FINAL
Pre-Remedial Design Data Gaps Memorandum

Budd Inlet Sub-Area 2 (West Bay)
Budd Inlet Sediment Site
Olympia, Washington

January 4, 2025

Prepared for

Port of Olympia
606 Columbia St NW
Suite 300
Olympia, Washington 98501

Prepared by

Dalton, Olmsted & Fuglevand
1001 SW Klickitat Way
Suite 200B
Seattle, Washington, 98134

DOF DALTON OLMSTED FUGLEVAND

The Budd Inlet Team

Grette Associates ENVIRONMENTAL CONSULTANTS | WestLand Engineering & Environmental Services, Inc. | MAUL FOSTER ALONGI | CRETE CONSULTING, INC. | moffatt & nichol | IAS | LA LANDAU ASSOCIATES

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EXECUTIVE SUMMARY

As shown on Figure 1-1, the potential Budd Inlet Sediment Remediation Site, the boundaries of which are yet to be defined, has been divided into three Sub-Areas for sequential investigation, evaluation, design, and remedy implementation. This Pre-Remedial Design (PRD) Data Gaps Memorandum (PRD Memo) covers Budd Inlet Sub-Area 2 and discusses existing available data and data anticipated to be needed for design of the Port of Olympia's (Port's) proposed remedy for Sediment Management Areas (SMAs) within Sub-Area 2, as presented in the draft for Washington State Department of Ecology (Ecology) review *Revised Identification and Evaluation of Interim Action Alternatives Memorandum, Budd Inlet Sediment Site, Olympia, Washington* (Dalton, Olmstead & Fuglevand [DOF] et al. 2023).

Various types of physical and environmental data are needed for the evaluation of source control and remedial design of the Port's proposed sediment remedy within Sub-Area 2. Data necessary for remedial design within the overall Budd Inlet Site include the following for each of the Budd Inlet Sub-Areas.

- Site Maps
  - Accurate, up-to-date topographic and bathymetric data are needed to begin the design process within each Sub-Area.
- Source Control Data
  - Data are needed to evaluate potential ongoing chemical inputs to Budd Inlet for each Sub-Area. This includes data on the numerous outfalls that drain into each Budd Inlet Sub-Area, other potential historical and ongoing sources to each Sub-Area in Budd Inlet, and discharges from Capitol Lake to Sub-Area 2.
- Sediment Data
  - Nature and extent of chemical contamination throughout each Sub-Area within Budd Inlet, including identification of "hot spots."
  - Surface sediment chemistry, at 0-10 centimeter (cm) depth in subtidal areas and 0-45 cm depth in intertidal areas, for calculation of site-wide and intertidal surface-weighted average concentrations (SWACs).
  - Chemical concentrations in sediment, both horizontally and vertically, to support design, investigate potential chemicals of concern (COCs) in the Z-layer (the surface exposed by dredging), and potential capping of contamination below the Z-layer if necessary.
  - Sediment chemistry in the vicinity of existing and former outfalls for identification of potential current or historical sources.
  - Sediment chemistry for the development and evaluation of potential dredged material management options, including onsite confined disposal facilities (CDFs) either upland or in-water.
  - Sediment physical parameters such as grain size and density to evaluate dredgeability, dredged material management, and sediment management approaches other than dredging, including capping or enhanced monitored natural recovery (EMNR).
- Existing Structures in Remediation Area

  - Data on the location, type, construction materials, and condition of existing structures within or adjacent to the potential remedial areas and SMAs is needed to evaluate potential impacts and management approaches to the existing structures.

- Existing Habitat Conditions
  - Data are needed to sequentially document existing habitat and environmental conditions within and adjacent to each Budd Inlet Sub-Area in order to evaluate potential project impacts and the potential for habitat restoration and to prepare required permitting applications.

Much of the necessary data are not currently available, and data that are available may be older, such that the applicability to remedial design is limited.

- Site Maps
  - Existing bathymetry and topographic data are not contiguous across the project area, the result of various surveys performed at various times for other purposes. With the exception of the US Army Corps of Engineers (USACE) 2024 survey data for the federal navigation channel and turning basin, the existing data outside this survey area are several years old and may not represent current conditions. As a result, up-to-date mapping must be performed so that current data are available for all remedial design and action areas.
- Source Control Data
  - Limited data are available on the multiple potential contaminant inputs to each sub area within Budd Inlet. Up-to-date data are needed to evaluate existing surface and subsurface sediment conditions and the potential for recontamination. Existing surface sediment will provide insight into potential ongoing conditions, and subsurface sediment into potential historical sources.
- Sediment Data
  - Although several previous studies of sediment contamination have been performed in Budd Inlet, most of the available sediment data are more than 10 years old, much of it more than 20 years old. Owing to ongoing source control efforts and other factors, surface sediment conditions may have changed since the last data were collected. Although subsurface conditions are not expected to have changed significantly, the existing subsurface data are insufficient for remedial design because they do not exist at an adequate coverage density for the required COCs throughout the Budd Inlet Site. These ongoing source control efforts include comprehensive stormwater management programs maintained by the Port and City to reduce potential contaminant loading to Budd Inlet (City of Olympia 2021, Port of Olympia 2022).
- Existing Structures in Budd Inlet Sub-Area 2
  - Several structures, including the Marine Terminal dock, Fiddlehead Marina, Martin Marina, Olympia Yacht Club, Percival Landing dock and ramp, and West Bay Marina, are within or adjacent to the SMAs and have the potential to be impacted by the project. Up-to-date data on the condition of those structures are necessary to evaluate potential project impacts and prepare the remedial design.

- Existing Habitat Conditions
  - Although existing habitat conditions within Budd Inlet are generally considered impaired, detailed data on existing habitat and biological conditions across the project area are not available, including:
    - Fine-scale, location-specific substrate, slope, and vegetation data throughout the remedial area.
    - Detailed bathymetry of the remediation area.
  - A detailed shoreline habitat conditions survey is planned, and it will collect habitat data sufficient to characterize the entire remedial area for the purpose of evaluating remedial alternatives for potential habitat impacts.

To begin the remedial design of the project, collection of new data documenting existing conditions is required. The timely collection of the necessary data will be a significant driver on the overall project schedule and influence when remedial construction can be implemented. It is anticipated that, as data from the initial data gaps investigation are analyzed, additional refinement of data gaps for remedial design may be necessary. Subsequent data gaps for Sub-Area 2 will be included in a separate future data gap work plan, as necessary.

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FIGURES

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LIST OF ABBREVIATIONS AND ACRONYMS

µg/kg	micrograms per kilogram
Anchor	Anchor QEA, LLC
AO	Agreed Order
bgs	below ground surface
Cascade Pole	Cascade Pole Cleanup Site
CDF	confined disposal facility
City	City of Olympia
cm	centimeter
COC	chemical of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPT	cone penetration test
CSM	conceptual site model
CSO	combined sewer overflow
D/F	dioxin and furan
DOF	Dalton, Olmstead & Fuglevand
Draft Alternatives Memorandum	*Draft Revised Identification and Evaluation of Interim Action Alternatives Memorandum, Budd Inlet Sediment Site, Olympia, Washington*
DRO+ORO	diesel range organics plus oil range organics
Ecology	Washington State Department of Ecology
EMNR	enhanced monitored natural recovery
ft/foot	feet, foot
GIS	Geographic Information System
GPS	global positioning system
HCID	hydrocarbon identification
HTL	high tide line
LiDAR	light detection and ranging
Log Pond CDF	in-water CDF within the former Log Pond area
LOTT	Lacey, Olympia, Tumwater, and Thurston County Clean Water Alliance
mg/kg	milligrams per kilogram
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NFA	No Further Action
ng/kg	nanograms per kilogram
No.	number
NW-TPH	Northwest total petroleum hydrocarbons
NWTPH-Dx	Northwest diesel-range TPH extended
NWTPH-Gx	Northwest gasoline-range TPH extended

LIST OF ABBREVIATIONS AND ACRONYMS (CONTINUED)

PAH ..... polycyclic aromatic hydrocarbon
PCB ..... polychlorinated biphenyl
Port ..... Port of Olympia
PRD ..... pre-remedial design
PRD Memo ..... Pre-Remedial Design Data Gaps Memorandum
SLR ..... sea level rise
SM ..... Standard Method
SMA ..... Sediment Management Area
Study Area ..... Port of Olympia Budd Inlet Sediment Site Study Area
SVOC ..... semivolatile organic compound
SWAA ..... Southwest Washington Regional Airport Authority
SWAC ..... surface-weighted average concentration
TEQ ..... toxicity equivalence
TPH ..... total petroleum hydrocarbons
Upland CDF ..... upland CDF within the Marine Terminal area
USACE ..... US Army Corps of Engineers

1.0 INTRODUCTION AND PURPOSE

This Pre-Remedial Design (PRD) Data Gaps Memorandum (PRD Memo) has been prepared as required by Amendment No. 2 (June 2023) to Agreed Order (AO) No. DE 6083, entered by the State of Washington, Washington State Department of Ecology (Ecology), and the Port of Olympia (Port) on December 5, 2008. This memorandum has been prepared consistent with the requirement of "Task 7: Pre-Remedial Design Data Gaps Memorandum" of AO Amendment No. 2, effective June 9, 2023.

As required by Task 7 of Amendment No. 2, this PRD Memo presents:

> *"data gaps primarily focused on remedial dredging within the navigational areas (channels, marinas, and adjacent areas). The PRD Memo will present compiled existing data and a summary of data needs for design of dredging and dredging-related portions of the remedial action and be consistent with the Identification and Evaluation of Interim Action Alternatives Memorandum, including source control and remedy protection. In addition, the PRD Memo will address dredged material management considerations including data that will support evaluations of sediment reuse and disposal options. The PRD Memo will identify existing nearshore, shoreline, and overwater structures that could be impacted by an interim action and the data needed to evaluate remedial actions near these structures."*

As such, this PRD Memo is focused on the implementation of the Port's proposed remedy presented in the *Draft Revised Identification and Evaluation of Interim Action Alternatives Memorandum, Budd Inlet Sediment Site, Olympia, Washington* dated May 19, 2023 (Draft Alternatives Memorandum) currently under review by Ecology.

This PRD Memo is focused on Sub-Area 2 of the project, which includes West Bay, as detailed in the following sections. Separate PRD data gaps memorandums were or will be prepared for other sub areas of the project. It is anticipated that three separate work plans will be needed to guide data collection to fill data gaps for Sub-Area 2:

- Sediment Chemistry Work Plan;
- Source Control Work Plan; and
- Shoreline & Overwater Structures Work Plan.

The Budd Inlet Sediment Site is in South Puget Sound (Figure 1-1), in the southern portion of Budd Inlet. The full extent of the site is not yet defined and extends beyond the Project Area shown on Figure 1-1.

1.1 Project Areas Included in This Memorandum

This PRD Memo covers Budd Inlet Sub-Area 2 (Figure 1-2), which includes the following Sediment Management Areas (SMAs); Sub-Area 2 is a portion of the overall Budd Inlet Site:

- West Bay, from the junction of the federal navigation channels to the southern limit of West Bay. This includes the following SMAs:
  - Berthing Area
  - Under Pier
  - Capitol Lake Discharge
  - Marinas
  - West Bay Marina South
  - Open Water West
  - Navigational Channel West.

2.0 SITE HISTORY AND BACKGROUND

The history of Budd Inlet, the Port Peninsula, previous operations, site investigations, and 2009 interim action dredging of Berths 2 and 3 are described in multiple site documents (Anchor QEA, LLC [Anchor] 2012a,b,c, 2016) and are not repeated here. There are several other known contaminated sites, in addition to the Budd Inlet Sediment Site, within West Bay (Figure 2-1). There are additional sites where sediment/soil data in West Bay are currently available but are not summarized in previous project site documents.

2.1 Olympia City Sewer Pump Station Site and Unocal Hulco Bulk Plant Site

The Olympia City Sewer Pump Station site and the Unocal/Hulco Bulk Plant site are located on the southwest portion of the Port Peninsula. Both sites were in Ecology's Voluntary Cleanup Program. These sites were historically used for storage of petroleum products in aboveground and belowground tanks. Petroleum-impacted soils were encountered during early upland investigations, and cleanups were conducted in 1995 and 2001 to remove soil contaminated with petroleum hydrocarbons (Anchor 2013). Petroleum-impacted soils were then encountered during the construction of the Percival Landing shoreline walkway in 2010/11. A remedial investigation was conducted concurrent with the walkway construction, and soil samples were collected at nine intertidal soil boring locations (BH-1, BH-5, BH-6, BH-9, BH-10, BH-11, BH-12, BH-13, and BH-14), as shown on Figures 2-2 and 2-3, to depths as deep as 20 feet (ft) below ground. Samples were typically collected at 5-foot intervals and were screened by a qualitative hydrocarbon identification (HCID) test. HCID results were used to identify sample intervals BH-6-5-10, BH-6-10-15, BH-9-5-10, BH-9-10-15, BH-11-5-10, BH-13-0-5, and BH-13-5-10 for additional Northwest total petroleum hydrocarbons (NW-TPH) analysis. BH-6-5-10, BH-9-5-10, and BH-11-5-10 had detected diesel range organics plus oil range organics (DRO+ORO) concentrations greater than Model Toxics Control Act (MTCA) Method A screening levels. Intervals BH-6-5-10 and BH-11-5-10 were also analyzed for volatile organics and lead. Results for these analyses were either below action levels or non-detects (Anchor 2012). The intertidal soil was excavated down to approximately +6 ft mean lower low water (MLLW), removing all impacted soils with sample results above action levels within the excavation area. Thirteen (CS-6, CS-9, CS-11, CS-12, CS-13, CS-14, CS-15, CS-16, CS-17, CS-18, CS-19, CS-20, and CS-21) confirmation surface samples (0-10 centimeters [cm]) were collected and analyzed after the excavation was completed. Two confirmation samples, CS-17 and CS-19, were greater than MTCA Method A screening levels for DRO+ORO at 6,174 milligrams per kilogram (mg/kg) and 16,677 mg/kg, respectively. Confirmation sample CS-10 had a benzene concentration greater than the MTCA Method A screening level at 1.28 mg/kg. The soil exposed by the excavation was then covered with a minimum of 5 ft of clean cover material.

2.2 Solid Wood Inc.

The Solid Wood Inc. site is approximately 16.4 acres and is located on the west shore of West Bay. The Solid Wood Inc. site includes the former mill area, former railroad right-of-way, and peninsula. Past

operations at the site contaminated soil, groundwater, and sediment. Initial investigations found total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), and metals at levels that exceed the MTCA cleanup standards for soil or groundwater. In 2021 a supplemental sediment investigation was conducted. During this investigation 22 sediment samples (including one duplicate) were collected and analyzed from 16 locations (SD-60 through SD-75) as shown on Figures 4-9 and 4-10. Surface (0.0-0.5 ft) samples were collected at all stations, and subsurface samples (0.5-2.0 ft) were collected at locations SD-60 through SD-64, shown on Figure 4-10. Samples collected near the shoreline (SD-60 through SD-69) were analyzed for the following analytes:

- Volatile organic compounds (EPA Method 8260D)
- Semivolatile organic compounds (Stocks; EPA Method 8270)
- PAHs (EPA Method 8270)
- Metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc; EPA Method 6010/6020)
- TPH (Methods Northwest gasoline-range TPH extended [NWTPH-Gx] and Northwest diesel-range TPH extended [NWTPH-Dx])
- Polychlorinated biphenyls (PCBs; EPA Method 8082/1668)
- Phthalates (EPA Method 8270)
- Phenols (EPA Method 8151/2070)
- Dioxins/furans (D/Fs; EPA Method 1613)
- Total organic carbon (EPA Method 9060A)
- Grain size (PSEP 1995).

Samples offshore (SD-70 through SD-75) were analyzed for the following in addition to the analytes above:

- Ammonia (Standard Method [SM] 4500-S2/4500-NH3)
- Total volatile solids (SM 2540E)
- Sulfides (Plumb 1981/SM 4500-S2/4500-NH3).

The sample collected at SD-71 was the only one in which contaminants exceeded regional background. Contaminants in the surface sample exceeded action levels for phenol concentrations, at 3,100 µg/kg.

3.0 PORT OF OLYMPIA'S PROPOSED REMEDY

The Draft Alternatives Memorandum (DOF et al. 2023) presents approaches for sediment remediation and related dredged material management within the Port's Budd Inlet Sediment Site Study Area (Study Area) and adjacent areas of both East and West Bays based on multiple factors, including existing sediment data and current and future use of the site. Within that document, the Study Area and adjacent areas of both East and West Bays are divided into specific SMAs based on functional and environmental characteristics. SMAs within West Bay are shown on Figure 3-1. The Port's proposed remedial approach for each SMA in Sub-Area 2 is developed in the Draft Alternatives Memorandum and summarized below. Data gap identification is based on data needed to design the Port's proposed remedy, where a remedy is identified in the Draft Alternatives Memorandum, and on data needed to evaluate potential remedies within areas where a specific remedy was not proposed in the Draft Alternatives Memorandum.

Existing sediment data used in this document and in development of the regional background exceedance areas presented are generally 10 to 20 years old. As such, the areas exceeding regional background are likely to be modified as a result of future data collection.

3.1 Sediment Remediation

The Port's preliminary proposed alternative for sediment remediation within Budd Inlet Sub-Area 2 is stated in the Draft Alternatives Memorandum and summarized as follows. Figure 3-2 depicts areas where surface sediments exceed the regional background concentration for D/Fs, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), or both, based on data collected prior to the 2024 sediment sampling event in Sub-Area 1.

- Removal of impacted sediments (dredging) in all current navigational areas, including the Navigation Channel West SMA, Berthing Area SMA, Marinas SMA, West Bay Marina South SMA, and portions of Capitol Lake Discharge SMA.
- Removal of impacted sediments (dredging) in areas of significantly elevated chemicals of concern (COCs) with the potential to cause recontamination and in erosional areas of the non-navigational areas of the Under Pier, portions of Capitol Lake Discharge, and Open Water West SMAs.
- Capping/enhanced monitored natural recovery (EMNR) in the remaining non-navigational areas of the Under Pier, Marinas, Open Water West SMAs, and portions of Capitol Lake Discharge SMA.
- Potential use of combined dredging and capping if areas of deep sediment contamination are identified within all SMAs, for example:
  - Within navigational areas, capping may be considered if the depth of contamination is such that a cap could be installed below the depth of future dredging, including a 2-foot (ft) overdredge allowance and a 2-ft buffer below the overdredge depth and the top of any cap.

- Within non-navigational areas, capping may be considered if the depth of contamination below mudline is greater than 3 ft, such that dredging of 3 ft of sediment and cap construction could be completed without changing the elevation from the existing elevation within that area.

The Port's proposed alternative is preliminary and may change based on a change in future use, the results of additional data collection for Sub-Area 2, and additional Ecology review of the Draft Alternatives Memorandum.

3.2 Dredged Material Management

The cost-effective and environmentally protective management of dredged material is a core concept to cost-effective remediation by dredging within Budd Inlet. Conventional landfill disposal of the dredged material would significantly increase not only costs and potential impacts on neighboring communities through which the dredged material would be transported but also the carbon footprint of the project due to impacts of sediment transportation from Budd Inlet to a landfill in Eastern Washington or Eastern Oregon. By using alternatives to landfill disposal, dredged material management costs can be reduced, ancillary environmental impacts such as carbon footprint reduced, and pending sea level rise (SLR) impacts on the Port Peninsula mitigated by the selective onsite placement of the dredged material. Several types of onsite placement and beneficial reuse are included in the Port's proposed alternative, including an in-water confined disposal facility (CDF) within the former Log Pond area (Log Pond CDF); an upland CDF within the Marine Terminal area or adjacent Port property (Upland CDF), including upland portions of the Cascade Pole Cleanup Site (Cascade Pole); and select placement on the Port Peninsula to address SLR, including potentially raising future development sites and the Billy Frank Jr. Trail, which could provide a barrier along the length of the East side of the Peninsula (Figure 3-3). It is anticipated that significant quantities of debris may be encountered during the implementation of the remedy. Debris would be separated from the dredged material as practicable and disposed at an approved upland offsite landfill along with any sediments unsuitable for onsite placement owing to contamination, physical properties, overall project volume, or other unanticipated factors.

4.0 DATA REQUIRED FOR DESIGN, COMPARISON OF REQUIRED DATA TO EXISTING DATA, AND RESULTING DATA GAPS FOR DESIGN OF THE PORT OF OLYMPIA'S PROPOSED REMEDY

This section summarizes the data required for preparation of the remedial design, whether those data types exist, and the resulting data gaps for design of the Port's proposed remedy for either the project area as a whole or for specific areas or SMAs. Although several previous sediment studies have been performed within Budd Inlet, the existing sediment chemistry data are limited in geographic area and limited in analytes, which is inconsistent with project requirements, and surface sediment data may no longer be representative of existing conditions. In some areas, the data required for design and the data gaps are virtually identical because little to none of the existing data are suitable, cover only a small area, or do not exist, such that much of the data needed for remedial design are currently a data gap.

4.1 Project Area Base Map

4.1.1 Required Base Map Content and Mapping Data for Remedial Design

An up-to-date, accurate base map covering the extent of the project area and depicting current site bathymetry, topographic contours, and topographic features such as buildings, shoreline features, roads, paved area, utilities, etc. is needed for the design of the remedy and corresponding sediment management.

4.1.2 Existing Base Map Content and Mapping Data Suitable for Remedial Design

The existing project base map data consists of a mix of publicly available Geographic Information System (GIS) data, federal and local government topographic and hydrographic surveys, and a Port hydrographic condition survey. The data ranges in age from 2024 to 2017 or older, with the majority of upland and nearshore information originating from 2017 or earlier. Attempting to perform design-level activities from a mix of older surveys will impact the accuracies necessary to carry through a long-term project, especially in the nearshore and upland areas. Existing locations and vertical elevations of shoreline features such as structures, piling, shoreline protection, outfalls, seeps, and vertical walls are either limited or non-existent. The US Army Corps of Engineers (USACE) 2024 multibeam hydrographic channel condition survey is sufficient for design-level work but limited in its extent of coverage. The 2017 Southwest Washington Regional Airport Authority (SWAA) light detection and ranging (LiDAR) upland/nearshore coverage and accuracy quickly diminishes in the tidal flats area at the north end of the project area (Figure 4-1).

4.1.3 Base Map for Remedial Design Data Gaps

With the exception of the USACE 2022 and 2024 bathymetry survey data within the West Bay Navigation Channel and Marine Terminal berth area, none of the existing topographic or bathymetric survey data are of design-level quality or recency. As such, data gaps for bathymetric and topographic survey data

exist throughout all areas outside the West Bay Navigation Channel and Marine Terminal berth area. Additional bathymetric and topographic surveying will be required within remedial action areas to be identified, except possibly in the West Bay Navigation Channel and Marine Terminal berth area, prior to design. Base map data gaps investigation and data collection will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan and field investigation.

4.2 Nature and Extent of Sediment Contamination

4.2.1 Required Data on the Nature and Extent of Sediment Contamination for Delineation of Remedial Areas and Remedial Design

Data on the nature and extent of sediment contamination in surface, near-surface, and subsurface sediment is required for multiple purposes, including:

- Nature and extent of chemical contamination throughout each Sub-Area within Budd Inlet, including identification of "hot spots."
- Surface sediment chemistry, at 0-10 cm depth in subtidal areas and 0-45 cm depth in intertidal areas, for calculation of sitewide and intertidal surface-weighted average concentrations (SWACs).
- Chemical concentrations in sediment, both horizontally and vertically, to support design, investigate potential COCs in the Z-layer (the surface exposed by dredging, if dredging is performed), and evaluate potential capping of contaminated sediments within areas where capping is a selected remedy and below the Z-layer, if necessary, based on a proposed dredging remedy within that SMA.
    - Sufficient data density is required to define an accurate dredge prism, horizontally and vertically, to remove the impacted sediments.
- Sediment chemistry in the vicinity of existing and former outfalls for identification of potential current or historical sources.
- Sediment chemistry for the development and evaluation of potential dredged material management options, including onsite CDFs.
- Sediment physical parameters, such as grain size and density, to evaluate dredgeability, dredged material management, and sediment management approaches other than dredging, including capping or EMNR.

Within each of the SMAs shown on Figure 3-1, the following data are required to address the purposes listed above.

Navigation Channel West SMA—The Port's proposed remedy for contamination within the Navigation Channel West (includes turning basin) is removal by dredging. The horizontal and vertical extent of contaminated sediment is required to design a dredge prism to remove contaminated sediment, restore navigation depth, and allow USACE to resume maintenance dredging as needed.

