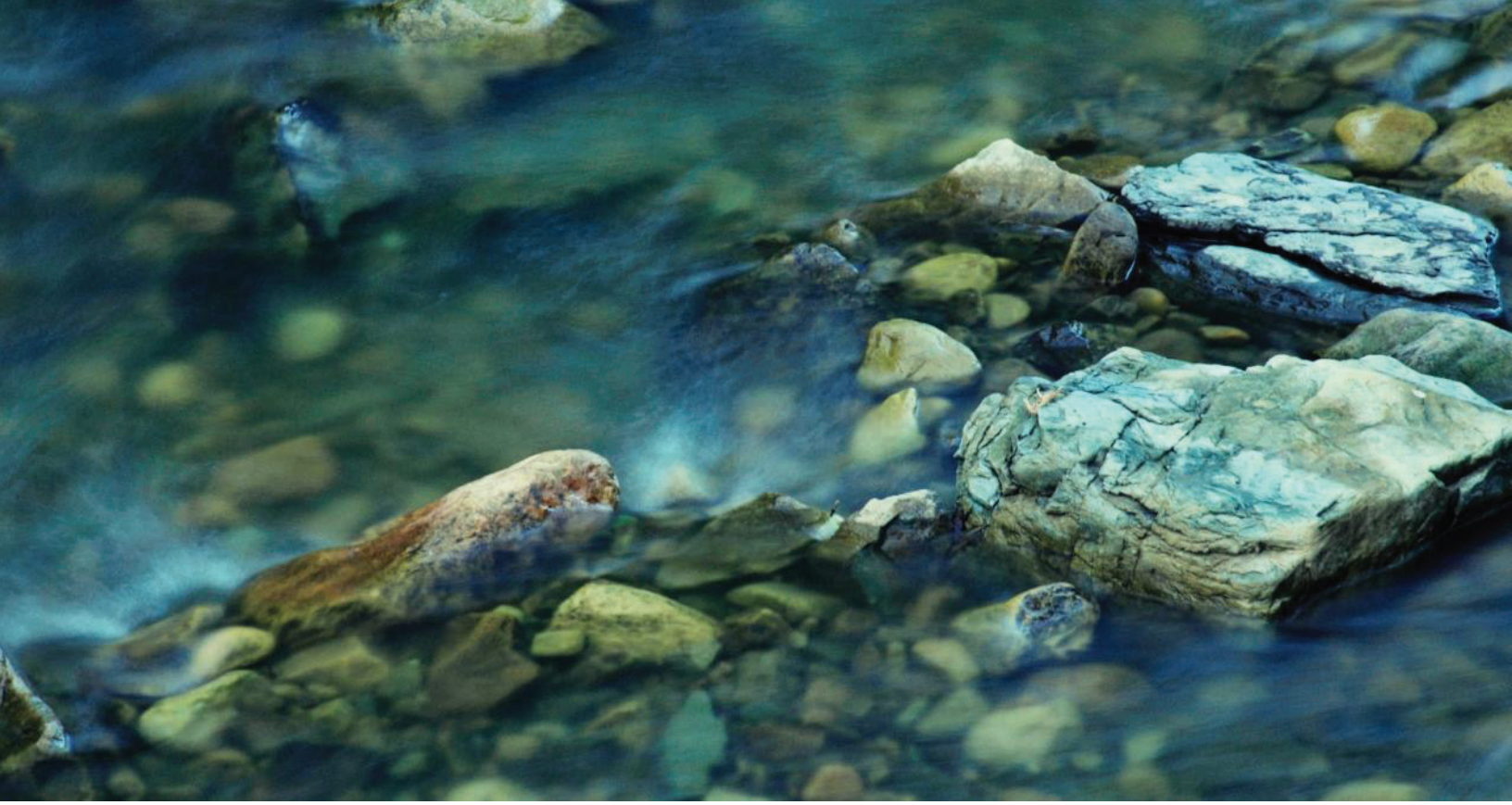

June 2024
Harris Avenue Shipyard Cleanup

ANCHOR QEA

Sediment Engineering Design Report

Prepared for Washington State Department of Ecology

June 2024
Harris Avenue Shipyard Cleanup

Sediment Engineering Design Report

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ABBREVIATIONS

APE	area of potential effects
ASB CDF	aerated stabilization basin confined disposal facility
BMP	best management practice
CAP	Cleanup Action Plan
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CUL	cleanup level
DU	dredging unit
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
ESA	Endangered Species Act
Fairhaven Industrial	Fairhaven Industrial Marine Repair Facility
HASP	Health and Safety Plan
HPA	Hydraulic Project Approval
JARPA	Joint Aquatic Resources Permit Application
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NOAA	National Oceanic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRDI	Pre-Remedial Design Investigation
PSAMP	Puget Sound Assessment and Monitoring Program
RCP	Representative Concentration Pathway
RI/FS	Remedial Investigation and Feasibility Study
RMC	residuals management cover
SCO	Sediment Cleanup Objectives
Site	Harris Avenue Shipyard Site
SMU	sediment management unit
SWAC	surface-weighted average concentration
SWPPP	stormwater pollution prevention plan
USACE	U.S. Army Corps of Engineers
UWI	Urban Water Initiative
WAC	Washington Administrative Code
WCRP	Washington Coastal Resilience Project
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WQC	Water Quality Certification

1 Introduction

This Engineering Design Report (EDR) has been developed for cleanup of contaminated marine sediment areas at the Harris Avenue Shipyard Site (Site) located in Bellingham, Washington (Figure 1).

The cleanup in these Site areas is being performed consistent with the cleanup requirements of the Model Toxics Control Act (MTCA), Chapter 70.105D in the Revised Code of Washington, as administered by the Washington State Department of Ecology (Ecology) under the MTCA Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC). The cleanup also complies with Sediment Management Standards (WAC 173-204).

The Port of Bellingham (Port) is leading cleanup of the Site consistent with the requirements of Agreed Order No. DE 19450 executed with Ecology. This EDR is described in the *Schedule of Deliverables* (Exhibit C: Scope of Work and Schedule) as Deliverable/Task C of the Agreed Order.

1.1 Purpose

Cleanup of the Site includes both upland and sediment remediation. A separate EDR has been developed describing the proposed remediation for upland soil and groundwater areas (Aspect 2023). This EDR presents the proposed remedy to address contaminated sediment and shoreline areas at the Site.

Previous work performed at the Site included development of a Remedial Investigation and Feasibility Study (RI/FS; Floyd Snider 2019a) and completion of an Interim Action addressing portions of both upland and in-water areas of the Site. A proposed cleanup was defined in a Cleanup Action Plan (CAP) finalized in 2021 after public review and comment (Ecology 2021a).

This EDR describes the work to be performed to implement the sediment portions of the final cleanup action. That work will be performed after procurement of applicable permits and approvals.

1.2 Site Location and Vicinity

The Site is located at 201 Harris Avenue in Bellingham, Washington (Figure 1). Portions of the upland and in-water areas have been and continue to be used historically for industrial purposes, primarily as a shipyard. The Site boundaries have been determined by the extent of identified contamination through investigations of soil, groundwater, and sediment quality within the study area (Ecology 2021a).

The Site consists of approximately 5 acres of upland and 5 acres of in-water area, totaling 10 acres. Portions of the Site are owned by the State of Washington and managed by the Port of Bellingham under a Port Management Agreement.

The Site is bordered on the north and west by Bellingham Bay and on the south by Marine Park and the BNSF Railway rail lines. Industrial properties owned by the Port are present to the east and

southeast of the Site. Properties to the east of the Site and their current uses include the former Arrowac Fisheries, Inc. warehouse on the uplands, and a parking lot. Farther to the east is the Bellingham Cruise Terminal, operated by the Port as the southern terminus for the Alaska State Ferry.

The Site is one of 12 cleanup sites located on and near the Bellingham Bay coordinated under the Bellingham Bay Demonstration Pilot Project. The Site was identified as high priority by Ecology in 2000 in a comprehensive strategy developed in cooperation with the Bellingham Bay Action Team.

1.3 Health and Safety

Prior to the start of any work, the contractor must provide a site-specific Health and Safety Plan (HASP). At a minimum, the HASP shall meet all the requirements of local, state, and federal laws, rules, and regulations and shall address all requirements for general health and safety.

The HASP will include the specific requirements for safety provisions and provide inspections and reports by the appropriate safety authorities to be conducted to ensure compliance with the intent of the regulations. The HASP will also inform employees and subcontractors and their employees of the potential danger in working with any potentially contaminated materials, equipment, soils, sediments, and groundwater at the Site.

The contractor will be required to provide a person designated as the Site Safety and Health Officer, who is thoroughly trained in construction safety, marine construction safety, rescue procedures, and the use of all necessary safety equipment that the work requires. The Site Safety and Health Officer must be present at all times while work is being performed.

1.4 Report Organization

The information contained in this report has been organized in the following manner:

- Section 2 summarizes the Site background
- Section 3 provides the basis of design
- Section 4 provides an overview of the cleanup action
- Section 5 summarizes the net environmental effects of the project
- Section 6 describes planned Site preparation and staging activities
- Section 7 presents the detailed cleanup design for offshore sediment areas
- Section 8 presents the detailed cleanup design for shoreline areas including planned structure removals and replacements
- Section 9 describes compliance monitoring to be performed during and after completion of the project
- Section 10 discusses the anticipated schedule

2 Background

This section provides the relevant Site background information including additional information regarding cultural resources considerations, summaries of previous investigations and cleanup actions, and other Site surveys completed to date.

2.1 Site Background

The Site is zoned by the City of Bellingham for water-dependent industrial use. The Site is currently leased by a Port tenant, Fairhaven Industrial Marine Repair Facility (Fairhaven Industrial). Fairhaven Industrial leased the Site for shipyard and boatyard uses, including vessel moorage, ship repair, and potential future operation of a dry dock.

Harris Avenue Shipyard has a well-established history of use for shipbuilding and shipyard repair activities from 1915 until the present day. Typical maintenance and repair operations at the Site have included the following: blasting and repainting ship hulls, freeboards, superstructures, and interior tanks and work areas; rebuilding and installing machinery; overhauling systems; replacing and installing new components; repairing propellers and rudders; and creating new machinery spaces through cut outs of existing steel structures (USEPA 1997).

The Port owns the area landward of the inner harbor line. A Port Management Agreement with the Washington Department of Natural Resources (WDNR) executed in 1997 granted primary property-management authority to the Port for multiple harbor-area parcels that are owned by the state and were previously managed by WDNR. The Port manages aquatic lands and lands of historical harbor infill above the high waterline located between the inner and outer harbor lines.

The in-water portion of the Site includes two piers, a marine railway, and two supporting overwater walkways. An extensive network of utilities exists at the Site, primarily in the uplands. Utilities include storm drains, sanitary sewer, natural gas, water, telecommunications, and electrical (Figure 2). Current utility maps include updated survey information developed as part of the Upland EDR (Aspect 2023).

Three outfalls discharge from the Site to Bellingham Bay (Floyd Snider 2019a), including Outfall No. 3, which transects the shoreline of the in-water portion of the Site; an outfall to the west; and a stormwater outfall to the east of the Harris Avenue Pier.

2.2 Cultural Resources

A subsurface archaeological site was identified on the property in 2017 during the Interim Action cleanup. The archaeological site, 45WH1026, is a multicomponent shell midden, parts of which have been disturbed by past industrial uses. The full boundaries of the archaeological site are not fully known and the current extent is thought to be within the original upland portion of the Site. This

area is generally south and east of the inner harbor line. Upland areas to the north and west of the inner harbor line represent recent fill materials placed as part of past industrial development.

Cultural resource monitoring in the recent shoreline fill deposits was performed as part of upland Pre-Remedial Design Investigation activities. Monitoring was conducted under the guidance of Archaeological Monitoring Permit No: 2021-85. Results of that monitoring are described in the *Results of Archaeological Monitoring for the Harris Shipyard Pre-Remedial Design Investigation Project* (ASM 2022a). The monitoring of shoreline fill areas identified fill deposits over glaciomarine deposits and showed no evidence of being associated with the archaeological site. Results support the archaeological site is confined to the historical (i.e., pre-1850s) shoreline.

Archaeological monitoring was conducted during the initial portions of the Sediment Pre-Remedial Design Investigation (PRDI). Initial results demonstrated that the observed sediment consisted primarily of fill with small quantities of debris (ASM 2022b). Monitoring was terminated under direction from the Washington State Department of Archaeology and Historic Preservation based on the low probability of encountering cultural resources.

Further cultural resource review and consultation will be conducted in coordination with the U.S. Army Corps of Engineers (USACE) as part of the permitting process. However, based on the results of previous upland and in-water archaeological monitoring and the distance from the known archaeological site, it is not likely that cultural resources will be disturbed during the planned sediment remediation activities.

2.3 Previous Investigation and Cleanup Actions

This section provides a concise summary of previous investigation and cleanup actions that have been completed at the Site. Historical sediment sampling locations are shown in Figure 3 and Figure 4.

- Early 1990s: Initial Site Investigations and Ecology inspections occurred, including the first chemical testing of upland soil and sediment.
- 1998: Detailed Phase 2 testing investigations were performed in the upland and sediment areas of the Site.
- 2000 to 2006: A Working Draft Sediments RI/FS (RETEC 2004) was completed in 2004 and amended in 2006 (RETEC 2006). Core samples were collected in 2004 to characterize sediment suitability for open-water disposal, in accordance with the Puget Sound Dredged Disposal Analysis program and the Dredged Material Management Program.
- 2006: One sample adjacent to the Site boundary was collected by Ecology's Puget Sound Assessment and Monitoring Program's (PSAMP's) Spatial/Temporal Monitoring program as part of routine ambient sediment monitoring. PSAMP investigated sediment conditions in eight Puget Sound regions sampled on an annual, rotational cycle.

