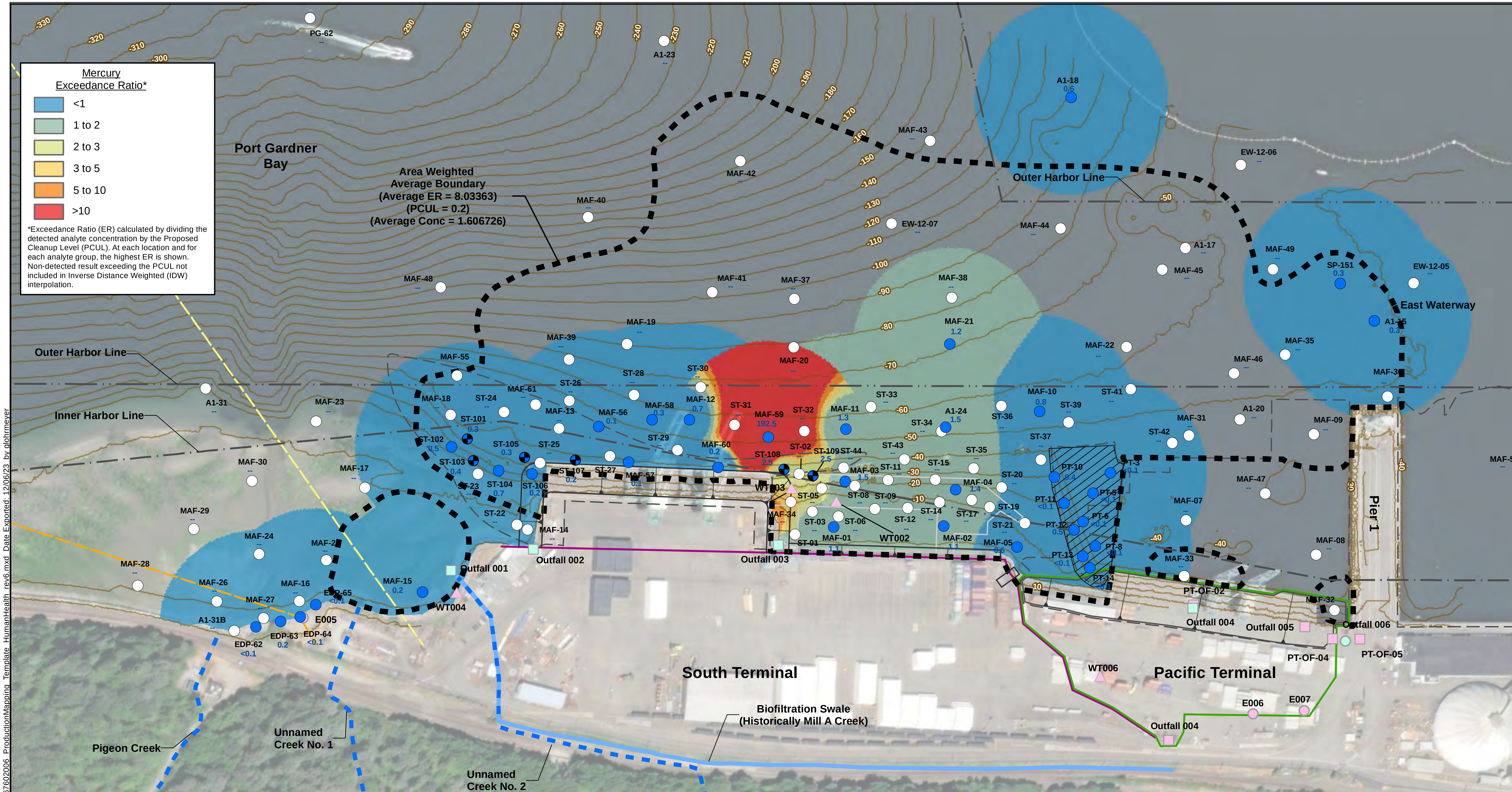

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 Sample Location Identification
1.22 Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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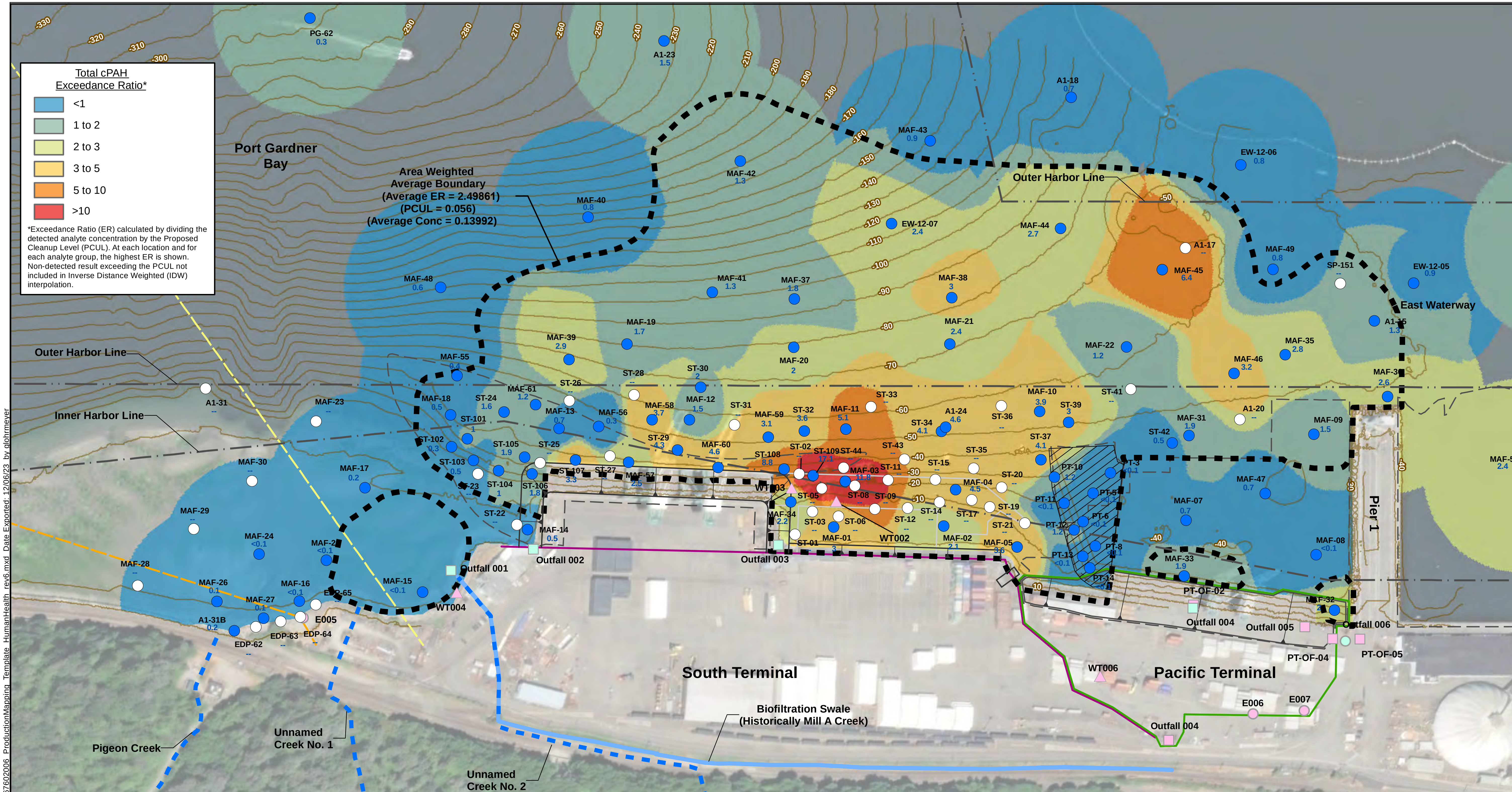
Mercury Results (Human Health) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 62



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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

300 0 300
Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
- Historical Piling Area
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- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
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- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

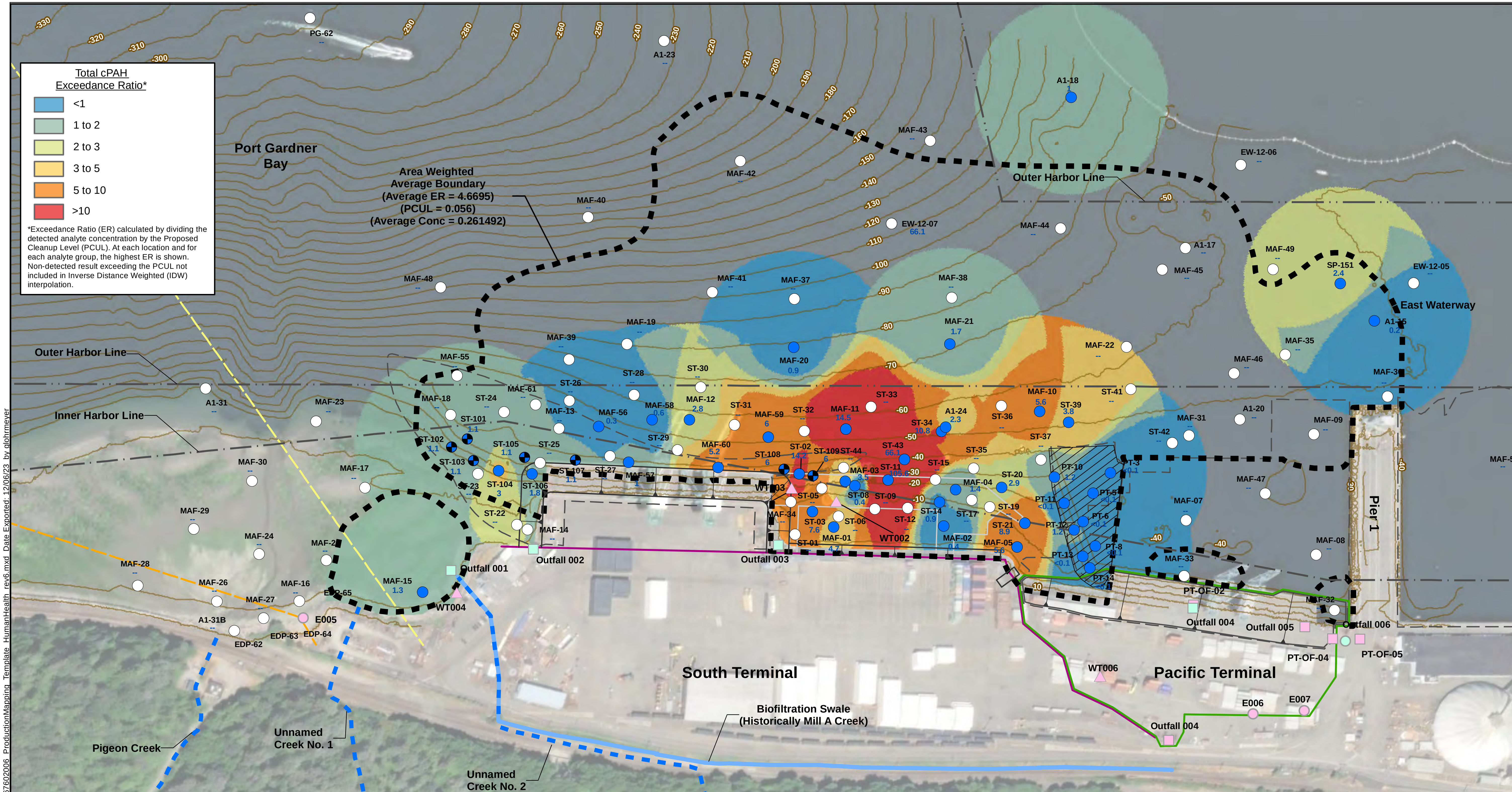
Total cPAH Results (Human Health) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 63

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_ProductionMapping_Template_HumanHealth_rev6.mxd Date Exported: 12/06/23 by dlohrmeyer



P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_ProductionMapping_Template_HumanHealth_rev6.mxd Date Exported: 12/06/23 by dlohrmeyer

300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Total cPAH Results (Human Health)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

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Figure 64

P:\0\0676020\GIS\MXD\RI_Data_Report\067602005_F45_cpah_interpolation_rev072816.mxd Date Exported: 11/06/17 by cchelf

Legend

- Sediment Sample Location
- MAF-SS-01 Investigation Location Identification
- 172 JT cPAH TEQ Concentration (µg/kg)
- cPAH Carcinogenic Polycyclic Aromatic Hydrocarbon
- TEQ Toxicity Equivalency Quotient
- µg/kg microgram per kilogram

cPAH TEQ Concentration (µg/kg)

- <21
- 21 - 30
- 30 - 50
- 50 - 80
- 80 - 120
- 120 - 150
- 150 - 200
- 200 - 300
- 300 - 500
- 500 - 700
- 700 - 1,000
- >1,000

N W E S

500 0 500

Feet

Notes:
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Data Source: Aerial Photograph - ESRI 2016

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total cPAH Results (Human Health)
Marine Area and East Waterway Surface Sediment

Weyerhaeuser Mill A Former
Everett, Washington

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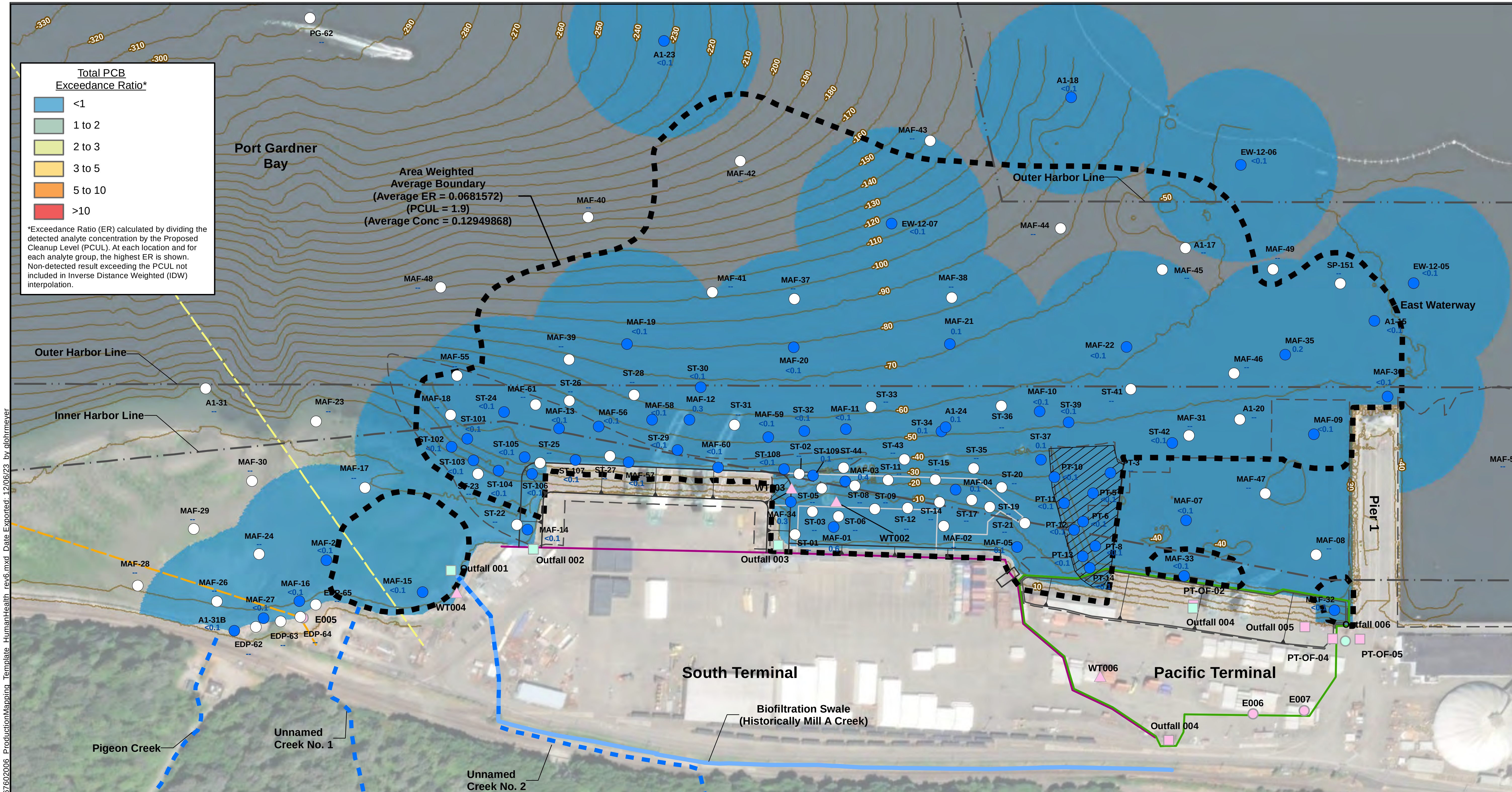
Figure 65



P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_ProductionMapping_Template_HumanHealth_rev6.mxd Date Exported: 12/06/23 by dlohrmeyer

300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Total PCB Results (Human Health)
Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

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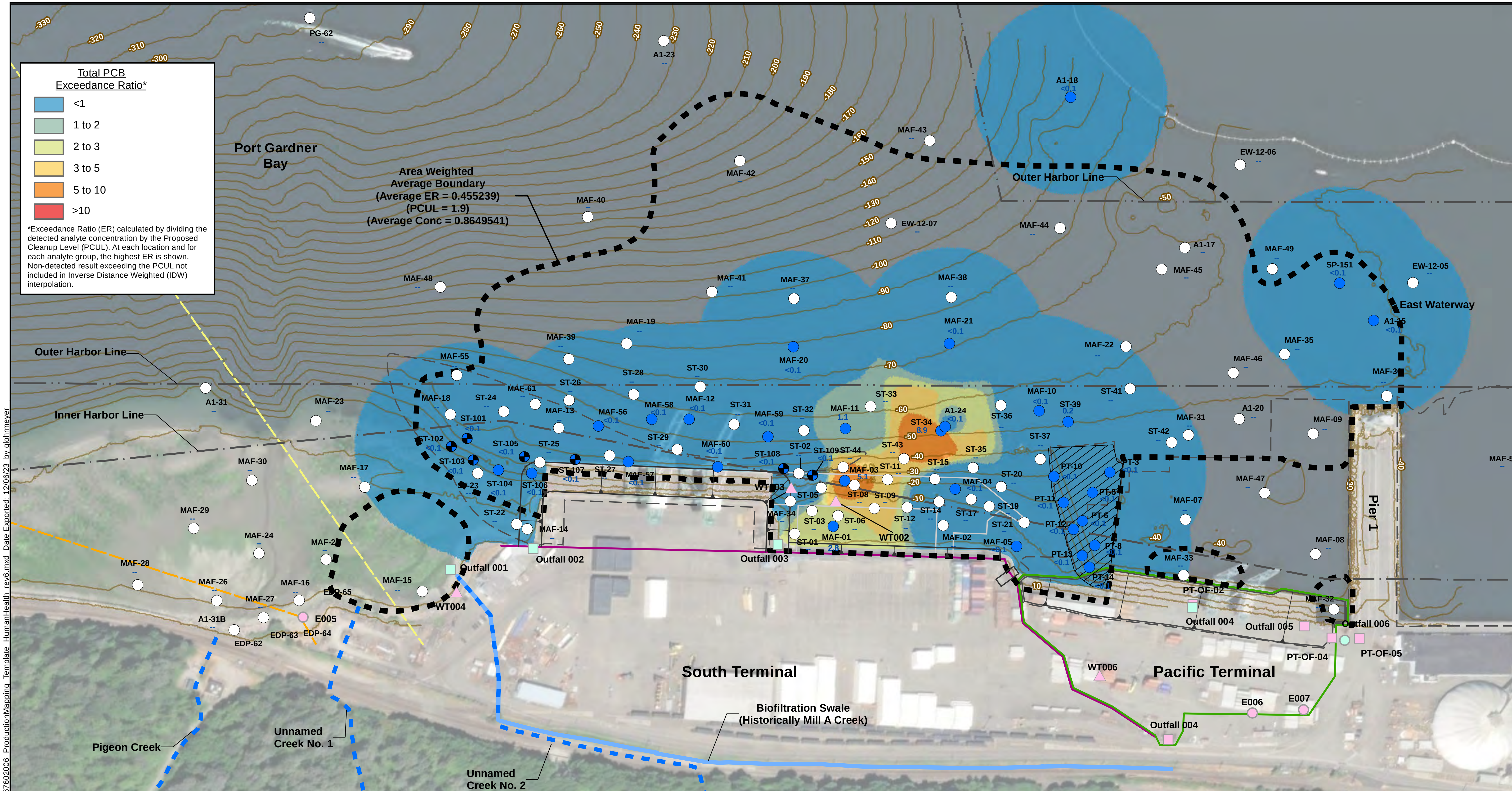
Figure 66



300 0 300
Feet

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

**Total PCB Results (Human Health)
Subsurface Sediment (0-22 ft)**

Weyerhaeuser Mill A Former
Everett, Washington

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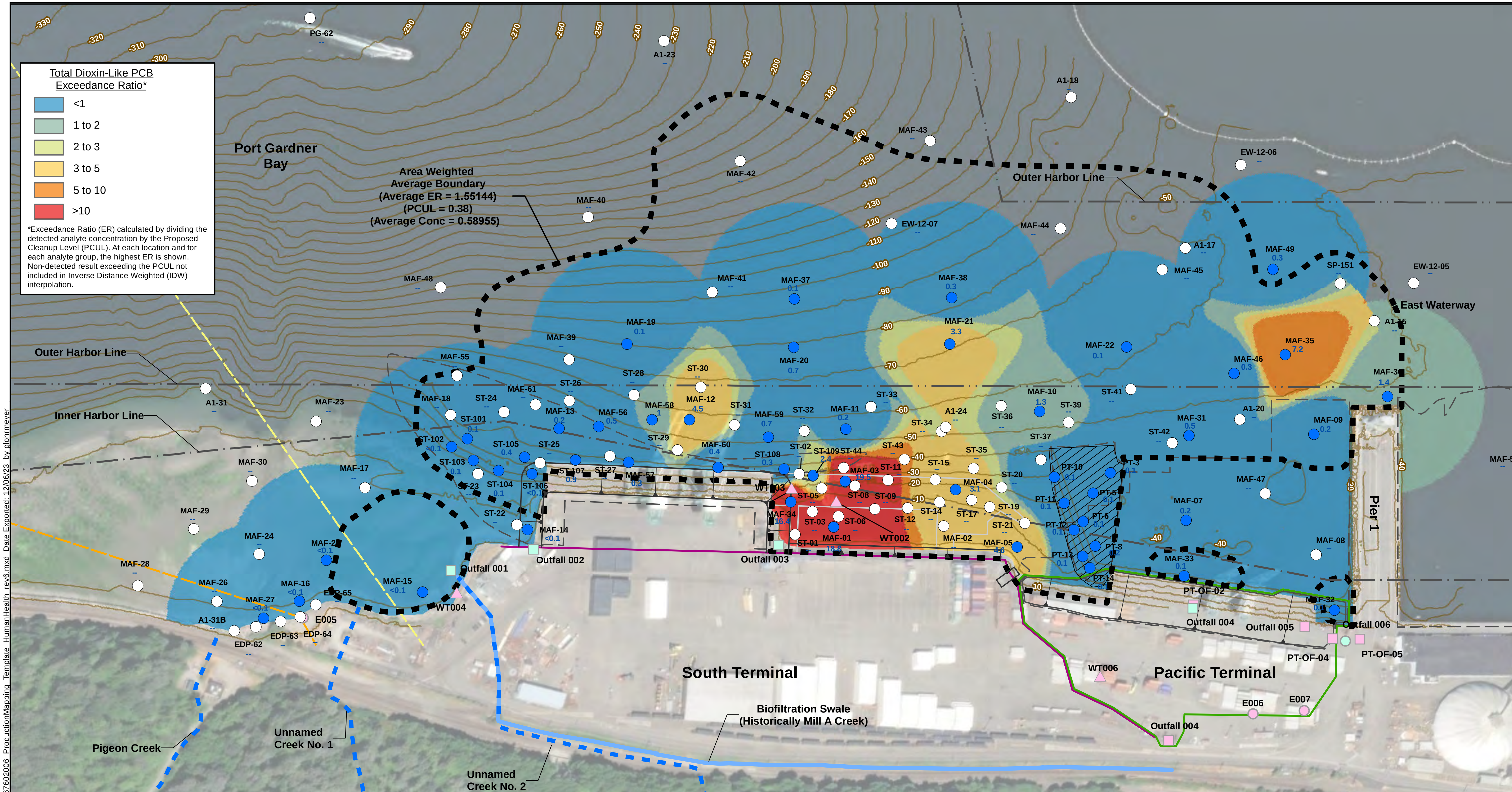
Figure 67



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300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

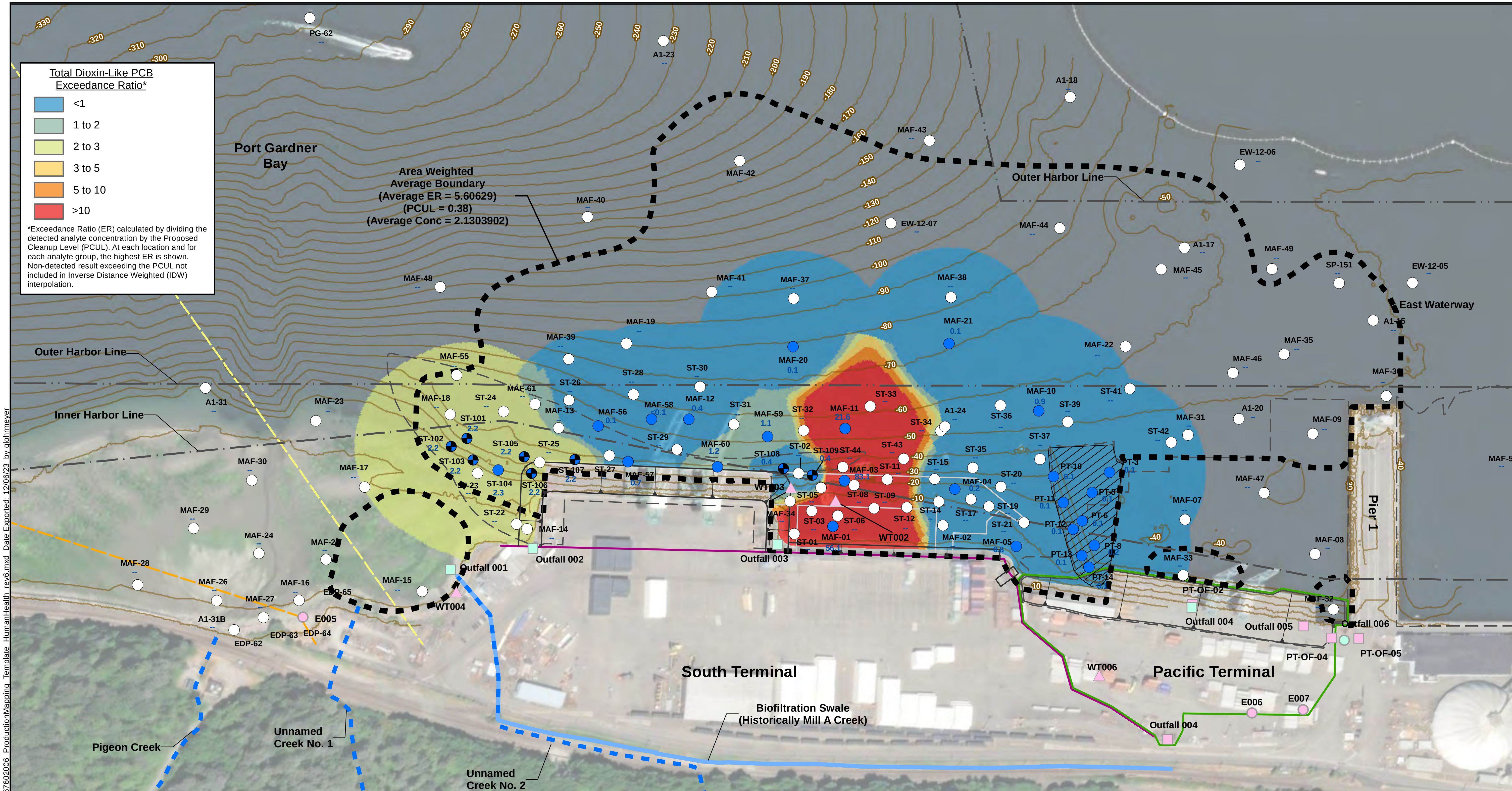
MAF-01 / 1.22 — Sample Location Identification / Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Total Dioxin-Like PCB Results (Human Health) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 68



Total Dioxin-Like PCB Results (Human Health)
Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 69

Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

Notes:
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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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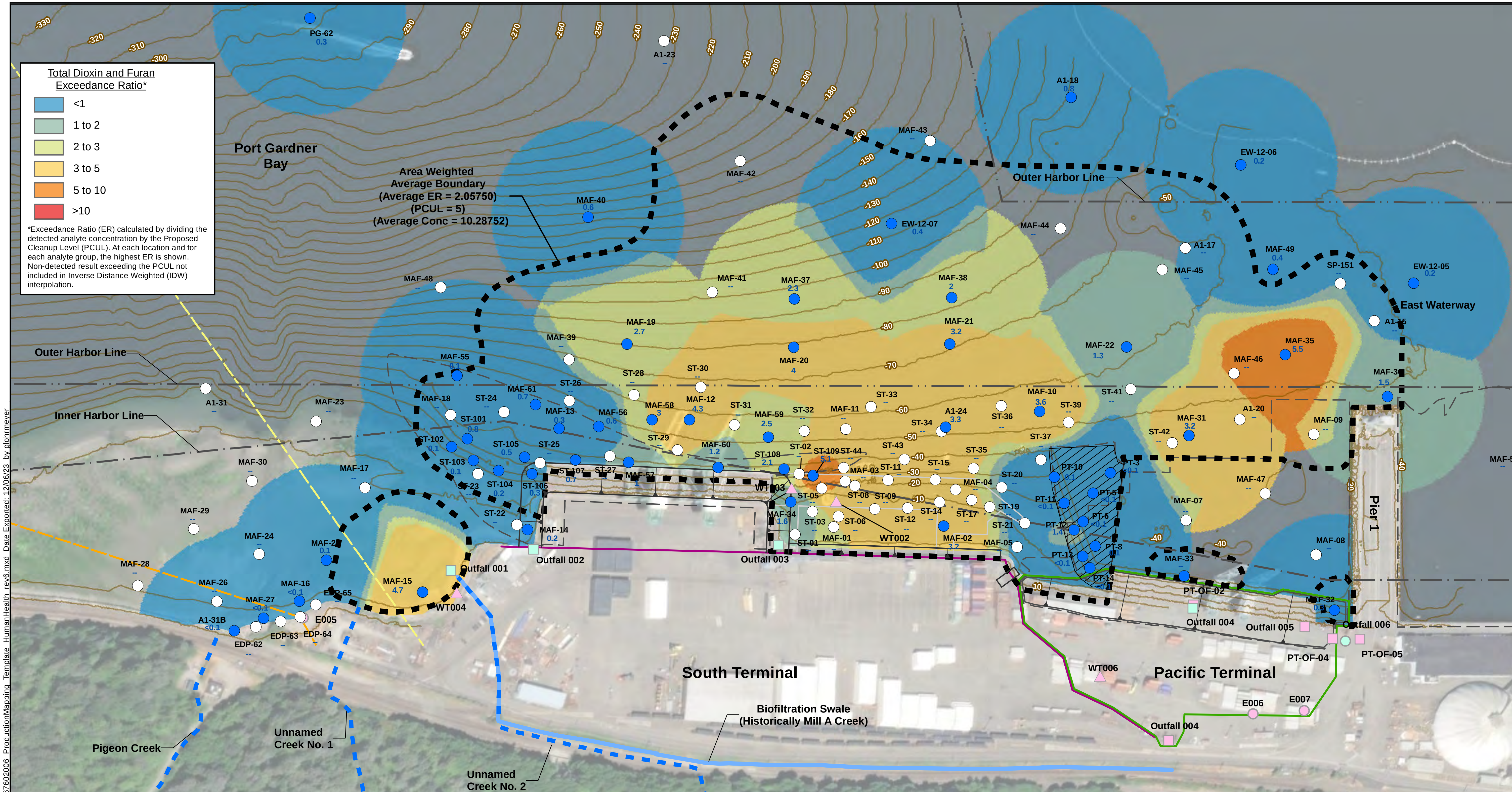

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300 0 300
Feet

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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12. Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

Marine Area Remedial Investigation Sampling Locations
- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

- MAF-01 1.22 — Sample Location Identification Result
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)

