

DRAFT

March 2026
JELD-WEN Site



Final Draft Marine Engineering Design Report – Revision 1

Prepared for Washington State Department of Ecology and JELD-WEN, Inc.
Cleanup Site ID 4402

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Prepared for

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Appendix B	Geotechnical Engineering Assessment
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Appendix D	Preliminary Sediment Cap Chemical Isolation Layer Design Analysis
Appendix E	Construction Best Management Practices
Appendix F	Inadvertent Discovery Plan
Appendix G	60% Construction Plans

ABBREVIATIONS

µg/kg	microgram per kilogram
AO	Agreed Order
Baywood	Baywood Products Site
BFE	base flood elevation
BMP	best management practice
CAP	Cleanup Action Plan
CAR	Critical Areas Report
CEM	Coastal Engineering Manual
COC	contaminant of concern
COPC	contaminants of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CUL	cleanup level
D/F	dioxin/furan
dw	dry weight
EA	exposure areas
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EMNR	Enhanced Monitored Natural Recovery
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
HASP	Health and Safety Plan
IDW	inverse distance weighting
IHS	indicator hazardous substance
JELD-WEN	JELD-WEN Inc.
lb/ft ³	pound per cubic foot
lidar	light detection and ranging
MHHW	Mean Higher High Water
MIDP	Monitoring and Inadvertent Discovery Plan
MLLW	mean lower low water
MMMP	marine mammal monitoring plan
MNR	Monitored Natural Recovery
MTCA	Model Toxics Control Act
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
ng/kg	nanogram per kilogram
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
OHWM	ordinary high-water mark
OMMP	Operation, Maintenance, and Monitoring Plan
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PHS	priority habitats and species

PLP	potentially liable party
POC	point of compliance
PQL	practical quantitation limit
PRDI	pre-remedial design investigation
PSO	Protected Species Observer
RCW	Revised Code of Washington
REL	remediation level
RI/FS	Remedial Investigation/Feasibility Study
SCL	sediment cleanup levels
SCO	sediment cleanup objective
SEPA	State Environmental Policy Act
Site	JELD-WEN Site located at 300 West Marine View Drive, Everett, Washington, 98201
SMA	Sediment Management Areas
SMP	Shoreline Master Program
SMS	sediment management standards
SPME	Solid-Phase Micro Extraction
SPT	Standard Penetration Test
SSW	south-southwest
SWAC	surface-weighted average concentration
SWAN	Simulating Waves Nearshore
SWPPP	stormwater pollution prevention plan
TEQ	toxicity equivalence
TESC	temporary erosion and sediment control
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WNW	west-northwest

1 Introduction

This Marine Engineering Design Report (EDR) describes the approach and criteria for the design of the marine cleanup actions in the intertidal aquatic areas of the JELD-WEN Site (Site) located at 300 West Marine View Drive, Everett, Washington, 98201 (Ecology Cleanup Site ID 4402). Cleanup of the Site includes both upland and sediment remediation. A separate EDR is being developed describing the proposed remediation for upland contamination. This marine EDR presents the proposed remedy to address contaminated sediment in marine and shoreline areas at the Site.

The required cleanup actions at the Site are set forth in the JELD-WEN Final Cleanup Action Plan (CAP; Ecology 2023), and in accordance with the requirements of Agreed Order (AO) Number DE 5095 and subsequent First Amendment and Second Amendment to the AO between JELD-WEN Inc. (JELD-WEN) and the Washington State Department of Ecology (Ecology). This EDR has been prepared to meet the requirements of the Model Toxics Control Act (MTCA; Ecology 2024a) and Sediment Management Standards (SMS; Ecology 2013] regulations administered by Ecology under Chapters 173-340 and 173-204, respectively, of the Washington Administrative Code (WAC).

This EDR provides a summary of existing background information used to characterize and define the extent of contamination and describes physical, biological, and operational conditions at the Site based on available information. This EDR also describes the proposed remedial actions intended to address sediment contamination and the design elements and criteria that are the basis for the marine remedial design. This EDR presents a narrative discussion of performance standards and how the Site remedial design will meet professional engineering standards of practice and regulatory requirements. This EDR describes the work to be performed to implement the marine remedial actions.

1.1 Site Location and Vicinity

The Site is located at the confluence of the Snohomish River to the north and Port Gardner Bay (Possession Sound) to the west (Figure 1). The Site is contained within 12 adjoining parcels and has a combined land area of approximately 55 acres that consists of both in-water tidal mudflats and upland. The upland area is approximately 36 acres above ordinary high-water level. The Site is bound to the east-northeast by tidal mudflats and commercial/industrial property owned by the Port of Everett and Baywood Industries, LLC.; to the west by tidal mudflats owned by Port of Everett and W&W Everett Investments, LLC; to the southeast by West Marine View Drive (City of Everett), beyond which to the east is the railway and vacant marshland (Maulsby Marsh) owned by BNSF Railway; and to the north-northwest by the Snohomish River navigation channel and Port Gardner Bay.

1.2 Report Organization

This EDR is organized following MTCA requirements, as detailed in WAC 173-340-400, and includes the following sections:

- Section 2 summarizes the Site background information.
- Section 3 summarizes design criteria used in the engineering analysis of the cleanup remedy.
- Section 4 summarizes remedial technologies and anticipated construction methods.
- Section 5 describes construction best management practices (BMPs).
- Section 6 describes the net environmental effect of the project.
- Section 7 describes Site preparation and staging designs.
- Section 8 describes remedial design elements.
- Section 9 describes the required compliance monitoring.
- Section 10 describes the proposed institutional and engineering controls.
- Section 11 describes the construction sequencing and schedule.
- Section 12 describes ongoing design considerations.
- Section 13 provides a list of references used to develop this EDR.

The following appendices provide supporting technical evaluations for this EDR:

- Appendix A: Ex Situ Solid-Phase Microextraction Testing Results
- Appendix B: Geotechnical Engineering Assessment
- Appendix C: Coastal Engineering Analysis
- Appendix D: Preliminary Sediment Cap Chemical Isolation Layer Design Analysis
- Appendix E: Construction Best Management Practices
- Appendix F: Inadvertent Discovery Plan
- Appendix G: 60% Design Construction Plans

2 Background

This section provides relevant Site background information, including Site characteristics such as cultural resources considerations and biological surveys; summaries of previous investigations; Site surveys completed to date; the nature and extent of contamination; required sediment cleanup levels (CULs); points of compliance; and marine sediment remediation levels.

2.1 Site Characteristics

This section describes Site characteristics relevant to the engineering design of marine remedial actions, including the project physical setting, stormwater, coastal conditions, cultural resources, and recent biological surveys.

2.1.1 *Physical Setting and Ownership*

The Site includes former operating areas where industrial activities had occurred and hazardous material had been stored, deposited, or migrated to. The current property owners of the upland area of the Site are W&W Everett Investments LLC and HM Pacific Northwest 1, LLC. Owners of surrounding tidal mudflat areas include the Port of Everett, W&W Everett Investments LLC, and Baywood Industries, LLC (Figure 1).

The Site lies on an area of fill material that created the peninsula that extends into Port Gardner Bay. The majority of the Site is relatively flat, with a maximum elevation of approximately 15 feet mean lower low water (MLLW) while the Knoll Area elevation extends to approximately 26 feet MLLW. The tidal mudflats and a portion of the upland areas of the Site lie within the 100-year floodplain.

The current zoning of the Site property is industrial and future use of the Site property is expected to remain industrial. The known existing utilities on the Site are illustrated in Appendix G, Sheet G4.

Surface water in the Site vicinity is utilized both commercially and recreationally. The Tulalip Tribes Reservation is located approximately 1 mile north of the Site, on the north side of the Snohomish River. Tulalip tribal members living on the Tulalip Reservation are engaged in both commercial and subsistence fishing near the confluence of Port Gardner Bay and the Snohomish River.

The marine portions of the Site have been divided into three subareas (i.e., the Logway, South Shoreline, and Knoll Area) based on their physical location, characteristics, and cleanup actions (Figure 1). The following subsections briefly describe each area.

2.1.1.1 Logway

The Logway is defined as the channel along the northern edge of the property boundary, separating the Site and the neighboring Baywood property. The Logway is a narrow inlet tidal flat area with a steep armored slope to the upland portion of the Site. The elevation of the majority of the tidal flat

area is approximately 2 to 4 feet MLLW, while the steep armored slope to the upland portion of the Site extends to approximately 14 feet MLLW. It contains an active outfall at the head of the inlet that discharges stormwater from the adjacent Baywood property, two historical outfalls (status unknown), two wooden bulkheads¹, and numerous wood piles. Historical operations within the Logway included log storage and transloading.

2.1.1.2 The South Shoreline

The South Shoreline is defined as the marine area along the Site's south shoreline. The South Shoreline is a tidal flat with elevations ranging between 2 and 6 feet MLLW with a slope to the upland portion of the Site to approximately 14 feet MLLW. It contains approximately six historical outfalls (status unknown), and numerous wood piles. Historical operations within the South Shoreline included log rafting.

2.1.1.3 Knoll Area

An approximately 2-acre vegetated knoll is located at the southern end of the Site. The Knoll was created through several apparent filling operations, initially being filled to match the surrounding grade in the early to mid-1960s. Additional fill material was placed during the 1970s that created the existing "knoll" feature (Figure 1). The Knoll Area is primarily tidal flat adjacent to the Knoll with elevations ranging between 6 and 11 feet MLLW with a near vertical bluff along the upland portion of the Site and contains one outfall, the remnants of a wooden barge, and numerous wood piles. The outfall in the Knoll Area drains Maulsby Marsh.

2.1.2 Stormwater

The subject property appears to support a network of stormwater lines that discharge towards the Logway, South Shoreline, and the stormwater network below the west-adjacent West Marine View Drive (Appendix G, Sheet G4). JELD-WEN performed an assessment of the stormwater system as part of the source control evaluation (SLR 2019). Results of the assessment indicated that the stormwater pipes and infrastructure had not been serviced or cleaned for several years and many of the catch basins and stormwater lines were partially or completely filled with sediment, debris, or stagnant water. Some stormwater pipes were completely blocked with sediment or debris, which made tracing of those lines unsuccessful.

2.1.3 Coastal Conditions

The Site is situated within tidal flats at the confluence of the Snohomish River to the north and Port Gardner Bay (part of Possession Sound) to the west. While no water level gauges are located directly at the Site, the National Oceanic and Atmospheric Administration tidal station in Everett,

¹ Original design intent of the wood bulkhead structures is unknown. The structures are composed of an unknown number of piles and timber lagging.

Washington (Station ID: 9447659), provides representative datum information. According to this station, tidal elevations at Mean Higher High Water (MHHW) reach 11.09 feet MLLW. The Federal Emergency Management Agency (FEMA) Flood Insurance Study for Snohomish County designates the Site within Flood Zone AE, with a base flood elevation (BFE) of 13 feet North American Vertical Datum of 1988 (NAVD88), or 15.03 feet MLLW.

Wind data from the National Centers for Environmental Information wind gauge located at the Everett Snohomish County Airport (WBAN: 24222) indicate that the dominant wind directions are from the north and south, with southerly winds generally exhibiting the highest magnitudes. These wind patterns may generate wind-driven waves affecting the Site. The Site is potentially exposed to wave energy generated across the long fetch of Possession Sound, as well as from shorter fetches within Port Gardner and the Snohomish River.

Jetty Island provides protection from direct wave action originating from the west; however, its shielding effect does not extend to winds from the west-northwest (WNW). WNW winds can generate wave energy that may enter the Snohomish River via the Port Gardner Bay inlet north of the Site, potentially impacting the Logway during high tide. While waves from the west are typically blocked, under extreme flooding conditions such as those represented by the FEMA BFE, portions of Jetty Island may become inundated, reducing its effectiveness and allowing wave energy from the west to reach the Site. Additionally, strong south-southwesterly (SSW) winds may generate wave activity capable of impacting the South Shoreline during high tide, due to wave development over the shorter fetches within Port Gardner and the Snohomish River.