- 2010: Surface sediment data at one location were collected as part of the Urban Water Initiative (UWI) through Ecology's Environmental Assessment Program. The purpose of this program was to assess sediment quality throughout selected urban bays in Puget Sound over time. The location assessed in the 2006 PSAMP study was reoccupied in 2010.
- 2011: Floyd Snider conducted a Supplemental Site Investigation to gather additional data to further characterize upland Site conditions, address the upland and sediment data gaps, and better define the preliminary Site-wide conceptual site model.
- 2013: Floyd Snider conducted a Data Gaps Investigation to fill data gaps identified as part of the Supplemental Site Investigation work and to further define the nature and extent of known contaminants of concern for completion of the RI/FS.
- 2015: Floyd Snider conducted a Pre-Interim Action Investigation to facilitate design of an Interim Action addressing certain upland and sediment areas of the Site. In the uplands, data were used to define the lateral and vertical extent of the excavation. In the sediments, samples were used to delineate the final depths of contamination within the Interim Action Area.
- 2017: The one location that was sampled in both the PSAMP (2006) and UWI (2010) studies was reoccupied in 2017 and tested by Ecology's UWI Program.
- 2017 to 2018: Interim Action cleanup activities were performed at the Site consistent with the Interim Action Work Plan and an Agreed Order Amendment. The work included contaminated soil excavation and replacement, overwater structure removal, subtidal and intertidal sediment dredging, intertidal sediment excavation and backfill, and reconstruction of a portion of the main shipyard pier. Confirmation sampling was conducted to document post-construction conditions. Sample results were reported in the Interim Action Construction Completion Report finalized in March 2019 (Floyd Snider 2019b).
- 2021: The CAP for the Site was finalized in 2021 after public review and comment (Ecology 2021a).
- 2022: PRDI sampling was conducted in upland and in-water portions of the Site to fill remedial design data gaps. Sampling included sediment sample collection, geotechnical analyses, upland soil borings, and groundwater collection, as well as utility, debris, bathymetric, and eelgrass surveys.

2.4 Site Surveys

This section summarizes the results of the completed survey activities for the in-water portion of the Site, including eelgrass and macroalgae surveys, bathymetric surveys, utility and shoreline debris mapping, and structural conditions assessment. Survey methods for each of these activities are described in more detail in the Work Plan (Anchor QEA 2021) and additional details of the results are provided in Appendix A of this EDR.

2.4.1 Eelgrass and Macroalgae

Intertidal and subtidal eelgrass and macroalgae surveys were conducted to determine geographic extent and associated shoot densities of eelgrass beds, to identify the presence of other important macroalgae resources in the Site cleanup and adjacent areas, and to determine if the potential remedy would impact these resources. The eelgrass and macroalgae surveys were performed by Anchor QEA and Gravity Marine Consulting, Inc., on June 21, 2022, using sonar, towed video, diver, and shoreline survey methods in accordance with the *Eelgrass/Macroalgae Habitat Interim Survey Guidelines* (WDFW 2008).

An eelgrass report summary, including sonar data, photographs, video, and additional details, is provided in Appendix A. Two areas of existing eelgrass were observed within the Site. As shown in Figure 5, one small area was identified near the marine railway. A larger, more significant area of eelgrass was observed near the shoreline west of the West Dock. No important macroalgae resources were identified in the Site.

2.4.2 Utilities and Debris

A diver survey was conducted in January 2022 to document utilities, structures, or other obstructions (e.g., debris) that may be present at the surface of the seabed. The divers swam a grid pattern throughout the entire in-water portion of the Site. To supplement this survey, a land-based (wading) survey at low tide was conducted in April 2022 in areas that were inaccessible by boat (e.g., underpier areas) or areas that were too shallow for video use.

The debris survey report included in Appendix A describes the locations of in-water utilities, debris, and notable underwater features present in the Site. This information will be used in the final design of dredging operations. In addition to the presence of smaller debris in the planned dredging areas, two anchor systems were noted to the north of the West Dock, consisting of a combination of Ecology blocks, spuds, and anchor chains attached to buoys. The survey also confirmed the alignment of the stormwater outfall that runs through the existing bulkhead wall before bending to the west and terminating under or near the West Dock where it is anchored with a piling and buried in the surficial sediment.

2.4.3 Bathymetry

Site-wide, multibeam bathymetric surveys were conducted in subtidal and intertidal areas during high tide cycles to support dredge and backfill design. The surveys were conducted on August 29, 2022, by Northwest Hydro, Inc., a licensed surveyor, using multibeam bathymetry equipment. Underpier areas were surveyed to the extent practicable. The survey data were determined to be suitable for use. Bathymetry data are provided in Appendix A and are shown in Figure 2.

2.4.4 Structural Assessment

A structural conditions assessment was conducted by WSP as described in Appendix A. The survey was conducted at low tide and included the West Marine Walkway, the three Site dolphins (northwest, southwest, and southeast dolphins), the existing shoreline bulkhead (Ecology wall), the East Marine Walkway, the marine railway, the West Marine Walkway, and the Harris Avenue Pier.

The structural assessment consisted of a visual inspection of the marine structures that would potentially be impacted by the proposed remediation or Site modifications, including an above-deck and below-deck assessment. Above-deck observations focused on east pier appurtenances, bull rail, mooring fittings, and fender elements. The below-deck condition assessment focused on the condition of the deck framing elements, pile caps, above-water portion of piles, fender system, and general condition of the shoreline. No underwater inspection was performed.

The most significant findings from the structural assessment affected the Harris Avenue Pier and the shoreline bulkhead wall. Findings for the Harris Avenue Pier indicated that the pier would be able to support planned under-dock remediation, including limited dredging. In contrast, the existing shoreline bulkhead wall (constructed largely of Ecology blocks) was found to have limited strength and was incapable of supporting planned remediation activities. WSP recommended that the existing bulkhead wall be replaced if sediment removal was to be performed near the wall.

3 Basis of Design

This section describes the basis for design for the sediment cleanup remedy as described in this EDR. That remedy is described in overview format in Section 4 and is presented in detail in Sections 6 through 8.

3.1 Required Cleanup Actions

Figure 6 illustrates the sediment management units (SMUs) as defined in the CAP (Ecology 2021a). The main focus of the remedy is to remove contaminated sediments by dredging and off-site disposal. The CAP remedy proposed removal and off-site disposal for the majority of the Site sediments, except where dredging was understood to be impracticable. Capping with institutional controls was to be applied in the remaining areas, including under-dock areas and the area adjacent to and beneath the marine railway. No further work was anticipated in the Interim Action Area at the time the CAP was finalized. However, as noted below, several modifications to the CAP remedy are being proposed.

The remedial design presented in this EDR has been informed by work completed subsequent to CAP finalization, including completion of the PRDI investigations, the structural evaluations, and Port land use decisions regarding Site marine structures. As influenced by that subsequent work, this EDR includes several modifications to the remedy to make it more permanent, including the following:

- **Additional dredging in Interim Action Area:** Results of PRDI testing confirmed that dredging residuals remain present at elevated concentrations within the previous Interim Action Area. Additional dredging and residuals management will be performed in this area to address this remaining contamination and comply with Site cleanup levels (CULs).
- **Additional dredging in northeast corner of the Site:** At the time the CAP was finalized, the northeastern Site boundary and SMU 1 had not been confirmed. The Site boundary and planned dredging limits have both been expanded in this area of the Site.
- **Use of dredging rather than capping beneath Harris Avenue Pier:** The CAP proposed that the area beneath the Harris Avenue Pier (SMU 3a) be remediated using a sediment cap. However, the structural evaluations performed during the PRDI indicated that the pier was capable of supporting under-dock dredging, provided that appropriate limited-access equipment (i.e., barge-based excavator) are used. This EDR proposes full contaminated sediment removal rather than capping in this area.
- **Use of dredging rather than capping near marine railway:** To facilitate a more permanent and thorough remedy, the Port will remove the existing marine railway, its many creosote-treated foundation piling, and the West and East Marine Walkways so that this area may be remediated using dredging rather than capping. This will result in a more permanent cleanup in this area (SMU 4a and 4b) and will also remove the creosote-treated piling as a potential

source of future sediment carcinogenic polycyclic aromatic hydrocarbon (cPAH) recontamination. The marine railway will not be replaced. Rather, its function will be replaced by construction of two finger piers for future operation of a travel lift.

- **Replacement of shoreline bulkhead to allow more complete sediment dredging:** The existing shoreline bulkhead was found during PRDI structural surveys to be incapable of supporting planned contaminated sediment removal and backfill in this area (SMU-2a). This EDR proposes to replace the bulkhead with a new sheet-pile structure capable of supporting planned sediment removal. The bulkhead construction will be coordinated with marine railway removal as described above.
- **Protection of eelgrass meadow in the southwest portion of the Site:** Based on the results of PRDI testing and remedial design evaluations, dredging will not be required in the southwest portion of the Site (SMU 3b located beneath the West Dock, and also the area west of it) in order to meet Site CULs. The extent of planned dredging in this area has been reduced to protect the existing eelgrass meadow identified in the southwest portion of the Site.

As a result of the planned adjustments to the remedy defined in the CAP, no sediment capping will be required in any of the offshore sediment areas. The remedy adjustments result in a substantial increase in estimated sediment dredging volume from an estimated 18,600 cubic yards (RI/FS volume including overdredge) to approximately 34,000 cubic yards in this EDR (including overdredge volume and contingencies).

The ability to cost-effectively manage the increased dredging volume is supported by the availability of the aerated stabilization basin confined disposal facility (ASB CDF) being developed by the Port as part of the Whatcom Waterway site cleanup. The cleanup decision for that site authorizes sediment disposal from other Port dredging projects. Sediments removed from the Site will be transported by barge and permanently disposed in the ASB CDF along with Whatcom Waterway site sediments.

3.2 Sediment Cleanup Levels

Sediment CULs and points of compliance were defined in the CAP (Ecology 2021a) and Agreed Order for the Site. Site CULs include both those to protect the health of benthic organisms and to protect human health.

Site CULs are provided in Appendix A and Table 1. The CULs/remedial action levels and points of compliance include the following:

- **Protection of benthic organisms:** Sediment CULs require compliance with current Sediment Cleanup Objectives (SCO) for protection of marine benthic organisms. These values are defined in the current version of Ecology's Sediment Cleanup User's Manual (Ecology 2021b). Existing sediment quality exceeds these values for arsenic, copper, zinc, total polychlorinated biphenyls (PCBs), fluoranthene, and pyrene. Compliance with the SCO is to be determined on

a point-by-point basis using a combination of chemical testing with contingent bioassay testing as needed. Samples that exceed the chemical SCO but pass bioassay testing are considered to comply with the SCO, consistent with Washington's Sediment Management Standards regulations.

- **Protection of human health:** Sediment CULs for the protection of human health were determined on a site-specific basis. These CULs were developed to protect both on-Site workers as well as people, such as tribal fishermen, who might be exposed to sediments through direct contact, fishing activities, or consumption of seafood collected from the Site. Compliance with sediment CULs for the protection of human health are determined on an area-wide basis using a surface-weighted average concentration (SWAC) throughout either the Site or the applicable exposure area. For fishing and seafood consumption, the appropriate SWAC averaging area is the entire Site. For direct human contact with beach sediments, the appropriate SWAC averaging area is the shoreline intertidal area. The CAP clarified that the extent of remedial action required to comply with sediment CULs for human health was to be defined in the EDR.
- **Sediment points of compliance**: Compliance with the sediment CULs is measured based on the thickness of the biologically active zone in sediment. In Bellingham Bay, this thickness is the upper 12 centimeters of the sediment bed.

3.3 Future Use Expectations

The Site is expected to be used for shipyard-related industrial activities for the foreseeable future. This is consistent with historical uses of the Site since 1915 and is consistent with the current zoning and shoreline designations for the Site.

3.3.1 Offshore Areas

Offshore areas of the Site will continue to be used to support shipyard activities. The Harris Avenue Pier is expected to continue to be used for the foreseeable future, as will the West Dock. It is likely that one or more floating marine drydocks will be located at the Site in the future, as they were in the past.

The Port has elected to remove the marine railway and replace its function with a travel lift and pair of finger piers. This change makes it possible to remove the marine railway and associated structures (including the West and East Marine Walkways) to allow the use of dredging rather than capping in this area. This also allows for removal of the creosote-treated foundation piling that support the marine railway and West Marine Walkway. Previously the marine railway was used to move vessels into the upland for construction or repair work. This work will be coordinated with the cleanup in the shoreline area (Section 3.3.2).

3.3.2 Shoreline Areas

The configuration of the shoreline area will be adjusted to permit completion of the proposed cleanup, including the removal of the marine railway as described previously. Because the existing bulkhead is in poor condition and will not support required dredging and shoreline backfill activities, the Port has elected to replace it as part of the cleanup. The replacement sheet-pile bulkhead will support required sediment removal and elimination of the marine railway. The upland portion of the marine railway will be removed and the cavity filled to match general upland elevations and grades. Two new finger piers will be constructed to replace the function of the marine railway and enable ongoing use of the Site as a shipyard.

3.4 Site-Wide Design Criteria

3.4.1 Project Datums

The horizontal datum that will be used for the in-water design is Washington State Plane North Zone, North American Datum of 1983, measured in units of U.S. Survey feet.

The vertical datum will be National Ocean Survey mean lower low water (MLLW) based on National Oceanic and Atmospheric Administration (NOAA) Station No. 9449211, located in Bellingham, Washington. Table 2 outlines the different water levels based on the NOAA Station No. 9449211 benchmarks.

3.4.2 Geotechnical Studies

The results of a geotechnical investigation performed in April 2022 are described in Appendix B. That work included three geotechnical borings that were completed between April 27 and April 29, 2022. As described in Appendix B, the geotechnical borings encountered silty sand and gravel (fill) over layers of sandy silt, cohesive clay and silt, and silty sand. The deepest soil unit encountered was the Bellingham glaciomarine drift.