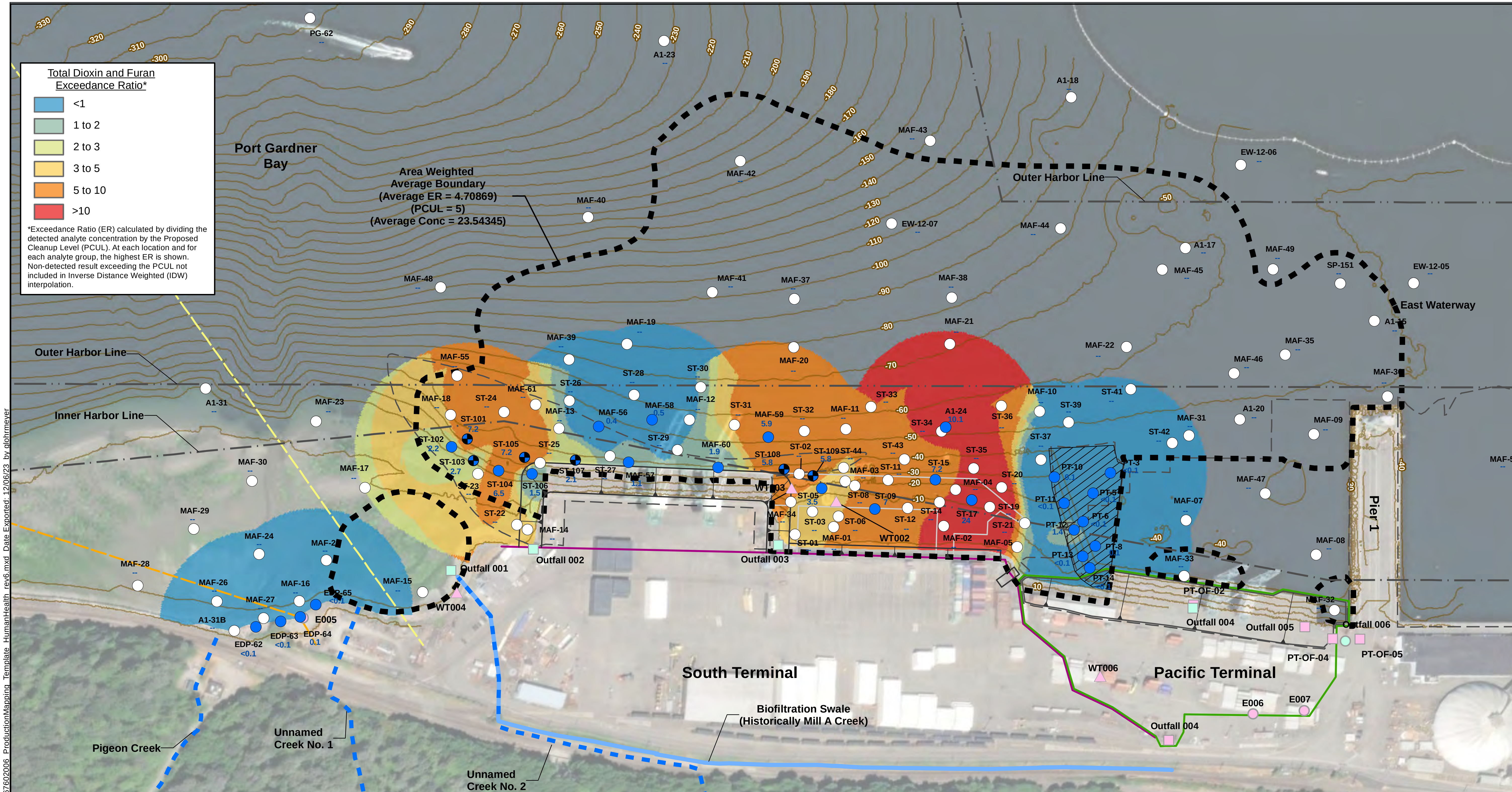
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Total Dioxin and Furan Results (Human Health) Surface Sediment (0-10 cm)

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 70



Legend

Marine Area Remedial Investigation Sampling Locations

- Discrete Sample Result
- No Sample/Result
- Non-Detect Result Exceeds PCUL
- Composite Sample Result
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)

MAF-01 / 1.22 — Sample Location Identification / Result

- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300
Feet

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3. Interpolation Method = Inverse Distance Weighted (IDW) Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Total Dioxin and Furan Results (Human Health) Subsurface Sediment (0-22 ft)

Weyerhaeuser Mill A Former
Everett, Washington

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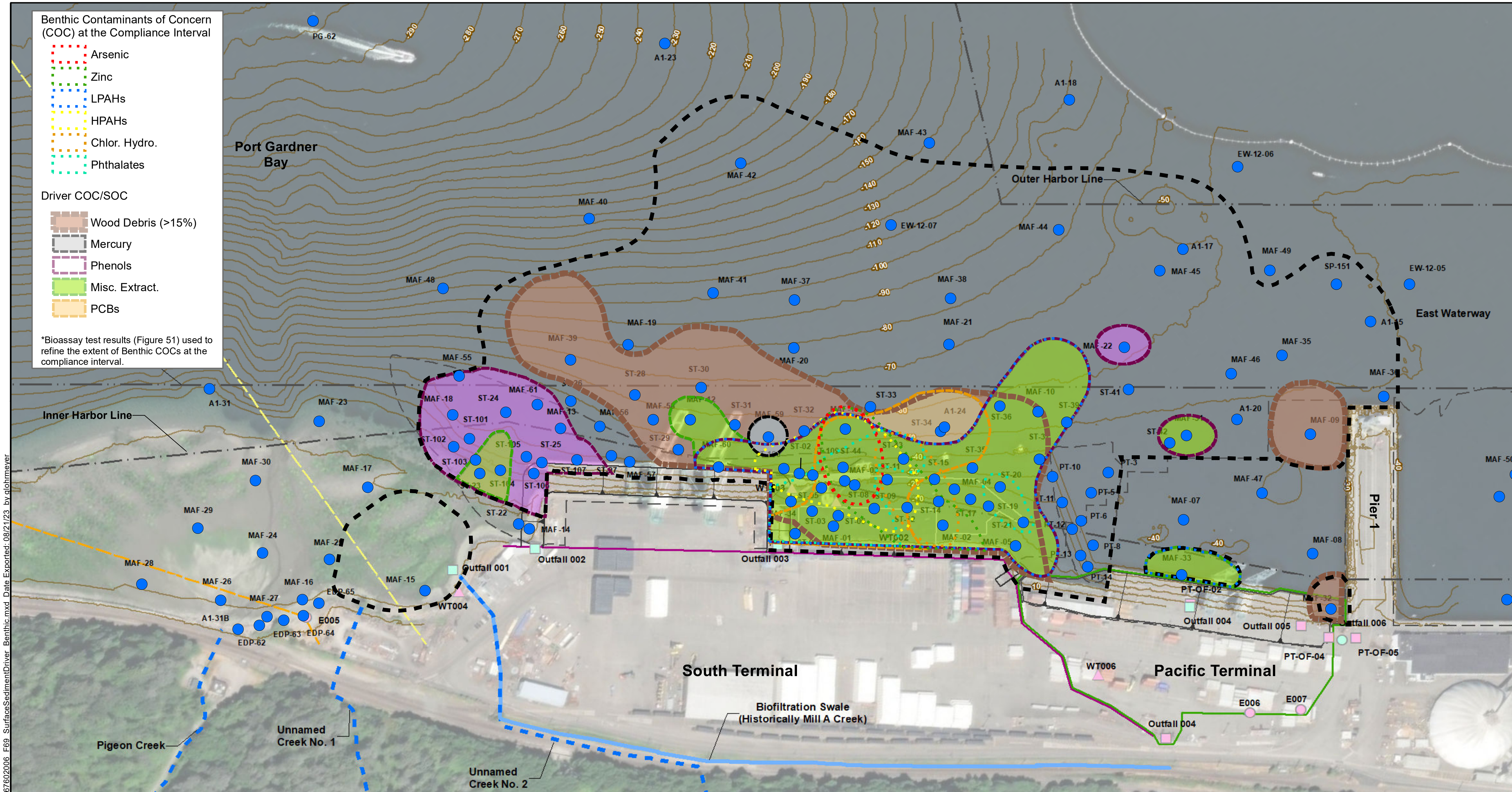
Figure 71

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_ProductionMapping_Template_HumanHealth_rev6.mxd Date Exported: 12/06/23 by dlohrmeyer



300 0 300

Feet

Legend

- Sediment Sample Location
- Extent of PCUL Exceedances Requiring Cleanup Action
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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Compliance Interval Benthic Driver COCs

Weyerhaeuser Mill A Former
Everett, Washington

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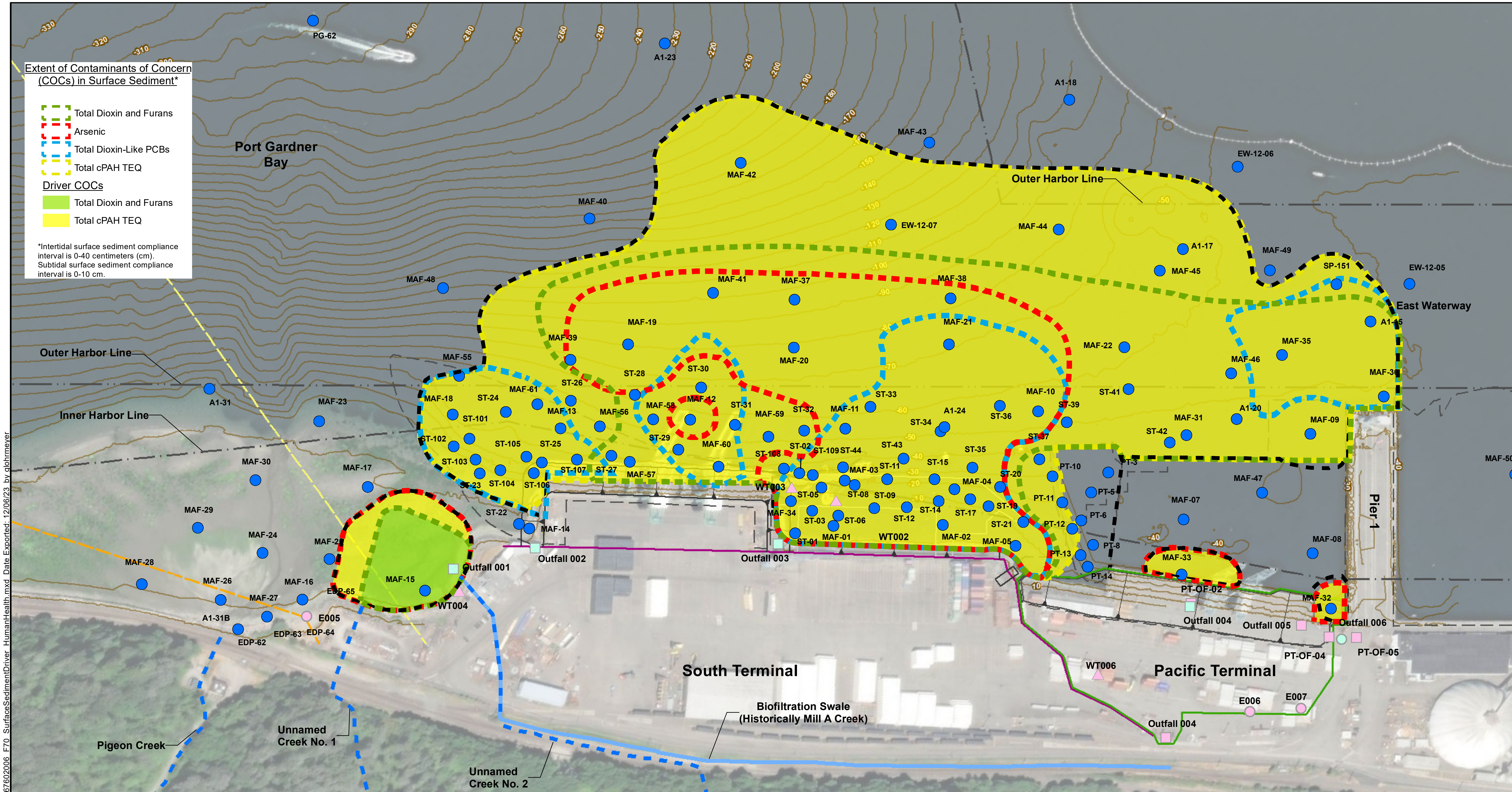
Figure 72



300 0 300
Feet

Legend

- Surface Sediment Sample Location
- Extent of PCUL Exceedances Requiring Cleanup Action
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- 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])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

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3. Interpolation Method = Inverse Distance Weighted (IDW), Power = 6, Neighbors = 12, Radius = 300 feet.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

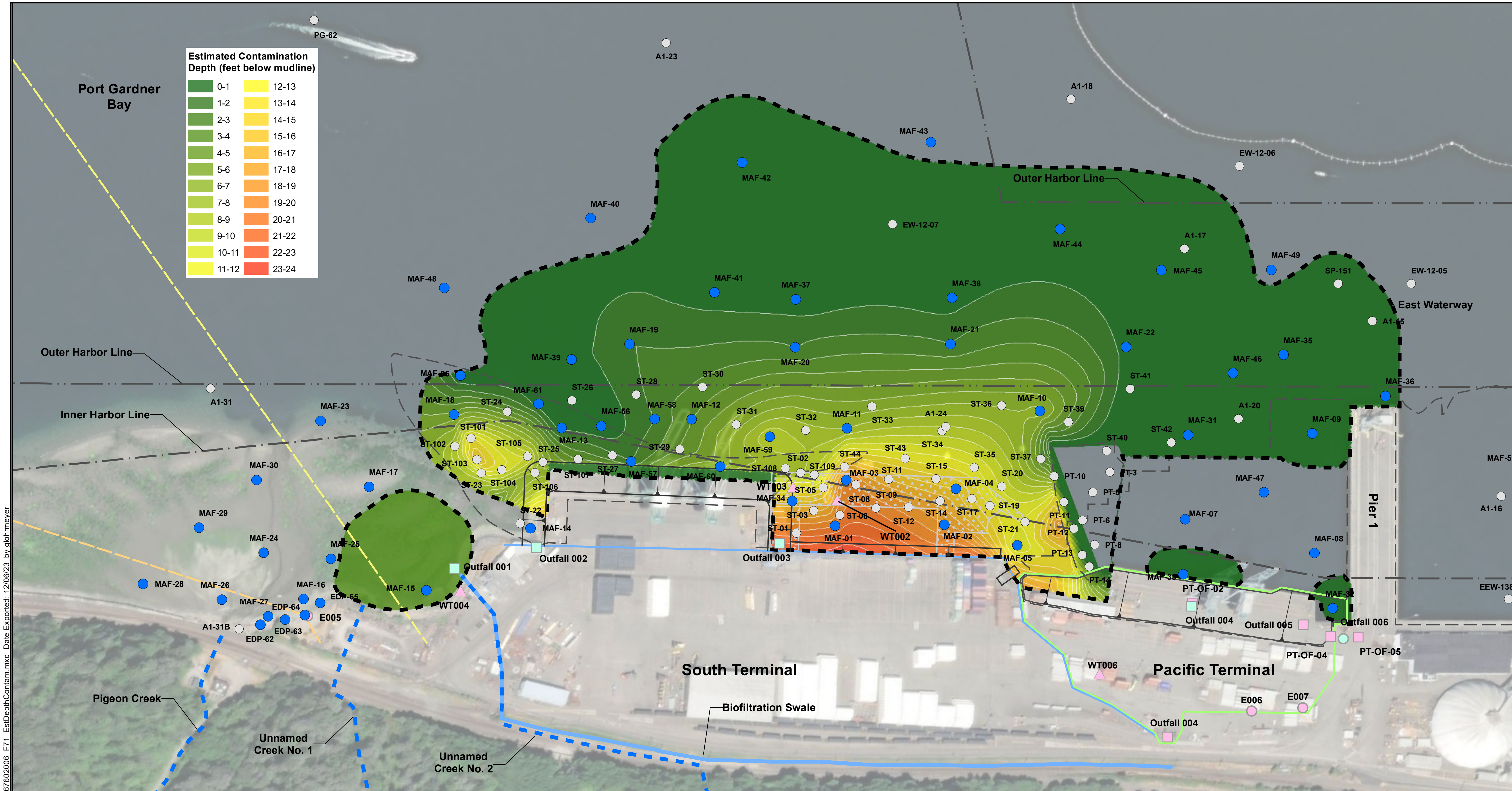
Driver COCs (Human Health) Surface Sediment Compliance Interval

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 73

P:\0\0676020\GIS\MXD\MarineArea_RI_Report\0676020006_F70_SurfaceSedimentDriver_HumanHealth.mxd Date Exported: 12/06/23 by gbohrmeyer



P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F71_EstDepthContam.mxd Date Exported: 12/06/23 by gbohrmeyer

Notes:
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Data Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- Marine Area Remedial Investigation Sampling Location
- Previous Environmental Study/Dredged Material Characterization Study Sampling Location
- Extent of PCUL Exceedances Requiring Cleanup Action
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (approximate)
- Bulkhead
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Estimated Depth of Contamination

Weyerhaeuser Mill A Former
Everett, Washington

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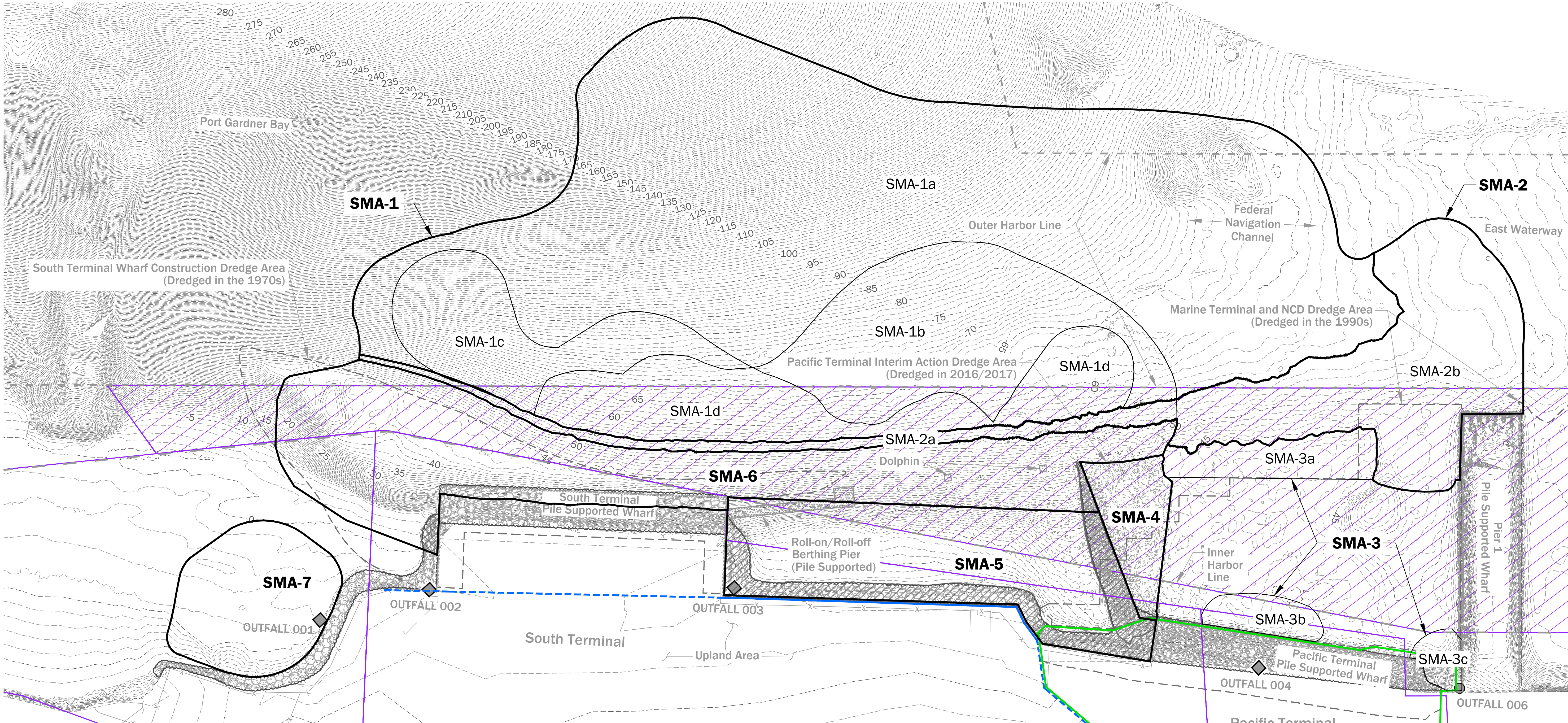
Figure 74



Notes:

1. The overall extent of sediment management areas is based on the limits of contamination shown on Figures 69 and 70 of the Remedial Investigation (RI) report.
2. 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.
3. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
4. The locations of all features shown are approximate.
5. 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 2 and 3.

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[1]
- -45 Existing Contours[2,3] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Previously Dredged Areas
- Areas of Known Armoring
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

250 0 250
Feet

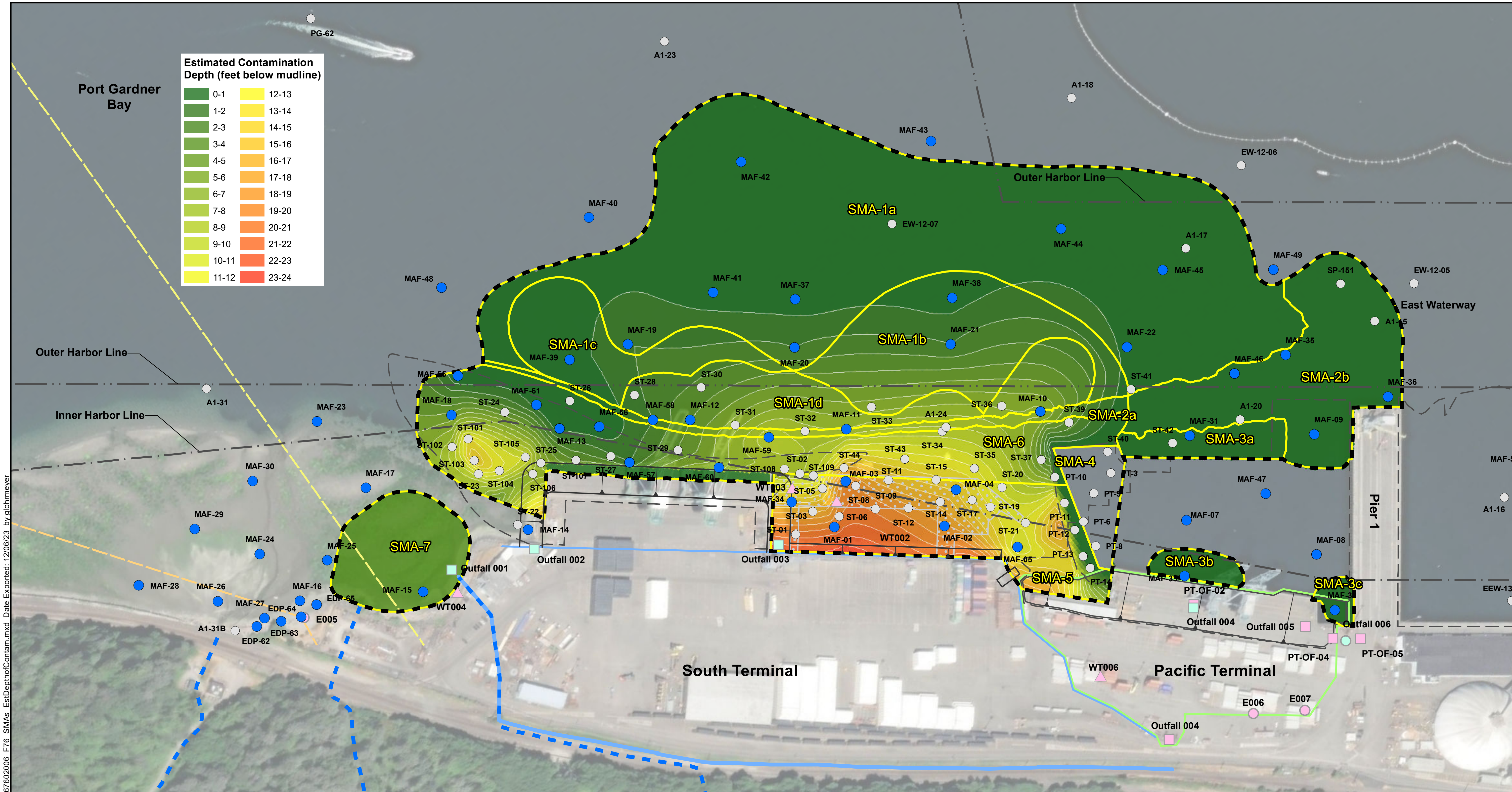
Sediment Management Areas

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 75

P:\0\0676020\CAD\07\Task 1500-02 (RI-FS)\0676020007_F075_Sediment Management Areas.dwg F112 Date Exported:12/12/2023 12:06 AM - by Chad Stickel



P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F76_SMAs_EstDepthofContam.mxd Date Exported: 12/06/23 by glohrmeyer

300 0 300
Feet

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 Source: Base aerial from ESRI, 2022
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

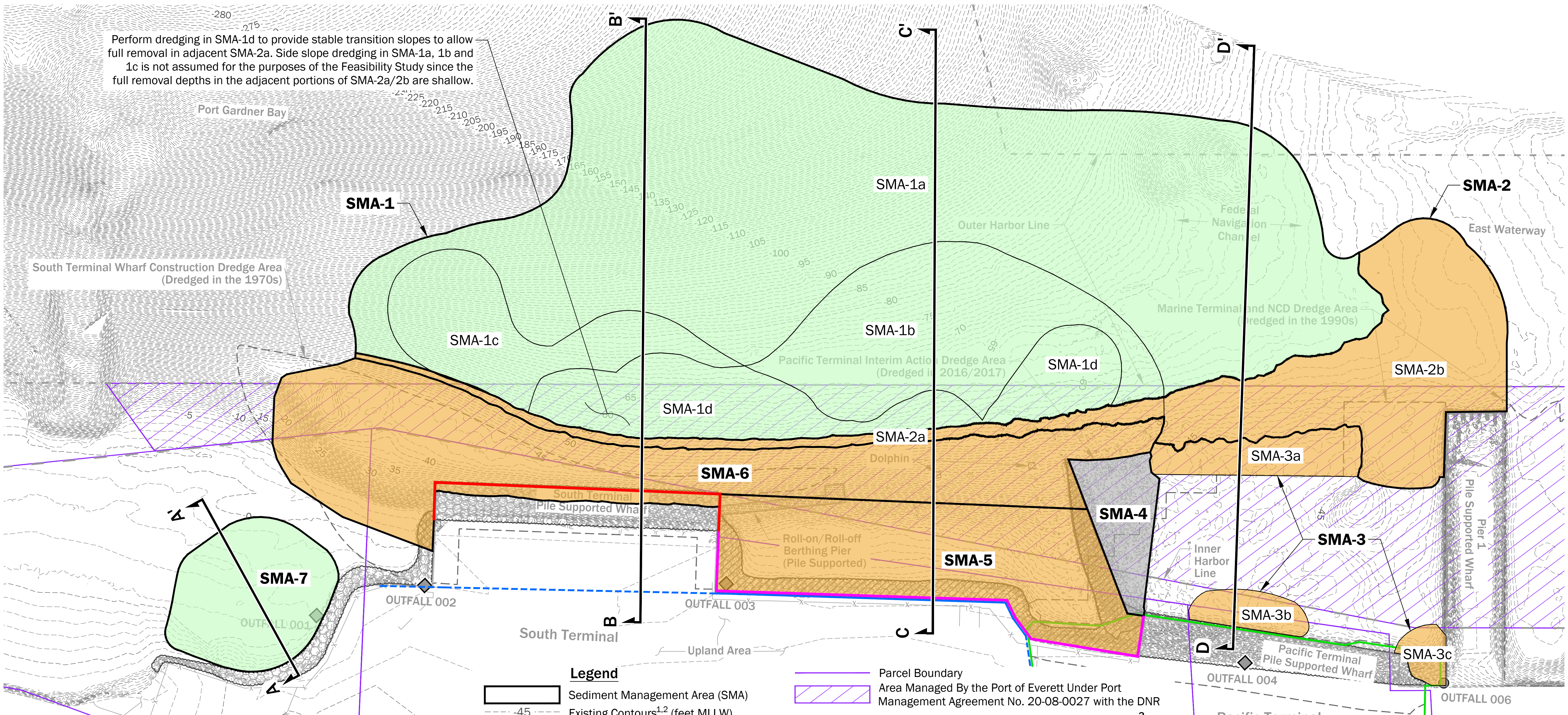
- Marine Area Remedial Investigation Sampling Location
- Previous Environmental Study/Dredged Material Characterization Study Sampling Location
- Extent of PCUL Exceedances Requiring Cleanup Action
- Sediment Management Area Boundary
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/City of Marysville Outfall 100 (approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (approximate)
- Bulkhead
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

Sediment Management Areas and Estimated Depth of Contamination

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 76



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Monitored Natural Recovery (MNR)
- Remove Existing Pile-Supported Roll-on/Roll-off Berthing Pier and Dolphins
- Remove Existing Armor
- Remove and Replace Existing Armor
- No Action
- South Terminal Toe Wall
- Upland Retaining Wall

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

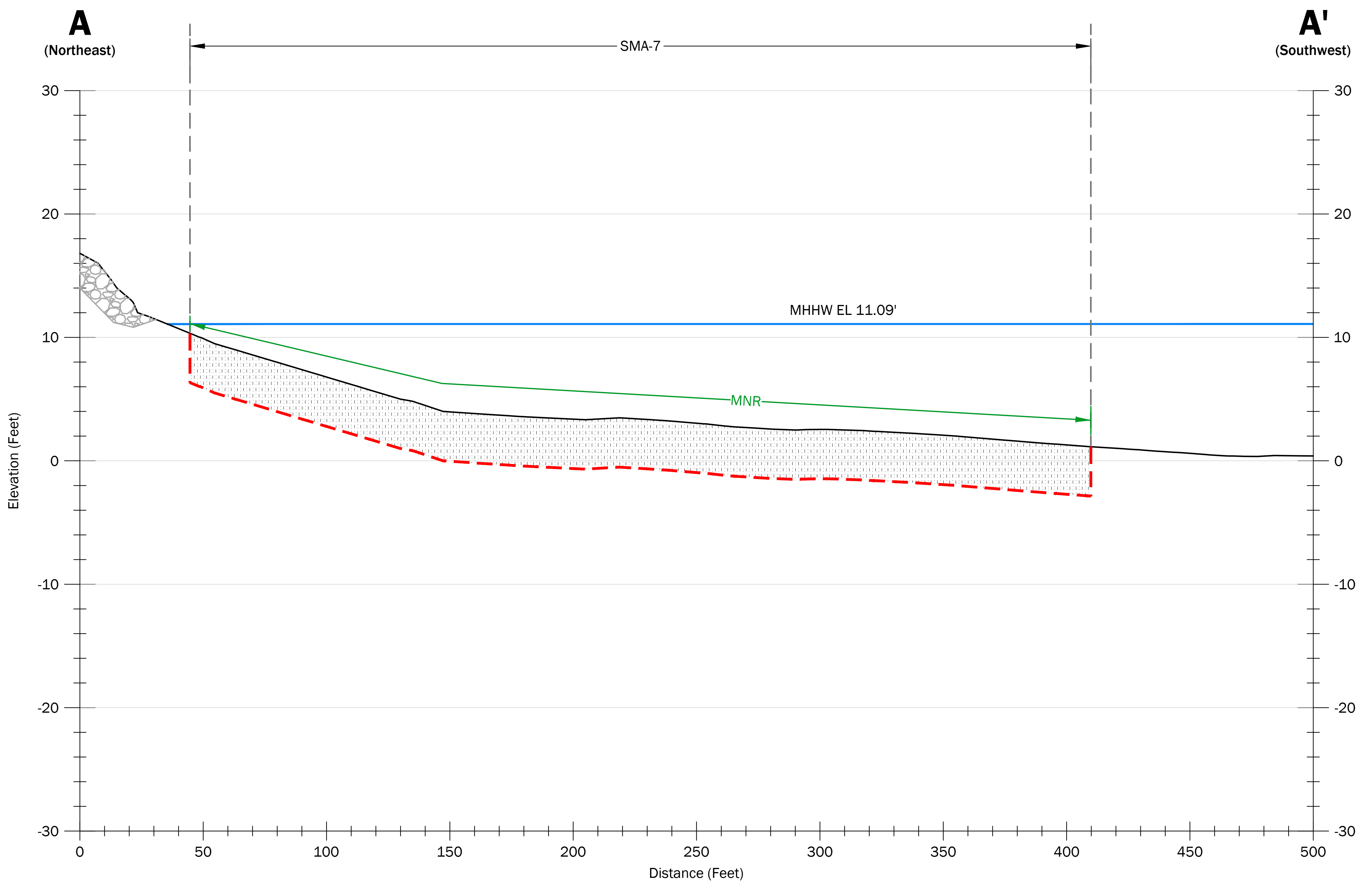
Alternative 1

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 77

P:\0\0676020\CAD\07\task 1500-02 (ri-fs)\067602007_F077_Alternative 1.dwg F77 Date Exported:12/11/2023 9:04 PM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation
MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