Projected sea level rise data for the Site under Representative Concentration Pathways (RCP) 4.5 and 8.5 scenarios are available through the Washington Coastal Hazards Resilience Network's visualization tool. These projections were reviewed to assess the potential influence of sea level rise on future coastal conditions at the Site, including increased frequency of inundation and potential enhancement of wave exposure under elevated water levels.

2.1.4 Cultural Resources

During the remedial design and permitting phase of the cleanup action, the implementing parties, in consultation with the Washington Department of Archaeology and Historic Preservation, the Tulalip Tribes, and other stakeholders as appropriate, will identify areas that may be affected by the cleanup action. These areas will include locations where cleanup-related disturbance may occur, including removal areas, staging areas, transport routes, and mooring areas, as appropriate.

The Archaeological and Historic Preservation Act (16 United States Code § 496a-1) is applicable if any covered materials are discovered during excavation activities performed as a part of the Site cleanup actions. During the pre-remedial design investigation (PRDI), cultural resources were assessed by a

professional archaeologist during the development of the 2022 State Environmental Policy Act Environmental Checklist for the Site (JELD-WEN 2022). It was determined that there is low potential to encounter archaeological or cultural resources during this sampling effort.

Sampling completed in June through August 2024 took place under a Monitoring and Inadvertent Discovery Plan (MIDP; Henley and Bush 2025). The MIDP expected the area may contain historic fill and objects related to industrialization and industrial use on Site as well as possible precontact sites related to transportation and marine resource procurement. Monitored borings included those completed using direct push (73), hallow-stem auger (9), and sonic (14). No historic or archaeological resources were observed. Four stratigraphic layers were observed, including two layers of fill (M1 and M2) underlain by disturbed and quickly accumulated recent sediment that likely was deposited in a subtidal environment after historic land disturbance and river alteration by nonnative settlers. A possible native mudflat was observed below these layers at depths typically between 40 and 50 feet below the existing ground surface. Based on collected data, project disturbance above 40 feet below the existing ground surface is not expected to encounter cultural resources.

During implementation of the remedial cleanup actions, consistent with Section 106 requirements of the National Historic Preservation Act and Washington State laws, detailed compliance monitoring plans will be developed during the remedial design and permitting phase, consistent with regulatory requirements. If the project includes excavation or constructed elements at or below 30 feet below the ground surface, then a professional archaeologist will review plans and provide recommendations as to whether additional monitoring is needed; however, this is not currently anticipated.

2.1.5 Biological Surveys

A Critical Areas Report (CAR) was prepared as part of the Remedial Investigation/Feasibility Study activities (RI/FS; SLR/Anchor 2021). The CAR characterized ecological conditions in the study area to allow for the avoidance, minimization, and mitigation of impacts to critical habitats and protected species related to future cleanup activities. The CAR identified and delineated 14 estuarine wetlands within the Site (Wetlands E1 through E14). Most of these estuarine wetlands are small patches or groups of small patches of salt-tolerant vegetation near the marine ordinary high-water mark (OHWM), and 8 of the 14 wetlands are less than 100 square feet in total area (Appendix G, Sheet G4).

Additionally, the City of Everett manages a Shoreline Master Program (SMP), which designates the tidal mudflats south of the Site as “Urban Maritime Interim.” The Logway (inlet area north of the Site) and Malsby Marsh (referred to as Malsby Swamp in the SMP) are designated in the SMP as Aquatic Conservancy.

Concentrations of shorebirds and waterfowl are included in Washington Department of Fish and Wildlife (WDFW)’s priority habitats and species (PHS) list. A federally listed threatened and state

candidate bird species (the purple martin, *Progne subis*) has been identified at the Everett waterfront, in the vicinity of the Site. Bald eagles, which are listed as a federal species of concern and a state sensitive species, may also be found near the Site. While no nesting bald eagles have been observed on the Site, the Site is located within the 800-foot shoreline nest buffer. In addition, during prior work, Anchor QEA personnel observed great blue heron (*Ardea herodias*) nesting approximately 3,500 feet away from the Site and osprey (*Pandion haliaetus*) nesting creosote-treated piles planned for removal within the Site.

Federally listed species that may be found in the Snohomish River near the Site include summer and fall-run Chinook salmon (*Oncorhynchus tshawytscha*), summer and winter-run steelhead (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*; NMFS 2025; USFWS 2025). NOAA's Northwest Fisheries Science Center monitored fish in the Snohomish estuary for over a decade in collaboration with Tulalip Tribes. In 2013, juvenile chinook salmon were observed during the fish monitoring conducted at established index sites in the lower Snohomish River mainstem adjacent to the project area (Rice et al. 2013). Additional species identified in the Snohomish River near the Site include coho salmon (*Oncorhynchus kisutch*), fall-run chum salmon (*Oncorhynchus keta*), pink salmon (*Oncorhynchus gorbuscha*), and sockeye salmon (*Oncorhynchus nerka*; NWIFC 2025). Any of the above species may migrate through the project area during certain periods of the year, including during outmigration between February and June.

No surf smelt, sand lance, rock sole, or herring spawning areas were identified in the Site area. Dungeness crab is included as a priority species in WDFW's PHS list. Dungeness crab habitat was identified in areas surrounding the Site (SLR/Anchor 2021).

2.2 Previous Investigations

This section provides a summary of previous investigations that have been completed in the marine area of the Site. Additional details regarding these investigations can be found in the RI/FS (SLR/Anchor 2021), the CAP (Ecology 2023), and the PRDI Data Report (Anchor QEA 2025).

2.2.1 SAIC 2009

A single surface sediment sample (0 to 10 centimeters [cm]) was collected in August 2008 within the Site area as part of the larger Port Gardner sediment quality investigation conducted by Ecology. The surface sediment sample was collected using a modified Van Veen grab sampler. The sample was analyzed for dioxins/furans (D/F) and total polychlorinated biphenyls (PCBs; Aroclor method).

2.2.2 Baywood Products 2009

Two surface sediment samples were collected by the Port of Everett in June 2009 from the adjacent northern tidal mudflat area as part of the RI/FS for the adjacent Baywood Products Site (Baywood; Cleanup Site ID: 2581). The Baywood surface sediment samples were collected from a depth of 0 to

10 cm at low tide by hand. The two locations were collected by measuring a 1-square-meter grid at the station location and then collecting equal volumes of 0 to 10 cm sediment from each corner of the square using a stainless-steel trowel. Surface sediment samples were analyzed for D/F.

2.2.3 *SLR 2009*

A total of 34 surface sediment (0 to 10 cm) samples were collected by JELD-WEN in June 2009. Samples were collected from fine-grained materials using hand tools at low tide. Sediment samples were located adjacent to each of the nine identified historical and current stormwater outfalls. Surface sediment samples were also collected from the eastern-most segment of the channel along the north boundary of the Site and in the vicinity of the former fish net storage building and Knoll Area at the southeastern corner of the Site. At each sampling location, three separate grab samples were collected either along the stormwater flow alignment (for outfall area samples) or in a radial pattern (for all other samples), with each sample approximately 10 feet equidistant from the other(s).

2.2.4 *Anchor QEA 2012/2014*

The 2008 and 2009 sampling data, summarized above, identified D/F and total PCBs as contaminants of potential concern (COPCs) in the marine sediments at the Site. However, additional data was needed to characterize the horizontal and vertical extent of these COPCs at the Site. In addition, since elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) were detected in upland soils and groundwater at the Site, further sampling and analysis were needed to determine if PAHs may also be a COPC in Site sediments. In May 2012, surface sediment (0 to 10 cm) samples were collected from 10 exposure areas (EAs) located immediately adjacent to the Site shoreline. Two Site EAs were targeted for more detailed composite sampling and analysis of surface sediment and tissue. The first composite area targeted tidal mudflats in the Logway Area immediately adjacent to stormwater outfalls draining uplands at the northeastern corner of the Site. The second composite area targeted tidal mudflats immediately adjacent to the former fish net storage building and Knoll Area at the southeastern corner of the Site. For comparison purposes, sediment and tissue samples were also collected from upstream, downstream, and regional reference areas with similar grain size and other habitat characteristics.

In September 2013, the final two surface sediment samples to complete the RI/FS were collected and analyzed.

In March 2014, clam tissue samples were collected and analyzed from an additional three locations to further refine the PCB biota-sediment accumulation factor.

2.2.5 *Anchor QEA 2023/2024*

Data collected during the 2023/2024 PRDI were intended to fill data gaps as outlined in the respective PRDI Work Plans (Anchor QEA 2023, 2024). The existing data collected prior to the 2023/2024 PRDI

were sufficient to characterize the nature and extent of contaminant of concern (COC) contamination in the marine portions of the Site, for the purpose of the RI/FS. Further lateral delineation in Enhanced Monitored Natural Recovery (EMNR) and removal and capping areas was needed to refine these areas for the remedial design. The collection of additional surface sediment (0 to 1-foot bml) chemical concentration data to inform the remedial design of Monitored Natural Recovery (MNR) areas (SMA-1), ENMR areas (SMA-2), and complete removal or partial removal and engineered capping areas (SMA-3) was collected during the 2023 Step 1 PRDI investigation as follows:

- Eighty-two D/F and 40 PCB surface sediment samples were collected for additional delineation of D/F and PCBs.
- Fifty-three surface sediment samples were collected for post-cleanup carcinogenic polycyclic aromatic hydrocarbon (cPAH) surface-weighted average concentration (SWAC) evaluation.

Based on review of the Step 1 data, data gaps regarding the presence wood waste, cPAH SWACs (to evaluate the post-construction compliance), D/F and PCB surface and subsurface delineation (removal prisms and EMNR area design), shoreline geotechnical properties (excavation and shoring design), and sediment porewater (chemical isolation cap design) were identified and filled during the 2024 Step 2 PRDI investigation as follows:

- Thirty-five additional D/F and 10 additional PCB surface sediment samples were collected.
- Six additional surface sediment samples were collected for the post-cleanup cPAH SWAC evaluation.
- One composite surface sediment sample (0- to 0.5-foot) was collected from sediment accumulated behind the two derelict wooden structures that will be removed as part of the cleanup.
- Thirty-one subsurface sediment cores of varying lengths were collected and analyzed for vertical delineation of D/F and PCBs.
- Thirteen subsurface short cores (0- to 3-foot) were collected for wood volume measurements.
- Nine sediment cores were collected for ex situ porewater evaluation using the Solid-Phase Micro Extraction (SPME) methodology.

The 2023/2024 PRDI data identified removal/capping and EMNR remediation level (REL) exceedance areas (for the Logway, South Shoreline, and Knoll) that were smaller than those defined in the CAP. These smaller remediation areas resulted from revised interpolations using the additional PRDI bounding data.

Additional cPAH samples were used to update the SWAC for cPAH TEQ within the marine site boundary. The remedial action needs to result in a post-cleanup cPAH TEQ SWAC that meets the cPAH TEQ background concentration. Following the incorporation of the PRDI data, the cPAH SWAC

for the Site was 41.4 µg/kg. The remedial design, as presented in Section 8, provides a remedy that achieves a post-cleanup SWAC in compliance with the target background concentration of 21 µg/kg.

Elevated concentrations of D/F were identified in the sediments accumulated behind the bulkheads to be removed from the Logway and these PRDI data will be used to determine disposal requirements for this material.

The subsurface sediment cores identified the depth of contamination exceeding RELs for removal in the South Shoreline (3 to 4 feet bml) and the Knoll Area (2 feet bml). The depth of contamination exceeding RELs for removal in the Logway was not determined at all locations; however, the selected remedy in areas of deeper contamination will be sediment removal and engineered cap placement. This remedy does not require complete delineation of depth of contamination, only data to inform the concentrations immediately below the engineered cap.

Wood waste was identified in the CAP as a potential cleanup action. The 2023/2024 data characterization included work to determine if wood waste content exceeded the threshold of 25% by volume. Wood waste volume measurements collected from the Site were all less than 25% by volume. Ecology determined that total volatile solid and wood sieving percentage data sufficiently characterize the shallow sediments throughout the Site and wood waste cleanup is not required (Ecology 2024b).