The geotechnical studies will be used to support geotechnical evaluations associated with the design of the proposed bulkhead retaining wall along the shoreline, the travel lift finger piers, and the final dredge design. Geotechnical evaluations of lateral earth pressures, slope stability, bearing capacity, and other parameters will be performed as part of final design.

3.4.3 Coastal Engineering Design Criteria

Coastal engineering design criteria include the following:

- Wave conditions in the project area based on wind hindcasting for 1-, 2-, 10-, 20-, 50-, and 100-year recurrence interval events based on wind data obtained from the Bellingham International Airport

- Stable sediment and armor sizes for shoreline areas impacted by waves calculated using guidance in the USACE (2006) *Coastal Engineering Manual*
- Erosion protection armor sizes for shoreline protection in areas subject to vessel propeller wash forces throughout the project area
- The impacts of predicted sea level rise for the years 2050 and 2100 on predicted wave heights and proposed stable rock sizes for shoreline protection

Each of these design elements are discussed in further detail in the Coastal Engineering and Propeller Wash Evaluation Summary (Appendix C).

3.4.3.1 Wind Waves

Wind-generated wave effects were evaluated based on best practices from USACE and Palermo et al. (1998a, 1998b) as discussed in Section 3.1 of Appendix C. Wind-wave data were obtained from the Bellingham International Airport from 1948 to 2023 and compiled into eight directional bins to calculate significant wind speeds and directions capable of generating waves that would impact the shoreline at the Site. The results of the wind-generated wave analysis indicated that a maximum D_{50} stone armor size of 7 inches was required to protect against waves generated during a 100-year event. Further details of the methodology and calculations are described in Appendix C. This stone size is adequate for wind waves within the intertidal zone, i.e., within 200 feet of shore. In deeper areas within the project area, the seabed is subject to vessel action and propeller wash erosive forces tend to be the controlling erosive force.

3.4.3.2 Propeller Wash

Potential propeller wash effects of representative vessels that operate at the Site were evaluated in accordance with Appendix A of Palermo et al. (1998b) armoring design guidance. A site-specific analysis of propeller wash was conducted to evaluate erosive forces under future anticipated operating conditions (i.e., after removal of the marine railway and construction/operation of the travel lift). Propeller wash forces were calculated using Equation 6 from Appendix A of Palermo et al. (1998a) to predict the maximum propeller jet velocity along the seabed for two representative vessels that operated at the project Site.

Cover material placed within the footprint of the finger piers to support the travel lift will be robust enough to withstand erosive forces generated by the departing maneuvers of vessels being launched from the travel lift. Similar erosive forces are expected along the Harris Avenue Pier. In these areas, a stone size with a D_{50} of 18 inches would protect against most frequent propeller jet velocities. Within the West Dock Area, cobble-sized material with a D_{50} of 6 inches would be suitable to sustain expected propeller wash forces in deeper waters. The detailed analysis is further described in Appendix C.

3.4.3.3 Filter Criteria

As discussed in Section 3.4 of Appendix C, the minimum filter criteria suggest that five times the D_{85} (85% passing by weight sieve size) of the underlying material should be greater than the D_{15} (15% passing by weight sieve size) of the overlying material. If the filter criterion is not met, an additional filter layer between the armor stone and the underlying surface will be required to prevent piping and associated erosion.

3.4.3.4 Sea Level Rise

Sea level rise considerations for the Site were developed using the most recent sea level rise projection developed for Washington State. In 2018, the Washington Coastal Resilience Project (WCRP) published a report (Miller et al. 2018) to establish projections of sea level rise for Washington. The report provides sea level rise projections for all areas of the Washington coast including within the Puget Sound, taking into consideration recent research, land movement, and greenhouse gas emissions. Greenhouse gas emission scenarios depend on a variety of factors related to human behavior, as such, probabilistic projections for sea level rise have been made based on both low and high greenhouse gas scenarios. Climate projections are made for two greenhouse gas emissions scenarios in the WCRP report: Representative Concentration Pathway (RCP) 4.5 and RCP 8.5. RCP 4.5 is a low estimate in which greenhouse gas emissions peak by midcentury and decrease thereafter. RCP 8.5 is a highest emissions scenario in which there is a continuous increase in greenhouse gasses until the end of the twenty-first century (Mauger 2015).

Site-specific projections for sea level rise were developed using the projections developed by the WCRP and a report prepared for Ecology, *Adaptation Strategies for Resilient Cleanup Remedies: A Guide for Cleanup Project Managers to Increase the Resilience of Toxic Cleanup Sites to the Impacts from Climate Change* (Asher et al. 2017). The guidance presented in Asher et al. provides guidelines to assess risk levels for remediation projects and helps to assign appropriate sea level rise projections based on the selected risk category. Based on the very high-risk assessment due to the project location and remedial strategies, the guidance suggests that 4 to 6 feet of sea level rise should be considered by the end of the century as well as the increase in frequency of the 100-year storm event occurring every 10 years. Although this project lies outside of the Bellingham Waterfront District, these projections are consistent with the current projections of sea level rise required by the City of Bellingham (4.1 feet over the next 100 years) for projects within the waterfront district.

Because these projections do not take into consideration the potential increase in frequency of storms as a result of increased sea levels, the Coastal Storm Modeling System (CoSMoS) model, developed by the U.S. Geological Survey, was used to understand the impacts of sea level rise and coastal storms. The model was developed for adaptive project planning for assessment of hazards associated with future changes in sea level and climate scenarios and is available for the majority of coastal California; however, it has recently been expanded to include a Puget Sound model

(PS-CoSMoS). The model incorporates the same data provided by the WCRP but also features coastal storms to provide a full range or hazards for risk planning and tolerance. The results from these coastal engineering models will be used during completion of in-water engineering design for the Site to inform and develop specific coastal engineering design criteria that account for predicted sea level rise at the Site. Implications of sea level rise are two-fold for the analysis presented in Appendix C. First, armoring the shoreline against erosion should consider appropriate elevations for allowance of sea level rise, and second, propeller wash forces may be reduced as sea level rises.

3.4.4 In-Water Work Window and Allowable Construction Work Hours

In-water construction activities will be performed consistent with approved in-water work windows established by state and federal agencies (USACE and Washington Department of Fish and Wildlife [WDFW]). Project permits specified allowable in-water work windows based on protection of different fish species of concern (juvenile salmonids—regulated by WDFW—and Chinook salmon and bull trout—regulated by USACE). Most major in-water work activities, including dredging, will be limited to the period between August 1 and February 15; however, some in-water work conducted between February 16 and March 14 may be allowed but reserved exclusively for placement of shoreline backfill and residuals management cover (RMC). No dredging will be allowed to occur during the February 16 to March 14 work window.

In addition to the work windows mentioned previously, work conducted below the ordinary high water mark in the dry (i.e., during periods of low tide) will be allowed to be completed between July 15 and July 31.

Based on the current land use classifications for the Site area (heavy industrial or marine industrial), there are currently no hours of work restriction, and construction activities are assumed to be allowed 24 hours per day, 7 days per week. The Port may elect to reduce these work hours or limit certain days of the week based on input from the tenant or to reduce impacts to neighbors and the public, but these decisions would be made closer to construction.

3.4.5 Structural Design Criteria

Structural design criteria are applicable to structural design, demolition, and improvements to existing structures. Codes and standards to be implemented for this project are as follows:

- City of Bellingham Building Code
- International Building Code 2018
- American Association of State Highway and Transportation Officials Load and Resistance Factor Design (AASHTO LRFD) Bridge Design Specifications
- American Concrete Institute (ACI) 318-19, Building Code Requirements for Structural Concrete
- American Institute of Steel Construction Steel Construction Manual 15th Edition

A minimum design life for any new proposed structure is 50 years, assuming regular inspection and maintenance is performed throughout the structure(s) lifetime.

3.5 Anticipated Permits and Approvals

This section outlines the federal, state, and local environmental permits and regulatory approvals anticipated to be required for the Project, including regulatory triggers (actions that create the requirement to obtain a given permit), time frames for issuance, application materials, and the general requirements associated with each permit and approval.

3.5.1 Federal Permits and Approvals

3.5.1.1 Section 10/404 Nationwide Permit and Nationwide Permit 38

USACE is anticipated to be the federal lead agency for the project. The project includes Rivers and Harbors Act Section 10 and Clean Water Act Section 404 actions that will require coverage under a USACE Nationwide Permit 38. Nationwide Permit 38 can be issued for "specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority" (USACE 2022). The Joint Aquatic Resources Permit Application (JARPA) package will include sufficient documentation to cover archaeological and cultural resources and Endangered Species Act (ESA) consultation. The Nationwide Permit 38 review process is initiated via submittal of a JARPA to USACE. The time frame for the Nationwide Permit review is anticipated to be approximately 9 to 15 months from the complete application determination.

3.5.1.2 National Historic Preservation Act Section 106 Concurrence

The lead agency for Section 106 of the National Historic Preservation Act consultation is USACE. Section 106 requires that the federal agency determine whether a project will have an adverse effect on historic properties, including archaeological and cultural resources, historic structures, and Traditional Cultural Properties. The Section 106 process requires identification of the area of potential effects (APE), evaluation of potential historic properties in the APE, and a determination of project effects. Consultation with tribes and the State Historic Preservation Officer occurs as part of Section 106 consultation. Typically, USACE requires the applicant to provide documentation that describes the APE, identifies and evaluates historic properties, and describes project effects, which the agency then shares with tribes and the State Historic Preservation Officer. The review process will occur concurrent with Nationwide Permit 38 review and/or Individual Permit review and is anticipated to take approximately 9 to 18 months to complete.

3.5.1.3 Endangered Species Act Section 7 Concurrence

The lead agency for ESA Section 7 consultation, in coordination with the National Marine Fisheries Service and U.S. Fish and Wildlife Service, is USACE. The project proposes in-water activities that have

the potential to affect ESA-listed species or critical habitat. To avoid or minimize adverse impacts to ESA-listed species, best management practices (BMPs) and conservation measures will be incorporated into the project definition, including working within the in-water work window when ESA-listed fish species are less likely to be present. The ESA consultation process will occur concurrent with Nationwide Permit 38 review and/or Individual Permit review and is anticipated to take approximately 9 to 18 months to complete.

3.5.1.4 Coastal Zone Management Act Consistency Determination

The lead agency for Coastal Zone Management Act consistency review in coordination with Ecology is USACE. A Certification of Consistency with the Washington State Coastal Zone Management Program for Federally Licensed or Permitted Activities form is completed and submitted with the JARPA. The Coastal Zone Management Act consistency determination is typically issued after federal, state, and local permits and approvals are obtained (estimated 9 to 18 months).

3.5.2 State Permits and Approvals

3.5.2.1 Section 401 Water Quality Certification

Ecology is the review agency for the Clean Water Act Section 401 Water Quality Certification (WQC). Ecology reviews all projects requiring work within waters of the state for consistency with the Washington State Water Quality Standards per WAC Chapter 173-201A. The WQC review process is initiated via submittal of a pre-filing request form to Ecology, at least 30 days prior to submitting the JARPA and a Water Quality Monitoring Plan to Ecology. As part of the 401 process, a 30-day internal coordination period is now required between USACE and the U.S. Environmental Protection Agency to identify any impacts to neighboring jurisdictions. It is recommended that the Ecology permit applications are submitted concurrent with the USACE submittal to take advantage of the joint public notice to streamline the process. The time frame for WQC review is anticipated to be 9 to 12 months from the complete application determination.

3.5.2.2 Aquatic Use Authorization

WDNR administers the review and approval process for activities occurring on or over state-owned aquatic lands. The Port and WDNR currently have a Port Management Agreement in place for state-owned aquatic lands within the project area. The Port will coordinate Port Management Agreement consistency with WDNR related to project actions in these areas. The Aquatic Use Authorization process is initiated via submittal of the JARPA and a completed JARPA Attachment E: Aquatic Use Authorization on DNR-Managed Aquatic Lands to WDNR. WDNR reviews and issues a signed Attachment E within months of submittal. However, the Aquatic Use Authorization, in the form of a lease or similar agreement, is typically not issued by WDNR until all local, state, and federal permits and approvals are obtained (estimated 12 to 15 months). Therefore, it is anticipated that most of the permits and approvals described herein are predecessors to obtaining this authorization.

3.5.3 Substantive Compliance

Because the work will be conducted under the Agreed Order from Ecology, the project is exempt from the procedural requirements of most state and local permits. However, MTCA requires compliance with the substantive provisions of these regulatory programs. In the past, Ecology has assisted the Port in working with state and local agencies to demonstrate substantive compliance. The substantive requirements of the following approvals, known at this time to be applicable to the cleanup, will be addressed during design and permitting.

3.5.3.1 Hydraulic Project Approval

The lead review agency for the Hydraulic Project Approval (HPA), issued under the Washington State Hydraulic Code, is WDFW. The project will not require a formal HPA due to substantive compliance. The HPA defines state requirements for construction activities in order to avoid unnecessary disturbance to fish, shellfish, and wildlife. The Port and Ecology will work with WDFW to ensure protection of fish, shellfish, and wildlife during project construction.

3.5.3.2 Shoreline Permit

The City of Bellingham is the lead review agency for Shoreline Management Act consistency. Shoreline Management Act regulations defer to Ecology for site-specific review of cleanup actions conducted under MTCA. Ecology will consider the substantive provisions of the City of Bellingham's Shoreline Master Program (City of Bellingham 2013) as part of the project, but a shoreline permit will not be required. As of 2023, the City of Bellingham was still updating their 2013 Shoreline Master Program.

3.5.3.3 Critical Areas Ordinance Consistency Determination

The City of Bellingham is the lead review agency for Critical Areas Ordinance consistency. The substantive provisions of the City's Critical Areas Ordinance will be considered by Ecology as part of the project, but a critical areas consistency determination will not be required.

4 Cleanup Overview

This section and Figures 7 through 12 provide a high-level overview of the sediment cleanup as detailed in this EDR. Sections 6 through 10 provide a detailed description of the remedial design and the associated compliance monitoring.