MNR Monitored Natural Recovery

Alternative 1 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

50 0 50
Horizontal Scale in Feet
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

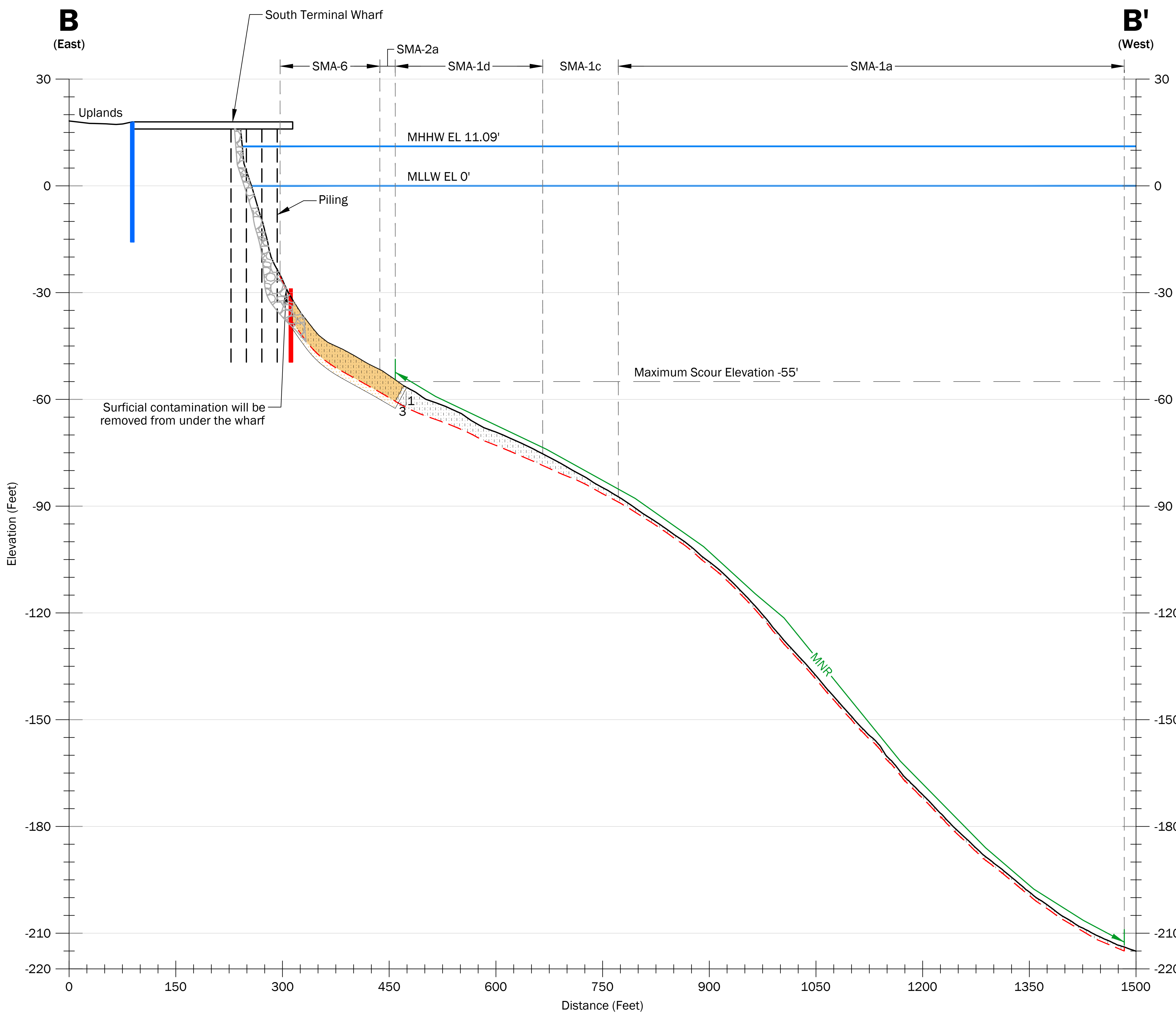
Alternative 1
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 78

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F078_Cross Section A - A' [Alt 1].dwg F17 Date Exported:12/12/2023 9:14 AM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 1 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

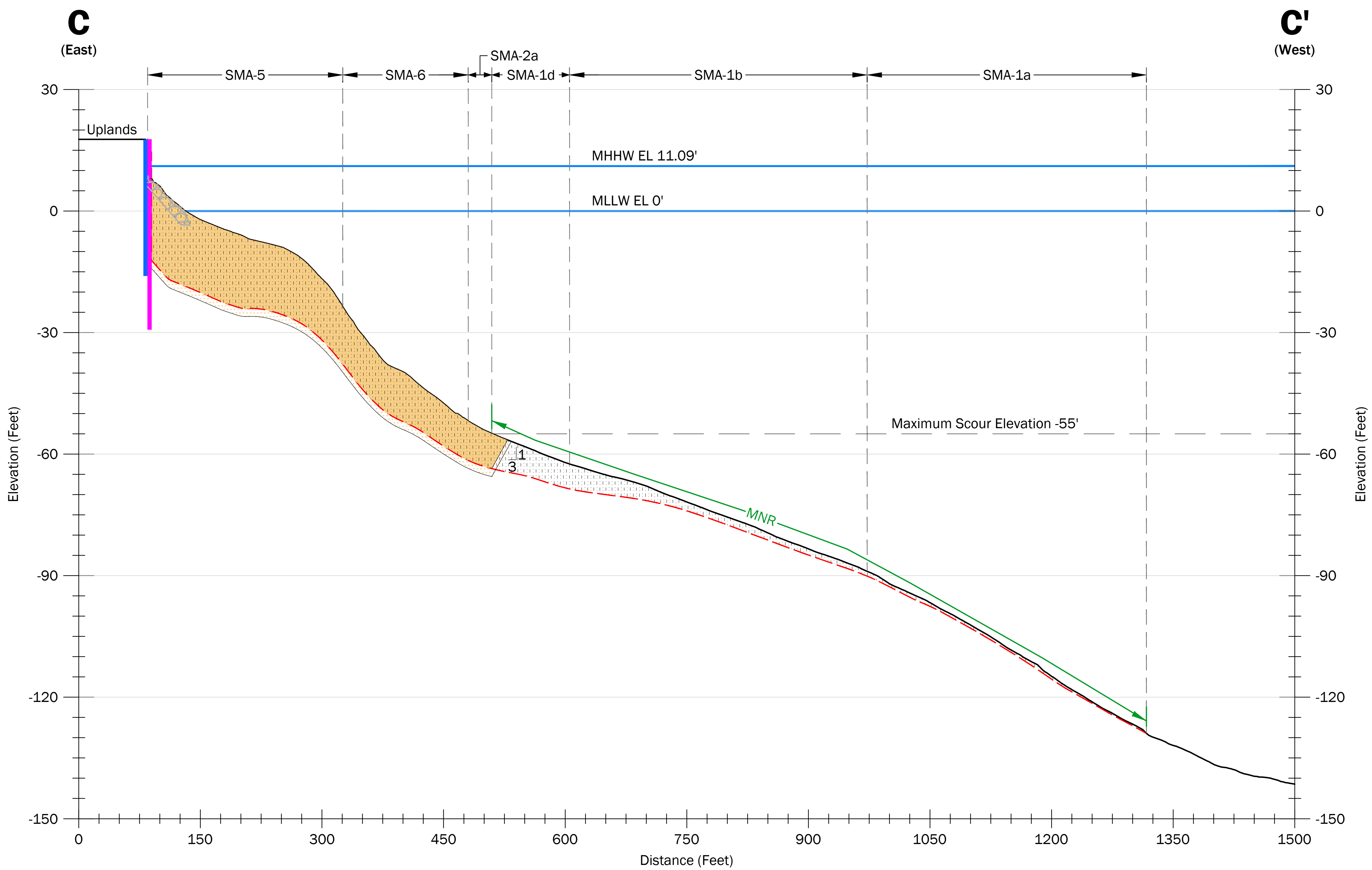
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 1
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 79



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Upland Retaining Wall[2]

Alternative 1 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

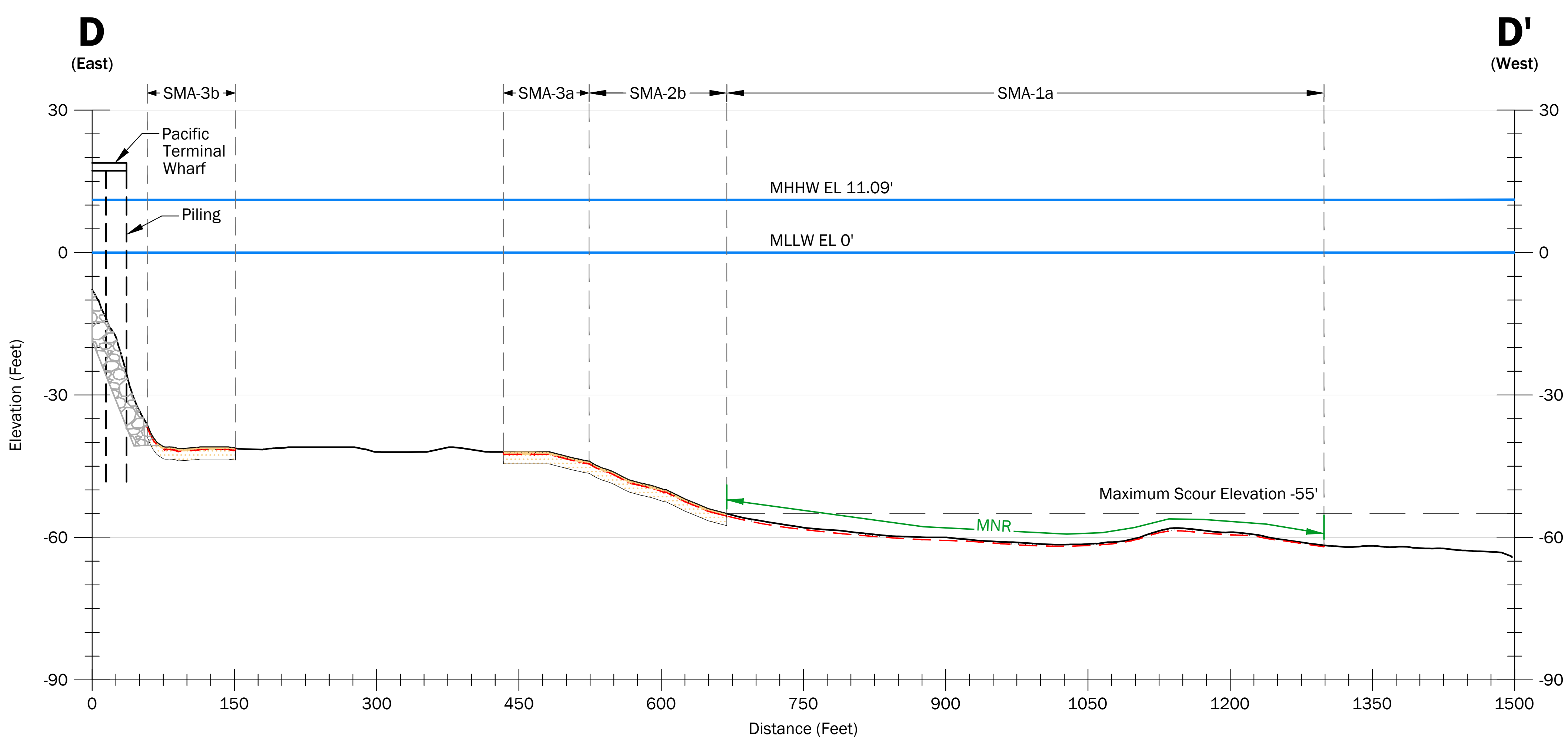
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 1
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 80



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- EL Elevation
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance

Alternative 1 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

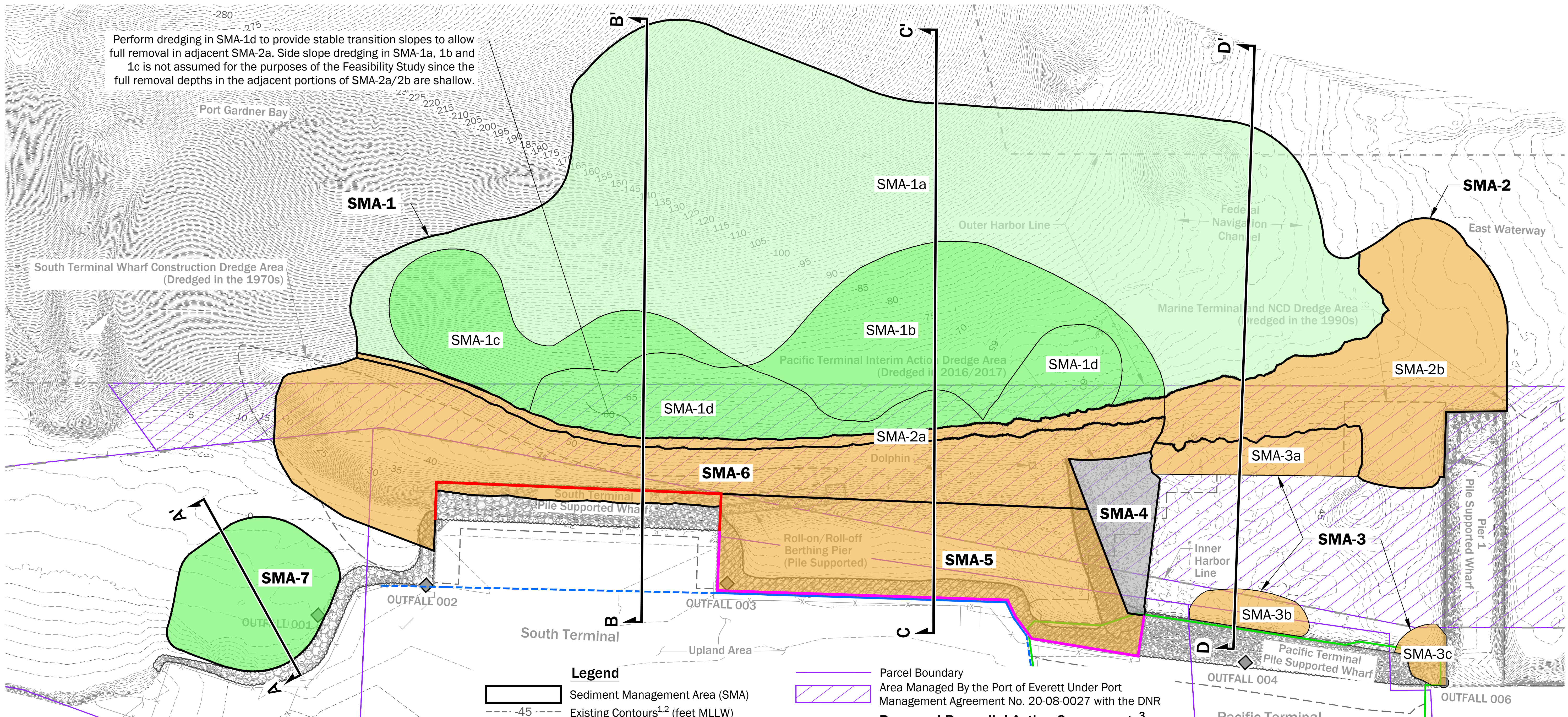
Alternative 1
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 81

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F081_Cross Section D - D' [Alt 1].dwg 81 Section D [Alternative 1] Date Exported:12/12/2023 9:14 AM - by Chad Stickel



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Enhanced Natural Recovery (ENR)
- Monitored Natural Recovery (MNR)
- Remove Existing Pile-Supported Roll-on/Roll-off Berthing Pier and Dolphins
- Remove Existing Armor
- Remove and Replace Existing Armor
- No Action
- South Terminal Toe Wall
- Upland Retaining Wall

250 0 250
Feet

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

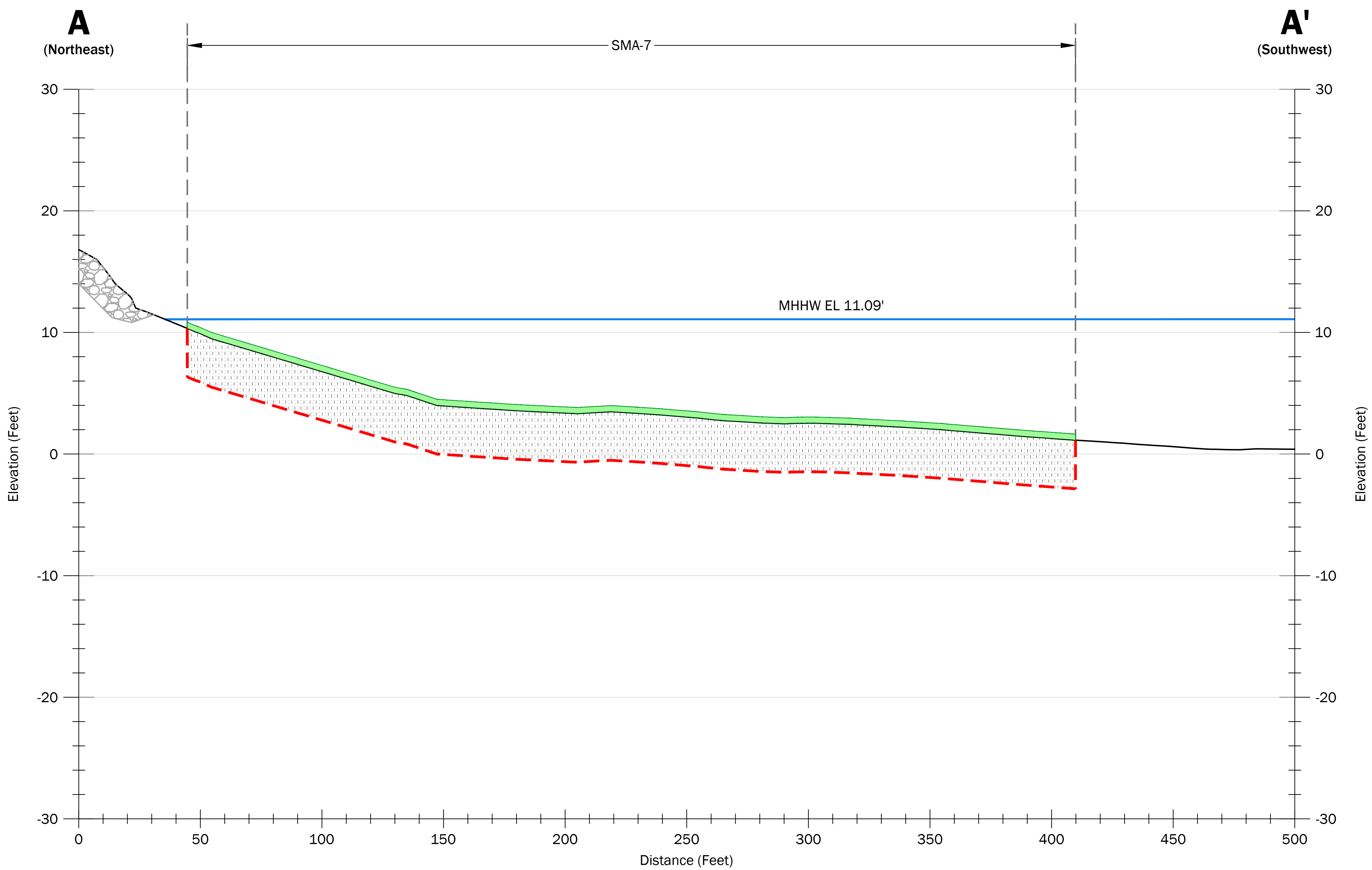
Alternative 2

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 82

P:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F082_Alternative 2.dwg F77 Date Exported:12/11/2023 9:05 PM - by Chad Stickel



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

Enhanced Natural Recovery

Alternative 2 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

50 0 50
Horizontal Scale in Feet

10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

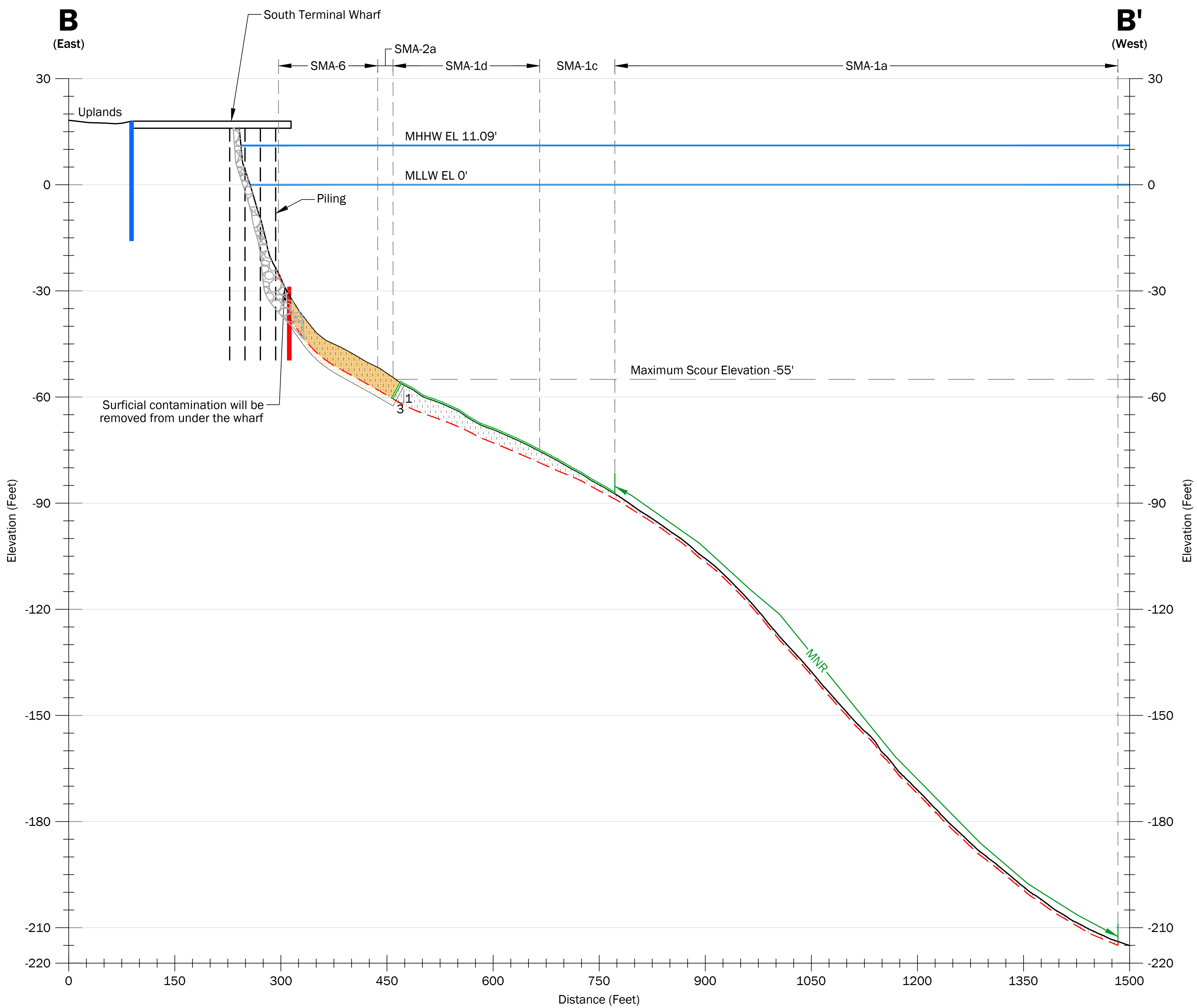
Alternative 2
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 83

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F083_Cross Section A - A' [Alt 2].dwg 83 Section A [Alternative 2] Date Exported:12/12/2023 9:43 AM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 2 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

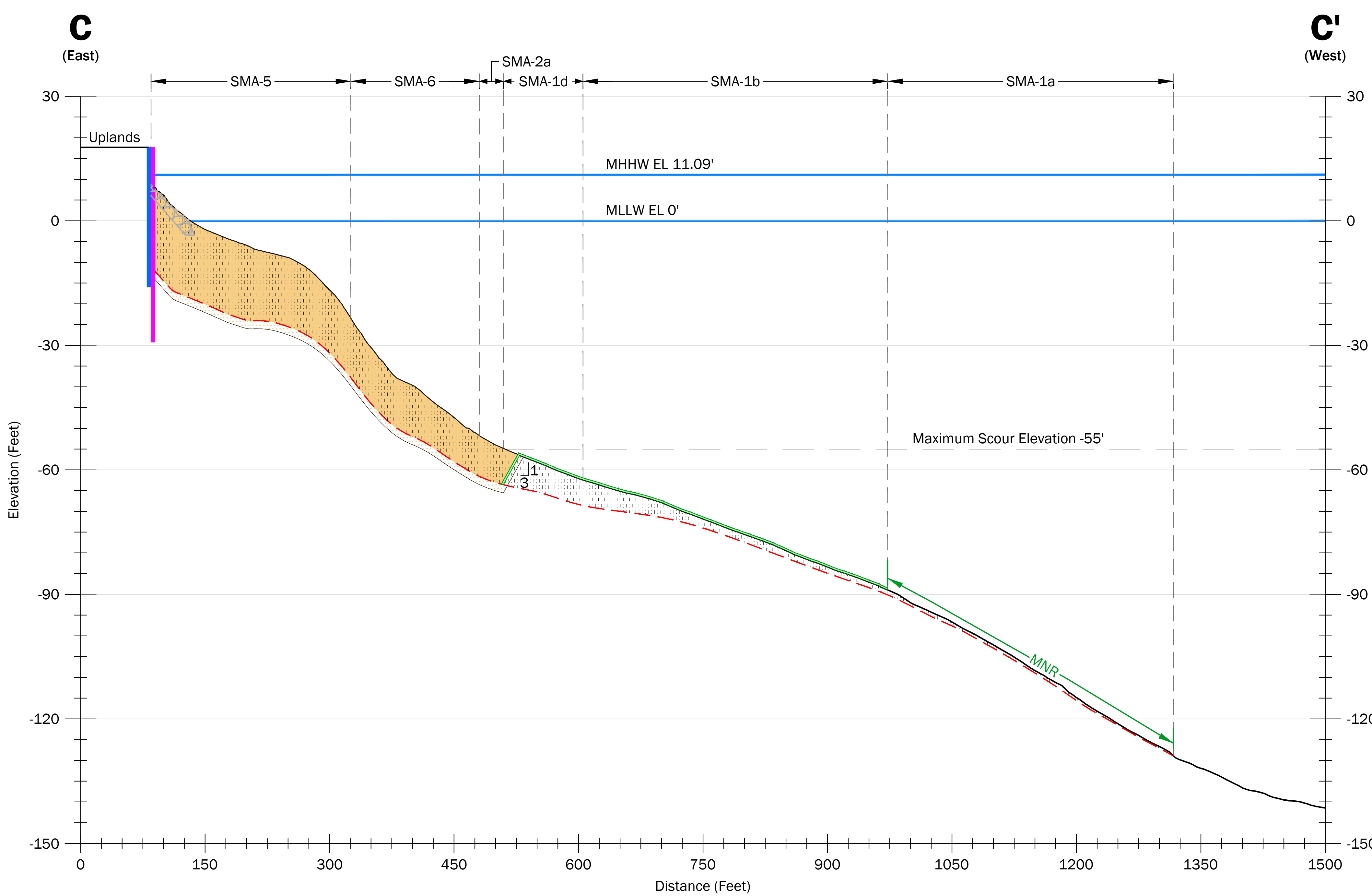
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 2
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 84



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Upland Retaining Wall[2]

Alternative 2 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

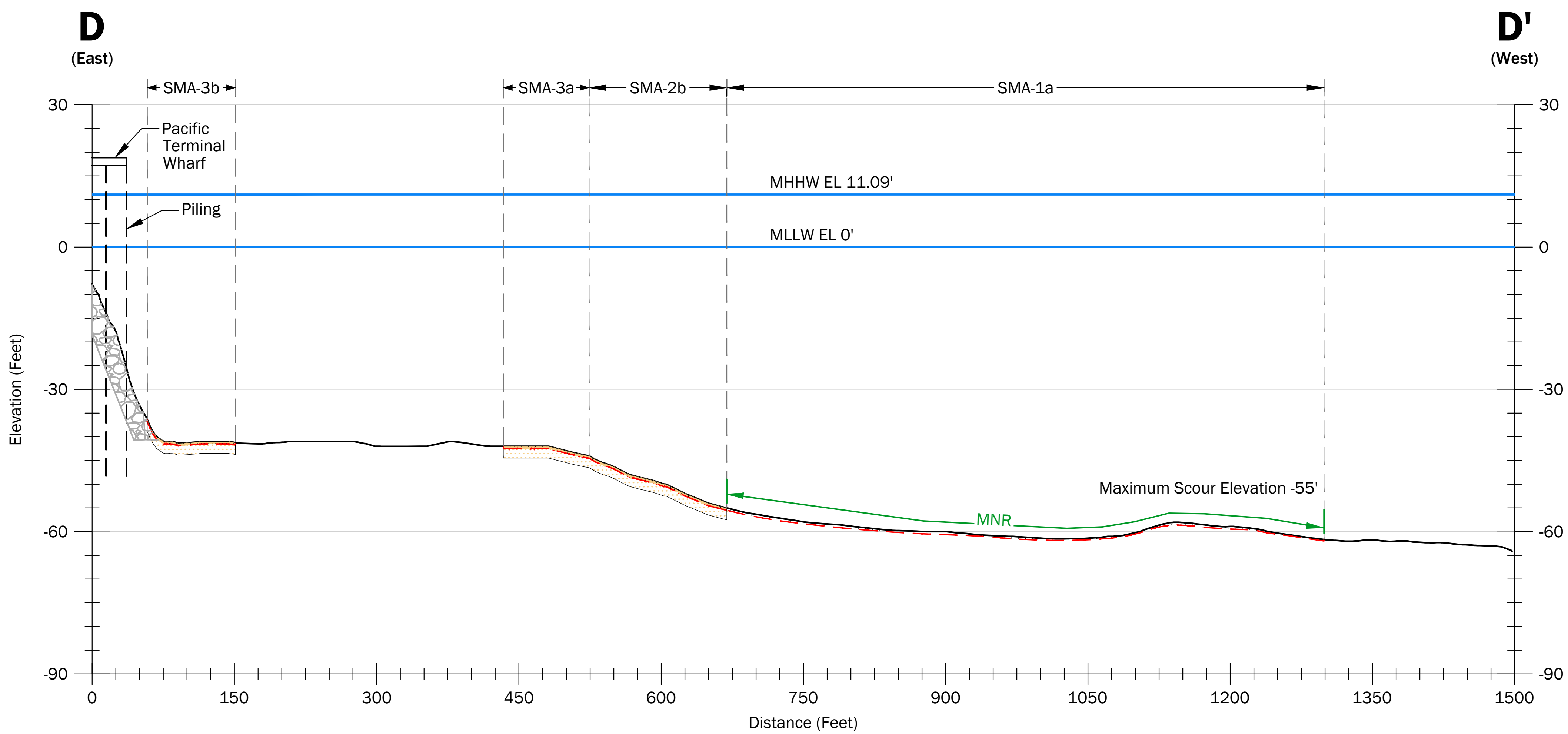
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 2
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 85