Berth Area SMA—The Port's proposed remedy for contamination within the Berth Area SMA is removal by dredging. The horizontal and vertical extent of contaminated sediment is required to design a dredge

prism to remove contaminated sediment, restore navigation depth, and allow the Port to resume future maintenance dredging as needed. Dredging depth in the Berth Area SMA will impact the remedial approach in the Under Pier SMA.

Under Pier SMA—The Port's proposed remedy for contamination within the adjacent Berth Area SMA is removal by dredging. Remediation in the under-pier area will be impacted by berth dredging depth. The Under Pier SMA could be remediated by removal of the impacted material, capping, or a combination of both. The horizontal and vertical extent of contaminated sediment is required to design a dredge prism to remove contaminated sediment, restore navigation depth, and allow the Port to resume future maintenance dredging as needed.

Marinas SMA—A dredging and/or capping remedy for contamination within the Marinas SMA will be evaluated after the horizontal and vertical extent of contaminated sediment has been determined and the base map data updated with current mudline elevations.

West Bay Marina South SMA—The West Bay Marina uplands area was previously remediated and was issued a No Further Action (NFA) determination by Ecology in 2020. The NFA determination did not include offshore sediments. The Port's proposed remedy for contamination within the West Bay Marina South SMA will be evaluated after data gaps data collection is complete, with a combination of dredging and capping likely. The horizontal and vertical extent of contaminated sediment is required to design a dredge prism for the potential removal of contaminated sediment and restore navigation depth as needed. Wood waste evaluation is anticipated for this SMA based on historical information.

Capitol Lake Discharge SMA—The Port's proposed remedy is a combination of EMNR and dredging. The surficial extent of contamination is needed for assessment of EMNR. The horizontal and vertical extent of contaminated sediment is required to design a dredge prism to remove contaminated sediment or to design a sedimentation basin to collect sediment that may be released as part of future discharges from Capitol Lake dam removal.

Open Water West SMA—The horizontal and vertical extents of contaminated sediment are required to design a dredge prism to remove contaminated sediment from potential erosion areas or "hot spots" and to design a cap or EMNR as appropriate for non-erosional areas.

Stormwater Outfall areas within any SMA—Localized areas around outfalls may have different sediment impacts, due to COCs, than the larger SMAs in which they are located. The horizontal and vertical extents of contamination in sediment associated with stormwater outfalls are necessary to evaluate contaminant contributions from stormwater and develop effective source control measures.

4.2.2 Existing Data on the Nature and Extent of Sediment Contamination

The existing sediment chemistry data within each SMA are outlined below and summarized in Tables 4-1, 4-2, and 4-3 (surface, near-surface, and subsurface laboratory results, respectively).

Navigation Channel West SMA—The Navigation Channel West SMA covers approximately 2.7 million square feet of the project area. There are eight surface (0-10 cm) data locations (Figure 4-2), six near-surface (10-45 cm) data locations (Figure 4-3), and 19 subsurface (more than 45 cm) data locations (Figure 4-4) for D/Fs; there are four surface (0-10cm) data locations (Figure 4-5), three near-surface (10-45 cm) data locations (Figure 4-6), and one subsurface (more than 45 cm) data locations (Figure 4-7) for cPAHs within the Navigation Channel West SMA.

Based on existing data, 15 of the surface sediment samples collected within the Navigation Channel West area exceed regional background concentrations for D/Fs (19 nanograms per kilogram [ng/kg]), cPAHs (78 micrograms per kilogram [µg/kg]), or both (Figure 4-8).

From 19 subsurface core locations, a total of 40 subsurface samples were collected and analyzed for D/Fs, and two were analyzed for cPAHs. Seven samples exceeded regional background concentrations for D/Fs, with a range of 0.34 to 78.2 ng/kg. One cPAH sample exceeded regional background concentrations, with a range of 46.4 to 174 µg/kg. The maximum depth below mudline for D/F exceedances was approximately 7 ft; the maximum depth below mudline for cPAH exceedances was approximately 3 ft. Mudline elevation was not available for the determination of exceedance elevations.

Berthing Area SMA—The Berthing Area SMA covers approximately 0.2 million square feet of the project area. There are 10 surface (0-10 cm; Figure 4-2), three near-surface (10-45 cm; Figure 4-3), and 19 subsurface (more than 45 cm; Figure 4-4) data locations for D/Fs; there are two surface (0-10 cm) data locations (Figure 4-5), no near-surface (10-45 cm) data locations (Figure 4-6), and one subsurface (more than 45 cm) data location (Figure 4-7) for cPAHs within the Berthing Area SMA.

Based on existing data, 14 of the surface sediment samples within the Berthing Area SMA exceeded regional background for D/Fs (19 ng/kg) or the regional background for cPAHs (78 µg/kg; Figure 4-8).

From 19 subsurface core locations, a total of 33 subsurface samples were collected and analyzed for D/Fs, and one sample was analyzed for cPAHs. Nineteen samples exceeded regional background concentrations for D/Fs, with a range of 0.245 to 357 ng/kg. Both cPAH samples exceeded regional background concentrations at 1,390 and 3,470 µg/kg. The greatest exceedance for both D/Fs and cPAHs occurred at the same location and depth of approximately 13 ft below mudline. The mudline elevation was not available for the determination of exceedance elevations.

Under Pier SMA—The Under Pier SMA covers approximately 0.2 million square feet of the project area. There are 15 surface (0-10 cm) data locations (Figure 4-2), five near-surface (10-45 cm) data locations (Figure 4-3), and 18 subsurface (more than 45 cm) data locations (Figure 4-4) for D/Fs; there are four surface (0-10 cm) data locations (Figure 4-5), no near-surface (10-45 cm) data locations (Figure 4-6), and four subsurface (more than 45 cm) data locations (Figure 4-7) for cPAHs within the Under Pier SMA.

Based on existing data, all but six of the surface/near-surface sediment sample locations within the Under Pier area exceeded regional background concentrations for D/Fs (19 ng/kg), cPAHs (78 µg/kg), or both (Figure 4-8).

From 18 subsurface core locations, a total of 46 subsurface samples were collected and analyzed for D/Fs, and four samples were analyzed for cPAHs. Twenty-four samples exceeded regional background concentrations for D/Fs, with a range of 0.208 to 46 ng/kg. Fifteen cPAH samples exceeded regional background concentrations, with a range of 66.5 to 4,210 µg/kg. The greatest exceedance for both D/Fs and cPAHs occurred at the same location and depth of approximately 11.2 ft below mudline.

Marinas SMA—The Marinas SMA covers approximately 0.9 million square feet of the project area. There are 10 surface (0-10 cm) data locations (Figure 4-2), no near-surface (10-45 cm) data locations (Figure 4-3), and 15 subsurface (more than 45 cm) data locations (Figure 4-4) for D/Fs; there are 12 surface (0-10 cm) data locations (Figure 4-5), no near-surface (10-45 cm) data locations (Figure 4-6), and 10 subsurface (more than 45 cm) data locations (Figure 4-7) for cPAHs within the Marinas SMA.

Based on existing data, all of the surface sediment samples within the Marinas SMA exceed regional background concentrations for D/Fs (19 ng/kg), cPAHs (78 µg/kg), or both (Figure 4-8).

From 19 subsurface core locations, a total of 15 subsurface samples were collected and analyzed for D/Fs, and 10 were analyzed for cPAHs. Only one sample exceeded regional background concentrations for D/Fs, with a range of 0.14 to 21.1 ng/kg. The exceedance for D/Fs occurred at a depth of 3.1 ft below mudline, and the deepest exceedance for cPAHs occurred at a depth of approximately 8.5 ft below mudline. The mudline elevation was not available for the determination of exceedance elevations.

West Bay Marina South SMA—The West Bay Marina South SMA covers approximately 0.2 million square feet of the project area. There is one surface (0-10 cm) data location (Figure 4-2), and there are no near-surface (10-45 cm) or subsurface (more than 45 cm) data locations (Figures 4-3 and 4-4, respectively) for D/Fs; there are four surface (0-10 cm) data locations (Figure 4-5) and no near-surface (10-45 cm) or subsurface (more than 45 cm) data locations (Figures 4-6 and 4-7, respectively) for cPAHs within the West Bay Marina South SMA.

Based on existing data, all of the surface sediment samples within the West Bay Marina SMA exceed regional background concentrations for cPAHs (78 µg/kg; Figure 4-8).

Capitol Lake Discharge SMA—The Capitol Lake Discharge SMA covers approximately 1.6 million square feet of the project area. There are five surface (0-10 cm) data locations (Figure 4-2), no near-surface (10-45 cm) data locations (Figure 4-3), and two subsurface (more than 45 cm) data locations (Figure 4-4) for D/Fs; there are three surface (0-10 cm) data locations (Figure 4-5) and no near-surface (10-45 cm) or subsurface (more than 45 cm) data locations (Figures 4-6 and 4-7, respectively) for cPAHs within the Capitol Lake Discharge SMA.

Based on existing data, two of the surface sediment sample locations within the Capitol Lake Discharge SMA exceed regional background concentrations for D/Fs (19 ng/kg) or cPAHs (78 µg/kg; Figure 4-8).

From two subsurface core locations, two subsurface samples were collected and analyzed for D/Fs and none were analyzed for cPAHs. None of the samples exceeded regional background concentrations for D/Fs, with results of 3.57 and 9.62 ng/kg for the two samples. The deepest sample was approximately 4.3 ft below mudline. The mudline elevation was not available for the determination of exceedance elevations.

Open Water West SMA—The Open Water West SMA covers approximately 7.1 million square feet of the project area. There are 42 surface (0-10 cm) data locations (Figure 4-2), four near-surface (10-45 cm) data locations (Figure 4-3), and 17 subsurface (more than 45 cm) data locations (Figure 4-4) for D/Fs; there are 44 surface (0-10 cm) data locations (Figure 4-5), one near-surface (10-45 cm) data location (Figure 4-6), and seven subsurface (more than 45 cm) data locations (Figure 4-7) for cPAHs within the Open Water West SMA.

Based on existing data, significant areas of the surface within the Open Water West SMA exceed regional background concentrations for D/Fs (19 ng/kg), cPAHs (78 µg/kg), or both (Figure 4-8), with potential areas of significantly elevated chemistry near in the western portion of the SMA adjacent to historical industrial sites and outfalls.

From 21 subsurface core locations, 30 subsurface samples were collected and analyzed for D/Fs, and nine were analyzed for cPAHs. There were three exceedances for D/Fs, with a range of 0.132 to 50.4 ng/kg. The deepest exceedance of D/Fs was approximately 3.3 ft below mudline. There were two regional background exceedances for cPAHs, with a range of 3.6 to 187 µg/kg. The deepest exceedance of cPAHs was approximately 2 ft below mudline. The mudline elevation was not available for the determination of exceedance elevations.

4.2.3 Nature and Extent of Sediment Contamination Data Gaps

Sediment contamination data gaps, based on differences between data needed for remedial design and available existing data, within each SMA are outlined below. Sediment contamination data gaps for Sub-Area 2 SMAs will be addressed in the Sub-Area 2 Sediment Chemistry Investigation Work Plan and Sub-Area 2 Sediment Chemistry Data Report. Existing outfalls discharge into several of these SMAs and areas around outfalls will be investigated accordingly to identify potential sediment impacts.

Navigation Channel West SMA—Existing surface and subsurface data are concentrated in the southern portion of the navigation channel and turning basin. Existing surface data indicate most of the surface area in the turning basin within this SMA exceeds regional background for both D/Fs and/or cPAHs. The existing subsurface sample locations alone do not provide enough detail for delineation of areas requiring remediation or remedial design within this SMA. Additional borings are needed to determine

the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface.

Berthing Area SMA—The Port performed an interim action in 2009 at Berths 2 and 3. Removed-sediment data is not included in the data gaps evaluation for the Berthing Area SMA. The extent of the dredged area is shown on Figures 4-9 and 4-10. Existing surface data indicate that the entire surface area within this SMA exceeds regional background for both D/Fs and cPAHs. The existing subsurface data indicate contamination extends to depths greater than 13 ft below mudline. Additional borings are needed to determine the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface.

Under Pier SMA—Existing surface data indicate that the entire surface area within this SMA exceeds regional background for either D/Fs or cPAHs. The existing data from subsurface sample locations indicate that contamination extends more the 11 ft below mudline at some locations. Additional borings are needed in areas where the vertical extent of contamination was not determined.

Marinas SMA—Existing surface data indicate that the entire surface area within this SMA exceeds regional background for both D/Fs and cPAHs. Additional borings are needed to determine the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface for potential dredge areas, if dredging is to be performed. Additional surface samples are needed to accurately define limits of surficial contamination.

West Bay Marina South SMA—Existing surface data indicate that the entire surface area within this SMA exceeds the regional background for cPAHs. Additional surface samples are needed to determine the extents of surficial contamination. There is no subsurface data for this SMA. Borings are needed to confirm the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface for potential dredge areas, if dredging is to be performed.

Capitol Lake Discharge SMA—The existing surface and subsurface sample locations alone do not provide enough detail for remedial design within this SMA. Additional borings are needed to determine the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface for potential dredge areas and design of a sedimentation basin. Additional surface samples are needed to accurately define limits of surficial contamination.

Open Water West SMA—The existing surface and subsurface sample locations, especially in the northern and southern portions of the SMA, do not provide enough detail for delineation of remedial areas, evaluation of remedial alternatives, or remedial design within this SMA. Additional borings are needed to determine the horizontal limits of subsurface contamination, depth of contamination, and resulting exposed (leave-behind or Z-layer) surface for potential dredged areas, if dredging is to be performed. Additional surface samples are needed to accurately define the limits of surficial contamination. This will include focused sampling near outfalls of potential concern.

4.3 Dredged Material Management Data

4.3.1 Required Sediment Properties Data for Sediment Management

Various data are required to support design of the proposed dredged material management options identified in the Draft Alternatives Memorandum (DOF et al. 2023) and include:

- Offsite disposal at an approved Subtitle D landfill.
- Several onsite potential beneficial reuse options are being investigated and are included in the Sub-Area 1 Data Gaps Memo (DOF et al. 2024). Beneficial reuse options include:
  - Placement in an upland CDF to be constructed within the Port Terminal area and incorporated into future SLR plans, adjacent to the existing Cascade Pole CDF, and
  - Incorporation as fill into other SLR and shoreline resiliency improvements throughout the Port property.

Each dredged material management option has both unique and overlapping design data needs. A thorough understanding of the sediment chemical characteristics (COCs, leaching properties, etc.) is required for offsite disposal profiling and to develop safe containment strategies for onsite placement. The sediment physical properties are required to evaluate dewatering and material handling requirements during dredging, transfer, and processing of the sediment, and to determine potential amendment requirements (e.g., stabilization/solidification using cement, fly ash, or other materials) for offsite transport and onsite placement.

4.3.2 Existing Sediment Properties Data for Sediment Management

As summarized in Section 4.2, numerous investigations have been performed within Budd Inlet to identify COCs. Additionally, multiple geotechnical investigations have been completed within selected portions of Budd Inlet and upland Port Peninsula property (Figure 4-9). Data from these investigations are summarized in the *Budd Inlet Sediment Site Existing Information Summary and Data Gaps Memorandum* (Anchor 2012a) and the *Final Investigation Report, Port of Olympia Budd Inlet Sediment Site* (Anchor 2016).

While the existing data are sufficient for feasibility evaluations, the age and spatial distribution of the data limits its use for higher resolution analyses and design of the dredged material management options listed above. Additionally, previous studies did not focus on the dredged material management options currently under consideration.

4.3.3 Sediment Property Data Gaps for Sediment Management

To facilitate design of the dredged material management options identified above, representative sediment samples will be needed from locations throughout the areas proposed for remediation by dredging, to supplement existing data (Table 4-4). To assess sediment characteristics and associated sediment processing requirements, it is anticipated that selected samples will be composited to represent the various SMAs defined in the Draft Alternatives Memorandum (DOF et al. 2023).

Compositing samples will allow adjustments to be made to the sediment processing design and to operations as the dredging progresses throughout Sub-Area 2. The composite samples will also be used for bench scale treatability testing to determine appropriate amendment materials (e.g., cement, bentonite, aggregate) and mixing ratios to achieve the properties required for both offsite transport and onsite placement of the sediment. The anticipated sediment properties required for design of the sediment management project elements are summarized in Table 4-5.

Table 4-5. Sediment Management Design Data Needs

Data Need	Purpose				
	Sediment Dewatering/ Handling	Offsite Landfill Disposal	Nearshore CDF Placement	Upland CDF/SLR Placement	Effluent Treatment
Chemical Properties (Budd Inlet COCs)		✓	✓	✓	✓
Physical Properties (bulk density, grain size, plasticity, water content, total organic carbon, total solids)	✓	✓	✓	✓	
Strength Properties (compressibility and shear strength)			✓	✓	
Elutriate Properties	✓		✓	✓	✓
Settling/Consolidation Properties			✓	✓	
Leaching Properties			✓	✓	

Based on preliminary review of existing information, it is anticipated that the additional data needs detailed in Table 4-5 above will be required to supplement existing Sub-Area 2 data for design of the SLR/shoreline resiliency improvements. The rationale, objectives, and details of these additional investigation activities will be developed as part of a future PRD Sub-Area 2 Shoreline & Overwater Structures Work Plan to support focused investigations (if required) and bench scale testing for onsite placement activities. This work plan will be prepared following initial PRD sediment chemistry investigation activities for Sub-Area 2 and identification of preliminary dredge limits and quantities within Sub-Area 2.

4.4 Sources of Contamination—Source Control and Remedy Protection

Source control is an essential element of the recommended remedial action for West Bay. Multiple transport pathways to the site have the potential to contribute contamination, including stormwater, shoreline erosion, groundwater, in-water structures, overwater activities, and in-water sediment resuspension and release. Source control will limit the potential for sediment recontamination and ensure that the remedy remains protective. This section presents the data required for remedial design, currently existing data, and data gaps specific to source control and remedy protection for East Bay.

4.4.1 Required Data for Source Control Evaluation

Based on information presented in the Draft Alternatives Memorandum, review of existing data, and communications with Ecology, the COCs for Sub-Area 2 (West Bay) are D/Fs, dioxin-like PCBs, PAHs, arsenic, cadmium, mercury, pentachlorophenol, and select SVOCs (DOF et al. 2023). COCs will be further evaluated and refined based on additional data collected as part of the West Bay investigation activities. As will be discussed in the forthcoming Source Control Work Plan, a source control framework will define the source control approach, roles and responsibilities, and timing and deliverables associated with implementation of a source control evaluation for Sub-Area 2 (West Bay).

Initially, sediment data will be collected in areas with potential sources of COCs (e.g., outfalls, marinas, cleanup sites, etc.) during the PRD Sub-Area 2 sediment chemistry investigation. This sampling program is designed to address known data gaps, such as outdated data or low data density. Based on the Sub-Area 2 sediment chemistry investigation results, additional data needs will be identified to further inform the source control investigation. The proposed Sub-Area 2 sediment chemistry investigation data collection scope is expected to be implemented in late fall/early winter 2024-2025. Following receipt and analysis of results from that sampling effort, a Source Control Work Plan will be prepared to describe the source control approach, for Ecology review, in advance of additional data gap sampling.

For the purpose of identifying data gaps as part of this PRD Memo, it is anticipated that the source control evaluation will focus on identification of potential sources of COCs and potential pathways to Sub-Area 2 (West Bay). Anticipated pathways to West Bay include stormwater, shoreline erosion, groundwater, in-water structures, overwater activities, and in-water sediment resuspension and release (e.g., from other cleanup sites with a nexus to Sub-Area 2).

For example, stormwater discharges will be evaluated to identify any potential for an ongoing source of COCs to West Bay, which would require implementation of source control measures. The evaluation will likely involve reviewing whether stormwater permit thresholds are being met and reviewing recent stormwater and catch basin solids data. Sediment data collected near outfalls discharging to West Bay may be evaluated to support identification of sources that may result in an ongoing source of contamination.

A broader assessment of other potential transport pathways will be required to develop a comprehensive conceptual site model (CSM) for potential ongoing sources of COCs to sediments within West Bay. The CSM will inform other potential assessment needs along potentially complete pathways to West Bay, possibly including erosive shoreline embankments, groundwater seeps, bulkhead drains, and direct overwater or overland flow discharges.

Elevated D/F, cPAHs, and cadmium concentrations throughout West Bay also suggest ongoing contributions from diffuse sources. Diffuse sources may include local and regional background sources that potentially contribute to chemical concentrations in sediments within Budd Inlet. Background concentrations of chemicals such as D/F, cPAHs, and metals can be found in soils and sediments

throughout much of the state, either due to natural occurrences or as a result of widespread regional human activities. The potential contributions from these ubiquitous sources and the development of background concentrations for some widespread and/or naturally occurring contaminants and chemicals are considered data gaps that will be further assessed in the forthcoming Source Control Assessment Memorandum. For example, regional background concentrations have not been developed for cadmium.

4.4.2 Existing Source Control Data

Multiple studies offer regional- and site-specific information relevant to West Bay source characterization (Anchor 2012a, 2012b, 2014, 2016, 2017; Ecology 2018; SAIC 2008). These investigations included evaluation of stormwater, catch basin solids, and stormwater sediments, focusing on discharges. Additionally, the investigations identified that stormwater discharges potentially contribute to widespread input of COCs to West Bay, particularly D/F and cPAHs. Outfalls discharging to West Bay are shown on Figure 4-12. Further, as shown on Figures 4-11 and 4-12, concentrations of cPAHs and D/Fs in surface sediments exceeding regional background concentrations are present near some outfalls. As discussed in the Draft Alternatives Memorandum, COCs in sediment are elevated near several of the outfalls, with concentrations decreasing beyond the immediate outfall location. This indicates the significance of evaluating the need for source control measures for the stormwater pathway.

Further, the studies mentioned above and the Draft Alternatives Memorandum identify several historical and ongoing sources that likely contribute to elevated COC concentrations in West Bay sediments. These studies have generally categorized potential historical and ongoing sources to Budd Inlet as follows: atmospheric deposition, a historical waste pit located at the north end of the Port Terminal area, other cleanup sites along Budd Inlet, and stormwater and combined sewer overflow (CSO) discharges to West Bay. These potential sources will be further evaluated and discussed in the Source Control Assessment Memorandum. A comprehensive assessment of these potential sources to West Bay and any potential effect on sediment quality will supplement existing data to determine recontamination potential.

4.4.3 Source Control Evaluation Data Gaps

It is anticipated that based on the forthcoming preliminary source control strategy framework in the Source Control Work Plan, the source control evaluation will primarily focus on potential sources discharging to West Bay via the stormwater pathway and discharges from Capitol Lake. Specifically, other private and public outfalls discharging to West Bay (Figure 4-10). A current evaluation of stormwater discharges to West Bay will need to be completed to fully characterize stormwater sources to West Bay. This evaluation will inform the scope of source control measures that may be required to ensure that the remedy for West Bay remains protective.

Additionally, the recontamination CSM will identify additional sources and pathways to West Bay for further evaluation. This could include additional public and private outfalls not previously investigated, erosive shoreline embankments, groundwater seeps, bulkhead drains, and direct overwater or overland flow discharges.

A refinement of data gaps will be completed based on a comprehensive review of available data following completion of sediment chemistry investigation to determine areas of potential impacts. Once specific data gaps have been identified, a sampling and investigation approach will be developed and presented in the Sub-Area 2 PRD Source Control Work Plan. Sampling will require coordination with multiple parties and landowners.

4.5 Existing Structures

The project areas covered by this PRD Memo include several existing structures that could potentially affect or be impacted by the remedy construction and that need to be evaluated and addressed during the design process.

Existing structures within Sub-Area 2 that could be impacted by the remedial action (or have impacts on the remedial action) include the following:

- **Fiddle Town Marina, Martin Marina, and Olympia Yacht Club docks, ramps, piling, and marina tenants in the Marinas SMA.**
- **Marine Terminal Dock in the Berth Area and Under Pier SMAs.**
- **Fifth Avenue Dam in the Capitol Lake SMA.**
- **Percival Landing boardwalk, ramps, dock, and piling in the Marinas SMA.**
- **West Bay Marina docks, ramps, piling, and marina tenants in the West Bay Marina South SMA.**
- **Existing outfalls on shorelines of Sub-Area 2.**

4.5.1 Required Data for Potentially Impacted Structures

Currently, it is not fully known what data is required; therefore, potential impacts on structures cannot be fully quantified or evaluated at this time. As such, information on existing structures and potential impacts due to remediation and data needs will be evaluated based on remedial method (dredging, capping, etc.) after the nature and extent of the contamination is determined.