Figure 7 presents the areas within which contaminated sediment removal will be performed. The removal depths and elevations are shown for each dredging unit (DU) on the figure based on the neatline elevations and in Table 3. Additional removal will occur as an overdepth allowance beneath those depths/elevations. The overdepth allowance is typically 1 foot. Expectations for each area are as follows:

- The DU1 and DU7 areas will be dredged to remove the sediment to 3 feet below mudline. This depth is expected to remove all contaminated sediments. The DU1 areas include those areas of SMU 1 not previously dredged (i.e., excluding the Interim Action Area and no action areas).
- The DU2 areas are those located within the previous Interim Action Area (portion of SMU 1). The DU2 areas will be re-dredged to a depth of 1 foot below mudline to remove dredging residuals remaining from the Interim Action.
- The under-dock area (DU3) at the Harris Avenue Pier will be dredged to 3 feet below mudline. This will require use of limited-access equipment given the presence of the dock structure. Sample results indicate this area may meet site-wide SWAC CULs without dredging. Additional sampling may be collected during later design phases to determine if action underneath the dock is warranted.
- Sediment dredging within and adjacent to the marine railway will be performed following removal of the marine railway structure and the East and West Marine Walkways. The nearshore dredging in DU4 and DU5 will be performed to an elevation of 7 feet below MLLW. This dredging will require prior installation of the new shoreline bulkhead to stabilize the shoreline. Dredging in DU6 will be performed to 5 feet below mudline.
- The shoreline area near the West Dock (DU8) will be dredged to depths of 3 feet below mudline.
- In a small area to the southwest of the primary dredging boundary (DU9), a small surficial spot removal will be conducted to a depth of 1 foot below existing grades. This area will then be backfilled and armored to stabilize the shoreline against potential future erosion.
- No dredging will be performed in the northeast corner of the Site, beneath the West Dock, or in the southwest corner of the Site. Dredging in these areas is not required to comply with sediment CULs. The limits of dredging have also been adjusted to protect the existing eelgrass meadow located in the southwest corner of the Site.

Figure 8 illustrates the material placement to be conducted following dredging in each area. This placement primarily includes the placement of a layer of RMC. This sandy cover material is used to actively manage dredging residuals. The residuals analysis (Appendix D) determined that a nominal 6-inch layer of RMC will be sufficient to comply with Site CULs. However, the RMC thickness has been doubled within the marine railway area (DU5 and DU6) to provide an additional margin of safety. This is warranted because of the additional debris and difficult dredging conditions anticipated in this area.

The replacement bulkhead location is shown in Figures 7 and 8. The marine railway cavity located shoreward of the bulkhead will be filled with clean soil and matched to existing grades as shown in Figure 8. The shoreline area between the end of the bulkhead and the West Dock will be backfilled and armored to ensure long-term stability and resiliency of the shoreline.

Figures 9, 10, and 11 show the design of the bulkhead and of the finger piers that will replace the function of the marine railway. The travel lift system will include a mobile travel lift adequately sized to transition vessels from the upland area, behind the new bulkhead, to the waterway via two finger piers. Vessels will then be launched or retrieved from the basin created between the two finger pier structures. Piers will be constructed using steel pipe piles supporting the concrete deck. It is anticipated that piers will be approximately 150 feet long by 10 feet wide.

5 Net Environmental Effects

The cleanup of the Site sediments is expected to have a beneficial impact on environmental conditions and specifically aquatic habitats within the Site.

Three types of habitats can be found in the in-water portion of the Site. The habitats include intertidal, shallow subtidal, and subtidal. In general, these habitats are highly degraded due to long-term industrial use of the Site and associated sediment contamination, in- and overwater structures, the presence of humanmade shoreline debris, and other habitat-limiting factors. It is expected that the implementation of this cleanup and source control work will result in an overall improvement of habitat conditions for all three types of habitats within the Site by addressing these habitat-limiting factors. The net environmental improvement will result due to the following:

- Removal of contaminated sediment present in the seabed, with the project focusing on full removal of contamination to provide a more permanent remedy
- Protection from potential future erosion of contaminated soils in the Site upland by appropriately stabilizing the shoreline
- Removal of hundreds of existing creosote-treated timbers associated with the West Marine Walkway and the marine railway
- Removal of humanmade shoreline and subtidal debris

Eelgrass disturbance will be minimized during the remedy. The sediment remedy includes provisions to prevent damage to an existing eelgrass meadow located in the southwestern portion of the Site.

A small outward adjustment to the location of the ordinary high water line may occur along the face of the replacement bulkhead used to stabilize the shoreline. The current conditions in this area are characterized by humanmade debris and shoreline armor. Appropriate mitigation will be incorporated into the project as part of project permitting to compensate for this change. This mitigation is expected to be performed as part of the Advance Mitigation framework being developed by the Port in association with the Whatcom Waterway site cleanup project.

Potential short-term impacts of the cleanup will be mitigated to the extent practicable. It is expected that the benthic community will fully recolonize Site sediment and structures within several years of the completion of the remediation, as there are numerous nearby similar habitats with benthic organisms that will aid in recolonization. It is likely that the remediation will increase suitable benthic habitat because the future substrate will have significantly reduced levels of contaminants. Additionally, BMPs (see Appendix E) will be employed during the work to reduce the water quality impacts associated with environmental dredging.

Overall, the project will create a net positive environmental effect. A number of the project's effects and goals are in line with the Bellingham Bay Pilot Comprehensive Strategy (Ecology 2000), which

provides an integrated strategy to expedite source control, sediment cleanup, and associated habitat restoration in Bellingham Bay. These goals include providing clean sediments to support functions and species, endeavoring to achieve net gains in aquatic areas, and restoring lost habitat attributes by removing remnant structures and replacing treated timber structures where practicable. The implementation of the current cleanup project accomplishes these objectives.

6 Site Preparation and Staging Areas

As part of cleanup construction activities, the selected contractor will be required to bring the necessary barges, dredges, and other water-based specialized equipment to the Site. The equipment will be moored and repositioned within the work area as necessary to complete the work. Completion of the work may also require mobilization of land-based equipment including backhoes, shore-based cranes, pile-driving equipment, loaders, and other equipment. This section discusses potential Site areas that may be used by the contractor to stage equipment, or for staging, stockpiling, or loading contaminated sediments and other materials.

6.1 Staging and Transload Facilities

It is assumed the majority of dredged sediments would be loaded directly onto barges and transported directly to the ASB CDF for disposal. Required BMPs for sediment transportation and disposal at the ASB CDF are described in Appendix E.

Portions of the upland area will be made available to the contractor for use in construction and staging activities. This may include storage of construction equipment and materials, construction activities associated with construction of the bulkhead and filling of the marine railway cavity, and potential offloading and/or stockpiling of debris removed during remediation. Other locations may alternatively be proposed for use by the contractor for sediment and debris offloading and staging, pending the approval of the project engineer, the Port, and Ecology.

Required BMPs for upland staging and transload facilities are described in Appendix E. The contractor will be required to submit a Construction Work Plan that will detail operations, including set-up, breakdown, stormwater management, and cleaning of the offload facility.

6.2 Stormwater Management

It is assumed that a construction general stormwater permit will be obtained for construction activities at the upland stockpile and staging areas (as determined). Given that hazardous substances are present in the construction areas, the stormwater permit will require issuance by Ecology of an order to establish discharge limits for heavy metals, polycyclic aromatic hydrocarbon (PAH) compounds, and PCBs. Treatment and monitoring will be required for any stormwater from the construction areas prior to discharge to Bellingham Bay.

Stormwater will be managed according to permit conditions at the upland materials stockpile and staging areas. The contractor will prepare a stormwater pollution prevention plan (SWPPP) that meets conditions of the permit, and details BMPs to minimize generated waters and ensure

compliance with applicable water quality criteria and discharge requirements. The SWPPP will include the following:

- Identify potential sources of pollution that may be reasonably expected to affect the quality of stormwater discharge from the work area.
- Describe and ensure implementation of practices that will be used to reduce the pollutants in stormwater discharge from the work area.
- Identify applicable BMPs and treatment requirements for stormwater management.

6.3 Other Environmental Considerations

Other environmental considerations that will be addressed associated with upland staging and stockpiling activities include the following:

- **Control of fugitive dust:** The contractor will control fugitive dust from the stockpile and staging areas using appropriate BMPs. The tracking of sediment or dust off site to City of Bellingham streets will be controlled.
- **Mitigation of traffic impacts:** Traffic impacts associated with project construction activities will be mitigated to the extent practicable. This will include using barges where appropriate to transport material to and from the Site, using designated truck haul routes. Flaggers will be used if necessary to ensure traffic safety.

7 Offshore Sediment Remediation

This section describes the cleanup to be performed in offshore areas. This work includes Site preparation, removal of contaminated sediments (dredging), and management of dredging residuals. The cleanup in shoreline areas is described separately in Section 8.

7.1 Overall Dredging Design

This section describes the remedial design for dredging that is applicable to all areas. Special requirements for specific areas are detailed in Section 7.2.

The dredge plan development was an iterative process that included integrating multiple design criteria, including the extents of contamination, and operational requirements into one constructable dredge surface.

7.1.1 Dredge/Excavation Prism Design

Dredge prisms were designed based on the nature and extent of contamination in each area and on the target sediment removal depths. These target removal depths consider the proposed final elevation design in areas where vessel operating depths must be maintained. Secondary considerations in dredge prism designs included geotechnical properties of the sediment, locations, and characteristics of adjacent structures, and the typical precision and accuracy of dredging equipment that will likely be utilized to implement the work.

The maximum overdredge is 1 foot below the neatline elevation/dredge cut thickness. This is the maximum payable depth. The contractor is expressly prohibited from dredging below the maximum overdredge allowance.

The primary criterion of the dredge prism is to provide a constructable surface that removes all of the contaminated sediment above the predicted contaminated neatline surface. The dredge prism also needs to balance being overly conservative and dredging too much "clean" sediment as part of remedial dredging, which has the potential to significantly increase project costs. The dredge prism design is based on both a quantitative evaluation (use of the interpolated neatline surface and required operational depths) and a subjective evaluation based on past dredging experience. Because the dredge prism design relies on multiple sets of data, the precision of each dataset (e.g., bathymetry, sediment sampling results, and interpolated contaminant extents) affects the level of certainty that the dredge prism removes all of the contaminated sediments.

In addition to completion of water quality monitoring, the completeness of dredging will be verified as described in the Construction Quality Assurance Plan and in the Compliance Monitoring and Contingency Response Plan (to be completed at a later date). Progress surveys will verify that design

dredge elevations have been met, and in locations where adequate depth has not been achieved the contractor will be required to remove additional material.

7.1.2 Allowable Overdredge

Allowable overdredge is defined as additional material removed from below the required dredge prism to account for equipment accuracy and tolerance. An allowable overdredge of 1 foot is recommended for this project, based on consideration of the Site conditions, local dredging experience, and anticipated equipment types.

With careful vertical control and modern positioning systems, it should be possible to limit the payable overdredge allowance to a maximum of 1 foot. It is recommended that allowable overdredge of 1 foot be included in the project specifications. It should be noted that the 1-foot allowance represents a maximum allowable overdredge and dredging below this would represent excessive dredging.

7.1.3 Dredge Cut Side Slopes

Based on identified sediment geotechnical properties and best professional judgement, external side slopes of 3 horizontal to 1 vertical (3H:1V) have been incorporated into the design around the perimeter of extent of required dredging areas. These side slopes were determined based on the geotechnical analysis (Appendix B) and experience with similar projects.

Internal transitions between dredging areas with different required final elevations may require work by the contractor to remove sloughed material. The occurrence of such slough between one dredging area and another will vary depending how the work is implemented. Slough material will be removed prior to acceptance of the work in these transition areas.

7.1.4 Equipment Selection

Dredging work will be conducted using mechanical dredge equipment. Dredging method selection for these areas has considered the following factors:

- Ability of mechanical dredging equipment to meet project requirements, including compliance with applicable water quality criteria
- Presence of debris within the dredging areas (hydraulic dredging equipment is subject to fouling with such debris)
- Ability of mechanical dredging to achieve higher solids loadings in the dredged materials, without necessitating costly and area-intensive dewatering methods
- Mechanical dredging produces lesser quantities of generated waters, minimizing both risks to receiving waters and the water treatment needs necessary to address those risks

- Improved availability of equipment and expertise within the Pacific Northwest for mechanical dredging as opposed to hydraulic dredging
- Ability to use mechanical dredging equipment for other project activities (e.g., placement of RMC)

The selected contractor will determine the specific pieces of mechanical dredging equipment required to perform the project work. It is assumed that the contractor will use dredge derricks, barges, and tugs. The contractor may select land-based excavation equipment for the shoreline areas and/or under-dock areas, if desired.

The contractor will be required to specify equipment and procedures in advance as part of their Construction Work Plan. Equipment selection choices will comply with environmental control and permit requirements associated with water quality criteria. Potential construction BMPs associated with specialized equipment are described in Appendix E.

7.2 Dredging Requirements for Specific Areas

This section describes specific design requirements for dredging in certain offshore portions of the Site.

7.2.1 Open-Water Dredging Areas

Dredging thicknesses in most open-water dredging areas (DU-1 and DU-7) are established at 3 feet. These thicknesses are estimated to reach the clean sediment horizon. Payable overdredge allowances are 1 foot in these areas.

7.2.2 Re-Dredging in Interim Action Area

The proposed work includes targeted re-dredging within the 2017-2018 Interim Action Area (DU-2). That work did not include active management of dredging residuals. Post-construction monitoring data and data collected during the PRDI testing (Appendix A) confirmed that further work is required in this area to address dredging residuals and comply with Site CULs.

Based on the PRDI testing results, target dredge thicknesses within the Interim Action Area are 1 foot, with 1 foot of payable overdredge allowance.

