Cleanup Action Plan
Western Port Angeles Harbor

Port Angeles, Washington

Toxics Cleanup Program

Washington State Department of Ecology
Olympia, Washington

May 2025

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Contact Information

Toxics Cleanup Program

Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775
Phone: 360-407-6300

Website[2]: Washington State Department of Ecology

Connie Groven, PE, Cleanup Project Manager
P.O. Box 47775
Olympia, WA 98504-7775
Phone: 360-584-7037
Connie.Groven@ecy.wa.gov

Nancy Davis. Public Involvement Coordinator
P.O. Box 47775
Olympia, WA 98504-7775
Phone: 360-489-4971
Nancy.Davis@ecy.wa.gov

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[1] https://www.ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database
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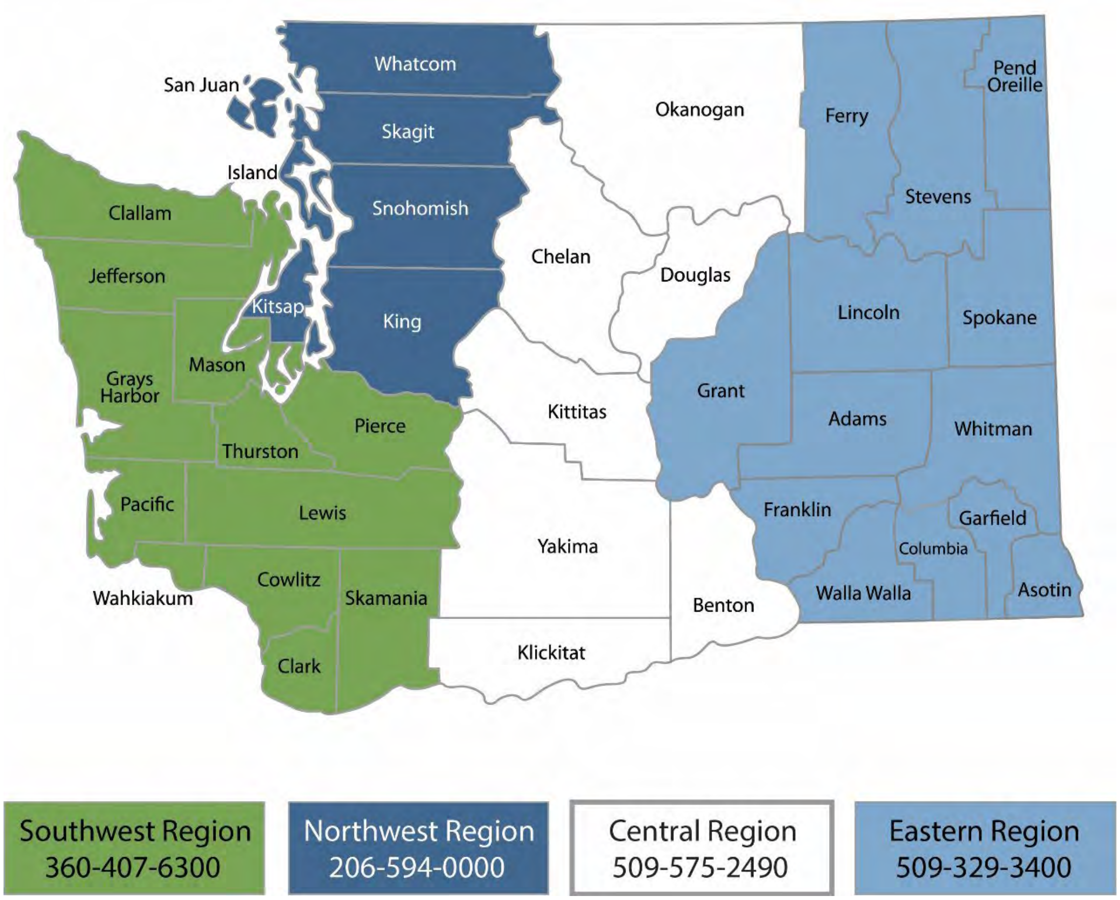

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Headquarters	Statewide	P.O. Box 46700 Olympia, WA 98504	360-407-6000

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Executive Summary

This Cleanup Action Plan (CAP) describes the sediment cleanup actions selected for a portion of the Western Port Angeles Harbor (WPAH) Site in Port Angeles, Washington, in which contaminant concentrations in sediment exceed the sediment cleanup levels as a result of historical operations in the western portion of Port Angeles Harbor. The area of cleanup is referred to as the WPAH Sediment Cleanup Unit (SCU).

This CAP was prepared by Ecology in collaboration with the Western Port Angeles Harbor Group (WPAH Group) to meet the requirements of the Model Toxics Control Cleanup Act (MTCA) administered by Ecology under Chapter 173-340 WAC. The WPAH Site potentially liable persons include the Port of Port Angeles; Georgia-Pacific LLC; Nippon Paper Industries USA Co., Ltd.; the City of Port Angeles; Merrill & Ring Inc.; and Owens Corning. The WPAH Group consists of the Port of Port Angeles, Georgia-Pacific LLC, Nippon Paper Industries USA Co., Ltd., the City of Port Angeles, and Merrill & Ring Inc. This CAP is based on findings described in the October 2020 *Western Port Angeles Harbor Sediment Cleanup Unit Remedial Investigation/Feasibility Study* approved by Ecology and describes Ecology's selected cleanup actions for the SCU and sets forth the requirements to be met by the cleanup actions.

Port Angeles Harbor (Harbor) is located on the northern coast of Washington's Olympic Peninsula and along the southern shoreline of the Strait of Juan de Fuca. The Harbor has been identified as a priority environmental cleanup and restoration project by Ecology. The Harbor is located within the traditional territory of the Lower Elwha Klallam Tribe (LEKT), a federally recognized Tribe with treaty fishing, hunting, and gathering rights in the Harbor, whose people have lived throughout the northern Olympic Peninsula, including the Harbor, for thousands of years. Industrial development of the Harbor began in the late 1800s, with the founding and growth of the City of Port Angeles. Historical industries included sawmills, plywood manufacturing, pulp and paper production, other operations related to wood processing, commercial fishing and fish packing, bulk fuel facilities, boat building and refurbishing, marinas, and marine shipping and transport.

As a result of historical and current activities, hazardous substances in the Harbor pose risks for both human health and the environment. Risks for human health are associated with the consumption of fish and shellfish. Benthic invertebrates living within Harbor sediments may also be at risk. For each potential exposure pathway, hazardous substances that drive human health or environmental risks have been identified, and cleanup standards have been developed to protect the receptors for those pathways.

To evaluate cleanup options that address human health and environmental risks, investigations were conducted within the WPAH Study Area, which includes the area to the south of Ediz Hook and west of the Rayonier Mill Study Area. The area within the WPAH Study Area where contamination concentrations exceeded preliminary sediment cleanup levels was designated as the WPAH SCU. The SCU was divided into three cleanup areas, which are referred to as Sediment Management Areas (SMAs): SMA 1, SMA 2, and SMA 3. Several alternatives were considered for each of the SMAs by means of a MTCA/SMS comparative evaluation. The evaluation identified a cleanup remedy for all three SMAs that protects human health and the environment, is permanent to the maximum extent practicable, achieves the sediment cleanup levels within a reasonable time frame, anticipates the potential discovery and protection of cultural resources, and is consistent with current and anticipated future recreational, commercial, and industrial uses of the western Harbor.

The combined cleanup remedy includes the following actions and approximate extents:

- 3 acres of intertidal excavation (SMA 1 and 2) to remove contaminated sediment and provide space for capping deeper contaminated sediment.
- Excavation of 0.8 acre of upland fill soils used to create the lagoon causeway and additional shoreline to construct aquatic habitat, offsetting the loss of aquatic habitat (SMA 2).
- 4 acres of intertidal excavation/subtidal dredging* to remove contaminated sediment in areas suitable for enhanced monitored natural recovery following removal (SMA 2).
- 42 acres of engineered cap (SMAs 1 and 2) to contain contaminated sediment.
- 180 acres of enhanced monitored natural recovery (SMAs 2 and 3) to enhance the rate of natural recovery (reduction in contaminant concentrations in surface and near surface sediments via input of sediments from creeks discharging to the Harbor).
- 950 acres of monitored natural recovery (SCU-wide) to confirm sediment improvement associated with sedimentation over time.

In total, approximately 25,000 cubic yards of intertidal and subtidal sediment and nearshore soils will be excavated, and approximately 280,000 cubic yards of sand and gravel will be placed, requiring approximately six seasons of construction. Achievement of the sediment cleanup levels throughout the western Harbor is expected within 10 years of the completion of construction, with implementation of institutional controls, as necessary to ensure continued protectiveness of the remedy. Monitoring will be performed to confirm the effectiveness of the cleanup and restoration of sediment quality.

The total cleanup remedy is anticipated to result in no net loss of aquatic habitat area or function. Placement of engineered caps within SMA 2 intertidal areas will result in the loss of approximately 0.8 acres of aquatic habitat. Habitat area mitigation will be on-site and in-kind by excavating approximately 0.8 acres of existing upland fill soils, placed in the 1960s to create the causeway in the southwest corner of the lagoon, as well as additional adjacent upland soils excavation along the SMA 2 shoreline, resulting in no net loss of aquatic habitat area. The specific locations and layout of shoreline upland excavation required for aquatic habitat mitigation will

* Intertidal sediment removal is referred to as "excavation." Subtidal sediment removal is referred to as "dredging." Use of the term "dredging" may include sediment removal "in the dry" below the MLLW elevation during low tide stages using standard construction equipment. Specific means and methods for sediment removal will be determined during remedial design.

be determined during remedial design and will be informed by pre-remedial design data collection to refine the intertidal capping area.

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
AO	Agreed Order
ARAR	Applicable or relevant and appropriate requirement
BMP	Best management practice
CAP	Cleanup Action Plan
CAR	Cleanup Action Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
City	City of Port Angeles
cm	Centimeters
Corps	U.S. Army Corps of Engineers
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CQAAMP	Construction Quality Assurance and Adaptive Management Plan
CSL	Cleanup Screening Level

Acronym/ Abbreviation	Definition
CSM	Conceptual site model
CY	Cubic yards
DCA	Disproportionate cost analysis
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EIM	Environmental Information Management System
EJScreen	Environmental Protection Agency’s Environmental Justice Screening and Mapping Tool
EMNR	Enhanced monitored natural recovery
Harbor	Port Angeles Harbor
IHS	Indicator hazardous substance
LEKT	Lower Elwha Klallam Tribe
McKinley	McKinley Paper Company
MDP	Monitoring and Discovery Plan
MLLW	Mean lower low water
MNR	Monitored natural recovery
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
NPIUSA	Nippon Paper Industries USA, Co., Ltd.
OMMP	Operations, Maintenance, and Monitoring Plan
PCB	Polychlorinated biphenyl
POC	Point of compliance
Port	Port of Port Angeles
PQL	Practical quantitation limit
QAPP	Quality Assurance Project Plan
RAL	Remedial action level
RAO	Remedial action objective
RDWP	Remedial Design Work Plan

Acronym/ Abbreviation	Definition
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SCL	Sediment cleanup level
SCO	Sediment cleanup objective
SCU	Sediment Cleanup Unit
SEPA	State Environmental Policy Act
SMA	Sediment management area
SMS	Sediment Management Standards
SPI	Sediment profile imaging
SWAC	Surface-weighted average concentration
TEQ	Toxic equivalent
Trustee Council	Port Angeles Harbor Trustee Council
WAC	Washington Administrative Code
WPAH	Western Port Angeles Harbor
WPAH Group	Western Port Angeles Harbor Group

1.0 Introduction

This Cleanup Action Plan (CAP) describes the sediment cleanup actions selected by the Washington State Department of Ecology (Ecology) for the Western Port Angeles Harbor (WPAH) Site near Port Angeles, Washington (Figure 1.1). The WPAH Site potentially liable persons include the Port of Port Angeles; Georgia-Pacific LLC; Nippon Paper Industries USA Co., Ltd.; the City of Port Angeles; Merrill & Ring Inc.; and Owens Corning. The WPAH Group consists of the Port of Port Angeles, Georgia-Pacific LLC, Nippon Paper Industries USA Co., Ltd., the City of Port Angeles, and Merrill & Ring Inc. A Remedial Investigation/Feasibility Study (RI/FS) was completed for the WPAH Site (WPAH Group 2020) pursuant to Agreed Order (AO) No. DE 9781 between Ecology and the WPAH Group.

The RI/FS summarized the investigations that were conducted within the WPAH Study Area, which includes the area to the south of Ediz Hook and west of the Rayonier Mill Study Area. The WPAH Study Area is shown on Figure 1.2. Based on sampling results, the area within the WPAH Study Area where contamination concentrations exceeded preliminary cleanup levels was designated as the WPAH Sediment Cleanup Unit (SCU). The consent decree in which this CAP is incorporated provides that the Site “consists of the Western Port Angeles Harbor Sediment Cleanup Unit (SCU).”

This CAP describes the cleanup actions that will be performed in the WPAH SCU, which is shown in Figure 1.2. The cleanup actions described in this CAP fulfill the requirements of the Model Toxics Control Act (MTCA), set forth in Revised Code of Washington, Chapter 70A-305, and administered by Ecology under the MTCA Cleanup Regulations (Chapter 173-340 WAC).

This CAP describes and summarizes the following:

- Port Angeles Harbor setting
- Previous sediment investigations
- WPAH SCU conditions
- WPAH SCU-specific sediment cleanup levels (SCLs) and points of compliance (POCs) for indicator hazardous substances (IHSs)
- Selected cleanup actions for the WPAH SCU and the rationale for remedy selection
- How selected cleanup actions comply with applicable state and federal laws
- Engineering and institutional controls required for management of residual contamination in the WPAH SCU after cleanup action construction
- Compliance monitoring requirements
- Schedule for implementing the CAP

1.1 Preliminary Determination

Ecology has made a preliminary determination that the cleanup actions described in this CAP comply with the requirements for selection of cleanup actions under WAC 173-340-360. Specifically, Ecology has determined that the selected remedy is protective of human health and the environment, complies with applicable or relevant and appropriate requirements (ARARs), complies with cleanup standards, provides for compliance monitoring, uses permanent solutions to the maximum extent practicable, provides for a reasonable restoration timeframe, and addresses public concerns received to date. This CAP will be provided for public review, and Ecology will consider public comments and concerns prior to finalizing the CAP.

1.2 Regulatory Framework

Under Ecology oversight, the WPAH Group evaluated the WPAH Study Area in accordance with AO No. DE 9781 (as amended on November 30, 2020) between Ecology and the WPAH Group. The AO required the completion of an RI/FS and, in a 2020 amendment, preparation of a preliminary draft CAP, pursuant to the requirements of MTCA and SMS. The RI/FS was prepared by the WPAH Group and approved by Ecology in December 2020. A preliminary draft CAP was prepared and submitted in March 2021 and a revised preliminary draft CAP was submitted in December 2021 to fulfill the requirements of AO No. DE 9781. Ecology used these preliminary draft CAPs to prepare this CAP.

Project milestones and deliverables under the AO included the following:

- Final RI/FS Work Plan, May 2013 (WPAH Group 2013)
- RI/FS sampling: June–July 2013
- Final RI/FS Data Report, February 2014 (Integral et al. 2014)
- Draft White Paper: Site-specific Sediment Cleanup Levels, Remediation Levels, and Sediment Management Areas for Bioaccumulative Chemicals, May 2014 (WPAH Group 2014)
- Supplemental RI/FS sampling: September 2014
- Final White Paper: Western Port Angeles Harbor: RI/FS Approach, April 2017 (WPAH Group 2017)
- Agency Review Draft RI/FS, April 2018
- Public Review Draft RI/FS, March 2019
- Final RI/FS, October 2020 (WPAH Group 2020)
- Preliminary Draft Cleanup Action Plan (WPAH Group 2021a)
- Revised Preliminary Draft Cleanup Action Plan (WPAH Group 2021b)

Cleanup actions within the SCU must comply with ARARs. Because cleanup actions in the SCU are expected to be conducted under a Consent Decree with Ecology, these actions would be exempt from procedural requirements of certain Washington state laws and regulations and all local permits (WAC 173-340-710[9][b]). However, implementation of the cleanup actions must comply with the substantive requirements of ARARs, and Ecology must provide an opportunity for comment by the public and by the state agencies and local governments that would otherwise implement these laws (WAC 173-340-710[9][d]). A full list of ARARs, including substantive requirements for procedurally exempt local and state laws and regulations, is provided in Section 4.3.3.

In-water construction within the SCU will require authorization from the U.S. Army Corps of Engineers (Corps) under Nationwide Permit 38 promulgated under the Clean Water Act. Prior to issuing the permit, the Corps will consult with other appropriate federal jurisdictions and tribes.

The State Environmental Policy Act (SEPA) process for review and analysis of environmental impacts resulting from the cleanup actions will be conducted by Ecology prior to project construction.

2.0 Summary of Sediment Cleanup Unit Conditions

2.1 Harbor Description and Setting

Port Angeles Harbor (Harbor) is a natural deep-water harbor located on the northern coast of Washington's Olympic Peninsula and along the southern shoreline of the Strait of Juan de Fuca in Port Angeles, Washington (Figure 1.1). Since its incorporation in 1890, the City has grown into the largest urban center on the northern Olympic Peninsula. Over the past 130 years, operations within or adjacent to the Harbor have included sawmills, plywood manufacturing, pulp and paper production, other operations related to wood processing, commercial fishing and fish packing, bulk fuel facilities, boat building and refurbishing, marinas, and marine shipping and transport. The Harbor has been identified as a priority environmental cleanup and restoration project by Ecology as part of the Puget Sound Initiative.

The Harbor is bounded to the west and south by City property and to the north by Ediz Hook, an approximate 3-mile-long sand spit that extends eastward from the Harbor's west end (Figure 1.2). Ediz Hook protects the Harbor from the open-ocean waves within the Strait of Juan de Fuca. The Harbor contains approximately 26 miles of marine shoreline with water depths as great as 170 feet near Ediz Hook (Ecology 2012). An approximate 25-acre lagoon is located at the far western end of the Harbor and is connected to the Harbor by a channel.

A variety of marine aquatic species currently reside in the Harbor, including a functional benthic community, macroalgae, seagrass, and more than 60 species of fish, shellfish, birds, and marine mammals. The western Harbor is fished recreationally but has been closed to tribal treaty commercial and subsistence harvest of Dungeness crab due to the contaminant-based moratorium imposed by LEKT in 2007.

Five long-standing health advisories related to seafood consumption apply to Port Angeles Harbor, including a 2006 Washington State Department of Health Puget Sound-wide fish advisory for mercury and polychlorinated biphenyls (PCBs)[4], a 2016 Harbor-wide crab and crab butter consumption advisory[5], and the Harbor-wide closure of shellfish harvesting[6] due to the presence of bacterial pollution and the periodic presence of paralytic and diarrhetic shellfish biotoxins.

2.2 Historical and Current Use

2.2.1 Historical Use

[4] Washington State Department of Health. 2006. *Human Health Evaluation of Contaminants in Puget Sound Fish*. https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs/334-104.pdf?uid=64f7bce71aa30. October.

[5] Washington State Department of Health. 2016. Human Health Evaluation of Contaminants in Puget Sound Dungeness Crab (*Metacarcinus magister*) and Spot Prawn (*Pandalus platyderos*). https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs/334-378.pdf?uid=64f7bfca81395. May.

[6] Washington State Department of Health. Shellfish Safety Information. https://fortress.wa.gov/doh/biotoxin/biotoxin.html

Port Angeles Harbor is located within the traditional territory of the LEKT. For over 2,000 years, Klallam Indians lived in numerous villages on much of the northern Olympic Peninsula and south Vancouver Island. The Harbor area was historically inhabited by two major Klallam villages: I'e'nis and Tse-whit-zen (Ecology 2012). The barrier-beach lagoon at the base of Ediz Hook provided a salt marsh habitat that served as a rich source of diverse aquatic life, and was thus an ideal location for Tse-whit-zen village, as well as continued occupation by tribal fishing houses well into the first half of the twentieth century. In 1937, Lower Elwha Indians were relocated from the Harbor and elsewhere to lands at the mouth of the Elwha River, which was acquired by the United States in trust for the Tribe under the recently enacted Indian Reorganization Act of 1934 (and which the Interior Secretary formally proclaimed as the Lower Elwha Indian Reservation in 1968). Since then, LEKT has maintained a strong presence at the Harbor, harvesting aquatic resources under its treaty rights, restoring the shoreline and other aquatic habitat, and protecting cultural resources and remains of its ancestors at Tse-whit-zen. Given the location of Tse-whit-zen in the western portion of the Harbor, and significant identified artifact deposits, there is a high probability that archaeological material related to Native American residential activities and resource procurement may be found within the Harbor area.

The industrial history of the Harbor began with the development of sawmills and fish-packing operations in the late 1800s. Over the past 130 years, industrial operations within the harbor or along its shoreline have included sawmills, plywood manufacturing, pulp and paper production, wood handling, fish packing, marine shipping and transport, boat building, bulk fuel facilities, marinas, and commercial fishing. In the early 20th century, the tidal flats that formed the lagoon's barrier beach were filled in, which reduced the surface connectivity between the lagoon and the harbor, and the main connecting channel was also straightened and armored. The lagoon nevertheless continues to provide significant salt marsh habitat. In general, waterfront industrial operations within the Harbor peaked in the 1950s and 1960s.

Several pulp mills—including ITT Rayonier (1930 until 1997), part of the adjacent Rayonier Mill SCU—operated within the Harbor. A paper mill has operated since 1920 at the base of Ediz Hook (1805 Marine Drive); the mill is currently owned by McKinley Paper Company (McKinley) and was historically owned by NPIUSA, as well as corporate predecessors to Georgia-Pacific. From 1919 through 1970, a paperboard plant owned by Fibreboard and its predecessors operated at 1313 Marine Drive. Owens Corning is the corporate successor to Fibreboard. For a large part of the 20th century, these facilities discharged industrial process wastewater into the Harbor. From 1958 to 1988, Merrill & Ring operated a lumber mill at 1608 Marine Drive, as well as on an adjacent property, which included wood-treating operations.

Historically, these various lumber-related facilities have, at one time or another, transported and stored logs, wood chips, and/or sawdust in nearshore areas or on barges in the Harbor. Some of these industrial operations have resulted in the accumulation of wood debris in log-handling areas of the Harbor, including logs, large pieces of wood, small pieces of wood or wood chips, very fine wood particles/fibers, and pulp-like material. Hog fuel boilers have also historically been used at these facilities, which discharged contaminants via emissions into the air.

Several bulk petroleum storage and distribution facilities have historically been present in the Harbor. Marathon (formerly Tesoro) operates the remaining active petroleum facility on Ediz Hook.

The Port acquired and/or created property along the Port Angeles waterfront, starting with Terminal 1 in 1927, which is used for top side repair and berthing of large vessels, as well as Terminal 3, which is the Port's primary cargo loading pier for forest products. From 1941 through 2011, upland lands leased to Peninsula Plywood Group, LLC (PenPly) were used for a plywood mill. The Port also owns Terminal 2 (from 1959 to the present), which supports a ferry terminal, and the Port Angeles Boat Haven marina (from late 1946 to the present). The Port also provides facilities for handling logs.

Historical discharges to the Harbor have included the City's sanitary and storm sewer system. Some of the Port's tenants and other private entities also historically discharged industrial effluents and stormwater into the Harbor.

2.2.2 Current Use

Currently, the shoreline areas in the western portion of the Port Angeles Harbor are primarily owned by the City, the Port, McKinley, LEKT, and the U.S. government. The Port owns three sites on the Harbor shoreline that are undergoing MTCA cleanup, one that has been largely remediated (the K Ply Site), one that is at the draft CAP phase (the Marine Trades Area Site), and one that is in the remedial investigation phase (Terminals 5, 6 & 7 Uplands).