The ex situ SPME porewater data determined the concentrations of porewater in sediment at the Site. These porewater concentrations will be used to evaluate the chemical isolation protectiveness of the engineered cap that will be designed and constructed in the areas of the Logway where deeper sediment REL exceedances will be capped in place.

The PRDI Data Report (Anchor QEA 2025) details the collection of Step 1 and Step 2 data and the results. Revised inverse distance weighting (IDW) interpolations for surface sediment were created using the data from the PRDI along with the existing data from the RI/FS and CAP. These updated interpolations for D/F and PCBs were combined using the criteria for MNR, EMNR, and capping/removal, consistent with the CAP to establish updated SMAs. The revised PRDI SMAs are depicted in Figure 2 and inform the remedial design.

2.2.6 D/F Shallow Soils 2025

During 2025 further characterization of D/Fs in shallow soil on the Jeld Wen Site was conducted. A total of 23 soil samples were collected from nine locations at depths ranging from 0.5 to 5.0 feet below ground surface. Of these samples, eight (35%) had concentrations of D/Fs exceeding the background concentration of 5.2 picograms per gram (the cleanup level to be applied within the D/F cleanup area). These data were submitted to Ecology on May 30, 2025.

The D/Fs in shallow soil appear to be highly variable spatially, and no clear spatial trend was found. The D/Fs in shallow soil are believed to originate from atmospheric deposition of D/Fs that resulted from historical burning of salt-laden wood waste materials. Such burning reportedly occurred at multiple locations, hence identifying specific sources for D/Fs in soil in a given area can be challenging (Ecology 2025a).

2.3 Site Elevation Surveys

The bathymetric and shoreline survey was performed by eTrac (Woolpert) acting as a subcontractor to Anchor QEA. The survey was conducted using aerial and stationary lidar and collected on November 15 and 18, 2024, at low tides of -3.07 and -3.26 feet MLLW, respectively, as measured at the Everett, Washington, tide station (#9447659). The survey was conducted within the marine site boundary (Figure 2) and a 100-foot buffer beyond the boundary where possible. Limitations in lidar data collection occurred where standing water was present during low tides, as lidar cannot penetrate water surface; however, this data gap was determined to be minor and limited to small shallow pools within the intertidal mudflat. The survey encompassed the in-water project area and included some upland and shoreline locations, to supplement and link into existing upland survey data. Lidar was collected with a Riegl VZ400 Terrestrial Scanner, supported by Applanix POS MV V5 Base Station. Data processing utilized Horizontal Datum/Projection of North American Datum of 1983 (NAD83; 2011) and Vertical Datum of mean lower low water (MLLW) using NAVD88 GEOID (2012B). A local benchmark was referenced for conversions in developing the Site-specific bathymetric and upland survey data as follows: U.S. Coast and Geodetic Survey disk stamped as follows: U.S. Coast & Geodetic Survey tidal station disk 4 1934 located at N 47.98000; E -122.22300, with an elevation of 39.89 feet NAVD88 (41.93 feet MLLW). Datum elevations for the Site are presented in Table 1.

2.4 Nature and Extent of Contamination

Under MTCA, a site (or facility) is an area where a hazardous substance has come to be located. As such, the nature and extent of contamination in the sediment defines the marine area Site boundary. More specifically, the marine site boundary includes sediment contaminated with PCBs and D/F above sediment management standards.

2.4.1 Shallow Soils

Per the D/F Shallow Soils 2025 investigation, Ecology concluded that prevention of recontamination via shoreline erosion prevention is warranted in areas where sediment cleanup work is required, including shorelines adjacent to removal, engineered capping, and EMNR areas. Shoreline erosion in the Logway and Southern Shoreline areas has potential to bring additional contamination on top of the added clean materials.

Recontamination via erosion is not considered a concern in the Knoll Area because D/F or PCBs have not been encountered in bank soils in this area. Because recontamination is not a risk, shoreline armoring in the Knoll Area is not part of the cleanup, which will provide for a shoreline more conducive to habitat in this area.

2.4.2 *Sediment*

The following chemicals were identified as COCs for sediment in the CAP based on exceedances of the applicable SMS Sediment Cleanup Objective (SCO) criteria as follows:

- **Total PCBs (Aroclors or congeners):** Concentrations exceed the SCO criterion of 130 µg/kg dry weight (dw) based on benthic protection and the SCO criterion of 30 µg/kg dw (based on protection of human health).
- **Total D/F toxicity equivalence (TEQ):** Concentrations exceed the SCO criterion of 5 nanograms per kilogram (ng/kg) dw (based on the practical quantitation limit [PQL]).
- **Total coplanar PCB congener TEQ:** Concentrations do not exceed the Site-specific SCO of 1.5 ng/kg dw (based on the PQL); however, the risk from D/F and coplanar PCB congener TEQ levels are additive. Areas with elevated PCB congener TEQ are spatially delineated within the extent total PCB and D/F TEQ exceedance area; therefore, coplanar PCB congener TEQ are COCs but are not considered an indicator hazardous substance (IHS).
- **cPAH TEQ:** Concentrations exceed the SCO criterion of 21 µg/kg dw, based on natural background. However, it is important to note that the regional background for cPAH TEQ in Port Gardner Bay has been established as 56 µg/kg in the Washington State Department of Ecology Sediment Cleanup User's Manual (SCUM) Table 10-2 based on the Port Gardner Bay Regional Background: Data Evaluation and Summary Report (Ecology 2014), which also exceeds the SCO criterion. Areas where sediment exceeds the SCO are spatially delineated within the extent of the total PCB and D/F TEQ exceedance area; therefore, cPAH TEQ is a COC but is not considered an IHS. However, PAH source control (creosote-treated pile/structure removal) is integrated into the selected remedial action.

The PRDI results, as summarized in Section 2.2.5 of this EDR and presented in the PRDI Data Report (Anchor QEA 2025) presents data collected resulting from implementation of the Ecology-approved Step 1 and Step 2 Pre-Remedial Design Investigation Work Plans (Anchor QEA 2023, 2024) to inform the marine remedial design. This data was used to refine the SMA boundaries. Figure 2 illustrates the revised SMAs based on the PRDI results.

2.4.3 *Porewater*

Porewater D/F and PCB data were collected as part of the PRDI (Section 2.2.5). A total of nine sediment cores were collected for ex situ porewater evaluation using the SPME methodology. These data are used to inform the cap design.

In the ex situ SPME test, the highest total D/F porewater concentrations were observed in the Logway (2.97 at PW-041 and 1.75 at PW-044 picograms per liter [pg/L], which correspond to 0.078 and 0.141 pg/L TEQ, respectively). All other total D/F porewater concentrations were lower than 0.60 pg/L, including total D/F porewater concentrations in the South Shoreline and Knoll areas. The total PCB porewater concentration in the Knoll Area was 0.20 nanograms per liter. The complete porewater evaluation including a detailed description of the methodology, calculations of freely dissolved D/F and PCBs in porewater, quality control and quality assurance discussion, and tabulated porewater concentrations is presented in Appendix A.

2.4.4 Structures

Ecology's SCUM (Ecology 2021) identifies creosote-treated piling removal as a form of source control. Creosote-treated structures are present at the Site and include the following: two bulkhead structures containing an unknown number of wooden piles and lagging, a remnant wooden barge, and approximately 53 free-standing piles or dolphins. These structures and debris will be removed as part of the marine remedial actions (Appendix G, Sheet C1).

2.5 Cleanup Levels

The sediment cleanup level (SCL) is defined as the concentration or level of biological effects of a contaminant in sediment determined by Ecology to be protective of human health and the environment (WAC 173-204-560(2)). The applicable SCLs² were defined in the CAP and are summarized in Table 2.

2.6 Points of Compliance

For marine sediments, the vertical point of compliance (POC) is surface sediments within the biologically active zone. The biologically active zone is the depth in surface sediments where the species critical to the function, diversity, and integrity of the benthic community are located. As described in the CAP, the vertical POC at the Site is 30 centimeters (approximately 1 foot). Benthic protection is required on a point-by-point SCL basis (benthic protection criteria in accordance with the SMS).

For bioaccumulative COPCs, such as total PCBs and D/F TEQ, the horizontal POC defined under SMS is based on the SWAC. SWACs are applied to the entire Site area that exceeds the Site-specific SCL. In accordance with the CAP, the SWAC compliance area encompasses all surface and near-surface sediment areas (i.e., to a depth of 1 foot below mudline) with concentrations of total PCBs or D/F TEQ exceeding preliminary SCO chemical criteria.

² The applicable SCL refers to the sediment cleanup level specified in WAC 173-204-560(2)(a).

2.7 Marine Sediment Remediation Levels

As described in WAC 173-340-355, a cleanup action selected for a site will often involve a combination of cleanup action components, and RELs may be used to identify the concentrations of hazardous substances at which different cleanup action components will be implemented. RELs are not CULs and, by definition, these exceed CULs. RELs must meet each of the minimum requirements of cleanup as specified in WAC 173-340-360.

The following concentration break points were used to establish REL values in the Feasibility Study and were defined in the CAP:

- **Total PCBs:**
 - MNR REL: 30 µg/kg dw (human health protection-based SCO)
 - EMNR REL: 117 µg/kg (hill-topping-based REL to achieve a 30 µg/kg dw SWAC)
 - Removal REL: 130 µg/kg dw (benthic protection SCO)
- **D/F TEQ:**
 - MNR REL: 5 ng/kg dw (PQL-based SCO)
 - EMNR REL: 8 ng/kg dw (hill-topping-based REL to achieve a 5 ng/kg dw SWAC)
 - Removal REL: 15 ng/kg dw (best professional judgement based on direct sediment contact [Ecology 2021])

Wood debris in marine sediments³ was identified in the CAP as having the potential to adversely affect the benthic community when present in sufficient quantities. Locations with less than 25% wood debris by volume are unlikely to cause adverse effects to the benthic community, and 25% has been selected as an SCL for other remediation sites managed by Ecology (Ecology 2013). Based on the results from the wood volume measurements collected during the PRDI the Site meets cleanup requirements for wood, less than 25% wood debris by volume, and no cleanup actions to address wood debris are required (Ecology 2024b).

³ Wood debris in marine sediments is likely related to historical log rafting, log storage, and lumber processing operations not associated with the former Nord Door Facility operations.

3 Basis of Design

This section summarizes the overall basis of design for the marine remedy as described in the CAP and updated based on the results of the PRDI.

3.1 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.

3.2 Required Cleanup Actions

3.2.1 *Assumed Source Control Activities*

The remedial investigation included the finding that marine sediments were contaminated near the stormwater outfalls. Therefore, as part of source control, the performing potentially liable persons (PLPs) must remove and dispose accumulated sediment and debris from stormwater systems within the Site including, but not limited to, stormwater pipes, catch basins, vaults, and manholes. The cleanout of accumulated sediments must be completed, prior to conducting the marine sediment cleanup. The stormwater cleanup actions are being completed as part of the upland remediation project and details regarding that effort will be included in the upland EDR. This work will be conducted independently of the marine work described in this EDR. Property owners and their leasees are responsible for obtaining permits and compliance with stormwater regulations associated with all upland industrial use areas at the Site.

Additionally, the prevention of recontamination via shoreline erosion prevention is considered source control in areas where sediment cleanup work is required, including shorelines adjacent to removal, engineered capping, and EMNR areas within the Logway and Southern Shoreline areas. Shoreline erosion has potential to bring additional contamination on top of the added clean materials. Prior to shoreline

stabilization and erosion prevention measures are implemented, anthropogenic debris and degraded asphalt along the shorelines that potentially contain CPAHs will be removed (Appendix G, Sheet C1).