7.2.3 Dredging in Marine Railway Area

Under the original CAP, the contaminated sediments within the marine railway area were to be capped in place. This was due to the inability to achieve full removal of the contaminated sediments with the railway structure in place. However, the Port has elected to remove the marine railway to allow a more complete cleanup of sediments in this area.

As proposed, the existing marine railway and associated walkways and foundation piling will be completely removed. Following removal, the contaminated sediment below the railway will be removed by dredging and/or removal by land-based equipment.

The depths of dredging vary by location and consider 1) the defined depth of contamination, 2) the likelihood of difficult dredging conditions due to the presence of historical, broken-off piling that may be present in this area, and 3) the water depth requirements associated with future navigation uses following completion of the cleanup. Target removal depths and elevations are as follows:

- The shoreward portions of the marine railway area (DU4 and DU5) will be dredged to a maximum elevation of -7 MLLW. Portions of these areas may be excavated with land-based equipment. Payable overdredge allowances are 1 foot in these areas.
- The offshore portions of the marine railway area (DU6) will be dredged to a depth of 5 feet below existing grades. Payable overdredge allowances are 1 foot in this area.

Following dredging, residuals management (see Section 7.4), and compliance monitoring, the Port will construct finger piers within the area to replace the function formerly provided by the marine railway. The finger piers and associated work are described in Section 8.

7.2.4 Dredging in Under-Dock Area

Under the original CAP, the contaminated sediments beneath the Harris Avenue Pier were to be capped in place. However, the Port has elected to remove these contaminated sediments by dredging to provide a more complete cleanup of sediments in this area.

Dredging thicknesses in the under-dock area (DU-3) are established at 3 feet. These thicknesses are estimated to reach the clean sediment horizon. Payable overdredge allowances are 1 foot in these areas.

Removal of sediments in the under-dock area will require the use of limited-access equipment. This is expected to include a long-arm excavator either operating from a barge or operating from the dock surface.

7.3 Sediment Handling, Transport, and Disposal

Dredged sediments from all offshore areas will be managed for disposal at the ASB CDF. Transport of dredged sediment will be performed using a barge with sidewalls of sufficient height to fully contain the material and will be watertight. Any water collected on the barge after leaving the work Site will need to be collected and managed at the receiving facility (i.e., at the ASB CDF).

Dredged sediment will be offloaded at the ASB CDF. It is expected that the offloading will occur directly from the material barge and be transported directly to the ASB CDF using a transload pump and/or conveyor. Proposed BMPs for sediment offloading are included in Appendix E.

Debris removed during dredging and excavation will be transloaded and transported to an upland Subtitle D landfill. Final transportation to the landfill may occur by rail and/or truck, depending on the selected landfill facility and the transportation logistics selected by the contractor. Examples of permitted Subtitle D landfills that have historically managed dredged sediments and debris include the Waste Management landfills in Wenatchee, Washington, and Arlington, Oregon, and the Allied Waste facility located in Roosevelt, Washington. Other landfills may be utilized for disposal management, provided that they meet Subtitle D permitting requirements.

7.4 Residuals Management

Appendix D includes a detailed analysis of dredging residuals expected to occur within each of the sediment removal areas. The thickness of the dredge residuals layer typically varies depending on the dredge material properties, the presence of debris, and other factors. Dredging residuals are to be minimized through the application of BMPs as described in Appendix E. But dredging residuals occur with all types of dredging.

Placing clean sand cover, (i.e., RMC) in dredged areas (following dredging activities) provides greater certainty in achieving post-construction performance standards (i.e., reductions in surficial sediment concentrations) based on case study project sites evaluated in Desrosiers and Patmont (2009). Dredging residuals will be actively managed during the cleanup to achieve compliance with Site CULs following completion of construction.

Residuals management will include 1) compliance with project BMPs, 2) post-dredge compliance monitoring, and 3) placement of RMC (clean sandy sediment) within the completed dredging areas. The placed RMC material is not a sediment cap. Rather, it is intended to mix with the veneer of dredging residuals to produce a final sediment surface that meets cleanup objectives.

RMC placement will be performed in the identified areas as shown in Figure 8. As described in Appendix D, the placement of 6 inches of RMC is expected to be sufficient to comply with Site CULs. However, a thicker placement of RMC has been included within the offshore portions of the marine railway area (DU-5 and DU-6) to provide additional protection in this area where a higher incidence of dredging residuals could result from the presence of debris and difficult dredging conditions.

RMC placement will be conducted after required dredging is completed and has been verified through post-dredge bathymetric surveys. Placement of the RMC layer will be performed in each area using one or more of the following methods:

- Directly placing the material at the mudline using a rehandling bucket. The rehandling bucket would grab cover material from a haul barge and lower the material through the water column before opening slightly above the mudline.
- Placing the sand with a barge-mounted, crane-operated clamshell. The clamshell placement method involves taking a bite of sand from a material barge and slowly releasing the sand from the bucket at the water surface as the operator methodically moves the bucket in a sweeping motion from side to side.
- Hydraulically spraying the cover material off the deck of a flat-deck material barge over the cover area.
- Placement of material from a barge with a variable speed telebelt, which would project material over the cover area. This method is typically applied to under-dock areas.

8 Shoreline Remediation

This section describes the sediment remediation and shoreline stabilization activities to be conducted in the shoreline areas of the Site. This work will result in the removal of contaminated sediment and placement of clean backfill and shoreline protection elements to prevent potential future erosion of cleanup elements in the upland areas of the Site.

8.1 Shoreline Stabilization Structures

As described in Section 7, and in order to allow for a more complete removal of contaminated sediments, the Port has elected to remove the marine railway. This additional work includes placement of a new shoreline bulkhead to allow removal of contaminated sediments in the marine railway area to the extent practicable.

A new sheet-pile wall will be installed in the approximate location shown in Figures 7 and 8. The cavity behind the bulkhead will be filled with clean backfill materials and graded to integrate with the upland cap.

Figures 9, 10, and 11 illustrate the proposed bulkhead construction. The design of the bulkhead will anticipate construction and post-construction conditions as follows:

- The bulkhead will accommodate dredging at the bulkhead face to an elevation of -7 feet MLLW.
- The bulkhead will be designed to accommodate an upland ground surface elevation of +15 feet MLLW.
- The bulkhead will be designed to accommodate surcharge loads associated with a 400-ton travel lift or equivalent equipment.
- Scour protection will be included at the face of the bulkhead to protect against prop wash forces as described below.

Scour protection will be placed at the face of the bulkhead to prevent potential future scour and undermining of the bulkhead. The scour protection will be consistent with the coastal engineering analysis as described in Appendix C. That analysis determined that prop wash erosive forces were greater than those associated with wind waves.

To resist propeller wash forces, armor stone with a D_{50} of 26 inches will be placed at the face of the bulkhead (i.e., at the intersection of the -7-foot MLLW mudline and the new bulkhead).

8.2 Nearshore Dredging and Backfill

Nearshore dredging along the bulkhead alignment (inshore portions of DU4 and DU5) will be completed following marine railway demolition and installation of the new bulkhead. Dredging in

these areas may be conducted with either barge-mounted or shoreline-based equipment as described in Section 7.

In the areas west of the new bulkhead (DU8), dredging will be conducted to a depth of 3 feet below existing grades. These areas will then be backfilled and armored to stabilize the shoreline against potential future erosion. Cover material placed in this area of the shoreline should be sized with a D_{50} of 7 inches to appropriately to withstand wind-generated waves for the 100-year storm.

In a small area to the southwest of the primary dredging boundary (DU9), a small surficial spot removal will be conducted to a depth of 1 foot below existing grades. This area will then be backfilled and armored to stabilize the shoreline against potential future erosion.

8.3 Structure Replacements

Following completion of contaminated sediment removal, the marine railway will not be replaced. Rather, a pair of travel lift piers will be constructed to replace the function of the marine railway. The two finger piers will be approximately 150 feet long and 10 feet wide and will be placed approximately 35 feet apart. The piers will be supported by piles.

Figure 11 illustrates the construction of the travel lift piers. The travel lift piers will also include handrails around the exterior of the deck. Design parameters for the travel lift piers include the following:

Dead loads:

- Pier structure self-weight including all appurtenances.

Live loads:

- Accommodate 400-ton travel lift

Seismic loads:

- Applicable seismic loads will be determined using spectral accelerations adjusted for Site Class D.

Operational criteria:

- Max vessel draft, 5 feet
- Max vessel beam, 30 feet
- Max vessel length, 150 feet
- Operation occurs at a tide of +2 or higher

9 Compliance Monitoring

Compliance monitoring activities to be performed during remediation include both protection monitoring and performance monitoring.

Protection monitoring will include implementation of a water quality monitoring plan to be developed and included as an attachment to the final version of this EDR. That work will be used to verify that work activities do not adversely impact water quality. The plan will include contingency actions to adjust or stop the work in the event of non-compliance with water quality goals.

Protection monitoring may also include implementation of a Marine Mammal Monitoring Plan as a requirement of the project permits.

Performance monitoring will include both bathymetric surveys and post-construction sediment monitoring, described as follows:

- **Progress Surveys:** Progress bathymetric surveys will be performed within the dredging areas to verify that sediments have been removed to target elevations and to document the extent of sediment removal achieved through sloughing and targeted removal in under-dock areas.
- **Completion Survey:** A bathymetric survey will be performed after the completion of residuals cover placement and sediment backfill/armoring to document final bathymetric conditions within the work area.
- **Post-Construction Sediment Monitoring:** Post-construction monitoring of surface sediments will be performed at the locations shown in Figure 12 within 1 month of overall construction completion. Samples will be collected by a Van Veen sediment sampler (open-water areas) or diver (under-dock areas) from the sediment bioactive zone (0 to 12 centimeters below mudline). Sampling will include analysis for heavy metals, semivolatile organic compounds, and PCBs. If numeric SCO criteria for benthic protection are exceeded, then contingent bioassay testing may be performed. Results for arsenic, cadmium, cPAHs, and total PCB Aroclors will be compared to the site-specific cleanup standards to confirm that human health CULs have been met using the appropriate SWAC basis.

Table 4 illustrates the expected post-remediation conditions at the Site as determined using residuals management forecasting (Appendix D). The results of that forecasting demonstrate that site-specific CULs can be met under expected performance conditions.

The results of protection and performance monitoring will be documented in an As-Built Report to be prepared and submitted to Ecology within a time frame to be determined via future coordination with Ecology and the Port.

10 Anticipated Schedule

This work described in this EDR is distinct from the upland cleanup work at the Site. There are no direct dependencies between the upland and in-water cleanup actions.

In-water cleanup is expected to be conducted within a single construction season, as shown in Appendix F. The work will comply with applicable work windows established in final project permits and approvals.

The contractor will prepare a construction sequencing approach in their Construction Work Plan that describes how they will meet sequencing requirements of all dredging, material placement, and structural work. It is generally expected that the work will follow the general sequence outlined as follows:

- Demolition of marine railway structures (including timber piles, timber deck planks, timber railing, and timber and steel rail beams) and walkways (including steel piles, steel walkway framing and railing, and fiber reinforced plastic grating) will be performed prior to dredging in DU4, DU5, and DU6.
- Nearshore dredging in portions of DU4 and DU5 will be performed following construction of the replacement bulkhead, required for shoreline stability.
- Dredging in other areas will be performed in a phased manner, taking into account tenant coordination requirements and construction phasing needs.
- Placement of piling for the new finger piers will occur following completion of dredging but prior to RMC placement.
- RMC will be placed in all dredging areas following construction as called for in Figure 8.
- Following the completion of all remedial work post-construction compliance monitoring will be performed as defined in Section 9.

11 References

Anchor QEA, 2021. *Pre-Remedial Design Investigation Work Plan*. Harris Avenue Shipyard Cleanup. Prepared for Washington State Department of Ecology. October 2021.

Asher, C., T. Michelsen, S. O'Dowd, and H. Froyland, 2017. *Adaptation Strategies for Resilient Cleanup Remedies: A Guide for Cleanup Project Managers to Increase the Resilience of Toxic Cleanup Sites to the Impacts from Climate Change*. Prepared for Washington Department of Ecology Toxics Cleanup Program. Publication No. 17-09-052. November 2017.

ASM, 2022a. *Results of Archaeological Monitoring for the Harris Shipyard Pre-Remedial Design Investigation Project, Bellingham, Whatcom County, Washingto*n. Prepared for Anchor QEA. August 2022.

ASM, 2022b. *Memo of On-Call Archaeological Monitoring between January 18-19, 2022 for the Harris Shipyard Pre-Remedial Design Investigation Project, Bellingham, Whatcom County, Washington*. Prepared for Anchor QEA. February 2022.

Aspect, 2023. *Engineering Design Report for Upland Cleanup Action*. Prepared for Port of Bellingham. Harris Avenue Shipyard Site. June 30, 2023.

City of Bellingham, 2013. *Title 22 Bellingham Municipal Code Shoreline Master Program*. Accessed October 6, 2023. Available at: https://cob.org/services/planning/environmental/shoreline-program

Desrosiers, R., and C. Patmont, 2009. *Environmental Dredging Residuals – Case Study Summaries and Analyses*. 5th International Conference on Remediation of Contaminated Sediments (Jacksonville, Florida); February 4, 2009.

Ecology (Washington State Department of Ecology), 2000. *Bellingham Bay Comprehensive Strategy. Final Environmental Impact Statement*. October 2000.

Ecology, 2021a. *Cleanup Action Plan. Harris Avenue Shipyard, Port of Bellingham*. Issued by Washington State Department of Ecology Toxics Cleanup Program, Southwest Regional Office, Olympia, Washington. February 2, 2021.

Ecology, 2021b. *Sediment Cleanup User's Manual (SCUM)*. Publication No. 12-09-057. Original publication March 2015. Third revision December 2021.

Floyd Snider, 2019a. *Remedial Investigation/Feasibility Study*. Port of Bellingham Harris Avenue Shipyard. June 2019.