Current in-water activities are conducted under active Washington State Department of Natural Resources (DNR) leases, including aquatic land currently leased to the Port and managed under a Port Management Agreement. The Port currently operates four deep-water marine terminals (Terminals 1, 3, 4, and 7), as well as terminals for ferry service, boat repair, and other industrial activities, and a marina. The Port also conducts log handling and rafting.

Industrial facilities currently discharge wastewater and/or stormwater through outfalls permitted under the National Pollutant Discharge Elimination System (NPDES). Municipal stormwater also currently discharges into the Harbor through NPDES-permitted outfalls.

In addition to the LEKT's historical presence in the harbor, the LEKT's interests include: its present-day treaty rights to harvest shellfish and other aquatic species in the Harbor; protection of the Tse-whit-zen site and cultural resources throughout the Harbor and shoreline; shoreline restoration projects on its own and adjacent properties on inner Ediz Hook; and participation in the Port Angeles Harbor Trustee Council ("Trustee Council"), which was formed in 2012 to pursue resolution of claims arising under MTCA, CERCLA, and other laws for injury to natural resources of the Harbor resulting from releases of toxic contamination. Ecology works collaboratively with the LEKT and the LEKT has commented and coordinated with Ecology on all aspects of the cleanup.[7] The cleanup is a distinct process from the natural resource damages process.[8]

2.3 Environmental Investigations

Beginning in 2002, numerous environmental investigations of Port Angeles Harbor have been conducted to characterize environmental conditions in the western Harbor. Based on prior environmental investigations, the WPAH Group worked collaboratively with Ecology to identify remaining RI/FS data gaps. Consistent with Ecology-approved work plans, sampling and analysis was conducted in 2013 and 2014 to fill remaining data gaps to support the RI/FS, including surface sediment sampling, sediment bioassays, bioaccumulation analyses, and sediment profile imaging (SPI) assessments of benthic habitat and community structure (WPAH Group 2020). Altogether, between 2002 and 2014, more than 240 surface sediment samples were collected from the WPAH Study Area and analyzed for a wide range of potential chemicals of concern to characterize the nature and extent of sediment contamination and define the SCU boundary. Details of these investigations are provided in the final RI/FS (WPAH Group 2020).

Overall, the environmental studies conducted in the western Harbor concluded the following:

- Limited benthic toxicity was observed within the western Harbor. Stations with benthic toxicity were primarily located in the inner harbor (i.e., the western portion of the SCU outside the lagoon) and were generally associated with chemical contamination.
- Various types of woody debris were observed throughout the western Harbor, with greater abundance observed near historical and current log storage area.
- Although distributions of hazardous substances varied within the western Harbor, surface sediments in the inner harbor and lagoon (i.e., the far western portion of the SCU) generally contained greater concentrations of metals (cadmium, mercury, and zinc) and the combined dioxin/furan toxic equivalent (TEQ) and PCB congener TEQ ("Total TEQ").[9] Other organic compounds, including carcinogenic polycyclic aromatic hydrocarbons (cPAHs), tended to be more widely distributed, with greater concentrations in areas of the western and southern Harbor shorelines near creosote pilings, stormwater discharges, and active industrial areas.

[7] Tribal Engagement is an integral part of Ecology's responsibility under chapter 70A.305 RCW, the Model Toxics Control Act (WAC 173-340-620(1)). See also WAC 173-340-380.

[8] Two other federally recognized Klallam/S'Klallam Tribes also have an interest in the Harbor, the Jamestown S'Klallam Tribe and the Port Gamble S'Klallam Tribe, who also hold treaty rights and participate in the Trustee Council. In addition to the three Tribes, the Trustee Council also includes Ecology, the U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration.

[9] Ecology established a WPAH SCU-specific IHS "Total TEQ" that combines the dioxin/furan TEQ and the PCB congener TEQ regional background values to establish an SCL representative of the combined regional background levels of dioxin/furan and PCB congeners. Dioxin/furan TEQ and total PCBs are, therefore, not considered separately as human health IHSs but are combined as Total TEQ.

2.4 Human Health and Environmental Exposure and Risk

Multiple exposure pathways in the SCU have been evaluated and are discussed in the RI/FS (WPAH Group 2020). A graphical representation of the current conceptual site model (CSM) of sources and exposure pathways is provided in Figure 2.1.

The primary sources of contamination in the WPAH SCU include upland, in-water, and overwater operations; spills; leaks; direct discharge of stormwater, sewage, and wastewater; nearshore hog fuel burning; log rafting; and creosote-treated wood piling. In general, the scale and nature of the historical operations were considerably different from current operations.

Hazardous substances present in the western Harbor pose risks to both human health and the environment. Risks for human health are associated with direct contact to sediment and the consumption of seafood. Risks are also posed to aquatic life such as benthic invertebrates living within the Harbor sediments.

For each exposure pathway, IHSs that drive human health or environmental risks were identified. Human health risks are associated with the bioaccumulation of metals (cadmium and mercury), cPAH TEQ, and Total TEQ. Risks for benthic communities are associated with metals (cadmium, mercury, and zinc). Cleanup standards for these hazardous substances were used to focus the development and evaluation of remedial alternatives in the RI/FS (WPAH Group 2020).

Based on a weight-of-evidence evaluation in the RI/FS, including radioisotope analyses, SPI surveys, and hydrodynamic calculations, most sediments in the western Harbor are highly stable and are not subject to resuspension even under worst-case hydrodynamic conditions (WPAH Group 2020). However, there are localized areas of the western Harbor that are subject to periodic scour and resuspension. These areas are either proximal to actively used docks and associated vessel propeller wash, or subject to peak tidal flows (e.g., the lagoon channel connected to the inner harbor) and nearshore waves.

3.0 Cleanup Requirements

3.1 Cleanup Standards

The sediment cleanup standards for the WPAH SCU consist of (1) SCLs that are protective of human health and the environment and (2) pathway specific POCs that designate the locations where the SCLs must be achieved.

SMS describes a two-tier framework for establishing the SCL. First, the sediment cleanup objective (SCO) and cleanup screening level (CSL) are established.

The SCO is established as the highest value of one of the following:

- Natural background
- Practical quantitation limit (PQL)
- A risk-based value, which is the lowest of the following:
  a) The SCO benthic criteria
  b) The SCO human health criteria which includes:
    i. 10^{-6} risk level for individual carcinogen
    ii. 10^{-5} risk level for multiple carcinogens or exposure pathways
    iii. Hazard quotient of 1 for individual non-carcinogens
    iv. Hazard index of 1 for multiple non-carcinogens
  c) The higher ecological trophic level species criteria
  d) Requirements of other applicable laws

The CSL is established as the highest value of one of the following:

- Regional background
- PQL
- A risk-based value, which is the lowest of the following:
  a) The CSL benthic criteria
  b) The CSL human health criteria which includes:

i. 10^{-5} total site risk level for individual or multiple carcinogens or exposure pathways

ii. Hazard quotient of 1 for individual non-carcinogens

iii. Hazard index of 1 for multiple non-carcinogens

c) The higher ecological trophic level species criteria

d) Requirements of other applicable laws

Once the final SCO and CSL have been established, the SCL is established within the range of levels at the SCO, the CSL, or at a level in between. The SCL is initially established at the SCO, which is the goal for all sediments in the state. The SCL can be adjusted upwards from the SCO without exceeding the CSL if one of the following conditions are met:

- Technical possibility. Whether it is technically possible to achieve and maintain the cleanup level at the applicable point of compliance (WAC 173-204-560(2)(a)(ii)(A)), or
- Net adverse environmental impacts. Whether achieving and maintaining the cleanup level will have a net adverse environmental impact on the aquatic environment (WAC 173-204-560(2)(a)(ii)(B)).

A POC is established on the appropriate spatial scale for each exposure scenario. For benthic risk, the POC is based on the depth of the biologically active zone and compliance is measured on a point-by-point basis. For human health and upper trophic level risk, the POC can be based on both depth and the area-wide average. The depth is established depending on the exposure scenario and any site-specific circumstances established in the CSM, such as the potential to be disturbed by anchoring or propeller wash.

The following exposure pathways were considered in establishing the SCLs:

- Protection of human health via direct contact with intertidal sediments.
- Protection of human health and higher trophic levels via consumption of seafood.
- Protection of benthic species in sediments.

The derivation of preliminary site-specific sediment cleanup levels, points of compliance, and the justification for adjusting the human health bioaccumulative sediment cleanup levels to the regional background based CSLs can be found in the Western Port Angeles Harbor: RI/FS Approach White Paper in Appendix A of the RI/FS (WPAH Group 2020).

3.1.1 Sediment Cleanup Levels and Points of Compliance

This section summarizes the IHSs in the SCU sediments for each exposure pathway and the associated SCLs. The POCs for sediment as they relate to each potential exposure pathway are indicated in Table 3.1. The exposure areas identified for each of the pathways are shown in

Figure 3.1. Details on the identification of IHSs and POCs can be found in Section 8 of the RI/FS (WPAH Group 2020)

Table 3.1
Sediment Cleanup Levels and Points of Compliance

<table>
<tr><th>Indicator Hazardous Substance</th><th>SCL</th><th>Point of Compliance Depth and Basis for Compliance</th><th>SCL Basis</th></tr>
<tr><td colspan="4">SCU-Wide below Elevation MHHW</td></tr>
<tr><td colspan="4">Bioaccumulative IHSs – mobile seafood species [1]</td></tr>
<tr><td>Mercury (mg/kg)</td><td>0.13</td><td rowspan="3">0 to 10 cm based on protection of human health from exposures via consumption of mobile seafood with bioaccumulative contaminants; SCU-wide SWAC compliance area</td><td>Regional background</td></tr>
<tr><td>cPAH TEQ (µg/kg)</td><td>64</td><td>Regional background</td></tr>
<tr><td>Total TEQ [2] (ng/kg)</td><td>5.2</td><td>Regional background</td></tr>
<tr><td colspan="4">Benthic IHSs</td></tr>
<tr><td>Cadmium (mg/kg)</td><td>5.1</td><td rowspan="3">0 to 10 cm based on protection of benthic organisms from toxicity; point-by-point compliance</td><td>SCO</td></tr>
<tr><td>Mercury (mg/kg)</td><td>0.41</td><td>SCO</td></tr>
<tr><td>Zinc (mg/kg)</td><td>410</td><td>SCO</td></tr>
<tr><td colspan="4">Lagoon Intertidal and Inner Harbor Intertidal Areas between Elevations MHHW and MLLW [3]</td></tr>
<tr><td colspan="4">Bioaccumulative IHSs – sessile seafood species</td></tr>
<tr><td>Cadmium (mg/kg)</td><td>2.4</td><td rowspan="3">0 to 45 cm based on protection of human health from exposures via consumption of sessile seafood with bioaccumulative contaminants; lagoon and inner harbor intertidal SWAC compliance area [1]</td><td>Regional background</td></tr>
<tr><td>Mercury (mg/kg)</td><td>0.13</td><td>Regional background</td></tr>
<tr><td>cPAH TEQ (µg/kg)</td><td>64</td><td>Regional background</td></tr>
</table>

Notes:

1. Consistent with SMS guidance (Ecology 2019), bioaccumulative exposures occur on an area-wide basis; therefore, compliance with the SCLs based on regional background levels will be evaluated on a SWAC basis.
2. The combined dioxin/furan toxic equivalent (TEQ) and the PCB congener TEQ.
3. The lagoon and inner harbor intertidal SWAC POC area was defined in an Ecology memorandum, Western Port Angeles Harbor: Remedial Investigation/Feasibility Study Approach (Ecology 2017).

Abbreviations:

cm	Centimeters
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
IHS	Indicator hazardous substances
µg/kg	Micrograms per kilogram

Indicator Hazardous Substance	SCL	Point of Compliance Depth and Basis for Compliance	SCL Basis

mg/kg Milligrams per kilogram
MHHW Mean higher high water
MLLW Mean lower low water
ng/kg Nanograms per kilogram
POC Point of compliance
SCL Sediment cleanup level
SCO Sediment cleanup objective
SCU Sediment cleanup unit
SWAC Surface-weighted average concentration

3.1.2 Remedial Action Levels

Remedial action levels (RALs) are concentrations of IHSs that define where active remedial technologies (e.g., removal or capping) should be applied in order to achieve SCLs. For this reason, RALs are often applied on a point-by-point basis when determining where to apply a particular remedial technology. Regardless of whether RALs are used at a site, compliance with SCLs for bioaccumulative IHSs may be evaluated by means of a surface-weighted average concentration (SWAC) in sediment, because bioaccumulative-based protective SCLs are developed on the basis of area-wide exposures.

RALs for the SCU were established using a “hill-topping” procedure (WPAH Group 2020). The procedure determines maximum point-based concentrations (i.e., RALs) that, upon application of remedial technologies to effectively reduce the concentration, will result in the achievement of the intended postconstruction SWAC. Separate RALs were developed for IHSs in intertidal areas because compliance with the SCLs in those areas is considered separately. The FS concluded that implementation of active remedial technologies in certain areas of the SCU will achieve compliance with the SCLs over the SCU within a reasonable restoration time frame. The RALs are summarized in Table 3.2.

Table 3.2
Remedial Action Levels

Indicator Hazardous Substance	Remedial Action Level	Depth of Sampling Interval to Compare with Remedial Action Level
Sediment Cleanup Unit		
Mercury (mg/kg)	0.84	0 to 10 cm point by point within SCU
cPAH TEQ (µg/kg)	434	
Total TEQ (ng/kg)	17	
Lagoon Intertidal and Inner Harbor Intertidal Areas[1]		
Cadmium (mg/kg)	5.9	0 to 45 cm point by point within the lagoon intertidal and inner Harbor intertidal areas
Mercury (mg/kg)	0.49	
cPAH TEQ (µg/kg)	203	

Notes:

1 The lagoon intertidal and inner harbor intertidal areas are shown in orange on Figure 3.1.

Abbreviations:

cm Centimeters
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
ng/kg Nanograms per kilogram

After the collection of additional pre-design investigation data and the completion of constructability analyses during forthcoming remedial design, these RALs may be modified using hill-topping, interpolation, and other methods consistent with those used in the RI/FS (WPAH Group 2020). Any modification of the RALs must be approved by Ecology and result in SWAC-based compliance with SCLs.

RALs differ from remediation levels defined in MTCA (WAC 173-340-360(2)(h). Remediation levels define concentrations of a hazardous substance in soil, water, air, or sediment above which a particular remedial technology, such as dredging or capping, will be required. RALs define the concentrations that must be addressed with active remediation to bring the SWAC across a site down to the bioaccumulation based SCL. RALs and remediation levels are tools used to plan and implement the cleanup plan. They do not change the cleanup standards that must be met at the site. Benthic SCLs must still be met on a point-by-point basis.

3.2 Remedial Action Objectives

Remedial action objectives (RAOs) define what must be achieved by the cleanup to ensure the attainment of project goals and to address concerns defined in the CSM (WPAH Group 2020). The RAOs for the cleanup actions include the following:

- Achieve SCLs that protect against benthic toxicity and bioaccumulative risks for human health within an acceptable restoration time frame throughout the SCU.
- Identify potential contaminant migration pathways for further consideration by Ecology to prevent sediment recontamination at levels of concern relative to SCLs.
- Develop cleanup actions that minimize measurable adverse impacts on operations and navigational uses within the working Harbor during construction or in the long-term.
- Balance the overall environmental benefit of reducing contaminant concentrations in surface sediments with the potential for impact on cultural resources, aquatic habitat, and/or the existing benthic community resulting from implementation of the cleanup actions.

3.3 Sediment Management and Remediation Areas

Relatively larger cleanup areas such as the SCU can be subdivided into smaller areas for evaluation and selection of cleanup actions. The SCU has been divided into three such sediment management areas (SMAs), which are based on risks for human and benthic health, relative bioavailability of bioaccumulative IHSs, as well as access and operational considerations in different areas of the SCU. The three SMAs are SMA 1 in the inner harbor, SMA 2 in the lagoon, and SMA 3 covering the rest of the waterfront and outer harbor with the SCU (Figure 3.2).

Within each SMA, remediation areas define where specific cleanup technologies will be applied to achieve the RAOs. Areas in which active cleanup technologies cannot be implemented protectively and/or effectively, such as in productive salt marsh habitats, beneath pier structures, and within active operational terminals, were considered in determining the remediation areas. The delineation of SMAs and the remediation area within each SMA are summarized in the following subsections. Cleanup actions within each remediation area are described in Section 4.1. Pre-remedial design data collection and evaluation will refine the prospective remediation and no-action areas.

3.3.1 SMA 1

3.3.1.1 Delineation

SMA 1 covers approximately 37 acres in the inner harbor, as shown on Figure 3.2. Relative to other areas of the SCU, SMA 1 poses the greatest human health and environmental risks. Contaminant characteristics in SMA 1 include the following:

- Surface sediment Total TEQ greater than 70 nanograms per kilogram.
- Benthic bioassay toxicity exceedances in areas with exceedances of the benthic SCO chemical criteria and wood debris.
- Surface sediment concentrations of mercury greater than 1.5 milligrams per kilogram.
- Average surface sediment cPAH TEQ of 248 micrograms per kilogram.

Selection of cleanup actions in SMA 1 considered the location near multiple industrial overwater operations and existing structures. The access and operational considerations of SMA 1 include the following:

- SMA 1 is accessible by marine construction equipment from the Harbor. The inner harbor intertidal area is accessible by upland equipment from the shoreline but would require access agreements for private property entry.
- The eastern edge of the SMA 1 boundary extends to approximately -50 feet MLLW, which is the water depth at which most regional marine construction equipment (e.g., dredges) can effectively and safely operate.
- Based on radioisotope and SPI profiles along with hydrodynamic evaluations, part of SMA 1 has the potential for mixing of surface and subsurface sediments resulting from propeller wash and other higher energy forces.
- SMA 1 has existing overwater structures, operating terminals, and berths.
- Buried wood debris (including logs) is present throughout SMA 1.

3.3.1.2 Remediation Area

The remediation area within SMA 1, shown on Figure 3.3, covers 33 acres of the 37-acre SMA. Intertidal sediments (above MLLW) in SMA 1 cover approximately 1.3 acres, except in areas where this tidal level is currently armored and stabilized by riprap or bulkheads, as defined under the AO. The remainder of the remediation area includes subtidal sediments (below MLLW), excluding an assumed 50-foot offset from existing overwater structures, riprap, or bulkheads (offsets will be refined during the remedial design process; refer to Section 5.1.1). In SMA 1, these structural offsets surround the McKinley facility and the western end of the Port’s Terminal 5.

3.3.2 SMA 2

3.3.2.1 Delineation

SMA 2 covers approximately 25 acres within the lagoon, as shown on Figure 3.2. SMA 2 is associated with lower human health and environmental risks than SMA 1, including lower concentrations of Total TEQ, cPAH TEQ, and mercury. In the three locations where bioassay testing was conducted, no sediment toxicity greater than SCO biological criteria were measured; however, no bioassay testing was conducted in two locations with benthic SCO-based SCL exceedances. Although the lagoon was extensively connected to the Harbor until the early part of the twentieth century, it remains connected to the inner harbor by a narrow lagoon channel and has a relatively large intertidal area. As such, it remains a tidally influenced salt-water environment, and retains many of its unique habitat characteristics.

Selection of cleanup actions in SMA 2 considered its physical configuration and adjacent industrial operations. Access and operational considerations in the lagoon include the following:

- SMA 2 is located on private property and access is restricted. SMA 2 is not accessible by marine equipment from the water due to the narrow channel connecting the lagoon to the harbor, and the developed shoreline of the McKinley facility also limits potential options for shoreline construction. Upland access to the lagoon intertidal area is somewhat limited by bluffs (south) and upland industrial operations; however, much of the eastern shoreline can be readily accessed via the adjacent Marine Drive. Cleanup actions that involve removal of contaminated sediment or placement of clean materials will require negotiation of access to the lagoon through the adjacent privately owned uplands.

- Buried wood debris (including logs) is present to an estimated depth of 4 feet.
- An established eelgrass meadow is present in the subtidal area in the northeastern corner of the lagoon.
- An established salt marsh is present at the far western corner of the lagoon.
- An inactive elevated water main runs along the southwestern edge of the lagoon.

3.3.2.2 Remediation Area

The remediation area within SMA 2, shown on Figure 3.4, covers 24 acres of the 25-acre SMA. Intertidal sediments account for approximately 10 acres, consisting of the entire lagoon shoreline. The rest of the remediation area consists of approximately 14 acres of subtidal sediments (below MLLW). The remediation area in SMA 2 excludes productive salt marsh in the far western corner of the lagoon and the high-energy lagoon channel that connects the lagoon to the Harbor. The lagoon channel is unlikely to have contaminated sediment concentrations due to the high velocity currents during peak ebb and flood tidal flows, which prevents deposition of fine sediment where contaminants are commonly detected. In addition, remedial technologies are limited due to high tidal velocities, structural constraints, and access constraints.

3.3.3 SMA 3

3.3.3.1 Delineation

SMA 3, shown on Figure 3.2, consists of the rest of the SCU, which covers approximately 1,100 acres that span the industrial/commercial waterfront of Port Angeles as well as the outer harbor of the SCU. SMA 3 is associated with lower human health and environmental risks than both SMA 1 and SMA 2; lower concentrations of Total TEQ, cPAH TEQ, and mercury; and some benthic toxicity. Application of active cleanup technologies throughout the entire 1,100-acre SMA is not required given the current SWACs. Cleanup actions in SMA 3 are constrained by extensive, albeit low, concentration of IHSs and relatively deeper water. Access and operational considerations in SMA 3 include the following:

- Active marine operations, including structures and berths, are present along the shoreline.
- Much of the subtidal area is characterized by water depths greater than -50 feet MLLW.

Because of its depth, large size, and proximity to the working waterfront, SMA 3 presents significant challenges in terms of remediation implementability, limiting the options for cleanup technologies.

3.3.3.2 Remediation Area

The active remediation area within the 1,100-acre SMA 3, shown on Figure 3.5, covers 164 acres of subtidal sediments (below MLLW), including sediments with contaminant concentrations exceeding the RALs (refer to Section 3.1.2). The SMA 3 remediation area does not include any intertidal areas and assumes a 50-foot offset from overwater structures, and overwater operational areas within or immediately adjacent to the remediation area, including the Port's Terminal 5, Terminal 7, Boat Haven marina, Terminal 1, Terminal 2, and the City pier (offsets will be refined during the remedial design process; refer to Section 5.1.1).

4.0 Selected Cleanup Actions

4.1 Description of the Cleanup Actions

The cleanup actions selected by Ecology for implementation in the WPAH SCU are consistent with the recommended cleanup alternatives proposed in the RI/FS (WPAH Group 2020) for SMAs 1 and 3. For SMA 2, Ecology selected a different alternative. This section describes the selected cleanup actions and provides supporting rationale. The selected cleanup action is depicted on Figure 4.1.

Development of an appropriate sediment cleanup remedy for the western Port Angeles Harbor considered a wide range of potential environmental and implementability challenges. For example, remedies in intertidal areas of the Harbor must provide lasting erosion protection and consider potential impacts due to climate change and potential alteration of sediment transport along the shoreline, which in turn can adversely affect the functions of aquatic habitat. Cleanup actions along a working waterfront must take into consideration the ability of the western Harbor to continue to support industrial and maritime operations. The presence of overwater structures and operational areas also presents significant implementability challenges for remediation. Additionally, as specified in the final RI/FS, all ground-disturbing work that has the potential to impact cultural resources from precontact and historic periods must be reviewed in consultation with the LEKT. Finally, the potentially large scale of cleanup actions to remove most or all contamination in the western Harbor could require years to decades of construction, with corresponding disruptions to both habitat and the working waterfront.