3.2.2 *Sediment Cleanup Actions*

As described in the CAP, sediment cleanup actions are considered a comprehensive remedy for sediments exceeding Site CULs and will comply with all applicable remedy selection requirements under MTCA and SMS. The cleanup actions to remediate the marine sediments will include the following:

- Remove and dispose of piling and creosote-treated wood debris (SMA-1, -2, and -3)
- Demolish and dispose of two shoreline bulkheads and a remnant barge structure.
- Monitor the natural recovery of surface sediments in SMA-1 (areas with sediment concentrations between 5 and 8 ng/kg dw D/F TEQ and areas with sediment concentrations between 30 and 117 µg/kg dw total PCBs).
- Place a minimum 6-inch-thick layer of clean sand as an EMNR layer in SMA-2 in areas with sediment concentrations between 8 and 15 ng/kg dw D/F TEQ and in areas with sediment concentrations between 117 and 130 µg/kg dw total PCBs.
- Excavate sediments in SMA-3 in areas with sediment concentrations above 15 ng/kg dw D/F TEQ, and in areas with sediment concentrations above 130 µg/kg dw total PCBs.
- Construct shoreline erosion protection along the Logway and Southern Shoreline areas, as shown in Appendix G.
- Construct engineered caps over portions of SMA-3 (Logway area), following excavation.
- Implement institutional controls to protect and maintain engineered caps.

The selected cleanup includes periodic post-construction sampling and testing of sediments within the biologically active zone to verify that cleanup standards are met and continue to be met. The scope and details of the long-term monitoring are discussed further in Section 9.

3.3 **Sediment Management Areas**

This section summarizes the SMAs within the Site boundary for marine remedial actions. Figure 2 illustrates the SMA boundaries based upon the data collected during the PRDI efforts. SMAs shown in Figure 2 are as follows:

- **SMA-1:** Includes areas where the remediation cleanup technology will be MNR and includes areas within the marine site boundary where IDW interpolated surface sediment concentrations are below 8 ng/kg for D/F TEQ and 117 µg/kg for total PCBs (MNR RELs). Surface sediments will be monitored for natural attenuation according to the Operation, Maintenance, and Monitoring Plan (OMMP), described further in Section 9.
- **SMA-2:** Includes areas where the remediation cleanup technology will be EMNR and includes areas within the marine site boundary where IDW interpolated surface sediment concentrations are between 8 and 15 ng/kg for D/F TEQ and between 117 and 130 µg/kg for total PCBs

(EMNR RELs). Cleanup actions include placing a minimum 6-inch-thick layer of clean sand as an EMNR layer and monitoring according to the OMMP, described further in Section 9.

- **SMA-3:** Includes areas where the remediation cleanup technology will be removal or capping and includes areas within the marine site boundary where IDW interpolated surface sediment concentrations are above 15 ng/kg for D/F TEQ or 130 µg/kg for total PCBs (capping/removal RELs). Monitoring will be performed according to the OMMP, described further in Section 9.

Cleanup actions within this SMA vary between the areas and are as follows:

- Knoll Area: Removal of surficial material exceeding the CULs for this area of SMA-3 to a depth of 1 to 2 feet below existing grade and backfill with clean sand to pre-construction grades.
- South Shoreline: Removal of surficial material exceeding the CULs for this area of SMA-3 to a depth of 2 to 3 feet below existing grade and backfill with clean sand to pre-construction grades.
- Logway: Removal of surficial material exceeding the CULs for this area of SMA-3 to a depth of 2 feet below existing grade and backfill with engineered cap materials, as described in Section 8.5.

3.4 Future Use Assumptions

The current zoning of the Site property is industrial and future use of the Site property is expected to remain industrial.

3.5 Engineering Design Criteria

This section summarizes design criteria used in the engineering analysis of the sediment cleanup remedy.

3.5.1 *Project Datums*

The horizontal datum used is Washington State Plane North Zone, NAD83, measured in units of feet. The vertical datum used is National Ocean Survey MLLW measured in units of feet.

3.5.2 *Stormwater*

Details regarding the source control activities that will be conducted for existing stormwater infrastructure will be included in the upland EDR (prepared by others). As discussed in Section 3.2.1, the required cleanout of accumulated sediments from stormwater infrastructure must be completed prior to conducting the marine sediment cleanup. This work will be completed as part of upland remedial efforts.

As previously stated, outfall locations may be required to remain within the sediment cleanup extent following remedy construction. JELD-WEN will continue to engage with the property owners

throughout the design process to integrate property owner-specified outfall locations, materials, and connection details for integration in future construction plans and specifications development. Stormwater infrastructure improvements will be required to include protective measures for the marine remediation, which may include energy dissipation features at the outfalls to prevent damage and erosion to the marine remedial elements (Section 8).

3.5.3 *Geotechnical Design Criteria*

Geotechnical data used to support remedial design is based on results of in situ and laboratory test results as well as geotechnical engineering analysis to determine Site-specific design parameters. Design includes evaluation of the proposed remedial elements with specific regard to short- and long-term slope stability in upland slopes and removal cut slopes, consolidation settlement performance of underlying sediments in engineered cap areas, and determination of long-term slope stability mitigation measures (e.g., shoreline armoring) as appropriate, and filtration analysis on cap and armoring materials.

Information obtained and presented during the PRDI Data Report (Anchor 2025) consists of data collected from eight shoreline geotechnical hollow stem auger borings. Borings were advanced using the standard penetration test (SPT) and soil samples were collected with a split spoon sampler. Soil and sediment samples collected during the geotechnical investigation were visually classified in the field and further characterized with laboratory geotechnical testing that included moisture content, grain size distribution, specific gravity, and Atterberg limits tests. To supplement these data, laboratory results and sediment descriptions obtained from sediment core logs are also utilized to support geotechnical design.

Geotechnical performance criteria for the remedial design include the following:

- **Slope Stability:** Slopes for dredge and cap and cover areas and adjacent upland slopes need to be stable. Soil modeling parameters were derived using the *Naval Facilities Engineering Command Design Manual 7.1 Soil Mechanics* (NAVFAC 2022). Stability was evaluated using the infinite slope equation for submerged material according to *Soil Strength and Slope Stability* (Duncan, Wright, and Brandon 2014) and limit equilibrium methods considering circular and noncircular slip surfaces in accordance with *Slope Stability* (USACE 2003). The target factor of safety is 1.3 for temporary slopes and 1.5 for long-term slopes (USACE 2003).
- **Compressibility:** Compressibility of materials to be capped or covered was assessed for cap design to inform construction quality assurance measures (i.e., evaluation of cap thickness field measurements). Compressibility was assessed based on the gradation and density of the materials to be capped or covered using Terzaghi and Peck's one-dimensional consolidation theory (Terzaghi and Peck 1967). Consolidation parameters were estimated using correlations derived from laboratory testing results of site materials.

- **Bearing Capacity:** Bearing capacity of existing materials was assessed to inform the cap and cover design as it relates to lift thickness and placement rates. Bearing capacity was evaluated using methodology set forth by the United States Environmental Protection Agency ([EPA];Palermo et al. 1998), modified to meet a target factor of safety of 1.5 consistent with similar sediment remedy design approaches nation-wide.
- **Filtration and Material Gradation:** Filtration analyses were conducted to evaluate the compatibility of specified material gradation values. To minimize the potential for base material “wash out” or insufficient filtration, filter criteria equations developed by Terzaghi and USACE (Cedergren 1989) were utilized to select appropriate gradation values for the cap and armoring layers along the Logway and South Shoreline.

Additional information regarding model development and geotechnical engineering design may be found in Appendix B and Appendix C.

3.5.4 *Coastal Engineering Design Criteria*

To address the coastal engineering design criteria for the Site, publicly available and Site-specific bathymetry data were used to perform numerical modeling, and scenario-based wave analysis. Key coastal data inputs—including bathymetry of the Site and surrounding region, historical water level records, and wind measurements—were compiled to establish the baseline environmental forcing conditions. These inputs inform the modeling framework developed to evaluate wave exposure under both existing and future conditions.

An extremal wind analysis was conducted to determine appropriate return-period wind speeds for design, focusing on the 100-year wind events. These wind conditions were applied within a stationary Delft3D Flexible Mesh (Delft-FM) model configured with a broad computational domain that includes the Site and the adjacent Possession Sound region. The model simulated wind forcing from three key directions: the WNW, representing the longest over-water fetch (approximately 12 miles); the SSW, which is the dominant and strongest wind direction at the Site; and the west, which is particularly relevant under FEMA BFE conditions when portions of Jetty Island may be inundated, potentially allowing waves to propagate toward the Site.

These wind scenarios were evaluated across several water level conditions, including Mean Sea Level, MHHW, and FEMA BFE, with each scenario also evaluated under 100 years of projected sea level rise conditions in accordance with Ecology guidance.

To simulate wave transformation and nearshore wave conditions, a stationary wave model was developed using Delft-FM coupled with SWAN (Simulating Waves Nearshore). The model generated Site-specific wave parameters such as significant wave heights, wave periods, and near-bottom orbital velocities. After evaluating the comprehensive range of forcing conditions described above,

the most conservative design scenario was chosen for each area of the Site. Additional information regarding model development and coastal engineering design may be found under Appendix C.

3.5.5 *Engineered Cap Design Criteria*

Engineered caps are primarily designed to isolate or attenuate chemicals in underlying sediment to mitigate risk to human health and the environment. Caps provide both physical isolation and chemical isolation. At a minimum, engineered caps include a chemical isolation layer, which is the layer that provides physical separation between the contaminated sediments and the benthic community and surface water and limits the transport of the dissolved phase COCs to the surface of the cap and surface water. An erosion protection layer (cap armoring) is often placed on top of the chemical isolation layer to provide protection against erosive forces. Where the gradation differences between chemical isolation and cap armoring are significant, an intermediate “filter” layer may be needed. In some cases, the appropriate grain size can be specified such that the functions of all layers can be combined into a single material type.

This section describes the design process for modeling the chemical isolation layer and the cap armor layer.

3.5.5.1 **Cap Chemical Isolation**

Modeling was conducted to evaluate the effectiveness of a chemical isolation layer in engineered caps in the Logway to address the flux of the dissolved phase D/F and identify a chemical isolation layer design configuration (i.e., thickness and composition, including whether sorptive amendments would be included and, if so, the amounts) that would provide long-term effectiveness in limiting concentrations at the cap surface to which benthic organisms can be exposed to levels less than the sediment CUL of 5 ng/kg dw on a SWAC basis. As described in the CAP, although most organisms burrow to a depth of 10 cm, soft-shell clams (*Mya arenaria*) have been identified in the tidal flats and can burrow as deep as 30 cm; therefore, the POC at this Site is the top 30 cm.

The modeling analyses were performed in accordance with guidance on cap design set forth by EPA and the U.S. Army Corps of Engineers (USACE; Palermo et al. 1998) and the Interstate Technology and Regulatory Council (ITRC 2014, 2023). The widely used model of chemical transport within sediment caps, CapSim (version 4.2; Reible 2023), was used for this evaluation. CapSim, or its predecessors, has been used for protectiveness and sediment cap design evaluations at numerous Superfund and MTCA sediment cleanup sites. This model simulates the time variable fate and transport of chemicals (dissolved and sorbed phases, including partitioning between these phases) under the processes of advection, diffusion and dispersion, biodegradation, bioturbation and bioirrigation, and exchange with the overlying surface water within a sediment cap using a one-dimensional representation of the various cap layers in the vertical direction. Details on the model structure and underlying theory and equations are provided in Shen et al. (2018), Lampert and Reible (2009), and Go et al. (2009).

Details of the modeling approach, model inputs, and results are included in Appendix D. The modeling showed that a 6-inch sand chemical isolation layer is sufficient to meet the marine sediment CUL of 5 ng/kg dw using conservative assumptions.

3.5.5.2 Cap Armoring

Two methods will be used to evaluate stable sediment and armor stone sizes based on the physical forcing conditions at the Site. The selection of appropriate sediment and armor rock sizes will be informed by a representative design case developed through wave modeling described in detail in Appendix C. This case will incorporate applicable wind and water level scenarios and predicted wave characteristics—including wave height, period, and depth—as well as predicted near-bottom wave orbital velocities.