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance

Alternative 2 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

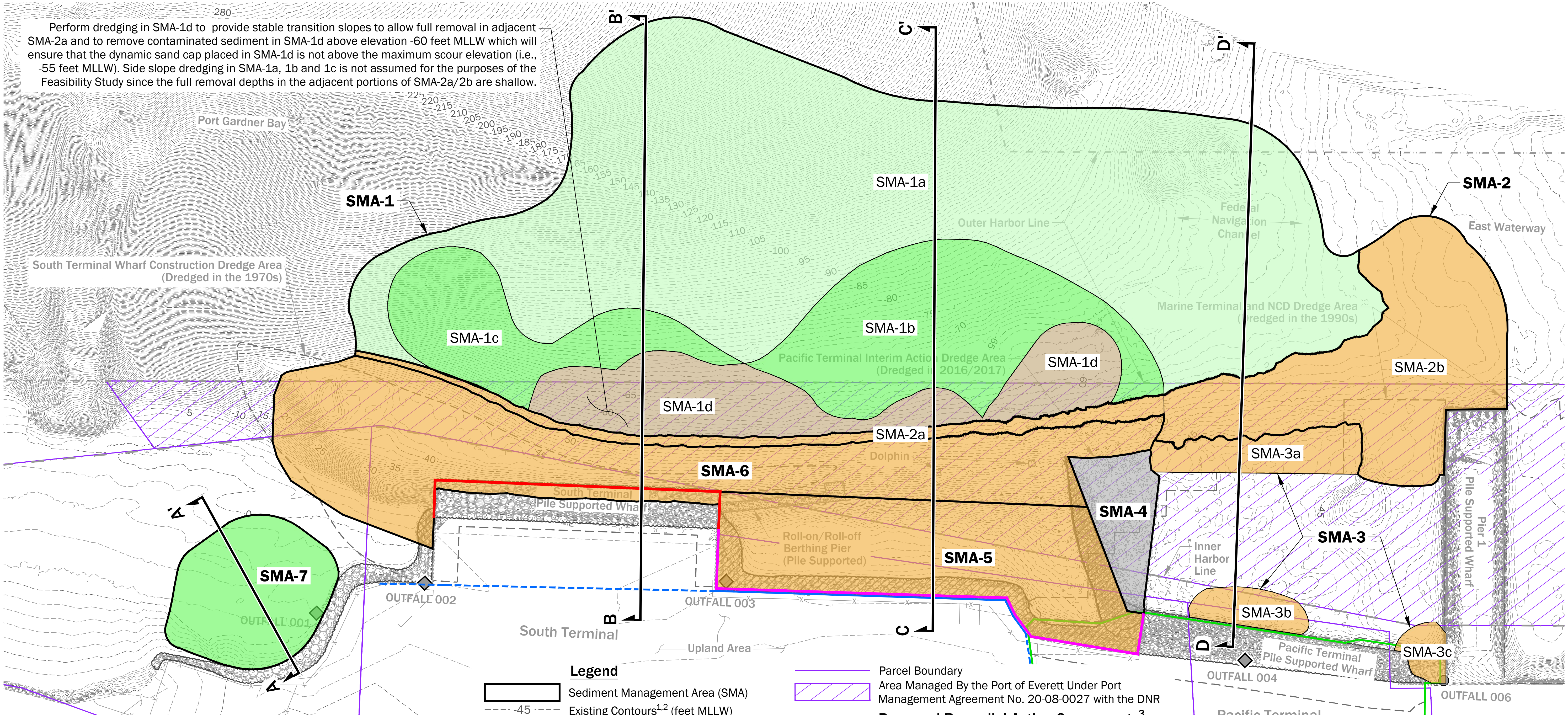
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 2
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 86



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

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

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

250 0 250
Feet

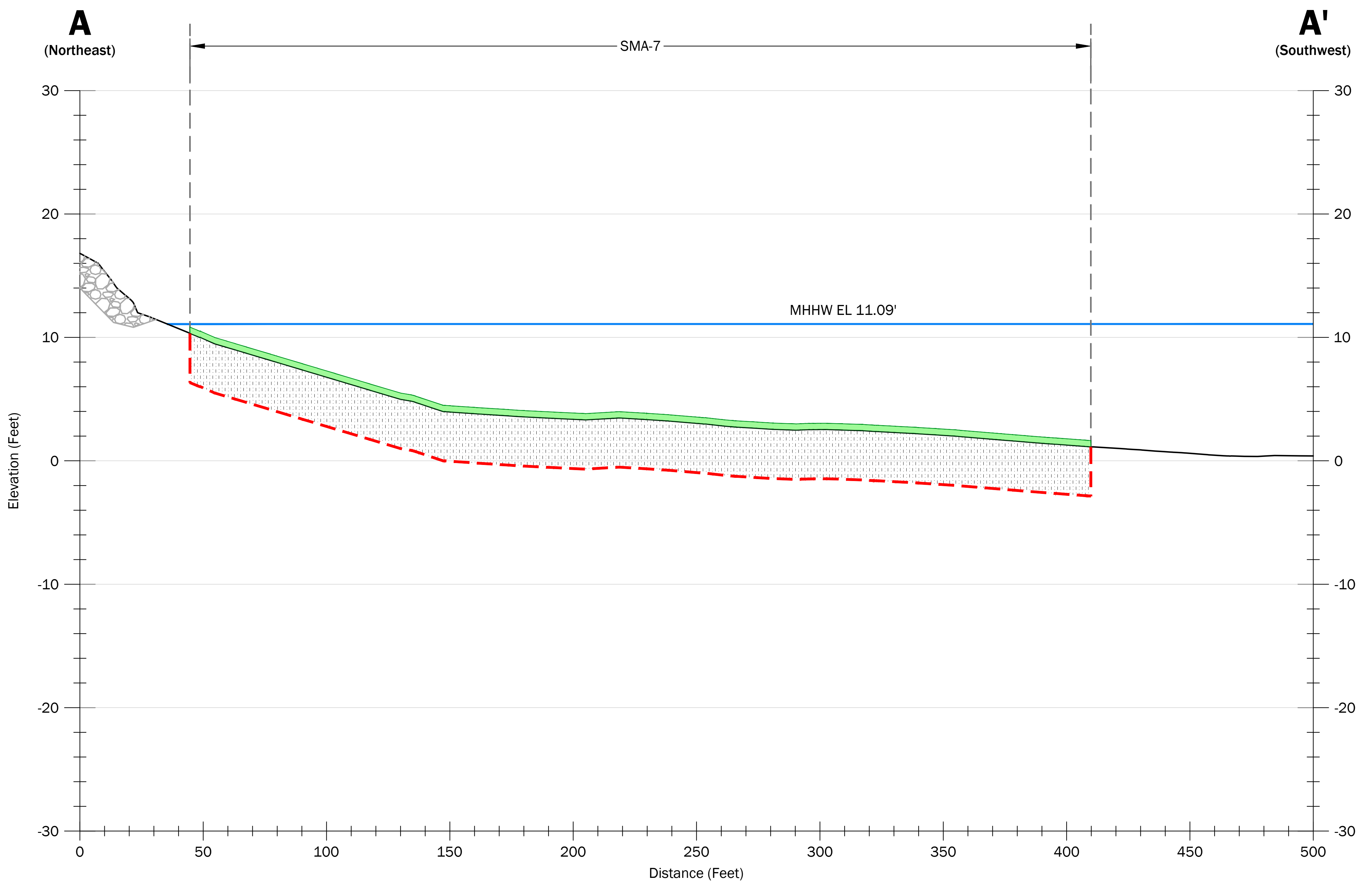
Alternative 3

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 87

P:\0\0676020\CAD\07\task 1500-02 (ri-fs)\067602007_F087_Alternative 3.dwg F77 Date Exported:12/12/2023 1:59 PM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation
MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery

Alternative 3 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

50 0 50
Horizontal Scale in Feet
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

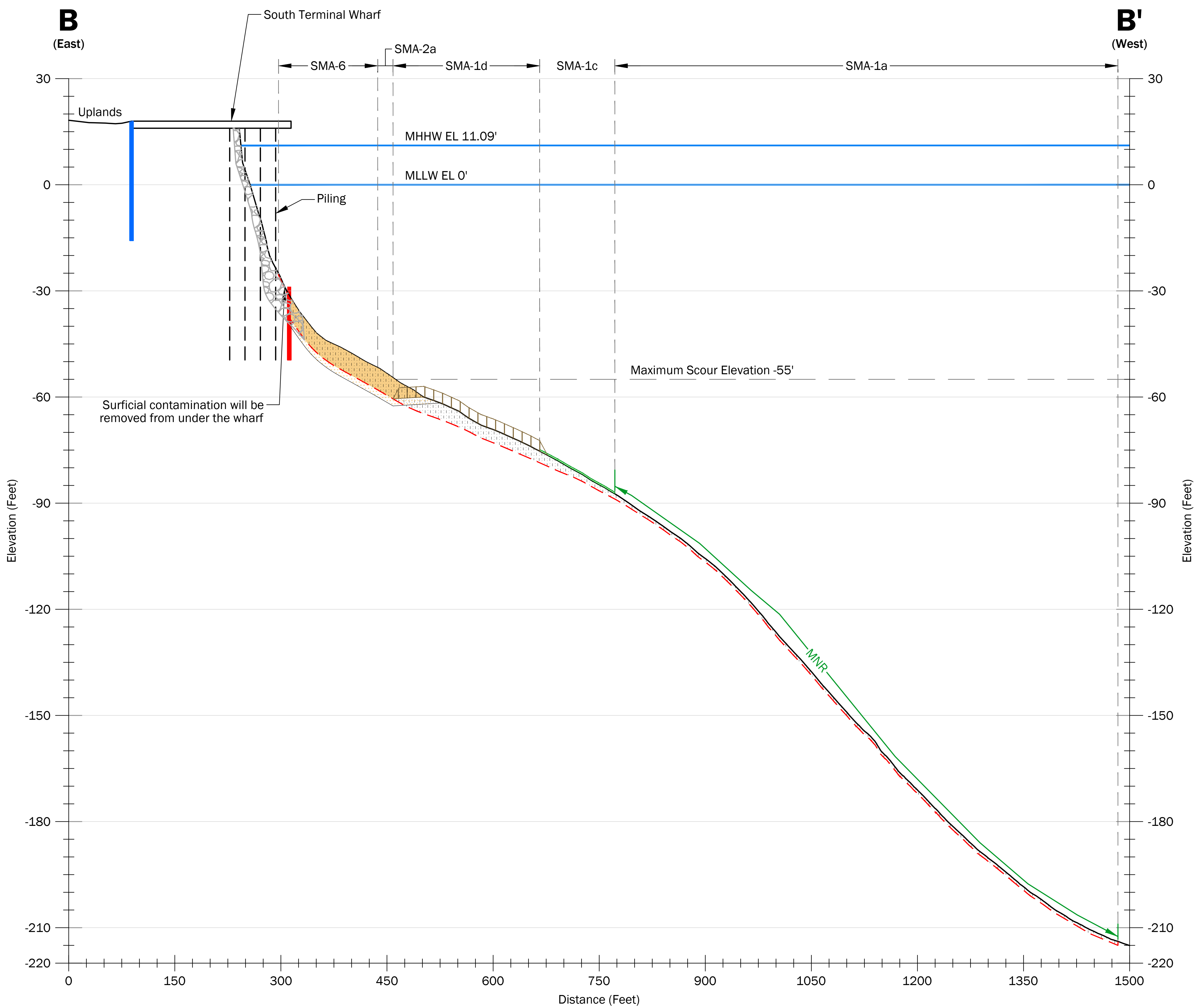
Alternative 3
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 88

p:\0\0676020\CAD\07\task 1500-02 (ri-fs)\067602007_F088_Cross Section A - A' [Alt 3].dwg 88 Section A (Alternative 3) Date Exported:12/13/2023 8:28 AM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Dynamic Sand Cap
- South Terminal Toe Wall[2]

Alternative 3 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

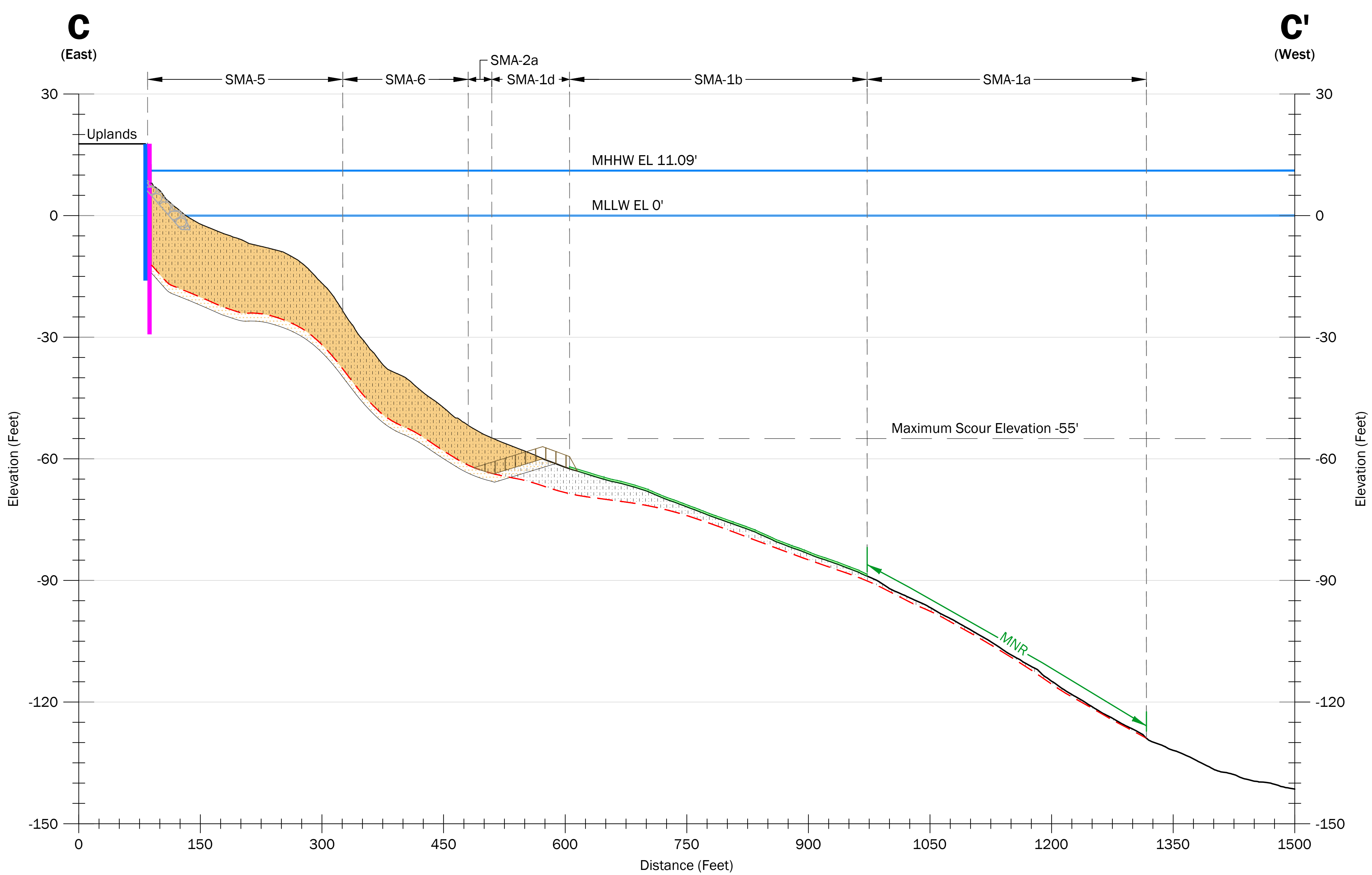
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 3
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 89



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)
- EL Elevation
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Dynamic Sand Cap
- Upland Retaining Wall[2]

Alternative 3 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

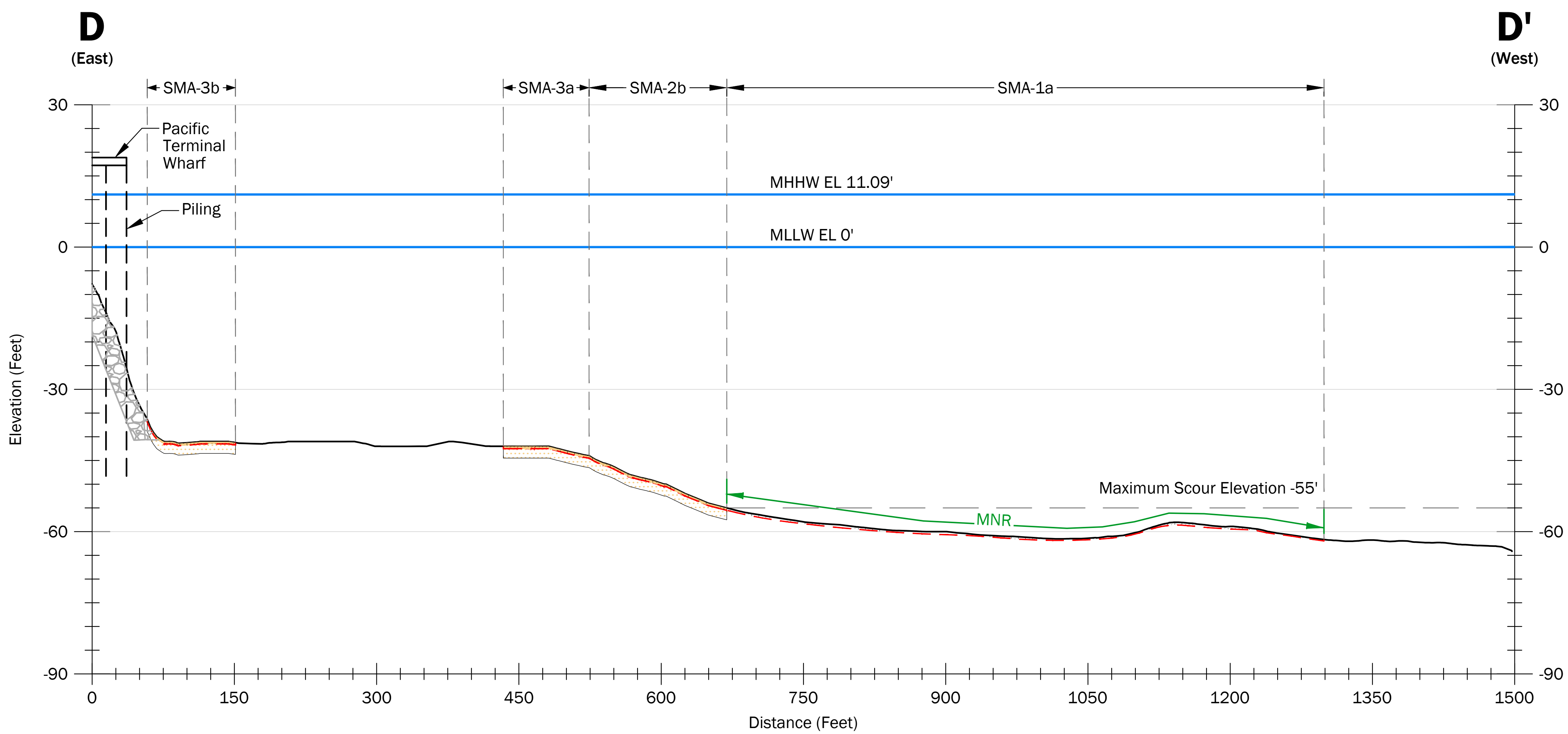
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 3
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 90



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

MNR Monitored Natural Recovery

Full Removal of Contaminated Sediment and Wood Debris

2-Foot Overdredge Allowance

Alternative 3 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

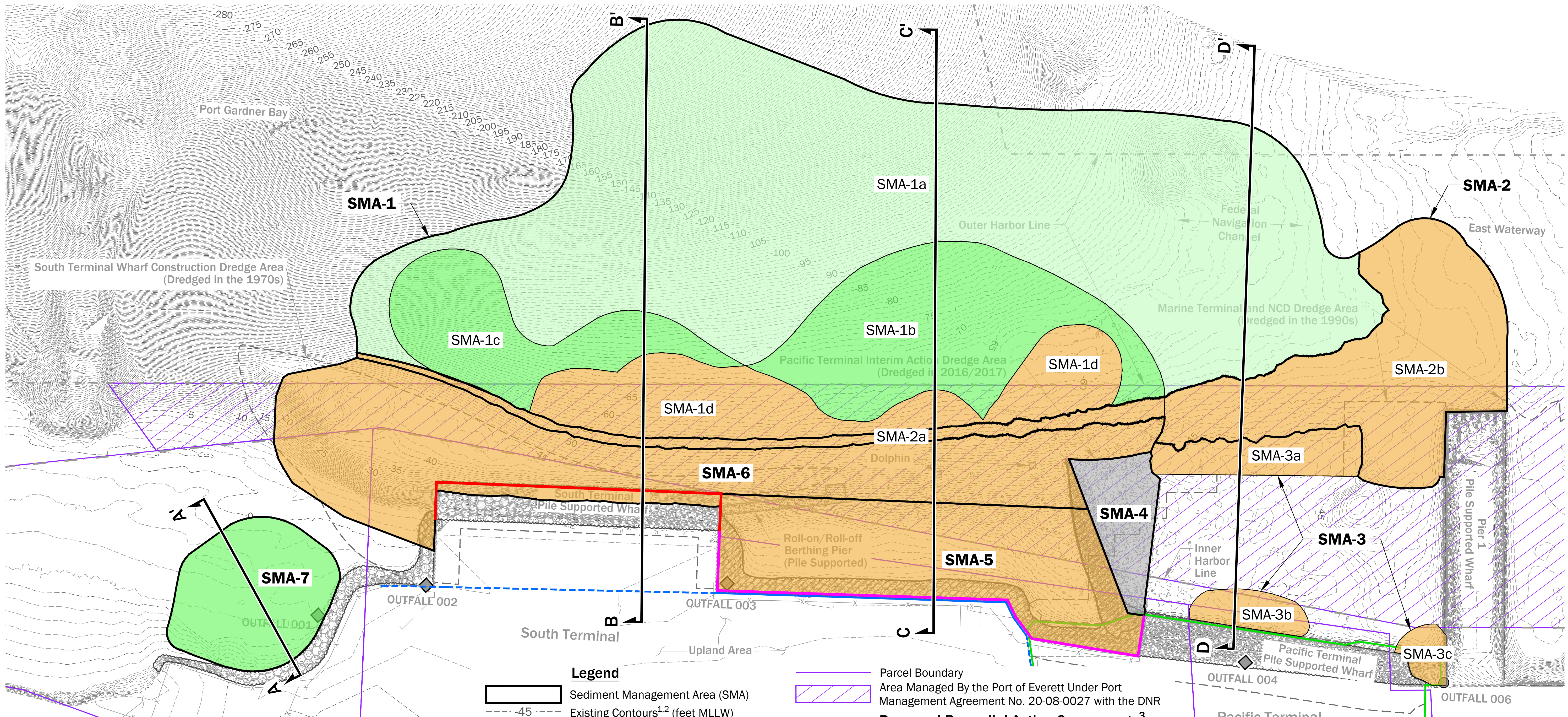
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 3
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 91



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Enhanced Natural Recovery (ENR)
- Monitored Natural Recovery (MNR)
- Remove Existing Pile-Supported Roll-on/Roll-off Berthing Pier and Dolphins
- Remove Existing Armor
- Remove and Replace Existing Armor
- No Action
- South Terminal Toe Wall
- Upland Retaining Wall

250 0 250
Feet

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

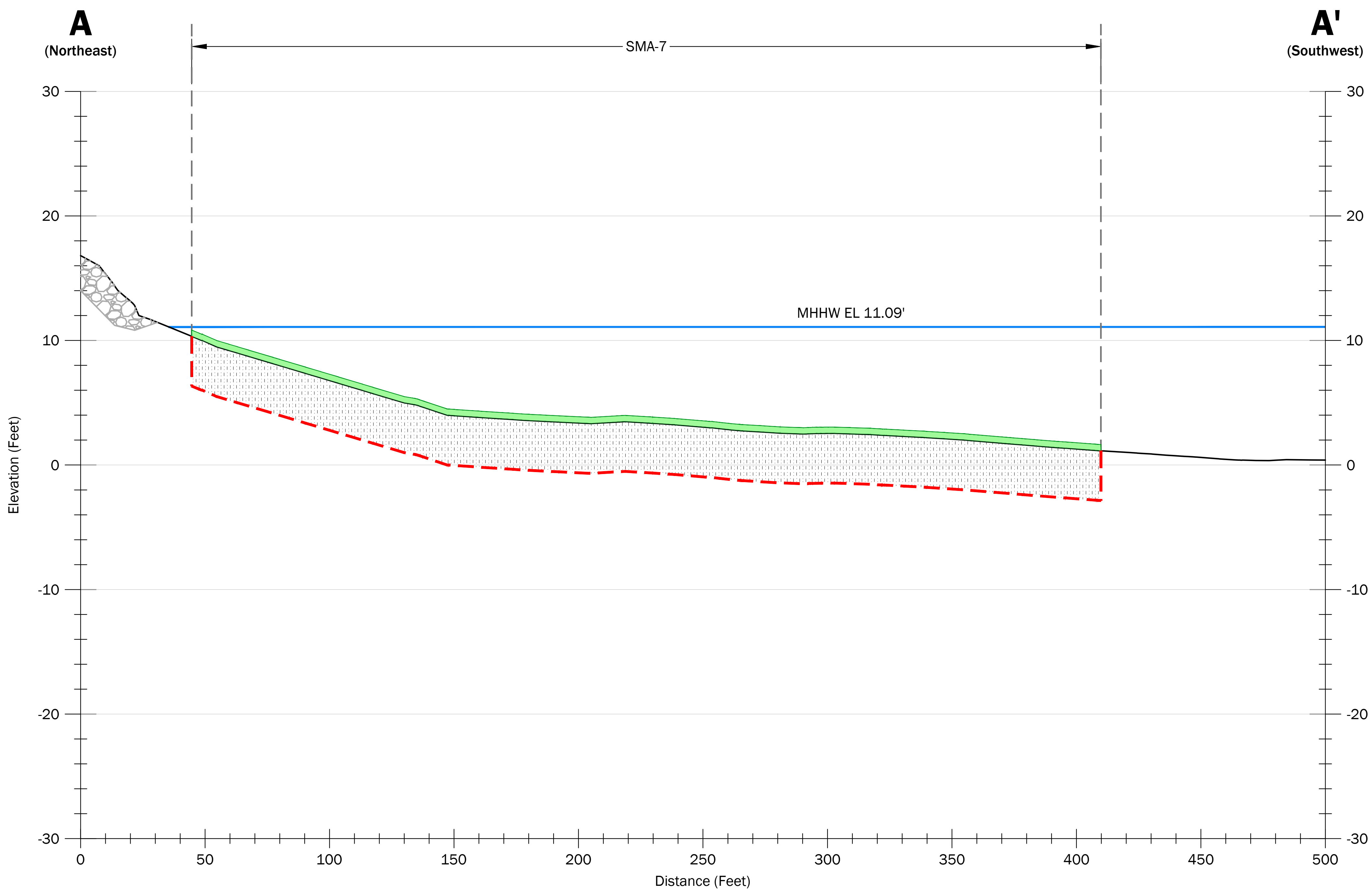
Alternative 4

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 92

P:\0\0676020\CAD\07\Task 1500-02 (RI-FS)\067602007_F092_Alternative 4.dwg F77 Date Exported:12/11/2023 9:03 PM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- EL Elevation
- MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery

Alternative 4 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

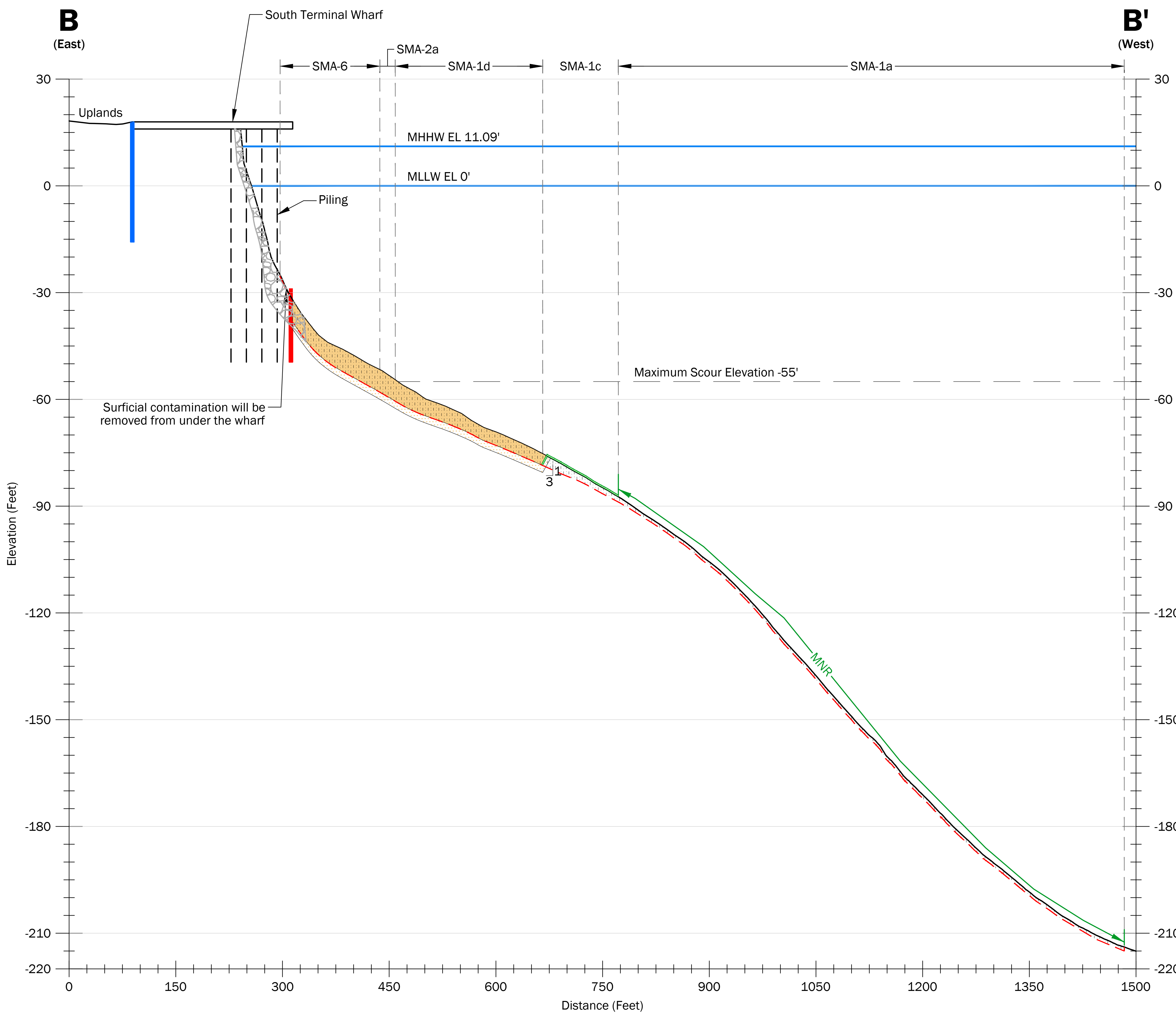
50 0 50
Horizontal Scale in Feet
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 4
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 93



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)
- EL Elevation
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 4 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

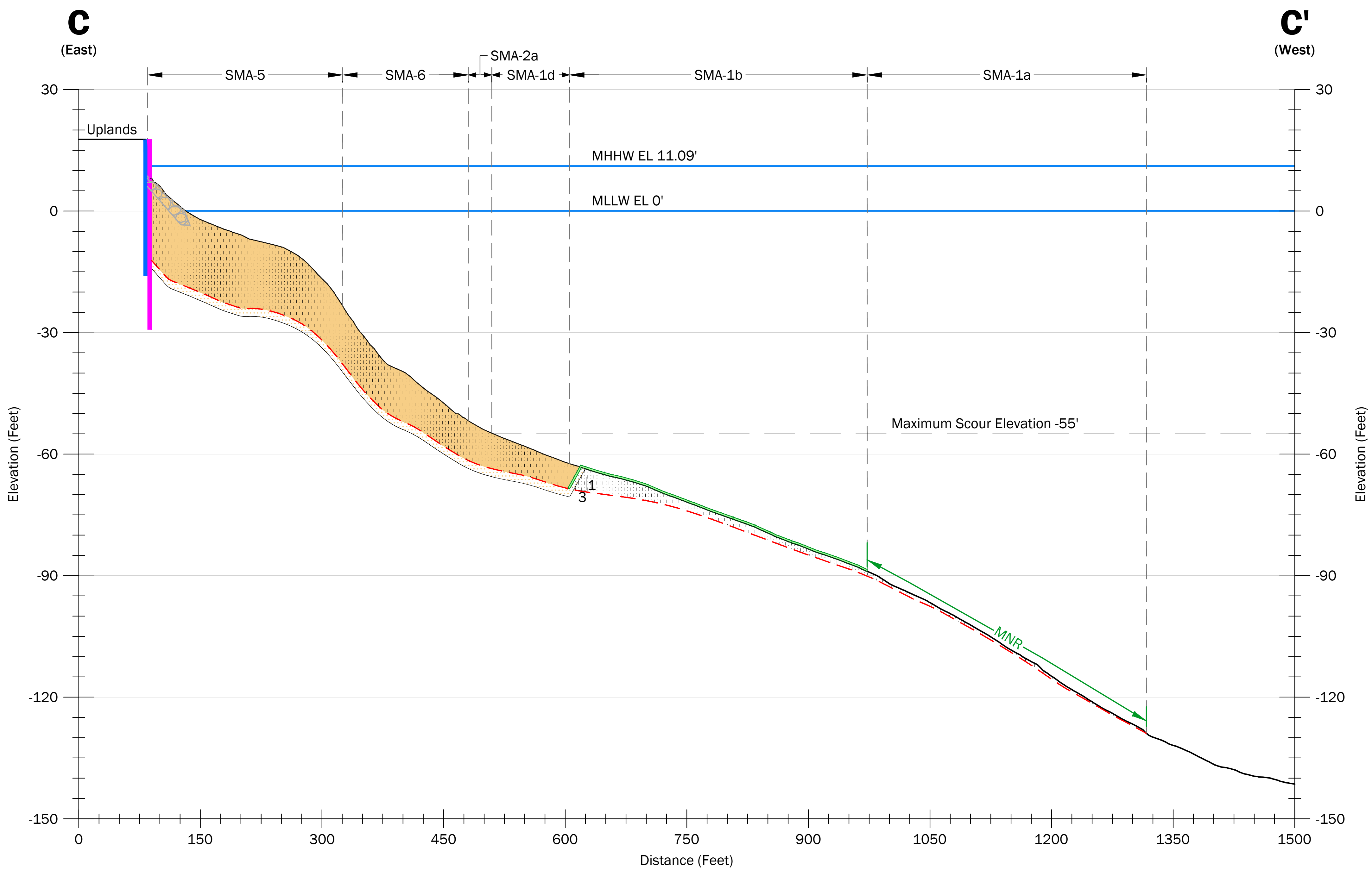
Alternative 4
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 94