4.5.2 Existing Data for Potentially Impacted Structures

A preliminary review of the existing site conditions and limited available records was conducted.

The following was conducted to support these data review efforts.

- Site condition visual review during a summer, daylight site visit at low tide (July 2022)
- Preliminary-level compilation of readily available historical Port records, including drawings of the terminal dock

- Interview with Port staff
- Review of publicly available data.

A data gap analysis was conducted based on a review of available existing information and was supplemented with a site visit. The focus of the data gap analysis is on implementation of the Port's proposed remedy from the Draft Alternatives Memorandum (DOF et al. 2023), within the West Bay.

4.5.3 Potentially Impacted Structures Data Gaps

Investigation and data collection for structures that may be impacted by remedial activities will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

- **Fiddle Town Marina; Martin Marina; Olympia Yacht Club docks, ramps, and piling; and marina tenants in the Marinas SMA.** Depending on the extent of remediation, particularly dredging, data will be needed on the dock and pier structures at the marinas, including pile embedments, will be required to evaluate the potential impacts of any remedial action.
- **Port of Olympia Terminal.** The Port's proposed remedy of a combination of dredging and capping in the berth area along the pier and a combination of dredging, capping, and EMNR under the pier as required based on sampling. Data will be needed on the dock, including pile embedments, to evaluate the potential impact on the structure during implementation of the remedy.
- **Fifth Avenue Dam in the Capitol Lake SMA.** Depending on the extent of sediment remediation required and the selected remedial alternative, structural or hydrodynamic (discharge) data may be needed regarding the Fifth Avenue Dam and spillway. The future Deschutes Estuary Restoration Project is anticipated to occur in 2033 and will remove this dam. Coordination with the Deschutes Estuary Restoration Project will be necessary to coordinate remedial design in this area.
- **Percival Landing boardwalk, ramps, dock, and piling in the Marinas SMA.** Depending on the extent of sediment remediation required and the selected remedial alternative, structural data may be needed.
- **West Bay Marina docks, ramps, piling, and marina tenants in the West Bay Marina South SMA.** Depending on the extent of sediment remediation required and the selected remedial alternative, structural data may be needed.
- **Existing outfalls on shorelines of Sub-Area 2.** LOTT Outfall 2 and several City stormwater outfalls are located on the shorelines of Budd Inlet Sub-Area 2. Depending on the extent of sediment contamination identified during sediment sampling and on the resulting required remediation and remedial approach in the vicinity of these outfalls, structural data may be required to complete the remedial design in the vicinity of one or more outfalls. Data needs and existing data investigations and evaluations will be performed during design as needed based on remediation requirements.

Investigation and data collection for structures that may be impacted by remedial activities will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan and field investigation.

4.6 Geotechnical Data

4.6.1 Required Geotechnical Data

Geotechnical data are required to support several elements of the remedial design, including evaluating potential impacts to existing piling, docks, and the Fifth Avenue Dam, and dredging within the berthing and Under Pier areas. Determining the geotechnical properties of the dredged material is also required.

This PRD Memo presents a summary of geotechnical data needs for the design of dredging and dredging-related portions of the remedial action in West Bay. The data gaps discussed herein assume that dredging for West Bay will be part of the likely preferred remedy, and that data will be collected to support evaluations of sediment reuse and disposal options. Table 4-6 presents a summary of relevant historical geotechnical explorations; relevant historical geotechnical explorations and geotechnical data gaps are presented in the sections below.

4.6.2 Existing Geotechnical Data

Numerous previous investigations have advanced geotechnical explorations in West Bay and around the Port Peninsula. Although cone penetration tests (CPTs) have been advanced for some studies, historical geotechnical explorations include primarily conventional geotechnical borings with standard penetration test data and laboratory index tests (i.e., specific gravity, water content, grain size, *in situ* density, and Atterberg Limits). Some investigations have included advanced laboratory tests to determine the strength or compressibility characteristics of soils; however, the number of such tests is limited, and most of these investigations were completed in the 1970s and 1980s. The deeper data from the 1970's and 1980's will likely have not changed today but the upper 10 to 20 feet may have changed over time due to site development and cleanup actions.

Historical geotechnical explorations for PRD have been identified for sediment properties relative to general sediment management. Historical geotechnical explorations reviewed and determined to be related to these remedial and design elements are listed in Table 4-6. Figure 4-9 illustrates locations of relevant historical geotechnical explorations identified during the historical data-review process. Historical geotechnical data are summarized as follows:

- Sediment properties for sediment management.
  - As shown on Figure 4-9, numerous subsurface investigations were advanced in Budd Inlet and the Port Peninsula but are limited in the West Bay to near the terminal pier area. Due to limited data and the age of these limited explorations in West Bay, subsequent changes in site geometry, and relatively low confidence in the position accuracy of many of these explorations, their utility for current geotechnical design is limited. Of the numerous explorations advanced in West Bay, only one was advanced more recently than 1982. Of these explorations, 15 were advanced to depths greater than 50 ft below ground surface (bgs) at the time of exploration. While historical explorations in West Bay may be useful for understanding the distribution of various soil units within the subsurface, owing to their age and changing site conditions, they will

not be reliable for determining the engineering parameters (such as density, compressibility, or strength) of these soils.

4.6.3 Geotechnical Data Gaps

Geotechnical data gaps for PRD have been identified for sediment properties relative to general sediment management and SLR/shoreline resiliency placement design. Sub-Area 2 geotechnical data gaps investigation will be included in the Sub-Area 2 Sediment Chemistry and Shoreline & Overwater Structure Work Plans. Geotechnical data gaps related to these remedial and design elements are as follows:

- Sediment properties for sediment management.
  - Additional in-water exploration will be required to characterize the physical and strength properties of the sediment and to support the design of replacement float piles as necessary, based on remedy design within the marina where dredging is a potential remedy within Sub-Area 2. Borings will generally extend 50 ft below the mudline. To support float pile design, one-dimensional consolidation tests and consolidated, undrained triaxial tests will also be completed.
  - To support dredge spoils characterization, samples collected within the anticipated dredging depths will be tested for bulk density, grain size, plasticity, and moisture content.
  - Geophysical surveys will be completed across the dredge area to determine sediment thickness.
  - Geophysical surveys will be completed at the site to determine the average shear wave velocity of the soils present at the site.

4.7 Permitting and Habitat Data

4.7.1 Required Permitting and Habitat Data and Data Gaps

Up-to-date data are required to evaluate habitat conditions. Areas where data are needed depend on areas requiring remediation, remedial approach and related permitting, and mitigation of habitat restoration needs.

High tide line (HTL): The jurisdictional line for Section 10/404 permitting is the HTL. This line is field-located, site-specific, and is not correlated to any site-wide elevation.

Salt marsh coverage: Salt marsh—a type of coastal wetland—is present along much of the Budd Inlet shoreline and much of the remedial area. Owing to the potential for remedial design to affect salt marsh, its extent must be known and mapped for permitting in order to track any impacts.

Salt marsh elevation: The elevation at which salt marsh begins and ends would need to be established with confidence.

Shoreline habitat conditions: Habitat required conditions include slope, substrate, and vegetation coverage. These data are necessary to characterize the habitat that may be affected by remediation.

Select sampling locations: The permitting process may require location-specific chemical contamination data within potential habitat areas, dependent on remedial design needs.

Bathymetry: Bottom depths of areas to be remediated would need to be known.

Benthic debris: The presence of debris on the benthic surface of the areas to be affected by remediation would affect the valuation of this habitat and thus would need to be known for permitting in order to account for habitat impacts.

Overwater structures: If any overwater structures would be affected by the remedial action (i.e., removed or altered), these would need to be described in detail, including square footage, composition materials, pile counts, pile diameter, and whether the structures would be rebuilt.

Areas and volumes of removal and fill: Any sediment that would be removed or placed below the HTL needs to be quantified.

Presence/absence of contaminants in potential habitat areas: For all areas in the West Bay that would be excavated to create habitat, sediment chemistry data is required.

4.7.2 Existing Permitting and Habitat Data

There is limited up-to-date data available to support project permitting or habitat evaluations. Previously the project completed limited initial evaluations of existing benthic debris and overwater structures.

General natural resource information can be found in the following:

- Coast & Harbor Engineering's *City of Olympia West Bay Environmental Restoration Assessment* (Coast & Harbor Engineering 2016)
- JA Brennan Associates' *City of Olympia West Bay Restoration & Park Master Plan Alternatives 1, 2 & 5 Comparison Memorandum* (Brennan 2022).
- Additionally, Grette Associates has prepared a draft *Shoreline and Intertidal Habitat Technical Memorandum* (Grette 2023), which provides qualitative shoreline habitat data for the remedial area. A more detailed shoreline habitat conditions survey will be conducted prior to remedial design.

4.7.3 Permitting and Habitat Data Gaps

HTL: The HTL must be delineated in the field and included in the figure set. A site visit to delineate the HTL per USACE guidance along the entirety of the remedial area will be necessary for permitting. HTL delineation will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

Salt marsh coverage: Delineation and mapping of existing salt marsh coverage needs to be completed for the site. This would be done by conducting a site visit to record the extent of salt marsh using a sub-meter global positioning system (GPS) unit. Salt marsh coverage delineation will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

Salt marsh elevation: The elevation at which salt marsh begins and ends would need to be established with confidence. Salt marsh elevation extents determination will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

Shoreline habitat conditions: Habitat conditions data need to be collected. Habitat conditions include slope, substrate, and vegetation coverage. Shoreline habitat conditions data collection will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

Select sampling locations: Specific locations are not determined, but the habitat and permitting team would need the opportunity to direct the location, with Ecology review and approval, of some samples, as applicable. Sample location coordinates will be included in the Sub-Area 2 Sediment Chemistry.

Bathymetry: Bottom depths of areas to be remediated would need to be known with a high degree of certainty and precision. This information would drive the calculations of the changes in aquatic habitat by elevation zone. Needed habitat bathymetry data will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

Benthic debris: The presence of debris on the benthic surface and mapping of this debris is currently not available. A debris survey and mapping will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

Overwater structures: Data for structures that may be impacted by the planned remedy will need to be collected prior to remedy implementation. These data gap needs will vary by structure and remedy selection. Structure data gaps needs will be addressed in the Sub-Area 2 Shoreline & Overwater Structures Work Plan as needed.

Areas and volumes of removal and fill: Removal/fill volumes would be calculated as part of the remedial design process. Bathymetric data needed to calculate these volumes will be included in the Sub-Area 2 Shoreline & Overwater Structures Work Plan.

Presence/absence of contaminants in potential habitat areas: Chemical contamination data are sparse for the west shore of West Bay, where potential mitigation actions could be implemented. Additional sampling in this area is necessary. Sediment chemistry data needs along the west shore of West Bay will be included in the Sub-Area 2 Sediment Chemistry Work Plan and assessed during the field investigation.

5.0 NEXT STEPS

This PRD Memo is for Sub-Area 2 of three Sub-Areas within the overall Budd Inlet Sediment Site. Sub-Area 1 work has already been initiated and continues to be advanced. As work related to Sub-Areas 1 and 2 is advanced, pre-design investigation work will continue in Sub-Area 3 to encompass the overall Budd Inlet Sediment Site.

Three works plans for Sub-Area 2 will focus on sediment chemistry, source control, and shoreline and overwater structures. The Sediment Chemistry Work Plan and field investigation will be completed first. Evaluation of the resulting sediment chemistry data will allow for refinement of the nature and extent of sediment contamination within Sub-Area 2 and subsequent reevaluation of proposed remedial alternatives. Then, work plans for Sub-Area 2 will be prepared and submitted for source control and shoreline and structural investigations. These work plans will be based on revised remedial alternatives and the proposed sediment chemistry investigation.

The PRD Field Investigation Work Plan for Sub-Area 2 is currently in process so that the field investigation for Sub-Area 2 can start in the fall of 2024 or the winter of 2025. Table 5-1 below illustrates the correlation between the data gaps outlined in Section 4.0 with the work plan/investigation where these data gaps are anticipated to be addressed.

Table 5-1. Data Need and Anticipated Correlated Work Plan

Data Need	Anticipated Correlated Work Plan	Data Type to Be Collected
Nature and Extent of Sediment Contamination	Sub-Area 2 Sediment Chemistry Work Plan	Horizontal and vertical extents of contamination in sediment.
Sediment Geotech—Dredged Material Management	Sub-Area 2 Sediment Chemistry Work Plan	Sediment geotechnical data for sediment management, including soil classification and grain size.
Sources of Contamination—Source Control and Remedy Protection	Sub-Area 2 Source Control Work Plan	Sediment chemistry data to evaluate impacts of potential sources on Budd Inlet sediment.
Existing Structures	Sub-Area 2 Shoreline and Overwater Structures Work Plan	PRD for sediment properties for general sediment management and Fifth Avenue Dam). Potential impacts to existing structures based on the remedy construction.
Sediment Geotech—Remedy Design	Sub-Area 2 Sediment Chemistry Work Plans and Sub-Area 2 Shoreline & Overwater Structures Work Plan	Sediment geotechnical data to support potential slope stability for dredge slopes.
Project Area Base Map	Sub-Area 2 Shoreline & Overwater Structures Work Plan	Bathymetric and topographic survey data, as needed. To be revisited prior to design based on actual remedial areas.
Permitting and Habitat	Sub-Area 2 Shoreline & Overwater Structures Work Plan	Bathymetric and topographic survey data to delineate habitat areas.

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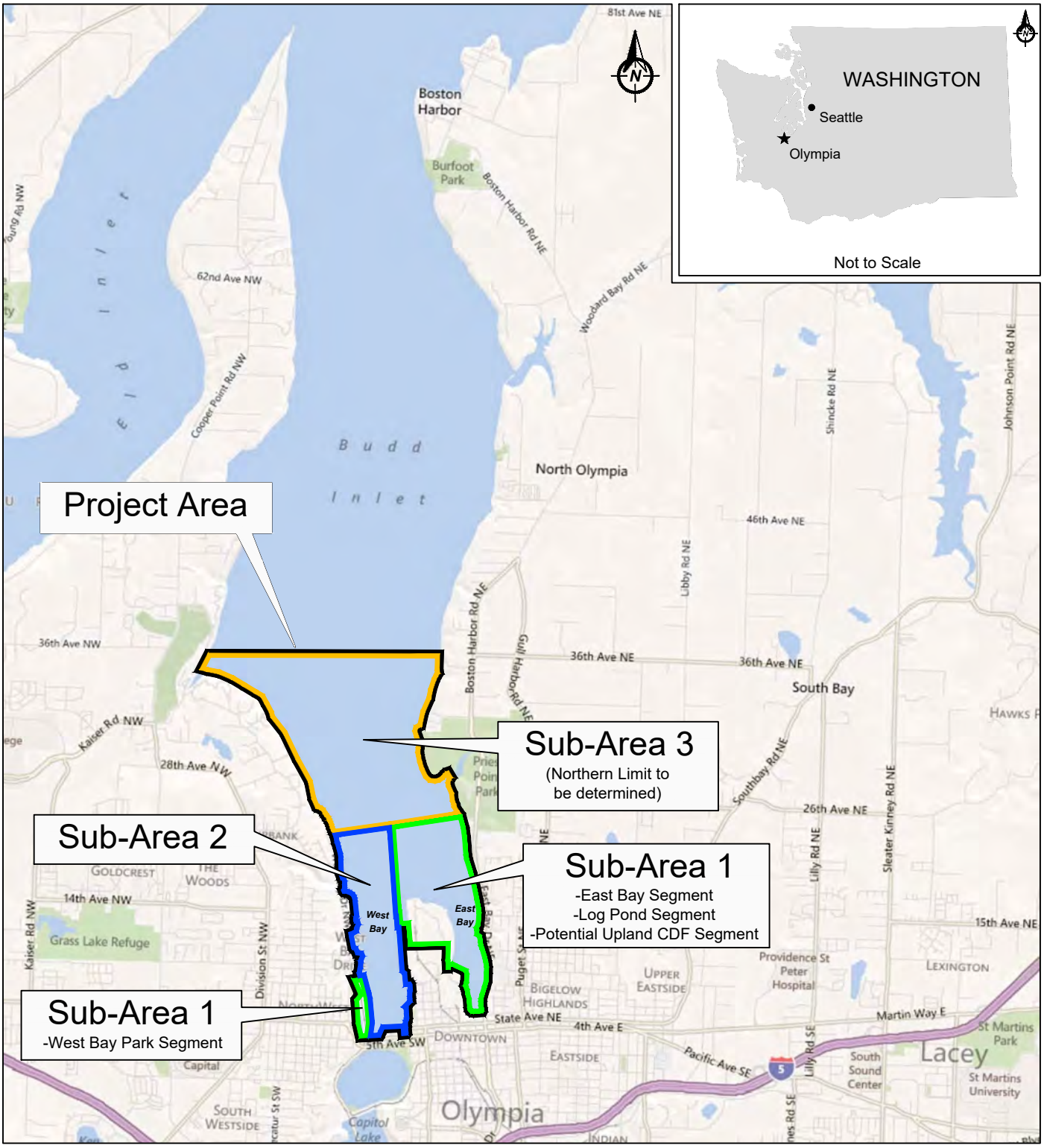

Note

1. Background imagery: Bing Maps
2. All boundaries are approximate.

Legend

- Project Area (Northern Limit to be determined)
- Sub-Area 1
- Sub-Area 2
- Sub-Area 3 (Northern Limit to be determined)

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The Budd Inlet Team

PORT of OLYMPIA
Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Vicinity Map & Budd Inlet Project Sub-Areas

Figure 1-1

October 25, 2024

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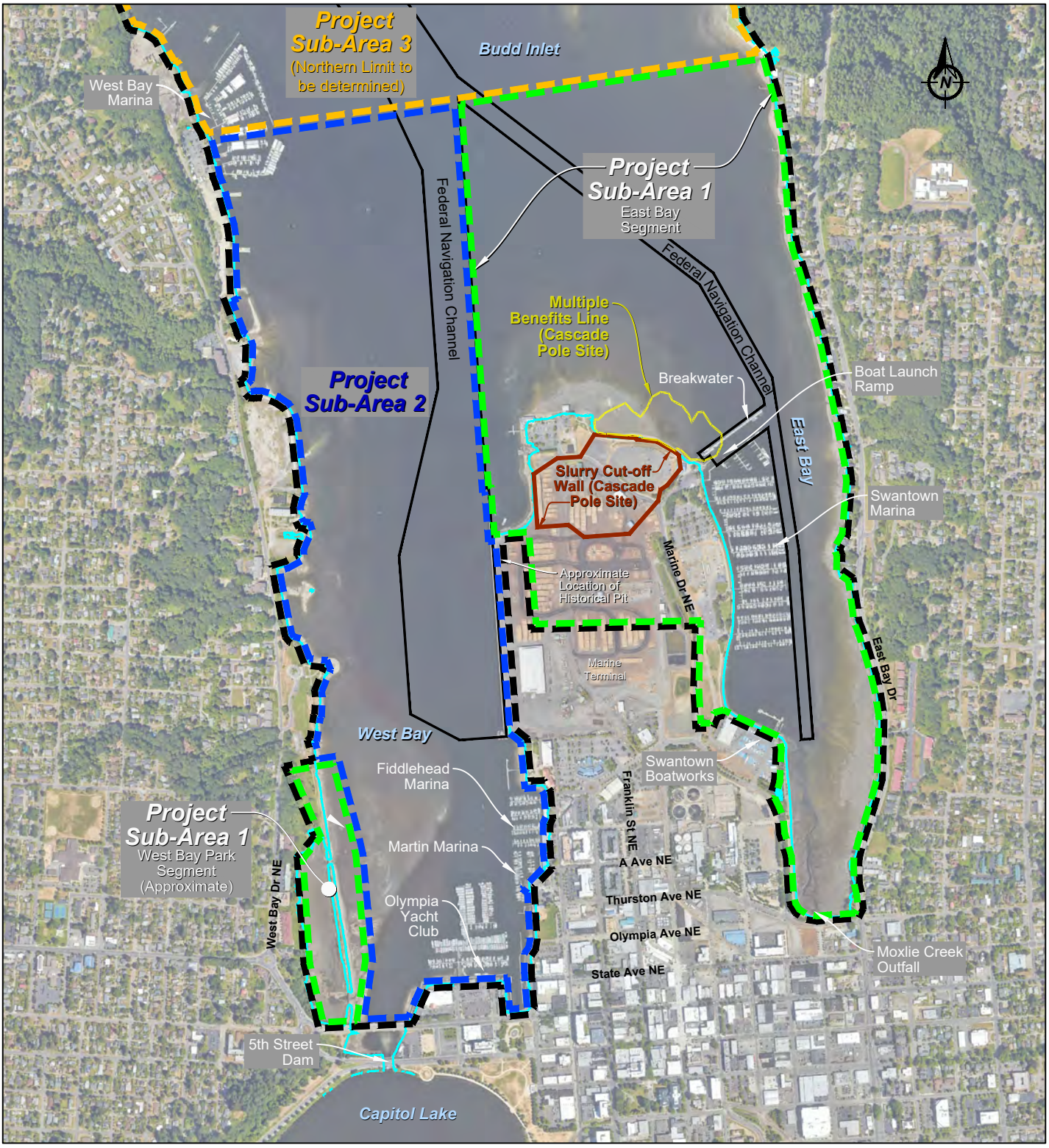

Notes

1. Horizontal Datum: Washington State Plane South, NAD83.
2. Background imagery: Google Earth Pro, 07/25/2022.
3. All boundaries are approximate.