Floyd Snider, 2019b. *Interim Action Construction Completion Report.* Prepared for Port of Bellingham. March 2019.

Mauger, G.S., J.H. Casola, H.A. Morgan, R.L. Strauch, B. Jones, B. Curry, T.M. Busch Isaksen, L. Whitely Binder, M.B. Krosby, and A.K. Snover, 2015. *State of Knowledge: Climate Change in Puget Sound.* Report prepared for the Puget Sound Partnership and the National Oceanic and Atmospheric Administration. Climate Impacts Group, University of Washington, Seattle.

Miller, I.M., H. Morgan, G. Mauger, T. Newton, R. Weldon, D. Schmidt, M. Welch, and E. Grossman, 2018. *Projected Sea Level Rise for Washington State – A 2018 Assessment.* A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, Oregon State University, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project.

Palermo, M.R., J.E. Clausner, M.P. Rollings, G.L. Williams, T.E. Myers, T.J. Fredette, and R.E. Randall, 1998a. Guidance for Subaqueous Dredged Material Capping. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. Technical Report DOER-1. June 1998. Available at: http://acwc.sdp.sirsi.net/client/en_US/search/asset/1004019;jsessionid=7AF293182A9146DE000EAA94263047CF.enterprise-15000.

Palermo, M.R., J. Miller, S. Maynord, and D.D. Reible, 1998b. Guidance for In-Situ Subaqueous Capping of Contaminated Sediments. Assessment and Remediation of Contaminated Sediments (ARCS) Program. Prepared for the Great Lakes National Program Office, U.S. Environmental Protection Agency, Chicago, Illinois. EPA 905-B-96-004. September 1998.

RETEC, 2004. *Sediments Remedial Investigation and Feasibility Study*. Prepared for the Port of Bellingham. December 2004.

RETEC, 2006. *Sediments Remedial Investigation and Feasibility Study*. Prepared for the Port of Bellingham. January 2006.

USACE (U.S. Army Corps of Engineers), 2006. Coastal Engineering Manual. Engineering Manual EM 1110-2-1100, U.S. Army Corps of Engineers: Washington, D.C.

USACE, 2022. *Nationwide Permit 38 – Cleanup of Hazardous and Toxic Waste.* February 25, 2022.

USEPA (U.S. Environmental Protection Agency), 1997. *EPA Office of Compliance Sector Notebook Project: Profile of the Shipbuilding and Repair Industry*. November 1997.

WDFW (Washington Department of Fish and Wildlife), 2008. *Eelgrass/Macroalgae Habitat Interim Survey Guidelines*. June 2008.

Tables

Table 1
Sediment Cleanup Levels

Contaminant of Concern	Benthic Protection[1] (Point by Point)	Human Health Protection	
		Seafood Consumption (Site-Wide SWAC)	Direct Contact (Intertidal SWAC)
Arsenic	57	13	20
Cadmium	--	0.8	--
Copper	390	--	--
Zinc	410	--	--
Total PCB Aroclors	0.13*	0.033	--
Fluoranthene	1.7*	--	--
Pyrene	2.6*	--	--
cPAH TEQ	--	0.14	--

Notes:
All values are presented on a milligram per kilogram dry-weight basis.
Only PCB Aroclors 1254 and 1260 have been frequently detected at the Site.
1. Confirmatory bioassay testing may be performed to establish compliance with benthic protection cleanup levels.
* Value based on the Puget Sound Apparent Effects Threshold (AETs) reported on a dry-weight basis.
cPAH: carcinogenic polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SWAC: surface-weighted average concentration
TEQ: toxicity equivalence

Table 2
Datum Elevations (Station No. 9449211)

Tide Level	Meters (MLLW)	Feet (MLLW)
Highest observed (1/5/1975)[1]	3.177	10.4
Ordinary high water	3.116	10.2
Mean higher high water	2.594	8.5
Mean high water	2.375	7.8
Mean tide level	1.546	5.1
Mean sea level	1.51	5
Mean low water	0.718	2.4
Mean lower low water	0	0
Lowest observed (12/30/1974)[1]	-1.057	-3.5
NAVD88	0.147	0.5

Notes:
1. NOAA Station No. 9449211 was active from March 30, 1973, to July 21, 1975. Tidal predictions for the area have been higher and lower than those observed.
MLLW: mean lower low water
NAVD88: North American Vertical Datum of 1988

Table 3
Dredge Unit Depths and Estimated Quantities

Dredge Unit	Estimated Surface Area (square feet)	Dredge Depth Below Mudline/Elevation (feet/MLLW)	Estimated Neatline Volume (cubic yards)	Estimated Total Volume[4] (cubic yards)	Estimated Total Quantity[4] (tons)	Depth Interval of Deepest Contamination (feet)
DU-1	31,143	3	3,500	4,653	3,068	0-2
DU-2	55,694	1	2,100	4,163	2,744	0-0.5
DU-3	9,009	3	1,000	1,334	879	0-2[3]
DU-4	7,776	-7 MLLW	1,700	1,988	1,310	0-0.5[1]
DU-5	2,799	-7 MLLW	1,000	1,104	728	0-0.5[1]
DU-6	5,570	5	1,100	1,306	861	0-0.5[2]
DU-7	123,218	3	14,000	18,564	12,237	2-4[3]
DU-8	3,423	3	380	507	334	2-4[3]
DU-9	1,200	1	381	426	281	0-0.5
Totals:	**239,832**		**25,162**	**34,044**	**22,442**	

Notes:

MLLW: mean lower low water

1. Dredge depths based on operational considerations
2. Dredge depths based on assumed contamination from creosote pilings of the marine railway
3. Dredge depths based on historical data and assuming a 3-foot average dredge over these areas per the Cleanup Action Plan
4. Inclusive of a 1-foot overdredge allowance

Table 4
Expected Post-Remediation Condition

	Surface-Weighted Average Concentration at 5% Generated Residuals			
	Arsenic (mg/kg)	**Cadmium (mg/kg)**	**cPAH TEQ (µg/kg)**	**Total PCBs (µg/kg)**
Post-Remediation Site-Wide SWAC	8.49	0.89/0.60[1]	79.66	23.86
Seafood Consumption Site-Wide CUL	13	0.8	140	33

Notes:

1. The calculation used cover material with two different cadmium concentrations: 1 mg/kg and 0.6 mg/kg - as described in Table D-2 of Appendix D. The first number in the table above is the resulting SWAC if the cover material cadmium concentration was assumed to be 1 mg/kg, and the second number is the resulting SWAC if the cover material cadmium concentration was assumed to be 0.6 mg/kg.

cPAH: carcinogenic polycyclic aromatic hydrocarbon
CUL: cleanup level
µg/kg: micrograms per kilogram
mg/kg: milligrams per kilogram
PCBs: polychlorinated biphenyl
SWAC: surface-weighted average concentration
TEQ: toxicity equivalence

Figures

LEGEND:

- Sediment Cleanup Area
- Upland Cleanup Area
- Interim Action Area
- Whatcom Waterway Site Boundary
- Harbor Line

0 2,000
Feet

NOTES:
1. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
2. Basemap is Esri, 2021.
3. Bathymetry is NW Hydro, August 2022. Elevations are mean lower low water, feet.

ABBREVIATIONS:
ASB: Aerated Stabilization Basin

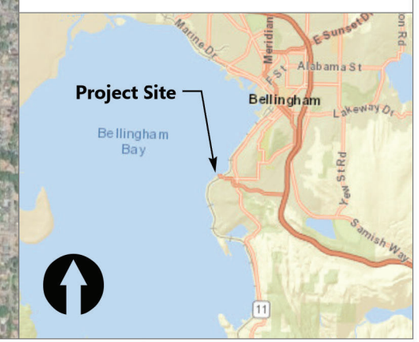

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Figure 1
Site Vicinity Map

Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup

LEGEND:

- Harbor Line

Bathymetry (2022)

- Major Contour (5' Interval)
- Minor Contour (1' Interval)

Utilities

- Stormwater Sewer
- Culvert
- Sanitary Sewer
- Water Line
- Overhead Power
- Buried Power
- Overhead Communications
- Buried Communications
- Natural Gas
- Buried Air
- Propane Tank
- Utility Vault
- Steel Sump Covers
- O/W Separator
- Transformer
- Utility Switch

0 100

Feet

NOTES:

1. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
2. Aerial image is Whatcom County, 2022.
3. Bathymetry is NW Hydro, August 2022. Elevations are mean lower low water, feet.

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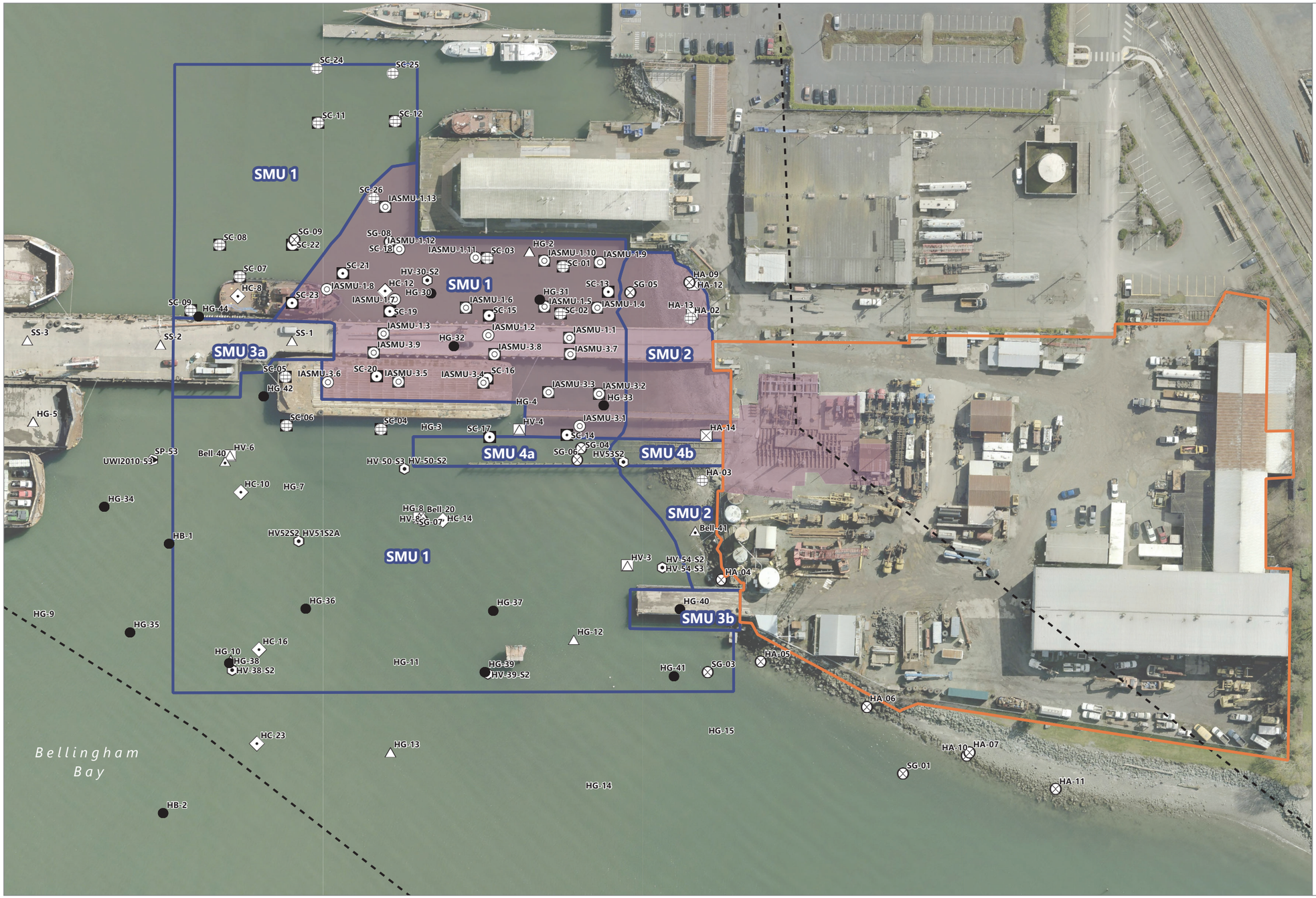
Figure 2
Existing Site Features

Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup



LEGEND:

- Sediment Management Unit [1]
- Upland Site Boundary
- Interim Action Area
- Harbor Line

Surface Sediment Sample Locations

- Floyd|Snider Grab Sample (2011, 2013)
- Floyd|Snider Grab Sample (2015)
- Floyd|Snider Grab Sample (2017, 2018)
- RETEC Grab Sample (1993)
- RETEC Grab Sample (1998)
- RETEC Grab Sample (2000, 2003)
- RETEC Grab Sample (2006)
- UWI Grab Sample (2017)

Subsurface Sediment Sample Locations

- Floyd|Snider Hand Auger (2015, 2017)
- Floyd|Snider Vibracore (2015)
- Floyd|Snider Vibracore (2017, 2018)
- RETEC Vibracore (1998)
- RETEC Vibracore (2000)
- RETEC PSDDA Vibracore (2004)

0 100
Feet

NOTES:
1. SMU boundaries are those identified in the Cleanup Action Plan as amended following completion of the PRDI.
2. Sediment data presented are provided by Ecology EIM.
3. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
4. Aerial image is Whatcom County, 2022.

ABBREVIATIONS:
SMU: Sediment Management Unit
PRDI: Pre-Remedial Design Investigation

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Figure 3
Historical Sediment Sample Locations

Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup

LEGEND:

- Sediment Management Unit [1]
- Upland Site Boundary
- Interim Action Completed
- Harbor Line

Bathymetry (2022)

- Major Contour (5' Interval)
- Minor Contour (1' Interval)

Sediment Sample Locations

- Surface Sediment
- Stratified Surface Sediment
- Hand Auger
- Sediment Core
- Sediment Core Composite
- Geotechnical Boring

0 100
Feet

NOTES:
1. SMU boundaries are those identified in the Cleanup Action Plan as amended following completion of the PRDI.
2. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
3. Aerial image is Whatcom County, 2022.
4. Bathymetry is NW Hydro, August 2022. Elevations are mean lower low water, feet.