To highlight the tradeoffs associated with different cleanup approaches in the western Harbor, a range of remedial alternatives were developed in the RI/FS (WPAH Group 2020), including combinations of the following sediment remediation technologies:

- Intertidal and shallow subtidal sediment excavation “in the dry” during low tide stages, followed by off-site transport and disposal.
- Subtidal sediment dredging “in the wet” with associated construction-related releases, followed by transloading, water management, and off-site transport and disposal.
- Capping sediments with an approximately 2-foot-thick[10] engineered cap composed of clean sand, gravel, and/or rock as appropriate for the specific location.
- Placing a 6-inch layer of clean sand and/or gravel to enhance natural recovery.
- Monitoring active cleanup areas.
- Monitoring the continued natural recovery of the western Harbor from the deposition of cleaner sediments over time.

[10] The RI/FS assumed a 2-foot-thick cap. The final design and thickness of the sediment cap will be determined during the remedial design process.

The MTCA/SMS comparative evaluation detailed in the RI/FS (WPAH Group 2020) and summarized in Section 4.2 indicated the following:

- In parts of SMA 1 and SMA 2, intertidal excavation during low tide stages can be efficiently performed from the shoreline with standard construction equipment provided that the potential discovery and protection of cultural resources is anticipated. Intertidal excavation areas will be capped to restore aquatic habitat to the current grade, achieving cleanup standards immediately upon completion of construction.
- Much of the western Harbor is either too deep for or inaccessible by subtidal sediment dredging equipment. Moreover, because of the buried logs and debris in the sediment bed, subtidal dredging would result in significant releases of contaminants into the water column, and dredging residuals would require capping to achieve cleanup standards.
- Most sediments in the SCU are stable, and engineered caps made of clean sand, gravel, and/or rock where appropriate and feasible for the site conditions can provide a permanent cleanup remedy. Engineered caps have been shown to be very effective at numerous other Puget Sound sediment cleanup sites.
- Natural recovery processes in much of the western Harbor occur relatively slowly, requiring many decades. Monitoring to further assess the rate of reductions in contaminant concentrations will occur over time.
- Placing a 6-inch layer of sand and/or gravel is intended to enhance natural recovery rates in the western Harbor, also allowing benthic organisms to rapidly recolonize the clean sediment. Applying this enhanced monitored natural recovery (EMNR) approach to eelgrass meadows in parts of SMA 2 (if applicable) and in the relatively large SMA 3 subtidal area is intended to allow SCLs to be achieved throughout the western Harbor within 10 years.
- Intertidal excavation and subtidal dredging with off-site disposal of excavated materials have low vulnerability to climate change impacts such as sea level rise, coastal storms, or extreme precipitation and flooding. Capping remedies can potentially be affected by climate change impacts from sea level rise and the potential for an increase in storm severity. Extreme storm events have the potential to increase scouring and erosion of shallow cap material. Engineered cap specifications would be designed to ensure that any caps remain protective under a range of potential future climate change scenarios. Long-term monitoring and maintenance would ensure that caps remain protective. EMNR has a moderate vulnerability to climate change impacts in shallow water depths such as more frequent coastal storms that could lead to repair, maintenance or additional monitoring needs. EMNR in subtidal areas are less likely to be impacted by coastal storms and extreme events.

On November 19, 2020, Ecology approved the RI/FS (WPAH Group 2020). Ecology's approval of the RI/FS stated the RI/FS contained sufficient information for Ecology to select a cleanup action. The WPAH Group submitted a preliminary DCAP for review on March 26, 2021. After reviewing the preliminary DCAP, considering new information about SMA 2 (the lagoon), and completing additional evaluation of the SMA 2 disproportionate cost analysis (DCA), Ecology selected a different alternative, 2-D, for SMA 2 instead of alternative 2-E recommended by the WPAH Group in the RI/FS (Ecology 2023b).

New SMA 2 information considered includes:

- An increased awareness and knowledge of the cultural and historical significance of the lagoon to all three of the Klallam/S'Klallam Tribes. The unique natural resources of the lagoon were important to the location of the Aboriginal Tse-whit-zen village and cemetery site. Ecology recognizes the Tribes' expertise and knowledge of the local habitat. Ecology has a duty to collaborate and share knowledge with Tribes on program implementation matters that directly affect Tribes and has worked particularly closely with the LEKT on all aspects of the Port Angeles Harbor cleanup.
- The RI/FS justified capping and awarded greater benefit scores to alternatives that avoided disturbance of cultural resources. The LEKT has pointed out that, based on its experiences, there are effective protocols for monitoring dredging or excavation to minimize or prevent cultural resource disturbance in both submerged lands and uplands. LEKT has further noted that justifying capping to avoid disturbance of cultural resource is at cross-purposes with the Tribe's focus on environmental and cultural restoration of the lagoon.
- Ecology gained an increased understanding of the lagoon as a regionally rare, tidally influenced barrier beach system providing the only salt marsh habitat in Port Angeles Harbor.
- The lagoon is designated critical habitat for threatened Puget Sound Chinook salmon and a critical food source for Southern Resident killer whales, listed as endangered under the Endangered Species Act.
- The lagoon is mapped in a 2020 National Oceanic and Atmospheric Administration (NOAA) fisheries publication as a pocket estuary, a habitat type with high potential value for juvenile Puget Sound Chinook Salmon.
- The lagoon is located adjacent to and connected with migration routes for juvenile salmon and forage fish and likely provides essential rearing habitat and prey protection for juvenile fish, shellfish, birds and other wildlife. The lagoon contains a known eelgrass bed ecologically important as nurseries for a range of fish.
- The effects of capping without excavation would be greater than just the loss of fringe aquatic lands as assumed by mitigation calculations in the RI/FS. An error was also found in the acreage of lost aquatic habitat and required mitigation in the RI/FS text (though the RI/FS appendices had the correct values).
- National Marine Fisheries Service has determined that shoreline development actions which result in adverse impacts to Chinook Salmon critical habitats are likely to

jeopardize the species and is pressing “reasonable and prudent alternatives” to avoid, minimize or mitigate for any loss of habitat function.

- The Trustee Council considers the uncommon barrier beach lagoon one of the greatest opportunities to restore ecosystem services in the harbor and maximize public benefit. The Trustees are concerned that large scale capping without first excavating or dredging will limit recovery and future options for natural resources restoration.
- Regarding Port Angeles-related cleanup, Ecology continues to hear public support for remedies that include removal of contamination rather than just capping or containing it.

Based on this new information, Ecology revised the DCA for SMA 2. The results, shown in Table 4.1, show the revised, total estimated cost with the total weighted benefits of each alternative. The yellow highlights show revised scores. These changes resulted in Alternative 2-D having the highest total benefit per cost.

Table 4.1: SMA 2 Revised DCA

Criteria	Weighting	2-A	2-B	2-C	2-D	2-E
Protectiveness	30%	5.0	4.5	3.0	2.0	1.0
Permanence	20%	5.0	4.0	3.0	2.5	1.5
Effectiveness Over the Long-Term	20%	5.0	4.0	3.0	3.0	2.0
Management of Short-Term Risk	10%	2.5	3.0	3.5	4.0	4.5
Technical and Administrative Implementabilty	10%	1.5	2.0	3.5	3.5	4.0
Consideration of Public Concerns	10%	2.5	4.0	4.5	5.0	2.0
Total Weighted Benefits		4.2	3.9	3.3	3.0	2.1
Estimated Cost ($M)[1]		$59.0	$30.1	$13.9	$9.9	$7.0
Total Benefit per $M		0.07	0.13	0.23	0.30	0.29

[1]Estimated costs in 2019 dollars.

The alternative with the highest benefits to cost ratio is not necessarily the alternative that uses permanent solutions to the maximum extent practicable. MTCA’s disproportionality test states costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the lower cost alternative. Therefore, we continued our evaluation by reviewing incremental costs and incremental benefits.

Considering the incremental changes in costs and benefits as percentages is a way to convert the different scales of costs and benefits to a similar scale so they can be compared. Table 4.2 shows the incremental change in costs and benefits as percentages. This evaluation supports the selection of Alternative 2-D since incremental costs (41%) are less than the incremental benefits (44%) gained.

Table 4.2: SMA 2 Comparison of Incremental Changes in Costs and Benefits

Alternative	2-A	2-B	2-C	2-D	2-E
Benefit	4.2	3.9	3.3	3.0	2.1
Cost ($Million)	59.0	30.1	13.9	9.9	7.0
Alternatives compared	2-B to 2-A	2-C to 2-B	2-D to 2-C	2-E to 2-D	
Incremental benefit (%)	8%	18%	10%	44%	
Incremental cost (%)	96%	117%	40%	41%	
Ratio of IC (%) / IB (%)	12.3	6.3	4.0	0.9	

The full, revised SMA 2 DCA with qualitative descriptions and quantitative scores and Ecology's evaluation and decision to select Alternative 2-D instead of Alternative 2-E as recommended in the RI/FS is included in Ecology's April 4, 2023, letter (Ecology 2023b).

Based on the RI/FS and Ecology's additional evaluation of the SMA 2 remedy, the selected cleanup actions in each SMA are as follows:

- SMA 1: Partial intertidal excavation with engineered capping and subtidal capping (Alternative 1-D in the RI/FS).
- SMA 2: Optimized intertidal capping, partial intertidal excavation and capping, partial intertidal excavation/subtidal dredging and EMNR, subtidal EMNR, and partial shoreline excavation for habitat mitigation (Alternative 2-D in the RI/FS).
- SMA 3: Partial EMNR so that bioaccumulation-based SCLs will be achieved within 10 years of the completion of construction (Alternative 3-B).

Overall, the selected cleanup actions across the SCU include the following approximate extents of each component:

- 3 acres of intertidal excavation (SMA 1 and 2) to maintain existing habitat characteristics, including net elevations and inundation regimes, and partial removal of contaminated sediment to provide depth for capping deeper contaminated sediment without changing existing elevations.
- 0.8 acre of upland fill soil excavation from the lagoon causeway and additional shoreline excavation, as needed, to create new aquatic habitat, ensuring no net loss of aquatic habitat (SMA 2).

- 4 acres of intertidal excavation or subtidal dredge[11] to maintain existing habitat characteristics, including net elevations and inundation regimes, and removal of contaminated sediment to provide depth in areas suitable for EMNR of deeper contaminated sediment following removal (SMA 2).
- 42 acres of engineered capping (SMA 1 and 2) to eliminate pathway of exposure from contaminated sediment.
- 180 acres of EMNR (SMA 2 and 3) to enhance natural recovery due to sedimentation (i.e., reduction in contaminant concentrations in surface and near surface sediment via input of cleaner sediments from creeks discharging to the Harbor).
- 950 acres of monitored natural recovery (MNR) SCU-wide.

In total, approximately 25,000 cubic yards (CY) of intertidal sediment and nearshore soils will be excavated from SMA 1 and SMA 2. Approximately 280,000 CY of sand and gravel will be placed, requiring approximately six seasons of construction. The final schedule and sequence for construction activities, including details on if work may be conducted in multiple SMAs at the same time, will be finalized when a construction contractor has been hired. The estimated cost for all remediation activities is approximately $37.3 million (2019 dollars). SCLs are expected to be met throughout the SCU approximately 10 years after the completion of construction. Long-term monitoring will be performed to assess the restoration progress. Final monitoring requirements (i.e., sampling locations and monitoring parameters) will be defined in the Construction Quality Assurance and Adaptive Management Plan (CQAAMP) and the Operations, Maintenance, and Monitoring Plan (OMMP) to be prepared as part of remedial design process (refer to Attachment A for conceptual frameworks of these documents). Detailed contingency response actions, as needed, will also be described in the CQAAMP and OMMP.

There are four noncontiguous locations that show benthic bioassay toxicity outside the identified cleanup action areas (two on inside of Ediz Hook, one adjacent to the Port log rafting area, and one within the Terminal 7 berthing area (See Figure 4.1). The areas will be resampled to determine benthic protection during the pre-remedial design sampling. If the pre-remedial design data show benthic protection, no further cleanup action will be performed at these stations. If confirmatory bioassays verify sediment toxicity exceeding the SCLs, these areas will be added to the cleanup action areas during remedial design.

In each SMA, the selected cleanup action provides the greatest degree of benefit for the associated cost of the actions. The overall cleanup action for sediments is a comprehensive final cleanup for the SCU that will comply with all applicable requirements for the selection of a cleanup action under MTCA and SMS.

[11] Intertidal sediment removal is referred to as "excavation." Subtidal sediment removal is referred to as "dredging." Use of the term "dredging" may include sediment removal "in the dry" below the MLLW elevation during low tide stages using standard construction equipment. Specific means and methods for sediment removal will be determined during remedial design.

The MTCA/SMS comparative evaluation summarized in Section 4.2 identifies a cleanup remedy for all three SMAs that protects human health and the environment, is permanent to the maximum extent practicable, achieves the SCLs within a reasonable time frame, anticipates the potential discovery and protection of cultural resources, considers climate resiliency, and is consistent with current and expected future recreational, commercial, and industrial uses of the SCU.

4.1.1 SMA 1 Selected Cleanup Action

The selected cleanup action in SMA 1 includes placement of an engineered cap over approximately 33 subtidal acres, incorporating offsets as determined necessary during engineering design from existing structures to protect their integrity, along with partial (approximately 2 feet deep) excavation in approximately 1.3 acres of contaminated intertidal sediments (Figure 3.3). The intertidal excavations will be backfilled to return these areas to current grade, obviating the need for mitigation to replace lost aquatic lands. The caps will be engineered for long-term stability and chemical isolation, including appropriate armoring to resist wave action, tidal currents, and propeller wash forces.

During the remedial design process, sampling and analysis of the prospective 1.3-acre intertidal excavation area will be performed to more accurately delineate areas with IHS concentrations that exceed the RALs across the intertidal POC, which is 45 centimeters (cm) deep. Intertidal sediments with IHS concentrations less than the RALs will be delineated as no action areas.

The selected cleanup action in SMA 1 includes excavation of approximately 4,300 CY of in-place contaminated intertidal sediments and approximately 105,000 CY of cap placement over 33 acres. Contaminated sediments removed from the SMA will be transported and disposed of at a regional Subtitle D landfill, or, subject to further remedial design characterization and as approved by Ecology, suitable excavated sediment and nearshore soils that meet upland cleanup levels may be beneficially reused locally or regionally, as appropriate. Implementation of the selected cleanup action in SMA 1 will extend over approximately two in-water construction seasons.

4.1.2 SMA 2 Selected Cleanup Action

The SMA 2 design goals include maximizing contaminated sediment removal while minimizing the footprint of disturbance to ecologically sensitive areas, including a subtidal eelgrass meadow. In addition to these goals, the cleanup action must not preclude future habitat restoration opportunities and should maintain the habitat characteristics, including approximate net elevations and inundation regimes, currently found in the lagoon.

The selected cleanup action in SMA 2 includes a combination of engineered cap placement over intertidal sediments, partial excavation of intertidal sediment with fill or engineered cap, partial excavation or dredge of varying depths of intertidal and subtidal sediments with EMNR, and subtidal EMNR. EMNR placement over two construction seasons (i.e., 3-inch-thick placement each year) will minimize impacts to subtidal eelgrass meadows (Figure 3.4). The caps will be engineered for long-term stability and chemical isolation, including appropriate armoring to resist wave action and tidal currents.

During the remedial design process, sampling and analysis of the 25-acre lagoon will be performed to more accurately delineate areas with IHS concentrations that exceed the RALs across the 45-cm-deep intertidal POC and 10-cm-deep SCU-wide POC, and to characterize sediment quality needed to optimize the application of remedial technologies.. The information gathered during pre-remedial design sampling will ensure the remedial design protects human health and the environment and optimizes the following SMA 2 remedial design goals:

- Minimize the footprint of disturbance to ecologically sensitive areas including salt marshes and eelgrass meadows.
- Maintain approximate habitat characteristics, including net elevations and inundation regimes, currently found in the lagoon.
- Achieve contaminated sediment removal by excavating or dredging sediment with the highest chemical concentrations consistent with the estimated sediment removal volumes of the conceptual design.
- Preserve future habitat restoration opportunities.

Intertidal sediments with IHS concentrations less than RALs will be delineated as no action areas.

The conceptual design shown in Figure 3.4 was used to estimate volumes and costs used in this plan. This includes partial excavation and backfill/cap in up to 2.0 acres of contaminated intertidal sediments, partial excavation/dredging and backfill or EMNR placement in up to 4.3 acres of intertidal and shallow subtidal contaminated sediments, placement of a 2-foot-thick cap over up to an additional 6.4 acres of intertidal sediments, along with placement of an average 6-inch-thick EMNR layer over approximately 11 subtidal acres of SMA 2.

This estimate results in excavation of approximately 21,000 CY of in-place contaminated intertidal and subtidal sediment (13,600 CY) and shoreline soils (7,100 CY for habitat mitigation) and approximately 42,000 CY of cap and EMNR placement. Contaminated sediments removed from the SMA will be transported and disposed of at a regional Subtitle D landfill, or, subject to further remedial design characterization and as approved by Ecology, suitable excavated sediment and nearshore soils that meet upland cleanup levels may be beneficially reused locally or regionally, as appropriate. Implementation of the selected cleanup action is expected to extend over two partial in-water construction seasons to minimize impacts on the existing eelgrass meadows.

Informed by detailed pre-remedial design sampling and analysis (refer to Section 5.1.1), a SMA 2 pre-design evaluation memo will consider design options and identify the optimal design based on SMA 2 remedial design goals summarized above. The balance and amounts of each remedial action type estimated in the conceptual design are expected to remain approximately the same, but the locations where the actions are applied will be refined and optimized.

Placement of engineered caps in the estimated 6.4 acres of intertidal sediments (delineated during remedial design) will result in the loss of up to approximately 0.8 acres of aquatic habitat. Aquatic habitat will be mitigated on-site and in-kind, if possible and approved by permitting agencies, by excavating existing upland fill soils from approximately 0.8 acres of the existing causeway and along the SMA 2 shoreline (shown conceptually in Figure 3.4) resulting in no net loss of aquatic habitat area. The specific location and layout of the causeway excavation and any shoreline upland excavation area required for aquatic habitat mitigation will be determined during the remedial design process. Causeway removal will be prioritized before other SMA 2 shoreline removal.

The SMA 2 remedy is anticipated to result in no net loss of aquatic habitat function. Removing existing upland fill from the SMA 2 causeway or shoreline is anticipated to improve circulation and habitat connectivity (Figure 3.4). During permitting, the scope of mitigation required to meet regulatory requirements (no net loss of aquatic habitat area or function) will be refined. The proposed 0.8 acres is an estimate of the area that may require mitigation.

4.1.3 SMA 3 Selected Cleanup Action

The selected cleanup action in SMA 3 includes EMNR placement over approximately 164 acres to achieve the bioaccumulation-based SWAC SCLs approximately 10 years after the completion of construction, as well as achieving point-by-point compliance with the benthic SCLs immediately after the completion of construction (Figure 3.5).

The selected cleanup action in SMA 3 includes placement of approximately 132,000 CY of EMNR material (e.g., silty, gravelly sand). The EMNR material is expected to be transferred from trucks to barges at the Port’s Terminal 6 property, which would be developed as a transload facility for the cleanup implementation. Implementation of the selected cleanup action in SMA 3 is expected to extend over approximately three in-water construction seasons.

4.1.4 SCU-Wide Actions

4.1.4.1 Institutional Controls

Contamination will remain beneath the containment caps and in the EMNR areas within the SCU at concentrations exceeding the SCLs. Therefore, the cleanup action will include site use restrictions or institutional controls that will protect humans and ecological receptors from contacting contaminated media while the contaminant concentrations remain greater than the SCLs. Site use restrictions and institutional controls will continue as long as contaminants are left onsite that pose risks to human health and the environment.[12]

The institutional controls will be detailed in the OMMP after the collection of additional data during the remedial design process to confirm the location and extent of contamination requiring controls. Institutional controls are expected to accomplish the following:

[12] WAC 173-340-440(4)

- Limit or prohibit activities that could interfere with the integrity of the cleanup action or result in exposure to hazardous substances.
- Provide requirements for future in-water construction (including possible habitat restoration actions) in capped areas to ensure that the work is conducted safely with limited exposure and to ensure that disturbed caps are appropriately restored.
- Provide maintenance requirements for post cleanup monitoring and maintenance.
- Maintain sufficient and adequate financial assurance mechanisms to fund all costs associated with the maintenance of the cleanup action.

The institutional controls will be finalized in consultation with the appropriate tribes and federal, state, and local agencies. The institutional controls implemented upon completion of cleanup action construction are expected to involve the following:

- Identification of engineered cap areas on National Oceanic and Atmospheric Administration Office of Coast Survey navigation charts and in Clallam County geographic information system (GIS) files to inform potential future permit reviews for in-water construction actions that may be performed in these areas.
- The institutional controls may be implemented by a variety of contractual mechanisms. For state-owned land managed by DNR, these mechanisms may include a remediation easement between DNR and the performing parties, documentation in DNR geospatial records, an administrative agreement between DNR and Ecology, or a comparable mechanism for state-owned property subject to the Port Management Agreement between the Port and DNR. Institutional controls on non-state-owned lands may include restrictive covenants for platted tidelands, no-anchor zones or fish consumption advisories.
- Maintenance requirements - The OMMP will provide direction for the requirements and schedule for post cleanup monitoring and maintenance, including long-term inspection, monitoring, and maintenance of the soil and sediment caps and long-term groundwater monitoring. The OMMP will also include guidance for conducting contingent actions or otherwise modifying the cleanup action in the future if elements of the cleanup become damaged or are not performing as designed.
- Financial assurances - The CD to which this DCAP is an exhibit, requires the potentially liable person to maintain sufficient and adequate financial assurance mechanisms to fund all costs associated with the operation and maintenance of the cleanup action.

Multiple fish advisories that are unassociated with this cleanup are currently in effect in the Harbor. These advisories are expected to remain in place after the completion of this cleanup because the cleanup does not directly address the basis of the advisories—which include Paralytic and Diarrhetic Shellfish Poison biotoxin, bacterial pollution, and a Puget Sound-wide advisory for mercury and PCBs. No new advisories associated with the selected cleanup action are expected to be issued.

4.1.4.2 Cultural Resource Considerations

Since the partial excavation of Tse-whit-zen in 2003, and because of the high probability of encountering archaeological materials between the bluff and the shoreline areas of the Harbor, certain sediment cleanup actions in the Harbor and adjacent upland areas (depending on the nature of the activity) may be subject to the conditions imposed by the Settlement Agreement between the LEKT and the State of Washington, the Port, and the City dated August 14, 2006, as well as the relevant Monitoring and Discovery Plan (MDP; Appendix F of the RI/FS). The 2006 Settlement Agreement requires consultation with the LEKT and review of ground-disturbing work to prevent disturbance of potential archaeological and cultural artifacts. The MDP includes established protocols for monitoring and reporting discoveries of cultural resources and/or human remains. These or comparable protocols will be used during future investigation and cleanup activities that have the potential to disturb artifacts.

A cultural resources survey will be performed in prospective intertidal excavation areas, consistent with the MDP. If the survey reveals that excavation actions could potentially cause disturbance of cultural resources, the local Tribes will be consulted regarding avoidance or mitigation of impacts before making cleanup decisions. Similarly, unacceptable impacts on sensitive aquatic habitats such as productive salt marsh areas due to intertidal excavation will also be avoided or mitigated as appropriate. Excavation residuals may require management (e.g., with a post-excavation cover or engineered cap) if contaminant concentrations exceeding the RALs (or an established performance standard) remain after excavation.