For the engineered caps at the Logway, the Hydraulic Design of Flood Control Channels Manual (EM 1110-2-1601), as referenced in the USACE Coastal Engineering Manual (CEM; USACE 2002), was considered for the analysis of “blanket stability in current fields.” This method incorporates wave-induced bottom currents—captured in the model output as orbital velocities at the seabed—to evaluate the potential for sediment mobilization beneath the wave action. However, the resulting orbital velocities at the Logway were too small and this method was deemed inapplicable. Instead, the methodology for rock sizing for submerged structures outlined in the CEM was employed.

The cap design resulting from these evaluations consists of an armor layer overlying one filter layer. The filter layers are sized to prevent winnowing of finer sediment within the chemical isolation layer through the pore space of the overlying coarse material due to wave action. The number of required filter layers depends on the degree of contrast in particle size and gradation between the in situ sediments and the selected armor material. In most configurations, one of the filter layers also functions as a chemical isolation layer. The overall geometry and gradation of the cap system follow established design guidance from the CEM (USACE 2002) and supporting literature such as Maynard (2012).

Armor layers for the engineered caps in the Logway Area have also taken into consideration stormwater flow from the large outfall in the head of the area where stormwater from the Baywood property is discharged.

Further discussion and armor sizing of the engineered cap is available in Appendices B and C.

3.5.6 Demolition Design Criteria

Demolition and removal of creosote-treated timber piles, bulkheads, derelict barge structure and armored slopes will be conducted in several areas of the Site (Appendix G, Sheet C1). Piling and timber bulkheads will be removed using equipment and BMPs adopted from U.S. Environmental Protection Agency guidance (USEPA 2007); and the Department of Natural Resources Puget Sound Initiative—Derelict Creosote Piling Removal, BMPs for Pile Removal and Disposal (DNR 2011), as

discussed in Section 5. Demolition and removal actions will be conducted so as to minimize residual creosote-treated wood fragments and particle loss during cutting and removal as well as meet geotechnical design criteria for stable slopes.

Armored slopes are generally composed of angular quarry spall rock, broken asphalt and concrete fragments on slope areas within and adjacent to SMA boundaries. In the Logway, armored slopes consisting of armor rock, concrete, and asphalt debris have been over steepened to approximately 2 horizontal to 1 vertical (2H:1V) and are currently supported at the lower mid-slope and toe by timber piles and bulkhead structures in some locations. Furthermore, buried water and telecommunications utility services and a paved site access road run parallel to the shoreline on the upland, offset from the top of slope by approximately 2 feet. Protection of these utilities may require temporary shoring or other measures when working in the Logway.

Demolition of slopes and structures must be protective of existing upland areas such as structures and buried utilities. Temporary, contractor-designed shoring will be necessary to maintain upland slopes and prevent slope instability during the course of demolition and removal work.

3.5.7 Shoreline Stabilization Design Criteria

Based on the results of the coastal engineering design analysis, a conservative design scenario was selected to guide the shoreline stabilization design for each area of the Site. The results of this analysis indicated that the highest water level elevations do not always correlate with the largest waves. The FEMA BFE and FEMA BFE with sea level rise fully submerge the shoreline, but the relatively deep water and relatively small waves result in little impact to the shoreline itself. The design scenario selected for the South Shoreline armoring was the rock size resulting from the 100-year wind-induced waves originating from SSW at MHHW with 100 years of sea level rise. For the Logway, the analysis showed maximum armoring rock size resulting from the 100-year wind induced waves originating from WNW at MHHW with 100 years, conservatively assuming the breakwaters were not functional.

Shoreline stabilization will primarily consist of rock armoring, as described by Ecology (Ecology 2025b), with a focus on the prevention of recontamination via shoreline erosion. Armor stone sizing and gradation will be determined in accordance with design methodologies outlined in the USACE CEM and the Rock Manual published by Construction Industry Research and Information Association. Additional information on armor stone sizing may be found in Appendix B and Appendix C.

Additionally, shoreline design slopes must also meet the geotechnical design criteria discussed in Section 3.4.2 for shoreline short and long-term stability and provide long-term slope stability at slopes adjacent to removal cuts and cap areas.

3.6 Anticipated Permits and Approvals

Table 3 summarizes the environmental permits and approvals anticipated to be required for the project. The table is based on the Applicable or Relevant and Appropriate Requirements listed in the Final CAP (Table 3.2) as well as experience in permitting similar projects in the Puget Sound region.

3.6.1 *Work Window and Allowable Construction Work Hours*

In-water construction activities will be performed consistent with allowable work windows established in coordination with state and federal resource agencies and tribes. The USACE permit application states that work below the highest astronomical tide will be completed during the approved work windows for Tidal Reference Area 7 (Everett), which includes saltwater areas in Port Gardner, Port Susan, and parts of Possession Sound and Saratoga Passage (WAC 220-660-310(g)). These work windows are (WAC 220-660-330):

- July 15 to February 15 for all work except dredging in Port Gardner and the Snohomish River.
- September 15 to February 15 for dredging in Port Gardner.
- September 1 to February 15 for dredging in the Snohomish River.

No surf smelt or herring spawning beds are mapped in or near the project Site (DNR 2024), and work windows for those species do not apply.

A great blue heron colony has been observed approximately 1 kilometer south of the Site. WDFW recommends that construction activities within shoreline and wetland habitats within 3 kilometers of a great blue heron colony be limited to outside of the primary nesting period between March 1 and August 31.

In order to comply with federal and state law, direct harm of migratory birds and disturbance of active nesting sites are prohibited. Osprey nests on the Site (present on piles) will need to be monitored and assessed to confirm that they are no longer in use prior to removal. Osprey nests are typically active between February 1 and August 31 but could remain active through September.

Based on the location of the Site, it is assumed that the October 1 to February 15 work window will apply to avoid the noise impacts on nesting birds, monitoring will begin on September 1 to determine the presence of active osprey nests and great blue heron foraging. If no active nests are observed after September 1, WDFW will be notified and construction activities will begin. Seasonally, the lowest tides during daytime working hours typically occur in June and decrease dramatically in the later summer, fall, and winter months, as shown in Table 3. If the work cannot be completed in one season, permissions to begin work in June may be requested as part of the permitting extension process. The final work windows will be specified in the issued permits for the project, based on discussions with the regulatory agencies.

4 Remediation Technologies

Removal of contaminated sediment and creosote-treated wood structures will likely entail accessing removal areas from the shoreline at low tide using land-based equipment. Placement of EMNR material and engineered caps using land-based equipment and working in the dry, to the extent practicable, (times when tidal elevations are below excavation elevations) will allow for more accurate placement and verification than through water column subtidal placement methods.

This section summarizes and reviews the technologies that form the basis for the marine remedial design presented in this EDR. Applicable best management practices are presented in Section 5.

4.1 Demolition Methods

All demolition of structures, removal of debris, and piling removal will be performed using mechanical means with access from upland areas, where feasible, prior to or in conjunction with contaminated sediment removal in each area. Temporary shoring will be installed to support the shoreline and existing upland utilities prior to the demolition of the bulkheads in the Logway Area. Piling removal will be completed in accordance with the construction BMPs, as outlined in Section 5.

4.2 Excavation Methods

All excavation activities are assumed to be performed using land-based equipment, where feasible. Intertidal excavation will be performed using mechanical means with access from upland areas. Intertidal sediment to be removed will be excavated using mechanical means during low-tide conditions in the dry, to the extent practicable. Conducting intertidal sediment and shoreline bank soil excavation in the dry during low-tide periods will reduce the potential for release of impacted intertidal sediment and shoreline bank soils during construction and will facilitate more efficient handling and processing of excavated sediments because the volume of entrained water is significantly lower than that occurring during wet excavation (i.e., dredging).

Depending on weather, tides, scheduling, and contractor production, it may be necessary to conduct intertidal excavation below the water surface. As necessary, intertidal excavation during shallow water conditions (e.g., to address weather, access, or schedule constraints) would be described in the contractor's Construction Work Plan and would be subject to approval by the Project Engineer and Ecology to ensure protectiveness.

4.3 Cover, Cap, and Armor Material Placement

After excavation is completed, the design includes placing various backfill or capping materials depending on the specific SMA. All material placement activities are assumed to be performed using land-based equipment from upland areas, where feasible. Backfill and capping material will be placed using mechanical means during low-tide conditions in the dry, to the extent practicable.

An EMNR layer will be placed in SMA-2. A variety of sands and gravels, engineered caps, and shoreline armoring will be placed in SMA-3. The Construction Specifications identify acceptable placement methods and material specifications. The contractor will be required to demonstrate that they can consistently meet material placement thickness tolerances.

5 Construction Best Management Practices

BMPs will be employed during implementation of the marine cleanup actions at the Site. BMPs are management practices that are determined to be effective, practical, and sustainable means of achieving an environmental performance objective (e.g., compliance with water quality criteria) during Site cleanup. BMPs will be used to meet these performance objectives during construction and to limit potential adverse construction impacts. The BMPs presented in Appendix E are proposed for implementation of the marine cleanup actions at the Site. Final BMPs will be updated in the specifications where necessary to incorporate additional BMPs if defined during final permits or substantive requirements.

6 Net Environmental Effects

All sediment cleanup activities have the potential for short-term environmental impacts in and around the work area; in the long term, sediment cleanup is intended to provide a net environmental benefit. This section describes the evaluation of net environmental effects and discusses potential compensatory mitigation considerations. Measures to avoid and reduce impacts to target resources are identified in multiple sections of the document, such as Sections 8, 9, and 11 (i.e., work windows, sequencing, and methods).

6.1 Net Environmental Effects Analysis

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

The intertidal habitat within the Site boundary is highly degraded due to long-term industrial use of the Site and associated sediment contamination, in-water debris and creosote-treated piles, the presence of anthropogenic shoreline debris, and other habitat-limiting factors. It is expected that implementation of this cleanup and source control work will result in an overall improvement of habitat conditions for the intertidal 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
- Removal of existing creosote-treated piles, two bulkheads, and the remnants of a wooden barge
- Removal of anthropogenic shoreline debris in areas adjacent to SMA-3
- Capping of contaminated sediment, therefore removing exposure pathways
- Placement of clean sand backfill to manage residuals from SMA-3 removal activities and provide EMNR throughout SMA-2
- Protection from potential future erosion of the upland areas of the Site and shoreline, adjacent to SMA-2 and SMA-3, by appropriately stabilizing the shoreline

Shoreline stabilization will be accomplished by installing temporary sheet piles (as needed) and placing riprap along vulnerable sections of the shoreline where contaminated upland soils are present. Hard armoring methods like this are considered habitat-limiting compared to soft or hybrid methods because they typically are not considered supportive of habitat connectivity, sediment transport and accretion, and habitat area for nearshore vegetation, forage fish, and juvenile salmonids. In this instance, however, stabilization of the shoreline along with the removal of creosote-treated piles and removal and capping of contaminated sediments are crucial to removing exposure pathways. The removal of these exposure pathways will overall increase the quality of the existing habitat area and potentially support the native species colonization of the degraded intertidal area.

Potential short-term impacts of the cleanup will be mitigated to the extent practicable. It is expected that the intertidal community will fully recolonize Site sediment and structures within a few years of the completion of the remediation, as there are numerous nearby similar habitats with intertidal organisms that will aid in recolonization. It is likely that the remediation will increase suitable intertidal habitat because the future substrate will have significantly reduced levels of contaminants. Low velocity and fine substrate habitats like the remediated Site tidal area may provide suitable habitat for eelgrass and macroalgae to colonize. Eelgrass is an important spawning substrate for Pacific Herring; an important food source for juvenile salmonids and provides refuge for juvenile salmonids as they grow and migrate into the ocean environment. The removal of anthropogenic shoreline debris, existing creosote-treated piles, two bulkheads, and the remnants of a wooden barge are expected to increase the overall available habitat and further improve water and sediment quality by removing these ongoing sources of contaminants. Overall, the project will create a net positive environmental effect. This project includes removing ongoing sources of contamination, 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 removing treated timber piles where practicable.