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F094_Cross Section B - B' [Alt 4].dwg 94 Section B [Alternative 4] Date Exported:12/12/2023 9:46 AM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Upland Retaining Wall[2]

Alternative 4 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

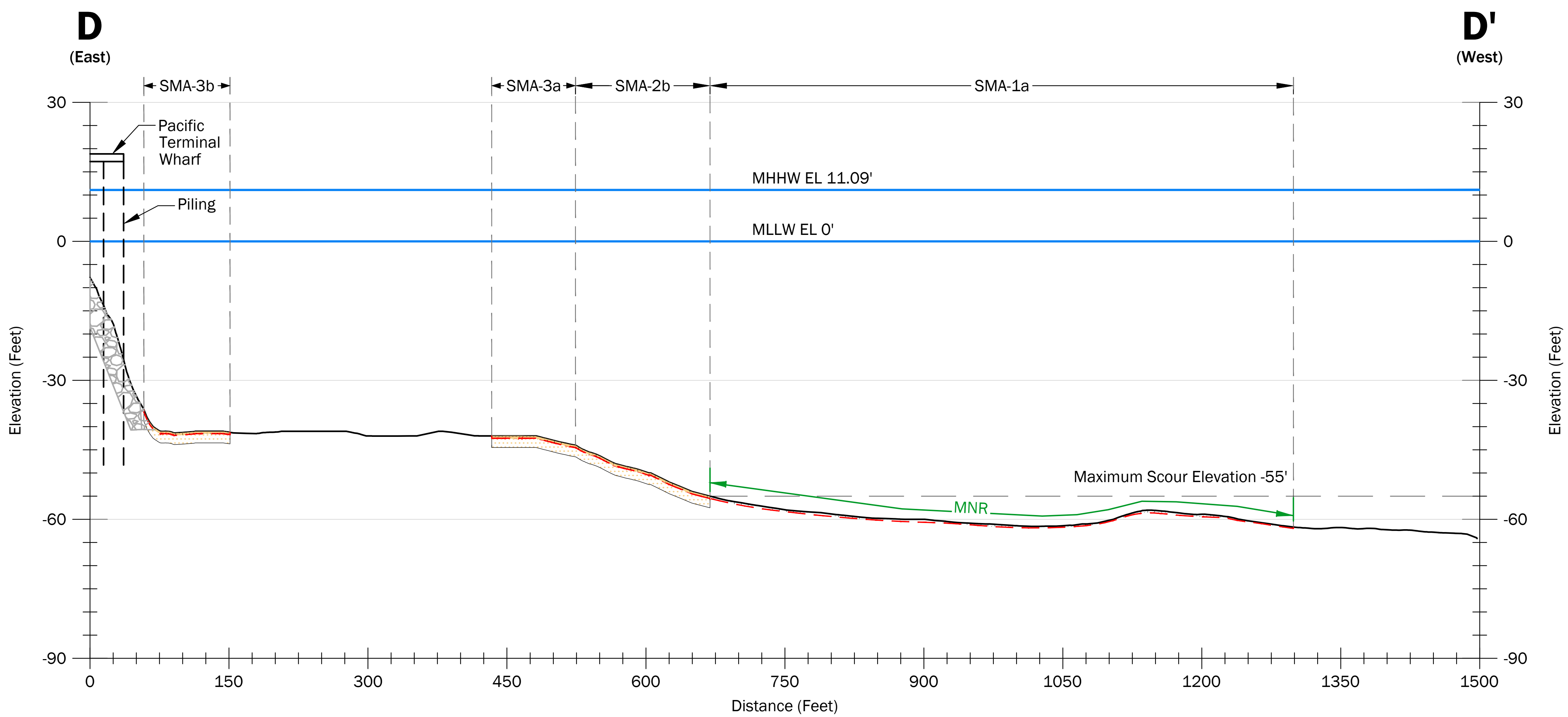
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 4
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 95



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

MNR Monitored Natural Recovery

Full Removal of Contaminated Sediment and Wood Debris

2-Foot Overdredge Allowance

Alternative 4 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150

Horizontal Scale in Feet

30 0 30

Vertical Scale in Feet

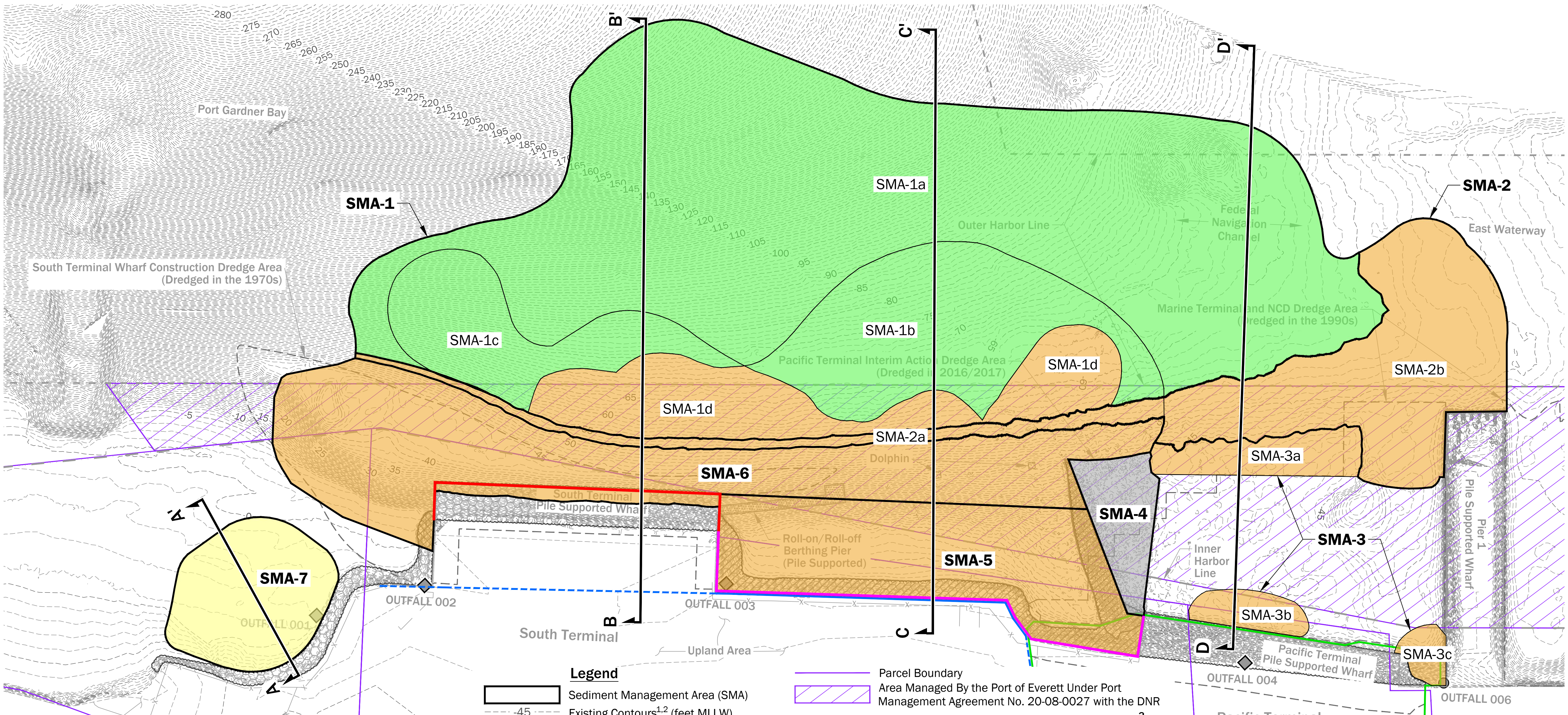
Vertical Exaggeration = 5X

Alternative 4
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 96



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Full Removal and Backfill
- Enhanced Natural Recovery (ENR)
- Remove Existing Pile-Supported Roll-on/Roll-off Berthing Pier and Dolphins
- Remove Existing Armor
- Remove and Replace Existing Armor
- No Action
- South Terminal Toe Wall
- Upland Retaining Wall

250 0 250
Feet

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

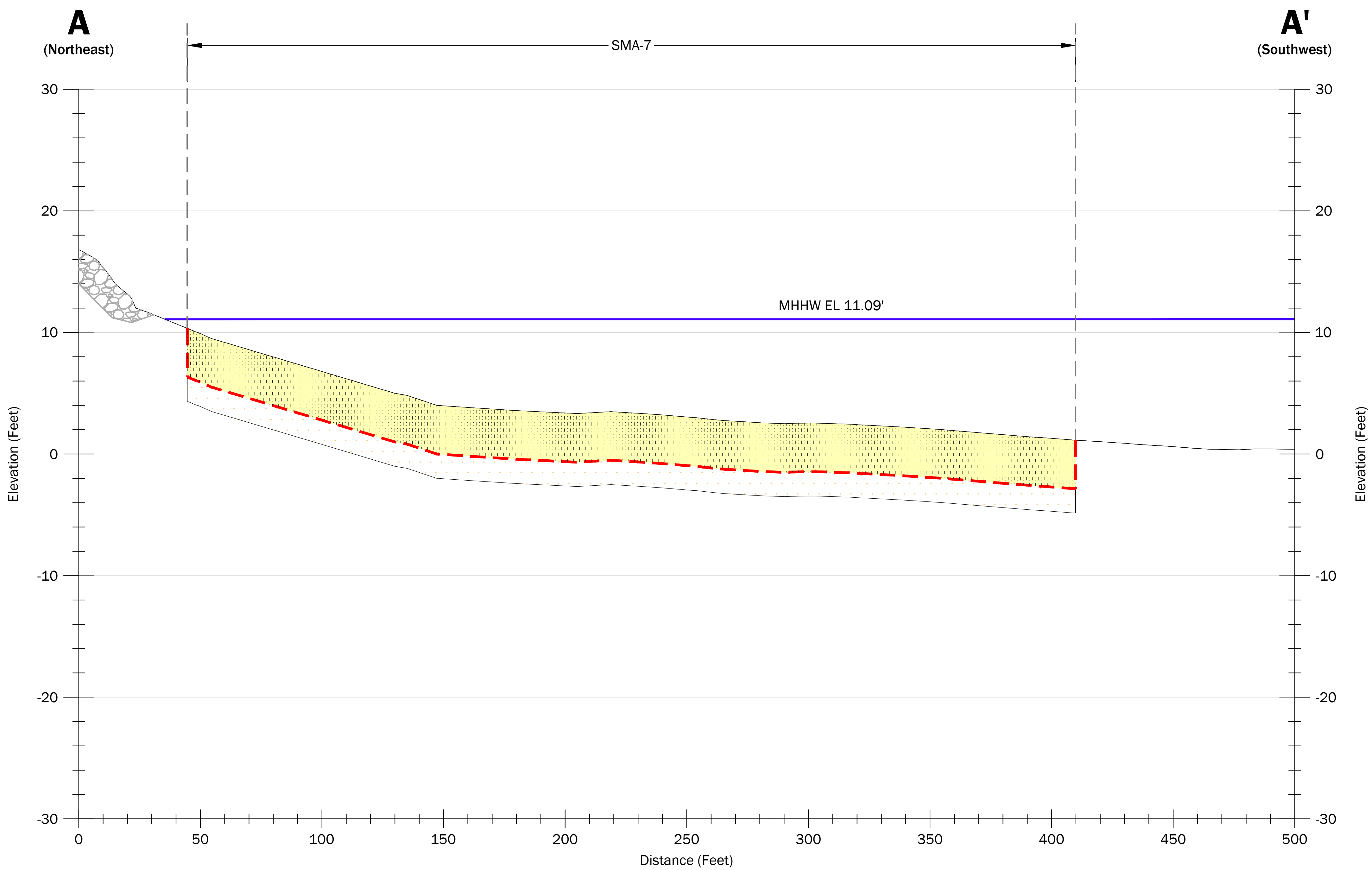
Alternative 5

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 97

P:\0\0676020\CAD\07\Task 1500-02 (RI-FS)\067602007_F097_Alternative 5.dwg F77 Date Exported:12/11/2023 9:14 PM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- EL Elevation
- MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

- Full Removal and Backfill
- 2-Foot Overdredge Allowance

Alternative 5 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

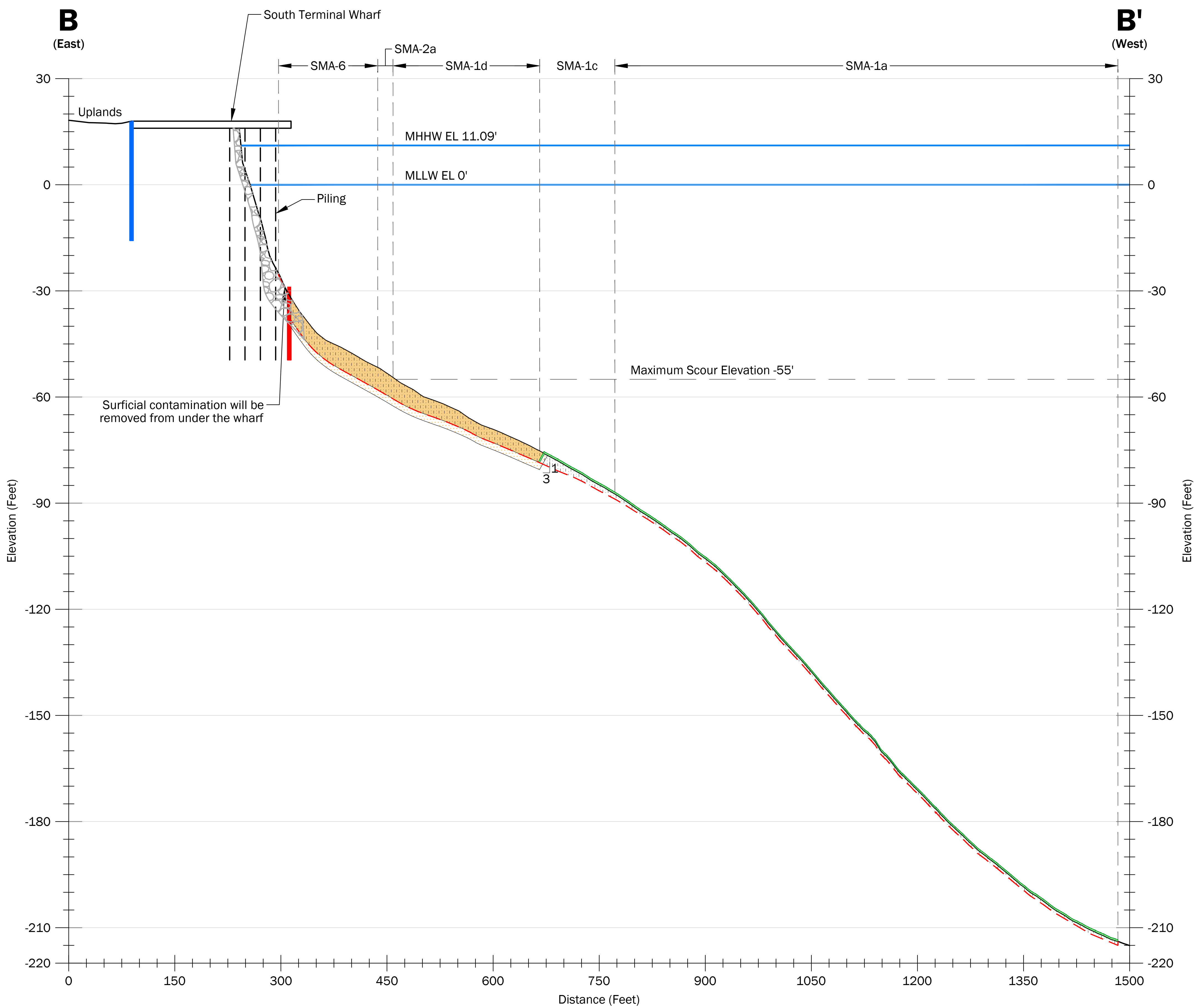
50 0 50
Horizontal Scale in Feet
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 5
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 98



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 5 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

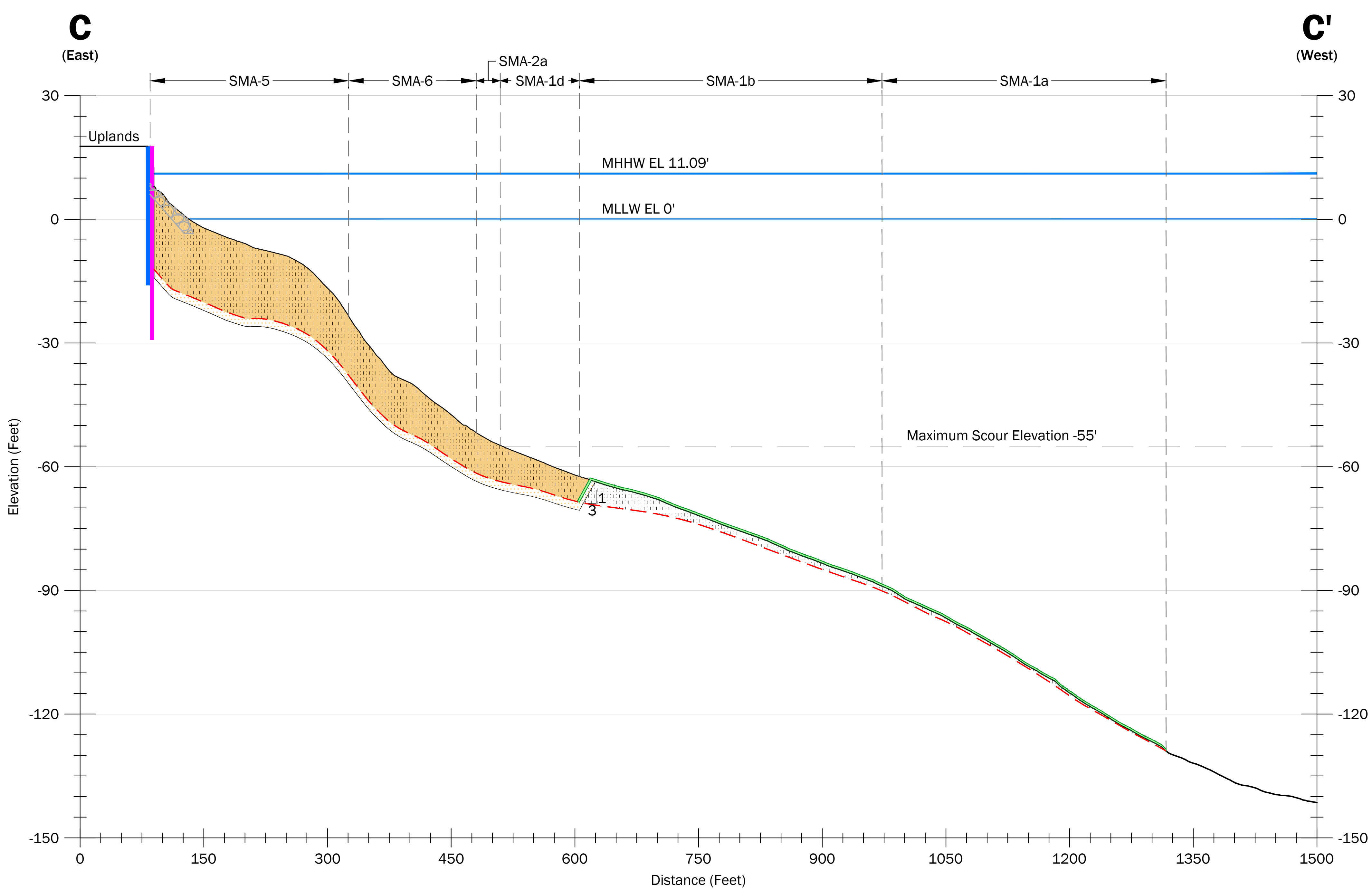
Alternative 5
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 99

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F099_Cross Section B - B' [Alt 5].dwg 99 Section B [Alternative 5] Date Exported:12/12/2023 9:48 AM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Upland Retaining Wall[2]

Alternative 5 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area..

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

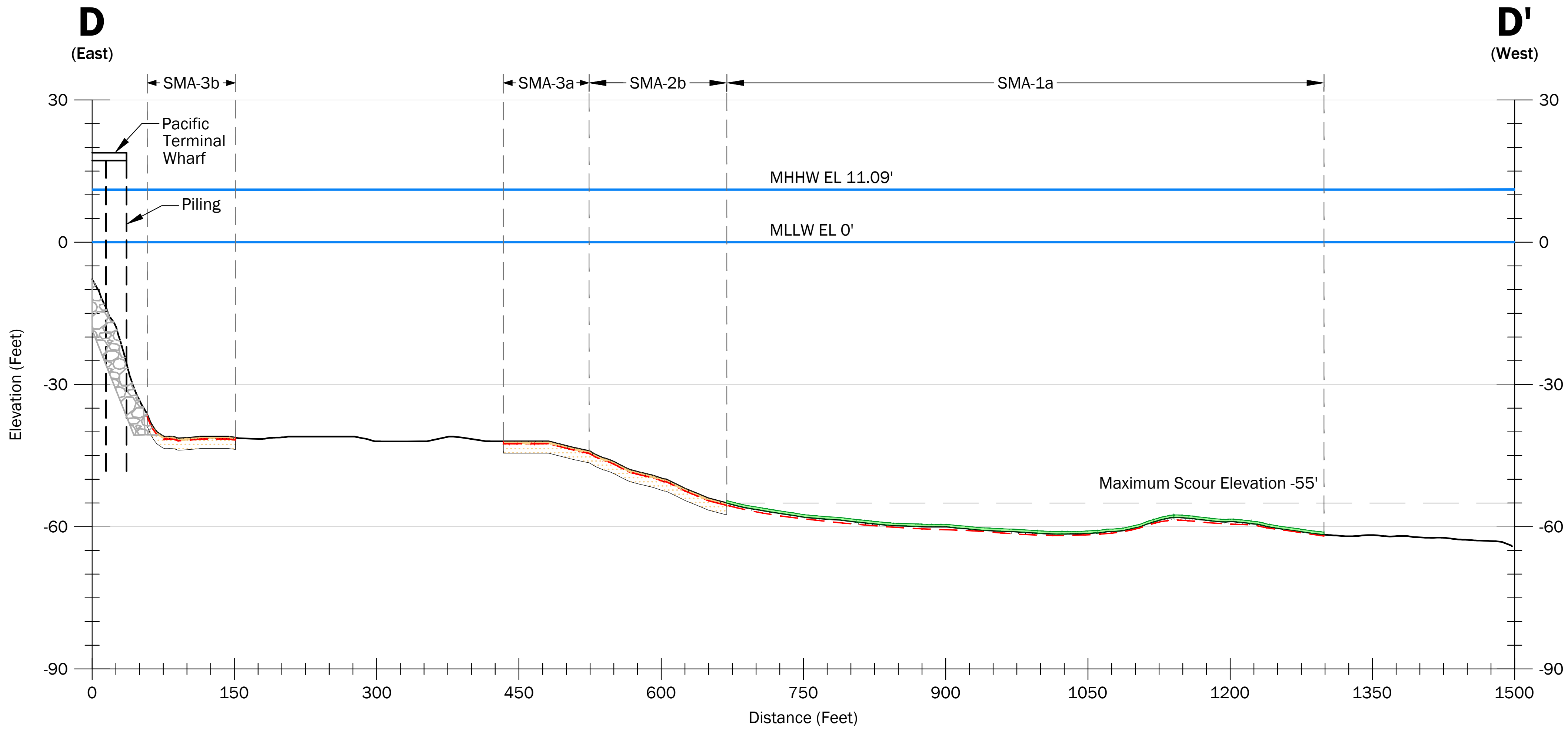
Alternative 5
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 100

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F100_Cross Section C - C' [Alt 5].dwg 100 Section C [Alternative 5] Date Exported:12/12/2023 9:49 AM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance

Alternative 5 Notes:

1. A summary of remedial alternative components is presented in the figure. Refer to the FS report for the detailed description of remedial alternative components.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

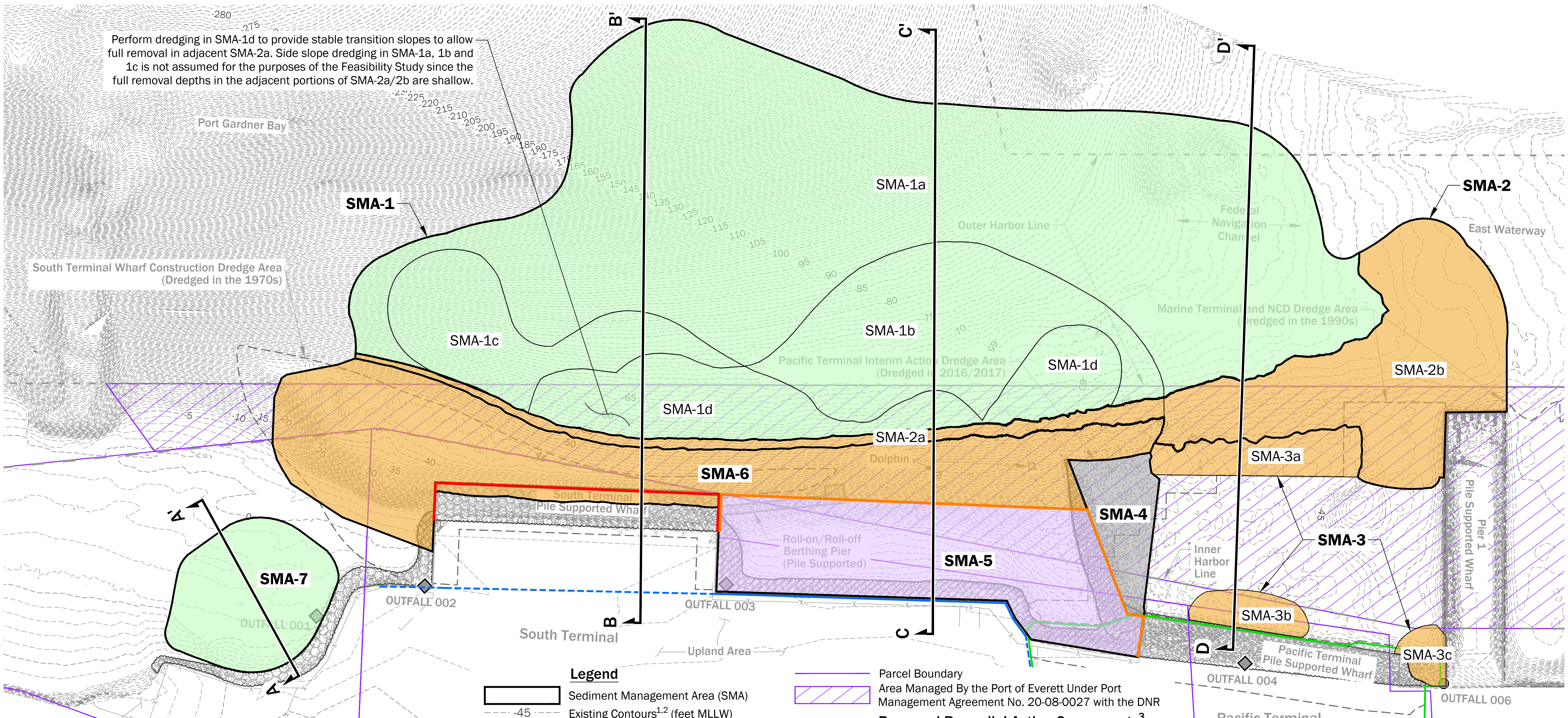
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 5
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 101



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Monitored Natural Recovery (MNR)
- 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
- South Terminal Toe Wall
- Containment/CDF Wall

250 0 250
Feet

W N S E

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

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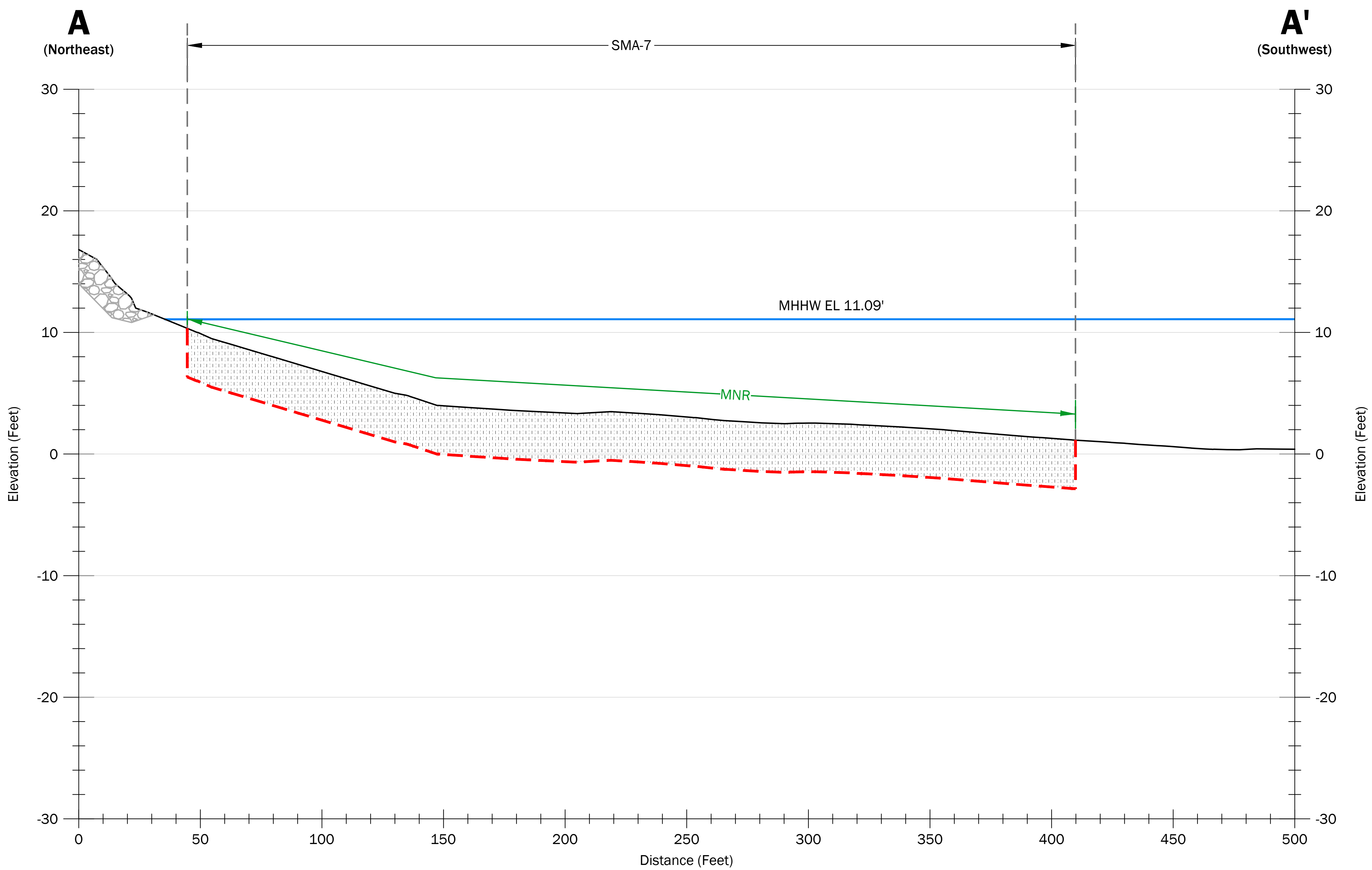
Alternative 6