4.2 Selection of the Cleanup Actions

This section includes a summary of cleanup action alternatives evaluated in the RI/FS (WPAH Group 2020) and the rationale for selecting the cleanup actions.

4.2.1 Cleanup Alternatives Considered

4.2.1.1 SMA 1 Alternatives

In the RI/FS, multiple cleanup alternatives were evaluated for each SMA (WPAH Group 2020). The six alternatives evaluated for SMA 1 ranged from full removal of contaminated sediment to a combination of EMNR and limited capping.

- 1-A: Maximum dredging and excavation
- 1-B: Partial dredging and excavation with capping
- 1-C: Partial subtidal dredging with subtidal and intertidal capping
- 1-D: Partial intertidal excavation and capping with subtidal capping
- 1-E: Subtidal and intertidal capping
- 1-F Intertidal/berthing area capping with subtidal EMNR

The RI/FS included two additional alternatives (1-G: EMNR and 1-H: MNR) that were eliminated from evaluation because they would not address the 45 cm intertidal point of compliance.

4.2.1.2 SMA 2 Alternatives

The five alternatives evaluated for SMA 2 ranged from full removal of contaminated sediment to MNR.

- 2-A: Maximum dredging and excavation
- 2-B: Partial dredging and excavation with capping
- 2-C: Partial Intertidal excavation and capping with subtidal EMNR
- 2-D: Optimized intertidal capping, partial intertidal excavation and capping, partial intertidal excavation/ subtidal dredge and EMNR, subtidal EMNR, and partial shoreline excavation for habitat mitigation
- 2-E: Intertidal capping with subtidal EMNR

The RI/FS includes two additional alternatives (2-F: EMNR and 2-G: MNR) that were eliminated from evaluation because they would not address the 45 cm intertidal point of compliance.

4.2.1.3 SMA 3 Alternatives

The four alternatives evaluated for SMA 3 included the use of EMNR and MNR, at varying extents, resulting in achievement of the cleanup standards over different time frames. The recovery time frames for the alternatives considered for SMA 3 ranged from 0 to 70 years after the completion of construction.

- 3-A: Year 0 EMNR. Includes EMNR placement over approximately 250 acres of SMA 3 to achieve SCU-wide SCLs immediately following completion of construction.
- 3-B: year 10 EMNR. Includes EMNR placement over approximately 164 acres of SMA 3 to achieve SCU-wide SCLs approximately 10 years following completion of construction.
- 3-C: Year 25 EMNR. Includes EMNR placement over approximately 41 acres of SMA 3 to achieve SCU-wide SCLs approximately 25 years following completion of construction.
- 3-D: MNR. Includes MNR across the entire SMA estimated to require more than 70 years to achieve SCLs.

Other cleanup technologies were not included in the alternatives evaluated for SMA 3, as both dredging and capping were determined to be technically impracticable. This determination was based on considerations of potential environmental and community impacts, logistical complications, and overall feasibility of conducting a large-scale cleanup action in the Port Angeles community.

4.2.2 Rationale for Selection of the Cleanup Actions

In the RI/FS, alternatives for each SMA were evaluated relative to each other using the MTCA evaluation and disproportionate cost criteria (WPAH Group 2020). Ecology further evaluated alternatives for SMA 2 using the MTCA evaluation and disproportionate cost criteria and considered new information available since the RI/FS (Ecology, 2023b).

The cleanup action that best balances the MTCA criteria for permanence, protectiveness, restoration time frame, and cost is selected as the cleanup action. The DCA was the primary tool used to identify the selected MTCA cleanup remedy (WAC 173-204-570). However, identification of the selected cleanup remedy also included further assessments of the degree of risk and certainty associated with each alternative, including remedy stability under both current conditions and future conditions that may include changes or increases in overwater operations. These considerations are detailed in the RI/FS and Ecology 2023b and are summarized in the following sections.

4.2.2.1 SMA 1 Rationale

In SMA 1, Ecology selected the alternative recommended in the RI/FS. Partial intertidal excavation/engineered capping and subtidal capping will provide relatively high overall benefits at a cost of approximately $12.1 million (2019 dollars) and a high degree of certainty that the remedy will protect human health and the environment within a reasonable restoration time frame. Whereas other remedial alternatives that included more excavation and/or dredging would provide slightly higher total benefits, some degree of capping of remaining contamination would still be required, and the costs associated with removing more contaminants would be disproportionately high compared to costs to remove a smaller volume of contaminants and contain the remainder beneath protective caps (WPAH Group 2020, Table 14.1).

4.2.2.2 SMA 2 Rationale

In SMA 2, Ecology selected a different alternative than recommended in the RI/FS. After reviewing the preliminary draft Cleanup Action Plan provided by the WPAH Group, considering new information about SMA 2, and evaluating the SMA 2 DCA, Ecology selected Alternative 2-D rather than the recommended Alternative 2-E. Ecology documented the rationale in a letter *Re: Ecology's proposed remedy for Western Port Angeles Harbor* (Ecology, 2023b) to the WPAH Group and in Section 4.1 above.

Optimized intertidal capping, partial intertidal excavation and capping, partial intertidal excavation/ subtidal dredging and EMNR, subtidal EMNR, and causeway and shoreline excavation for habitat mitigation will provide moderate overall benefits at a cost of approximately $9.9 million (2019 dollars) and a high degree of certainty that the remedy will protect human health and the environment within a reasonable restoration time frame. The alternative is the most permanent alternative that is not disproportionate to its cost. Whereas other remedial alternatives that included more excavation and/or dredging would provide an increased level of benefit, the costs associated with removing more contaminants would be disproportionately high compared to the costs to remove a smaller volume of contaminants and contain the remainder (WPAH Group 2020, Table 14.2). The alternative with less excavation and more intertidal capping would provide a slightly lower level of benefit for a lower cost, but MTCA requires selection of the most permanent alternative that is not disproportionate in cost.

4.2.2.3 SMA 3 Rationale

In SMA 3, Ecology selected the alternative recommended in the RI/FS. This selected alternative includes EMNR to an extent that SCLs will be achieved within 10 years of the completion of construction and will provide relatively high overall benefits at a cost of approximately $15.4 million (2019 dollars) and a high degree of certainty that the remedy will protect human health and the environment within a reasonable restoration time frame.

The RI /FS showed another remedial alternative that included employing EMNR over a larger area providing slightly higher overall benefits; however, the costs associated with the larger footprint of EMNR would be disproportionately high compared to the slightly higher benefit attributed to the limited reduction in time frame to achieve cleanup goals. The less costly alternatives that rely more on MNR did not provide reasonable restoration time frames and had a higher degree of risk associated with the SMS-required sediment recovery zone process. Therefore, it was determined that the selected cleanup action of EMNR for SMA 3 will provide the most benefit that is not disproportionately costly, while also achieving the MTCA/SMS restoration time frame expectations (WPAH Group 2020, Table 14.3).

4.3 Compliance with MTCA Requirements

In addition to being permanent to the maximum extent practicable, cleanup actions must comply with the MTCA cleanup standards and ARARs and provide for a reasonable restoration time frame. The selected cleanup action's compliance with these requirements is summarized in the following sections.

4.3.1 Permanence to the Maximum Extent Practicable

This section summarizes the evaluation in the RI/FS (WPAH Group 2020) and Ecology's additional evaluation of SMA 2 alternative (Ecology 2023b) and provides the reasons for the identification of the selected cleanup action as the action that will be permanent to the maximum extent practicable using a DCA.

- **Overall Protectiveness.** There will be an improvement in overall environmental quality resulting from implementation of the selected cleanup actions. The selected cleanup actions will achieve the SCLs at the POC immediately after the completion of construction for SMAs 1 and 2 and within 10 years for SMA 3 and SCU-wide. The cleanup actions will reduce the potential exposure of receptors to remaining contaminated sediment by removal and/or durable engineered caps and EMNR layers that control the routes of exposure to remaining on-site contaminants. Caps and EMNR layers will provide protection by eliminating the exposure pathway; however, they will require ongoing monitoring and maintenance to ensure that the cleanup levels and cap integrity are maintained. Institutional controls will further ensure that the caps remain stable and effective throughout their lifespan.

- **Permanence.** The selected cleanup actions will provide a significant reduction in contaminant toxicity for human and ecological receptors by means of excavation, dredging, capping, and EMNR that will interrupt the exposure pathways for the remaining contamination and reduce the mobility of contaminants that remain in place within the SCU.
- **Effectiveness over the Long-Term.** The SCU-wide cleanup actions are expected to achieve remedial action objectives by means of focused excavation, dredging, capping, EMNR, and removal of contaminants with the use of technologies that are commonly applied at contaminated sediment sites. The evaluation of long-term effectiveness was performed according to the technology hierarchy specified in the SMS regulation.
- **Short-Term Risk Management.** The short-term risks associated with the selected cleanup actions will be managed with the use of plans and methods for limiting turbidity and resuspension-related releases during in-water construction and minimizing risk associated with heavy truck traffic on public roads resulting from the off-site disposal of removed material or the importation of engineered cap and/or EMNR material. Careful planning and contingency plans will minimize, but not fully eliminate, the potential for release of contaminated sediment to the water column during dredging. The transport of materials to and from the SCU on public roadways will require interactions with the public. Operation of the transload facility adjacent to the Tse-whit-sen village and cultural site will require interaction between the WPAH Group and local tribes about potential mitigation. Plans for implementation of best management practices (BMPs) will be developed, and all contractors participating in the cleanup will be required to comply with the project work plans.
- **Technical and Administrative Implementability.** The selected cleanup actions have a moderate to high degree of implementability. They are technologically feasible, include a reasonable and achievable scope, and will avoid significant impacts on commercial operations in the harbor by retaining structures and maintaining berth depths. The cleanup actions will also provide for on-site in-kind habitat mitigation. All necessary off-site facilities, materials, and services are available within the region and are accessible. The cleanup actions comply with all applicable administrative and regulatory requirements and will be managed and constructed by specialty professionals familiar with the type of work. Actions in lagoon will require obtaining permission for access across private property. Excavation and placement of cap and EMNR materials within the lagoon will be involve moderate technical challenges on private property and adjacent to an operating facility. Access to other parts of SCU for construction and long-term monitoring is available because the Port is a participating party to the cleanup and has agreed to provide terminal access to the waterfront for use as a transload facility. The cleanup actions can also be integrated with both existing and future site uses.
- **Consideration of Public Concerns.** The RI/FS included a public review process before finalization (WPAH Group 2020). Based on public comments on the RI/FS, the selected

cleanup actions are expected to address the public desire to reduce risks relatively quickly, be cost-effective and remove contamination.

4.3.2 Compliance with Cleanup Standards

The selected cleanup actions will comply with cleanup standards by means of focused intertidal excavation/subtidal dredging (SMA 1 and 2), containment of contaminated sediment that remains in place to control the potential exposure of humans and ecological receptors (SMA 1 and 2), and EMNR to accelerate natural recovery (SMA 2 and 3). The SCLs and POCs are detailed in Section 3.1. Compliance with the SCLs at the 45-cm-deep intertidal POC will be achieved immediately after the completion of construction in the intertidal excavation and cap areas. Compliance with the SCLs at the 10-cm-deep subtidal POC will be achieved immediately within the sediment cap construction areas in SMA 1 and 2 and within the EMNR placement areas in SMAs 2 and 3. EMNR areas will be monitored to ensure continued compliance over time. Compliance throughout the SCU on a SWAC basis for bioaccumulation-related cleanup standards is expected within 10 years of the completion of construction.

4.3.3 Compliance with Applicable or Relevant and Appropriate Requirements

The selected cleanup actions must comply with the MTCA Cleanup Regulations (Chapter 173-340 WAC), the SMS (Chapter 173-204 WAC), federal laws, and substantive requirements of applicable local and state laws. Together, these requirements, regulations, and laws are identified as ARARs. Under WAC 173-340-350 and WAC 173-340-710, the term “applicable requirements” includes regulatory cleanup standards; standards of control; and other environmental requirements, criteria, or limitations established under state or federal law that specifically address a cleanup action, location, IHSs, or other circumstance at a site. The “relevant and appropriate requirements” include regulatory requirements and guidance that are not directly applicable to the SCU but have been determined to be appropriate for use by Ecology.

The selected cleanup actions will comply with all ARARs pursuant to MTCA and the SMS under the terms of the implementing Consent Decree. Chemical-specific ARARs will be met by compliance with applicable SCLs. The cleanup actions will comply with location specific ARARs by compliance with all applicable state, federal, and local regulations in place for the SCU. Applicable action-specific ARARs will be met by implementation of construction activities in compliance with all applicable construction-related requirements, such as health and safety requirements, site use and other local permits, and disposal requirements for excavated material.

The individual ARARs and expected substantive compliance of the selection cleanup actions are summarized in Table 4.4. ARAR compliance will be further refined during the remedial design process.

4.3.3.1 Exemptions from Procedural Requirements

WAC 173-340-710 provides an exemption for the procedural requirements of most state and local ARARs related to the on-site cleanup actions performed in accordance with a consent decree, enforcement order, or AO. This exemption makes it unnecessary to obtain most environmental permits but still requires that the work be performed in a manner that satisfies the substantive requirements of those ARARs.

4.3.4 Environmental Justice

WAC 173-34-380(5)(c) requires that cleanup action plans summarize how impacts on likely vulnerable populations and overburdened communities were considered when selecting the cleanup action. Ecology's Implementation Memorandum No. 25: Identifying Likely Vulnerable Population and Overburdened Communities under the Cleanup Regulations (Publication No. 24-09-044, Ecology 2024) provides a process for evaluating whether the population threatened by a contaminated site includes likely vulnerable populations or overburdened communities. Vulnerable populations and overburdened communities are indicated by a Washington State Department of a Health's Environmental Health Disparities[13] rank of 9 or 10 or by a Demographic Index or Supplemental Demographic Index from the Environmental Protection Agency's Environmental Justice Screening and Mapping Tool (EJScreen)[14] at or above the 80th percentile.

The are four census tracts near or adjacent to the Site (53009000700, 53009000800, 53009000900, 530090001000). The Environment Health Disparities rank for each of these census tracts is 5, 5, 5 and 4, respectively. This is below the rank of 9 or 10 defined to indicate vulnerable populations or overburdened communities using Publication No. 24-09-044. Using EJScreen, the potentially exposed population within a 0.25-mile radius around the WPAH Study Area boundary ranked 48th percentile of Washington state's Demographic Index and 69th percentile of Washington state's Supplemental Demographic Index. Using a 1-mile radius around the WPAH Study Area boundary ranked 52nd percentile of the Washington state's Demographic Index and 69th percentile of the Washington state's Supplemental Demographic Index. This is below the 80th percentile defined to indicate vulnerable populations or overburdened communities using Publication No. 24-09-044. Based on this evaluation, the cleanup plan is unlikely to impact any vulnerable populations or overburdened communities.

4.3.5 Tribal Engagement

Tribal Engagement is an integral part of Ecology's responsibility under chapter 70A.305 RCW, the Model Toxics Control Act (WAC 173-340-620(1)). See also WAC 173-340-380. Ecology's goal is to provide Indian tribes with timely information, effective communication, continuous opportunities for collaboration and, when necessary, government-to-government consultation, as appropriate for each site.

[13] https://doh.wa.gov/data-and-statistical-reports/washington-tracking-network-wtn/washington-environmental-health-disparities-map

[14] https://www.epa.gov/ejscreen

Ecology will develop a site tribal engagement plan that identifies Indian tribes that may be affected by the site, opportunities for government-to-government collaboration and consultation, and protocols for communication. Ecology will maintain meaningful engagement with Indian tribes through the cleanup process. Ecology works collaboratively with the LEKT and the LEKT has commented and coordinated with Ecology on all aspects of the cleanup. Ecology has provided opportunities for updates and consultation with the Port Gamble S'Klallam Tribe and the Jamestown S'Klallam Tribe.

4.3.6 Provision of a Reasonable Restoration Time Frame

The selected cleanup actions will meet the SMS requirements by protecting human health and the environment and achieving the cleanup standards within a reasonable restoration time frame. The selected cleanup actions will actively address areas currently exceeding the RALs with capping or EMNR throughout the SCU, and cleanup standards will be met throughout the SCU approximately 10 years after the completion of construction, which meets the definition of a reasonable time frame consistent with the SMS.

4.3.7 Compliance Monitoring

The compliance monitoring requirements associated with implementation of the selected cleanup actions to ensure their protectiveness will be implemented in accordance with WAC 173-340-410, Compliance Monitoring Requirements.

Three types of compliance monitoring will be performed: protection, performance and confirmational:

- Protection monitoring will be conducted during construction to ensure permit requirements are met, and that human and environmental health is protected.
- Performance monitoring will be conducted at the end of the construction period to confirm that design specification (e.g., final slopes, grades, cap thickness, areal coverage) and cleanup standards are achieved.
- Confirmational monitoring collects information that allows the performance of the remedy to be evaluated over time to ensure the protectiveness and integrity of the remedy is maintained. Confirmational monitoring is also used to assess rates of recovery in ENR and MNR areas and to assess recontamination, if any.

Detailed monitoring elements will be described in the CQAAMP and the OMMP to be prepared for Ecology review and approval as a part of the remedial design. The conceptual frameworks for these plans are presented in Attachment A. The CQAAMP will describe quality assurance protocols and methods to be used for ensuring that the cleanup actions are implemented in accordance with the cleanup design and associated permitting requirements. The OMMP will describe postconstruction monitoring as well as an overall framework for contingency actions and adaptive management to ensure the long-term protectiveness of the cleanup actions. Both plans will be finalized during development and Ecology approval of the Engineering Design Report

(EDR), which will describe the approach and criteria for the engineering design of sediment cleanup actions in the SCU.

The types of compliance monitoring to be undertaken within the SCU are outlined below.

4.3.7.1 Protection Monitoring

Protection monitoring is conducted during implementation of the remedy to assure that permit and contract requirements are met and to provide intermittent quality control checks. It is specific to the work area and adjacent areas potentially subject to construction impacts. Protection monitoring will occur throughout the construction period and may include the following elements:

- **Worker Safety.** All site workers will conduct work in accordance with site-specific Health and Safety Plans, which will include any monitoring actions necessary for ensuring worker safety as well as public safety during construction.
- **Water Quality.** During the cleanup actions, work will be performed in accordance with the permit conditions, including those establishing water quality criteria. Compliance will be verified by a combination of intensive monitoring (e.g., once per construction shift) and routine monitoring (e.g., once per week), as specified by the project permit conditions.

4.3.7.2 Performance Monitoring

Performance monitoring will be conducted to confirm that the design specifications and cleanup standards are met. Similar to QC checks conducted during construction, performance monitoring will include final location, areal extent, depth, elevation and thickness of various remedy components following completion of seasonal and final construction. Bathymetric and topographic surveys will be used to establish final elevations and slopes.

Additional sampling will be conducted at the end of construction to determine compliance with the cleanup standards and to describe baseline conditions for areas where EMNR is an element of the remedy.

- **Quality Control.** Quality control monitoring will be conducted on imported material, including cap and EMNR material, and will include confirmation of both chemical quality and geotechnical suitability.
- **Physical Integrity.** Physical integrity monitoring may include bathymetric surveys and direct inspections of intertidal and shoreline areas. Monitoring will be conducted during the cleanup actions to verify the performance objectives (e.g., minimum cap thickness or minimum excavation depths).
- **Adaptive Management.** Annual monitoring of completed EMNR construction actions to adaptively manage and refine engineering designs over the anticipated 6-year in-water construction duration. This includes SPI surveying of completed EMNR areas to

assess degree of mixing, and IHS and conventional parameters sampling from multiple intervals at representative core stations for chemical verification.

- **Sediment Quality.** Sediment quality throughout the SCU will be documented at the completion of post-construction (Year 0) and will continue to be monitored after completion of the cleanup action construction (refer to Section 4.3.5.3). Additional monitoring events may be required and/or the term extended as necessary. Surface sediment monitoring will be performed to verify that the SCU achieves compliance with the cleanup standards described in Section 3.1. Surface sediment samples will be collected throughout the SCU to compare the analytical results with cleanup standards. Samples will be analyzed for IHSs, including cadmium (intertidal only), mercury, PCBs and dioxins/furans (for calculation of Total TEQ), and cPAHs. In addition, sediment samples will be collected from the intervals of 0 to 2 cm and 2 to 10 cm to be archived and then analyzed if IHS concentrations in the interval of 0 to 10 cm are greater than the projected trends. Samples collected from 0 to 2 cm will be used to assess the quality of recently deposited sediment in the SCU, and samples from 2 to 10 cm will be used to evaluate mixing with underlying contaminated sediments. Select samples will also be analyzed for benthic IHSs (cadmium, mercury, and zinc) and compared to benthic cleanup standards.

4.3.7.3 Confirmational Monitoring

Confirmational monitoring assesses the physical integrity of the remedy elements such as the caps, performance of the natural recovery, and compliance with the cleanup standards and goals of the cleanup action performance over time.

Bathymetric surveys will be repeated periodically to monitor the degree of post-construction elevation change that may adversely affect cap performance. Visual inspections (actual or remote) will be conducted to assess the integrity of remedy elements over a broader area (e.g., video surveys to identify areas of scour).

Areas of the SCU utilizing ENR to achieve cleanup levels will be subject to periodic monitoring to evaluate the rate of contaminant reduction. Natural recovery monitoring will consist of sediment sampling and chemical testing and is assumed to be conducted at years 2, 5, and 10 following completion of cleanup action construction. Longer term monitoring is proposed to be conducted at 5-year increments, but this frequency may be modified based on earlier monitoring results.

In areas where contaminants will be left in place beneath caps, long-term monitoring will be conducted to evaluate continued compliance with cleanup standards. Monitoring will include continued physical and chemical monitoring of sediment at sampling frequencies sufficient to evaluate continued performance trends. Monitoring will initially be conducted Site-wide; however, the focus may change over-time depending on results. Depending on results of the initial monitoring, frequency could diminish over time. Special monitoring could be undertaken after severe storms or other events that could damage a cap.

- **Physical Integrity.** After the completion of construction, long-term physical monitoring of cap surfaces and EMNR areas (e.g., sediment cores to confirm cap thickness) will be performed to verify their integrity over time. Evidence of erosion may result in additional monitoring evaluation and contingency actions to protect human health and the environment.
- **Sediment Quality.** Sediment quality throughout the SCU will be documented during long-term confirmation monitoring. Sediment quality monitoring events are expected to be conducted approximately 2, 5, and 10 years after completion of the cleanup action construction. Additional monitoring events may be required and/or the term extended as necessary. Surface sediment monitoring will be performed to verify that the SCU achieves compliance with the cleanup standards described in Section 3.1. Surface sediment samples will be collected throughout the SCU to compare the analytical results with cleanup standards. Samples will be analyzed for IHSs, including cadmium (intertidal only), mercury, PCBs and dioxins/furans (for calculation of Total TEQ), and cPAHs. In addition, sediment samples will be collected from the intervals of 0 to 2 cm and 2 to 10 cm to be archived and then analyzed if IHS concentrations in the interval of 0 to 10 cm are greater than the projected trends. Samples collected from 0 to 2 cm will be used to assess the quality of recently deposited sediment in the SCU, and samples from 2 to 10 cm will be used to evaluate mixing with underlying contaminated sediments. Select samples will also be analyzed for benthic IHSs (cadmium, mercury, and zinc) and compared to benthic cleanup standards.

Final monitoring requirements (i.e., sampling locations and monitoring parameters) will be defined in the CQAAMP and OMMP to be prepared as part of remedial design and permitting process. Detailed contingency response actions, as needed, will also be described in the CQAAMP and OMMP.