6.2 Compensatory Mitigation and Wildlife Considerations

The presence of osprey (*Pandion haliaetus*) nests on creosote-treated piles would necessitate removal of the nests in order to complete the cleanup action. Under the Migratory Bird Treaty Act and state law, all active or occupied nests of migratory birds are protected and cannot be disturbed without specific authorization from WDFW or U.S. Fish and Wildlife Service Regional Office in Portland, Oregon; only inactive osprey nests may be removed (i.e., destroyed) to comply with federal and state wildlife laws. The early and primary nesting season for osprey is generally between February 1 and August 31; however, fledging may not be completed until as late as September (ODFW 2012). Because osprey have been observed nesting on the Site, nest status should be monitored and confirmed by a WDFW wildlife biologist or other professional wildlife biologist before any removal action occurs. Osprey also exhibit high site fidelity, so because there are no observed nests on piles identified for removal as part of the cleanup there is no anticipated need to install nest excluders or install replacement nests at the site. Work around occupied nests (typically between February 1 and August 31) must be restricted to a setback distance of up to 650 feet. To avoid the noise impacts on nesting birds, monitoring will begin on September 1 to determine the presence of active osprey nests. If no activity is observed after September 1, WDFW will be notified and construction activities may begin.

The great blue heron (*Ardea herodias*) nesting colony would also require consideration prior to work activities. WDFW recommends a series of buffer zones to protect nesting great blue heron populations during and outside of the nesting season. While the Site is well outside of the year-round and seasonal buffers, it is within the designated 3-kilometer foraging habitat (Azerrad

2012). In this instance, WDFW recommends work within key foraging areas be limited to outside the primary nesting period, which is approximately March 1 to August 31. Although the Site is within the designated foraging habitat for great blue heron, existing contamination and the lack of suitable vegetation for forage species reduce the value of the foraging habitat. Activities associated with the marine cleanup to remove contamination in nearshore areas will increase the value of the foraging habitat. Additionally, the Site is a very small portion of the overall foraging habitat, with minimally disturbed areas available for foraging to the north and to the west of the Site. To avoid the noise impacts on nesting birds, monitoring will begin on September 1 to determine the presence of great blue heron. If no activity is observed after September 1, WDFW will be notified and construction activities will begin. If the work cannot be completed in one season, permissions to begin work in June may be requested as part of the permitting extension process.

Although there are estuarine wetlands located at the Site, the habitat function of those wetlands is hindered due to the existing contamination. The marine cleanup actions will remove existing contamination and restore the Site to existing grade, which will permanently impact the existing wetlands. For the areas of the Site where wetland impacts cannot be avoided, credits will be purchased from the Blue Heron Slough Mitigation Bank, which is pending certification for wetland credits. A draft agreement is currently being developed to reserve the necessary credits to offset estuarine impacts at Ecology's ratio for Category II wetlands.

7 Site Preparation and Staging Areas

As part of construction activities, the Work will require mobilization of land-based equipment such as excavators, backhoes, dozers, loaders, dump trucks or other equipment and potentially water-based equipment including barges and other specialized equipment. The selected contractor or contractors will be required to bring the necessary equipment to the project area. The equipment will be staged, moored, and repositioned as necessary to complete the work and in compliance with all permitting requirements.

This section discusses the project areas that may be used by the contractor to stage equipment and stockpile or transload excavated soils, hardscape, debris, and capping and armor materials. The configuration and layout of upland staging areas will depend on the selected contractor's construction methods and the available space at the Site at the time of construction. Potential temporary staging, stockpiling, and transloading areas are shown in Appendix G, Sheet G6.

7.1 Staging and Transload Facilities

Portions of the uplands will be made available to the contractor for use in staging equipment and materials for the project, for access to conduct shoreline work, and for temporary stockpiling and transloading of backfill materials, excavated sediment, and debris. Approximately 5 acres of the uplands portion of the Site will be available to the contractor during construction as shown in Appendix G, Sheet G6. The northwestern portion will not be available and must remain accessible to the tenants at all times. The available area may be modified as necessary to coordinate construction activities with tenants. Other locations may alternatively be proposed for use by the contractor for staging and stockpiling, pending the approval of the Owners, tenants, and project engineer.

Locations and approximate dimensions of stockpiles within the Staging and Stockpile Area will be described in the contractor's work plans, complying with permitting requirements and subject to Ecology approval. All temporary stockpile areas will be appropriately contained to prevent uncontrolled runoff from entering surface water. Methods for containing the stockpiles will be described in the Construction Work Plan, which will be a required contractor submittal that will detail operations, including setup and breakdown, stormwater management, and maintenance and cleaning of upland work areas. An example containment scenario incorporates stacked ecology blocks, k-rails, or constructed berms, around the perimeter of each stockpile with an impervious geotextile fabric along the stockpile perimeter as shown in Appendix G, Sheet D1.

7.2 Stockpile and Excavation Dewatering

Effluent from contaminated sediment stockpile dewatering will be contained, treated, and discharged, as necessary under an NPDES permit. Stockpile and excavation dewatering will include the following:

- The contractor will be required to construct water-tight stockpile containment areas and cover stockpiled contaminated sediment to prevent precipitation from saturating stockpiles.
- The contractor will be required to collect, test, and treat (if needed) effluent water from stockpiling dewatering operations per local regulations prior to discharge into receiving waters.

7.3 Stormwater Management

It is assumed that a Construction Stormwater General Permit (CSGP) will be obtained for construction activities at the upland stockpile and staging areas. Clean material staging areas will be kept separate from excavated material stockpile areas. Given that contaminated substances are present in the construction areas, the CSGP may require issuance of an Ecology order to establish discharge limits for D/F, PAH compounds, and PCBs or proxy for contaminant removal such as turbidity or total suspended solids criterion. Treatment and monitoring may be required for any stormwater from the construction areas prior to discharge to the receiving waters.

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 CSGP, 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.

7.4 Temporary Site Controls

Upland temporary facilities will be controlled by the contractor with respect to safety, noise, dust, security, and traffic. The construction Site will be closed to the public; however, the owner's operations at the Site (including that of their tenants) will continue throughout construction.

Temporary erosion and sediment control (TESC) BMPs will be employed to prevent pollution of air and water and control, respond to, and dispose of eroded sediment and turbid water during construction. TESC BMPs will be employed in all work areas, equipment and material storage areas, stockpiles, and haul areas. Areas of the Site will be designated as clean support areas (e.g., imported material staging areas) or contaminated (e.g., excavated material stockpile areas and haul routes to

and from contaminated stockpiles). Equipment will be decontaminated before moving from contaminated areas to clean support areas to prevent cross contamination. BMPs such as excavation in the dry, daily backfill cover before tidal inundation, stockpile containment, and sweeping and housekeeping along contaminated material haul routes will further prevent cross contamination.

7.5 Other Environmental Considerations

Other environmental considerations 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 Everett 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 support traffic safety.

8 Remedial Design

The following sections describe the detailed design related to debris removal, contaminated sediment removal, backfill, and capping of cleanup areas, placement of EMNR and MNR within the Site boundary, including water management, sediment and imported material handling, transport, and sediment and debris disposal.

8.1 Structure and Debris Removal

Anthropogenic debris present throughout the Site boundary includes derelict piles, failed timber bulkheads⁴, the remnants of a wooden barge, asphalt, concrete objects, and metal objects of various sizes. Creosote-treated piling removal and anthropogenic debris/degraded asphalt removal is identified as a form of source control in the CAP. Therefore, the identified debris to be removed as part of the marine remedial actions consists of two bulkhead structures containing an unknown number of piles and lagging, a remnant wooden barge, approximately 53 free-standing piles or dolphins, and anthropogenic debris/degraded asphalt along the Logway and Southern Shoreline. The bulkheads, wooden barge, and 32 of the piles are located within the project boundary, an additional 21 piles identified outside of the Site boundary are also required to be removed. Additionally, broken asphalt, concrete objects, logs, wood, and metal objects of various sizes exist along the shorelines of the Logway and Southern Shoreline areas and will be removed.

Bulkhead, piling, and debris removal on shorelines adjacent to the Logway and Southern Shoreline require limiting disturbance during removal so that the uplands remain stable. Temporary shoring will be required to maintain the continued function of buried utilities located at the top of slope, which include water, sewer, and fiber optic infrastructure. In addition, existing concrete and asphalt debris in the Logway and South Shoreline will be removed with replacement by engineered armor to prevent erosion of the banks and future loss of uplands.

Removed structures and debris are expected to be managed and disposed of at a facility permitted to accept these materials. The contractor will select the disposal facility and confirm the facility is properly permitted, and document this information as part of their pre-construction submittals.

8.2 Sediment Removal Unit Design

This section describes the remedial design for the removal of contaminated sediment that is applicable to SMA-3. The Removal Unit development was an iterative process that included integrating multiple design criteria, including the extents of contamination, equipment operational requirements, and Site-specific constraints into one constructable removal prism.

⁴ Original design intent of the wood bulkhead structures is unknown. The structures are composed of an unknown number of piles and timber lagging.

Intertidal excavation during peak tidal exchange periods will increase the potential for water quality impacts. It is assumed excavations will be completed in the dry to the extent possible and backfilled during the same tidal cycle.

8.2.1 Removal Unit Design

The primary criterion of the Removal Unit design is to provide a constructable surface that removes contaminated sediment above the designed contaminated surface within SMA-3 for full removal of contaminated sediment above the Site CULs in the South Shoreline and Knoll areas where sediment contamination is less than 4 feet below grade. In areas where sediment contamination is greater than 4 feet below grade (Logway Area), engineered caps are proposed and the Removal Unit design is based on the thickness of the engineered cap, where removal depths equal the engineered cap thickness (with the exception of the engineered cap in the head of the Logway, where the armoring will tie into the existing armor elevations. The Removal Unit design is based on both a quantitative evaluation (use of the sediment core chemistry data) and a subjective evaluation based on past project experience.

Removal Units were designed based on the nature and extent of contamination in each area and based on the target contaminated sediment removal depths, as informed by the CAP and PRDI results. The lateral extents of removal areas are informed by the surface sediment delineation performed during the PRDI. The target removal depths consider the identified depths of contamination within each Removal Unit as the primary consideration. Secondary considerations in Removal Unit design includes geotechnical properties of the sediment, locations, and characteristics of adjacent shorelines, and the typical precision and accuracy of the equipment that will likely be utilized to implement the work (Appendix G, Sheets C2 through C9).

In addition to the completion of required monitoring (Section 9), the completeness of designed sediment removal will be verified as described in the Construction Quality Assurance Plan and in the Compliance Monitoring and Contingency Response Plan (submitted separately). Progress surveys will verify that design excavation elevations have been met, and in locations where adequate depth has not been achieved the contractor will be required to remove additional material.

8.2.2 Allowable Over-Excavation

Allowable over-excavation is defined as additional material removed from below the required removal surface to account for equipment accuracy and tolerance. With careful vertical control and modern positioning systems, it should be possible to limit over-excavation to 6 inches. Therefore, a 6-inch maximum over-excavation allowance will be used for this project.

8.2.3 Excavation Side Slopes and Temporary Shoring

Based on identified sediment geotechnical properties and best professional judgement, external excavation side slopes of 3H:1V have been incorporated into the design around the perimeter of the

extent of required removal units. Sloughing beyond 3H:1V may incidentally occur. The occurrence of such sloughing will vary depending how the work is implemented. Slough material will be removed to the extent practicable prior to acceptance of the work.

On the landward side of the removal units where steeper slopes may be undermined by contaminated sediment removal or bulkhead removal, temporary shoring will be required to protect the upland infrastructure and buried utilities at the top of the slope. Temporary shoring is expected to be limited to the Logway Area only.

The excavation side slope design and areas of temporary shoring are shown in Appendix G, Sheets C2 through C9 and slope stability design calculations are included as part of Appendix B.

8.3 Sediment Handling, Transport, and Disposal

Excavated sediments and all removed structures and debris will be transloaded and transported to a commercial landfill that is permitted to receive the waste. Final transportation to the landfill is not defined by this engineering design. The selected contractor may utilize barge, truck, and rail depending on their approach to the work and the selected landfill facility. Examples of permitted landfills that have historically managed contaminated 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 the contractor can demonstrate they are properly permitted.