Legend

- Project Area
- Sub-Area 1
- Sub-Area 2
- Sub-Area 3
- Multiple Benefits Line (Cascade Pole Site)
- Slurry Cut-off Wall (Cascade Pole Site)
- Federal Navigation Channel
- Mean Higher High Waterline (MHHW)

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Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Project Areas & Site Features in South Budd Inlet

Figure 1-2

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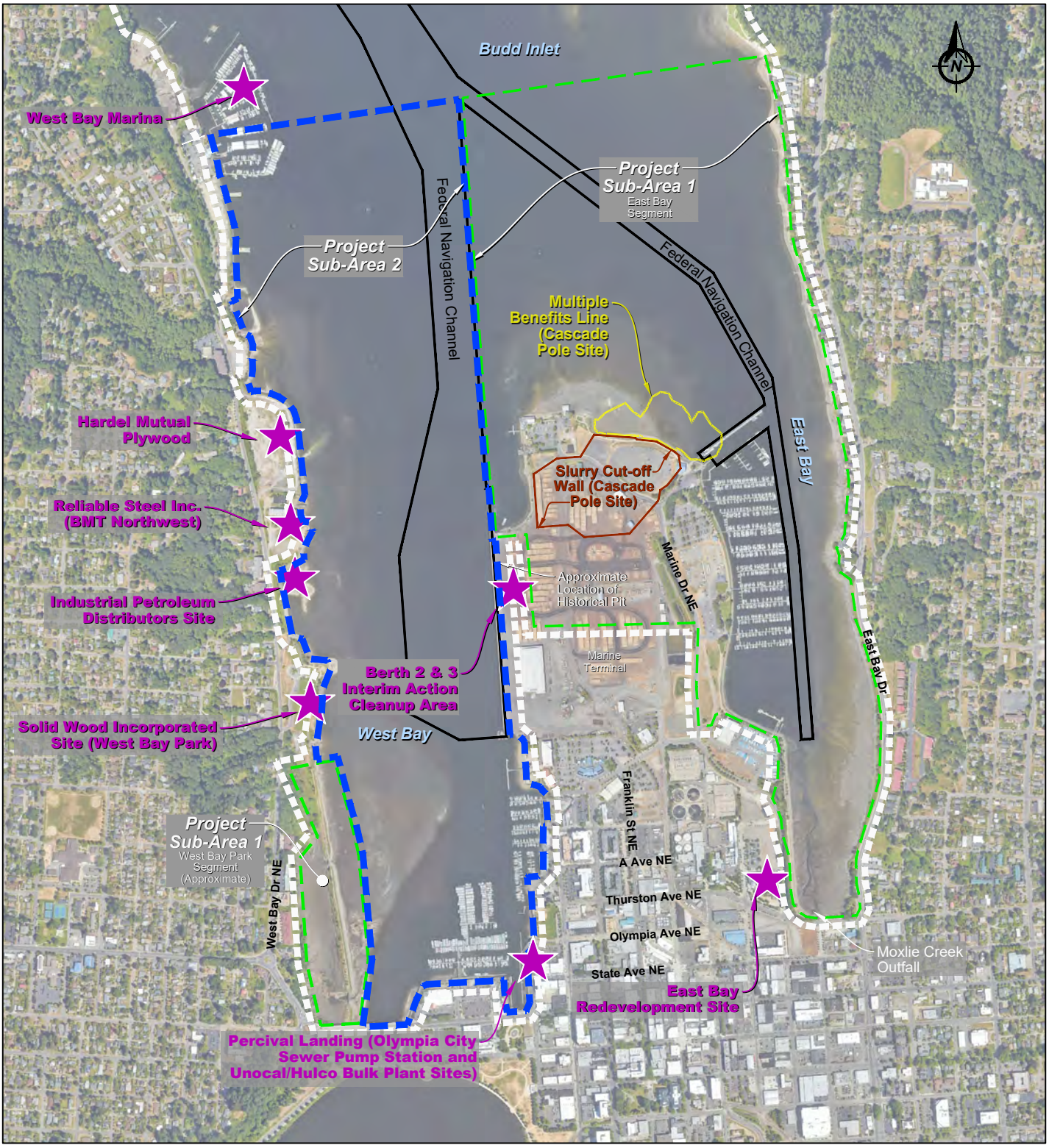

Notes

1. Background imagery: Google Earth Pro, 07/25/2022.
2. Source: Department of Ecology Website

Legend

- Known Contaminated Site
- Project Area
- Sub-Area 1
- Sub-Area 2
- Multiple Benefits Line (Cascade Pole Site)
- Slurry Cut-off Wall (Cascade Pole Site)
- Federal Navigation Channel

0 600 1200
Scale in Feet

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Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Locations of Other Known Contaminated Sites

Figure 2-1

October 25, 2024

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Budd Inlet

Project Sub-Area 1
East Bay Segment

Project Sub-Area 2

Federal Navigation Channel

LOTT Outfall 001
(Permit WA0037061)

LOTT Outfall 002
(Permit WA0037061)

Log Pond

Slurry Cut-off Wall
(Cascade Pole Site)

West Bay

East Bay

Marine Terminal

Swantown Marina

Swantown Boatworks

LOTT Wastewater Reclamation Facility

Navigation Channel East

Marine Dr NE

East Bay Dr

Franklin St NE

A Ave NE

Thurston Ave NE

Olympia Ave NE

West Bay Dr NE

Berth 3 North

Berth 3 South

Berth 2

Berth 1-2

Berth 1

Project Sub-Area 1
West Bay Park Segment
(Approximate)

Legend

- XXXX-XXXX — Previous Sample Location/ID
- Approx. Oly Yacht Club Dredge Area 2013/2014 (See note 1)
- Approx. Percival Landing Excavation Area 2010/2011 (See note 2)
- Approx. Berths 2 & 3 Dredge Area 2009 (See note 3)
- Berth Delineation

Site Features

- Project Area
- Sub-Area 1
- Sub-Area 2
- Federal Navigation Channel
- Slurry Cut-off Wall (Cascade Pole Site)
- LOTT Wastewater Outfall Pipe
- Intertidal Sediments Area

Notes

1. Olympia Yacht Club 2013 dredging permitted for 16,241 cy (JARPA NWS-2012-793).
2. Olympia City Sewer Pump Station & Unocal Hulco Bulk Plant 2010/2011 excavation of approximately 2,500 cy.
3. Port of Olympia Berths 2 & 3 dredging approximately 9,515 cy
4. Background imagery: Google Earth Pro, 07/25/2022.

Outfalls

- Industrial Stormwater Outfall (NPDES General Permit)
- Industrial Stormwater Outfall (NPDES Individual Permit)
- City of Olympia Stormwater Outfall
- LOTT Wastewater/CSO Outfall
- Industrial Outfall (Boatyard General Permit)
- Historical Outfall (~2013)

Source: City of Olympia and Thurston County GIS - November 2023

0 600
Scale in Feet

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Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Historical Surface (0-10 cm Subtidal, 0-45 cm Intertidal) Sample Locations

Figure 2-2

October 25, 2024

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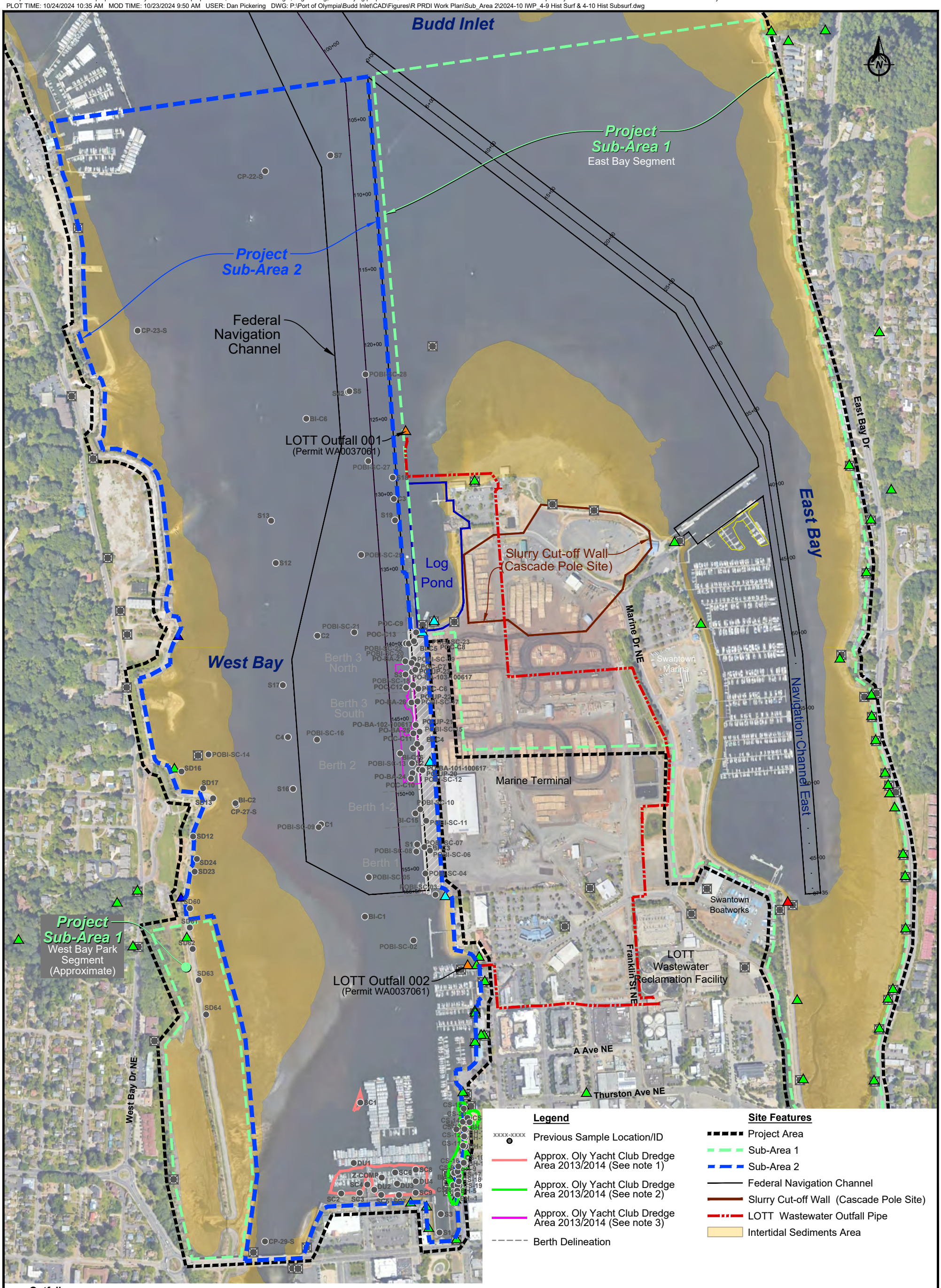

Notes

1. Olympia Yacht Club 2013 dredging permitted for 16,241 cy (JARPA NWS-2012-793).
2. Olympia City Sewer Pump Station & Unocal Hulco Bulk Plant 2010/2011 excavation extents
3. Background imagery: Google Earth Pro, 07/25/2022.

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Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Historical Subsurface (>10 cm Subtidal, >45 cm Intertidal) Sample Locations

Figure 2-3

October 25, 2024

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Budd Inlet
West Bay Marina South
Project Sub-Area 1
Navigation Dredging
Project Sub-Area 2
Open Water West
West Bay
Federal Navigation Channel
Multiple Benefits Line (Cascade Pole Site)
Potential Log Pond CDF
East Bay Dr
East Bay
Log Pond
Slurry Cut-off Wall (Cascade Pole Site)
Marine Dr NE
Swantown
Approximate Location of Historical Pit
Navigation Channel West
Marine Terminal
Potential Upland CDF Areas to be Evaluated
Swantown Boatworks
LOTT Wastewater Reclamation Facility
Franklin St NE
A Ave NE
Project Sub-Area 1
Capitol Lake Discharge
Marinas
Moxlie Creek Outfall

0 300 600
Scale in Feet

Sediment Management Area (SMA)
- Navigation Channel - West
- Open Water - West
- Capitol Lake Discharge
- Marinas
- West Bay Marina South
- Berthing Area
- Underpier

D/F and cPAHs Combined Regional Background Exceedance
- Exceedance Area

Legend
- Project Area
- Sub-Area 2
- Sub-Area 1
- Multiple Benefits Line (Cascade Pole Site)
- Slurry Cut-off Wall (Cascade Pole Site)

Dredging Area
- Navigation
- Marina

Confined Disposal Site (CDF)
- Potential Upland CDF Areas to be Evaluated
- Potential Log Pond CDF

Notes
1. Horizontal Datum: Washington State Plane South, NAD83.
2. Background imagery: Google Earth Pro, 07/25/2022.
3. All boundaries are approximate.

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PORT of OLYMPIA
Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Budd Inlet Sub-Area 2 SMAs

Figure 3-1

October 25, 2024

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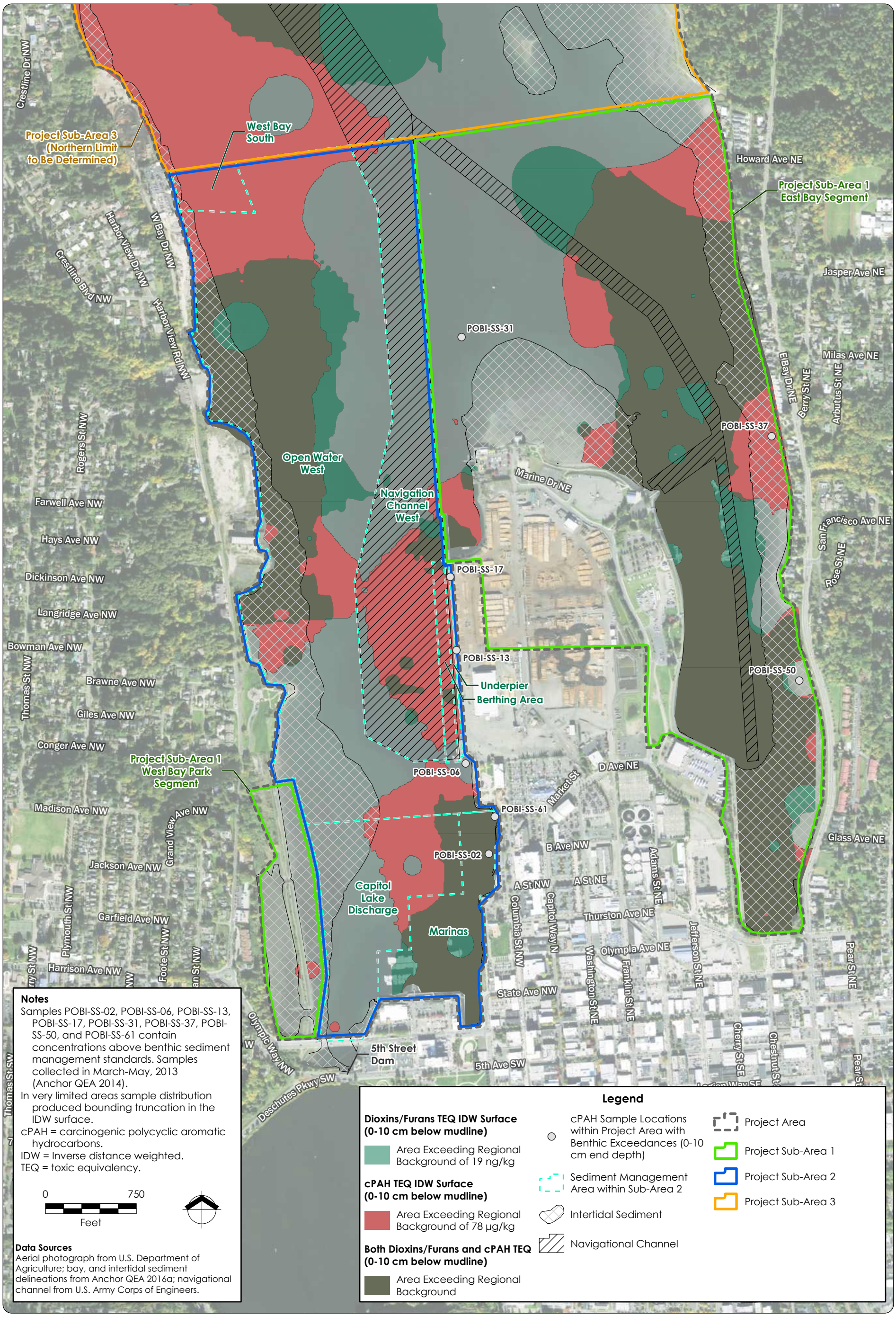
Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 3-2 SA2 DGM Regional Background and Sediment Management Context

Print Date: 7/26/2024

Reviewed By: DOF

Produced By: jroberts

Project: M0781.03.002



Notes

Samples POBI-SS-02, POBI-SS-06, POBI-SS-13, POBI-SS-17, POBI-SS-31, POBI-SS-37, POBI-SS-50, and POBI-SS-61 contain concentrations above benthic sediment management standards. Samples collected in March-May, 2013 (Anchor QEA 2014).

In very limited areas sample distribution produced bounding truncation in the IDW surface.

cPAH = carcinogenic polycyclic aromatic hydrocarbons.

IDW = Inverse distance weighted.

TEQ = toxic equivalency.

0 750

Feet

Data Sources

Aerial photograph from U.S. Department of Agriculture; bay, and intertidal sediment delineations from Anchor QEA 2016a; navigational channel from U.S. Army Corps of Engineers.

Legend

Dioxins/Furans TEQ IDW Surface (0-10 cm below mudline)

- Area Exceeding Regional Background of 19 ng/kg

cPAH TEQ IDW Surface (0-10 cm below mudline)

- Area Exceeding Regional Background of 78 µg/kg

Both Dioxins/Furans and cPAH TEQ (0-10 cm below mudline)

- Area Exceeding Regional Background

- cPAH Sample Locations within Project Area with Benthic Exceedances (0-10 cm end depth)
- Sediment Management Area within Sub-Area 2
- Intertidal Sediment
- Navigational Channel
- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3

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Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Regional Background and Sediment Management Context

Figure 3-2

July 31, 2024

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Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Potential Dredged Sediment Management Areas

Figure 3-3

October 25, 2024

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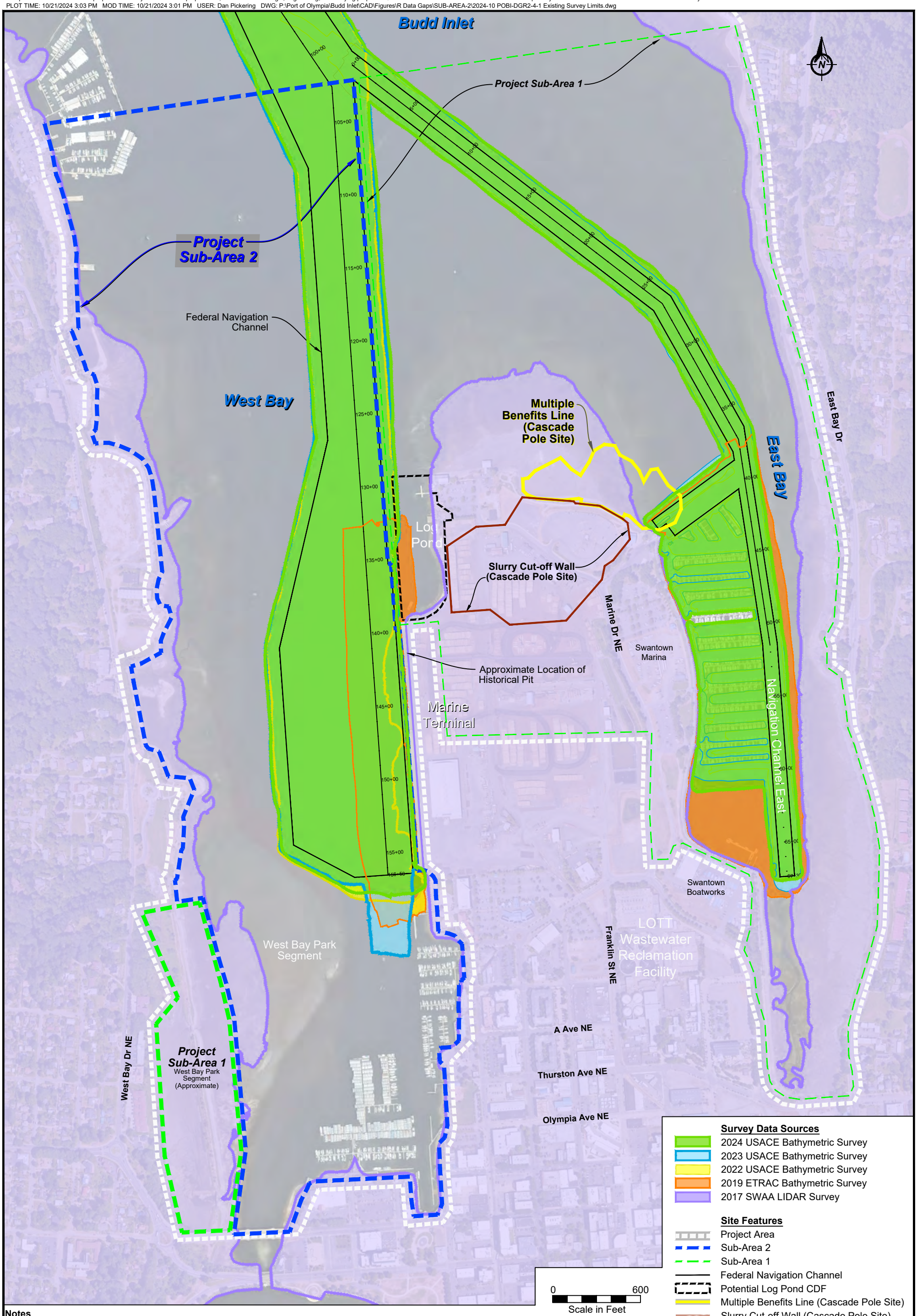

Notes

1. Surface generated from the following surveys: 2017 SWAA LiDAR uplands, 2019 Etrac Condition Survey, 2023 USACE Condition Survey.
2. Data sets earlier than 2017 not included due to obsolescence.
3. Horizontal Datum: Washington State Plane South, NAD83.
4. Background imagery: Google Earth Pro, 07/25/2022.

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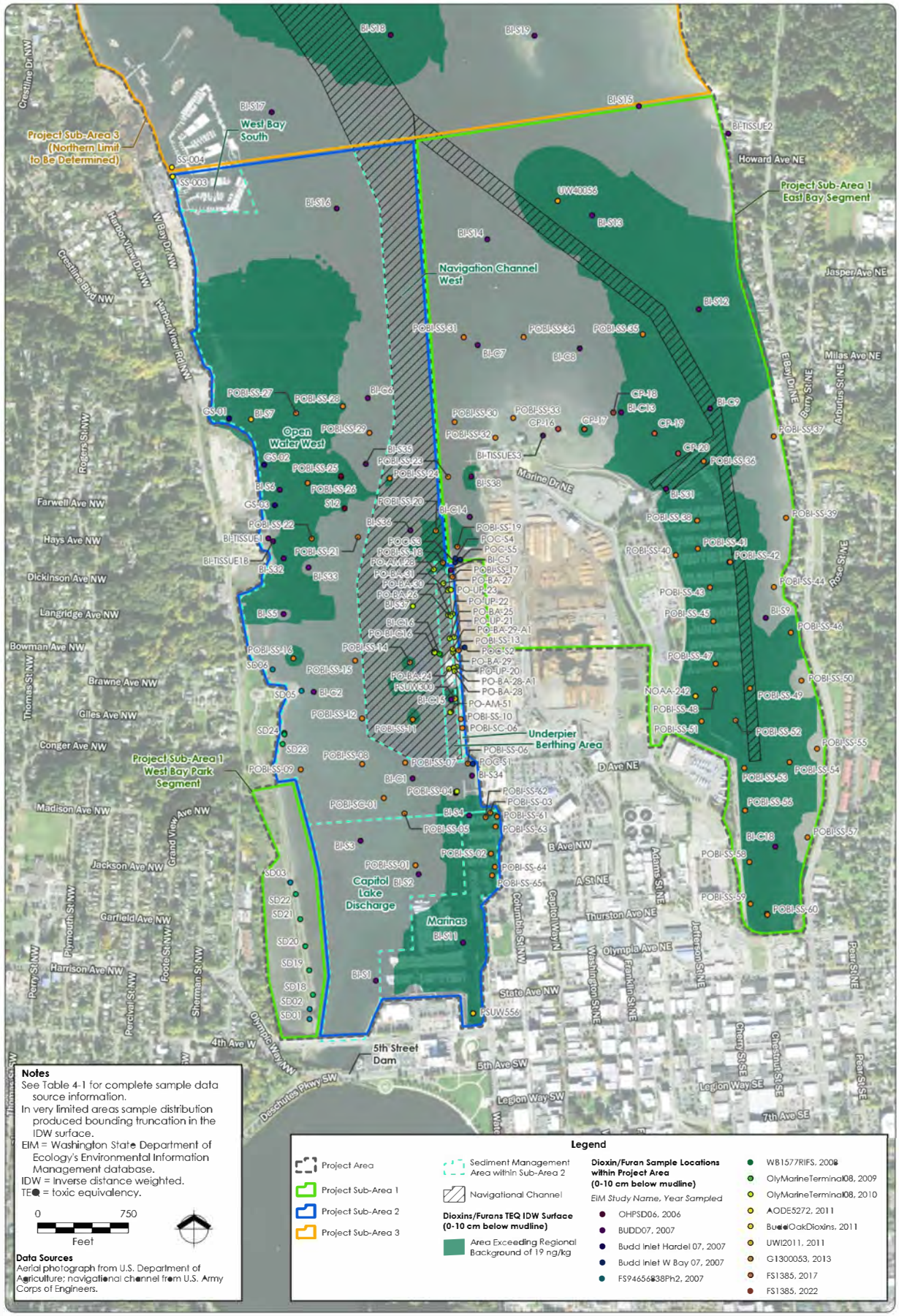
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Existing Survey Coverage

Figure 4-1

October 25, 2024



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Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Dioxins/Furans Sediment Surface (0-10 cm below mudline) Sample Density

Figure 4-2

July 31, 2024

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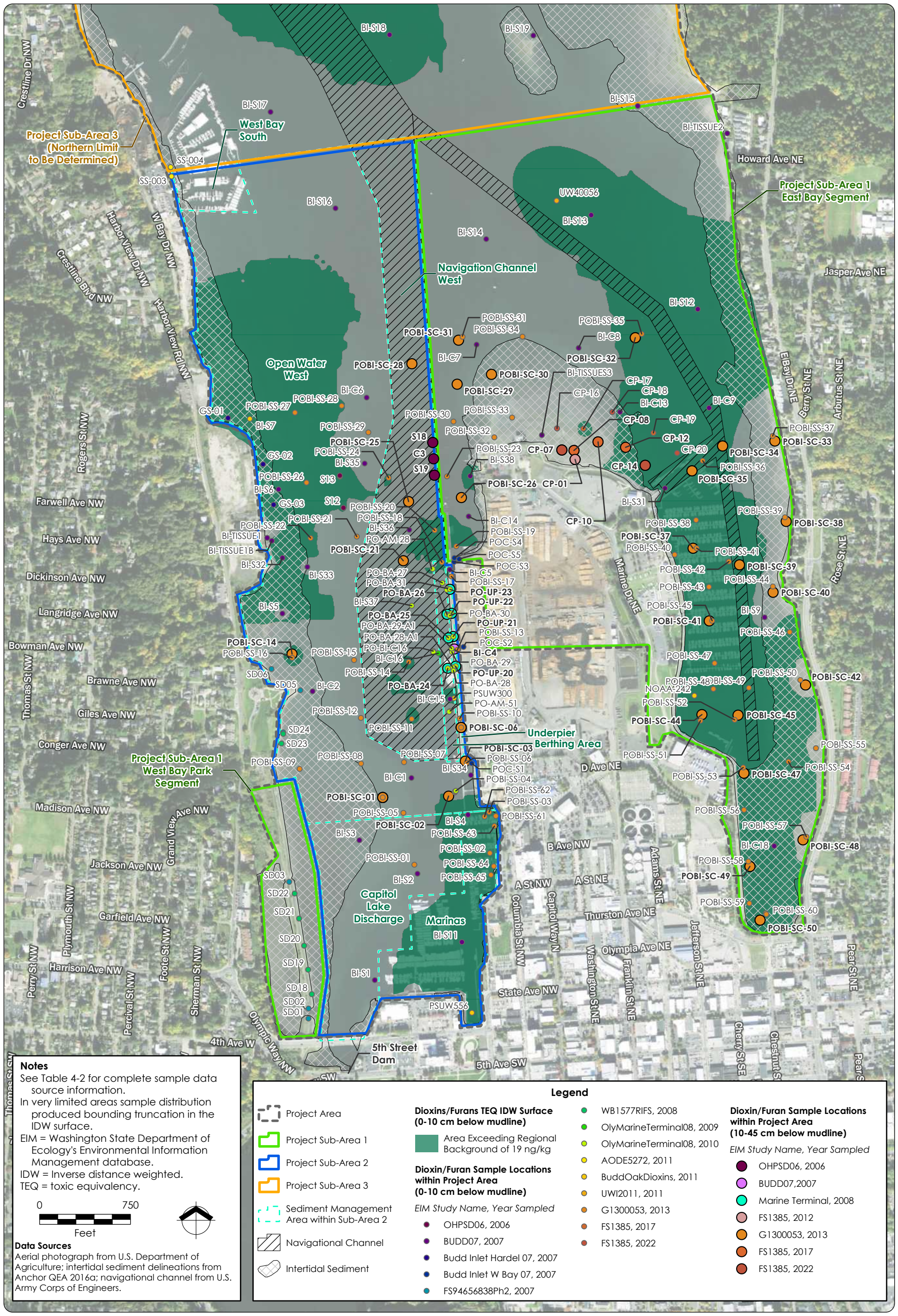

Notes

See Table 4-2 for complete sample data source information.