4.3.7.4 Contingency Response Actions

In addition to the monitoring information described above, the CQAAMP and OMMP will include contingency actions and adaptive management strategies that may be applicable in response to monitoring observations. The EDR will provide additional details regarding the contingency response actions for the proposed cleanup action.

5.0 Next Steps and Schedule

After the CAP has been finalized, signatories to a Consent Decree will proceed with the remedial design for the selected cleanup actions. This section summarizes the steps included in the remedial design and implementation process and the expected schedule for completion of the work.

5.1 Overview of Remedial Design Process

5.1.1 Data Collection and Engineering Evaluations

Additional data collection and engineering evaluations will be conducted to inform the remedial design process and to finalize the cleanup action details. These activities are expected to include, but are not limited to, the following:

- Sampling and analysis of intertidal excavation areas to refine areas with concentrations of IHSs that exceed the RALs across the 45-cm-deep POC for the lagoon intertidal area and the inner harbor intertidal area.
- Sampling and analysis of sediment in intertidal and subtidal areas of the lagoon to refine design of SMA 2 remedy.
- Sampling and analysis of lagoon causeway and shoreline areas that will potentially be excavated for habitat mitigation to evaluate quality of soils or sediment being excavated and sediments remaining following excavation.
- Habitat evaluation in SMA 2 to document the status, condition and ecological value of existing quality of habitat, including biota, and the location/extent of existing eelgrass meadow(s) and salt marsh.
- Bathymetric surveys to document baseline conditions and refine construction plans.
- Sampling and analysis of no action areas to document existing conditions.
- A cultural resources survey in the intertidal excavation areas, consistent with the MDP, the results of which will inform the final extent of intertidal excavation areas during remedial design. This will be completed in consultation with the LEKT.
    - If the survey indicates a potential for the excavation actions to result in an unacceptable disturbance of cultural resources, excavation in culturally sensitive areas will be avoided in the remedial design.
- Confirmatory bioassay testing at the four noncontiguous RI bioassay failure stations outside the identified remedial areas in the RI/FS (two on Ediz Hook, one adjacent to the Port log rafting area, and one within the Terminal 7 berthing area).
    - If the remedial design data verify benthic protection, no further cleanup action will be performed at these stations. Conversely, if confirmatory bioassays indicate sediment toxicity exceeding the SCLs, these areas would be addressed as appropriate during the remedial design (e.g., expanded EMNR or other actions).

- Location-specific analyses of bioturbation, erosion (e.g., propeller wash, tidal currents, waves, wakes, and slope stability), chemical isolation, consolidation, and operational considerations (e.g., placement tolerances).
    - These evaluations will provide information necessary for developing design specifications for the engineered caps and EMNR layers in the SCU.
- Geotechnical and structural analyses of structures, considering the variability of site conditions, type of structure, use, and level of protectiveness needed.
    - The results of these evaluations will inform to what degree the 50-foot offsets around structures, included in the conceptual cleanup action, can be reduced.

Subject to refinement during development of the Remedial Design Work Plan (see Section 5.2), the SMA 2 pre-design investigation will include collection of:

- Long cores (to native contact) in the lagoon causeway to determine the suitability of these soils for post-excavation beneficial reuse and/or disposal.
- Medium cores to characterize chemical concentrations in near-surface sediments and optimize the removal/cap design following the remedial design goals described in Section 4.1.2.
- Short cores to characterize chemical concentrations in near-surface sediments to optimize the removal, cap, and EMNR design following the remedial design goals described in Section 4.1.2.
- Surface grabs (to 10 cm) in subtidal areas to characterize chemical concentrations in surface sediments to inform the EMNR design.

5.1.2 Remedial Design and Permitting

After the collection of additional data and completion of the engineering evaluations, the remedial design will be conducted and involve the following:

- Preparation of an EDR for Ecology's review and approval.
- Development of construction documents, including design specifications and contract drawings. The construction contract documents will include, but not be limited to, details of the following:
    - Excavation/dredge prisms, cap and EMNR designs, material requirements, and requirements for material removal and placement.
    - Sequencing of intertidal and subtidal construction and allowable windows for in-water work.
    - Environmental controls and BMPs to be implemented during sediment removal and cap and EMNR material placement.

- Preparation of the final CQAAMP and OMMP, informed by the document frameworks included in Attachment A.
- Project permitting for the planned construction activities. Project permits will be obtained and substantive requirements of laws for which MTCA creates a permit exemption will also be determined.
- Consultation and coordination with tribes on protection and consideration of cultural resources during project planning and implementation, including construction of the proposed transload facility and associated mitigation.
- Assessing risks associated with a changing climate by doing a site-specific vulnerability assessment, identifying adaptation measures that increase climate-change resilience of the selected remedy, and including green remediation best management practices to increase the environmental benefits and reduce the environmental impacts from cleanup as outlined in Ecology's guidance *Sustainable Remediation: Climate Change Resiliency and Green Remediation – A Guide for Cleanup Project Managers* (Ecology 2023a).

5.1.3 Construction and Long-Term Monitoring

After the remedial design has been finalized and the necessary permits have been obtained, cleanup action construction will begin. The cleanup action construction is expected to extend over approximately six in-water construction seasons. In-water work will be conducted during the allowable construction window for Port Angeles Harbor, as determined by resource agencies. The means and methods of construction will be determined by the selected contractor and may include some upland construction outside the allowable in-water work window.

Long-term monitoring of the SCU will be conducted in accordance with the CQAAMP and the OMMP, which will be finalized during the remedial design process, and is expected to continue for a minimum of 10 years after the completion of construction (in years 0, 2, 5, and 10 after construction), followed by monitoring on an as-needed basis.

5.2 Project Deliverables

The following deliverables will be developed as part of the remedial design and construction processes summarized in Section 5.1. Ecology's comments will be addressed and incorporated into subsequent drafts of each document.

- **Draft and Final Remedial Design Work Plan (RDWP).** The RDWP will identify project milestones, work products, details on predesign sampling and analyses, plans and specifications, and schedules that meet the requirements of the MTCA Cleanup Regulations (Chapter 173-340 WAC) and the SMS (Chapter 173-204 WAC). If the project will be completed in phases, the RDWP should include a summary of the entire plan and the proposed phases. All data collection and analyses will be in accordance with the requirements of Chapter 173-340 WAC, Chapter 173-204 WAC, and Ecology's Toxics Cleanup Program Policy 840: Data Submittal Requirements (https://apps.ecology.wa.gov/publications/documents/1609050.pdf), which include Ecology's prior review and approval of a Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) that are attached to the RDWP. Laboratory data will be included in reports and must have met the quality assurance and quality control procedures outlined in the associated SAP and QAPP. The RDWP will also include a Health and Safety Plan (HSP).

- **Ecology's Environmental Information Management (EIM) System.** All data will be submitted to Ecology in both written and electronic formats according to Ecology's Policy 840: Data Submittal requirements. Data will be submitted electronically to EIM following the instructions at http://www.ecy.wa.gov/eim/
- **Draft and Final SMA 2 Pre-Remedial Design Evaluation Memo.** This memo will consider design options to optimize the design to meet the SMA 2 remedial action goals (See Section 4.1.2). The memo will be submitted for Ecology's approval prior to the Draft Engineering Design Report.
- **Draft and Final Engineering Design Report.** A draft and final EDR will be submitted to Ecology, in compliance with the requirements of WAC 173-340-400(4)(a) and Chapter 173-204 WAC. The EDR will provide engineering concepts and design criteria for major components of the selected cleanup actions. It will include excavation prisms, extent/design of caps and EMNR layers, seismic and slope stability analyses, evaluation of and adaptation to reduce potential impacts from climate change, inclusion of green remediation best management practices and institutional control language.
- **Draft and Final CQAAMP and OMMP.** (Attachments to EDR). The compliance monitoring requirements, which will be developed during the engineering design phase, will comply with the requirements of WAC 173-340-410 and Chapter 173-204 WAC. Building on the document frameworks described in Attachment A, each version of the CQAAMP and OMMP will include, but not be limited to, specific monitoring objectives, scope and frequency, duration, and contingency responses and triggers. The documents will include methods for the following:
    - Protection monitoring to ensure permit requirements are met, and that human and environmental health is protected during construction.
    - Performance monitoring to confirm that design specification (e.g., final slopes, grades, cap thickness, areal coverage) and cleanup standards are achieved.
    - Confirmational monitoring to confirm the long-term performance of the remedy including cap integrity, over time to ensure the protectiveness and integrity of the remedy is maintained. Confirmational monitoring is also used to assess rates of recovery in ENR and MNR areas and to assess recontamination, if any.
- **Draft 30%, 60%, 90% and 100% Final Construction Drawings and Design Specifications (Plans/Specs).** Draft and final plans/specs will be developed in compliance with the requirements of WAC 173-340-400(4)(a) and Chapter 173-204 WAC. Each subsequent version will address Ecology's comments on the previous

version. Plans/specs provide the contracting documents for the contractors hired to implement the cleanup actions. The plans/specs will include excavation prisms, extent/design of caps and EMNR layers, actions required for compliance with project permits, and performance metrics for the contractors to ensure that construction is conducted in accordance with all Ecology-approved project documents.

- **Annual Construction Progress Summary.** Following the completion of the in-water work window each year, an annual progress report will be developed and submitted to Ecology including a summary of the work completed with a graphical representation of the work performed and progress on the entire project.

- **Draft and Final Cleanup Action Report (CAR).** A CAR will be developed and submitted in accordance with WAC 173-340-400(6)(b) and Chapter 173-204 WAC after the completion of the cleanup action construction. The CAR will be submitted with graphical representations of the work performed and provide documented evidence that the cleanup action was constructed as designed and that institutional controls have been implemented. In accordance with WAC 173-340-400(6)(b)(ii) the report shall include as built drawings and document all aspects of the construction. The report shall contain an opinion from the engineer, based on testing results and inspections, the cleanup action has been constructed in substantial compliance with the plans and specification and related documents.

- **Progress Reports.** Unless otherwise directed by Ecology, monthly progress reports with be developed during design and construction of the cleanup action that describe the actions taken during the previous month to implement the CAP and the implementing order. Following completion of construction of the cleanup action, and unless directed otherwise by Ecology, quarterly progress reports with be submitted. The Progress Reports shall include the following:
  - A list of on-site activities that have taken place during the reporting period.
  - Description of any sample results which deviate from the norm.
  - Detailed description of any deviations from required tasks not otherwise documented in project plans or amendment requests.
  - Description of all deviations from the scope of work and schedule during the current reporting period and any planned deviations in the upcoming reporting period.
  - For any deviations in schedule, a plan for recovering lost time and maintaining compliance with the schedule.
  - All raw data (including laboratory analyses) received during the previous reporting period (if not previously submitted to Ecology), together with a detailed description of the underlying samples collected.
  - A list of planned activities for the upcoming reporting period.

- **Periodic Review Data Submittal.** Submit monitoring data, as required, to support periodic reviews every five years while contamination remains at the Site. See Section 5.4 for more detail.

5.3 Schedule for Actions and Deliverables

The timeline for completion of actions described in this CAP and submittal of the deliverables detailed in Section 5.2 are indicated in Table 5.1.

Table 5.1: Schedule for Actions and Deliverables

Actions and Deliverables	Due Date
Submit Draft Remedial Design Work Plan (RDWP) including SAP, QAPP and HSP for review and comment	220 days after execution of the Consent Decree
Submit redlines and responses to Ecology comments on the Draft RDWP for review and approval	60 days after receipt of Ecology comments on Draft RDWP
Submit Final RDWP addressing Ecology comments on the Draft RDWP for review and approval	60 days after receipt of Ecology approval of response to comments on Draft RDWP
Implement RDWP	Commence 90 days following approval of RDWP or as soon allowed under permit-designated in-water work windows
Submit final validated data collected during RDWP implementation to Ecology Environmental Information Management	60 days after receipt of final validated data packages
Submit Draft SMA 2 Pre-Remedial Design Evaluation Memo for review and comment	60 days after receipt of final validated data packages for SMA 2
Submit redlines and responses to Ecology comments on the Draft SMA 2 Pre-Remedial Design Evaluation Memo for review and approval	60 days after receipt of Ecology comments on Draft SMA 2 Pre-Remedial Design Evaluation Memo
Submit Final SMA 2 Pre-Remedial Design Evaluation Memo for review and approval	60 days after receipt of Ecology approval of response to comments on Draft SMA 2 Pre-Remedial Design Evaluation Memo
Submit Draft Engineering Design Report (EDR), and 30% Plans and Specifications (P&S) for review and comment	120 days after Ecology approval of the Final SMA 2 Pre-Remedial Design Evaluation Memo. [15]
Submit responses to Ecology comments on the Draft EDR and 30% P&S for review and approval	90 days after receipt of Ecology comments on Draft EDR and 30% P&S
Submit Pre-Final EDR and 60% P&S, including Draft Construction Quality Assurance and Adaptive Management Plan (CQAAMP) and Operations, Maintenance and Management Plans (OMMP).	90 days after Ecology approval of response to comments on the Draft EDR and 30% P&S

[15] This due date assumes permissions for use of Terminal 6 as a transload facility have been secured.

Actions and Deliverables	Due Date
Submit responses to Ecology comments on the Draft EDR, 60% P&S and supporting documents for review and approval	90 days after receipt of Ecology comments on Draft EDR, 60% P&S and supporting documents
Submit Final EDR and 90% P&S, including Final CQAAMP and OMMP	90 days after Ecology approval of response to comments on the Draft EDR, 60% P&S and supporting documents.
Submit Final (100%) Construction P&S for review and approval	30 days after receipt of Ecology comments on the 90% design P&S
Construct the remedy according the Final EDR and Final P&S	Commence within 210 days of Ecology approval of Final EDR and Final P&S or as soon as in-water work window opens and all final project permits and permissions are received if more than 210 days.
Annual Construction Progress Summary	Annually within 60 days following the end of the in-water work window
Submit Draft Cleanup Action Report (CAR) for review and comment	90 days after completion of construction
Submit responses to Ecology comments on the Draft CAR for review and approval	60 days after receipt of Ecology comments on Draft CAR
Submit Final CAR for review and approval	45 days after receipt of Ecology comments on the Draft CAR
Implement institutional controls	90 days after completion of construction
Progress Reports	Monthly during design and construction. Quarterly after construction completion.
Periodic Review Data Submittal	Submit monitoring results, as required, to support periodic reviews every 5 years following completion of construction as longs as contamination remains

5.4 Periodic Review

Because the selected cleanup actions will result in hazardous substances remaining in the SCU at concentrations exceeding the SCLs (e.g., beneath caps), Ecology will review the selected cleanup actions described in this CAP at least every five years to ensure protection of human health and the environment. Consistent with the requirements of WAC 173-340-420, the periodic review will include, but is not limited to, the following:

- A review of available monitoring data to verify the effectiveness of the completed cleanup actions, including engineered caps, in limiting exposure to hazardous substances remaining in the SCU.

- A review of monitoring data for EMNR and MNR areas to confirm effective recovery of these areas.
- A review of current and projected future land and resource uses in the SCU.
- A review of new scientific information for individual hazardous substances or mixtures present at the Site.
- A review of new applicable state and federal laws for hazardous substances present at the Site.
- A review of the availability and practicability of more permanent remedies.
- A review to verify that any environmental covenants are properly recorded.

Ecology will publish a notice of all periodic reviews in the site register and provide an opportunity for public review and comment by the potentially liable persons and the public. If Ecology determines that substantial changes in the cleanup action are necessary to protect human health and the environment at the Site, a revised CAP will be prepared and provided for public review and comment in accordance with WAC 173-340-380 and 173-340-600.

6.0 References

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Western Port Angeles Harbor
Sediment Cleanup Unit

Cleanup Action Plan

Tables

Table 4.1
Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirement	Agency	Applicability to Selected Cleanup Remedy	Compliance of Selected Cleanup Remedy with Applicable or Relevant and Appropriate Requirement
Federal Applicable or Relevant and Appropriate Requirements			
Clean Water Act, Section 40 (33 U.S. Code § 1341 and Chapter 173-225 WAC)	Federal process implemented by Washington State Department of Ecology	In-water work; discharge into navigable waters	Section 401 of the Clean Water Act (CWA) regulates any discharge into navigable waters of the United States. In-water work proposed as part of the selected cleanup remedy will result in turbidity or potentially fill (both defined as discharge) in the water body. The potential effects from this work will be minimized in accordance with Section 401 of the CWA and consistent with standard terms of an associated water quality certification, by means of a variety of best management practices that will be implemented during construction.
Clean Water Act, Section 402 (33 U.S. Code § 1342 and Chapter 173-220 WAC)	Federal process implemented by Washington State Department of Ecology	Upland clearing, grading, or excavation; discharge of stormwater into navigable waters	Section 402 of the CWA regulates any discharge of pollutants into navigable waters of the United States. The selected cleanup remedy may include upland clearing, grading, or excavation activities in an area greater than 1 acre, with stormwater discharge from this area to surface waters of the state. The potential effects from this work will be minimized in accordance with Section 402 of the CWA and consistent with standard terms of an associated construction stormwater general permit, by means of a variety of best management practices that will be implemented during construction.
Clean Water Act, Section 404 (33 U.S. Code § 1344)	U.S. Army Corps of Engineers	In-water work; discharge into navigable waters	Section 404 of the CWA regulates any discharge of dredged or fill material into navigable waters of the United States, including wetlands. In-water work proposed as part of the selected cleanup remedy will potentially fill navigable waters, and there is no practicable alternative that is less damaging to the environment because this work will be part of the cleanup remedy. The potential effects from this work will be minimized in accordance with Section 404 of the CWA and consistent with standard terms of a U.S. Department of the Army permit, by means of a variety of best management practices that will be implemented during construction.
Rivers and Harbors Act, Section 10 (33 U.S. Code § 403)	U.S. Army Corps of Engineers	In-water work; excavation or fill in navigable waters	Section 10 of the Rivers and Harbors Act regulates excavation or fill in any manner that alters or modifies the course, location, condition, or capacity of any port, roadstead, haven, harbor, or any navigable water of the United States. In-water work proposed as part of the selected cleanup remedy will potentially fill navigable waters. The potential effects from this work could be reviewed and permitted by the U.S. Army Corps of Engineers in accordance with Section 10 of the Rivers and Harbors Act.
Coastal Zone Management Act (16 U.S. Code § 1463)	Federal process implemented by Washington State Department of Ecology	In-water work; work within the shoreline district	The selected cleanup remedy is consistent with the overarching goal of the Washington State Coastal Zone Management Program, which is to preserve, protect, develop, and, where possible, restore or enhance the resources of the nation's coastal zone. The selected cleanup remedy, once completed, will result in an overall benefit to the environment and will be constructed in a way that will avoid, minimize, or mitigate potential adverse effects due to construction.
Endangered Species Act (16 U.S. Code § 1531–1544)	Collectively implemented by U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration	In-water work	Several endangered or threatened species exist within or near Port Angeles Harbor. These species are protected under the Endangered Species Act, which requires consultation to ensure that federal actions do not jeopardize the continued existence of a species or adversely affect its critical habitat. The selected cleanup remedy is not expected to have an adverse effect and will be constructed in a way that will avoid, minimize, or mitigate potential adverse effects on these protected species.
Migratory Bird Treaty Act (16 U.S. Code § 703–712)	U.S. Fish and Wildlife Service	Upland clearing	The Migratory Bird Treaty Act prohibits the "take" of migratory birds, which can result from construction-related activities near nests or nesting sites. Any upland clearing conducted as part of the selected cleanup remedy will avoid potential disturbance of nests and nesting sites, or appropriate consultation will be undertaken to obtain permission for potential take.

Table 4.1
Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirement	Agency	Applicability to Selected Cleanup Remedy	Compliance of Selected Cleanup Remedy with Applicable or Relevant and Appropriate Requirement
Federal Applicable or Relevant and Appropriate Requirements (cont.)			
National Historic Preservation Act (54 U.S. Code § 300101)	Federal process implemented by Washington State Department of Archaeology and Historic Preservation	In-water work; ground disturbance	The National Historic Preservation Act provides protection for important historic buildings and archaeological sites and requires coordination with consulting parties (led by the Washington State Department of Archaeology and Historic Preservation) to determine whether the undertaking would have a potential effect on such buildings and sites. The selected cleanup remedy will be designed and constructed to avoid potential effects on potential and known archaeological resources in the Western Port Angeles Harbor (WPAH) Sediment Cleanup Unit (SCU). Consultation with the Lower Elwha Klallam Tribe (LEKT), the City of Port Angeles, and other consulting parties will be conducted to ensure that potential effects are minimized or avoided, consistent with the terms of the existing Settlement Agreement between the LEKT and the State of Washington, the Port of Angeles, and the City of Port Angeles. This consultation will also ensure consistency with the federal Native American Graves Protection and Repatriation Act and the state Indian Graves and Archaeological Site protections.
Resource Conservation and Recovery Act Subtitle D, Solid Waste (RCRA; 42 U.S. Code, Chapter 82 § 6901 et seq.)	Federal process implemented by Washington State Department of Ecology	Management and disposal of nonhazardous waste	Subtitle D of RCRA establishes requirements for the generation, identification, handling and transportation, treatment, and disposal of nonhazardous waste. Contaminated material associated with implementation of the selected cleanup remedy will comply with these requirements, because the material is known to contain contaminants but does not contain hazardous materials that trigger the requirements of RCRA Subtitle C. Any nonhazardous waste generated by the cleanup remedy will be profiled, handled, and disposed of in accordance with the requirements of RCRA Subtitle D.
Occupational Safety and Health Act (OSHA; 29 U.S. Code, Chapter 15)	Federal process implemented by U.S. Department of Labor, Occupational Safety and Health Administration	Worker health and safety	OSHA establishes employer requirements for providing workers with a work environment that is free from recognized hazards including exposure to toxic chemicals, mechanical- and weather-related hazards, and unsafe or unhealthy environmental conditions. Work associated with the selected cleanup remedy will be performed by contractors with experience conducting operations in the known hazardous conditions of the project including, but not limited to, in-water work, heavy mechanical equipment operation, and contact with contaminated materials. Compliance with worker health and safety laws will be a contract requirement.
Occupational Safety and Health Standards (29 CFR 1910, 1926)	Federal process implemented by U.S. Department of Labor, Occupational Safety and Health Administration	Worker health and safety	Part 1910 of the Occupational Safety and Health Standards provides general workplace standards, and Part 1926 provides safety and health regulations for construction. The proposed work includes construction; therefore, both regulations apply. The selected cleanup remedy will be designed and constructed in a manner that complies with all applicable worker health and safety requirements.
State Applicable or Relevant and Appropriate Requirements			
State Environmental Policy Act (Chapter 43.21C RCW and Chapter 197-11 WAC)	State process implemented by City of Port Angeles	Agency actions	The selected cleanup remedy constitutes an agency action, through the proposed work and potential issuance of project-specific permits or approvals. Under the State Environmental Policy Act, these agency actions should undergo review to identify potential environmental impacts and mitigation measures. The selected cleanup remedy, once completed, will result in an overall benefit to the environment and will be constructed in a way that avoids, minimizes, or mitigates potential adverse effects due to construction.