The contractor will be responsible for transport and disposal of the contaminated material at the approved licensed disposal facility. The contractor will be required to meet the following specific requirements for transportation and disposal:

- The contractor will be required to identify its selected licensed disposal facility as part of its bid and provide certification from the disposal facility that they can, and are willing to, accept the project contaminated materials with its contaminant and salinity concentrations.
- Debris will be disposed with the dredge sediment at the selected licensed disposal facility. The separation of debris from the dredge sediment may be completed by the contractor or the contractor may coordinate with the disposal facility to complete separation.
- The contractor will be responsible for the safe transport of all waste (e.g., contaminated sediment, effluent, and debris) in accordance with all applicable regulations and guidelines.
- When wet materials are transported, haul trucks or containers will be lined or otherwise sealed to prevent release of sediment during transport.
- Waste will be tarped and adequately secured to minimize the release of odors and dust and to prevent spillage.
- The contractor will prepare and sign all manifests and obtain all approvals for the transport of contaminated sediment and debris.

- The contractor will not be permitted to modify its accepted disposal facility without prior approval.
- The contractor will be required to provide legible copies of all manifest, weight bills, bill of lading and other records associated with sediment and other material handling, that is associated with off-site transport and disposal.

8.4 Material Placement

It is assumed excavations and material placement will be completed in the dry to the extent possible and at least partially backfilled during the same tidal cycle that the excavation is performed. This section summarizes the materials and final grades proposed for each area. The final material placement design integrated multiple design criteria, including equipment operational capabilities, the extents of the removal units, engineered cap requirements, slope stability, tidal flat drainage, and surficial COC concentrations outside of Removal Unit boundaries. These criterion are further detailed in the subsequent subsections with material placement design presented in Appendix G, Sheets C10 through C17.

8.4.1 Allowable Overplacement

Allowable overplacement is defined as additional material placed above the required material placement design thickness to account for equipment accuracy and tolerance. With careful vertical control and modern positioning systems, it should be possible to limit overplacement to 3 inches. Therefore, a 3-inch maximum overplacement allowance will be used for each layer in a multilayer cap, or for the total thickness of backfill or EMNR.

8.4.2 Engineered Cap Design and Placement

This section summarizes the design for engineered caps to be constructed within SMA 3. An engineered cap will be placed to provide protective containment where contamination remains below the removal footprint. Engineered caps will include the following three layers:

- A minimum 6-inch-thick chemical isolation layer of clean sand
- A minimum 6-inch-thick filter layer of sand/gravel material with a D_{50} of approximately 0.4 (3/8) inches.
- A minimum 1-foot-thick armor layer of rock and quarry spalls materials with a D_{50} of approximately 4 inches and a maximum size of 8 inches.

These layers vary for the engineered cap in the head of the Logway Area to protect against the stormwater flows from the existing outfall. Sizing of the layers for this engineered cap are as follows:

- A minimum 6-inch-thick chemical isolation layer of clean sand

- A minimum 6-inch-thick filter layer of sand/gravel material with a D_{50} of approximately 0.4 (3/8) inches
- A minimum 6-inch-thick intermediate bedding layer of rock and quarry spalls materials with a D_{50} of approximately 5 inches and a maximum size of 8 inches
- A minimum 24-inch-thick armor layer with a D_{50} of approximately 11 inches and a maximum size of 16 inches

The layers provide protective containment consistent with cleanup requirements. All engineered cap armor layers will consist of angular materials and these areas will be covered with a nominal 6 inches of clean sand spread uniformly over the top of the armor. The gradations are summarized below.

Chemical Isolation Layer. The chemical isolation layer of the cap will consist of well-graded sand that is free of debris and organics, with less than 5% passing the US No. 200 sieve:

Sieve Size	Percent Passing
No. 4	99–100
No. 8	90–100
No. 16	56–90
No. 30	35–70
No. 50	10–30
No. 100	0–5
No. 200	0–3

Filter Layer. Filter layer of sand/gravel will conform to the following specifications:

Sieve Size	Percent Passing
2.5-inch	99–100
2-inch	65–95
1-inch	50–85
3/8-inch	40–60
No. 4	26–44
No. 40	16 max.
No. 200	5.0–9.0

Note:

2022 Washington Department of Transportation Standard Specification 9-03.11(1) Streambed Sediment

Quarry Spalls Armor Layer. Armor layer of will conform to the following specifications:

Sieve Size	Percent Passing
8-inch	100
3-inch	40 max.
3/4-inch	10 max.

Note:

Gradation consistent with Washington Department of Transportation Standard Specification 9-13.1 (5)

Head of Logway Armor Layer. USACE R-400 Graded Armor Layer (approximated based on stone with density of 165 pounds per cubic foot [lb/ft³]):

Sieve Size	Percent Passing
16-inch	99–100
13-inch	70–90
11-inch	30–60
8-inch	10 max.

8.4.3 Removal Area Backfill

Placing clean sand backfill in removal areas that are not slated for engineered caps (following excavation activities) provides greater certainty in achieving post-construction performance standards (i.e., reductions in surficial sediment concentrations). Additionally, with Removal Unit boundaries exclusively in the intertidal zone, the final surface is designed to provide drainage of the tidal flats while avoiding dramatic changes in post-construction elevations. Clean sand will be placed as backfill over all excavation extents, except where engineered caps are implemented, to pre-construction grades plus 6 inches, tying into the adjacent EMNR areas to provide consistent tidal flat drainage and habitat elevations.

8.4.4 Enhanced Monitored Natural Recovery

Following the incorporation of the PRDI data, as discussed in Section 2.2.5, the cPAH SWAC for the Site was 41.4 µg/kg and the estimated, theoretical, post-cleanup SWAC for the entire marine area was 31.5 µg/kg⁵. The post-cleanup SWAC will exceed the target background concentration of 21 micrograms per kilogram (µg/kg), unless remedial design areas for EMNR placement extend beyond the footprint of SMA 2. Therefore, the EMNR layer will be placed over additional areas outside of

⁵ The post-cleanup SWAC was estimated by using an assumed replacement value of 12 µg/kg cPAH TEQ for clean imported material in SMA-2 (areas exceeding the D/F and PCB RELs for EMNR) and in SMA-3 (areas exceeding the D/F and PCB RELs for capping/removal).

SMA-2 to achieve the cPAH TEQ SWAC, as needed to produce a final sediment surface that complies with Site CULs. Further discussion regarding the SWAC calculations is presented in Section 8.6.2.

All areas of SMA-2 include EMNR placement as the remedial action. The EMNR layer consists of a minimum 6-inch-thick layer of clean sand/gravel cover that will tie into the backfill for excavated areas. This clean material is not an engineered cap. Rather, it is intended to mix with the existing tidal mudflat surface. The EMNR material will be a clean, free-draining, granular material obtained from natural deposits and containing no organic matter. The EMNR material will be graded to the same limits as presented for Clean Sand in Section 8.4.2.

8.5 Shoreline Stabilization and Armoring

Shoreline stabilization will primarily consist of rock armoring with angular materials as described by Ecology (Ecology 2025b), throughout the shoreline along the Logway and South Shoreline areas to prevent shoreline erosion that may lead to recontamination. In some areas, shoreline armoring will be connected to the engineered caps and overlap as needed. Armor stone will be placed after the structure and debris removal and temporary shoring installation has been completed.

A armor sizing and layer thickness are dependent on armor placement location. The design scenario selected for the South Shoreline armoring resulted in armor stone with a D_{50} of 11 inches, an intermediate bedding layer with a D_{50} of 4 inches, and a filter layer with a D_{50} of 3/8 inches. The design scenario selected for the Logway shoreline armoring resulted in armor stone with a D_{50} of 6 inches and a filter layer with a D_{50} of 1/4 inches. However, due to the existing gradation and to simplify the required construction materials, the Logway will be constructed with the same armor stone and filter layers as seen on the South Shoreline. The filter layers and armor layers may be modified at subsequent phases of the design if further analysis or material availability warrants the use of geotextile fabric or rock mats.

Bedding and filter layer thicknesses of 6 inches underneath 24 inches of armor stone will be required to meet long-term slope stability design requirements as well as resistance to wave and current erosive forces. Discussion of armor layer thickness and nominal sizing is included in Appendices B and C, respectively. The various shoreline armoring components will be graded between the following limits:

- **Logway and South Shoreline Armor Layer:**
 - USACE R-400 Graded Armor Layer (approximated based on stone with density of 165 lb/ft³)

Sieve Size	Percent Passing
16-inch	99-100
13-inch	70-90
11-inch	30-60
8-inch	10 max.

- **Logway and South Shoreline Intermediate Bedding Layer:**
 - Washington Quarry Spalls Armor Layer

Sieve Size	Percent Passing
8-inch	100
3-inch	40 max.
3/4-inch	10 max.

Note:

Washington Department of Transportation Standard Specification 9-13.1 (5)

- **Logway and South Shoreline Filter Layer:**
 - 3/8-inch Filter Layer

Sieve Size	Percent Passing
2.5-inch	99–100
2-inch	65–95
1-inch	50–85
3/8-inch	40–60
No. 4	26–44
No. 40	16 max.
No. 200	5.0–9.0

Notes:

2022 Washington Department of Transportation Standard Specification 9-03.11(1) Streambed Sediment

8.5.1 Climate Change Resilience Considerations

Climate change is being addressed in this design by incorporating projected sea level rise and extreme wind events into the coastal design framework. The sea level rise memo prepared for this project (Anchor QEA 2020) designated the project as a long-term or high-risk remedial site that requires the consideration of sea level rise at the high end of the projections assumed for the end of the century, as well as inundation under both the BFE and MHHW. *Projected Sea Level Rise for Washington State – A 2018 Assessment* (Miller et al. 2018) states that the likely range of sea level rise is considered to fall between the 83% and 17% likelihood. In this case, by 2100 sea level rise could reach 1.6 to 2.9 feet (0.49 to 0.88 meters) under RCP 8.5, respectively. Due to the high-risk categorization of the Site determined using Ecology guidance, at a minimum, the upper end of this range should be considered. Rather than accounting solely for the end-of-century estimate, this analysis accounted for the 100-year sea level rise estimate using the RCP 8.5 50% likelihood estimate for 2130 of 3.0 feet (0.91 meters). In addition, extremal wind analyses were performed to characterize

the 100-year return-period wind speeds, ensuring that wind-driven wave conditions are appropriately captured under both current and anticipated future climates. These considerations help provide shoreline stabilization and cap designs that remain resilient and effective over the long term.

8.6 Post-Construction Surface Chemistry Conditions

A predicted SWAC of the post-construction surface was estimated using digital geospatial methods. Industry standard ArcGIS Pro software was used to conduct all geospatial analyses associated with this effort. The calculations are provided in the subsequent sections, along with the predicted post-construction surface concentrations in Figure 3.

8.6.1 *Inverse Distance Weighting Interpolation*

Chemistry interpolations of Site surface sediments concentrations were performed using the IDW algorithm, as implemented within the GeoStatistical Analyst extension to ArcGIS Pro. IDW is a relatively basic algorithm that is well suited to estimations involving environmental data. IDW assigns values to unsampled points within the interpolation domain using a weighted average of the sample points within some search distance of the unsampled points, with the points nearer to the unsampled point having greater influence over the concentration assigned to the unsampled point than points farther away. IDW interpolation parameters were selected based on exploratory analyses of the chemistry data. A brief discussion of IDW parameters used to perform the cPAH concentration interpolation is presented below:

- **Power:** Sample weights are assigned using the inverse of the distance between a sampled location and an estimated location raised to a mathematical power. Higher power values allow nearby sample locations to apply greater influence, while lower power values increase the influence of sample locations that are farther away. A power of 3 was used for inverse distance squared weighted interpolation because it provided the best compromise between minimizing the root mean squared error during cross-validation while maintaining interpolation continuity.
- **Search Radius:** The search radius defines the distance around each estimated location within which sample points are selected to calculate its estimated value. A search radius of 500 feet was selected to ensure that a sufficient number of neighboring data points would be captured within the search radius in site areas having lower data density.
- **Minimum Number of Neighbors:** This parameter defines the minimum number of sample points within a search radius that are used to calculate an estimated value. A value of 6 was selected to ensure that estimated values were based on a reasonably sized sample of neighboring values. If too few samples exist in the search area to meet this minimum criterion, the algorithm will interpolate values using whatever samples are available, down to a minimum of three samples.