In very limited areas sample distribution produced bounding truncation in the IDW surface.

EIM = Washington State Department of Ecology's Environmental Information Management database.

IDW = Inverse distance weighted.

TEQ = toxic equivalency.

0 750

Feet

Data Sources

Aerial photograph from U.S. Department of Agriculture; intertidal sediment delineations from Anchor QEA 2016a; navigational channel from U.S. Army Corps of Engineers.

Legend

- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3
- Sediment Management Area within Sub-Area 2
- Navigational Channel
- Intertidal Sediment

Dioxins/Furans TEQ IDW Surface (0-10 cm below mudline)

- Area Exceeding Regional Background of 19 ng/kg

Dioxin/Furan Sample Locations within Project Area (0-10 cm below mudline)

EIM Study Name, Year Sampled

- OHPSD06, 2006
- BUDD07, 2007
- Budd Inlet Hardel 07, 2007
- Budd Inlet W Bay 07, 2007
- FS94656838Ph2, 2007
- WB1577RIFS, 2008
- OlyMarineTerminal08, 2009
- OlyMarineTerminal08, 2010
- AODE5272, 2011
- BuddOakDioxins, 2011
- UWI2011, 2011
- G1300053, 2013
- FS1385, 2017
- FS1385, 2022

Dioxin/Furan Sample Locations within Project Area (10-45 cm below mudline)

EIM Study Name, Year Sampled

- OHPSD06, 2006
- BUDD07,2007
- Marine Terminal, 2008
- FS1385, 2012
- G1300053, 2013
- FS1385, 2017
- FS1385, 2022

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PORT of OLYMPIA

Budd Inlet - Olympia, WA

Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Dioxins/Furans Sediment Near-Surface (0-45 cm below mudline) Sample Density

Figure 4-3

July 31, 2024

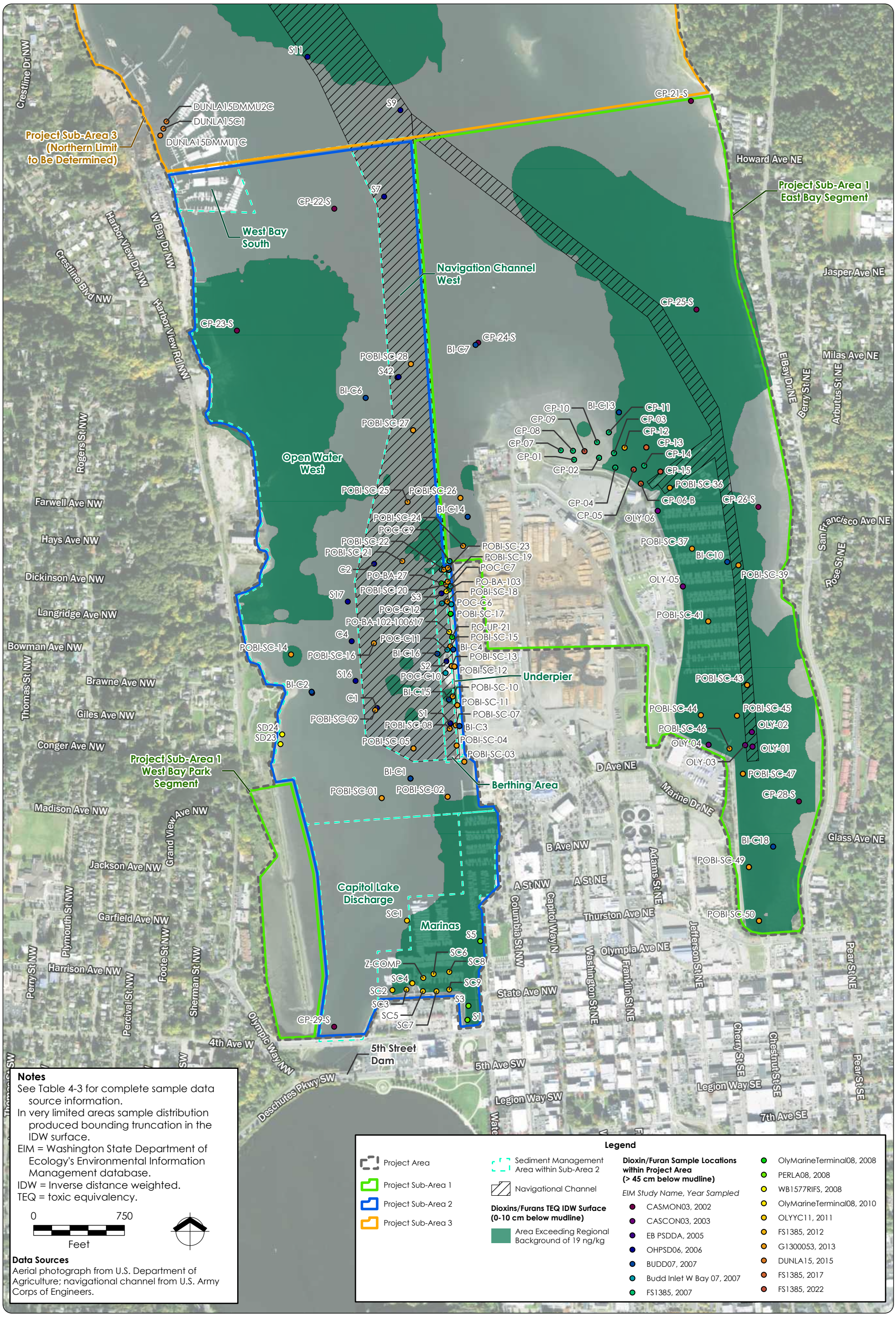
Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-3 SA2 DGM Dioxin-Furans Near-Surface Sample Density

Print Date: 10/18/2024

Reviewed By: DOF

Produced By: jroberts

Project: M0781.03.002



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PORT of OLYMPIA
Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Dioxins/Furans Sediment Subsurface (> 45 cm below mudline) Sample Density

Figure 4-4

July 31, 2024

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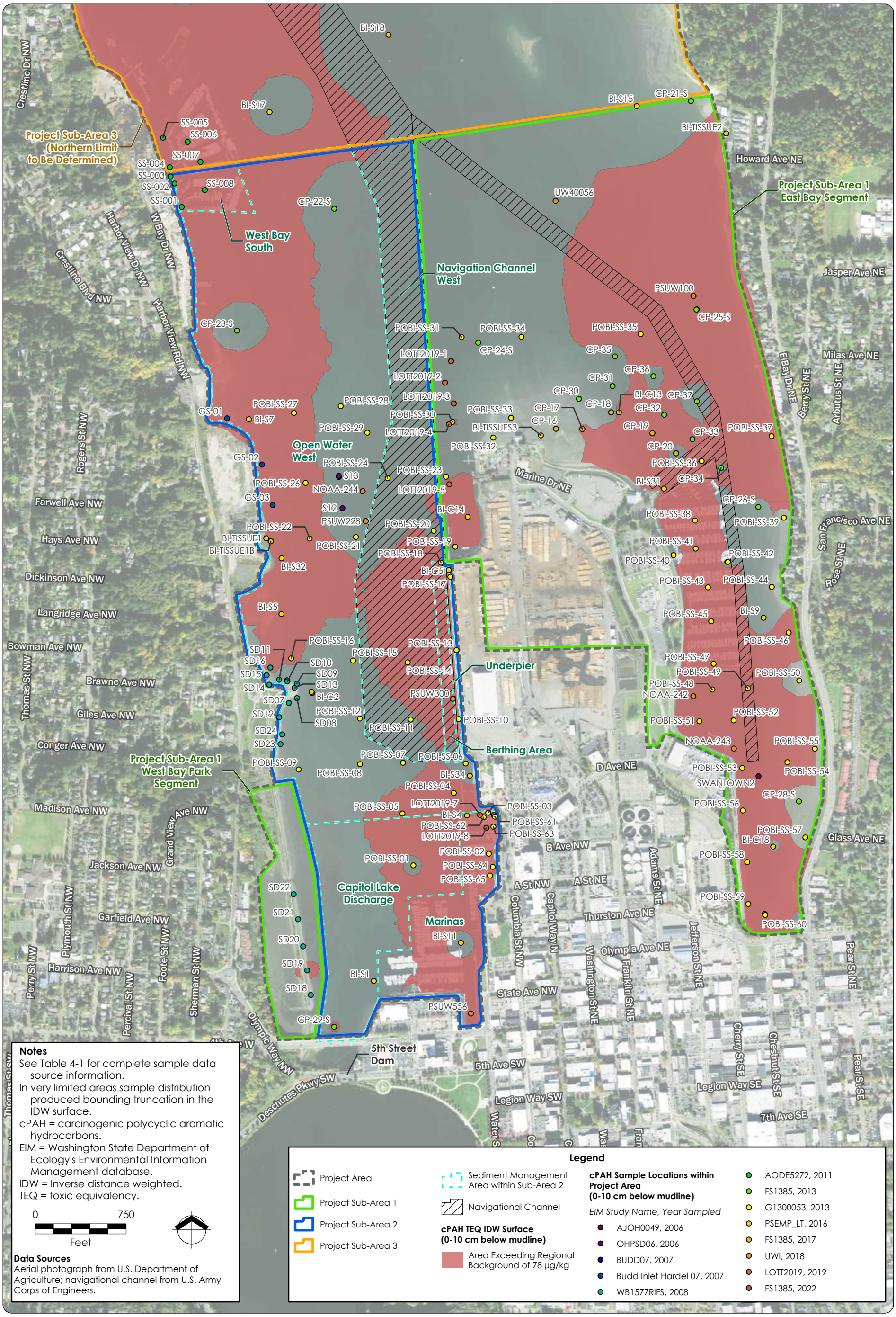
Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-4 SA2 DGM Dioxin-Furans Subsurface Sample Density
Print Date: 7/26/2024
Reviewed By: DOF
Produced By: jroberts
Project: M0781.03.002



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PORT of OLYMPIA

Budd Inlet - Olympia, WA

Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

cPAH Sediment Surface (0-10 cm below mudline) Sample Density

Figure 4-5

July 31, 2024

Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-5 SA2 DGM cPAH Surface Sample Density

Print Date: 7/26/2024

Reviewed By: DOF

Produced By: jroberts

Project: M0781.03.002

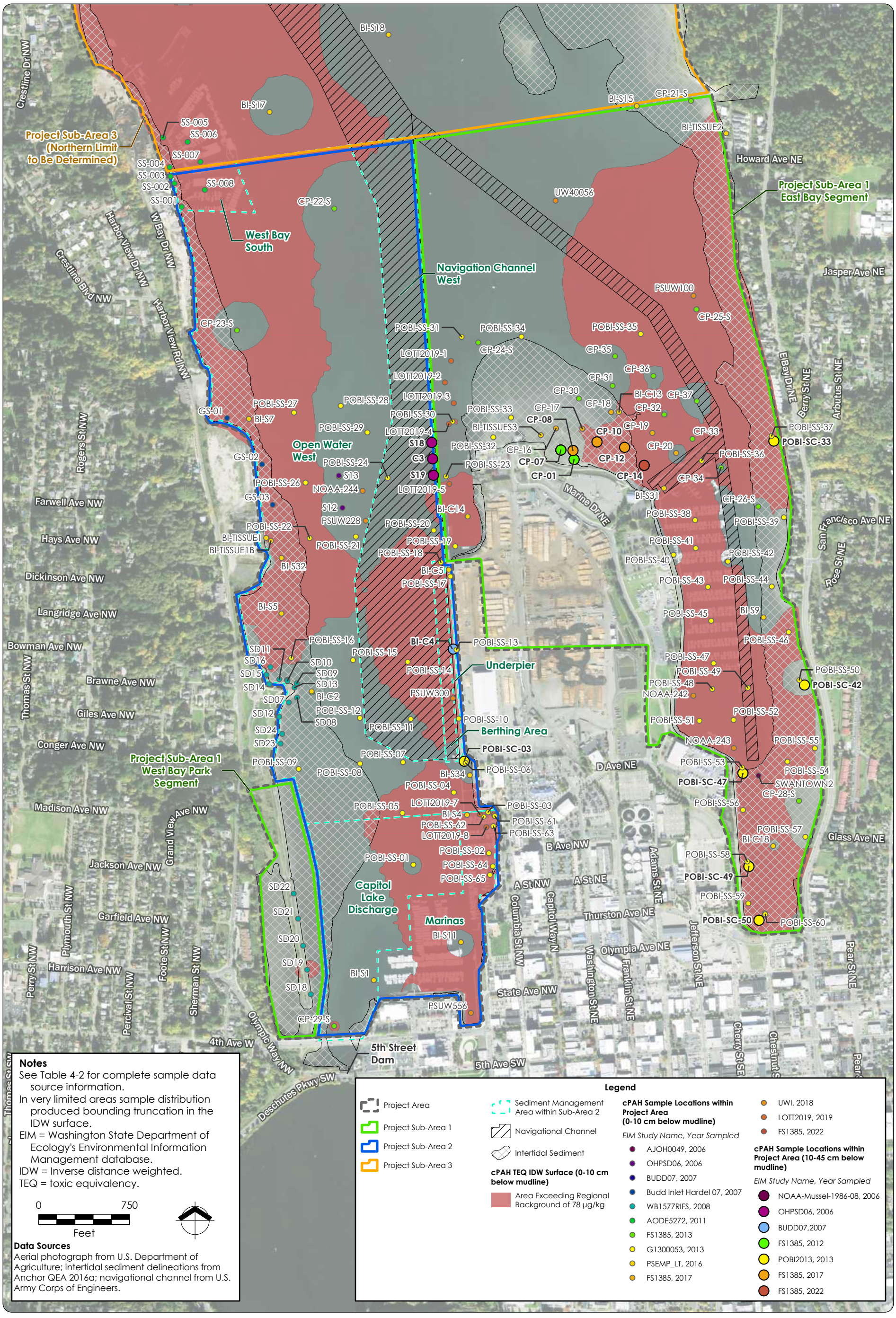
Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-6 SA2 DGM cPAH Near-Surface Sample Density

Print Date: 10/18/2024

Reviewed By: DOF

Produced By: jroberts

Project: M0781.03.002



Notes

See Table 4-2 for complete sample data source information.

In very limited areas sample distribution produced bounding truncation in the IDW surface.

EIM = Washington State Department of Ecology's Environmental Information Management database.

IDW = Inverse distance weighted.

TEQ = toxic equivalency.

0 750

Feet

Data Sources

Aerial photograph from U.S. Department of Agriculture; intertidal sediment delineations from Anchor QEA 2016a; navigational channel from U.S. Army Corps of Engineers.

Legend

- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3
- Sediment Management Area within Sub-Area 2
- Navigational Channel
- Intertidal Sediment

cPAH TEQ IDW Surface (0-10 cm below mudline)

- Area Exceeding Regional Background of 78 µg/kg

cPAH Sample Locations within Project Area (0-10 cm below mudline)

EIM Study Name, Year Sampled

- AJOH0049, 2006
- OHPSD06, 2006
- BUDD07, 2007
- Budd Inlet Hardel 07, 2007
- WB1577RIFS, 2008
- AODE5272, 2011
- FS1385, 2013
- G1300053, 2013
- PSEMP_LT, 2016
- FS1385, 2017
- UWI, 2018
- LOTT2019, 2019
- FS1385, 2022

cPAH Sample Locations within Project Area (10-45 cm below mudline)

EIM Study Name, Year Sampled

- NOAA-Mussel-1986-08, 2006
- OHPSD06, 2006
- BUDD07,2007
- FS1385, 2012
- POBI2013, 2013
- FS1385, 2017
- FS1385, 2022

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PORT of OLYMPIA

Budd Inlet - Olympia, WA

Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

cPAH Sediment Near-Surface (0-45 cm below mudline) Sample Density

Figure 4-6

DRAFT

July 31, 2024

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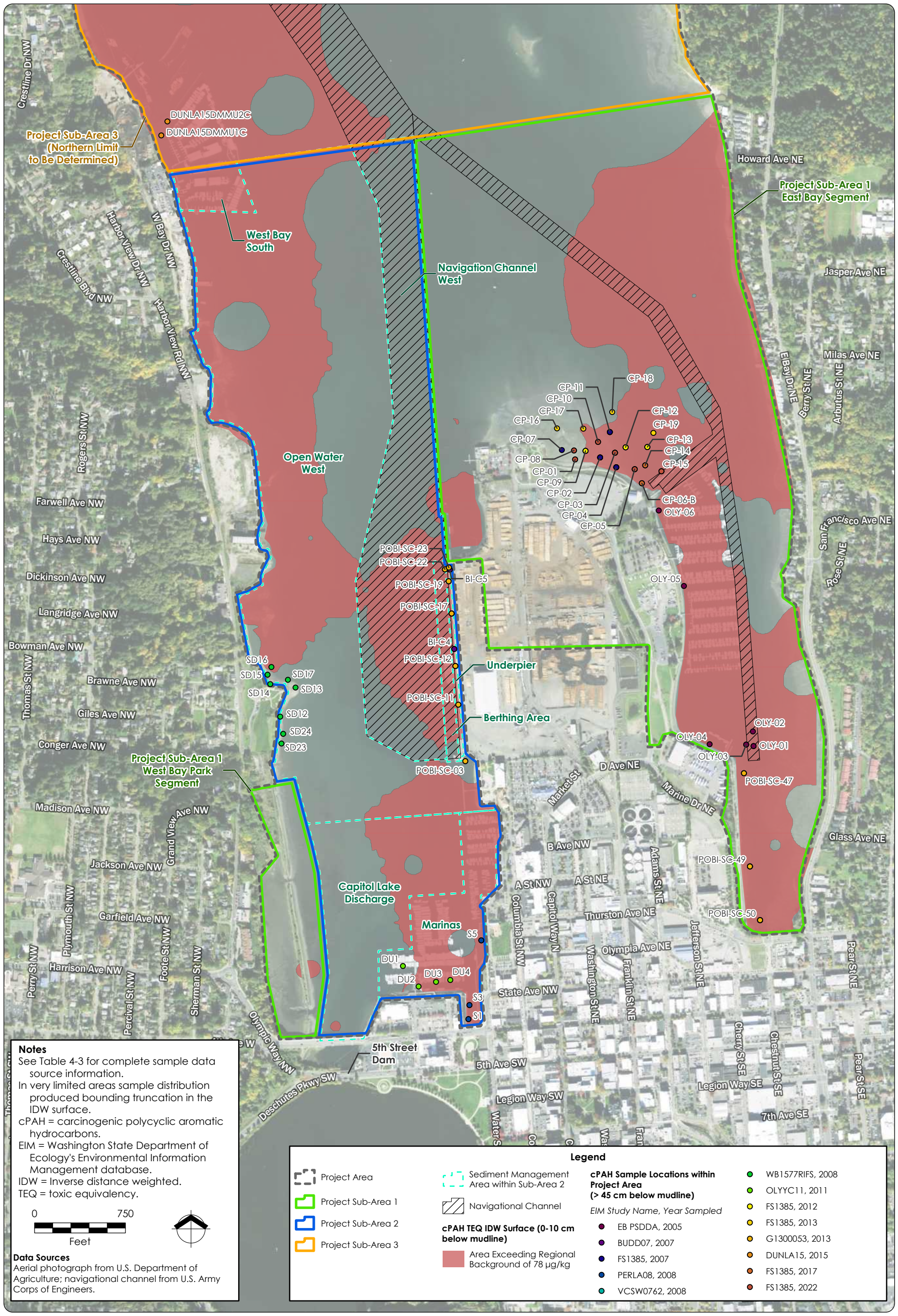

Notes

See Table 4-3 for complete sample data source information.

In very limited areas sample distribution produced bounding truncation in the IDW surface.

cPAH = carcinogenic polycyclic aromatic hydrocarbons.

EIM = Washington State Department of Ecology's Environmental Information Management database.

IDW = Inverse distance weighted.

TEQ = toxic equivalency.

0 750

Feet

Data Sources

Aerial photograph from U.S. Department of Agriculture; navigational channel from U.S. Army Corps of Engineers.