Table 4.1
Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirement	Agency	Applicability to Selected Cleanup Remedy	Compliance of Selected Cleanup Remedy with Applicable or Relevant and Appropriate Requirement
State Applicable or Relevant and Appropriate Requirements (cont.)			
Sediment Management Standards (Chapter 173-204 WAC)	Washington State Department of Ecology	Sediment cleanup standards	The sediment management standards have been used to establish cleanup standards for the future quality of surface sediments and to outline a management and decision process for the proposed cleanup of contaminated sediments.
Water Quality Standards (Chapter 173-201A WAC)	Washington State Department of Ecology	Water quality standards	The water quality standards could be applicable to the preferred cleanup remedy in order to protect aquatic life and human exposure from seafood consumption. The water quality standards provide numeric and narrative criteria to protect existing and designated uses within the water body.
Model Toxics Control Act (MTCA; Chapter 173-340 WAC)	Washington State Department of Ecology	Remedial actions	A Remedial Investigation/Feasibility Study was conducted under the MTCA to evaluate potential impacts on human health and the environment and to identify the preferred cleanup remedy to direct cleanup efforts in the WPAH SCU. Administrative processes and other standards, including cleanup standards, are also set by MTCA.
Shoreline Management Act (Chapter 173-27 WAC)	State process implemented by City of Port Angeles	In-water work; work within the shoreline district	The Shoreline Master Program of the City of Port Angeles outlines policies to protect natural resources, provide for water-dependent uses, and ensure public access to the shoreline. The selected cleanup remedy is intended to protect natural resources and will be constructed in a way that minimizes potential adverse effects on the shoreline resources, consistent with standard terms of a shoreline substantial development permit.
Hydraulic Code Rules (Chapter 220-660 WAC)	Washington Department of Fish and Wildlife	In-water work	The Hydraulic Code Rules regulate construction projects that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters in Washington State. The selected cleanup remedy will be constructed in a manner that minimizes potential effects on sea life, consistent with standard terms of a hydraulic project approval.
Aquatic Land Management (Chapter 332-30 WAC)	State process implemented by Dredged Material Management Program	In-water dredged material placement	Open-water disposal of dredged material is regulated by the Dredged Material Management Program (DMMP) to ensure that the dredged materials are suitable for in-water disposal and do not appear to pose a threat to human health, welfare, or the environment and that disposal will occur within an approved open-water disposal site. The chemical quality of any material proposed for open-water disposal will be reviewed by the DMMP, and approval will be obtained prior to disposal. Open-water disposal of dredged material is not expected to occur during the implementation of the selected cleanup remedy.
Solid Waste Handling Standards (Chapter 173-350 WAC)	State process implemented by Clallam County Solid Waste Division	Dredged and excavated material and construction waste disposal	The Solid Waste Handling Standards establish the minimum standards for handling and disposal of solid waste in Washington State. Solid waste includes wastes that are likely to be generated as a result of site remediation (e.g., contaminated sediments, construction and demolition wastes, and garbage).
General Occupational Health Standards (Chapter 296-62 WAC and 29 CFR 1952.4)	State process implemented by Washington Department of Labor and Industries, Division of Occupational Safety and Health	Worker health and safety	The federal OSHA approves state plans for enforcement of state occupational safety and health standards, which are equal to or more stringent than the federal standards. Washington State general occupational health standards (i.e., the Washington State plan) are established by Part 62 of the Washington Department of Labor and Industries Administrative Code. The Washington State plan for general occupational health standards has been approved by the Occupational Safety and Health Administration, which has entered into an operational status agreement with Washington State. The selected remedy will be conducted in accordance with the Washington State standards.

State Applicable or Relevant and Appropriate Requirements (cont.)			
Washington Industrial Safety and Health Act (WISHA; Chapter 49.17 RCW)	State process implemented by Washington Department of Labor and Industries, Division of Occupational Safety and Health	Worker health and safety	WISHA establishes employer requirements for providing workers with a work environment that is free from recognized hazards, including exposure to toxic chemicals, mechanical- and weather-related hazards, and unsafe or unhealthy environmental conditions. The selected cleanup remedy will be performed by contractors with experience conducting operations in the known hazardous conditions of the project including, but not limited to, in-water work, heavy mechanical equipment operation, and contact with contaminated materials. Compliance with worker health and safety laws will be a contract requirement.
Industrial Safety and Health Core Rules (Chapter 296-800 WAC) and Safety Standards for Construction (Chapter 296-155 WAC)	State process implemented by Washington Department of Labor and Industries, Division of Occupational Safety and Health	Worker health and safety	Part 800 of the Washington Department of Labor and Industries Administrative Code provides core rules for basic workplace safety and health standards and practices, and Part 155 provides safety standards for construction. The proposed work includes construction; therefore, both regulations apply. The selected cleanup remedy will be designed and constructed in a manner that complies with all applicable worker health and safety standards.
Local Applicable or Relevant and Appropriate Requirements			
Flood Damage Prevention (PAMC 15.12)	City of Port Angeles	Upland development; construction within the floodplain	Upland development or construction within any area of special flood hazard within Port Angeles must undergo review by the director of Public Works and Utilities to ensure that the proposed work will not increase potential risk for public and private losses due to flood conditions. This local flood damage prevention chapter implements the state and federal requirements of the National Flood Insurance Program Regulations.
Noise Control (PAMC 15.16)	City of Port Angeles	Construction noise greater than permissible levels	The City of Port Angeles has adopted the Washington State maximum environmental noise levels and implements these requirements through the noise control code, which sets permissible levels for construction-related noise and establishes a process for obtaining a variance for these noise levels, if needed. Construction of the selected cleanup remedy is not expected to result in noise levels that exceed the maximum environmental noise levels for the adjacent environments.
Environmentally Sensitive Areas and Wetland Protection (PAMC 15.20–15.24)	City of Port Angeles	Work within environmentally sensitive areas	The City of Port Angeles defines environmentally sensitive areas as surface streams and flood hazards, geologic hazards, fish and wildlife habitat areas, locally unique features, and wetlands, and it protects these features in accordance with the requirements of the Washington State Growth Management Act. The selected cleanup remedy will be designed and constructed to avoid or minimize potential disturbances of these areas and will be consistent with the associated development standards.
Clearing, Grading, Filling, and Drainage Regulations (PAMC 15.28)	City of Port Angeles	Upland clearing, grading, or excavation	Upland clearing, grading, or excavation within Port Angeles is regulated by provisions of the Port Angeles Municipal Code. Any upland ground disturbance required by the selected cleanup remedy will be designed to minimize potential effects on human health and safety and protect public and private resources of the City of Port Angeles, consistent with standard terms of a clearing and grading permit.

Western Port Angeles Harbor
Sediment Cleanup Unit

Cleanup Action Plan

Figures

WPAHG

Western Port Angeles Harbor Group

Cleanup Action Plan
Western Port Angeles Harbor
Sediment Cleanup Unit
Port Angeles, Washington

Figure 1.1
Vicinity Map

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1/11/2021

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Western Port Angeles Harbor Group

Draft Cleanup Action Plan
Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 1.2
Western Port Angeles Harbor Site,
Sediment Cleanup Unit and Study Area

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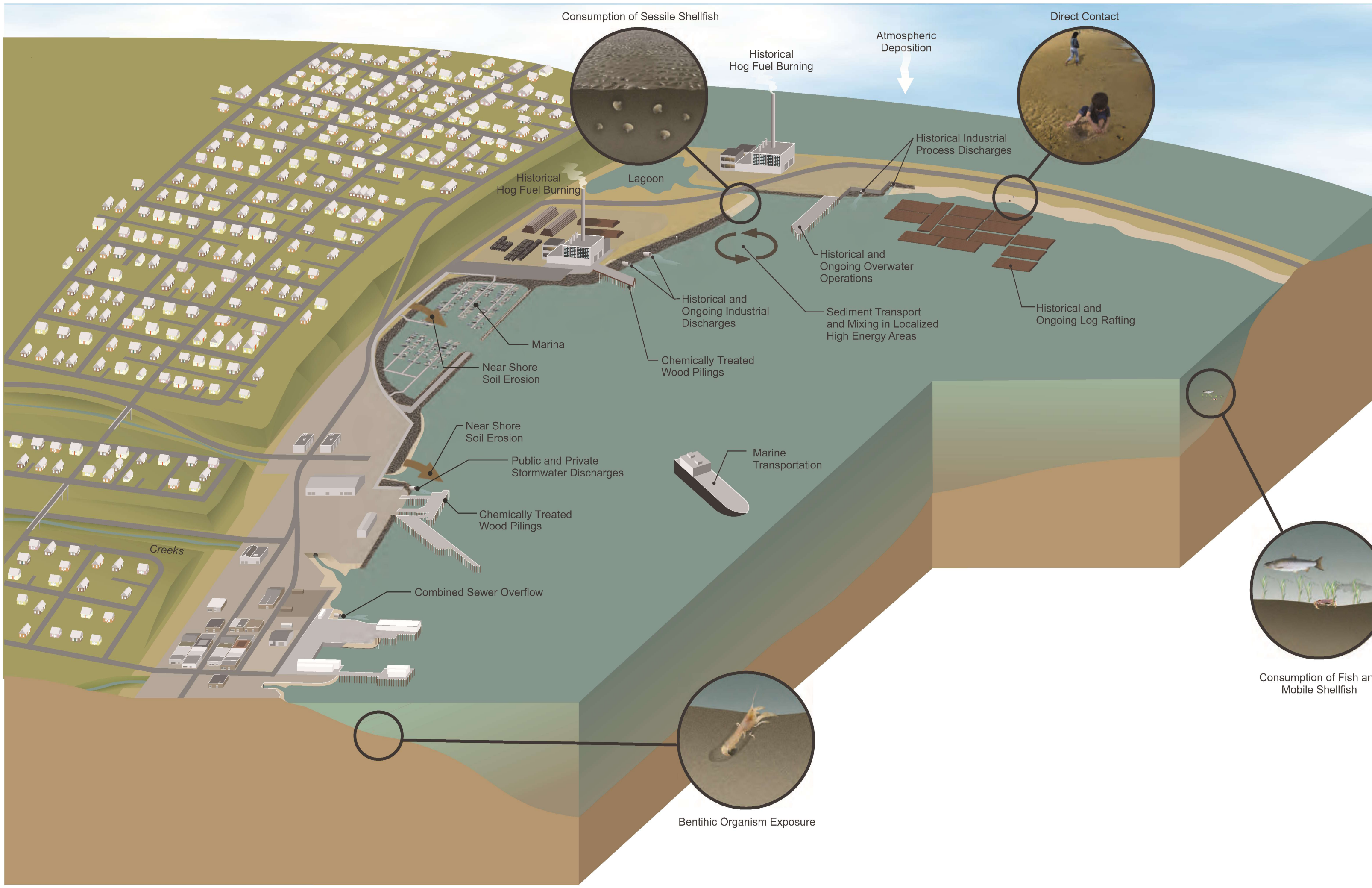
3/12/2024



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Cleanup Action Plan
Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 2.1
Conceptual Site Model

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03/26/2018

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Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 3.1
Exposure Areas

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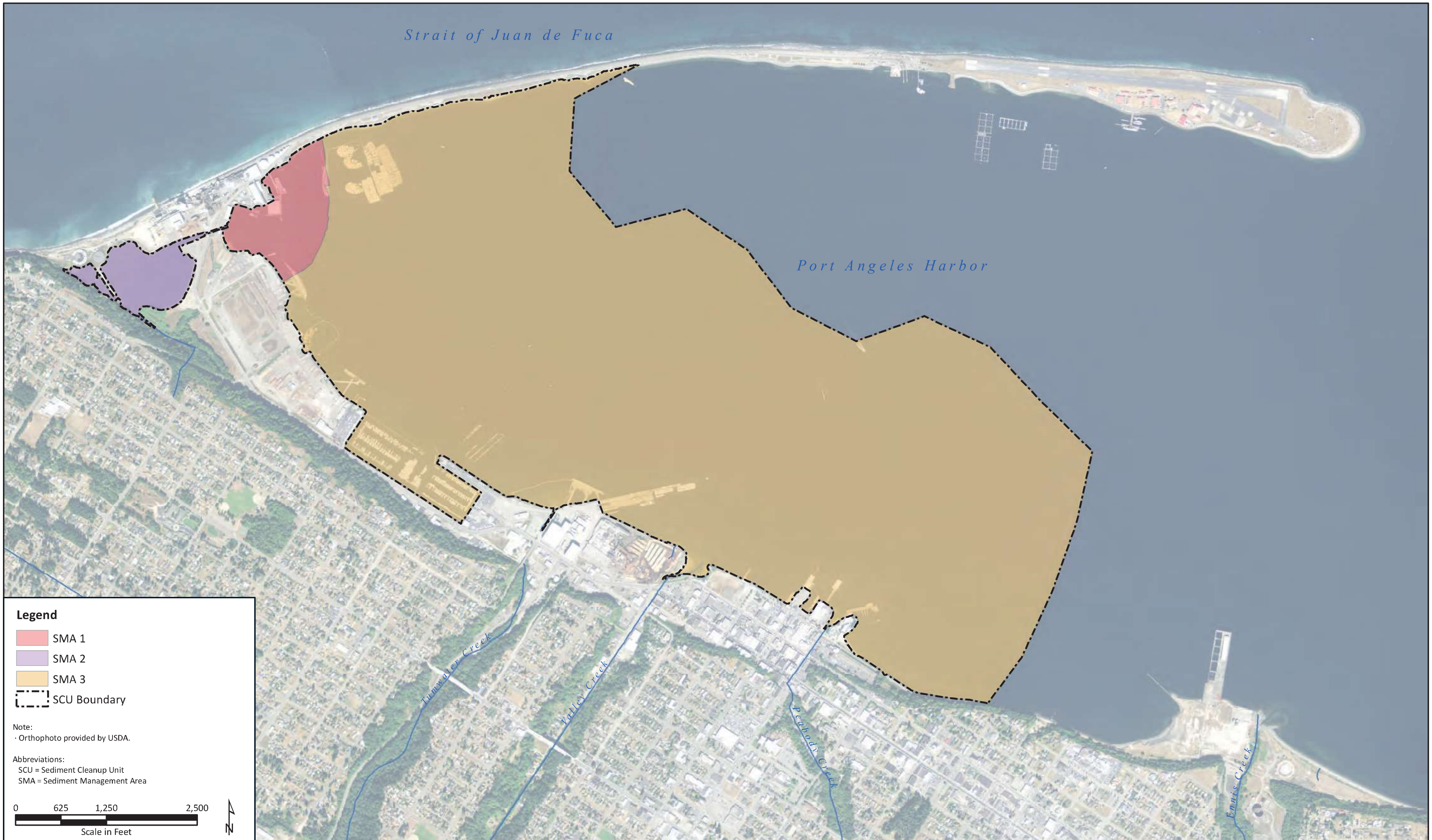
12/19/2023



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Cleanup Action Plan
Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 3.2
Sediment Management Areas

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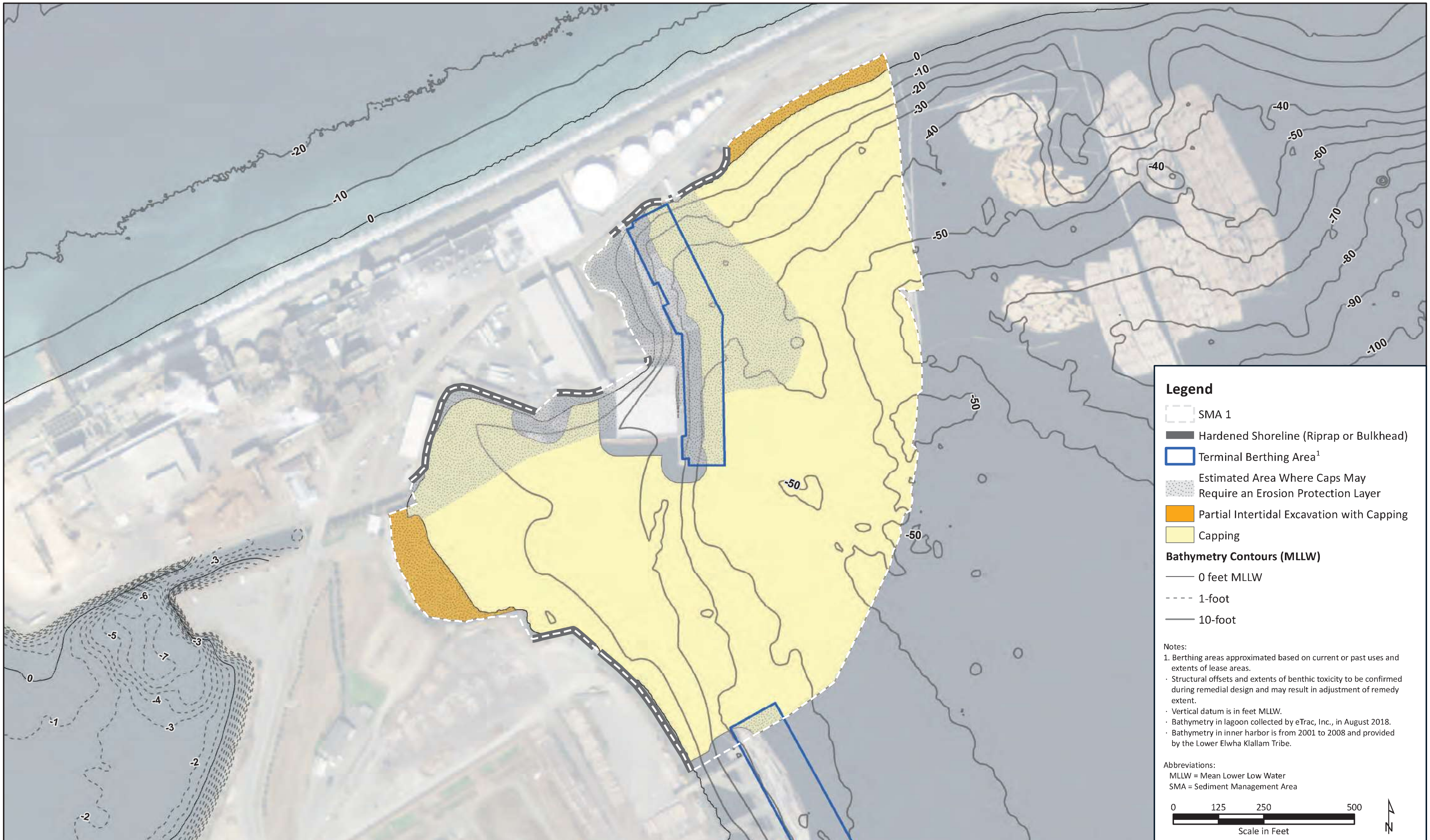

WPAHG
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Cleanup Action Plan
Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 3.3
SMA 1 Cleanup Action

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2/25/2021

WPAHG

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Cleanup Action Plan
Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 3.4
SMA 2 Cleanup Action

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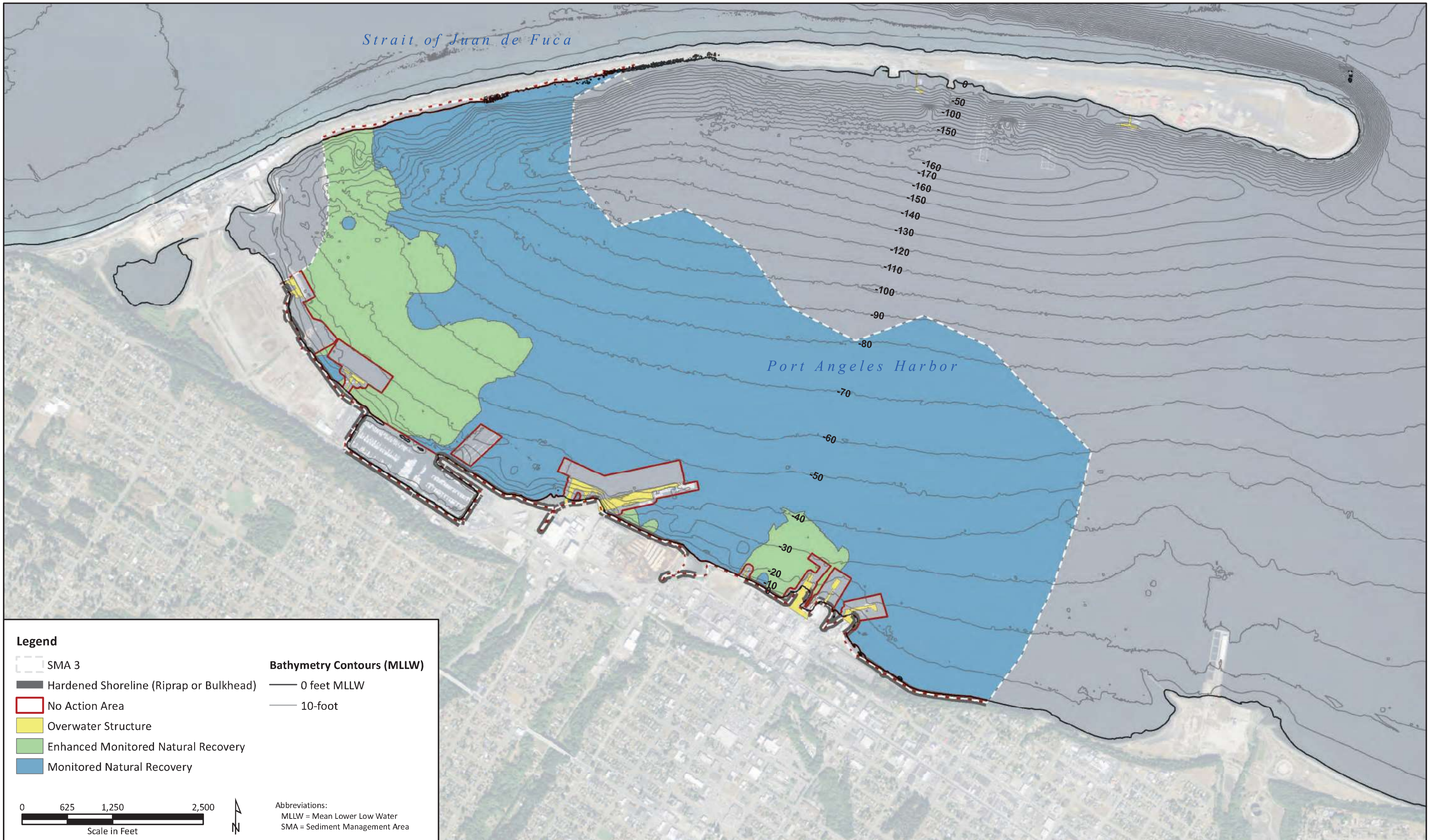
1/4/2024



WPAHG

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Cleanup Action Plan
Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 3.5
SMA 3 Cleanup Action

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2/25/2021

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Draft Cleanup Action Plan
Western Port Angeles Harbor Sediment Cleanup Unit
Port Angeles, Washington

Figure 4.1
SCU-Wide Cleanup Actions

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2/15/2024

Western Port Angeles Harbor
Sediment Cleanup Unit

Cleanup Action Plan

Attachment A
CQAAMP and OMMP Frameworks

DRAFT

Western Port Angeles Harbor
Sediment Cleanup Unit

Cleanup Action Plan

Attachment A
CQAAMP and OMMP Frameworks

Attachment A.1
CQAAMP

DRAFT

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
Contractor	Remedial Action Contractor
CQAAMP	Construction Quality Assurance and Adaptive Management Plan
CQAO	Construction Quality Assurance Officer
CQC	Construction Quality Control
CU	Certification unit
Ecology	Washington State Department of Ecology
EMNR	Enhanced monitored natural recovery
IHS	Indicator hazardous substance
MTCA	Model Toxics Control Act
NRC	National Research Council
NRC	Natural Research Council
OMMP	Operations, Maintenance, and Monitoring Plan
RAWP	Remedial Action Work Plan
RI/FS	Remedial Investigation/Feasibility Study
SCU	Sediment Cleanup Unit
SMS	Sediment Management Standards

Acronym/ Abbreviation	Definition
SPI	Sediment profile imaging
SWAC	Surface-weighted average concentration
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WPAH	Western Port Angeles Harbor

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1.0 Introduction

This document presents the preliminary framework of the Construction Quality Assurance and Adaptive Management Plan (CQAAMP) to verify protectiveness and optimize sediment cleanup actions within the Western Port Angeles Harbor (WPAH) Sediment Cleanup Unit (SCU). Further development of the CQAAMP will be informed by and finalized during remedial design; this preliminary framework provides supporting information relevant to the Remedial Investigation/Feasibility Study (RI/FS) and forthcoming Cleanup Action Plan (CAP).