- **Maximum Number of Neighbors:** This parameter defines the maximum number of sample points within a search radius that are used to calculate an estimated value. A value of 12 was selected as a reasonable but not excessive number of neighboring points to use for interpolation. Larger values of this parameter may produce smoother contours, but at the expense of more aggressive averaging and a reduced ability to resolve local heterogeneities in the concentration distribution.

All concentration data were log-transformed prior to interpolation to account for the pronounced skewness and lognormality of the datasets, which is typical of environmental data and further compounded by the heterogeneous conditions at the Site. Site cPAH surface sediment concentrations within the dataset range from 1.7 µg/kg to 300 µg/kg and include locally steep gradients. The cPAH IDW interpolation was conducted using log-transformed values, and a log-transformed raster surface was developed consistent with the generally lognormal data distributions. Then, a back-transformed raster surface was generated to enable presentation of the raster in its original units of µg/kg and to enable calculation of the SWAC for the Site.

8.6.2 *SWAC Calculation*

A SWAC is an area-weighted average of the interpolated sample concentration raster surface used to estimate mean contaminant concentration across a specified area. The interpolated raster surface created for cPAH using the IDW algorithm comprises a mesh of 1-foot by 1-foot grid cells distributed across all site areas within the marine site boundary. Because each grid cell is exactly the same area (i.e., 1 square foot), using the average of the interpolated concentration of all grid cells yields the average cPAH concentration within the marine site boundary.

A pre-construction SWAC of 41.37 µg/kg was calculated from the original cPAH interpolated raster surface without considering the remedial design implementation. Then a second, post-construction predicted SWAC was calculated from a modified version of the original cPAH interpolated raster where all concentrations within site areas targeted for sediment removal and backfill/capping or EMNR placement were replaced with a value of 12 µg/kg (approximately half of natural background concentrations). This replacement value was determined through an iterative evaluation of the effectiveness of EMNR and is based on assumed concentrations of import materials. The calculated post-construction SWAC is 20.1 µg/kg, which includes SMA-1 where no EMNR placement is occurring.

9 Compliance Monitoring

Compliance monitoring requirements associated with remedy implementation consist of the following:

- Protection monitoring during construction to confirm that environmental impacts associated with remedial activities are minimized
- Performance monitoring to ensure that remedy construction is in accordance with the project plans and design
- Confirmation monitoring following remedy completion to confirm compliance with cleanup standards (Ecology 2023)

Requirements for compliance monitoring will be further established in the OMMP and the Construction Quality Assurance Project Plan (CQAP), submitted separately to Ecology.

9.1 Protection Monitoring

The performing PLPs will conduct protection monitoring during construction and operation and maintenance activities to confirm the protection of human health and the environment. Protection monitoring requirements for worker safety will be described in Health and Safety Plans, and environmental protection monitoring will be described in the OMMP and Construction Quality Assurance Project Plan or equivalent documents developed as pre-construction submittals. Such documents will be reviewed and approved by Ecology.

Marine sediment protection monitoring may consist of the following:

- A Water Quality Monitoring Plan will be prepared for the event that intertidal excavation needs to be performed in water (during high tide periods when the work zone is submerged); however the intent is to perform this work in the dry during low tide, to the extent possible.

In-water construction activities will be performed during allowable work windows established in coordination with state and federal resource agencies and tribes. Final work windows will be specified in the issued permits for the project.

9.1.1 Marine Mammal Monitoring

Pile removal and temporary shoring installation will be completed during low tide (in the dry) as much as possible. Therefore, the project is not anticipated to require an Incidental Harassment Authorization to comply with the Marine Mammal Protection Act. For any of the pile installation or removal work that cannot be accomplished in the dry, a marine mammal monitoring plan (MMMP) will be developed and implemented specifically for Southern resident killer whale (*Orcinus orca*) and humpback whale (*Megaptera novaeangliae*), which are listed under the Endangered Species Act (ESA). Marine mammal monitoring will be conducted according to the MMMP by protected species observers (PSOs) only when pile removal or pile installation activities must occur in water due to

construction access. Pulling of broken or whole timber piles without using vibratory equipment will not require monitoring even if completed in water.

The monitoring area will consist of an Exclusion Zone that is inclusive of both the Level A Injury Zone and Level B Harassment Zone for each species. The Exclusion Zone will vary by the type of pile work and marine mammal functional hearing group (Southern resident killer whale is a mid-frequency cetacean; humpback whale is a low-frequency cetacean). The Exclusion Zone comprises the areas where a Stop Work Order will be issued and a take documented if an ESA-listed marine mammal is present. A temporary stop-work protocol may be triggered when an ESA-listed marine mammal is observed approaching the Exclusion Zone during in-water vibratory or impact pile driving. Exclusion Zones will be established for each hearing group based on the type of in-water pile and construction activities, which could include the following:

- Removal of up to 200 timber piles (12- to 24-inch)
- Installation of up to 600 linear feet of sheet pile
- Installation and removal of up to 10 temporary steel pipe piles (24-inch)

The Exclusion Zone will be monitored by a sufficient number of qualified PSOs to effectively implement the MMMP. The number of PSOs may be different for each pile activity, which will be determined during development of the MMMP.

9.1.2 *Bird Monitoring*

U.S. Fish and Wildlife and WDFW recommend a nesting bird survey be completed before the commencement of cleanup activities to identify any active nests and avoid disturbing protected species within the Site. Additionally, a WDFW or other professional biologist would need to monitor and assess any nesting sites prior to their destruction or relocation.

9.1.3 *Archaeological Monitoring*

Multiple state and federal preservation laws may require review of potential impacts to archaeological and historic properties, including but not limited to the National Historic Properties Act, the Archaeological Resources Protection Act, the State Environmental Policy Act, Governor's Executive Order 21-02, Revised Code of Washington (RCW) 27.44, RCW 27.43, and RCW 68.50. Since the project and excavation are anticipated to take place at least 10 feet above sediments with potential to contain unrecorded archaeological resources, no further analysis is anticipated. If proposed project elements or excavation may take place deeper than 30 feet below existing ground surface, then additional review by a professional archaeologist and Ecology may be needed.

There is low potential to encounter archaeological or cultural resources during the project. An MIDP is included in Appendix F and will be kept on Site during ground-disturbing activities.

9.2 Performance Monitoring

Performance monitoring will be performed during and immediately after cleanup construction to confirm that cleanup action has attained cleanup standards, remediation levels, other performance standards such as construction quality control measures or monitoring necessary to demonstrate compliance with a permit, or, where a permit exemption applies, the substantive requirements of other laws. Performance monitoring will be described in the Construction Quality Assurance Plan or equivalent documents developed for such monitoring. The performing PLPs will submit such documents to Ecology for review and approval.

Performance monitoring will consist of the following:

- Construction quality control surveys of intertidal material removal to ensure design criteria (limits and depths) are achieved during construction
- Construction quality control surveys of intertidal material placement (backfill, EMNR layer, and engineered caps) to ensure design criteria (thicknesses and tolerances) are achieved during construction
- Chemical and geotechnical testing of imported backfill and capping material

9.3 Confirmation (Long-Term) Monitoring

Confirmation monitoring will be performed after cleanup construction to confirm the long-term effectiveness of the cleanup action once cleanup standards have been attained. Confirmation monitoring will be described in the OMMP or equivalent documents developed for such monitoring. The OMMP will be submitted to Ecology for review and approval.

Confirmation monitoring will consist of the following:

- Routine visual inspections and surveys of engineered sediment cap areas to verify that the caps remain intact and protective
- Periodic post-construction sampling and testing of sediments within the biologically active zone to verify that cleanup standards are met and continue to be met
- Periodic post-construction sampling and testing of sediments near the outfalls to check for any recontamination.

Details of the confirmation monitoring requirements will be presented in the OMMP. The OMMP will specify details such as the following:

- Survey and inspection methods and frequency
- Sediment sampling methods, locations, analyses, and frequency
- Required maintenance activities

10 Institutional and Engineering Controls

Institutional controls to be implemented under this project include the recording of a restrictive covenant on the property with the County Assessor's Office. This covenant will include restrictions for sediment in capped areas. Institutional controls are needed where the cleanup action leaves contaminated sediment exceeding CULs. Sediment exceeding CULs will remain where engineered capping is the selected cleanup method, and a protective covenant will restrict disturbance in these areas. The covenant will also include requirements for any future use or development in capped areas so that the capping is not compromised or caps are reconstructed if disturbed. The covenant will be recorded following the completion of the work as described in this EDR.

11 Construction Sequencing and 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 marine cleanup actions with the exception that the upland stormwater infrastructure must be cleaned up prior to shoreline and sediment actions. However, there may be advantages to completing upland and in-water work under the same construction action. This section provides an overview of the anticipated implementation sequencing and schedule for the work.

Cleanup construction activities described in this EDR are targeted to be completed within a single season if possible. The work will comply with applicable work windows established in final project permits and approvals. The targeted start date for construction is October 2026, subject to final permitting approvals. Construction activities will be conducted in a manner that achieves the following goals:

- Provide for a safe work environment.
- Protect existing facilities from damage.
- Maintain reasonable access and operation for tenants.
- Minimize the potential for recontamination.
- Accomplish the work in a timely manner.
- Accomplish the in-water work during the allowable work windows established in the project permits (if applicable).
- Accomplish the work in a cost-effective manner.
- Comply with all state, federal, and local regulations.

Activities that are not subject to in-water work restrictions may include the following:

- Preparation and removal of staging areas
- Preparation, processing, testing (if needed for disposal), and removal of upland stockpile areas
- Upland staging or transportation and disposal of removed contaminated sediment, soils, debris, and other construction materials

The contractor will prepare a construction sequencing approach in their Construction Work Plan that describes how they will meet sequencing requirements of all material removal, debris and structure removal, and material placement. The estimated material removal volumes and material placement volumes for this phase of the design efforts, including estimated over-excavation and over-placement allowances are as follows:

- Sediment Removal: 8,000 cubic yards
- Engineered Cap Placement: 1,000 cubic yards
- General Backfill: 7,500 cubic yards
- Shoreline Armor: 10,000 cubic yards

- EMNR: 9,000 cubic yards

It is expected that the work will follow the general sequence outlined as follows:

- Demolition of marine structures (including the barge remnants and two bulkheads) and approximately 53 timber piles or dolphins
- Contaminated sediment removal and backfill of Removal Units (general backfill or engineered cap areas), completed in a phased manner such that all excavated areas are backfilled or at a minimum, initially covered during a single tide cycle to minimize contaminated sediment redistribution, including shoreline armoring
- EMNR placement per the Construction Plans, which may begin after all removal and backfill activities are complete within a given area. EMNR placement may occur simultaneously with removal activities, but only if the two activities are being completed in different areas (i.e., EMNR placement in the Logway Area while removal and backfill activities are occurring along the South Shoreline).
- Work may be completed over multiple seasons, depending on permitted work windows.
- Following the completion of all remedial work, implement the post-construction confirmation monitoring.

12 Ongoing Design Considerations

At this phase of development of design, several considerations will need to be addressed as discussions with Ecology and other permitting agencies progress. These considerations will be further explored, and design components will be proposed to address them as needed. The list of ongoing design considerations is as follows:

- Final work windows as determined in the issued permits, including measures to relocate or work around existing osprey nests
- Availability of backfill, capping, and EMNR materials to confirm if proposed gradations and chemical characteristics are achievable from local sources
- Refine shoreline armor sizing and details based on availability of materials.
- Refine top of slope details at existing edge of pavement and utilities.
- Refine the sequencing and preferred means and methods for removal and backfill.

Final locations and construction details for stormwater outfalls, energy dissipation structures, and other erosion control methods.

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