Legend

- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3
- Sediment Management Area within Sub-Area 2
- Navigational Channel

cPAH TEQ IDW Surface (0-10 cm below mudline)

- Area Exceeding Regional Background of 78 µg/kg

cPAH Sample Locations within Project Area (> 45 cm below mudline)

EIM Study Name, Year Sampled

- EB PSDDA, 2005
- BUDD07, 2007
- FS1385, 2007
- PERLA08, 2008
- VCSW0762, 2008
- WB1577RIFS, 2008
- OLYYC11, 2011
- FS1385, 2012
- FS1385, 2013
- G1300053, 2013
- DUNLA15, 2015
- FS1385, 2017
- FS1385, 2022

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PORT of OLYMPIA

Budd Inlet - Olympia, WA

Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

cPAH Sediment Subsurface (> 45 cm below mudline) Sample Density

Figure 4-7

July 31, 2024

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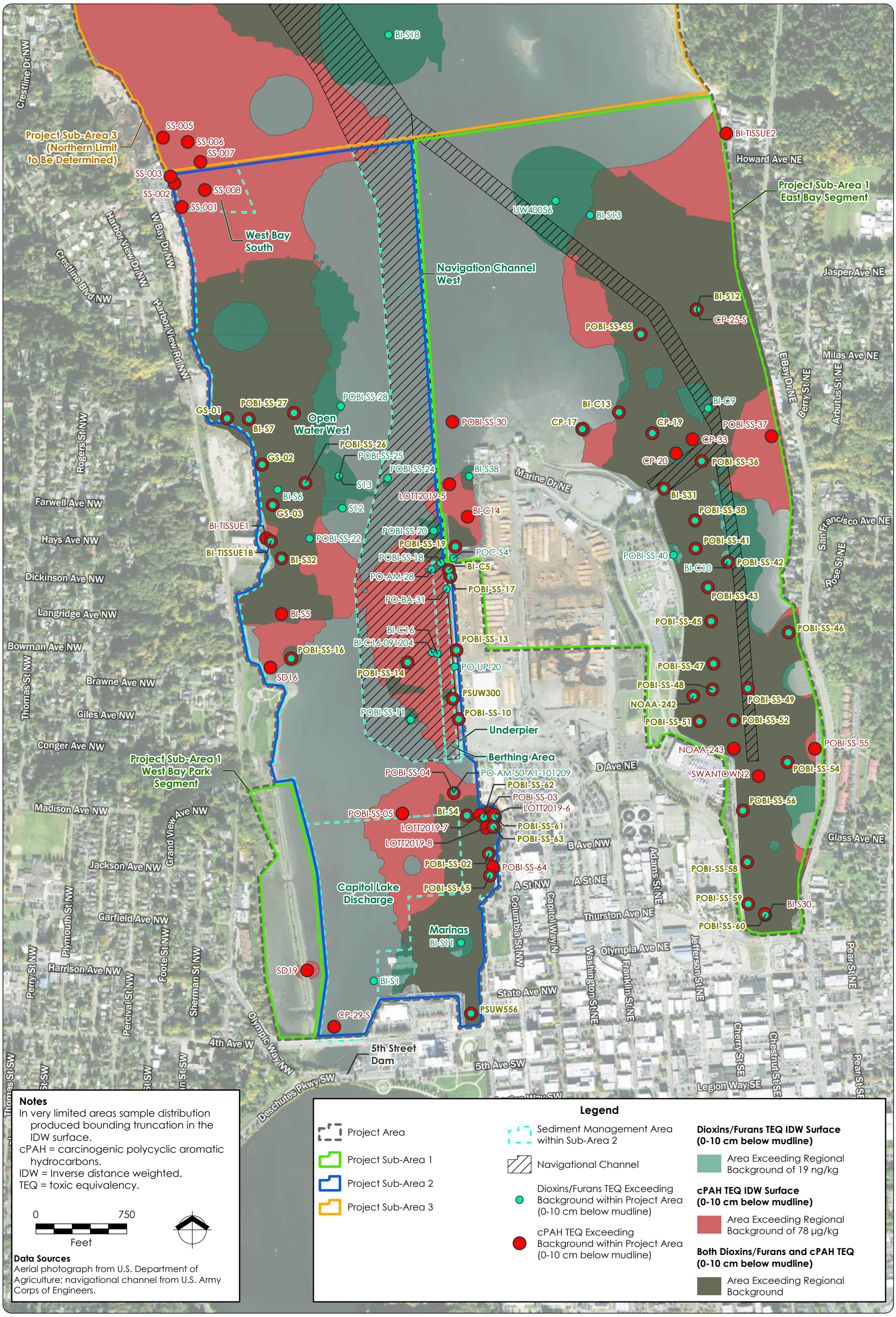
Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-7 SA2 DGM cPAH Subsurface Sample Density

Print Date: 7/26/2024

Reviewed By: DOF

Produced By: jroberts

Project: M0781.03.002



Notes

In very limited areas sample distribution produced bounding truncation in the IDW surface.
cPAH = carcinogenic polycyclic aromatic hydrocarbons.
IDW = Inverse distance weighted.
TEQ = toxic equivalency.

0 750
Feet

Data Sources

Aerial photograph from U.S. Department of Agriculture; navigational channel from U.S. Army Corps of Engineers.

Legend

- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3
- Sediment Management Area within Sub-Area 2
- Navigational Channel
- Dioxins/Furans TEQ Exceeding Background within Project Area (0-10 cm below mudline)
- cPAH TEQ Exceeding Background within Project Area (0-10 cm below mudline)

Dioxins/Furans TEQ IDW Surface (0-10 cm below mudline)

- Area Exceeding Regional Background of 19 ng/kg

cPAH TEQ IDW Surface (0-10 cm below mudline)

- Area Exceeding Regional Background of 78 µg/kg

Both Dioxins/Furans and cPAH TEQ (0-10 cm below mudline)

- Area Exceeding Regional Background

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PORT of OLYMPIA
Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Dioxin/Furans and cPAH TEQ Sediment Surface (0-10 cm below mudline) Regional Background Exceedance

Figure 4-8

July 31, 2024

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Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-8 SA2 DGM Dioxins-Furans and cPAH Background Exceedance
Print Date: 7/26/2024
Reviewed By: DOF
Produced By: jroberts
Project: M0781.03.002

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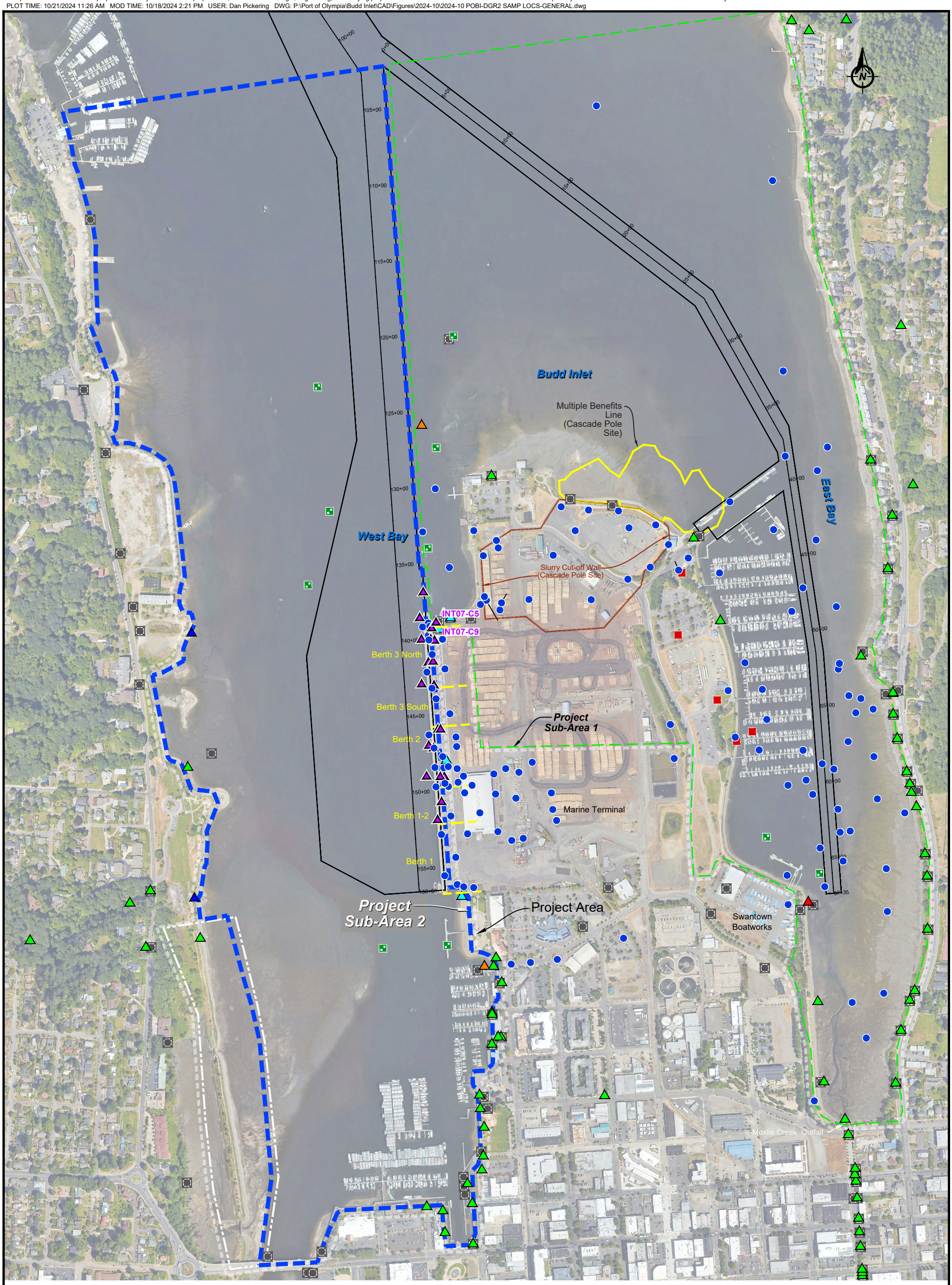

Site Features
- Project Area
- Sub-Area 2
- Sub-Area 1
- Multiple Benefits Line (Cascade Pole Site)
- Slurry Cut-off Wall (Cascade Pole Site)
- Federal Channel Line

0 600
Scale in Feet

Drainage System
- City of Olympia Stormwater Outfall
- LOTT Wastewater/CSO Outfall
- Industrial Outfall
- Historical Outfall

Legend
- Soil Boring
- Vane Shear
- Sediment Vibracore
- Dutch Cone

Notes
1. Background imagery: Google Earth Pro, 07/25/2022.

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PORT of OLYMPIA
Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Geotechnical Exploration Locations

Figure 4-9

Octiber 25, 2024

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Notes

1. Horizontal Datum: Washington State Plane South, NAD83.
2. Background imagery: Google Earth Pro, 07/25/2022.
3. Source: Anchor QEA, Figure 2-4.

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Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Stormwater / CSO Locations

Figure 4-10

October 25, 2024

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Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-13 SA2 DGM Dioxins-Furans Surface Interpolation

Project Sub-Area 3 (Northern Limit to Be Determined)

Project Sub-Area 1 East Bay Segment

West Bay South

Navigation Channel West

Open Water West

Underpier

Berthing Area

Project Sub-Area 1 West Bay Park Segment

Capitol Lake Discharge

Marinas

5th Street Dam

Crestline Dr NW
Harbor View Dr NW
W Bay Dr NW
Crestline Blvd NW
Thomas St NW
Rogers St NW
Farwell Ave NW
Hays Ave NW
Dickinson Ave NW
Langridge Ave NW
Bowman Ave NW
Brawne Ave NW
Giles Ave NW
Conger Ave NW
Madison Ave NW
Jackson Ave NW
Garfield Ave NW
Howard Ave NE
Jasper Ave NE
Milas Ave NE
E Bay Dr NE
Berry St NE
Arbutus St NE
Marine Dr NE
D Ave NE
B Ave NW
B St NE
A St NE
Glass Ave NE
Olympia Ave NE
Thurston Ave NE
State Ave NW
5th Ave SW
Legion Way SE
7th Ave SE
Columbia St NW
Capitol Way N
Adams St NE
Washington St NE
Franklin St NE
Jefferson St NE
Cherry St SE
Chestnut St SE
Pear St NE
Rose St NE
Water St SW
Capitol Way SE
Deschutes Pkwy SW

Notes

Sample results rounded to the nearest whole TEQ.

Not all sample locations labeled due map scale limitations.

In very limited areas sample distribution produced bounding truncation in the IDW surface.

Inverse distance weighted (IDW) surface calculated in ArcGIS Pro 3.1.0 with 50 by 50 foot cells, 1.5x power, and 5 maximum points. In very limited areas sample distribution produced bounding truncation in the IDW surface.

Samples POBI-SS-17, POBI-SS-31, POBI-SS-37, and POBI-SS-50 contain concentrations above benthic sediment management standards.

IDW = Inverse distance weighted.

TEQ = toxic equivalency.

0 750

Feet

Data Sources

Aerial photograph from U.S. Department of Agriculture; stormwater outfall compilation from Anchor QEA 2016a; navigational channel from U.S. Army Corps of Engineers.

Legend

Dioxin/Furan TEQ in ng/kg (0-10 cm below mudline)

- 1 - 5
- 5 - 10
- 10 - 14
- 14 - 19
- 19 - 23
- 23 - 31
- 31 - 99

Dioxin/Furan TEQ IDW Surface in ng/kg (0-10 cm below mudline)

- 2 - 5
- 5 - 10
- 10 - 14
- 14 - 19
- 19 - 23
- 23 - 31
- 31 - 90

- Stormwater Outfall
- Sediment Management Area within Sub-Area 2
- Navigational Channel
- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3

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PORT of OLYMPIA

Budd Inlet - Olympia, WA

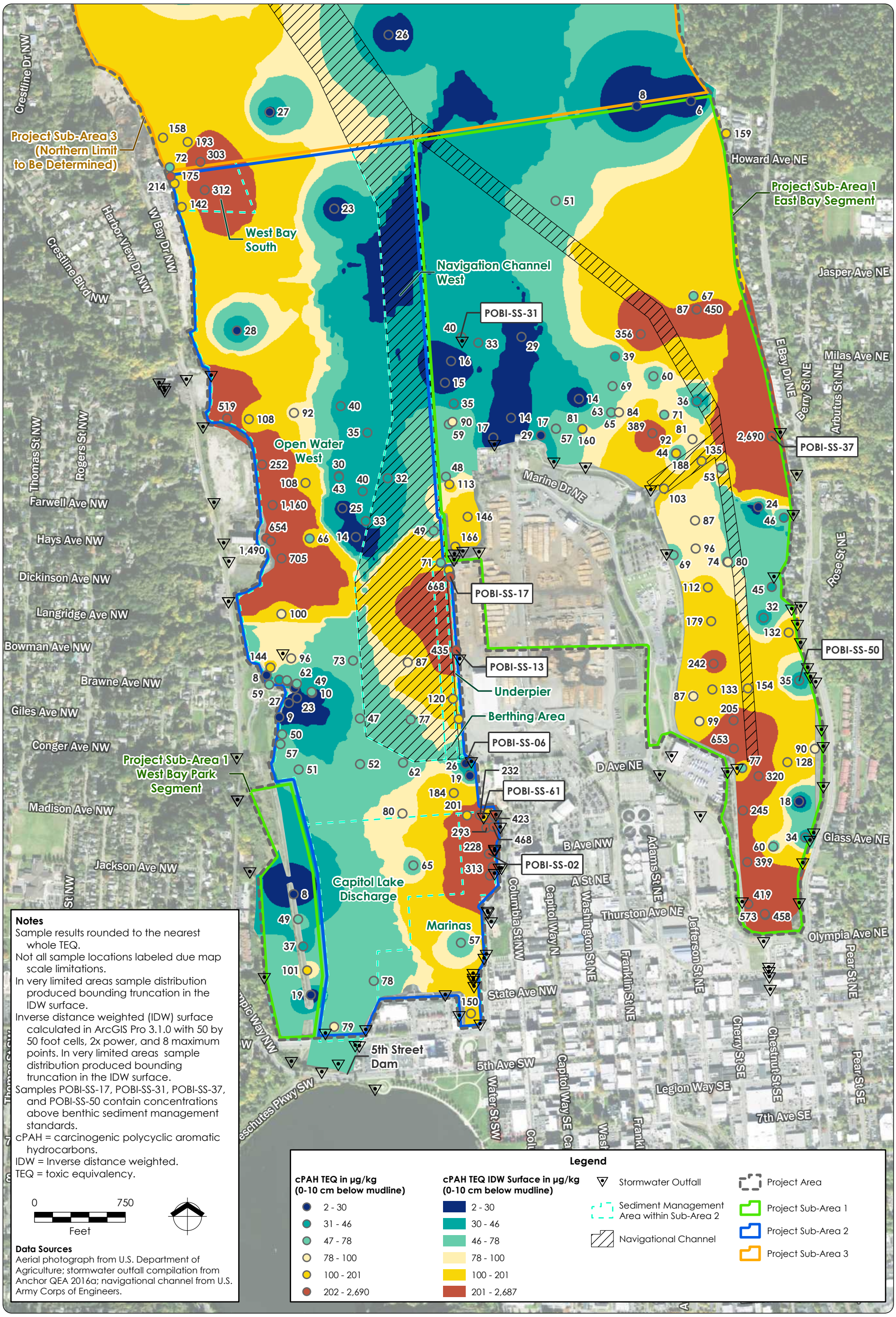
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

Dioxins/Furans Sediment Surface (0-10 cm below mudline) Interpolation

Figure 4-11

July 31, 2024

Project: M0781.03.002 Produced By: jroberts Reviewed By: DOF Print Date: 7/26/2024



Notes

Sample results rounded to the nearest whole TEQ.

Not all sample locations labeled due map scale limitations.

In very limited areas sample distribution produced bounding truncation in the IDW surface.

Inverse distance weighted (IDW) surface calculated in ArcGIS Pro 3.1.0 with 50 by 50 foot cells, 2x power, and 8 maximum points. In very limited areas sample distribution produced bounding truncation in the IDW surface.

Samples POBI-SS-17, POBI-SS-31, POBI-SS-37, and POBI-SS-50 contain concentrations above benthic sediment management standards.

cPAH = carcinogenic polycyclic aromatic hydrocarbons.

IDW = Inverse distance weighted.

TEQ = toxic equivalency.

0 750

Feet

Data Sources

Aerial photograph from U.S. Department of Agriculture; stormwater outfall compilation from Anchor QEA 2016a; navigational channel from U.S. Army Corps of Engineers.

Legend

cPAH TEQ in µg/kg (0-10 cm below mudline)

- 2 - 30
- 31 - 46
- 47 - 78
- 78 - 100
- 100 - 201
- 202 - 2,690

cPAH TEQ IDW Surface in µg/kg (0-10 cm below mudline)

- 2 - 30
- 30 - 46
- 46 - 78
- 78 - 100
- 100 - 201
- 201 - 2,687

- Stormwater Outfall
- Sediment Management Area within Sub-Area 2
- Navigational Channel
- Project Area
- Project Sub-Area 1
- Project Sub-Area 2
- Project Sub-Area 3

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PORT of OLYMPIA
Budd Inlet - Olympia, WA
Project Sub-Area 2 Pre-Remedial Design Data Gaps Memo

cPAH Sediment Surface (0-10 cm below mudline) Interpolation

Figure 4-12

July 31, 2024

Grette Associates LLC Environmental Consultants | WestLand 100% Employee Owned Engineering & Environmental Services, Inc. | Maul Foster Alongi | CRETE Consulting, Inc. | moffatt & nichol | TAS | LA Landau Associates

Path: C:\Workspace\0_MFA_Projects\M0781\03\002\Pro\M0781_03_002_005_SubArea_2_Data_Gaps.aprx\Fig 4-14 SA2 DGM cPAH Surface Interpolation

Print Date: 7/26/2024

Reviewed By: DOF

Produced By: jroberts

Project: M0781.03.002

Table 4-1
Sediment Management Area and Depth Summary—Surface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Berthing Area Sediment Management Unit						
BI-C15	2007-04-12	BUDD07	0	10	--	**19 T**
PO-AM-51-100616	2010-06-16	Marine Terminal	0	10	--	9.04 T
PO-AM-51-A1-101209	2010-12-09	Marine Terminal	0	10	--	7.19 T
PO-BA-24	2009-12-04	Marine Terminal	0	10	--	11.8 KJT
PO-BA-24	2009-03-13	Marine Terminal	0	10	--	0.256 JT
PO-BA-24	2009-02-26	Marine Terminal	0	10	--	**48.3 KJT**
PO-BA-24[(a)]	2008-09-25	Marine Terminal	0	10	--	**21.6 KJT**
PO-BA-24	2009-06-05	Marine Terminal	0	10	--	4.68 KJT
PO-BA-24	2010-06-15	Marine Terminal	0	10	--	6.45 T
PO-BA-24	2010-12-08	Marine Terminal	0	10	--	7.4 T
PO-BA-25	2010-12-08	Marine Terminal	0	10	--	6.73 T
PO-BA-25	2009-06-05	Marine Terminal	0	10	--	1.86 KJT
PO-BA-25	2009-02-26	Marine Terminal	0	10	--	**44.5 JT**
PO-BA-25	2010-06-15	Marine Terminal	0	10	--	3.3 T
PO-BA-25[(a)]	2008-09-25	Marine Terminal	0	10	--	**23.6 JT**
PO-BA-25	2009-03-16	Marine Terminal	0	10	--	0.635 JT
PO-BA-25	2009-12-04	Marine Terminal	0	10	--	4.7 KJT
PO-BA-26	2009-12-04	Marine Terminal	0	10	--	**35.5 KJT**
PO-BA-26	2009-12-04	Marine Terminal	0	10	--	2.82 KJT
PO-BA-26	2010-06-15	Marine Terminal	0	10	--	6.52 T
PO-BA-26[(a)]	2008-09-25	Marine Terminal	0	10	--	**21.8 JT**
PO-BA-26	2009-02-26	Marine Terminal	0	10	--	**47.5 JT**
PO-BA-26	2009-06-05	Marine Terminal	0	10	--	1.48 KJT
PO-BA-26	2010-12-08	Marine Terminal	0	10	--	3.71 T
PO-BA-26	2009-03-16	Marine Terminal	0	10	--	0.19 KJT
PO-BA-27	2010-06-15	Marine Terminal	0	10	--	7.9 T
PO-BA-27	2008-09-25	Marine Terminal	0	10	--	**22.5 KJT**
PO-BA-27	2009-12-04	Marine Terminal	0	10	--	17.2 KJT
PO-BA-27	2009-02-26	Marine Terminal	0	10	--	**32.1 KJT**
PO-BA-27	2009-06-05	Marine Terminal	0	10	--	1.72 KJT
PO-BA-27	2009-03-13	Marine Terminal	0	10	--	0.181 JT
PO-BA-27	2010-12-08	Marine Terminal	0	10	--	6.11 T
PO-BA-28-A1-101208	2010-12-08	Marine Terminal	0	10	--	5.56 T
PO-BA-31-A1-101208	2010-12-08	Marine Terminal	0	10	--	13.7 T
POBI-SS-18	2013-03-12	POBI2013	0	10	71.3 JT	**19.5 KJT**
PSUW300	2011-06-01	BuddOakDioxins	0	2	--	**32.6 JT**
PSUW300	2018-06-13	UWI	0	3	3.02 T	--
PSUW300	2018-06-13	UWI	0	3	**236 T**	--
PSUW300	2011-06-01	BuddOakDioxins	0	10	--	**26.4 JT**
PSUW300	2011-06-01	BuddOakDioxins	0	10	--	8.01 JT
Capitol Lake Discharge Sediment Management Area						
BI-S1	2007-04-11	BUDD07	0	10	77.5 T	**19.1 T**
BI-S2	2007-04-12	BUDD07	0	10	--	10.3 T
BI-S3	2007-04-12	BUDD07	0	10	--	6.99 T
CP-29-S	2013-01-08	FS1385	0	10	**79 T**	--
POBI-SS-01	2013-03-12	POBI2013	0	10	64.5 T	11.9 KJT

Table 4-1
Sediment Management Area and Depth Summary—Surface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Marinas Sediment Management Area						
BI-S4	2007-04-13	BUDD07	0	10	**201 T**	**32 T**
BI-S11	2007-04-13	BUDD07	0	10	56.9 T	**32.5 T**
LOTT2019-6	2019-09-23	LOTT2019	0	10	**423 T**	--
LOTT2019-7	2019-09-23	LOTT2019	0	10	**232 T**	--
LOTT2019-8	2019-09-23	LOTT2019	0	10	**293 T**	--
POBI-SS-02	2013-03-12	POBI2013	0	10	**228 T**	**36.8 JT**
POBI-SS-03	2013-03-12	POBI2013	0	10	**128 T**	17.5 KJT
POBI-SS-61	2013-05-22	POBI2013	0	10	**177 T**	**45.9 JT**
POBI-SS-61	2013-05-22	POBI2013	0	10	**220 T**	**45.4 JT**
POBI-SS-62	2013-05-22	POBI2013	0	10	**164 T**	**29.8 KJT**
POBI-SS-63	2013-05-22	POBI2013	0	10	**468 T**	**26.4 KJT**
POBI-SS-64	2013-05-22	POBI2013	0	10	**275 T**	15.7 KJT
POBI-SS-65	2013-05-22	POBI2013	0	10	**313 T**	**36.4 KJT**
PSUW556	2011-06-07	BuddOakDioxins	0	2	--	**26.1 JT**
PSUW556	2018-06-13	UWI	0	3	4.61 T	--
PSUW556	2018-06-13	UWI	0	3	**296 T**	--
PSUW556	2011-06-07	BuddOakDioxins	0	10	--	**41.9 JT**
Navigation Channel West Sediment Management Area						
BI-C16	2009-03-13	Marine Terminal	0	10	--	**24.7 JT**
BI-C16	2007-04-12	BUDD07	0	10	--	**19.2 T**
BI-C16-090605	2009-06-05	Marine Terminal	0	10	--	**21.3 JT**
BI-C16-091204	2009-12-04	Marine Terminal	0	10	--	**22.9 KJT**
BI-C16-100616	2010-06-16	Marine Terminal	0	10	--	5.37 T
BI-S36	2007-04-11	BUDD07	0	10	--	16.1 T
BI-S37	2010-06-16	Marine Terminal	0	10	--	5.92 T
BI-S37	2010-12-09	Marine Terminal	0	10	--	8.15 T
BI-S37	2009-06-05	Marine Terminal	0	10	--	**22.9 T**
BI-S37	2009-12-04	Marine Terminal	0	10	--	**21.8 KJT**
BI-S37	2007-04-11	BUDD07	0	10	--	15.2 T
BI-S37	2009-03-13	Marine Terminal	0	10	--	**23.3 JT**
PO-AM-28	2010-06-16	Marine Terminal	0	10	--	5.9 T
PO-AM-28	2009-03-13	Marine Terminal	0	10	--	**23.3 JT**
PO-AM-28	2009-06-05	Marine Terminal	0	10	--	**23.8 KJT**
PO-AM-28	2009-12-04	Marine Terminal	0	10	--	**21.5 JT**
PO-AM-28	2010-12-09	Marine Terminal	0	10	--	**20.4 T**
PO-BI-C16-A1-101209	2010-12-09	Marine Terminal	0	10	--	8.48 T
POBI-SS-11	2013-03-12	POBI2013	0	10	77.4 T	**20.8 KJT**
POBI-SS-14	2013-03-12	POBI2013	0	10	**87 JT**	**21.2 KJT**
POBI-SS-20	2013-03-11	POBI2013	0	10	48.6 T	**20.6 KJT**
POBI-SS-24	2013-03-11	POBI2013	0	10	31.5 JT	**19.6 KJT**