Construction quality assurance includes protocols and methods to ensure that remedial actions in the WPAH SCU will be implemented in accordance with the remedial design approved by the Washington State Department of Ecology (Ecology), as well as to comply with federal and other regulatory approval/permitting requirements. Because sediment cleanup actions within the WPAH SCU are anticipated to extend over approximately 6 years, timely monitoring of the performance of completed actions provides an opportunity to learn from initial actions and adaptively manage designs over the course of project implementation. The objective is to evaluate and build on designs that work effectively during the early implementation process—and modify the approaches or methods that do not work or are not fully efficient—so that performance standards can be achieved and construction schedule/cost effectiveness are appropriately optimized.

Integrated construction quality assurance and adaptive management will be applied to the following remedial actions to be performed at the WPAH SCU:

- 1.3 acres of intertidal excavation
- 43 acres of intertidal and subtidal capping
- 178 acres of subtidal enhanced monitored natural recovery (EMNR)

As discussed in the RI/FS, cleanup standards are anticipated to be achieved throughout the WPAH SCU, including 949 acres of subtidal monitored natural recovery, within 10 years following completion of construction.

Because of the relatively large extent of EMNR construction, and to minimize uncertainties of post-construction protectiveness, this preliminary CQAAMP framework focuses on verification and adaptive management of EMNR designs over the first 5 years of in-water construction. The accompanying post-construction Operations, Maintenance, and Monitoring Plan (OMMP) describes monitoring to ensure the long-term protectiveness of the remedy after construction is determined by Ecology to be complete.

Implementation of this CQAAMP will be performed consistent with the requirements of the Model Toxics Control Act (MTCA), Chapter 70.105D in the Revised Code of Washington, as administered by Ecology under the MTCA Cleanup Regulation, Chapter 173-340 of the

Washington Administrative Code (WAC). Implementation of this CQAAMP will also comply with the Sediment Management Standards (SMS) Chapter 173-204 WAC.

Separate from this CQAAMP, and following Ecology approval of the remedial design and receipt of permits for the remedial action, the selected Remedial Action Contractor (Contractor) will develop detailed construction work plans that will more fully describe the construction schedule; construction health and safety plans; quality control plans; excavation, capping, and EMNR plans; borrow source characterization; environmental protection plans; cultural resource protection plans; inadvertent discovery plans; and other cleanup measures.

2.0 Project Organization and Responsibilities

The roles and responsibilities of the parties involved in the WPAH SCU cleanup action are described in the following sections.

2.1 ECOLOGY AND OTHER AGENCIES

Ecology is the regulatory authority and is the responsible agency for overseeing and authorizing cleanup actions in the WPAH SCU. In this capacity, Ecology will review information described in the remedial design and this CQAAMP for consistency with the cleanup standards set forth in the CAP, including applicable or relevant and appropriate requirements. The Ecology Project Coordinator, or a designee, will exercise project oversight for Ecology, coordinate comments developed by Ecology and other agencies, and communicate agency observations with the Owner (designated performing parties of the Western Port Angeles Harbor Group for this CQAAMP) and the Project Engineer. The Ecology Project Coordinator shall notify the Owner if he identifies any concerns regarding the implementation of the cleanup action. The Owner, or a designated representative, will propose response measures or recommendations, as appropriate, to the Ecology Project Coordinator. Ecology, as appropriate, will make final decisions to resolve such issues or problems that may change the cleanup action scope. Ecology will work cooperatively with other government agencies as necessary.

2.2 OWNER

The Owner is the designated performing party (or parties) responsible for implementing the cleanup action in accordance with the CAP and related binding agreements (e.g., a consent decree). The Owner, or a designated representative, will implement this CQAAMP, review Contractor work products, and be the point of contact with Ecology.

Monitoring activities will be the responsibility of the Owner, who will be acting in coordination with Ecology. Certain aspects of monitoring activities, however, may be performed by the Contractor but overseen by the Owner to ensure that the Contractor's construction and monitoring work is completed as stipulated by project permits, approvals, and contract documents.

2.3 PROJECT ENGINEER

The Project Engineer (retained by and answerable to the Owner) is responsible for two main tasks:

- Preparing a remedial design that can satisfy Ecology's performance requirements as specified by the CAP and be successfully implemented by the Contractor

- Providing consultation and observations during construction to assist with implementation of the remedial action in conformance with the Ecology-approved design documents

During implementation of the remedial action, construction activities will be reviewed by the Project Engineer. The Project Engineer will determine if construction is acceptable, unacceptable, or acceptable with a design modification. Ecology will have final authority to approve design modifications proposed by the Project Engineer.

2.4 CONSTRUCTION QUALITY ASSURANCE OFFICER

The Construction Quality Assurance Officer (CQAO; retained by and answerable to the Owner) will be responsible for overseeing the implementation of this CQAAMP. In this capacity, the CQAO is responsible for monitoring construction performance for compliance with construction performance standards and design requirements during implementation of the cleanup action and is responsible for overseeing the required inspection and verification activities. The CQAO will review documentation submitted by and work completed by the Contractor for adherence to performance standards and design requirements. The CQAO will be sufficiently familiar with the Ecology-approved design documents and the construction operations to recognize deviations from those documents. The CQAO will also manage and maintain the integrity of the data generated during implementation of the remedial action.

The CQAO will be responsible for identifying those field conditions that may warrant deviation from the Ecology-approved design documents. In such circumstances, the CQAO will coordinate with the Project Engineer and the Ecology Project Coordinator to identify and agree upon any necessary changes to meet the overall objectives of the design. Any agreed-upon changes will be documented in progress reports to Ecology.

The CQAO may use inspectors with the requisite expertise and experience to help perform the duties described above.

2.5 REMEDIAL ACTION CONTRACTOR

One or more construction contractors will be selected by the Owner to perform construction activities including excavation and disposal, placement of cap and EMNR materials, and other required cleanup activities. The selected Contractor will have demonstrable experience with these construction activities. The Contractor is responsible for its own means and methods in the execution of its work and is responsible for ensuring that the work complies with the requirements of the contract construction specifications and drawings pursuant to the remedial action and associated permits.

As part of the remedial action implementation, the Contractor will be responsible for developing and implementing the Construction Quality Control (CQC) Plan, including the required monitoring, sampling, testing, and reporting needed to implement the project in accordance with the construction specifications and drawings. Independent of the Contractor's quality control program, the Owner (through the CQAO) will implement this CQAAMP to verify that the remedial action is implemented in accordance with the design.

The Contractor will use key personnel to help with the tasks described above, including an onsite superintendent, CQC supervisor, health and safety manager, and subcontractors as appropriate.

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3.0 Construction Quality Assurance

Construction quality assurance (CQA) is the planned and systematic means and actions that provide confidence that construction materials, methods, and results meet the design criteria and requirements. CQA activities provide for collection of independent third-party measurements of construction conditions, as well as review and confirmation of the quality of data collected as part of the Contractor's CQC activities. In the context of this CQAAMP, CQC refers to those actions taken by the Contractor (or their subcontractors) to verify compliance of the various components of the approved design specifications.

The CQA program is described in this section for each major construction activity. For each activity, the following is provided:

- Description of construction activities to be implemented
- Specific performance objectives and criteria for the activity
- Inspection and verification activities
- Contingency actions

Remedial action elements subject to the CQA program include the following:

- Intertidal sediment excavation, temporary upland stockpiling, and final placement of excavated materials in local uplands or approved upland disposal facility, as determined during remedial design and permitting
- Intertidal and subtidal capping using a protective layer of clean materials meeting gradation requirements as determined during remedial design
- Placement of a clean EMNR layer meeting gradation requirements as determined during remedial design

3.1 INTERTIDAL EXCAVATION

3.1.1 Intertidal Excavation Actions

Overview to be included in the final CQAAMP

3.1.2 Performance Objectives

The following performance objectives apply to intertidal excavation:

- Remove sediments from the required excavation prisms in accordance with the performance specifications determined during remedial design.
- Minimize impacts to cultural resources during excavation, in accordance with regulatory requirements.

- Minimize impacts to sensitive habitats (e.g., eelgrass beds) and biota (e.g., salmon) during excavation, in accordance with regulatory requirements.
- Minimize suspension of sediment into the water column, in accordance with regulatory requirements and performance specifications determined during remedial design.

3.1.3 Verification of Intertidal Excavation

- Verification of the completion of excavation will be performed on a certification unit (CU) basis[1] to assess statistical compliance with required excavation extents.
- CUs (to be determined during remedial design) will generally be sized to facilitate efficient excavation and backfill/capping and verification of construction completion within a manageable construction period.
- When electronic tracking methods are used (e.g., use of Hypack to track bucket locations), the Contractor will be required to provide this information to the Owner (through the CQAO).
- The Contractor will be required to track the daily volume and/or weight of material removed and make this information available to the Owner (through the CQAO) as part of the Contractor's daily reports.
- Pre-removal surveying will be performed to document pre-construction bathymetric elevations.
- Post-removal surveying will be performed to verify that minimum excavation requirements within a CU have been achieved.

3.1.4 Changes to Excavation Designs during Construction

- If potentially unstable conditions are encountered during construction, the Owner (through the Project Engineer) will assess whether such conditions may compromise the design. If necessary, excavation designs will be revised accordingly, subject to Ecology approval.
- If cultural resources are encountered, notification procedures will be followed in accordance with the inadvertent discovery plan; if continuation of excavation is not possible due to cultural discoveries, excavation designs will be revised accordingly, subject to Ecology approval.
- During construction, additional site conditions may be identified that could warrant location-specific modifications of excavation designs, subject to Ecology approval.

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[1] A CU is a construction subarea within a sediment management area that will be used to assess compliance with design specifications for required remedial actions (e.g., sediment removal, capping, EMNR placement).

3.1.5 Contingency Actions

- If required excavation extents have not been achieved within the specified tolerance, the Contractor will be required to remove additional material to meet design requirements.

3.2 CAP AND EMNR PLACEMENT

3.2.1 Cap and EMNR Placement Actions

Overview to be included in the final CQAAMP

3.2.2 Performance Objectives

The following performance objectives apply to cap and EMNR placement:

- Place the minimum design thickness over cap and EMNR areas in accordance with the performance specifications determined during remedial design.
- Optimize construction methods to:
  - Minimize material loss to the water column and associated turbidity.
  - Minimize resuspension of underlying sediment.
  - Minimize mixing of placed cap and EMNR materials with underlying sediment.

3.2.3 Verification of Cap and EMNR Placement

- For selection of cap and EMNR materials, the Contractor must demonstrate that the proposed material meets chemical quality and gradation requirements presented in the construction specifications:
  - Specifications will list maximum allowable concentrations of indicator hazardous substances (IHSs) in cap and EMNR materials, as determined in remedial design.
  - Specifications will list gradation requirements, as determined in remedial design.
  - Samples must be collected and analyzed at a frequency identified in the approved plans and specifications.
- Verification of the completion of cap and EMNR placement will be performed on a CU basis to assess statistical compliance with specified minimum design thicknesses.
- CUs (to be determined during remedial design) will generally be sized to facilitate efficient capping and/or EMNR placement, and verification of construction completion within a manageable construction period.
- The Contractor will be required to conduct bathymetric and topographic surveys both before and after cap and EMNR placement; for multi-layer engineered caps (e.g., those that require a surface armor layer and/or a granular filter underlayment, as

determined in remedial design), interim surveys will be required to measure the thickness of each layer.

- When electronic equipment tracking methods are used (e.g., use of Hypack to track bucket locations), the Contractor will be required to provide this information to the Owner (through the CQAO).
- The Contractor will be required to track the daily volume and/or weight of cap and EMNR material placed and make this information available to the Owner (through the CQAO) as part of the Contractor's daily reports.
- If thickness verification is complicated by settlement of the cap layers or subgrade, the Contractor may need to supplement the post-construction bathymetric survey and as-placed volume information with targeted probing, grab/core sampling, or other techniques identified during remedial design that are able; in these cases, the Owner (through the Project Engineer and CQAO) will use a multiple-lines-of-evidence approach to verify cap and EMNR thickness and placement consistency, to be detailed during remedial design.

3.2.4 Contingency Actions

- If proposed cap or EMNR material does not meet the contract specifications, the Owner (through the CQAO) will reject these materials and require the Contractor to seek an alternative source for cap or EMNR material.
- If material placement has not been achieved within the specified tolerance, the Contractor will be required to place additional cap or EMNR material to meet design requirements.

4.0 EMNR Construction Phase Adaptive Management

As discussed in Section 1.0, timely monitoring of the performance of completed EMNR construction actions provides an opportunity to learn from initial actions and adaptively manage engineering designs over the anticipated 6-year in-water construction duration of the WPAH SCU project. Adaptive management in this application is intended to appropriately refine EMNR designs informed by data and experience gained during the early years of cleanup construction.

The adaptive management process described in this preliminary CQAAMP framework builds on recent U.S. Environmental Protection Agency (USEPA) recommendations to promote and broaden the application of adaptive management at complex sediment cleanup sites where construction may extend over multiple years. USEPA's working definition of adaptive management for complex cleanup sites is as follows (USEPA 2018):

> Adaptive management is a formal and systematic site or project management approach centered on rigorous site planning and a firm understanding of site conditions and uncertainties. This technique, rooted in the sound use of science and technology, encourages continuous re-evaluation and management prioritization of site activities to account for new information and changing site conditions. A structured and continuous planning, implementation and assessment process allows USEPA, states, other federal agencies, or responsible parties to target management and resource decisions with the goal of incrementally reducing site uncertainties while supporting continued site progress.

The three basic tenets of the adaptive management process are defined by the National Research Council (NRC) as follows (NRC 2004):

1. Monitor the performance of completed actions and evaluate performance.
2. Re-assess and revise engineering designs or construction methodologies as appropriate.
3. Continue to fold lessons learned into future designs.

There are three general outcomes or responses to WPAH EMNR design, construction, and monitoring that may result from the adaptive management process:

1. Continue with EMNR construction using approved project designs, and continue CQA verification and performance monitoring to further inform follow-on evaluations.
2. Refine the monitoring approach to further reduce uncertainty and collect additional data to refine the conceptual site model prior to adjusting design or construction methods.

3. Subject to Ecology approval, modify EMNR engineering designs to correct inefficiencies, or implement construction method improvements to optimize efficiencies in achieving CAP performance requirements.

Annual EMNR performance monitoring to be conducted during the construction period and possible adaptive management outcomes are discussed in the following sections.

4.1 ANNUAL EMNR PERFORMANCE MONITORING

In addition to the EMNR CQA program implemented throughout construction as described in Section 3.2, EMNR monitoring will be conducted to further inform adaptive management of EMNR designs and will include the following:

- Annual post-construction monitoring will be performed shortly after seasonal completion of EMNR construction (typically March of any given construction year).
- During each annual monitoring event, representative stations within completed EMNR areas will be surveyed using sediment profile imaging (SPI) to visually assess the degree of mixing of placed EMNR materials with underlying sediments.
- Based on a collaborative review of the SPI data by the CQAO and Ecology, representative core stations will be selected within completed EMNR areas for chemical verification.
- Multiple intervals will be collected from a single core (sliced vertically) at each sampling station (refer to Table 1).[2] Collection of multiple cores may be required to provide sufficient sample volume.
- Each core section will be analyzed for IHSs identified in the CAP (Total TEQ, cPAH TEQ, cadmium, mercury, and zinc), along with conventional parameters (total solids, total organic carbon, and grain size).

[2] The preliminary framework of the post-construction Operations, Maintenance, and Monitoring Plan [OMMP; Attachment A.2] provides a description of the role of these depth intervals in performance monitoring and decision-making.

Table 1
EMNR Performance Monitoring Core Intervals and Analysis Framework

Depth Interval	Analyzed or Archived	Data Objective
0 to 10 cm	Analyzed	Preliminary comparisons of concentrations to the subtidal cleanup standard[1]
0 to 2 cm	Archived[2]	Early indication of sediment deposition within the SCU
2 to 10 cm	Archived[2]	Early indication of potential mixing of EMNR material with underlying sediments

Notes:

1 The subtidal cleanup standard is the SCL measured over the 10-cm point of compliance interval.

2 Analyzed if IHS concentrations in the 0- to 10-cm interval are greater than the SCL.

Abbreviations:

cm Centimeters

SCL Sediment Cleanup Level

Validated data from the annual EMNR performance monitoring program outlined above will be reviewed by the Owner (through the CQAO) and Ecology and entered into Ecology's Environmental Information Management system. After each performance monitoring event, SCU-wide surface-weighted average concentration (SWAC) estimates will be calculated for each IHS using data obtained within constructed EMNR areas. These SWAC estimates will be compared with post-placement EMNR projections developed during remedial design for EMNR areas. Initial projections developed during the RI/FS, which assumed no mixing of the upper 10 cm of the placed EMNR layer with underlying sediments, will be refined based on annual performance monitoring data so that subsequent annual SWAC estimates can serve as a better indicator that corresponding cleanup levels will be met after the final construction season and 10-year natural recovery period.

4.2 POSSIBLE ADAPTIVE MANAGEMENT OUTCOMES

Adaptive management requires flexibility so that a technical approach in general, and the specifics of implementation, can be changed—when warranted—without cumbersome procedural hurdles. To ensure the success of this process, it is critical that the Owner and Ecology share data, engineering evaluations, and other information early and throughout the process. A preliminary adaptive management decision tree is presented in Figure 1.

As presented in Figure 1, there are three general outcomes or responses to EMNR design, construction, and monitoring that may result from review of the annual EMNR performance monitoring data:

4.2.1 Outcome 1

- If SPI and core analyses correlate and confirm limited mixing of the placed EMNR layer with underlying sediment during construction and limited post-construction bioturbation, and constructed EMNR layer SWAC trends in the 0- to 10-cm or 2- to 10-cm intervals within the WPAH SCU are on track to achieve post-placement EMNR projections developed during remedial design, EMNR construction will continue using approved project designs. EMNR verification and performance monitoring will also continue, potentially with minor modifications as appropriate to improve the statistical power associated with EMNR performance assessments.

4.2.2 Outcome 2

- If SPI and core analyses and SWAC trends within the constructed EMNR layers indicate that 0- to 10-cm or 2- to 10-cm intervals within the WPAH SCU are on track to achieve post-placement EMNR projections developed during remedial design, but constructed EMNR areas exhibit greater variability in mixing conditions compared to design projections, EMNR construction will continue using approved project designs. However, EMNR verification and performance monitoring will be modified as appropriate to reduce uncertainties and increase statistical confidence associated with EMNR performance assessments.

4.2.3 Outcome 3

- If SPI and core analyses and SWAC trends within the constructed EMNR layers indicate that the 2- to 10-cm interval within the WPAH SCU is not on track to achieve post-placement EMNR projections developed during remedial design as a result of greater mixing of the placed EMNR layer with underlying sediment, then, subject to Ecology approval, EMNR engineering designs for the next year's construction would be modified to optimize efficiencies in achieving CAP performance requirements, potentially including one or more of the following engineering refinements:
  - Increase the thickness of the EMNR layer to minimize construction and/or post-construction bioturbation of underlying sediments into the top 10-cm point of compliance defined in the CAP. EMNR layer thicknesses modifications would first be limited to subsequent construction years (i.e., the season immediately following a given adaptive management assessment); however, as the project progresses and more data are collected, areas completed in earlier construction seasons may also be evaluated for supplemental placement.
  - Modify EMNR placement techniques to minimize construction-related mixing of underlying sediments into the top 10-cm point of compliance defined in the CAP.

The adaptive management review cycle will occur annually following the first three construction seasons. The Owner (through the Project Engineer) will submit annual Remedial Action Work Plans (RAWPs), incorporating a summary of adaptive management elements as appropriate, to Ecology by May 1 of each year of remedial action. Each RAWP will present the annual performance monitoring data, and the results of the adaptive management evaluations conducted collaboratively between the Owner and Ecology. Each year's RAWP will assess progress toward meeting CAP performance standards and summarize any adaptive responses taken during the previous year. Each such report will also include recommendations, as appropriate, for additional adaptive response actions, continuation or revision of the annual performance monitoring program, termination of monitoring in certain areas, or revisiting the goals for specific areas. Prior to submittal of these reports, a comprehensive review of the prior years' activities and results will be evaluated, and relevant adaptive management recommendations will be brought forth through a collaborative Owner/Ecology process.

A minimum of three annual adaptive management review cycles will be implemented under this CQAAMP. If the first 3 years of post-placement EMNR monitoring reveal that the approach and construction methods are highly effective in achieving remedial goals and protectiveness can be demonstrated, then the Owner and Ecology may collaboratively determine to curtail the program.