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 102



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

MNR Monitored Natural Recovery

Alternative 6 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

50 0 50
Horizontal Scale in Feet

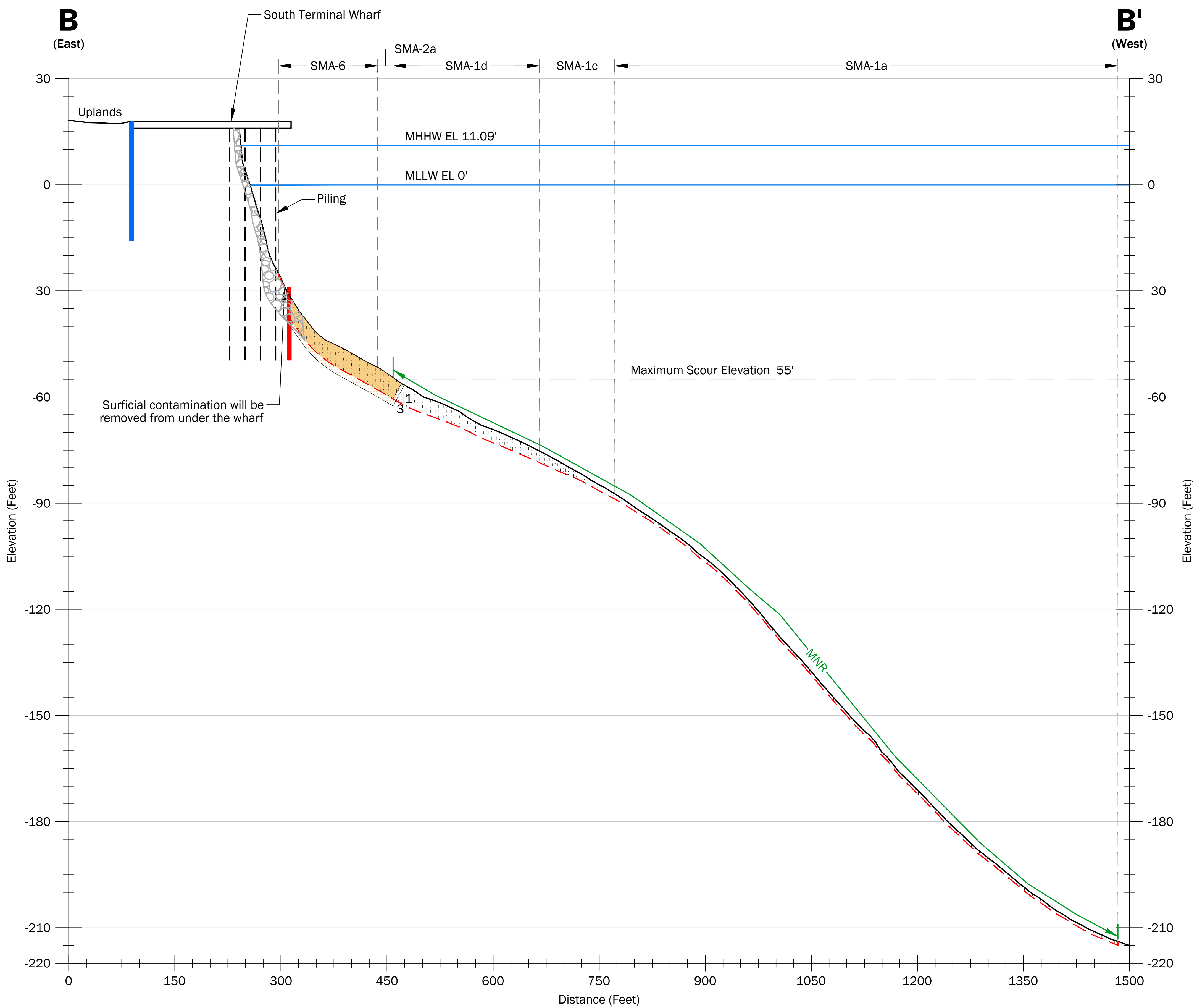
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 6
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 103



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 6 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

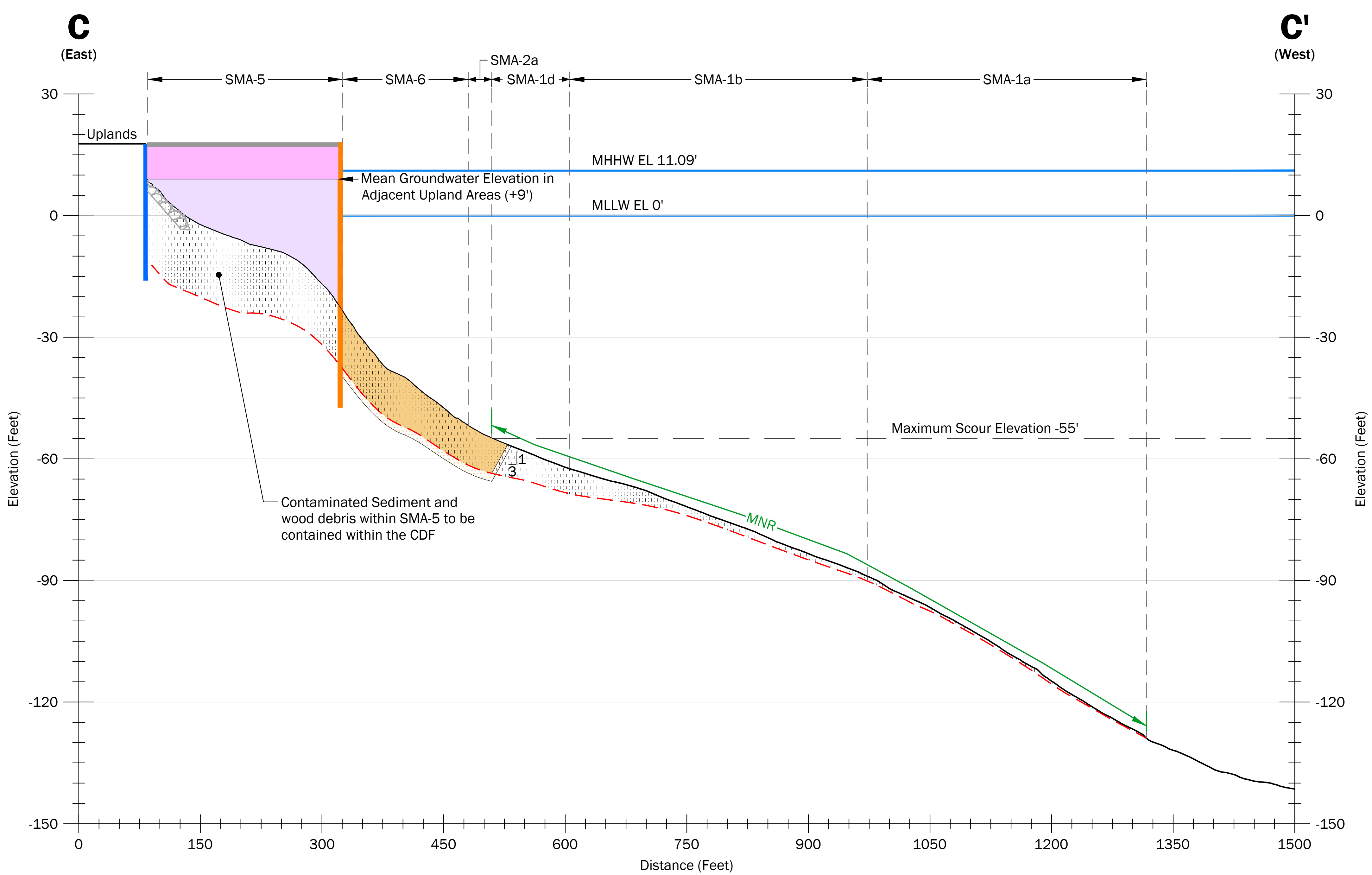
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 6
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 104



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

Bulkhead (Depth Unknown)

EL Elevation

MHHW Mean Higher High Water

MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

MNR Monitored Natural Recovery

Full Removal of Contaminated Sediment and Wood Debris

2-Foot Overdredge Allowance

Containment/CDF Wall[2]

Contaminated Dredged Material Fill

Imported Fill Material

Asphalt Surface with Stormwater Management System

Alternative 6 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

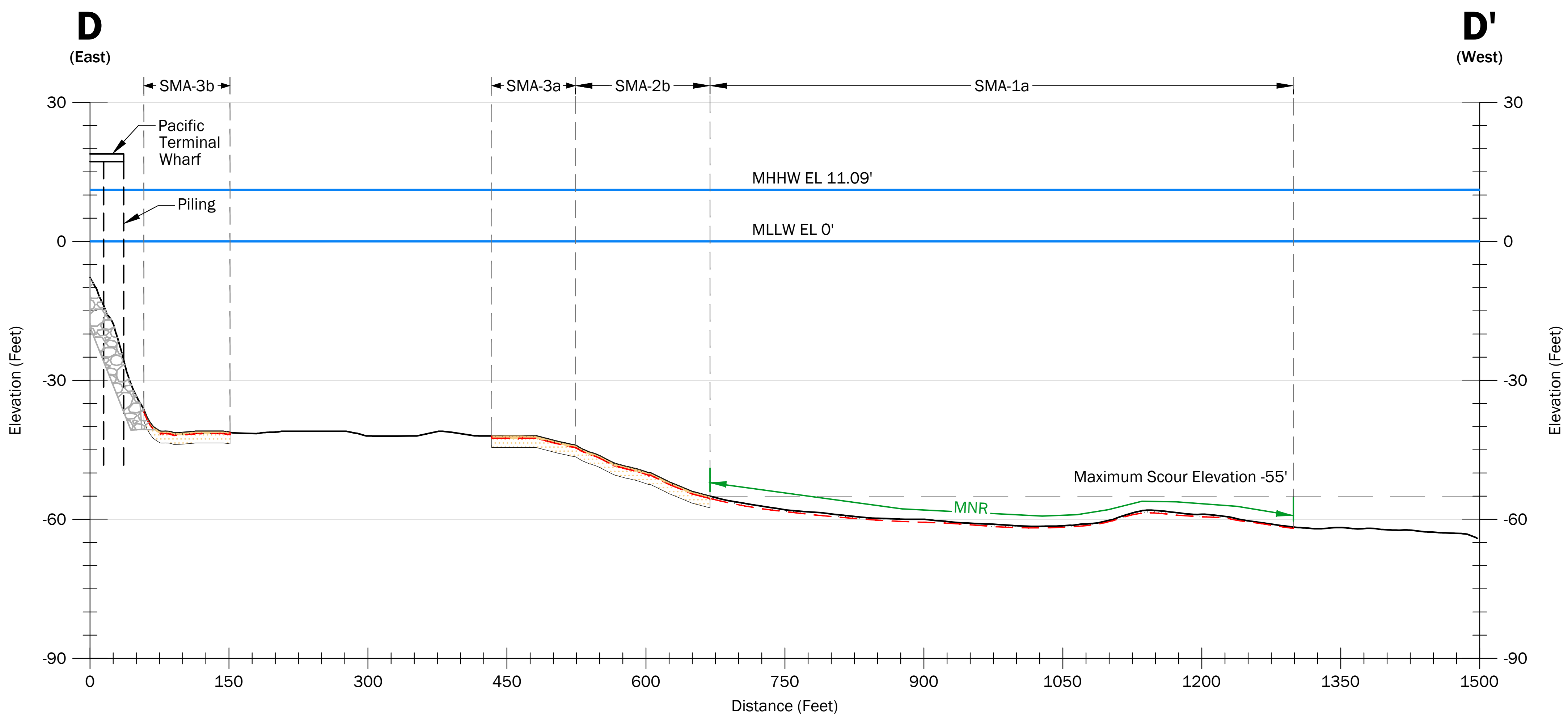
Alternative 6
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 105

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F105_Cross Section C - C' [Alt 6].dwg 105 Section C [Alternative 6] Date Exported:12/12/2023 9:50 AM - by Chad Stickel



Legend

Existing Mudline
Estimated Contamination Depth (feet below mudline)
Contaminated Sediment and/or Wood Debris
Approximate Shoreline Slope Armor (Rip-Rap)
EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

MNR Monitored Natural Recovery
Full Removal of Contaminated Sediment and Wood Debris
2-Foot Overdredge Allowance

Alternative 6 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

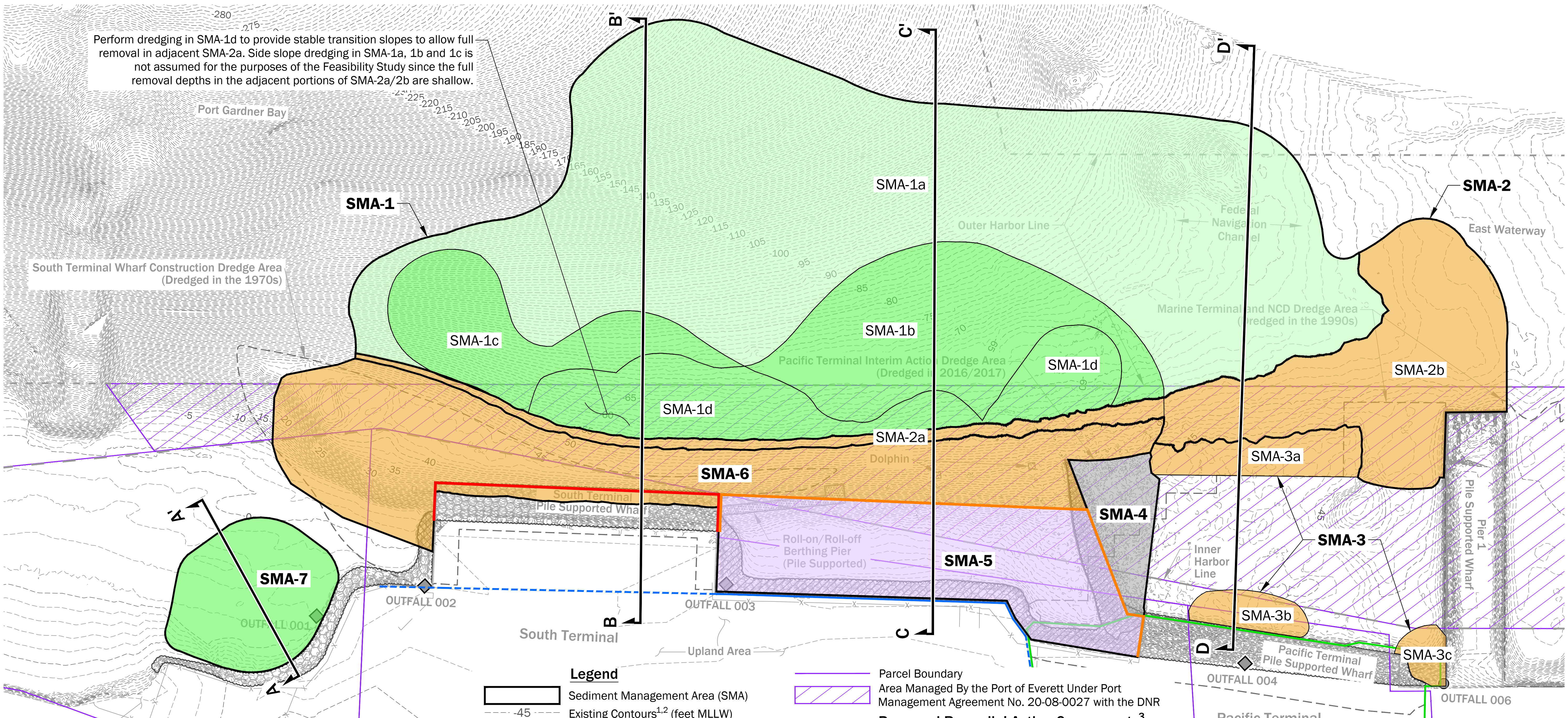
Alternative 6
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 106

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F106_Cross Section D - D' [Alt 6].dwg 106 Section D [Alternative 6] Date Exported:12/12/2023 9:50 AM - 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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Enhanced Natural Recovery (ENR)
- Monitored Natural Recovery (MNR)
- 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
- South Terminal Toe Wall
- Containment/CDF Wall

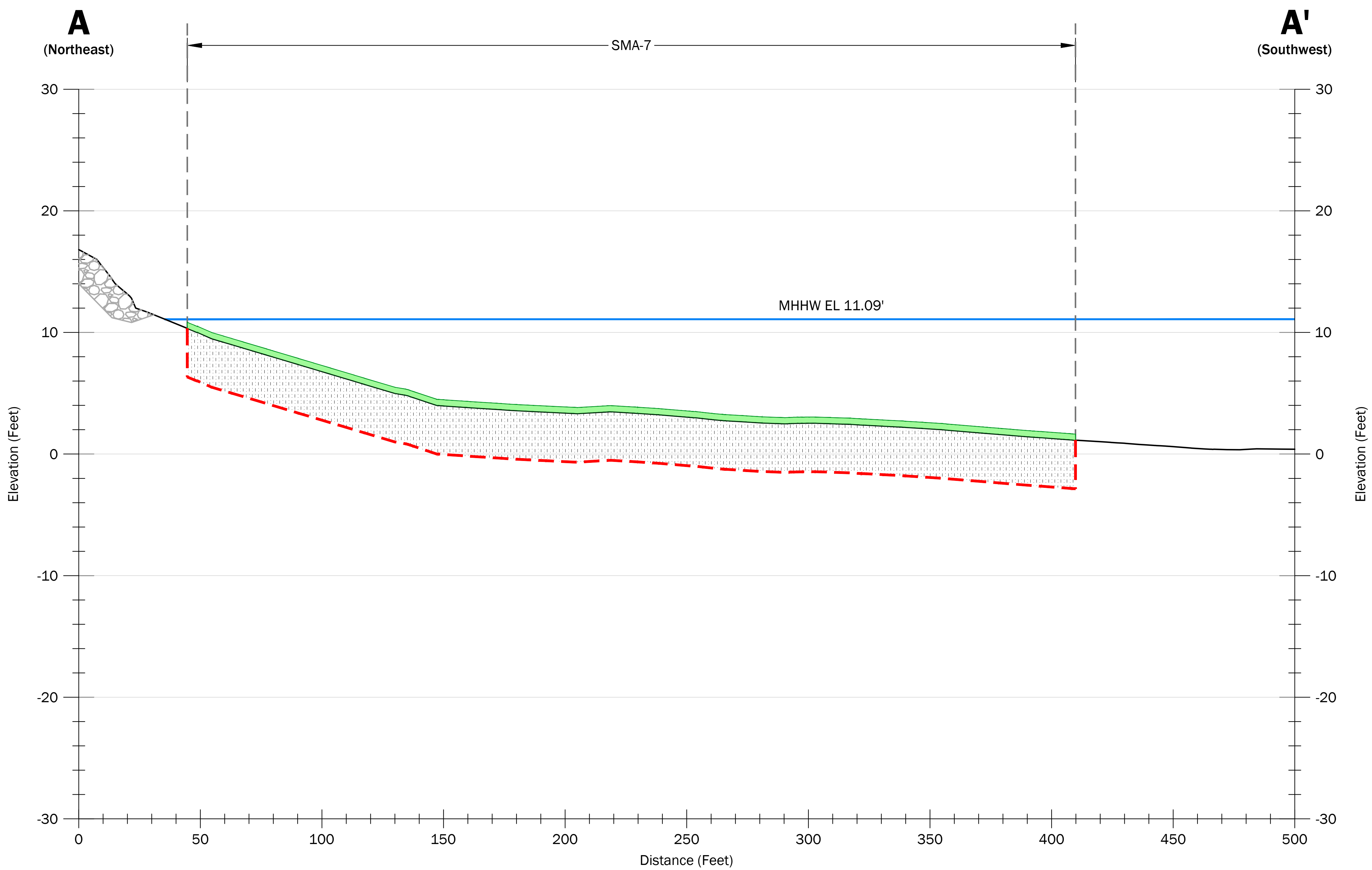
250 0 250
Feet

Alternative 7

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 107



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- EL Elevation
- MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery

Alternative 7 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

50 0 50
Horizontal Scale in Feet

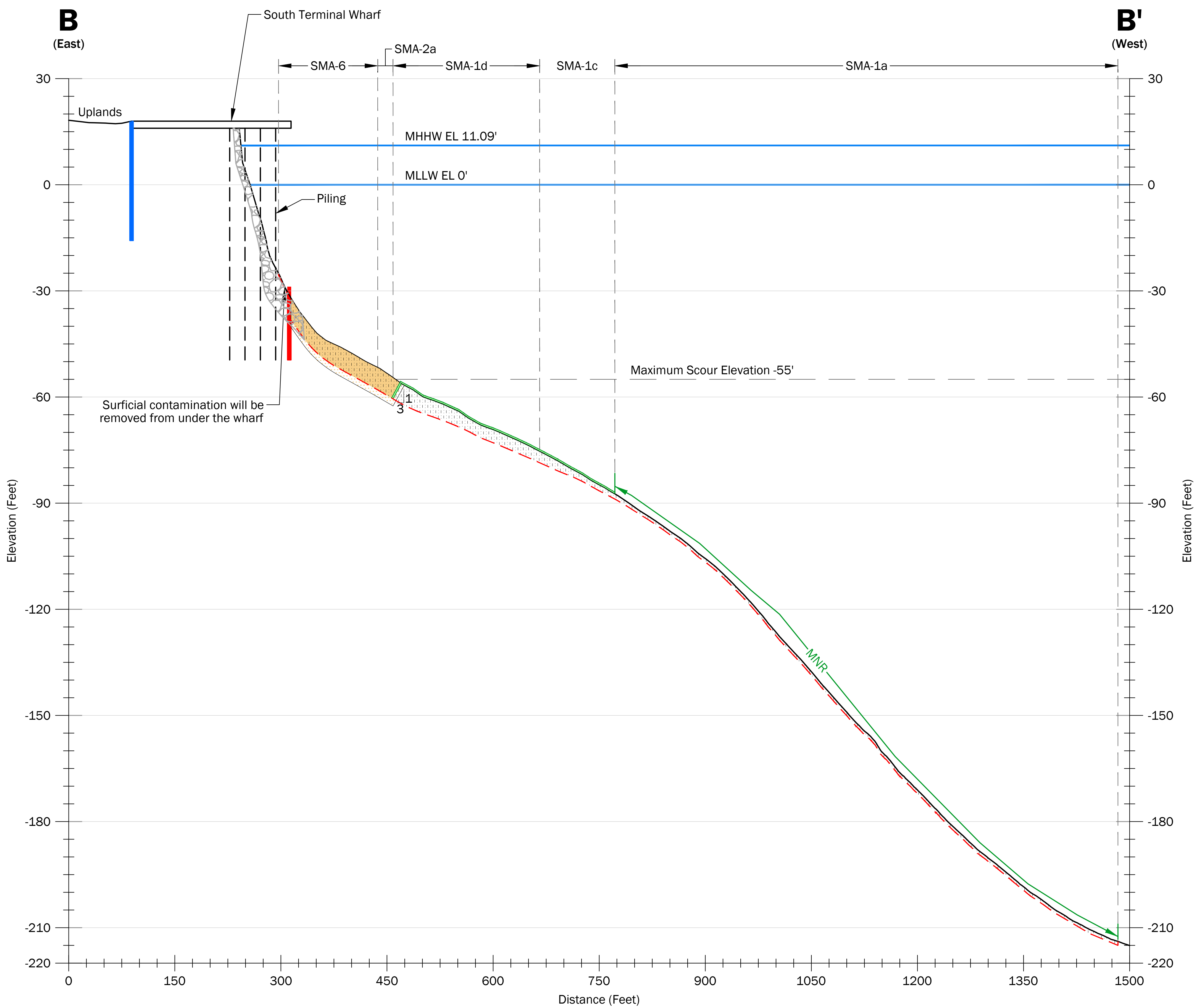
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 7
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 108



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 7 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

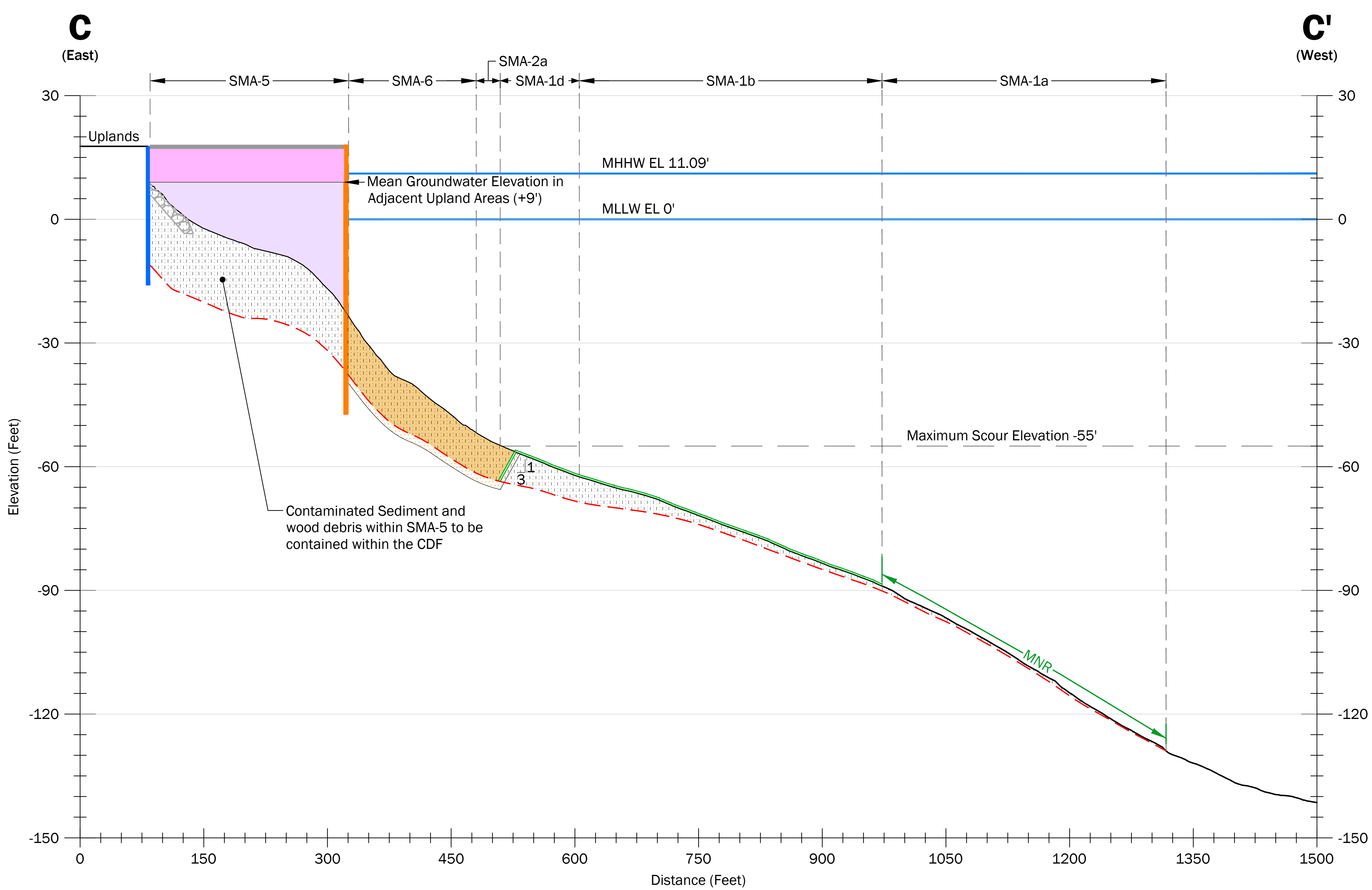
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 7
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 109



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)
- EL Elevation
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Containment/CDF Wall[2]
- Contaminated Dredged Material Fill
- Imported Fill Material
- Asphalt Surface with Stormwater Management System

Alternative 7 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

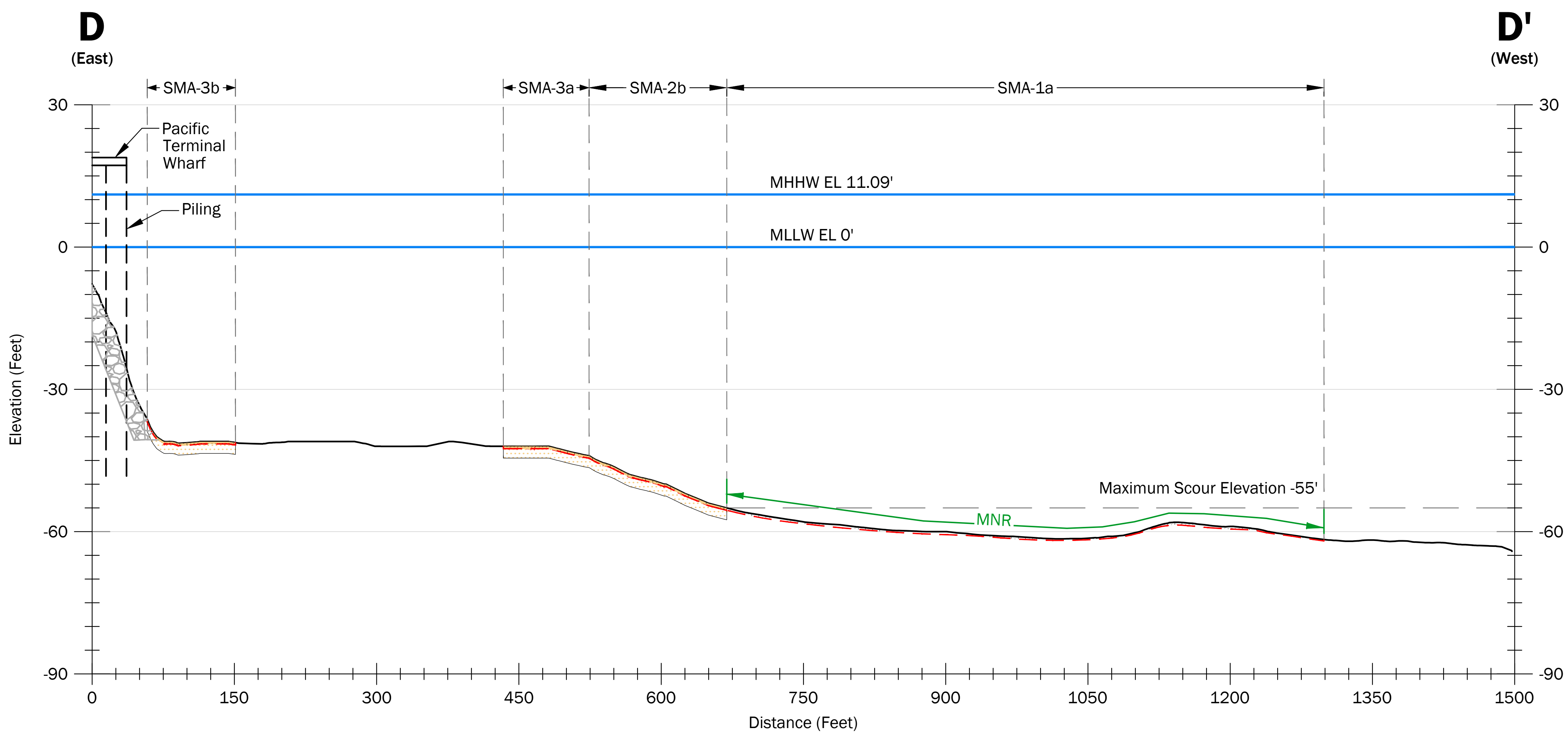
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 7
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 110