ABBREVIATIONS:
SMU: Sediment Management Unit
PRDI: Pre-Remedial Design Investigation

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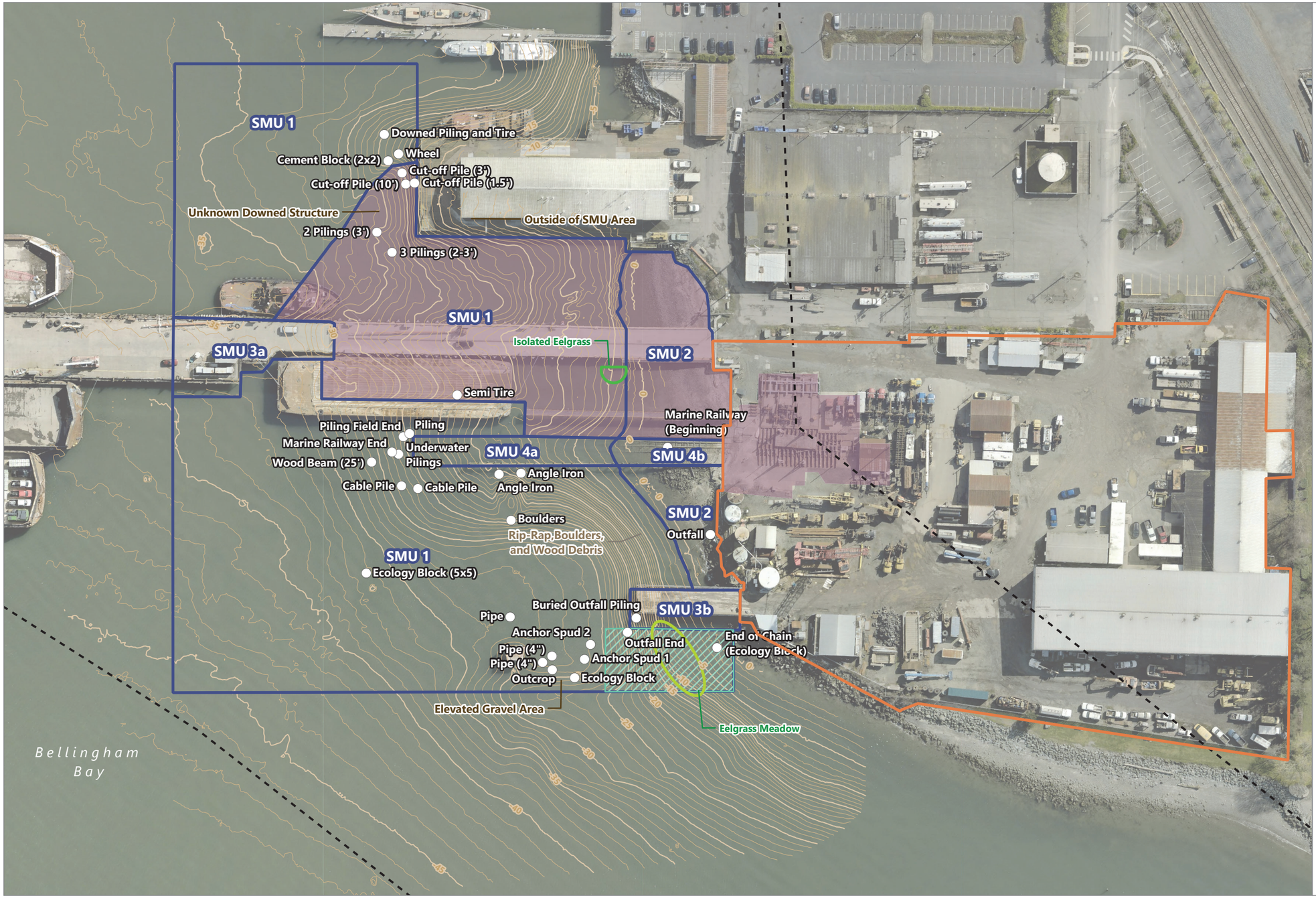
Figure 4
PRDI Sediment Sample Locations

Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup



LEGEND:

- Sediment Management Unit [1]
- Upland Site Boundary
- No Action Area
- Interim Action Completed
- Harbor Line

Eelgrass Areas (2022)

- Established Meadow
- Sparse Eelgrass

Debris Survey

- Debris Survey Location

Bathymetry (2022)

- Major Contour (5' Interval)
- Minor Contour (1' Interval)

0 100
Feet

NOTES:
1. SMU boundaries are those identified in the Cleanup Action Plan as amended following completion of the PRDI.
2. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
3. Aerial image is Whatcom County, 2022.
4. Bathymetry is NW Hydro, August 2022. Elevations are mean lower low water, feet.
5. Debris survey conducted by Gravity Marine, June 2022.

ABBREVIATIONS:
SMU: Sediment Management Unit
PRDI: Pre-Design Remedial Investigation

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Figure 5
Debris and Eelgrass Survey Results

Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup

LEGEND:

- Sediment Management Unit [1]
- Upland Site Boundary
- SMU Boundary from Cleanup Action Plan
- Approximate Upland Grading Area
- Interim Action Area
- Proposed Travel Lift Finger Pier
- Proposed Bulkhead
- Harbor Line

0 100
Feet

NOTES:
1. SMU boundaries are those identified in the Cleanup Action Plan as amended following completion of the PRDI.
2. Sediment data presented are provided by Ecology EIM.
3. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
4. Aerial image is Whatcom County, 2022.

ABBREVIATIONS:
SMU: Sediment Management Unit
PRDI: Pre-Design Remedial Investigation

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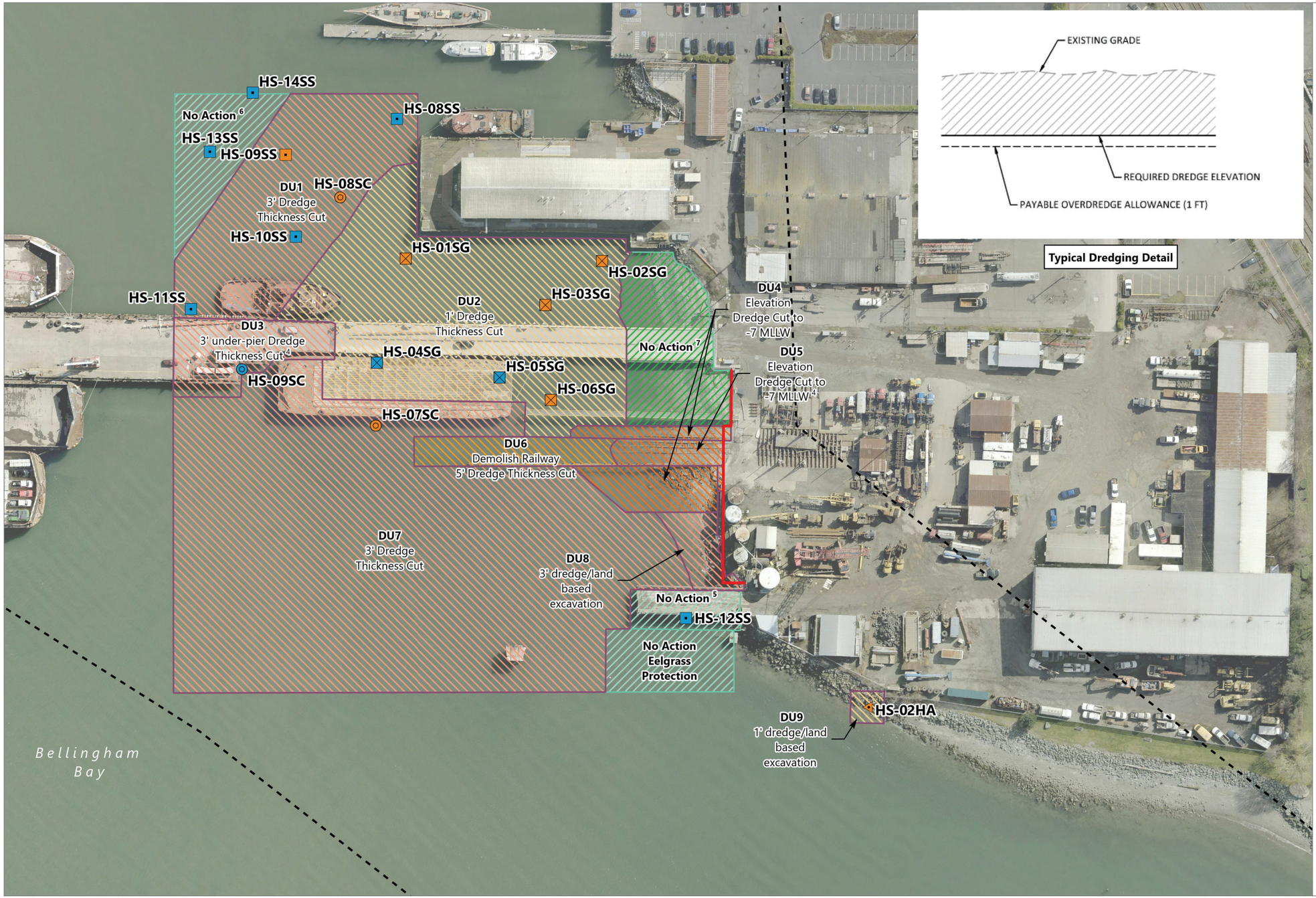
Figure 6
Sediment Management Units

Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup



LEGEND:

- Dredge Unit

Dredge Unit Cut Thickness/Elevation

- 1' Thickness Cut
- 3' Thickness Cut
- 5' Thickness Cut
- 7' MLLW Elevation Cut
- No Action Area
- Site Cleanup Levels Met
- Proposed Bulkhead
- Harbor Line

Sediment Sample Locations

- Surface Sediment
- Stratified Surface Sediment
- Hand Auger
- Sediment Core
- Sediment Core Composite

Cleanup Level Exceedances[8]

- > Benthic Protection
- < Benthic Protection

0 100
Feet

NOTES:

1. Dredge Unit boundaries are preliminary and may be adjusted during final design and permitting.
2. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
3. Aerial image is Whatcom County, 2022.
4. Area was previously proposed for capping but will be remediated via removal.
5. Based on results of PRDI sampling, no action is required under the stub pier to meet site cleanup levels.
6. Based on results of PRDI sampling, no action is required in this area to meet site cleanup levels.
7. Interim actions within this area met site cleanup levels.
8. Blue sample locations indicate results that are less than the benthic protection cleanup levels and unlikely to cause a SWAC exceedance. Orange sample locations indicate results that are greater than benthic protection cleanup levels and likely to cause a SWAC exceedance.

ABBREVIATIONS:

DU: Dredge Unit
MLLW: Mean Lower Low Water
PRDI: Pre-Remedial Design Investigation
SWAC: Surface Weighted Average Concentration

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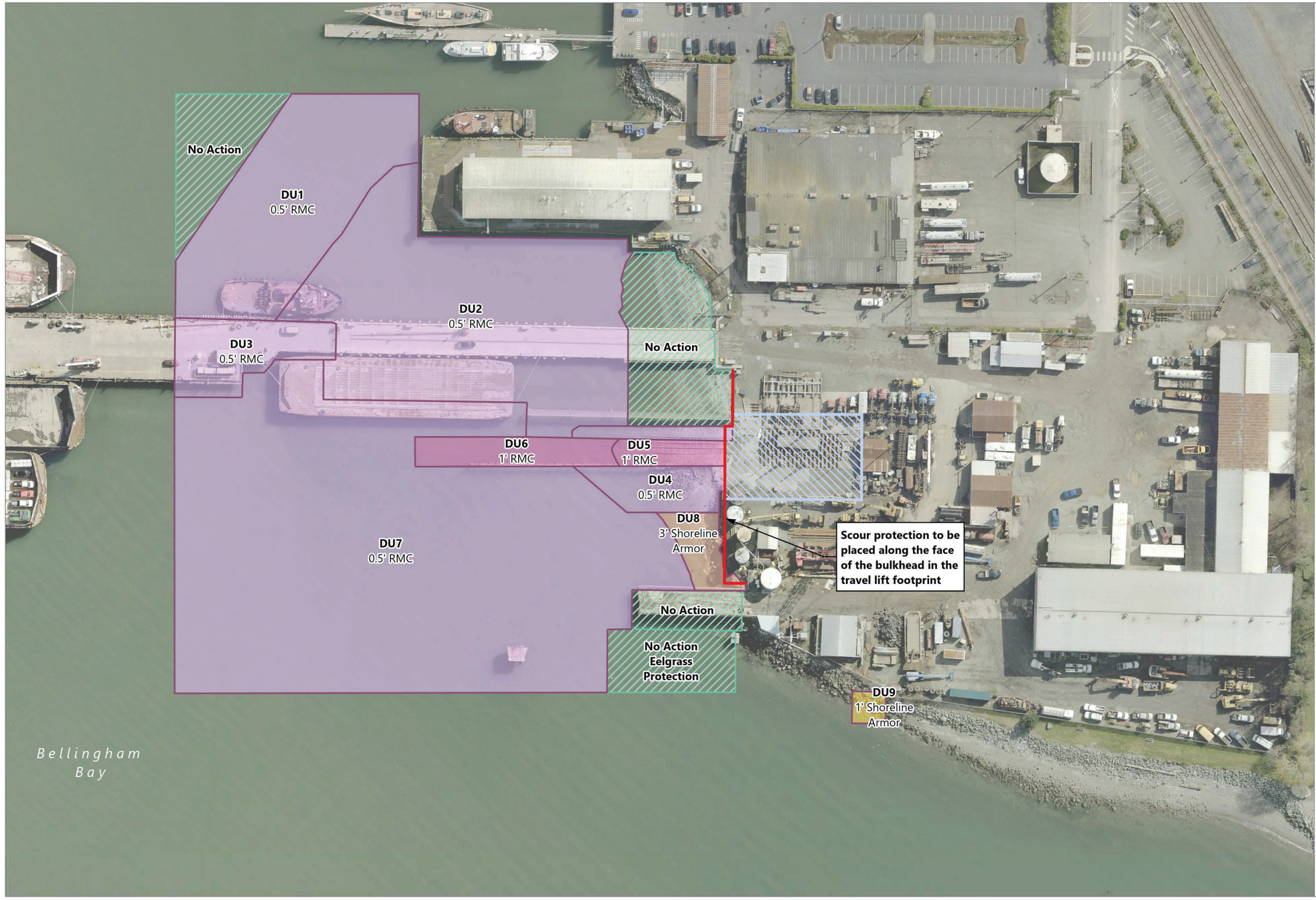
Figure 7
Dredge/Excavation Plan

Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup



LEGEND:

- Dredge Unit
- No Action Area
- Approximate Upland Backfill and Grading Area
- 0.5' RMC
- 1' RMC
- 1' Shoreline Armor
- 3' Shoreline Armor
- Proposed Bulkhead

0 100
Feet

NOTES:
1. Dredge Unit boundaries are preliminary and may be adjusted during final design and permitting.
2. Sediment data presented are provided by Ecology EIM.
3. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
4. Aerial image is Whatcom County, 2022.