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5.0 References

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Western Port Angeles Harbor
Sediment Cleanup Unit

Cleanup Action Plan

Attachment A
CQAAMP and OMMP Frameworks

Attachment A.1
CQAAMP

Figure

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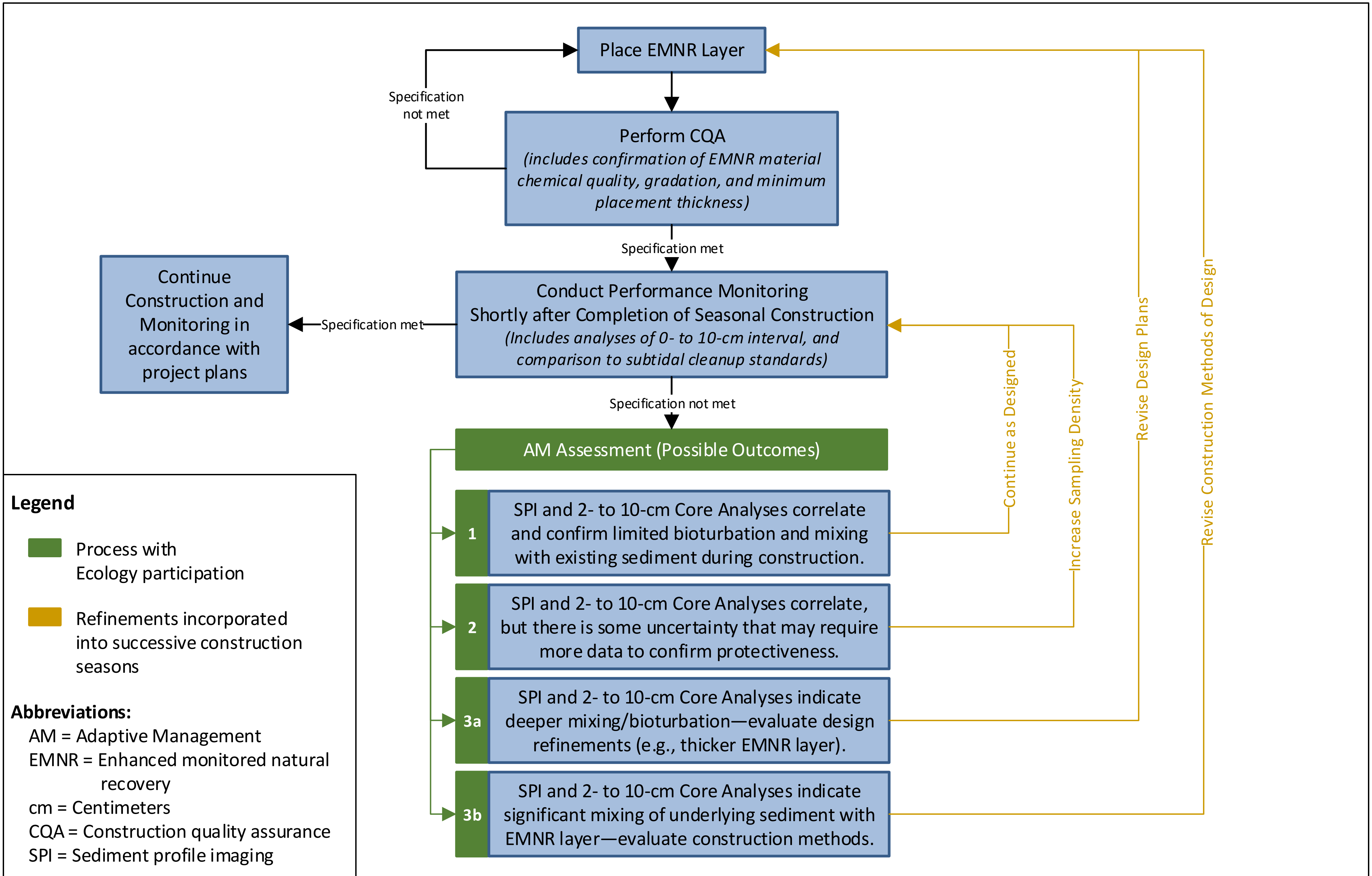

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Figure 1
EMNR Construction Phase Adaptive Management Decision Tree

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Attachment A
CQAAMP and OMMP Frameworks

Attachment A.2
OMMP

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Table of Contents

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	**Definition**
OMMP	Operations, Maintenance, and Monitoring Plan
WPAH	Western Port Angeles Harbor
SCU	Sediment Cleanup Unit
RI/FS	Remedial Investigation/Feasibility Study
CAP	Cleanup Action Plan
CQAAMP	Construction Quality Assurance and Adaptive Management Plan
MTCA	Model Toxics Control Act
Ecology	Washington State Department of Ecology
WAC	Washington Administrative Code
SMS	Sediment Management Standards
EMNR	Enhanced monitored natural recovery
MNR	Monitored natural recovery
USACE	U.S. Army Corp of Engineers
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SCL	Sediment cleanup level
HIS	Indicator hazardous substance
SWAC	Surface-weighted average concentration
QA/QC	Quality assurance and quality control
SPI	Sediment Profile Imagery
RPD	Relative percent difference

1.0 Introduction

This document presents the preliminary framework of the post-construction Operations, Maintenance, and Monitoring Plan (OMMP) that describes long-term compliance monitoring of the constructed remedial actions within the Western Port Angeles Harbor (WPAH) Sediment Cleanup Unit (SCU). The long-term monitoring described herein will be used to confirm that the constructed remedial action achieves cleanup standards. Potential contingency actions are also described in the event that the remedial actions do not achieve cleanup standards. Further development of the OMMP will be informed by and finalized during remedial design; this preliminary framework provides supporting information relevant to the Remedial Investigation/Feasibility Study (RI/FS) and forthcoming Cleanup Action Plan (CAP). The accompanying Construction Quality Assurance and Adaptive Management Plan (CQAAMP) describes protocols and methods to verify protectiveness and optimize sediment cleanup construction actions within the WPAH SCU over the anticipated 6-year in-water construction period. The construction is anticipated to be completed over a 6-year period to allow for intertidal excavation and placement of the cap and sand EMNR layer over a large area of the SCU.

Implementation of this OMMP will be performed consistent with the requirements of the Model Toxics Control Act (MTCA), Chapter 70.105D in the Revised Code of Washington, as administered by the Washington State Department of Ecology (Ecology) under the MTCA Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC). Implementation of this OMMP will also comply with the Sediment Management Standards (SMS; WAC 173-204).

Integrated remedial actions proposed to be constructed within the WPAH SCU include the following:

- 1.3 acres of intertidal excavation
- 43 acres of intertidal and subtidal capping
- 178 acres of subtidal enhanced monitored natural recovery (EMNR)

As discussed in the RI/FS, sediment standards are anticipated to be achieved throughout the WPAH SCU, including 949 acres of subtidal monitored natural recovery (MNR), within 10 years following completion of construction.

Long-term performance monitoring, including physical integrity and sediment quality assessments, is anticipated to begin immediately following completion of construction (Year 0) and will continue during Years 2, 5, and 10. Physical integrity monitoring will be performed to verify cap integrity and protectiveness over time. Surface sediment chemistry monitoring will be performed to verify that the WPAH SCU achieves compliance with cleanup standards set forth in the CAP at Year 10, when cleanup standards are projected to be achieved.

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2.0 Project Organization and Responsibilities

The roles and responsibilities of the parties involved in the WPAH SCU cleanup action are described in the following sections.

2.1 ECOLOGY AND OTHER AGENCIES

Ecology is the regulatory authority and is the responsible agency for overseeing and authorizing cleanup actions in the WPAH SCU. In this capacity, Ecology will review information described in this OMMP for consistency with the cleanup standards set forth in the CAP, including applicable or relevant and appropriate requirements. The Ecology Project Coordinator, or a designee, will exercise project oversight for Ecology, coordinate comments developed by Ecology and other agencies, and communicate agency observations with the Owner (designated performing parties of the WPAH Group for this OMMP). The Ecology Project Coordinator shall notify the Owner if he identifies any concerns regarding the implementation of the long-term monitoring. The Owner, or a designated representative, will propose recommendations, as appropriate, to the Ecology Project Coordinator. Ecology will work cooperatively with other government agencies as necessary.

2.2 OWNER

The Owner is the designated performing party (or parties) responsible for implementing long-term monitoring in accordance with the CAP and related binding agreements (e.g., a consent decree). The Owner, or a designated representative, will implement this OMMP and be the point of contact with Ecology. Monitoring activities will be the responsibility of the Owner, who will be acting in coordination with Ecology.

2.3 PROJECT MANAGER

The Project Manager (retained by and answerable to the Owner), is responsible for overall implementation of the long-term monitoring plan, maintaining quality assurance, and ensuring that the monitoring objectives are met. The Project Manager will track monitoring activities and schedule and coordinate with the field team who will conduct the activities.

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3.0 Physical Integrity Confirmation Monitoring

Post-construction physical integrity confirmation monitoring of the engineered capped area will include the following elements:

- Bathymetric surveys
- Cap integrity monitoring (topographic surveys and cap surface visual inspections)
- Collection of sediment cores if cap settlement or erosion is observed

These methods may be used alone or in combination, as necessary, to provide a multiple line of evidence assessment of the physical integrity of the various engineered caps. Each of these physical integrity monitoring elements are described in the following sections.

3.1 BATHYMETRIC SURVEYS

As discussed in the accompanying CQAAMP, bathymetric surveys along with other monitoring elements will be used during construction to verify that engineered caps are successfully constructed in accordance with the remedial design. After all construction is complete, multi-beam bathymetric surveys will be performed in Years 0, 2, 5, and 10 along the same CQAAMP surveying transects to the extent practicable to track changes in engineered cap surface elevations. Multi-beam surveys will be conducted by a licensed surveyor and will meet or exceed the accuracy standards for a U.S. Army Corp of Engineers (USACE) Navigation and Dredging Support Survey as referenced in the USACE Hydrographic Surveying manual (USACE 2013). Additional details about bathymetric surveys will be defined in the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) *(to be developed with Ecology as part of the final OMMP)*.

3.2 TOPOGRAPHIC SURVEYS AND CAP SURFACE VISUAL INSPECTIONS

For intertidal cap areas not included in the bathymetric survey, both an upland topographic survey and concurrent visual inspection will be performed to evaluate the integrity of caps relative to as-built post-construction conditions. Topographic surveys will be performed using established control points as part of long-term monitoring to track changes in intertidal cap elevations. Topographic surveys will be conducted by a licensed surveyor and will meet or exceed the accuracy standards for a USACE Total Station Topographic Survey as referenced in the USACE Control and Topographic Surveying manual (USACE 2007). Additional details about upland topographic surveys will be defined in the SAP/QAPP *(to be developed with Ecology as part of the final OMMP)*. Concurrent with the topographic survey, cap inspections may be performed at low tide to potentially allow for visual inspection of the lower intertidal armored areas and toe of armored slope.

3.3 SEDIMENT CORING

Sediment cores will be collected at locations identified by the bathymetric/topographic surveys or inspections where possible cap settlement and/or erosion of cap thicknesses may have occurred. If necessary, cores will be advanced to a minimum depth of approximately 1 foot below the minimum required cap thickness. A preliminary evaluation of cap design proposes a 2-foot cap thickness (refer to Appendix K of WPAH Group 2020); therefore, sediment cores would be advanced to a minimum depth of 3 feet. The cores will be processed in the uplands and visually inspected to determine the thicknesses of the cap material.

If the coring verifies the cap thickness specification in that area (e.g., reductions in cap surface elevations are primarily attributable to sub-grade settlement), no further cap monitoring in that area will be required during that event. Conversely, if the coring reveals that cap thickness specifications in that area have not been maintained, additional contingency evaluations—including surface sediment chemistry monitoring and/or cap maintenance or repair—will be performed as appropriate to meet specifications, subject to Ecology approval.

4.0 Sediment Quality Confirmation Monitoring

Sediment quality confirmation monitoring in the cap, EMNR, and MNR[1] areas will include stratified random grab sampling of surface sediments for chemical monitoring at different depth intervals (e.g., 0 to 10 centimeters [cm], 0 to 2 cm, and 2 to 10 cm), described in the following sections. Confirmation monitoring will occur in Years 0, 2, 5, and 10 post-construction.

4.1 BIOACCUMULATIVE INDICATOR HAZARDOUS SUBSTANCES

Surface sediment chemical monitoring will be conducted SCU-wide to assess natural recovery and compliance with bioaccumulative sediment cleanup levels (SCLs). As discussed in the CQAAMP, performance monitoring and adaptive management of EMNR construction, including surface sediment monitoring in constructed EMNR areas, will be performed during the anticipated 6-year in-water construction period to verify the protectiveness of EMNR layers placed in the WPAH SCU.

Building on the CQAAMP performance monitoring data, and using interpolation and forecasting methods developed in the RI/FS process and refined during remedial design, projected time trends of bioaccumulative indicator hazardous substance (IHS; Total TEQ, cPAH TEQ, and mercury) surface-weighted average concentrations (SWACs) for the 0- to 10-cm sample interval will be calculated for the WPAH SCU. The measured SWACs will be compared with SCLs. Samples of the 0- to 2-cm and 2- to 10-cm sample intervals at each core sampling station will be collected and archived, and then analyzed if IHS concentrations in the 0- to 10-cm interval are observed above projected trends. The analytical approach for assessing bioaccumulative IHSs is provided as a flowchart in Figure 1. IHS concentrations in the 2- to 10-cm interval can also be calculated by analyzing the 0- to 2-cm sample interval (or vice versa) in addition to the 0- to 10-cm interval, and then using mass balance, accounting for density differences between these intervals.

4.1.1 Sample Locations

- Target sampling location coordinates will be determined post-construction using a stratified random sampling approach.
- A total of 50 to 80 surface sediment sample locations will be identified across the SCU to evaluate compliance with bioaccumulative SCLs. Exact sample locations and numbers of samples to be collected in each of the following areas will be determined during remedial design. This will include the following:
    - Locations in the MNR area
    - Locations in the Sediment Management Area (SMA) 3 EMNR area
    - Locations in SMA 1 and SMA 2 subtidal areas
    - Locations in intertidal areas within SMAs 1 and 2

[1] The MNR area includes the area identified in SMA 3 and the no action areas identified throughout the SCU (refer to Figure 15.1).

4.1.2 Sampling Scheme

The following table presents a summary of the samples to be collected as part of the OMMP. Detailed procedures for field sampling, location control, number of samples, sample handling, and decontamination will be provided in the in the SAP (to be incl*uded as an attachment in the final OMMP)*. Detailed field and laboratory quality assurance and quality control (QA/QC) criteria, including method specifications, detection limits, accuracy, and precision requirements, will be provided in the QAPP *(to be included as an attachment in the final OMMP)*.

Area	Sample Depth	Analytes	Compliance Methodology
SMA 1 and SMA 2 intertidal cap	• 0 to 45 cm • 0 to 10 cm • 0 to 2 cm, archived • 2 to 10 cm, archived • 2 to 45 cm, archived	Total TEQ, cPAH TEQ, cadmium, mercury, total solids, total organic carbon, and grain size	SWACs calculated separately for the intertidal cap area with 0- to 45-cm samples (per NewFields 2016) are compared against bioaccumulative SCLs.
SMA 1 subtidal cap	• 0 to 10 cm • 0 to 2 cm, archived • 2 to 10 cm, archived	Total TEQ, cPAH TEQ, mercury, total solids, total organic carbon, and grain size	SCU-wide SWACs calculated with 0- to 10-cm samples (per NewFields 2016) are compared against bioaccumulative SCLs.
SMA 2 EMNR			
SMA 3 EMNR			
MNR areas			

Note: The SWAC interpolation method will be consistent with the methodology described in NewFields (2016). The methodology may be adjusted in coordination with Ecology in the future, if needed due to data density and location.

4.2 BENTHIC INDICATOR HAZARDOUS SUBSTANCES

Chemical testing will be conducted to evaluate compliance with benthic SCLs. A total of 10 to 25 surface samples from 0 to 10 cm will be collected within the WPAH SCU to evaluate compliance with benthic SCLs; these samples will be collocated with remedial design toxicity testing locations. Samples will be analyzed for the benthic IHSs (cadmium, mercury, and zinc) and total organic carbon, with results compared point-by-point against benthic SCLs to evaluate compliance. Additionally, consistent with the sampling approach for the bioaccumulative IHSs, samples of the 0- to 2-cm and 2- to 10-cm sample intervals at each sampling station will be collected and archived, and then analyzed if IHS concentrations in the 0- to 10-cm interval are greater than the benthic SCLs.

As with the bioaccumulative IHSs, detailed procedures for field sampling, location control, sample handling, and decontamination will be provided in the SAP *(to be included as an attachment in the final OMMP)*. Detailed field and laboratory QA/QC criteria, including method specifications, detection limits, accuracy, and precision requirements, will be provided in the QAPP *(to be included as an attachment in the final OMMP)*.

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5.0 Institutional Controls

To be determined in remedial design and included in the final OMMP.

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6.0 Potential Contingency Actions and Termination of Monitoring

6.1 POTENTIAL CONTINGENCY ACTIONS

In the event that monitoring indicates that remedial action performance standards may not be achieved 10 years post-construction, or have not been achieved at Year 10, the designated performing parties of the WPAH Group will evaluate the extent and significance of the exceedance in conjunction with Ecology. The determination of the need for additional response actions will take into consideration all monitoring results relative to an overall assessment of the successful performance of the remedial action. Through these discussions, an appropriate course of action will be developed and implemented, as necessary. The specific problem causing the need for a contingency will dictate which additional response actions may be most appropriate.

Possible additional response actions may include, but are not limited to, those listed for the following scenarios:

- Performance of engineered cap areas
  - Analyze 0- to 2-cm and 2- to 10-cm samples in areas contributing to elevated SWACs to identify source of elevated concentrations. If elevated concentrations are observed in the intertidal cap areas, analyze 0- to 2-cm and 2- to 45-cm samples.
  - Perform additional monitoring to further assess erosion and to determine the extent, cause, and potential solution to the verified erosion.
  - Perform additional sediment quality monitoring within those erosion or settlement areas where there may be a potential for underlying material to be exposed.
  - Investigate cause(s) of potential cap erosion or other instabilities and determine need for enhancement (e.g., increased size of erosion protection layer materials).
- Attainment of sediment cleanup levels within EMNR and MNR areas
  - Analyze 0- to 2-cm and 2- to 10-cm samples in areas contributing to elevated SWACs to identify source of elevated concentrations.
  - Collect additional surface grab samples in areas contributing to elevated SWACs.
  - Re-sample locations with SCL exceedances.
  - If a benthic SCL exceedance, conduct biological sediment toxicity testing to confirm or refute the occurrence of adverse ecological impacts.
  - Conduct Sediment Profile Imagery (SPI) to visually assess if mixing of EMNR materials with underlying sediment is occurring.
  - Conduct sediment trap monitoring if grab samples indicate bioaccumulative IHS concentrations in the top 0- to 2-cm layer exceed regional background-based SCLs. Sediment trap monitoring in this situation will characterize sedimentation rates

and the quality of depositional sediments. The duration of sediment trap deployment is expected to be a minimum of 3 months to collect sufficient sample volume for analysis; the length of deployment required will be determined during the first monitoring event.

- Place additional EMNR material.
- If exceedance indicates recontamination from ongoing sources, evaluate the applicability of, and if appropriate, revise the regional background values and/or other source control evaluations that may be conducted by Ecology.

6.2 POST-YEAR 10 EPISODIC PHYSICAL INTEGRITY MONITORING

Long-term monitoring of the physical integrity of the engineered cap is required for the life of the cap. Monitoring frequency will decrease as cap stability is demonstrated by the initial, routine monitoring. At a minimum, routine monitoring will be completed through Year 10. After Year 10, the monitoring results will be evaluated in cooperation with Ecology to assess the stability of the cap and the need for additional routine monitoring. When routine monitoring has sufficiently demonstrated stability, subsequent non-routine monitoring may be triggered by specific storm or seismic events (e.g., a wind event with a recurrence interval of 20 years or more, or a seismic event greater than a magnitude of 5.5). The identification of and process for determining major potential disturbance events that would trigger follow-on physical integrity monitoring will be developed with Ecology as part of the final OMMP.

6.3 TERMINATION OF SEDIMENT QUALITY MONITORING

Termination of the sediment quality monitoring in the OMMP program requires a weight of evidence justification. This weight of evidence is expected to include discussion of proper remedy installation, documented remedy stability, and achievement of SCLs at 10 years post-construction or clear trends indicating SCLs will be achieved in surface sediments (i.e., 0 to 10 cm). Achievement of SCLs will be evaluated consistent with the Sediment Cleanup User's Manual II, which states: "*Based on typical analytical relative percent differences (RPDs) and field variability, any individual or mean value within 20% of the cleanup standard is considered to be indistinguishable from the cleanup standard and in compliance*." (Ecology 2017):

- Chemical concentration trends will be established by examining data collected at 0, 2, 5, and 10 years. If chemical monitoring indicates that the SCLs have been achieved, monitoring (except physical integrity as noted above) will be terminated and the remedy will be considered complete.
- If chemical monitoring indicates that chemical concentrations are generally on a trajectory to achieve SCLs, monitoring may be terminated, in coordination with Ecology, if there is sufficient justification and other measures of remedy performance are acceptable.

- If chemical monitoring indicates that chemical concentrations are not achieving SCLs, and trend lines are indicating that the remedy may not reach SCLs by Year 10 post-construction, then several options may occur based on trends in the 0- to 10-cm, 0- to 2-cm, and 2- to 10-cm surface sediment concentrations collected during monitoring:
  - If the remedy is failing to meet SCLs due to elevated concentrations in the 0- to 2-cm interval, Ecology will revisit regional background and/or evaluate source control actions.
  - If the remedy is failing to meet the SCLs due to apparent remedy failure issues (e.g., physical integrity failure of a cap), discussions with Ecology will center on remedy modifications.

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7.0 References

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Western Port Angeles Harbor
Sediment Cleanup Unit

Cleanup Action Plan

Attachment A
CQAAMP and OMMP Frameworks

Attachment A.2
OMMP

Figure

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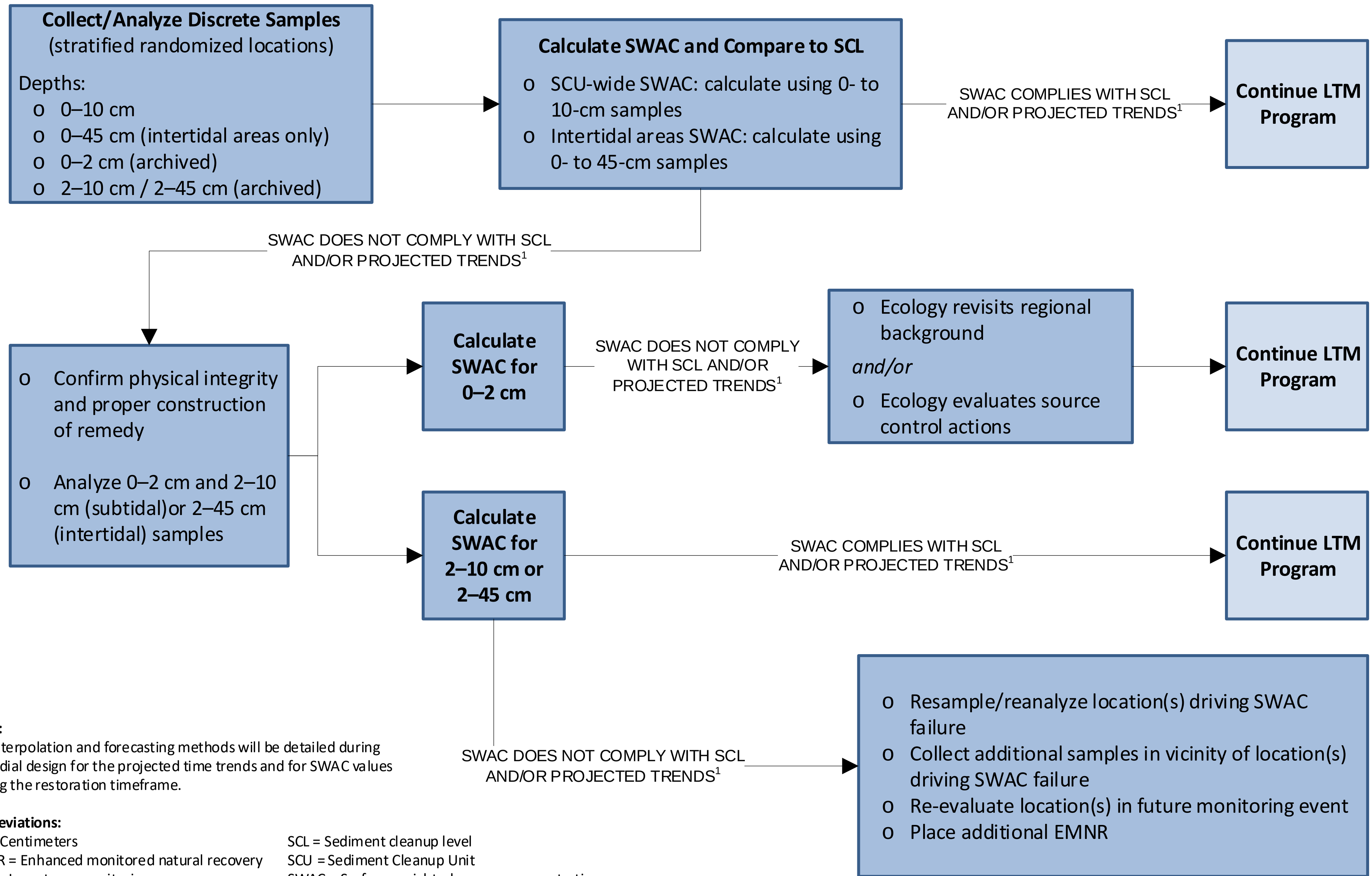

Note:
1 = Interpolation and forecasting methods will be detailed during remedial design for the projected time trends and for SWAC values during the restoration timeframe.

Abbreviations:
cm = Centimeters
EMNR = Enhanced monitored natural recovery
LTM = Long-term monitoring
SCL = Sediment cleanup level
SCU = Sediment Cleanup Unit
SWAC = Surface-weighted average concentration

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Figure 1
Bioaccumulative Compliance Monitoring Decision Tree