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

MNR Monitored Natural Recovery

Full Removal of Contaminated Sediment and Wood Debris

2-Foot Overdredge Allowance

Alternative 7 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

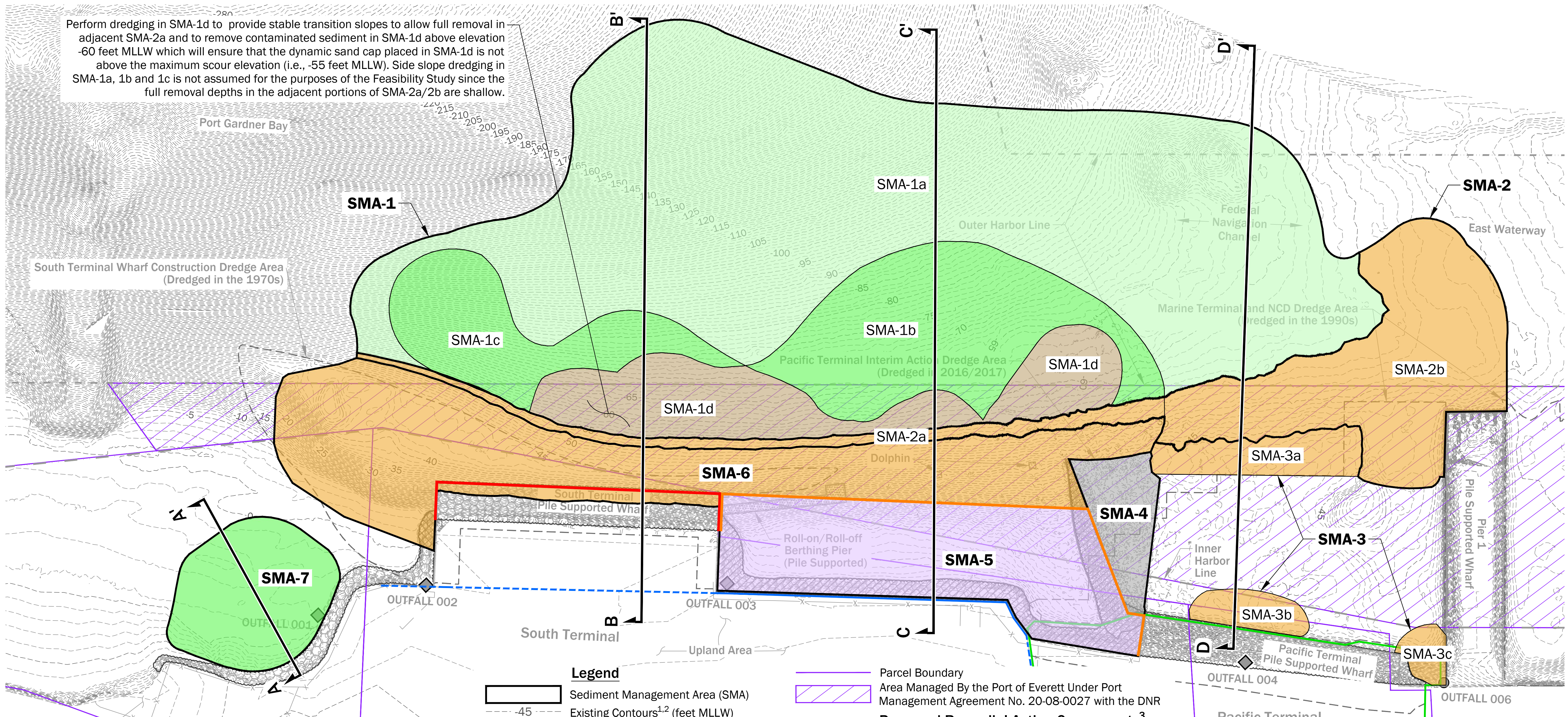
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 7
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 111



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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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Dynamic Sand Cap
- Enhanced Natural Recovery (ENR)
- Monitored Natural Recovery (MNR)
- 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
- South Terminal Toe Wall
- Containment/CDF Wall

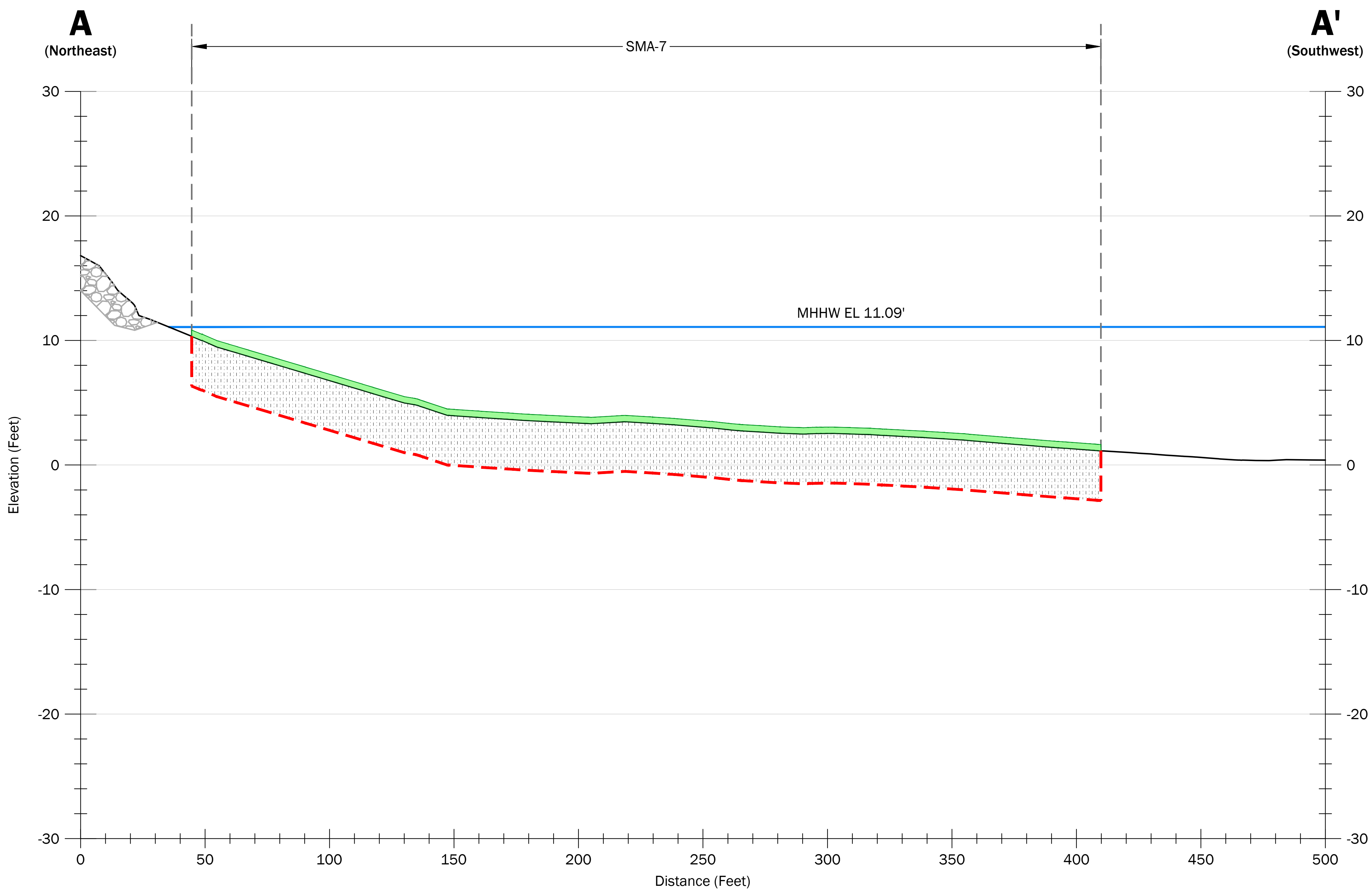
250 0 250
Feet

Alternative 8

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 112



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

Enhanced Natural Recovery

Alternative 8 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

50 0 50
Horizontal Scale in Feet

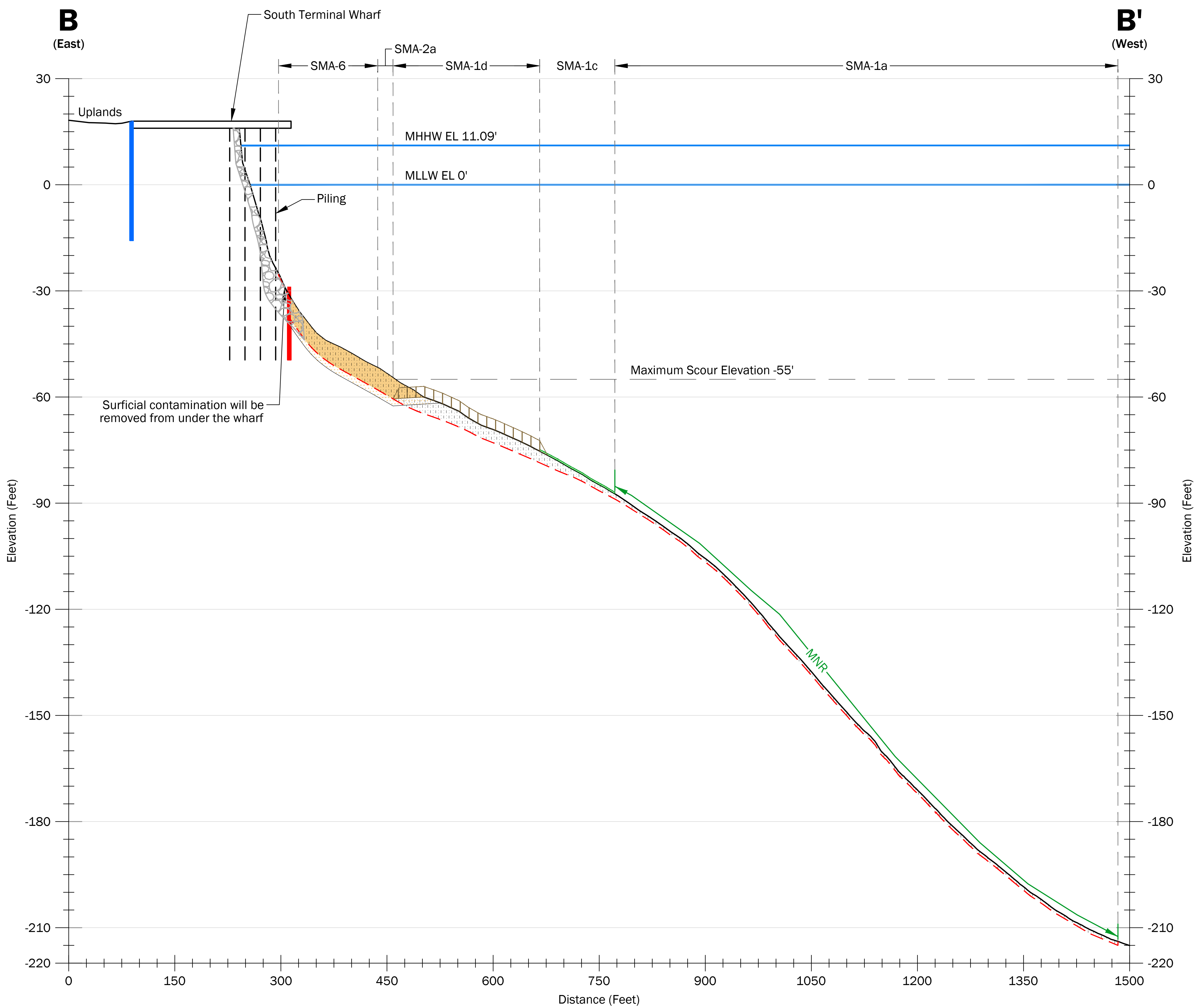
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 8
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 113



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Dynamic Sand Cap
- South Terminal Toe Wall[2]

Alternative 8 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

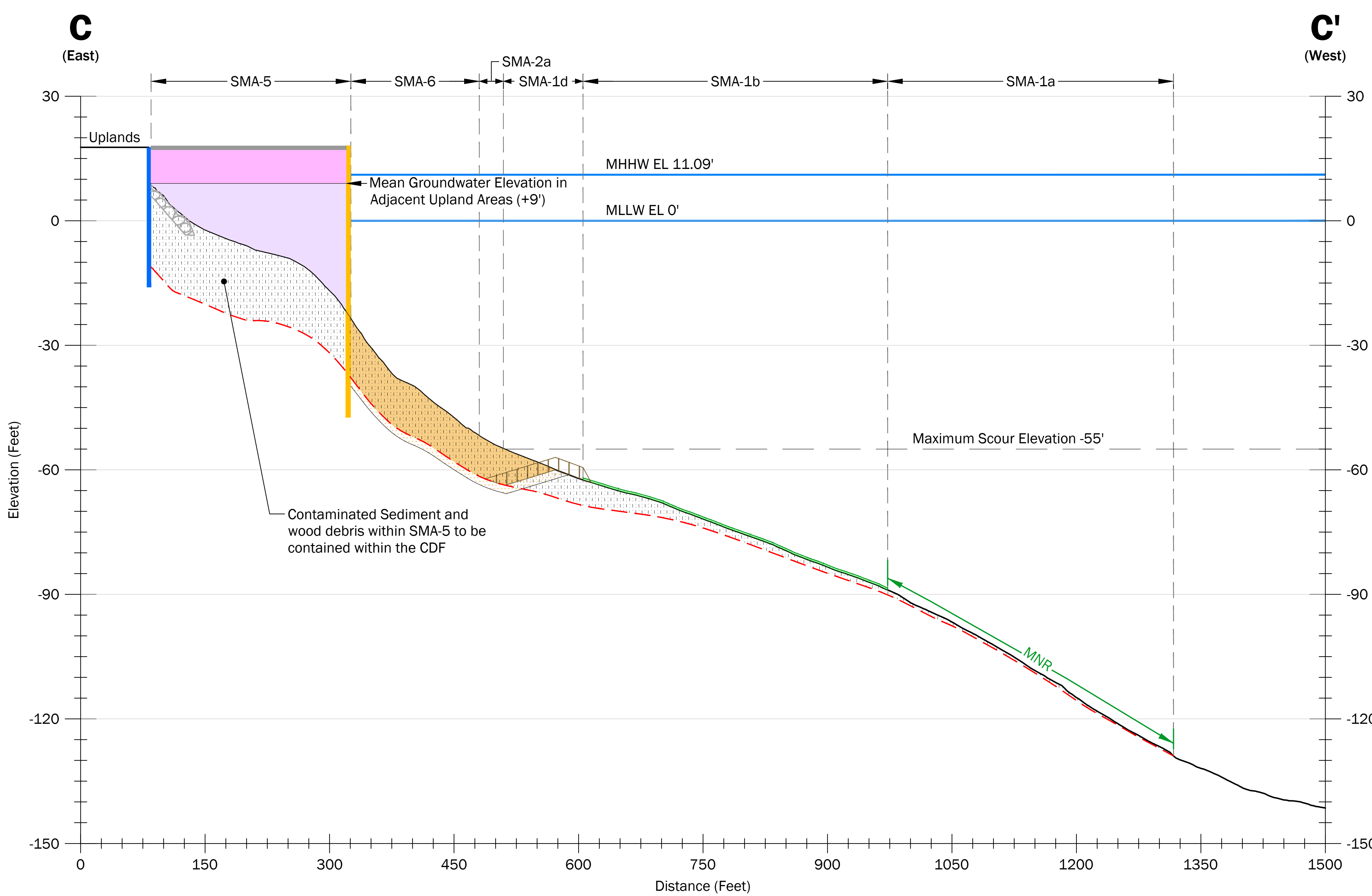
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 8
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 114



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)
- EL Elevation
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Dynamic Sand Cap
- Containment/CDF Wall[2]
- Contaminated Dredged Material Fill
- Imported Fill Material
- Asphalt Surface with Stormwater Management System

Alternative 8 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

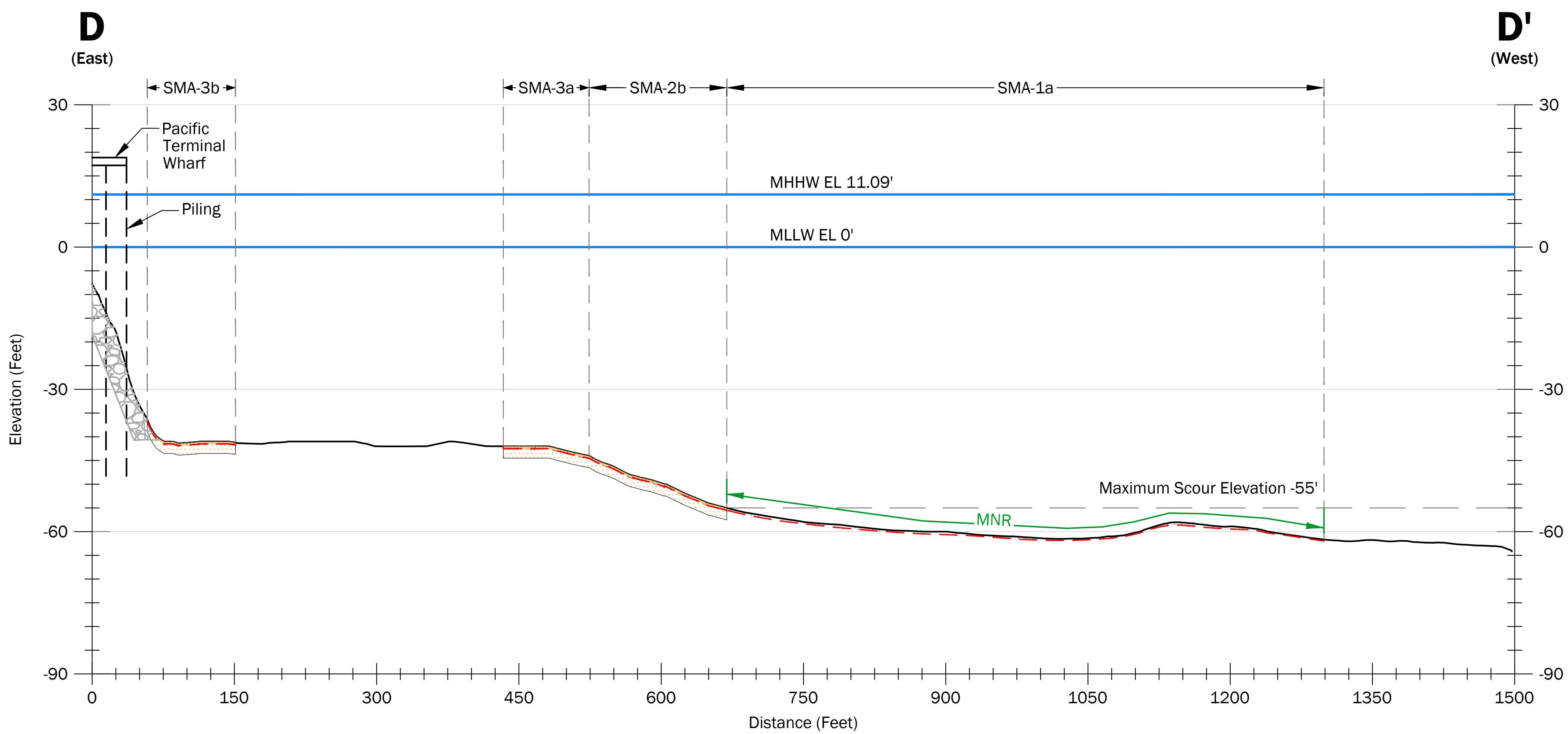
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 8
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 115



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance

Alternative 8 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

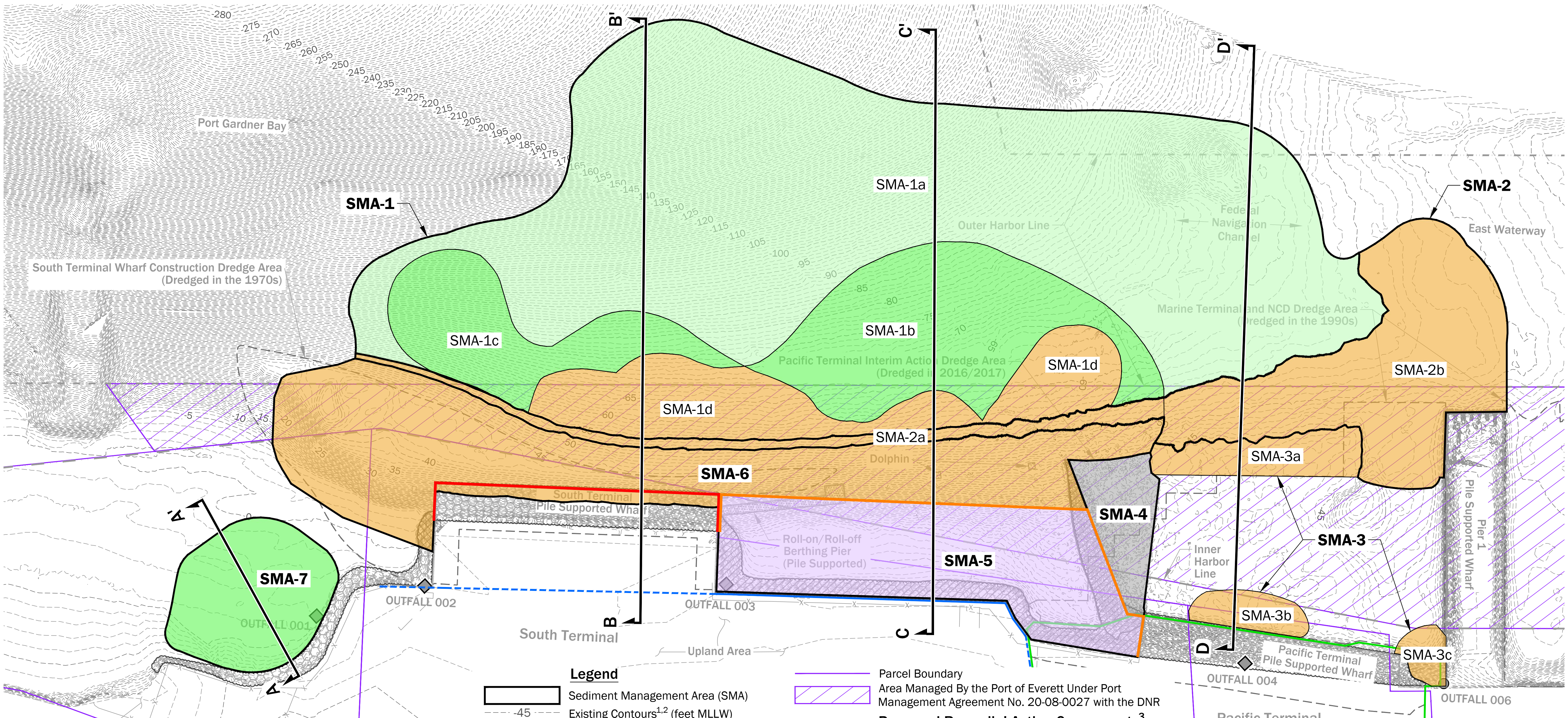
Alternative 8
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 116

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F116_Cross Section D - D' [Alt 8].dwg 116 Section D [Alternative 8] Date Exported:12/12/2023 9:54 AM - by Chad Stickel



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Enhanced Natural Recovery (ENR)
- Monitored Natural Recovery (MNR)
- 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
- South Terminal Toe Wall
- Containment/CDF Wall

250 0 250
Feet

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

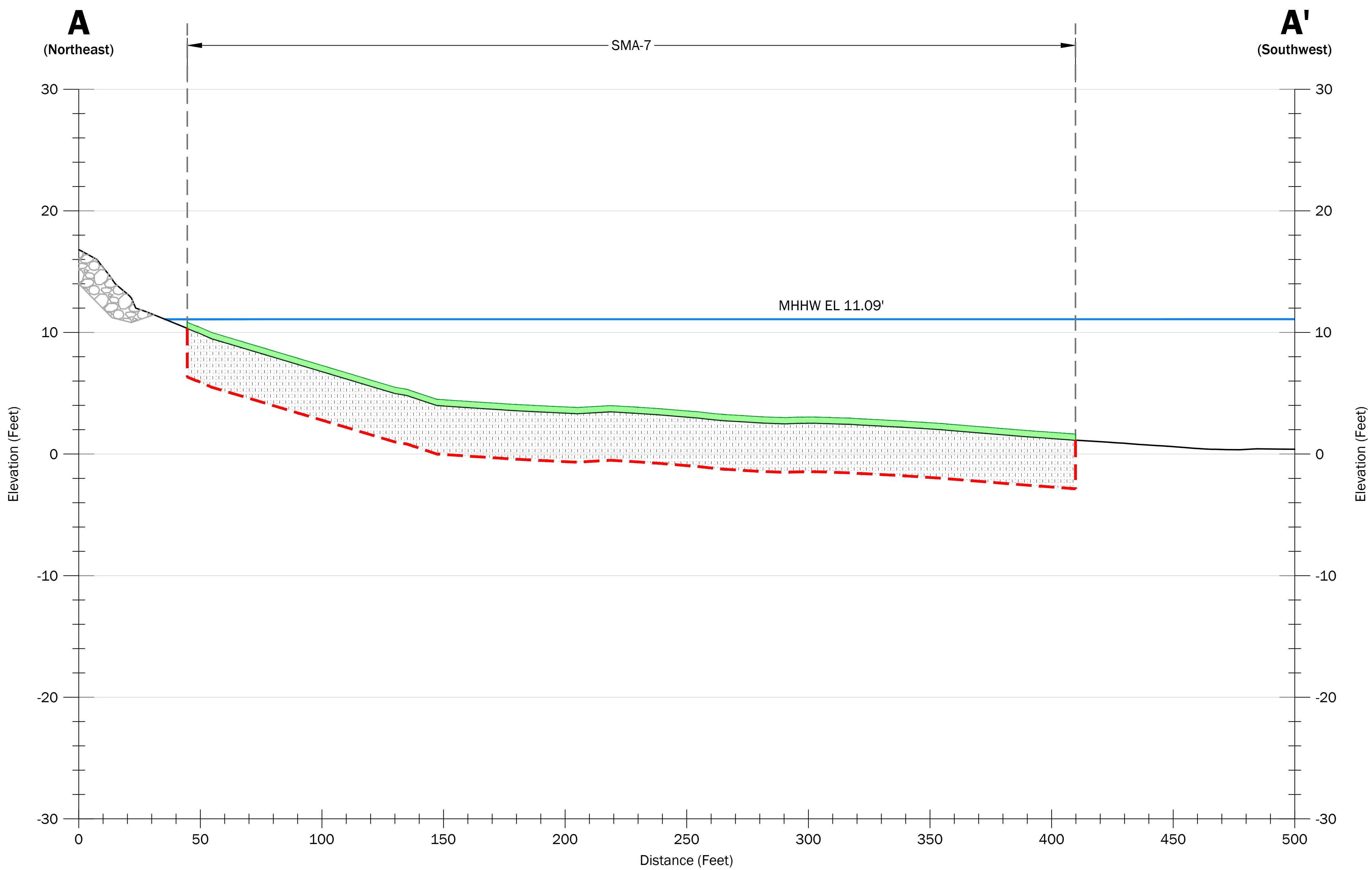
Alternative 9

Weyerhaeuser Mill A Former
Everett, Washington

GEOENGINEERS

Figure 117

P:\0\0676020\CAD\07\Task 1500-02 (RI-FS)\067602007_F117_Alternative 9.dwg F112 Date Exported:12/11/2023 10:14 PM - by Chad Stickel



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

Enhanced Natural Recovery

Alternative 9 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

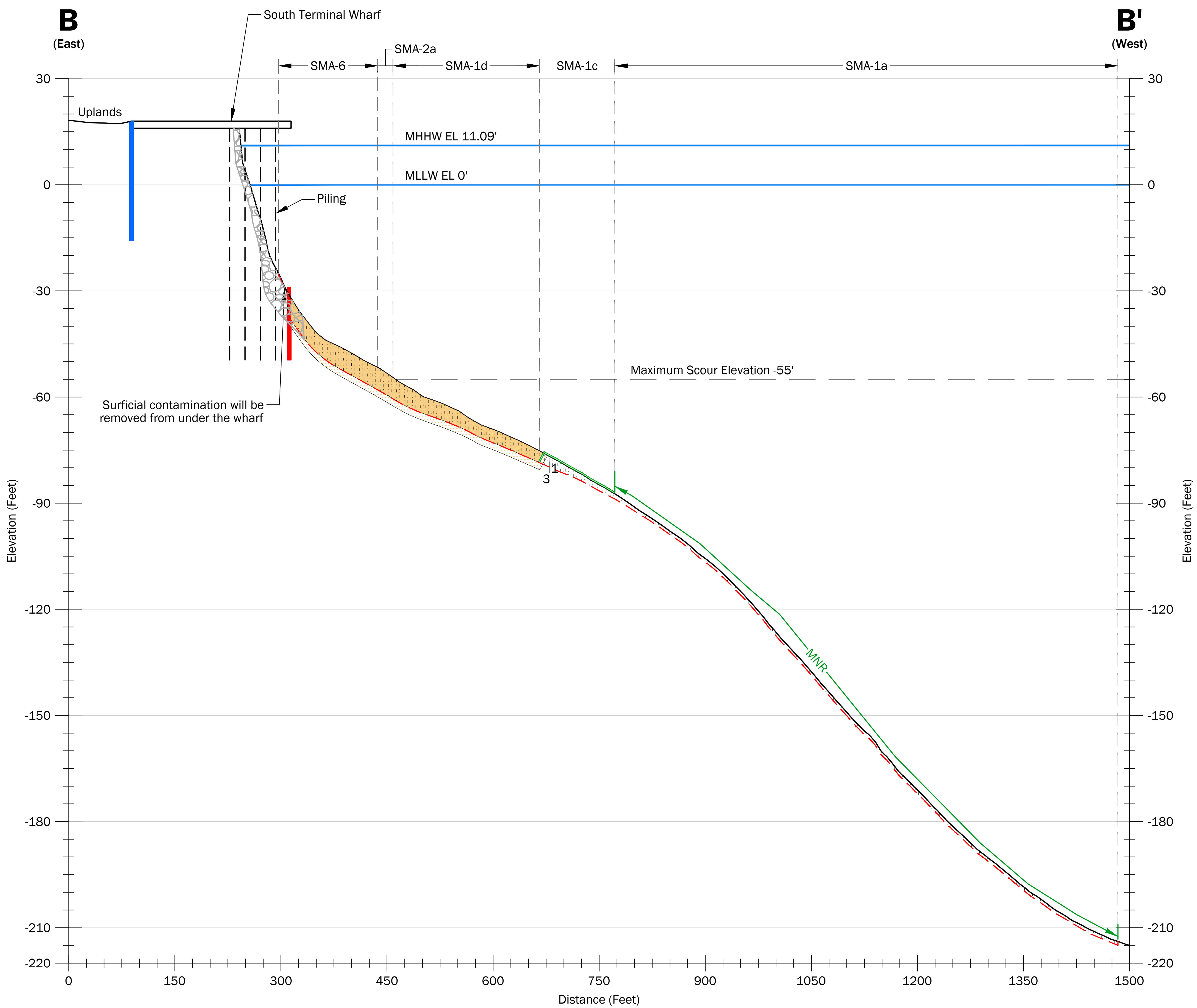
50 0 50
Horizontal Scale in Feet
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 9
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 118



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 9 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

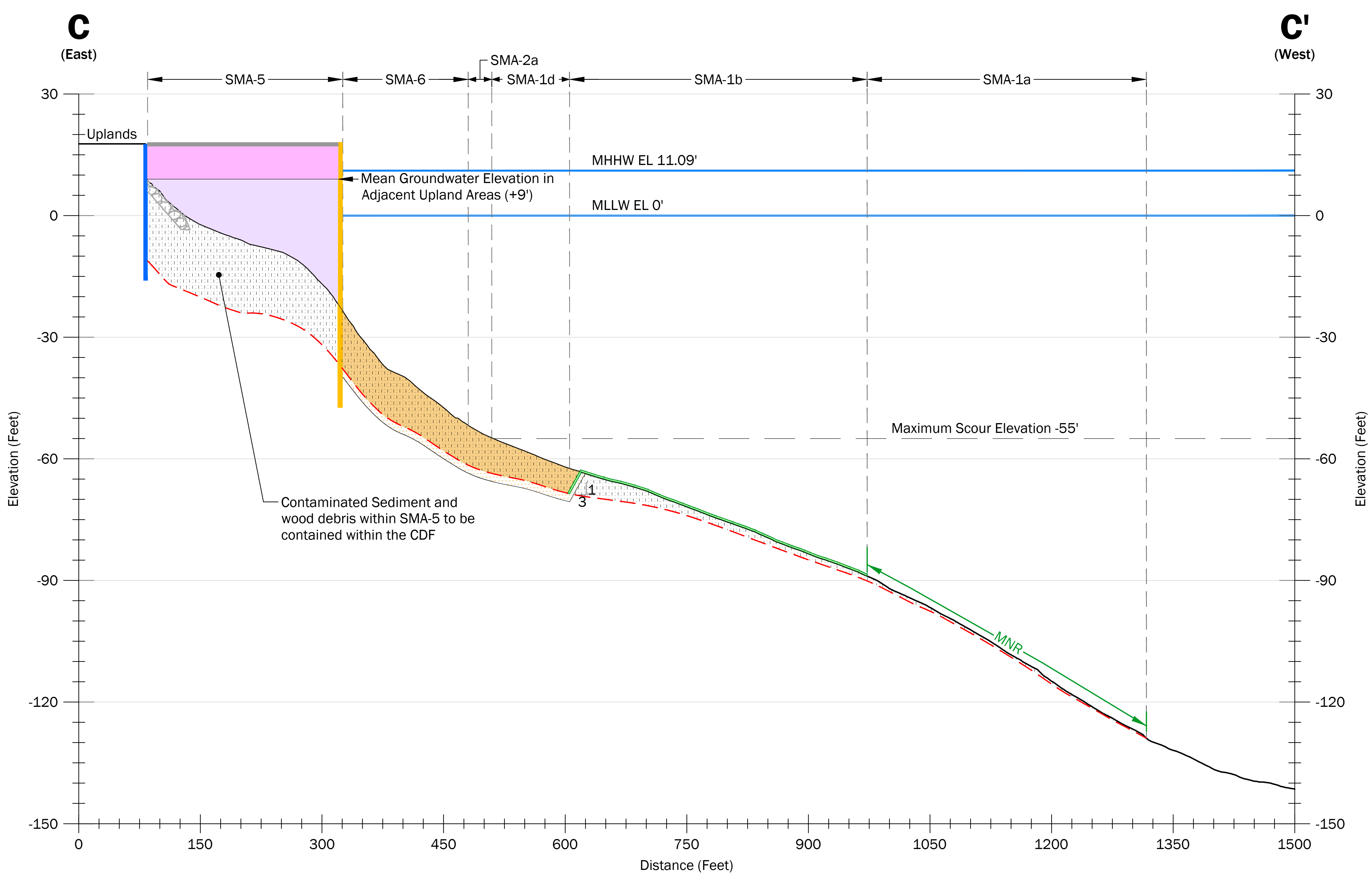
Alternative 9
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 119