Table 4-1
Sediment Management Area and Depth Summary—Surface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Open Water West Sediment Management Area						
BI-C1	2007-04-12	BUDD07	0	10	--	9.56 T
BI-C2	2007-04-12	BUDD07	0	10	48.5 T	14.5 T
BI-C6	2007-04-12	BUDD07	0	10	--	8.08 T
BI-S5	2007-04-12	BUDD07	0	10	**99.7 T**	18.5 T
BI-S6	2007-04-12	BUDD07	0	10	--	**32 T**
BI-S7	2007-04-12	BUDD07	0	10	**108 T**	**59.8 T**
BI-S7	2011-06-02	BuddOakDioxins	0	10	--	6.59 JT
BI-S7	2011-06-02	BuddOakDioxins	0	10	--	**62.5 JT**
BI-S16	2007-04-13	BUDD07	0	10	--	15.9 T
BI-S32	2007-04-14	BUDD07	0	10	**705 T**	**33.2 T**
BI-S33	2007-04-12	BUDD07	0	10	--	16.7 T
BI-S34	2007-04-06	BUDD07	0	10	18.7 T	5.21 T
BI-S35	2007-04-12	BUDD07	0	10	--	9.77 T
BI-TISSUE1B SBI	2007-04-06	BUDD07	0	10	**1490 T**	**25.1 T**
BI-TISSUE1 SBI	2007-04-06	BUDD07	0	10	**654 T**	4.29 T
CP-22-S	2013-01-08	FS1385	0	10	23 JT	--
CP-23-S	2013-01-08	FS1385	0	10	28.1 JT	--
CP-27-S	2013-01-08	FS1385	0	10	10.1 T	--
GS-01	2007-08-13	Budd Inlet Hardel 07	0	10	**519 JT**	**25.7 T**
GS-02	2007-08-13	Budd Inlet Hardel 07	0	10	**264 JT**	**37.3 T**
GS-02	2007-08-13	Budd Inlet Hardel 07	0	10	**239 JT**	**43 T**
GS-03	2007-08-13	Budd Inlet Hardel 07	0	10	**1160 JT**	**25.5 T**
NOAA-244	2018-06-12	UWI	0	3	44.4 JT	--
NOAA-244	2018-06-12	UWI	0	3	35.1 JT	--
NOAA-244	2011-06-02	UWI2011	0	3	35.7 T	--
OHPSD0224-S12	2006-03-10	OHPSD06	0	9	24.7 JT	**19.4 JT**
OHPSD0224-S13	2006-03-10	OHPSD06	0	9	30.1 JT	**24.2 T**
PO-AM-50-100616	2010-06-16	Marine Terminal	0	10	--	14.5 T
PO-AM-50-A1-101209	2010-12-09	Marine Terminal	0	10	--	**25.7 KJT**
POBI-SC-01	2013-03-06	POBI2013	0	20	--	10.4 KJT
POBI-SS-04	2013-03-12	POBI2013	0	10	**184 T**	15.4 KJT
POBI-SS-05	2013-03-12	POBI2013	0	10	**80 T**	7.6 KJT
POBI-SS-06	2013-03-12	POBI2013	0	10	25.8 JT	2.36 KJT
POBI-SS-07	2013-03-12	POBI2013	0	10	62 T	9.52 KJT
POBI-SS-08	2013-03-13	POBI2013	0	10	52.1 T	14.4 KJT
POBI-SS-09	2013-03-12	POBI2013	0	10	51 T	4.51 KJT
POBI-SS-12	2013-03-13	POBI2013	0	10	46.7 T	15.1 KJT
POBI-SS-15	2013-03-13	POBI2013	0	10	72.6 T	16.2 KJT
POBI-SS-16	2013-03-12	POBI2013	0	10	**95.8 T**	**24.2 JT**
POBI-SS-21	2013-03-06	POBI2013	0	10	14.2 JT	4.29 KJT
POBI-SS-22	2013-03-06	POBI2013	0	10	65.6 T	**19.1 JT**
POBI-SS-25	2013-03-11	POBI2013	0	10	43.3 JT	**23.8 KJT**
POBI-SS-26	2013-03-06	POBI2013	0	10	**108 T**	**19.9 KJT**
POBI-SS-27	2013-03-06	POBI2013	0	10	**92.4 T**	**48.6 JT**
POBI-SS-28	2013-03-11	POBI2013	0	10	39.7 JT	**19.5 KJT**
POBI-SS-29	2013-03-11	POBI2013	0	10	35.2 JT	11.3 KJT
POC-S1	2007-08-26	Budd Inlet W Bay 07	0	5.08	--	5.77 JT
PSUW228	2018-06-12	UWI	0	3	33 JT	--
SD04	2007-02-08	FS94656838Ph2	0	0	--	4.92 JT
SD05	2007-02-08	FS94656838Ph2	0	0	--	2.83 JT
SD06	2007-02-08	FS94656838Ph2	0	0	--	10.8 JT
SD07	2008-02-12	WB1577RIFS	0	0	26.9 T	--
SD08	2008-02-12	WB1577RIFS	0	0	22.8 T	--
SD09	2008-02-12	WB1577RIFS	0	0	61.8 T	--
SD10	2008-02-12	WB1577RIFS	0	0	35.2 T	--
SD10	2008-02-12	WB1577RIFS	0	0	57.3 T	--
SD11	2008-02-12	WB1577RIFS	0	0	38.6 T	--
SD12	2008-05-27	WB1577RIFS	†	†	< 8.5 UT	--
SD13	2008-05-27	WB1577RIFS	†	†	< 7.1 UT	--
SD16	2008-05-27	WB1577RIFS	0	0	**144 T**	--
SD17	2008-06-03	WB1577RIFS	0	0	52.9 T	--
SD23	2008-06-02	WB1577RIFS	0	0	59.7 T	6.57 JT
SD23	2008-06-02	WB1577RIFS	0	0	53.7 T	3.64 JT
SD24	2008-06-02	WB1577RIFS	0	0	49.5 T	8.04 JT

Table 4-1
Sediment Management Area and Depth Summary—Surface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Under Pier Sediment Management Area						
BI-C5	2007-04-14	BUDD07	0	10	**115 T**	**21.6 T**
PO-BA-28-100616	2010-06-16	Marine Terminal	0	10	--	10.4 T
PO-BA-29-100616	2010-06-16	Marine Terminal	0	10	--	14.8 T
PO-BA-29-A1-101208	2010-12-08	Marine Terminal	0	10	--	11.2 T
PO-BA-30-100616	2010-06-16	Marine Terminal	0	10	--	9.63 T
PO-BA-30-A1-101208	2010-12-08	Marine Terminal	0	10	--	9.54 T
PO-BA-31-100616	2010-06-16	Marine Terminal	0	10	--	**23.3 JT**
PO-UP-20	2010-06-15	Marine Terminal	0	10	--	13.7 T
PO-UP-20	2009-03-13	Marine Terminal	0	10	--	**39.4 JT**
PO-UP-20	2010-12-08	Marine Terminal	0	10	--	**24.5 JT**
PO-UP-20	2009-06-05	Marine Terminal	0	10	--	**39 JT**
PO-UP-20	2009-12-16	Marine Terminal	0	10	--	**33.9 T**
PO-UP-21	2009-03-13	Marine Terminal	0	10	--	**46 JT**
PO-UP-21	2009-12-04	Marine Terminal	0	10	--	**44.3 KJT**
PO-UP-21	2010-12-08	Marine Terminal	0	10	--	12.7 T
PO-UP-21	2009-06-18	Marine Terminal	0	10	--	**37.3 KJT**
PO-UP-21	2010-06-15	Marine Terminal	0	10	--	9.36 T
PO-UP-22	2009-03-13	Marine Terminal	0	10	--	**32.3 KJT**
PO-UP-22	2010-12-08	Marine Terminal	0	10	--	18 JT
PO-UP-22	2009-06-05	Marine Terminal	0	10	--	**36.2 JT**
PO-UP-22	2010-06-15	Marine Terminal	0	10	--	16 KJT
PO-UP-22	2009-12-16	Marine Terminal	0	10	--	**32.6 T**
PO-UP-23	2009-06-05	Marine Terminal	0	10	--	**36 T**
PO-UP-23	2009-12-16	Marine Terminal	0	10	--	**37.5 T**
PO-UP-23	2010-06-15	Marine Terminal	0	10	--	**28 JT**
PO-UP-23	2009-03-13	Marine Terminal	0	10	--	**37.8 T**
PO-UP-23	2010-12-08	Marine Terminal	0	10	--	14.3 T
POBI-SC-06	2013-03-13	POBI2013	0	20	--	11.4 KJT
POBI-SS-10	2013-03-11	POBI2013	0	10	**103 T**	**20.8 KJT**
POBI-SS-13	2013-03-12	POBI2013	0	10	**435 JT**	**24.6 KJT**
POBI-SS-17	2013-03-13	POBI2013	0	10	**668 JT**	**23 KJT**
POC-S2	2007-08-26	Budd Inlet W Bay 07	0	10.16	--	0.71 JT
POC-S3	2007-08-26	Budd Inlet W Bay 07	0	7.62	--	4.54 JT
West Bay Marina South						
HC-Westbay-SS-008	2011-03-30	AODE5272	0	10	**312 T**	--
SS-001	2011-04-18	AODE5272	0	10	**142 JT**	--
SS-002	2011-03-24	AODE5272	0	10	**175 T**	--
SS-003	2011-03-24	AODE5272	0	10	**214 T**	13.6 T

Notes, Abbreviations, and Acronyms:
Bold results exceed regional background.
[(a)]Sample was dredged.
-- = no result or value reported.
cm = centimeters.
cPAH = carcinogenic polycyclic aromatic hydrocarbons.
EIM = Ecology's Environmental Information Management database (https://apps.ecology.wa.gov/eim/search/default.aspx).
J = estimated value.
K = reported value from laboratory is an estimated maximum potential concentration.
µg/kg = micrograms per kilogram.
ng/kg = nanograms per kilogram.
T = result is based on calculation.
TEQ = toxic equivalency. TEQ calculated as the sum of each constituent concentration multiplied by the corresponding mammalian toxic equivalent factor. Non-detect results are multiplied by one-half the detection/reporting limit (as applicable).
U = analyte not detected.
† = specific depths not documented in EIM; determined to be surface from Anchor 2016b.

Table 4-2
Sediment Management Area and Depth Summary—Near-Surface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Berthing Area Sediment Management Area						
PO-BA-24	2008-09-26	Marine Terminal	46	76	--	**51.2 JT**
PO-BA-25	2008-09-26	Marine Terminal	37	67	--	**67.2 JT**
PO-BA-26	2008-09-26	Marine Terminal	46	76	--	**57.4 JT**
Navigation Channel West Sediment Management Area						
OHPSD0224-C3	2006-03-09	OHPSD06	0	30	**93 T**	18 T
OHPSD0224-S18	2006-03-08	OHPSD06	0	40	14.7 JT	8.7 JT
OHPSD0224-S18	2006-03-08	OHPSD06	0	40	--	**25 T**
OHPSD0224-S19	2006-03-08	OHPSD06	0	20	42 JT	1.44 JT
OHPSD0224-S19	2006-03-08	OHPSD06	0	20	--	**30.2 T**
POBI-SC-21	2013-03-01	POBI2013	30	60	--	5.34 KJT
POBI-SC-25	2013-02-28	POBI2013	30	60	--	2.11 KJT
POBI-SC-28	2013-03-07	POBI2013	30	60	--	11.3 KJT
Open Water West Sediment Management Area						
POBI-SC-01	2013-03-06	POBI2013	20	30	--	8.72 KJT
POBI-SC-01	2013-03-06	POBI2013	30	46	--	5.2 KJT
POBI-SC-01	2013-03-06	POBI2013	46	60	--	0.827 KJT
POBI-SC-02	2013-03-05	POBI2013	30	60	--	**48.8 JT**
POBI-SC-03	2013-03-05	POBI2013	0	60	17.5 JT	2.06 KJT
POBI-SC-14	2013-03-06	POBI2013	30	60	--	**24.7 JT**

Table 4-2
Sediment Management Area and Depth Summary—Near-Surface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Under Pier Sediment Management Area						
BI-C4	2007-04-04	BUDD07	0	30	**142 JT**	**29.1 T**
PO-UP-20	2008-09-26	Marine Terminal	0	61	--	**39.2 T**
PO-UP-21	2008-09-26	Marine Terminal	0	61	--	**32.9 T**
PO-UP-22	2008-09-26	Marine Terminal	0	46	--	**40 JT**
PO-UP-23	2008-09-26	Marine Terminal	0	61	--	**57.8 JT**
POBI-SC-06	2013-03-13	POBI2013	20	30	--	1.3 KJT
POBI-SC-06	2013-03-13	POBI2013	30	46	--	4.48 KJT
POBI-SC-06	2013-03-13	POBI2013	46	60	--	1.01 KJT

Notes, Abbreviations, and Acronyms:
Bold results exceed regional background.
-- = no result or value reported.
cm = centimeters.
cPAH = carcinogenic polycyclic aromatic hydrocarbons.
EIM = Ecology's Environmental Information Management database (https://apps.ecology.wa.gov/eim/search/default.aspx).
J = estimated value.
K = reported value from laboratory is an estimated maximum potential concentration.
µg/kg = micrograms per kilogram.
ng/kg = nanograms per kilogram.
T = result is based on calculation.
TEQ = toxic equivalency. TEQ calculated as the sum of each constituent concentration multiplied by the corresponding mammalian toxic equivalent factor. Non-detect results are multiplied by one-half the detection/reporting limit (as applicable).
U = analyte not detected.
† = specific depths not documented in EIM; determined to be surface from Anchor 2016b.

Table 4-3
Sediment Management Area and Depth Summary—Subsurface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Berthing Area Sediment Management Area						
BI-C15	2007-04-03	BUDD07	60	90	--	**33 T**
BI-C15	2007-04-03	BUDD07	100	200	--	**36.4 T**
BI-C15	2007-04-03	BUDD07	180	210	--	0.301 T
BI-C15	2007-04-03	BUDD07	300	300	--	0.245 T
OHPSD0224-S1	2006-03-08	OHPSD06	0	100	--	1.87 JT
OHPSD0224-S2	2006-03-08	OHPSD06	0	100	--	**54.5 JT**
OHPSD0224-S3	2006-03-08	OHPSD06	0	100	--	**37.9 JT**
PO-BA-27	2008-09-26	Marine Terminal	90	120	--	**59.4 JT**
PO-BA-101-100617	2010-06-17	Marine Terminal	88	130	--	18.5 JT
PO-BA-102-100617	2010-06-17	Marine Terminal	79	120	--	**154 JT**
PO-BA-103-100617	2010-06-17	Marine Terminal	94	140	--	**63.3 JT**
POBI-SC-04	2013-02-26	POBI2013	300	360	--	**25.9 JT**
POBI-SC-04	2013-02-26	POBI2013	360	411	--	1.57 KJT
POBI-SC-07	2013-02-26	POBI2013	370	400	--	**59.4 KJT**
POBI-SC-07	2013-02-26	POBI2013	370	400	--	**58.8 KJT**
POBI-SC-08	2013-02-26	POBI2013	100	160	--	**27.6 KJT**
POBI-SC-08	2013-02-26	POBI2013	160	200	--	**46.5 JT**
POBI-SC-08	2013-02-26	POBI2013	230	260	--	3.77 KJT
POBI-SC-10	2013-02-27	POBI2013	190	250	--	**37 KJT**
POBI-SC-10	2013-02-27	POBI2013	250	280	--	3.32 KJT
POBI-SC-13	2013-02-27	POBI2013	230	290	--	**50.8 JT**
POBI-SC-13	2013-02-27	POBI2013	290	317	--	11.2 KJT
POBI-SC-13	2013-02-27	POBI2013	290	317	--	10.5 KJT
POBI-SC-13	2013-02-27	POBI2013	317	347	--	1.02 KJT
POBI-SC-15	2013-02-26	POBI2013	270	300	--	1.53 KJT
POBI-SC-15	2013-02-26	POBI2013	300	326	--	1.15 KJT
POBI-SC-22	2013-03-07	POBI2013	323	369	**1390 JT**	**317 KJT**
POBI-SC-22	2013-03-07	POBI2013	369	393	**3470 T**	**357 KJT**
POC-C10[(a)]	2007-08-26	Budd Inlet W Bay 07	0	60	--	18.2 JT
POC-C11[(a)]	2007-08-26	Budd Inlet W Bay 07	0	60	--	2.58 JT
POC-C12	2007-08-26	Budd Inlet W Bay 07	0	60	--	**30.4 JT**
POC-C13	2007-08-26	Budd Inlet W Bay 07	0	60	--	**25.7 JT**
POC-C13	2007-08-26	Budd Inlet W Bay 07	100	160	--	**63.5 JT**
Capitol Lake Discharge Sediment Management Area						
CP-29-S	2002-04-11	CASMON03	0	24	--	3.57 T
OLYYC11-SC1	2011-12-20	OLYYC11	0	130	--	9.62 KJT
Marinas Sediment Management Area						
OLYYC11-DU1	2011-12-20	OLYYC11	0	160	21.7 T	--
OLYYC11-DU2	2011-12-20	OLYYC11	0	260	**93.8 JT**	--
OLYYC11-DU3	2011-12-20	OLYYC11	0	160	40.2 JT	--
OLYYC11-DU4	2011-12-20	OLYYC11	0	160	59.4 T	--
OLYYC11-SC2	2011-12-20	OLYYC11	0	130	--	1.86 KJT
OLYYC11-SC3	2011-12-20	OLYYC11	0	230	--	0.254 KJT
OLYYC11-SC4	2011-12-20	OLYYC11	0	300	--	0.233 KJT
OLYYC11-SC5	2011-12-20	OLYYC11	0	200	--	14.8 KJT
OLYYC11-SC6	2011-12-20	OLYYC11	0	140	--	3.44 KJT
OLYYC11-SC7	2011-12-20	OLYYC11	0	190	--	10.9 KJT
OLYYC11-SC8	2011-12-20	OLYYC11	0	130	--	5.75 KJT
OLYYC11-SC9	2011-12-20	OLYYC11	0	200	--	5.81 KJT
OLYYC11-Z-COMP	2011-12-20	OLYYC11	0	200	--	0.14 KJT
PERLA0292-S1	2008-02-14	PERLA08	0	70	**244 T**	4.26 JT
PERLA0292-S1	2008-02-14	PERLA08	70	140	**3880 T**	3.23 JT
PERLA0292-S3	2008-02-14	PERLA08	0	94	**211 T**	**21.1 JT**
PERLA0292-S3	2008-02-14	PERLA08	94	170	**171 T**	8.61 JT
PERLA0292-S5	2008-02-14	PERLA08	0	100	**742 T**	9.94 JT
PERLA0292-S5	2008-02-14	PERLA08	100	170	**293 T**	4.64 JT
Marinas Sediment Management Area						
BH-11	2010-09-27	2010_Unocal RIFS	200	300	< 59.2 UT	--

Table 4-3
Sediment Management Area and Depth Summary—Subsurface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Navigation Channel West Sediment Management Area						
BI-C16	2007-04-03	BUDD07	30	60	--	4.59 T
BI-C16	2007-04-03	BUDD07	60	90	--	0.176 JT
OHPSD0224-C1	2006-03-09	OHPSD06	0	130	--	16.6 T
OHPSD0224-C2	2006-03-09	OHPSD06	0	100	--	10 JT
OHPSD0224-S4	2006-03-08	OHPSD06	0	100	46.4 JT	4.28 JT
OHPSD0224-S4	2006-03-08	OHPSD06	0	100	**174 T**	**48.9 T**
OHPSD0224-S5	2006-03-07	OHPSD06	0	67	--	**30.6 T**
OHPSD0224-S6	2006-03-07	OHPSD06	0	100	--	**20 JT**
OHPSD0224-S6	2006-03-07	OHPSD06	0	100	--	0.684 JT
OHPSD0224-S7	2006-03-07	OHPSD06	0	210	--	3.03 JT
OHPSD0224-S20	2006-03-08	OHPSD06	0	120	--	18.1 T
OHPSD0224-S20	2006-03-08	OHPSD06	0	120	--	0.349 JT
OHPSD0224-S21	2006-03-08	OHPSD06	0	85	--	14.4 JT
OHPSD0224-S21	2006-03-08	OHPSD06	0	85	--	0.173 JT
OHPSD0224-S22	2006-03-08	OHPSD06	0	110	--	15.8 T
OHPSD0224-S22	2006-03-08	OHPSD06	0	110	--	1.84 JT
OHPSD0224-S23	2006-03-08	OHPSD06	0	140	--	**20.9 JT**
OHPSD0224-S23	2006-03-08	OHPSD06	0	140	--	0.708 JT
OHPSD0224-S42	2006-03-09	OHPSD06	180	210	--	0.135 JT
POBI-SC-05	2013-03-06	POBI2013	60	90	--	**21.2 JT**
POBI-SC-05	2013-03-06	POBI2013	90	100	--	15.4 KJT
POBI-SC-05	2013-03-06	POBI2013	90	100	--	16.2 KJT
POBI-SC-05	2013-03-06	POBI2013	100	200	--	17.7 JT
POBI-SC-05	2013-03-06	POBI2013	180	210	--	0.654 KJT
POBI-SC-09	2013-02-27	POBI2013	180	210	--	**69.2 KJT**
POBI-SC-09	2013-02-27	POBI2013	180	210	--	**52 JT**
POBI-SC-09	2013-02-27	POBI2013	300	300	--	6.4 KJT
POBI-SC-09	2013-02-27	POBI2013	200	300	--	13.4 JT
POBI-SC-16	2013-02-28	POBI2013	100	200	--	**56.7 JT**
POBI-SC-16	2013-02-28	POBI2013	180	210	--	1.54 KJT
POBI-SC-16	2013-02-28	POBI2013	180	210	--	15.6 KJT
POBI-SC-21	2013-03-01	POBI2013	60	90	--	1.19 KJT
POBI-SC-25	2013-02-28	POBI2013	60	90	--	1.14 JT
POBI-SC-25	2013-02-28	POBI2013	60	90	--	1.09 KJT
POBI-SC-25	2013-02-28	POBI2013	90	100	--	1.13 T
POBI-SC-27	2013-03-06	POBI2013	60	90	--	1.04 KJT
POBI-SC-27	2013-03-06	POBI2013	90	100	--	7.6 KJT
POBI-SC-27	2013-03-06	POBI2013	100	200	--	5.1 KJT
POBI-SC-28	2013-03-07	POBI2013	60	90	--	1.06 KJT
POBI-SC-28	2013-03-07	POBI2013	90	100	--	1.27 KJT