ABBREVIATIONS:
DU: Dredge Unit
RMC: Residuals Management Cover

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Figure 8
Material Placement Site Plan

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Harris Avenue Shipyard Cleanup

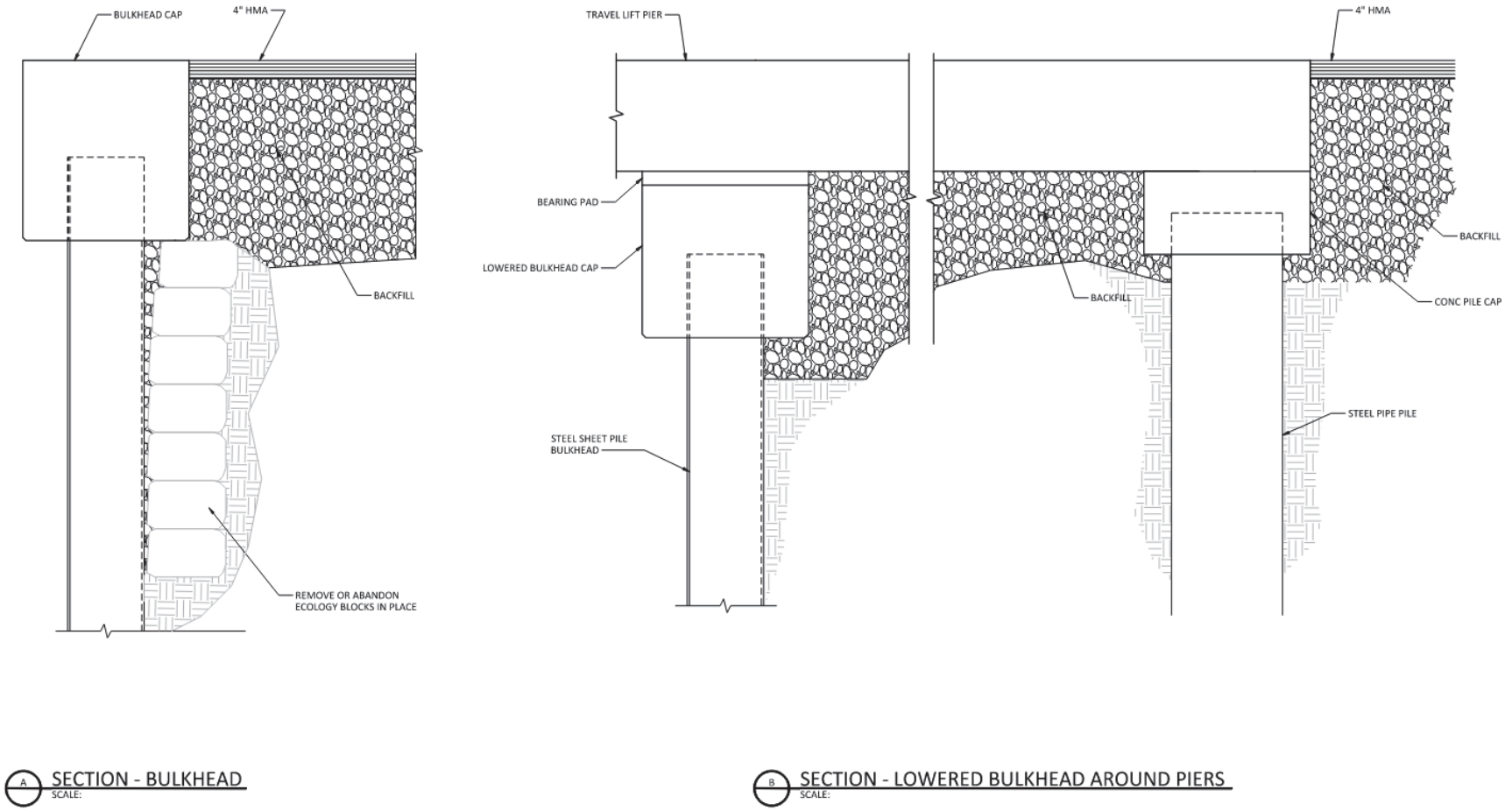

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Figure 9
Proposed Bulkhead Sections
Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup

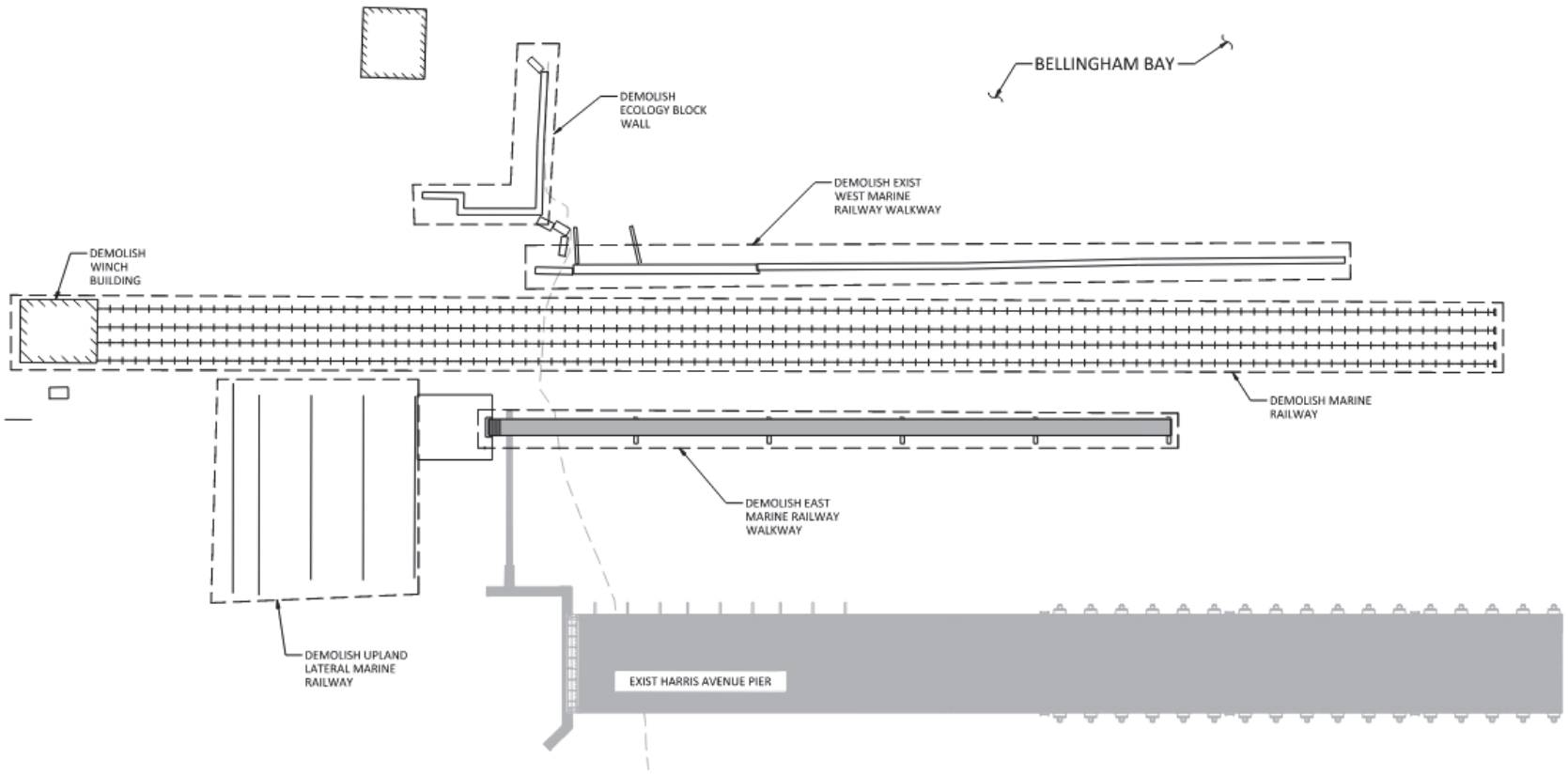

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Figure 10
Marine Railway Demolition Plans
Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup

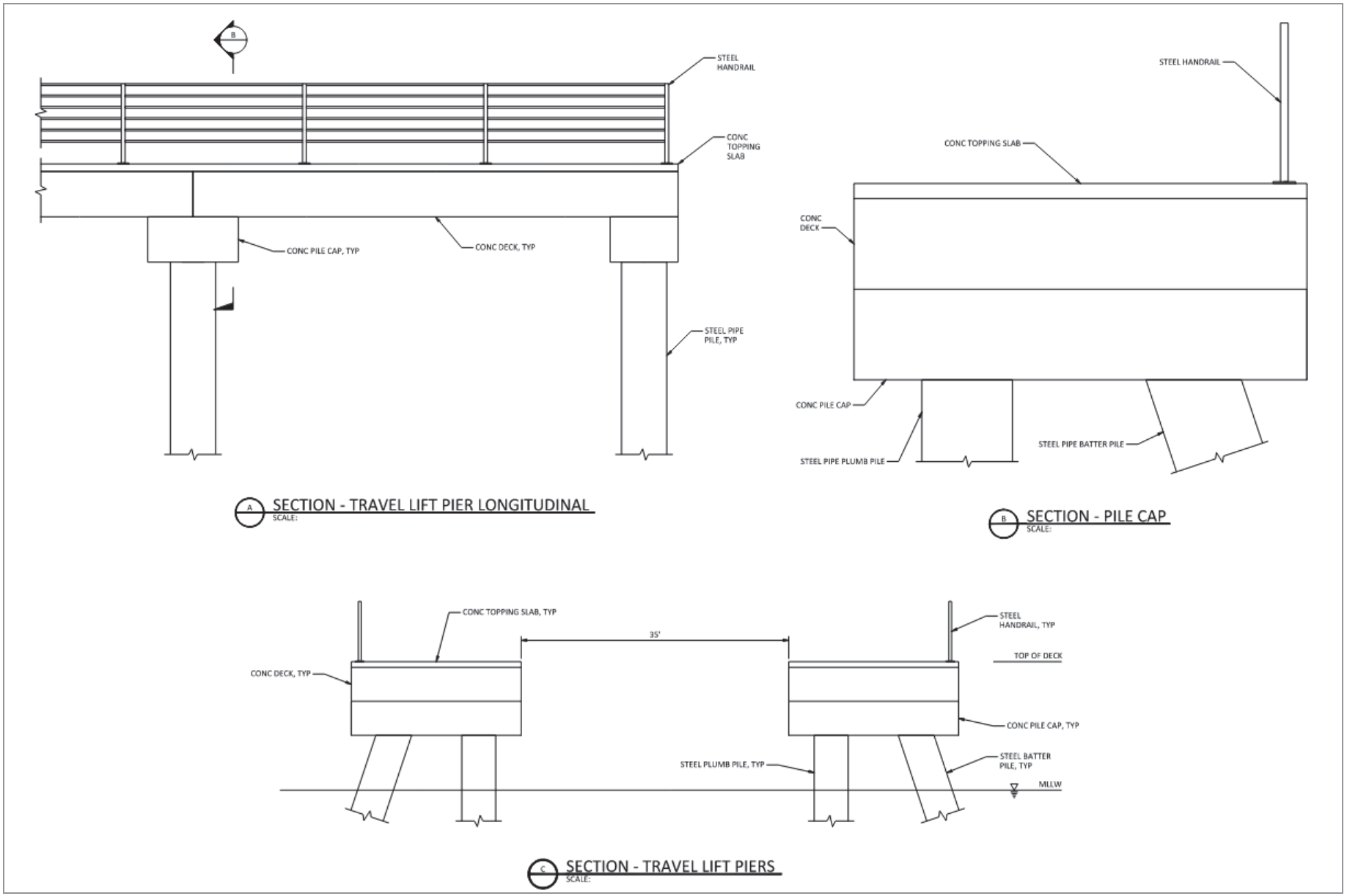

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Figure 11
Travel Lift Pier Sections
Sediment Engineering Design Report
Harris Avenue Shipyard Cleanup

LEGEND:

- Dredge Unit
- No Action Area
- Proposed Bulkhead

Compliance Monitoring Location

- Control Monitor
- Control Point

0 100
Feet

NOTES:
1. Dredge Unit boundaries are preliminary and may be adjusted during final design and permitting.
2. Horizontal datum: Washington State Plane North Zone, North American Datum of 1983, U.S. Survey Feet.
3. Aerial image is Whatcom County, 2022.

ABBREVIATIONS:
DU: Dredge Unit
CM: Control Monitor

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Figure 12
Compliance Monitoring Locations

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