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F119_Cross Section B - B' [Alt 9].dwg 119 Section B [Alternative 9] Date Exported:12/12/2023 9:55 AM - by Chad Stickel



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)
- EL Elevation
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR Monitored Natural Recovery
- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Containment/CDF Wall[2]
- Contaminated Dredged Material Fill
- Imported Fill Material
- Asphalt Surface with Stormwater Management System

Alternative 9 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

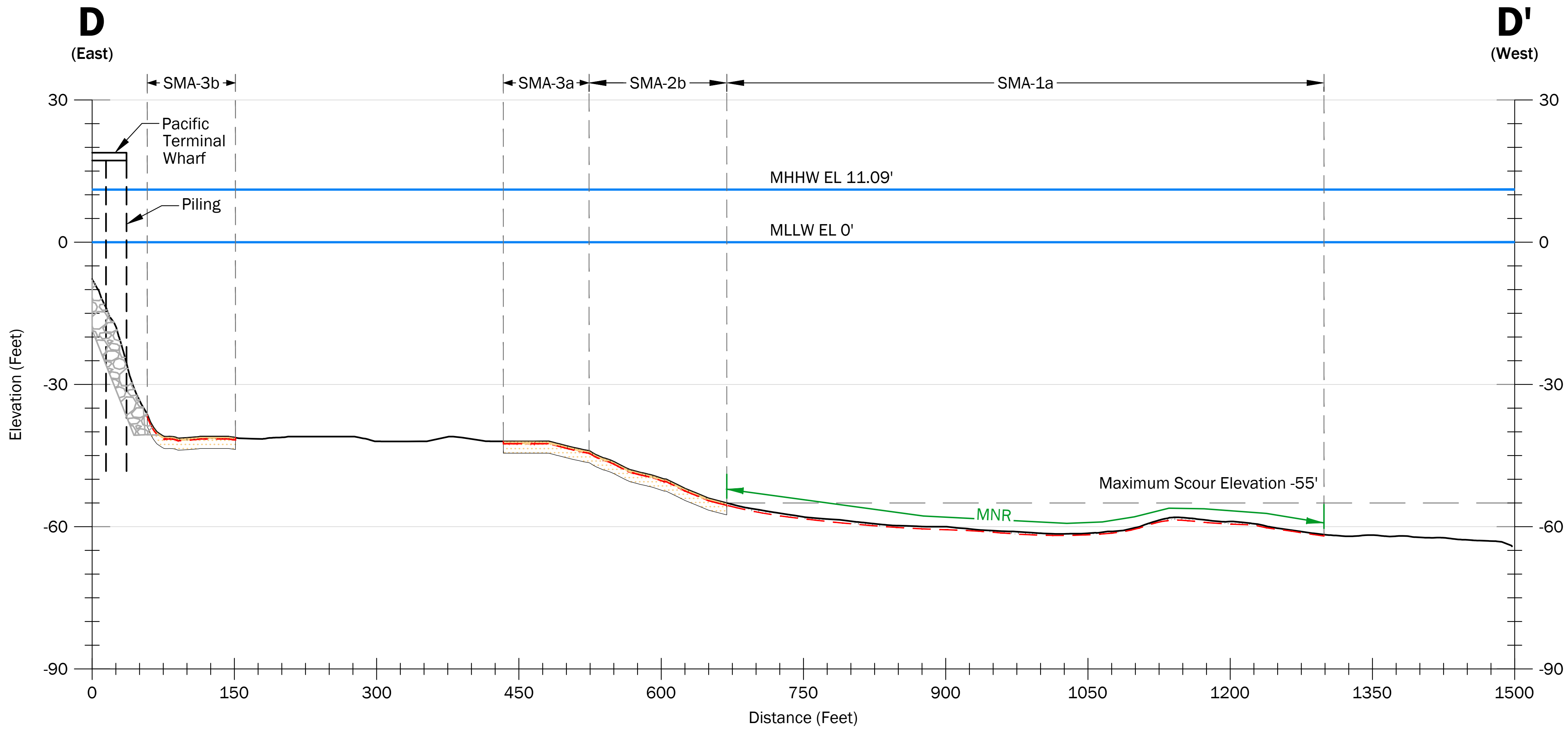
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 9
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 120



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- MNR — Monitored Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance

Alternative 9 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

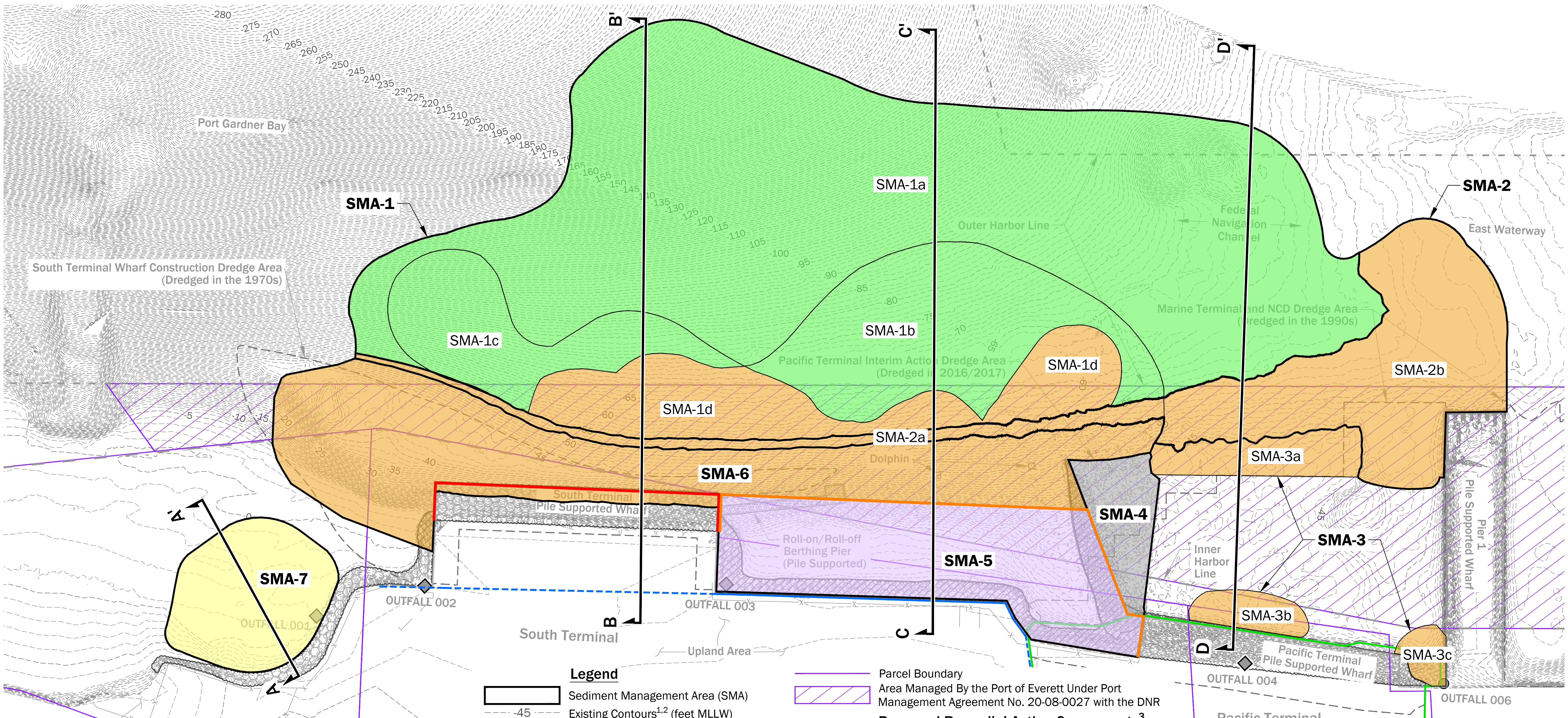
Alternative 9
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 121

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F121_Cross Section D - D' [Alt 9].dwg 121 Section D [Alternative 9] Date Exported:12/12/2023 9:55 AM - by Chad Stickel



Legend

- Sediment Management Area (SMA)
- -45 Existing Contours[1,2] (feet MLLW)
- MLLW Mean Lower Low Water
- MHHW Mean Higher High Water
- Outer Harbor Line
- Inner Harbor Line
- Bulkhead (Dashed where Buried)
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Fence
- Previously Dredged Areas
- Areas of Known Armoring
- Current Combined Sewer Outfall (SCO)
- Current Stormwater Outfall
- A A' Cross Section Location
- Parcel Boundary
- Area Managed By the Port of Everett Under Port Management Agreement No. 20-08-0027 with the DNR

Proposed Remedial Action Components[3]

- Full Removal of Contaminated Sediment and/or Wood Debris
- Full Removal and Backfill
- Enhanced Natural Recovery (ENR)
- 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
- South Terminal Toe Wall
- Containment/CDF Wall

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. Upland contours are based on surface elevations obtained at the upland boring locations as part of the RI.
3. A summary of remedial action components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
4. The locations of all features shown are approximate.
5. 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

250 0 250
Feet

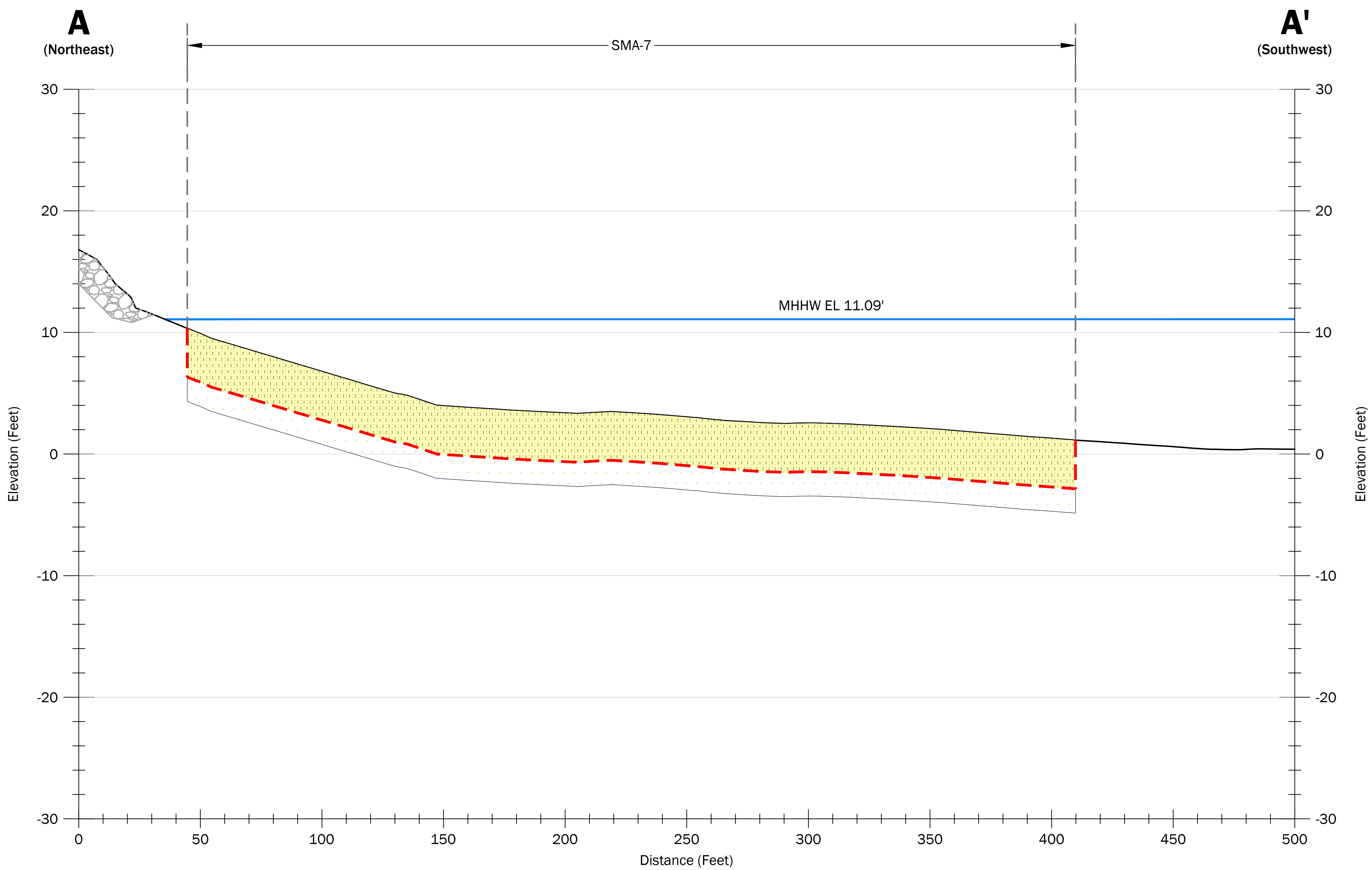
Alternative 10

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 122

P:\0\0676020\CAD\07\Task 1500-02 (RI-FS)\067602007_F122_Alternative 10.dwg F112 Date Exported:12/11/2023 10:24 PM - by Chad Stickel



Legend

Existing Mudline

Estimated Contamination Depth (feet below mudline)

Contaminated Sediment and/or Wood Debris

Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation

MHHW Mean Higher High Water

Proposed Remedial Alternative Components[1]

Full Removal and Backfill

2-Foot Overdredge Allowance

Alternative 10 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

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.

50 0 50
Horizontal Scale in Feet

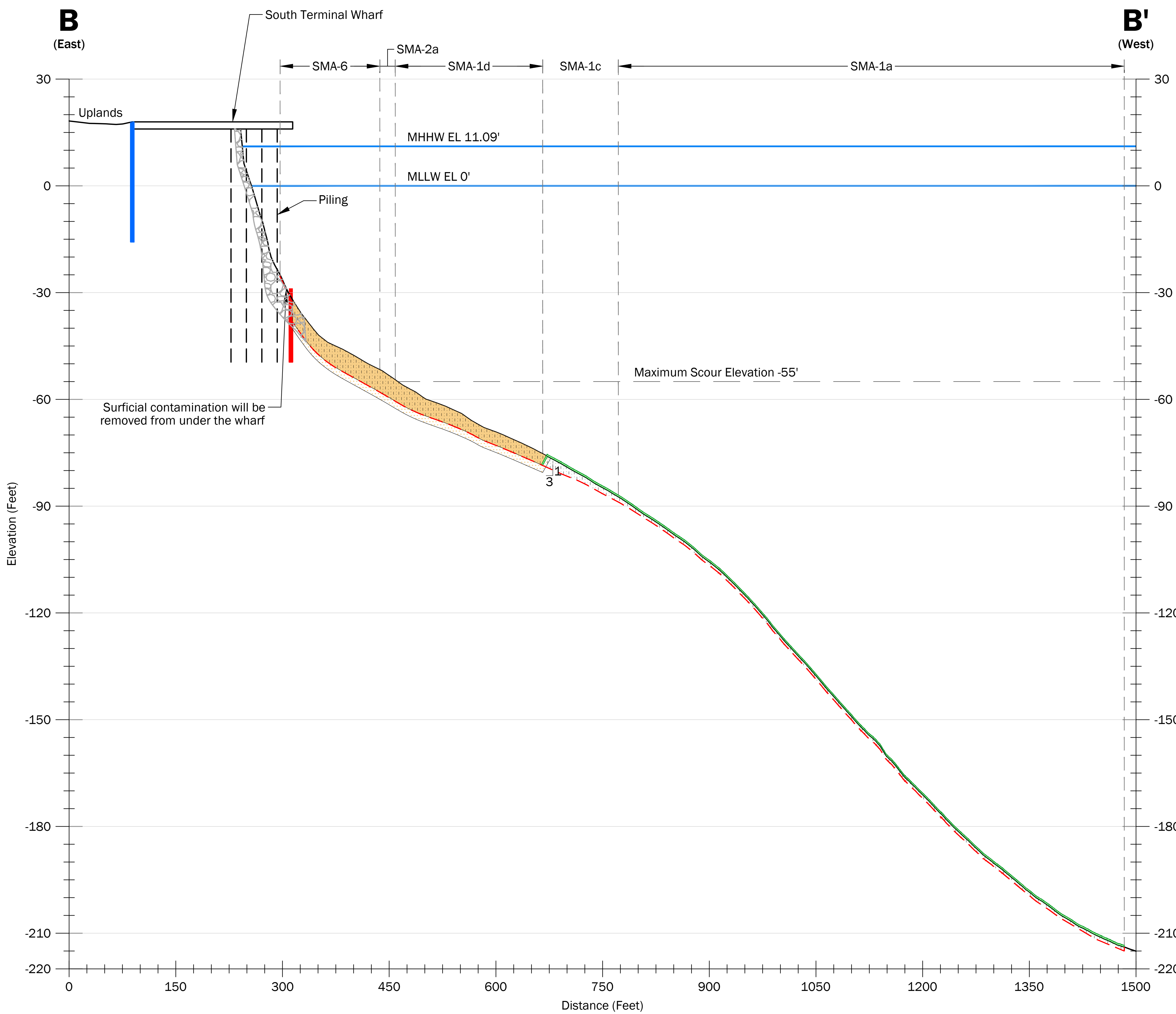
10 0 10
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 10
Cross Section A - A'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 123



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- South Terminal Toe Wall[2]

Alternative 10 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent armored slopes.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

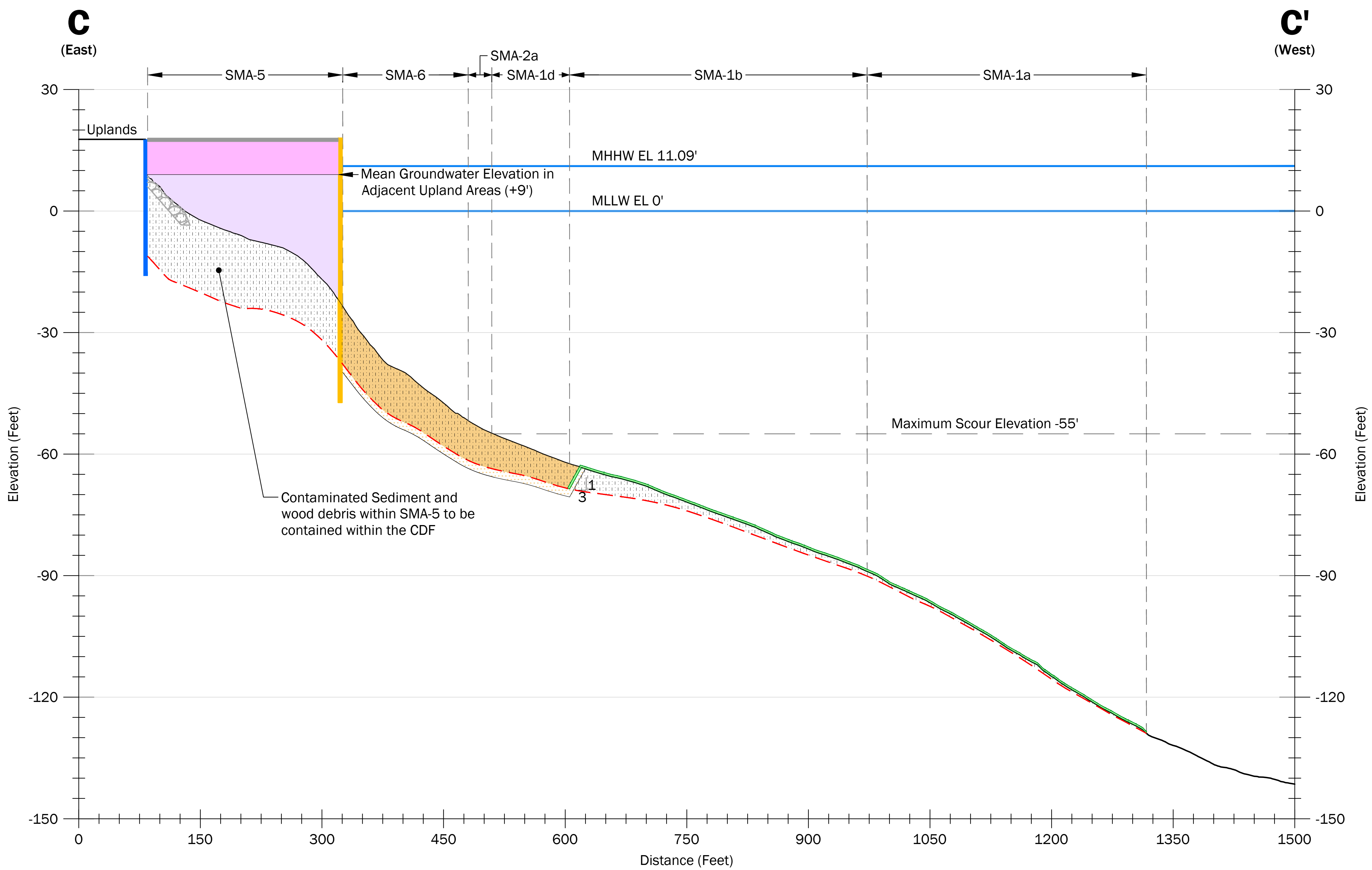
150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 10
Cross Section B - B'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 124



Legend

- Existing Mudline
- Estimated Contamination Depth (feet below mudline)
- Contaminated Sediment and/or Wood Debris
- Approximate Shoreline Slope Armor (Rip-Rap)
- Bulkhead (Depth Unknown)
- EL Elevation
- MHHW Mean Higher High Water
- MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

- Enhanced Natural Recovery
- Full Removal of Contaminated Sediment and Wood Debris
- 2-Foot Overdredge Allowance
- Containment/CDF Wall[2]
- Contaminated Dredged Material Fill
- Imported Fill Material
- Asphalt Surface with Stormwater Management System

Alternative 10 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.
2. The height and depth of the wall will be determined during remedial design. In general, the wall will be keyed into the native soil and will vertically extend upwards such that the top of the wall is at or above the surface elevations of the adjacent Upland area..

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet

30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

Alternative 10
Cross Section C - C'

Weyerhaeuser Mill A Former
Everett, Washington

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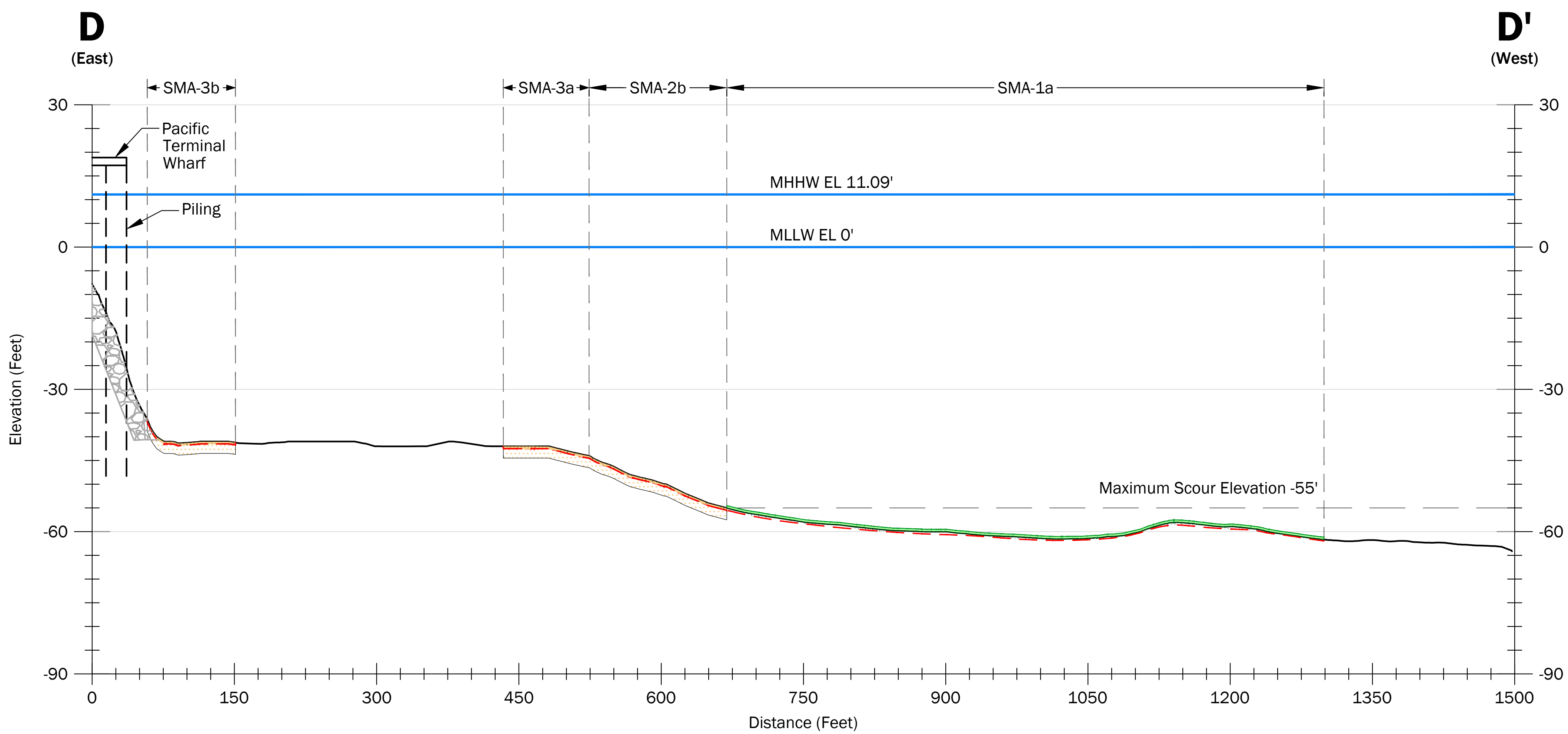
Figure 125

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F125_Cross Section C - C' [Alt 10].dwg 125 Section C [Alternative 10] Date Exported:12/12/2023 9:56 AM - by Chad Stickel



Legend

Existing Mudline
Estimated Contamination Depth (feet below mudline)
Contaminated Sediment and/or Wood Debris
Approximate Shoreline Slope Armor (Rip-Rap)

EL Elevation
MHHW Mean Higher High Water
MLLW Mean Lower Low Water

Proposed Remedial Alternative Components[1]

Enhanced Natural Recovery
Full Removal of Contaminated Sediment and Wood Debris
2-Foot Overdredge Allowance

Alternative 10 Notes:

1. A summary of remedial alternative components is presented in the figure. A detailed description of the remedial action components are presented in the Remedial Investigation/Feasibility Study (RI/FS) Report.

General Notes:

- The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: Mean Lower Low Water (MLLW)

150 0 150
Horizontal Scale in Feet
30 0 30
Vertical Scale in Feet
Vertical Exaggeration = 5X

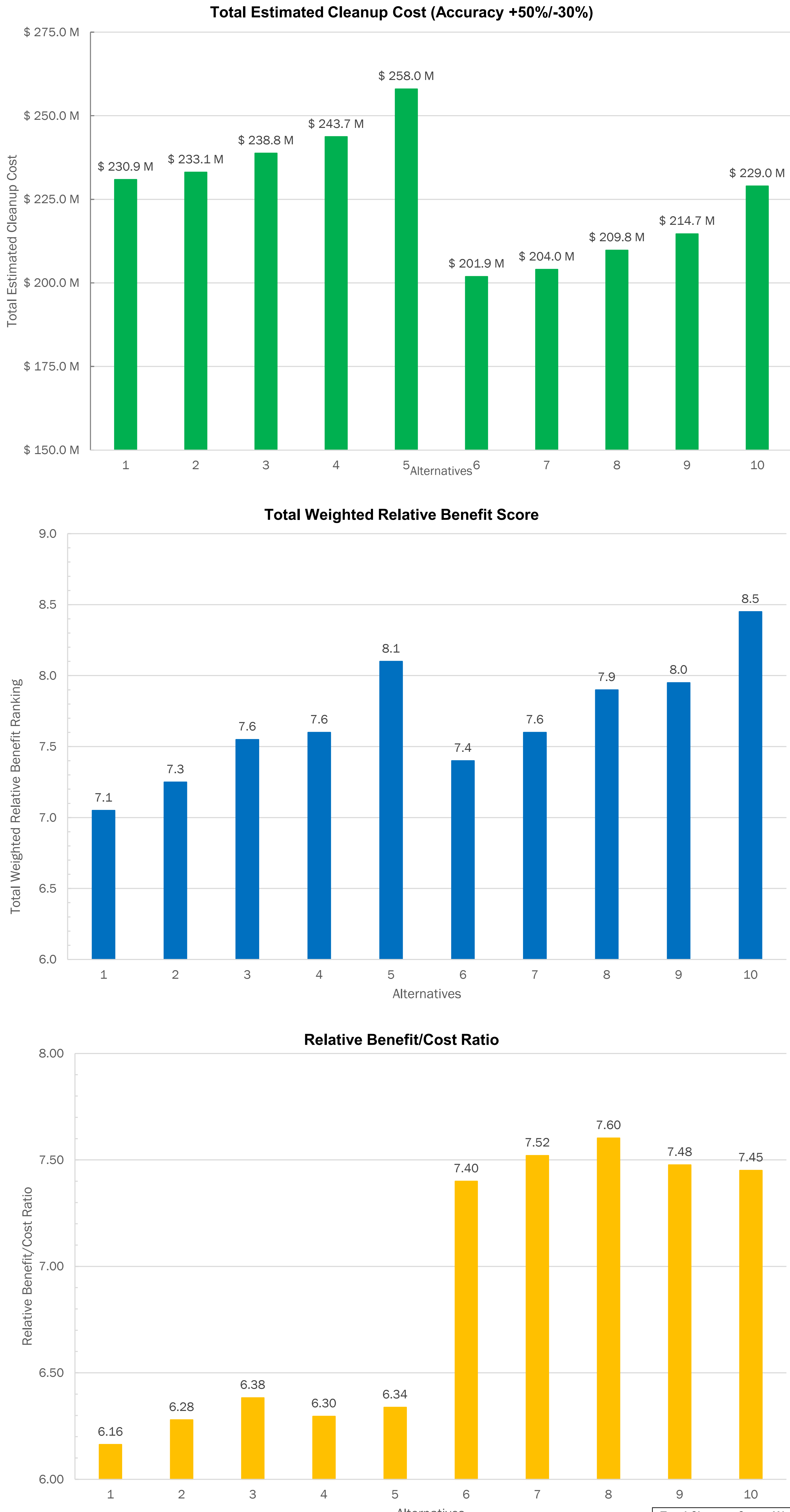
Alternative 10
Cross Section D - D'

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure 126

p:\0\0676020\CAD\07\task 1500-02 [ri-fs]\067602007_F126_Cross Section D - D' [Alt 10].dwg 126 Section D [Alternative 10] Date Exported:12/12/2023 9:56 AM - by Chad Stickel



Total Cleanup Costs, Weighted Relative Benefit Rankings and Benefit/Cost Ratio

Weyerhaeuser Mill A Former
Everett, Washington

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Figure 127

0676-020-07 Date Exported: 1/16/2023

APPENDICES

GeoEngineers

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