Table 4-3
Sediment Management Area and Depth Summary—Subsurface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Open Water West Sediment Management Area						
BI-C1	2007-04-02	BUDD07	60	90	--	**31.5 T**
BI-C1	2007-04-02	BUDD07	90	100	--	**21.4 T**
BI-C1	2007-04-02	BUDD07	100	200	--	15.9 T
BI-C1	2007-04-02	BUDD07	180	210	--	8.06 T
BI-C1	2007-04-02	BUDD07	300	300	--	1.79 T
BI-C2	2007-04-02	BUDD07	30	60	--	**50.4 T**
BI-C2	2007-04-02	BUDD07	60	90	--	0.151 T
BI-C6	2007-04-02	BUDD07	30	60	--	1.06 T
BI-C6	2007-04-02	BUDD07	60	90	--	0.318 JT
CP-22-S	2002-04-11	CASMON03	0	30	--	6.24 T
CP-23-S	2002-04-11	CASMON03	0	25	--	10.7 JT
CP-27-S	2002-04-11	CASMON03	0	28	--	6.21 JT
OHPSD0224-C4	2006-03-09	OHPSD06	0	100	--	14.7 JT
OHPSD0224-S16	2006-03-09	OHPSD06	100	280	--	1.45 JT
OHPSD0224-S17	2006-03-09	OHPSD06	100	600	--	0.163 JT
OHPSD0224-S28	2006-03-09	OHPSD06	0	100	--	5.05 JT
OHPSD0224-S28	2006-03-09	OHPSD06	0	100	--	0.132 JT
OHPSD0224-S29	2006-03-09	OHPSD06	0	100	--	**35.1 T**
OHPSD0224-S29	2006-03-09	OHPSD06	0	100	--	3.19 JT
POBI-SC-01	2013-03-06	POBI2013	100	200	--	1.16 KJT
POBI-SC-01	2013-03-06	POBI2013	200	300	--	1.13 KJT
POBI-SC-02	2013-03-05	POBI2013	100	200	--	3.78 KJT
POBI-SC-02	2013-03-05	POBI2013	180	210	--	1.15 KJT
POBI-SC-02	2013-03-05	POBI2013	180	210	--	2.98 KJT
POBI-SC-02	2013-03-05	POBI2013	180	210	--	1.93 KJT
POBI-SC-03	2013-03-05	POBI2013	60	100	< 3.6 UT	1.1 KJT
POBI-SC-03	2013-03-05	POBI2013	100	200	< 3.7 UT	1.11 KJT
POBI-SC-14	2013-03-06	POBI2013	60	90	--	2.18 KJT
SD12	2008-05-28	WB1577RIFS	60	60	**187 T**	--
SD13	2008-05-28	WB1577RIFS	60	60	< 8.5 UT	--
SD16	2008-06-03	WB1577RIFS	60	60	**114 T**	--
SD17	2008-06-03	WB1577RIFS	60	60	30.9 T	--
SD17	2008-06-03	WB1577RIFS	60	60	27.3 T	--
SD23	2008-06-02	WB1577RIFS	60	60	30.5 T	3.73 JT
SD24	2008-06-02	WB1577RIFS	60	60	41.4 T	8.86 JT

Table 4-3
Sediment Management Area and Depth Summary—Subsurface Laboratory Results
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Sample Location ID	Sample Date	EIM Study Name	Start Depth Below Mudline (cm)	End Depth Below Mudline (cm)	cPAHs TEQ (µg/kg)	Dioxins/Furans TEQ (ng/kg)
Under Pier Sediment Management Area						
BI-C3	2007-04-04	BUDD07	0	30	--	17.1 T
BI-C3	2007-04-04	BUDD07	30	60	--	15.5 T
BI-C3	2007-04-04	BUDD07	60	90	--	12.6 T
BI-C3	2007-04-04	BUDD07	90	100	--	3.17 T
BI-C3	2007-04-04	BUDD07	100	200	--	0.424 T
BI-C3	2007-04-04	BUDD07	180	210	--	0.227 T
BI-C4	2007-04-04	BUDD07	0	30	**142 JT**	**29.1 T**
BI-C4	2007-04-04	BUDD07	90	100	--	**41.3 T**
BI-C4	2007-04-04	BUDD07	180	210	**1610 T**	**62.5 T**
BI-C5	2007-04-03	BUDD07	90	100	**1950 T**	**231 T**
BI-C5	2007-04-03	BUDD07	180	210	**3480 T**	**4210 T**
PO-UP-20	2008-09-26	Marine Terminal	61	120	--	**54.1 JT**
PO-UP-21	2008-09-26	Marine Terminal	61	120	--	**44 KJT**
PO-UP-22	2008-09-26	Marine Terminal	46	91	--	**28.2 T**
PO-UP-23	2008-09-26	Marine Terminal	61	120	--	**251 JT**
POBI-SC-11	2013-03-13	POBI2013	60	100	**228 T**	**27.7 KJT**
POBI-SC-11	2013-03-13	POBI2013	180	210	**231 T**	11.5 KT
POBI-SC-11	2013-03-13	POBI2013	200	300	--	10.2 KJT
POBI-SC-12	2013-03-13	POBI2013	60	100	**780 T**	**38.8 KJT**
POBI-SC-12	2013-03-13	POBI2013	180	210	**148 T**	5.73 KJT
POBI-SC-12	2013-03-13	POBI2013	200	300	< 4 UT	1.68 KJT
POBI-SC-12	2013-03-13	POBI2013	300	341	< 4 UT	--
POBI-SC-17	2013-03-15	POBI2013	60	100	**475 T**	**24.6 KJT**
POBI-SC-17	2013-03-15	POBI2013	180	210	66.5 JT	1.09 KJT
POBI-SC-17	2013-03-15	POBI2013	200	300	< 3.8 UT	--
POBI-SC-17	2013-03-15	POBI2013	300	338	13.7 JT	--
POBI-SC-17	2013-03-15	POBI2013	300	338	< 3.6 UT	--
POBI-SC-18	2013-02-28	POBI2013	230	300	--	**66.1 KJT**
POBI-SC-18	2013-02-28	POBI2013	300	326	--	6.71 KJT
POBI-SC-19	2013-03-15	POBI2013	60	100	**2040 T**	**584 JT**
POBI-SC-19	2013-03-15	POBI2013	180	210	**2710 T**	**77.3 JT**
POBI-SC-19	2013-03-15	POBI2013	200	300	**475 T**	**25.9 KJT**
POBI-SC-19	2013-03-15	POBI2013	300	341	**2960 JT**	**61.8 KJT**
POBI-SC-20	2013-02-27	POBI2013	170	230	--	**131 JT**
POBI-SC-20	2013-02-27	POBI2013	230	270	--	**113 JT**
POBI-SC-23	2013-03-15	POBI2013	180	210	**1470 T**	**885 JT**
POBI-SC-23	2013-03-15	POBI2013	200	314	**148 JT**	1.62 KJT
POC-C6	2007-08-26	Budd Inlet W Bay 07	0	60	--	**20.5 JT**
POC-C6	2007-08-26	Budd Inlet W Bay 07	100	160	--	0.793 JT
POC-C6	2007-08-26	Budd Inlet W Bay 07	200	240	--	0.362 JT
POC-C7	2007-08-26	Budd Inlet W Bay 07	0	60	--	**28.1 JT**
POC-C7	2007-08-26	Budd Inlet W Bay 07	100	200	--	8.4 JT
POC-C7	2007-08-26	Budd Inlet W Bay 07	200	220	--	0.263 JT
POC-C8	2007-08-26	Budd Inlet W Bay 07	0	60	--	15.9 JT
POC-C8	2007-08-26	Budd Inlet W Bay 07	100	200	--	**703 T**
POC-C8	2007-08-26	Budd Inlet W Bay 07	200	300	--	0.338 JT
POC-C8	2007-08-26	Budd Inlet W Bay 07	351	357	--	0.195 JT
POC-C9	2007-08-26	Budd Inlet W Bay 07	0	60	--	**20.6 JT**
POC-C9	2007-08-26	Budd Inlet W Bay 07	100	200	--	0.208 JT
POC-C9	2007-08-26	Budd Inlet W Bay 07	200	300	--	0.374 JT

Notes, Abbreviations, and Acronyms:
Bold results exceed regional background.
[(a)]Sample was dredged.
-- = no result or value reported.
cm = centimeters.
cPAH = carcinogenic polycyclic aromatic hydrocarbons.
EIM = Ecology's Environmental Information Management database (https://apps.ecology.wa.gov/eim/search/default.aspx).
J = estimated value.
K = reported value from laboratory is an estimated maximum potential concentration.
µg/kg = micrograms per kilogram.
ng/kg = nanograms per kilogram.
T = result is based on calculation.
TEQ = toxic equivalency. TEQ calculated as the sum of each constituent concentration multiplied by the corresponding mammalian toxic equivalent factor. Non-detect results are multiplied by one-half the detection/reporting limit (as applicable).
U = analyte not detected.
† = specific depths not documented in EIM; determined to be surface from Anchor 2016b.

FINAL

Table 4-4
Sediment Study Summary
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

EIM Study Name	Study Description	Submitting Organization	# Discrete Samples[(a)]	Year	Sub-Area(s)	Chemical Groups Analyzed	Depth Intervals
CASMON03	Budd Inlet Dioxin & Tissue Mon-Post Sediment Remediation - Cascade Pole Company (CPC)	Unknown	9	2002	1, 2	Dioxins/Furans, Conventionals	Subsurface
CASCON03	Cascade Pole Sed Confirm Monitoring 2003	Unknown	1	2003	1	Dioxins/Furans, Conventionals	Subsurface
EB PSDDA*	East Bay PSDDA Characterization. *Not found in EIM. Originally cited in Anchor QEQ 2016b.	Unknown	16	2005	1	Dioxins/Furans, Metals, PCBs, Pesticides, SVOCs, VOCs, Conventionals	Subsurface
AJOH0049	Toxics in stormwater runoff from PS boatyards	Ecology	1	2006	1	Metals, PCBs, VOCs, Conventionals	Surface
NOAA-Mussel-1986-08	NOAA Mussel Watch Program	Hart Crowser	1	2006	NA (Upper Budd Inlet)	Metals, Pesticides, SVOCs,	Near Surface
OHPSD06	Olympia Harbor - Supplemental Dioxin Study, DY07	USACE	40	2006	2, 3	Dioxins/Furans, Metals, Pesticides, SVOCs, VOCs, Conventionals	Surface, Near Surface, Subsurface
Budd Inlet Hardel 07	C396_Hardel EIM Results	Integral	4	2007	2	Dioxins/Furans, Metals, PCBs, Pesticides, SVOCs, Conventionals	Surface
Budd Inlet W Bay 07	West Bay of Budd Inlet - Sediment Characterization Study: Berths 2 and 3 Interim Action Project.	Integral	23	2007	1, 2	Dioxins/Furans, Conventionals	Surface, Subsurface
BUDD07	Budd Inlet Sediment Characterization	SAIC	95	2007	1, 2, 3	Dioxins/Furans, Metals, PCBs, SVOCs, Conventionals	Surface, Subsurface
FS94656838Ph2	Solid Wood Inc. (West Bay Park) Rail Spur Phase II Environmental Site Assessment, Olympia, WA. Agreed Order # DE-08-TCP SR-5415	Parametrix	7	2007	1, 2	Dioxins/Furans, Conventionals	Surface
PERLA08	Percival Landing Redevelopment Project - Antidegradation Evaluation, DY10	USACE	6	2008	2	Dioxins/Furans, Metals, PCBs, Pesticides, SVOCs, VOCs, Conventionals	Subsurface
VCSW0762	Washington Department of Natural Resources (DNR) Marine Station, Olympia, WA (Federal ID Number: WAD337696)	Landau	16	2008	NA (Upper Budd Inlet)	Metals, PCBs, Pesticides, SVOCs, Conventionals	Subsurface
WB1577RIFS	Solid Wood Inc. (West Bay Park) RI/FS, Olympia, WA. Agreed Order # DE-08-TCP SR-5415	Parametrix	78	2008-2014	1, 2	Dioxins/Furans, Metals, PCBs, SVOCs, TPH, Conventionals	Surface, Subsurface
UWI	Urban Waters Initiative	Ecology	366	2018-2019	1, 2, 3	Metals, PCBs, Pharmaceuticals, SVOCs, Conventionals	Surface
2010_Unocal RIFS	RIFS, Former Unocal Bulk Plant 0828 and Hulco Property	Anchor QEA	19	2010-2011	2	Metals, TPH, VOCs, Conventionals	Surface, Subsurface
BuddOakDioxins	Budd Inlet and Oakland Bay Dioxin Study	Ecology	83	2011	1, 2, 3	Dioxins/Furans, Conventionals	Surface
OLYYC11	Olympia Yacht Club, DY13	USACE	14	2011	2	Dioxins/Furans, Metals, PCBs, Pesticides, SVOCs, Conventionals	Subsurface
UWI2011	Urban Waters Initiative	Ecology	66	2011	1, 2, 3	Dioxins/Furans, Metals, Pesticides, SVOCs, Conventionals	Surface
AODE5272	West Bay Marina Remedial Investigation, Olympia, WA	Hart Crowser	13	2009-2011	2, 3	Dioxins/Furans, Metals, PCBs, Pesticides, SVOCs, TPH, Conventionals	Surface
G1300053	Port of Olympia Budd Inlet Sediment Site 2013	Anchor QEA	223	2013	1, 2	Dioxins/Furans, Metals, PCBs, SVOCs, Conventionals	Surface, Near Surface, Subsurface
DUNLA15	Dunlap Towing, Olympia, WA, DY15	USACE	17	2015	3	Dioxins/Furans, Metals, SVOCs, VOCs, Conventionals	Subsurface
PSEMP_LT	Puget Sound Ecosystem Monitoring Program Long Term Sediment Component	Ecology	27	2016-2021	3	Metals, Pesticides, PFAS, SVOCs, Conventionals	Surface
LOTT2019	LOTT CWA 2019 Sediment Monitoring NPDES Permit No. WA0037061	Herrera Environmental Consultants	8	2019	1, 2	Metals, PCBs, SVOCs, Conventionals	Surface

Table 4-4
Sediment Study Summary
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

EIM Study Name	Study Description	Submitting Organization	# Discrete Samples[(a)]	Year	Sub-Area(s)	Chemical Groups Analyzed	Depth Intervals
FS1385	Cascade Pole Longterm Groundwater Compliance Monitoring and Sediment Sampling, Olympia, WA	Landau	103	2007-2022	1, 2	Dioxins/Furans, SVOCs, Conventionals	Surface, Near Surface, Subsurface
OlyMarineTerminal08	Port of Olympia: Berth 2 & 3 Interim Action Cleanup Sampling to Characterize Pre-Dredge, Post-Dredge, and Post-Cover conditions	Anchor QEA	183	2008-2010	2	Dioxins/Furans, Conventionals	Surface, Near Surface, Subsurface

Notes:

*Not documented in EIM. Cited in Anchor QEA 2016b.

[(a)]Discrete samples for all sub-areas.

Depth intervals are 0-10 cm for surface, 10-45 cm for near-surface, and >45 cm for subsurface.

Abbreviations and Acronyms:

CPC = Cascade Pole Company
DNR = Washington State Department of Natural Resources
Ecology = Washington State Department of Ecology
EIM = Ecology's Environmental Information Management database (https://apps.ecology.wa.gov/eim/search/default.aspx)
ID = Identification
Integral = Integral Consulting, Inc.
Landau = Landau Associates, Inc.
LOTT = Lacey Olympia Tumwater Thurston County.
NOAA = National Oceanic and Atmospheric Administration
PSDDA = Puget Sound Dredged Disposal Analysis
SAIC = Science Applications International Corporation
USACE = US Army Corps of Engineers
WA = Washington

Table 4-6
Geotechnical Data Summary Table Review (through February 23, 2023)
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Incorporation of Fine-Grained Sediment Erodibility Measurements into Sediment Transport Modeling, Capitol Lake, Washington	US Department of the Interior US Geological Survey	Capitol Lake Study	15 Sediment cores	10/31/2007	47.03537	-122.90839	N/A	Between 41 and 54 meters	From <0.5 to 3.6 meters
Geotechnical Engineering Report, The Laurana, 210 State Avenue NW, Olympia, Washington	Landau Associates	The Laurana	4 CPT borings	12/21/2016	47.045829	-122.903645	15	Between 21.5 and 121.5 ft	7 ft
Geotechnical Engineering Report, 320 Columbia Street Development, 320 Columbia Street NW Olympia, Washington	Landau Associates	320 Columbia Street	2 SPT borings	10/23/2017	47.046938	-122.902806	N/A	121.5 ft	5 ft
Geotechnical Engineering Services, Proposed Warehouse B Port of Olympia, Olympia, Washington	Landau Associates	Port Oly Warehouse	5 SPT borings	1/23/2023	47.053092	-122.904559	10 to 11 ft	Between 26.5 and 31.5 ft	4-9 ft
Geotechnical Report, Marine Fueling Station Project, Swantown Marina, Olympia, Washington	Landau Associates	Port of Olympia Fuel Dock (Olympia Area Rowing)	1 SPT boring	4/20/2016	47.057149	-122.899533	19.5	51.5 ft	10 ft
Supplementary Geotechnical Investigation, East Bay Marina, Olympia, Washington	Shannon and Wilson	East Bay Marina	12 borings	Mar-82	47.057149	-122.899533	2.6 to 16.8	Between 6 and 18.5 ft	N/A
Supplementary Geotechnical Investigation, East Bay Marina, Olympia, Washington	Canonie Engineers	East Bay Marina	5 borings	Jun-82	47.057149	-122.899533	N/A	Between 18 and 32 ft	N/A

Table 4-6
Geotechnical Data Summary Table Review (through February 23, 2023)
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Proposed Roadway Olympia, Washington	Dames and Moore	East Bay Marina	2 borings	May-72	47.057149	-122.899533	20 to 20.4	Between 60 and 91 ft	N/A
Supplementary Geotechnical Investigation, Proposed East Bay Development Program, Port of Olympia, Olympia, Washington	Dames and Moore	East Bay Marina	11 borings	Apr-73	47.057149	-122.899533	-5 to -18	Between 23 and 160 ft	N/A
Report of Soils Investigation, East Bay Drive Project 25-X259, Glass Avenue to Leavenworth Avenue, Olympia, Washington	Dames and Moore	East Bay Marina	15 borings	Jul-68	47.057149	-122.899533	N/A	Between 45 and 75 ft	N/A
Supplementary Geotechnical Investigation, Proposed East Bay Development Program, Port of Olympia, Olympia, Washington	Dames and Moore	East Bay Marina	13 borings	Aug-78	N9367	E1572	N/A	Between 25 and 75 ft	N/A
Supplementary Geotechnical Investigation, East Bay Marina, Olympia WA	Dames and Moore	East Bay Marina	8 boring, 8 CPT	9/9/1982	N/A	N/A	N/A	Between 15 and 60 ft	N/A
Brian Kolb - State Street Site	Bradley-Noble Geotechnical, Inc	Moxlie Creek	2 borings	May-89	N/A	N/A	N/A	Between 45 and 55 ft	~8ft
Proposed Olympia City Hall, Olympia, Washington	Landau Associates	Moxlie Creek	3 borings, 3 CPT	5/1/2007	N/A	N/A	N/A	Between 11.5 to 76.5 ft	4 to 5 ft

Table 4-6
Geotechnical Data Summary Table Review (through February 23, 2023)
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Preliminary Geotechnical Engineering Recommendations West Bay Mixed-Use Development Olympia, Washington	Landau Associates	West Bay Mixed Use Development	7 test pits, 2 borings	5/6/2020	47.057917	-122.913673	N/A	Test pits: between 5 and 16 ft Borings: 41.5 ft	2 ft
Geotechnical Report, Hands on Children's Museum, Olympia, Washington	Landau Associates	Hands On Children's Museum	3 borings, 3 CPT	1/8/2009	47.04830006	-122.8967249	N/A	Between 19 to 81.5 ft	6 ft
East Bay Flats and Townhomes, Olympia, Washington	Landau Associates	Westman Mill	3 borings, 3 CPT	4/30/2007	47.046959	-122.896589	N/A	Between 11.5 to 76.5 ft	3 to 4 ft
Geotechnical Data Report, City of Olympia, Port Storm Diversion Project, Olympia, Washington	Landau Associates	Olympia Avenue (East and West Bays)	3 borings	5/23/2016	47.049944	-122.902907	13 to 14 ft	Between 21.5 and 31.5 ft	7 to 9 ft
Final Work Plan: Soil Treatability Study, Cascade Pole Site, Port of Olympia, Washington	Landau Associates	Cascade Pole	10 borings	1/1/1991	47.057831	-122.901408	N/A	Between 15 and 25 ft	N/A
Materials Laboratory Report Index Testing, Port of Olympia Project	HWA Geosciences Inc.	HWA	8 borings	N/A	N/A	N/A	N/A	Between 40 and 100.5 ft	N/A
Berth No. 2 Reconstruction Cast in Place Deck Details - Scheme 2	Arvid Grant and Associates, Inc.	Berth2	5 Borings	12/30/1971	N/A	N/A	16.4 to 20.8 ft	Between 105 and 155 ft	~ 22 ft (tidal fluctuation)
Evaluation of Differing Site Condition Claim, East Bay Marina Dredging Project, Olympia, WA	Canonie Pacific Company	East Bay Marina Dredging	12 borings	May-82	N/A	N/A	19 to 23 ft	Between 6 and 18.5 ft	N/A

Table 4-6
Geotechnical Data Summary Table Review (through February 23, 2023)
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Evaluation of Subsurface Conditions, East Bay Marina Dredging, Small Boat Basin, Olympia, WA	Canonie Pacific Company	East Bay Marina Dredging	9 borings	Feb-83	N/A	N/A	N/A	Between 16 and 33 ft	N/A
Report of Preliminary Soil Investigation, Proposed Roadway, Olympia, Washington	Dames and Moore	Proposed Roadway in Olympia	2 borings	May-72	N/A	N/A	N/A	Between 25 and 40 ft	N/A
Report of Soils Investigation, Proposed East Bay Development Program, Port of Olympia, Olympia, Washington	Dames and Moore	Proposed Roadway in Olympia	11 borings	Apr-73	N/A	N/A	5 to 20.4	Between 15 and 100 ft	N/A
Report of Soils Investigation, Proposed East Bay Development Program, Port of Olympia, Olympia, Washington	Dames and Moore	Proposed Roadway in Olympia	9 borings	Jul-68	N/A	N/A	+7 to -14	Between 45 and 90 ft	N/A
Supplementary Geotechnical Investigation, East Bay Marina, Olympia, Washington	Dames and Moore	Proposed Roadway in Olympia	2 borings 5 CPTs	Aug-82	N/A	N/A	+20 to+28	Borings: Between 20 and 55 ft CPT: Between 20 and 55 ft	4-14 ft (tidal fluctuation)
Report of Soil Investigation Proposed East Bay Development Program Port of Olympia, Olympia, WA	Dames and Moore	Proposed Roadway in Olympia	12 offshore borings	Aug-78	N/A	N/A	N/A	Between 20 and 70 ft	N/A
Memorandum: Port of Olympia - Slope Stability Analysis West Bay Dredging	PND, Inc	Port of Olympia Main Berth	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Proposed Cold Storage, Warehouse Port of Olympia, Olympia, Washington	Dames and Moore	Proposed Cold Storage Warehouse	5 boring logs	Mar-81	N/A	N/A	N/A	Between 2 to 66 ft, and 6 to 25-30 ft	~ 10 ft

Table 4-6
Geotechnical Data Summary Table Review (through February 23, 2023)
Pre-Remedial Design Data Gaps Memorandum
Port of Olympia, Budd Inlet, Olympia Washington

Report Name	Report Author	Exploration Name(s)	Exploration Type	Drilling Dates	X-Coordinate	Y-Coordinate	Elevation (ft)	Exploration Depth	Water Level (ft/meters)
Report: Phase II Geotechnical Engineering Service, Berth 3 Reconstruction, Olympia, Washington	GeoEngineers	Berth 3 Reconstruction	5 boring logs	Aug-86	N/A	N/A	N/A	21 ft	N/A
Report of Soils Investigation, Proposed Pier Reconstruction - Berth 1, Olympia, Washington	Dames and Moore	Berth 1-Reconstruction	4 boring logs	Apr-79	N/A	N/A	19.7 to 20.8	Between 75 and 155 ft	Between 109 and 125
Proposed Warehouse B, Port of Olympia, Olympia, Washington	Landau Associates	Proposed Warehouse B	3 boring logs	4/19/2012	47.052954	-122.904664	N/A	Between 2 to 122 ft	~ 8 ft
Final Investigation Report -- Port of Olympia Budd Inlet Sediment Site	Anchor QEA	AN-3 through AN-8	6 boring logs	Feb/Mar-2013	47.057268	-122.905442		48 to 102 ft	

Abbreviations and Acronyms:

Apr = April
Aug = August
CPT = cone penetration test
Feb = February
ft = feet
Landau = Landau Associates, Inc.
Mar = March
N/A = not applicable
pg = page
SPT = standard penetration test
WA = Washington